

Gulf of Alaska (GOA) and Bering Sea Aleutian Islands (BSAI) Joint Groundfish Plan Team Meeting Minutes

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

September 13 - 16, 2016

BSAI Team		GOA Team	
Dana Hanselman	AFSC ABL (co-chair)	Jim Ianelli*	AFSC REFM (co-chair)
Grant Thompson	AFSC REFM (co-chair)	Jon Heifetz	AFSC ABL (co-chair)
Diana Stram	NPFMC (Coordinator)	Jim Armstrong*	NPFMC (coordinator)
Kerim Aydin	AFSC REFM	Mike Dalton	AFSC REFM
David Barnard	ADF&G	Obren Davis	NMFS AKRO
Liz Chilton	AFSC	Craig Faunce	AFSC FMA
Mary Furuness	NMFS AKRO	Sandra Lowe	AFSC REFM
Alan Haynie	AFSC REFM	Chris Lunsford	AFSC ABL
Allan Hicks**	IPHC	Patrick Lynch**	S&T NOAA HQ
Brenda Norcross	UAF	Jan Rumble	ADF&G
Chris Siddon	ADF&G	Paul Spencer	AFSC REFM
Cindy Tribuzio	AFSC ABL	Mark Stichert	ADF&G
		Ben Williams**	ADF&G
*partial attendance			
** initial meeting			

Contents

Administrative.....	2
Research Priorities	3
Halibut Discard Mortality Rates (DMRs).....	4
Stock Assessment Prioritization Plan	6
Ecosystem Considerations	9
Marine Mammal research update.....	10
Eastern Bering Sea (EBS) bottom trawl surveys	12
HFICE (Halibut Fishery Incidental Catch Estimation).....	12
Sablefish.....	12
Observer Program Update.....	14
Squid	15
Economic SAFE.....	16
Octopus	17
Stock Structure and Spatial Management (BSAI BS/RE)	17
Essential Fish Habitat (EFH)	19
Minutes of the Bering Sea and Aleutian Islands Groundfish Plan Team	22
BSAI Northern rock sole recruitment	22
Northern rockfish stock structure.....	23
BSAI Pacific cod CIE review	23

EBS Pacific cod assessment.....	24
Aleutian Islands Pacific cod assessment.....	26
Mid-year review of Pacific cod assessment models	28
BSAI Arrowtooth Flounder	29
BSAI Alaska Skate	30
EBS Acoustic trawl pollock survey	31
EBS pollock assessment	31
Multi-species stock assessment model (CEATTLE)	33
Tier 3 rockfish assessments	34
Stock structure template.....	35
2017 and 2018 harvest specification recommendations.....	35
Minutes of the Gulf of Alaska Groundfish Plan Team	36
Stock Structure Template.....	36
Dogfish catchability	36
Spiny Dogfish Demographic Model	37
Demersal shelf rockfish	37
GOA Pollock.....	39
GOA winter acoustics-trawl survey	39
GOA pollock assessment	39
Pacific cod.....	40
2017 and 2018 harvest specification recommendations.....	41

Administrative

Introductions: The Joint meeting of the Gulf of Alaska (GOA) and Bering Sea Aleutian Islands (BSAI) Groundfish Plan Teams convened Tuesday September 13, 2016 at 9:00 AM at the Alaska Fisheries Science Center in Seattle, Washington. Introductions were made including approximately 15 attendees that are not on the Plan Teams. New Plan Team members were welcomed (Allan Hicks on the BSAI Team, Patrick Lynch and Ben Williams on the GOA Team). Membership on the Plan Teams was reduced by administration starting this year such that members with expertise on marine mammals (Nancy Friday and Lowell Fritz from NMML) and seabirds (Leslie Slater from USFWS) were unable to continue participating. Diana Stram went over other administrative issues including assignments, access to documents and revisions to the agenda,

Documents and presentations: All documents provided prior to or during the meeting as well as presentations given during the meeting were posted to the [Council's Granicus site](#).

September 12, 2016 Abundance-based Halibut PSC Workshop: Diana Stram reviewed the purpose of the PSC workshop that had been conducted at the AFSC the previous day. She also described next steps in terms of the pending SSC and Council review in October and, specifically, the need for policy choices from the Council to guide the direction of future work.

Geostat Modeling: Dana Hanselman noted that the SSC requested a workgroup be formed to further study the geostatistical model used for dusky rockfish and its potential application to other species. These methods are based on the approach presented to the Teams last September by Jim Thorson. He suggested Pete Hulson, Paul Spencer had expressed interest, but was looking for additional Plan Team members or assessment authors that might be interested.

Model Numbering: Grant Thompson briefly reminded the Teams that model numbering guidance had been approved by the SSC and should be used for the current year when naming multiple iterations of models for PT and SSC review.

Other: The Teams also noted the importance of drafting the agenda in a timely manner and including names of presenters when the draft is reasonably complete. The notice to presenters should also request that a clear naming convention be used when submitting presentations for the Teams (i.e., to refrain from using names like “Sept Plan Team.ppt”).

Rules for recommendations:

1. Stand-alone paragraph
2. Bold font
3. Use “Team(s) recommend(s)”

Rules for editing:

1. Use “suggesting” mode for substantive changes (obvious typographical errors can be corrected in “editing” mode, however)
 - a. No “stealth edits!”

Research Priorities

Jim Armstrong discussed the NPFMC research priorities. Research priorities are an MSA mandate which directs the Council, in conjunction with the SSC, to establish priorities for 5-year periods and update as necessary.

Jim discussed the annual research process timeline which starts with a review and prioritization of a research list by a Groundfish Plan Team subgroup. These priorities are vetted through the Groundfish, Scallop, and Crab Plan Teams. At the June Council meeting, the SSC finalizes recommendations to the Council, and the Council adopts a research priority list that is distributed to funding bodies and reported to the Secretary of Commerce. The Plan Teams discussed improved coordination and alignment with NPRB research priorities.

The following are the revised categories/definitions for the research priority list:

Critical Ongoing Monitoring—Information provided by monitoring activities in this category (1) provide an essential management function; (2) cannot likely be acquired through other means; or (3) are required by regulation. This is monitoring essential to maintaining our compliance with federal requirements, including National Standards, or necessary for the ongoing management of the fishery. Postponement would have a significant an immediate impact on management.

Urgent—Research essential to maintaining our compliance with federal requirements, including National Standards, or that has been identified by management as necessary to aid decision-making. It is expected that a one or two year project would meet the information need. Postponement would have a significant impact on management.

Important (Near Term)—Obtaining a new set of data or research result that is likely to aid in the evaluation of a near term management goal. The research might be a several year program. Postponement will not have an immediate impact on fishery management; however, the information generated will likely inform near term (<5 year) Council actions.

Strategic (Future Needs)—Research that is valuable but is not associated with an immediate need or near-term (<5 years) Council action.

The Council has 9 management priorities. Most projects fall into the following management priorities: Prevent Overfishing, Preserve Food Web (EBFM), and Protected Species. The majority of projects are designated Urgent or Important and designated for the GOA/BSAI areas. Most projects are Partially Underway or Underway. Jim noted that there are separate halibut initiatives so 8 halibut projects are being deferred in this process.

Jim discussed the Research Priorities Database. It is an AKFIN database which is sortable and publically accessible. The database needs more work to make it truly functional and improve ease of access.

The Teams were asked for input on the annual review process. The Teams recognized that preparation for the September and November meetings, and competing items within the agendas for those meetings made it difficult to spend adequate time reviewing the large list of research priorities before and during the meetings. An alternative timeframe such as that used in the most recent review (May), was discussed as having the advantages of positioning the review apart from the assessment reviews, to reduce conflicts, and also right before the June Council meeting, to ensure more timely recommendations.

The Teams recommend moving the Groundfish Plan Team review of research priorities to May.

The difficulty with interpretation of the research priorities and the differing levels of specificity was noted by the Plan Teams.

Halibut Discard Mortality Rates (DMRs)

Jim Armstrong and Jennifer Cahalan of the halibut DMR working group provided an overview of new aggregation and estimation methods for halibut DMRs. DMRs calculated under the new methods represent the working group's recommendations for specifications for 2017. The inter-agency working group proposed new operational groupings for the application of DMRs which would replace current methods that assign DMRs to target fisheries. The groupings are considered by the working group to better represent differences in capture and handling factors that contribute to differences in DMRs among fishing operations. Additionally, the working group is proposing revisions to DMR estimation methods that are more statistically consistent with current observer program sampling design. The working group posed several questions for plan team input. DMRs estimated using methods that have been in place since the late 1990s are currently specified for 2017 in the final 2016 / 2017 harvest specifications.

Members of the public questioned how much of the DMR uncertainties are related to the groupings versus estimation procedures. The WG was not able to quantitatively address the uncertainty in the proposed rates or in rates calculated previously. The IPHC is evaluating assumed mortality associated with viability categories used by observers to classify halibut condition prior to discard. These viability categories are a fundamental factor in the calculation of DMRs and are based on studies done in the early to mid 1990s. A comprehensive review is being compiled by IPHC to summarize the origin of the historical viability rates and will be available in the 2017 Report of Assessment and Research Activities. This historical compilation will then form the basis for informing the direction of future efforts such as fieldwork to re-assess mortality associated with discard condition.

Questions from the public included to what extent the WG will move toward evaluation of vessel-specific DMRs as well as the distinction between rationalized and non-rationalized fisheries. Can DMRs be applied to trip level or vessel level? Jim noted that in British Columbia real-time DMRs are being used and vessel-specific DMRs could be applied in the future and may be considered in future revisions to the DMRs.

It was clarified that the EFP deck-sorting vessels are being assigned DMRs separately on a vessel by vessel basis by observers on board under the EFP. John Gauvin noted that in 2016, with observers instead of Sea Samplers, the data are now being incorporated into the CAS as well and are accounted for under the PSC limit for Amendment 80 and BSAI trawl limited access. Julie Bonney commented that for these proposed 2017 DMRs all trips in the Rockfish Program (RP) are being assigned a mortality of 100% and are not being treated separately when hauls are of a different target which may have lower mortality associated with those hauls. WG analysts noted that the assignment to RP is at the trip not haul level and that there are few, if any, viabilities associated with the different targets within the GOA RP fishery; thus, treating them differently is not possible at this time.

Timing for setting DMRs is still at the 2 year harvest specifications cycle. These may be annually updated but this has not been determined yet. The WG recommends changing the reference period for the DMRs (2013 forward) but have not yet determined how long to keep a rolling average of years moving forward.

Some specific questions were posed of the joint teams.

1. Does the Plan Team support the general approach of using operational groupings for DMRs as opposed to target fishery specific DMRs?

The Teams recommend moving forward with operational groupings for estimation and application of DMRs, since the operational differences associated with these groupings represent an improvement over target fishery aggregation. These operational groupings would avoid some of the issues associated with pooling different gear types by target when the viabilities of halibut associated with those targets are not consistent across gear types. Also, the sample sizes are increased by aggregating in this manner. Aligning estimation procedures with sampling design is also an improvement and can be used to better inform the observer program where additional sampling is needed. Additional data can then inform future evaluations of potential modifications.

2. Are the specific operational groupings described by the Working Group appropriate?

In general the teams agree with these operational groupings with additional considerations to encourage the working group to elaborate on the rationale for these groupings.

The Teams recommend some additional fine tuning of these groupings (working with the industry as appropriate) for best characterizations of operational groupings.

3. Are the methods for expanding viability samples into strata appropriate?

The Teams agree that these methods are appropriate.

4. The Working Group is recommending using annual DMR estimates from 2013 forward unless this results in inadequate sample size. Is this the appropriate reference period appropriate for calculating DMRs at this time?

The Teams agree with the recommendation to begin the reference period in 2013 in conjunction with the restructured observer program. In the future, with more data to inform these estimates, a different rolling time frame may be used. The WG does not have a firm recommendation at this time, and any future recommendations will be dependent on both the availability of data as well as the management aspect of how much change over time in DMRs is desirable. Julie noted that improvements to Pacific halibut mortality estimates by fleets, and incentivizing improvements, would not be picked up by a longer term average. Team members noted that slow moving averages may not be appropriate as they are unresponsive to changes in behavior. Cross-validation was suggested as a possible method of testing alternative estimators.

The Teams recommend that, for the short-term, this choice of averaging years and the reference period appears appropriate.

5. Are operational groupings for which sample size is an issue appropriately addressed for management purposes?

The assumptions involved in treatment of low sample size should be listed. Craig noted that inadequate *sample size* should not be confused with inadequate *sampling*. Some strata with limited viabilities may be a result of either no halibut bycatch or the halibut bycatch being

inaccessible for viability estimation, and neither of these should be presumed to imply a lack of observer coverage issue. In general, the Teams agree that the treatment of these groupings appears appropriate.

6. Can the proposed methods be used for management in 2017?

The Teams recommend that these methods be used for 2017 harvest specifications.

Stock Assessment Prioritization Plan

Anne Hollowed presented a discussion paper on the Stock Assessment Prioritization Plan (SAPP) and its contribution to the 2017 Stock Assessment Improvement Plan (SAIP). A large group of people contributed to the SAPP including the authors, assessment authors, and another panel of experts. She discussed the three main components of next generation of stock assessments outlined in the SAIP. This includes linking ecosystem stock assessments, and new methods. The SAPP addresses the “timely, efficient and effective” component of the SAIP. She showed the SAPP timeline, and that it started in 2011. Following the publication of the 2015 SAPP, the authors started the process leading up to the document presented. An important part of the SAPP was to facilitate some degree of standardization within and across regions. The prioritization exercise involved four main components: stock status, fishery importance, assessment information, and importance of the stock in the ecosystem.

A list of stocks was generated that collated these data for each stock assessment in the Alaska groundfish FMPs. The components are the target assessment level and the target assessment frequency. The talk focused on the latter, as a way to determine annual priorities. Stock status was not a very useful measure in the North Pacific, because most groundfish are not overfished or being overfished.

The NPFMC places a high priority on annual or biennial assessments. Many of our species are not overfished or are lightly exploited, and many are long-lived which all contribute to recommendations of less frequent assessment. Therefore, the authors strived toward a prioritization scenario that responds to the prioritization exercise, but also fills the needs at the NPFMC.

Twelve experts representing economists and fishery managers from AFSC, NPFMC, and AKRO examined fishery importance. For species importance data, the authors used some of the results of an online survey that collected data for a number of initiatives from stock assessment authors. Some of the critical data that were collected included mean-age, natural mortality, stock status, , recruitment variability, and ecosystem importance. Ecosystem importance scores were averaged from author responses and the Regional Ecosystem Expert score (Dr. Kerim Aydin). Ecosystem importance was considered for either top down or bottom up processes. The Ecosystem Expert said that going through this process that a number 3 for every other species did not mean the same thing.

The crux of the whole analysis was derived from mean age in the catch. A cascade of methods were used to estimate mean-age of the catch depending the availability of age data. The authors deviated from the guidance of $Z=2*M$ method because NPFMC stocks are so lightly exploited.

They came up with a number of scenarios and compared with what we currently do, or status quo. The first scenario was the “base case” recommended in the SAPP document and the maximum is 10 years. The base case would put many of the stocks between 5-10 years, and non-targets would be done annually because they turnover so fast (i.e., very high natural mortality). This seems extreme, given NPFMC and constituent demands, so other scenarios were developed.

Scenarios 2 and beyond used the AFSC CIE schedule as a cap which was 5 years maximum. Scenario 3 used more weight on fishery importance scores. Scenario 4, uses a regional scalar so that high value

commercial stocks are done annually. These stocks made up the top 75% of cumulative catch value (EBS Pollock, AK sablefish, BS cod, and YFS). Scenario 5 is a combination of scenario 3 & 4.

Scenarios 2 and 3 had similar results in the BS with many stocks still at 5 years. Scenarios 4 and 5 seemed to have an alignment more in line with regional priorities. The results were pretty similar across the Gulf of Alaska, with Scenarios 4 & 5 looking reasonable.

Other regions are using a list to determine what to do each year, while AFSC does not have such a list and generally does some version of all assessments every year. It was asked whether it is acceptable to the Plan Team and NPFMC to change the schedule to less frequent assessments. Questions for the plan team were whether we have a preferred scenario, and how often would we revisit these priorities? How should impact of altering the assessment cycle be evaluated? Do we need a formal requirement for when an assessment should be brought in out of the eventual preferred cycle? If we did propose an MSE process, it would be a different timeline for rolling out the prioritization plan. The timeline currently is to take it to the October SSC, revise as suggested, then adopt a new target frequency schedule. It may provide a more thorough review of some assessments, if fewer assessments were reviewed every year.

It was asked if an author would still be looking at the data to monitor for abrupt changes. Anne said she expected people would probably be looking at their new survey data as a force of habit. They may also be developing new methodologies and incorporating the new data into those analyses. It could also be a Plan Team review of survey biomass estimates to look for red flags. Often the assessments will be a year behind then, if a red flag invoked an off-schedule assessment.

It was asked whether if we start doing assessments less frequently, will we likely get less funding for surveys. Anne responded that if we recommend keeping major species at an annual assessment frequency, the need will still be compelling to continue annual and biennial surveys.

A Plan Team member commented that the data would still be needed for less frequent assessments. It was asked whether spending a lot of time on just target frequency overlooked the other aspects of the SAPP. A representative of NMFS headquarters said that the target frequency was more important than the final prioritization list at AFSC, because all the stocks have recently been assessed.

Anne responded that the authors skipped the last step because the annual assessment cycle here already has a complete list. Since we are already doing it, we need to prioritize, not generate a new list. However, the authors did collect the information to complete that final step, if necessary.

A member of the public said that the minor species can affect the target species and the analysis could focus more on choke stocks. Another member of the public suggested that many stocks could do something more like our current executive summaries for several years. Anne responded that the current analysis did not cover that, but it could be done. It was also mentioned that we often run the same model year after year and just “turn the crank.”

A Plan team member asked whether we have to do this at all if we like our current system. Now that we’ve gone down this technical road of looking at scenarios, but do we still need to step back and address the utility of the whole exercise. The Plan Team needs to take a hard look at it. Anne said that this can be adapted regionally. It has been clear that we are being asked to evaluate the status quo assessment frequency. It was not intended to be the final say on what assessments will be done. The guidance has left it open for adaptability. A member of the audience wanted to hear more about why we are being asked to do this. Anne said that going through the process may help guide our priorities. Lightly exploited stocks may need less attention. One thing we are also struggling with is what exactly running an assessment is, and if this is referring only to benchmark assessments, not updates.

A Plan Team member mentioned that it may be a benefit to stock assessment scientists to do more research. Another member suggested that it may be a way to reallocate funding. Another Plan Team member said that every center had made that argument, but it is not in the plan.

It was asked where the Council's opinion enters into this process and when can alternate scenarios be presented for consideration. There are a lot of decisions to be made. Maybe this can be used as a guidance to do less on an annual basis. One advantage of the status quo, is that incremental innovations have often evolved into benchmark assessments instead of sudden large changes. Anne suggested that we could add more +/- factors in for Council needs. Some of the short-lived species would definitely not be done annually. 5 year caps are important for the NPFMC.

An audience member talked about how some pollock year classes have seemed to disappear. If we weren't doing annual assessments, these changes may have not been detected. It was suggested that we should look at these issues in retrospective analyses to see what would have happened without annual assessments. The concern was that this process may move us away from achieving OY.

In the past we discussed that if we went to less frequent assessments, we would need to build in a bigger buffer, such as through the P* or decision-theoretic approach.

In response to many of these questions, a representative from NMFS HQ suggested that we try that last step to adjust priorities. A big part of that last step was setting the weights by managers. There are no rules about how that is done. There's a category called constituent demand that could be used to guide Council policy. A member of the public commented that in the past choke species have become choke species rather quickly, and if we were in a 5-year cycle on some of these stocks, we might get far down the path before we notice a problem. It is hard for industry and managers to anticipate how these things might happen in the future.

A Team member suggested that the subjective weights to be used in the final step of the SAPP do not lend much to a scientific process, and by using this method it is codifying these weights as some kind of science, when they are not. There is a lot of nonlinear processes at work here that cannot be really put into this process.

Another member suggested that we should choose a reasonable scenario, and go stock by stock through these and choose exceptions. Anne said we could delay decisions on this until later, but we should probably put some plan into place. The Team was discussing when it would be optimal to implement to start this in 2018. It may be better to start all assessments in 2017 as usual, then move into another cycle in 2018. The NWFSC has already formulated a prioritized list and is using it to guide their upcoming assessments. There may be some efficiency achieved by doing this here. A team member suggested this prioritization is mainly only going to affect long-lived species with low recruitment variability.

A member asked that if we used Scenario 4, is there an allowance for recovery time if the assessment was wrong and overfishing was occurring. It would take a long time for a rockfish to return to target levels, if we were wrong.

The Team discussed what to do if we are uncomfortable with the bookends provided. The Teams wanted to ensure that these concerns enter into the process and into what final decisions are made. A workgroup could be established, to take this further. An assessment author requested that they be invited to weigh in on each species that they assess, if we go through the list species by species. A member pointed out that this is different from other regions, we are going from high importance to reducing it, as opposed to increasing it like other regions. Council staff suggest that this is important enough that it should not be rushed. A Team member questioned the value spending a lot of AFSC and Council resources continuing to analyze these target frequencies, or if going forward with a reasonable scenario and spending time on the exceptions would be more useful.

The Teams recommend that, if a working group is established, it should explore the utility of completing the final step in the SAPP. The Teams also recommend that a meeting in January 2017 be convened to further develop the plan.

Ecosystem Considerations

Stephani Zador presented the current Ecosystem Considerations, including status and trends as available at present, and results of recent surveys.

The physical conditions include a strong El Nino last fall, with the eastern north Pacific warmer than average. In spring 2016, warm anomalies progressed into record warm anomalies in the summer. There is a modest chance of a La Nina developing in the fall/winter. In fall, winds from the west brought upwelling in the GOA. A deep low pressure system last winter brought lots of warm winds in the EGOA, resulting in more rain, less snow, and more freshening of surface water. In the Bering Sea, there was suppressed storminess, low mixing, and warm surface temperature. Additionally, there was a record low Arctic maximum ice extent in March 2016.

This year's positive Pacific Decadal Oscillation when heading into La Nina is unusual (and due to heat). The NPI showed low pressure in winter. The North Pacific Gyre Oscillation shows reduced flows into GOA and CalCOFI areas (2015) coming back to neutral. Current seasonal forecasts point to a 2016 fall/winter continuation of warm sea surface temperatures, with the strongest positive anomalies occurring in EBS and GOA.

The PAPA trajectory index for 2015/2016 is similar to the past couple years with a northward shift in the boundary between subarctic and subtropical species. It has stayed positive, even though in previous years the system seemed to be returning to pre-1977 conditions.

There was an unusually strong eddy that started off Yakutat, enhancing cross-shelf exchange. There was weak eddy activity in the Aleutians in 2016. The OSCURS model of Bering Sea flatfish recruitment showed inshore advection to favorable nursery grounds in 2008 and 2015; 2016 does not appear to be favorable.

The cold pool of the Bering Sea was greatly reduced and is at the lowest level on record. A "nowcast" from the ROMS oceanographic model shows continued high surface and bottom temperatures extending into September. The 2014-2015 BASIS survey measurements of temperature and salinity above the mixed layer support this warming trend.

A new coccolithophore index was presented, with a time series from 1998-2016. Preliminary data show that 2016 has high coccolithophore blooms.

For the northern Bering Sea, the results of the Yukon Estuary Survey were presented for 2014-2016. It was warmer in 2015-2016 than 2014. Chinook salmon were smaller in 2015-2016 than in 2014. In the estuary an alternating year pattern in species compositions occurred with stickleback and smelt predominant in 2014 and 2016 and capelin in 2015. The northern BASIS survey encountered large catches of age 0 pollock and juvenile chum in 2016.

In the southern Bering Sea the results of a 2016 spring egg and larval survey with a redesigned sampling design were presented. Numerous age-0 pollock were caught in the inner domain. 2016 was dominated by small copepods, as expected with warmer conditions. There were few large copepods in the inner and middle domains, where the majority of pollock larvae were found.

High larval pollock counts were present in the 2016 rapid assessment. They were distributed on-shelf, consistent with warm-year observations. A late summer survey showed overall low zooplankton volume

with mostly small copepods. There were high catches of age-0 pollock. Age-0 pollock were dominant prey of salmon, sandfish, smelt, and age1+ pollock.

In the western GOA, the 2015 ichthyoplankton survey showed that most species had low abundance in 2015, with the exception of rockfish and northern lampfish larvae.

An EVOS whale & herring study in Prince William Sound showed low whales in 2014. An estimated 15-20% of herring in PWS are consumed by humpbacks, which is comparable to what commercial fishery removals would be. There was a rise in whale stranding events in 2015. A new time series in whale entanglements was presented. Multiple lines of evidence show that in 2016, whale stress was on the rise. It was noted some of these observations may be in response to better reporting rates.

Chris Lunsford presented survey results from eastern Gulf of Alaska (EGOA) ecosystem surveys. In 2016 in the EGOA, conditions were warm, with low zooplankton biomass, high *L. helicina* biomass similar to 2015, and high levels of juvenile pink and chum. Juvenile pink numbers are generally predictive of returns, but 2006, 2015, and 2016 returns were lower than juveniles would predict, perhaps due to warm temperatures. The EGOA surface trawl survey found positive temperature anomalies, low crustacean zooplankton biomass, lots of salps, and high abundances of age-0 rockfish. Age 0 rockfish appear to use dense layers of jellyfish as refuge habitat.

The Plan Teams commend the authors on the integrated nature of the presentation, combining multiple surveys and indicators into a single picture across the Bering Sea, Aleutians, and Gulf of Alaska. However, there were feelings that some of the area- or stock-specific survey presentations (bottom trawl and acoustics surveys) should be given to their respective Plan Teams rather than in joint session.

Kalei Shotwell presented progress on developing Species Profiles and Ecosystem Considerations (SPECs) for stock assessments. SPECs are useful in stock and habitat assessment prioritization; productivity/susceptibility and climate vulnerability analysis, and classification of relative data availability, as well as determining ecosystem effects on or by a stock. Earlier this year, stock assessment authors filled out a detailed form on their species; then, a qualitative paring down of the answers led to selecting a set of factors relevant to the stock/region, rescaling the factors, and categorizing factors as a "cost" or "benefit" for the stock (Team members suggested looking at alternative terminology for those two concepts).

A preliminary SPEC Alaska Sablefish was presented as an example, with the results including (1) an Ecosystem Status Rating; (2) a life history conceptual model; (3) a species profile of relationships to indicators; and (4) a species-specific report card. Future research priorities for the stock would be identified through SPEC elements, and updated with SAFE comments or CIE review. The authors of the sablefish assessment plan to integrate the SPEC into this year's final assessment.

The Teams recommend producing SPECs for the other focal species from the GOA IERP project next (Pacific cod, walleye pollock, Arrowtooth flounder, and POP). If time allows, it would be useful to produce a SPEC for a low-data species (perhaps "other rockfish," as it is a habitat-focused assemblage), and to include crab through interaction with the Crab Plan Team.

Marine Mammal research update

Northern fur seals

Jeremy Sterling gave a presentation on northern fur seal foraging - linking biophysical processes and fur seal behavior to demography. Northern fur seals are listed as depleted under the Marine Mammal Protection Act (MMPA). They are not listed under ESA. Under the MMPA, a stock is considered to be "depleted" if it is below its optimal sustainable population size (OSP, MMPA biological reference point).

A stock may be depleted but not in danger of becoming extinct in the foreseeable future in all or a significant portion of its range (which is the trigger for ESA listing).

The eastern stock of northern fur seals is at about one third of its historical peak and well below OSP. To be delisted, the population would need to double in order to achieve 60% of historical carrying capacity. Preliminary results from the 2016 survey are likely to show about a 5% decline for the eastern stock of northern fur seals. Numbers on St. Paul declined ~12% and St. George Island showed ~7% increase.

There is a Conservation Plan for northern fur seals under MMPA rather than ESA and the demography work is a focus of the plan. The MML Alaska Ecosystems Program is conducting a data rescue, compiling telemetry data from 1991-2016, and has conducted a Sairdrone survey of fur seal foraging hotspots in the Bering Sea. The main objective is to identify factors influencing fur seal demography (eastern stock). Hypotheses focus on bottom-up processes in summer and winter. The MML utilizes a large integration of ecosystem data sets including MACE, RACE, REFM, and PMEL data.

Diet studies have shown that pollock, squid, and capelin are large components, and there is a strong spatial association with prey items. Jeremy presented data showing that: 1) pollock is the primary prey item for adult female fur seals (with pups) that forage on the shelf, and 2) foraging trips of adult females are shorter, nursing bouts more frequent, and pup weights at the end of the summer are greater as pollock abundance increases. Evidence suggests that cohorts produced in big pollock years have greater survival during their first pelagic winter in the North Pacific than skinnier pups produced in years with fewer pollock. Bogoslof numbers are noted to be anomalously high.

As part of the presentation, MML staff proposed a fur seal-based pollock harvest strategy with an objective other than those mandated by the MSA, viz., a strategy that would account explicitly for recovering fur seals under the MMPA. This was discussed further in the BSAI Plan Team meeting during the EBS pollock presentation (see BSAI Plan Team pollock notes).

Sairdrone as research platform

Carey Kuhn discussed NOAA's Sairdrone mission, which is a collaborative effort with NOAA fisheries, PMEL, and Sairdrone. It was first deployed in 2015. The goal of the Sairdrone studies are to characterize fine-scale prey resources available to fur seals by following near-real-time foraging tracks of individual seals. The 2016 survey added an integrated echo sounder to measure pollock distribution and abundance on the shelf in the foraging range and during the breeding season. Two sail drones completed 2 survey grids in 2016 and were recovered after a 101 day mission. The next steps are to recover the fur seal tracking instruments this September, measure mass change of adult females and pups to quantify foraging success, and process the echosounder data.

Steller sea lions

Lowell Fritz provided an update on the western stock of Steller sea lions. Several 2016 Steller sea lion surveys were conducted throughout Alaska. The 2016 results have not yet been analyzed. Graphs of predicted counts and annual rates of change for 1985-2015 were shown. The lowest recent predicted counts occurred in 2003. From 2003-2015, adults and juveniles and the pup counts have exhibited a slow increasing trend of 2% per year. There is a recommendation to change the begin-year of the 15-year down-listing and the 30-year de-listing periods from 2000 to 2003. Overall, the Russian and western Aleutian portions of the stock are in a declining trend, the Gulf of Alaska and Eastern Bering Sea shelf portions of the stock are showing an increasing trend, and the eastern stock has recovered. New information from DNA detections and bio-energetic reconstructions are available. Winter diet data indicate that Atka mackerel and Pacific cod provide >50% of the energy for Steller sea lions. Estimated lengths of Atka mackerel and Pacific cod from hard parts in Steller sea diet data indicate overlap with the commercial fishery.

Eastern Bering Sea (EBS) bottom trawl surveys

Shelf survey

Bob Lauth presented an overview of the 2016 EBS shelf bottom trawl survey. The survey was the 35th annual survey and conducted on the chartered vessels F/V Alaska Knight and F/V Vesteraalen. Over 170,000 lengths and 15,000 age structures were collected. Both random and length-stratified sampling were used for otolith collection to further explore discrepancies between random and length-stratified length-at-age data. Initial results suggest random sampling more accurately represents age structure in the Pacific cod population. Both surface and bottom temperatures observed during 2016 were the highest in the time series. The cold pool has been contracting since 2014 and was restricted to the northern half of the shelf in 2016. The effect of water temperature on fish distribution across the shelf was discussed for most species. In particular, temperature-dependent catchability of yellowfin sole was explored during the survey as a way to explain the observed increase in both biomass and abundance. Water temperature did not appear to affect yellowfin catchability, but may have shifted the timing of their spawning migration such that they were more distributed across the shelf during the 2016 survey. Observed biomass for pollock and cod were lower in 2016 compared to 2015 but still at or above long term averages. Biomasses for most flatfish species were higher compared to 2015.

Slope survey

Gerald Hoff presented an overview of the EBS upper continental slope bottom trawl survey conducted during the summer of 2016. This was the 6th slope groundfish survey conducted since 2002. A new vessel (F/V Cape Flattery) and new skipper were contracted for the 2016 survey. Six areas and 5 depth strata (200m intervals from 200–1200m) were surveyed. An Android tablet-based data entry application was implemented this year to collect length and specimen data electronically on deck; additional equipment modifications reduced human bias in length data collection. As with the shelf survey, surface water temperatures observed during the slope survey were the highest in the time series; the narrow range of observed surface water temperatures is due to the lack of sea ice encountered in the survey area. Trends in individual species biomass were mixed, but total slope biomass increased to the highest level in the time series.

HFICE (Halibut Fishery Incidental Catch Estimation)

Cindy Tribuzio provided an update of HFICE (Halibut Fishery Incidental Catch Estimation). HFICE is a method for estimating bycatch that combines data from the International Pacific Halibut Commission's (IPHC) annual longline survey and commercial catch per unit effort (CPUE). The primary purpose of the analysis was to compare HFICE estimates during 2013- 2015 to catch estimates provided by the catch accounting system (CAS) based on the restructured observer program. Prior to observer restructuring, the IFQ halibut fishery was unobserved and catch estimates of discarded species were not accounted for in CAS. The purpose of this comparison is to evaluate whether catch history prior to observer restructuring can be estimated. If HFICE agrees with CAS estimates, then this approach may provide discarded bycatch estimates in the halibut fishery prior to 2013. For three species of bycatch tested (spiny dogfish, sleeper shark, and longnose skate), estimates differed substantially, suggesting that HFICE performs poorly for reconstructing pre-observer catch history in the IFQ halibut fishery.

The Teams recommend that HFICE estimates not be used for catch reconstruction.

Sablefish

Dana Hanselman gave the sablefish presentation summarizing preliminary (using new area sizes, and not accounting for killer whales) longline survey results, providing an update of juvenile tagging, a summary

of the recent CIE review, and preliminary models that respond to CIE suggestions. This was an Aleutian Islands survey year and the longline survey coverage extended from the Aleutian Islands to southern Southeast Alaska. The Bering Sea survey takes place only on odd years. The results use the new area sizes calculated using GIS data and also use the 150-200 m depth strata the new area sizes allow.

In general, longline survey RPNs for sablefish were up 25%. For the Gulf of Alaska, grenadiers were down 33%, Pacific cod were down 6%, roughey were down 21%, thornyhead were down 7%, shortraker were down 29%, dogfish were down 9%, and halibut were down 10%. Bering Sea and Aleutian Islands halibut were down 33%. Length frequencies for selected species were compared to the previous 3 years and the 10-year mean. Results for roughey, arrowtooth, and turbot showed little change, Pacific cod showed a smaller size frequency than past years (similar to 2015), and female and male sablefish showed a substantial bump for the 2014 year class. There have been anecdotal reports of large numbers of YOY sablefish from 2014-2016. In response to the 2014 reports, ~500 juvenile sablefish were tagged in both Southeast and Kodiak. A repeat 2016 effort resulted in ~1,000 tagged juveniles in Southeast but none for Kodiak.

A CIE review of the sablefish assessment model was conducted from 10-12 May, consensus recommendations were available 27 May, and the individual CIE reviewer reports were posted on 27 July. Dana presented some brief responses and some highlights. Short-term responses included gaining imprecision, incorporating whale depredation, and showing structural uncertainty. Long-term responses were to include a tag-integrated model, estimation of growth inside the model, consider Canadian catches, and refining the fishery CPUE index.

Dana outlined alternative models for this year's assessment. B1 will include maintenance updates with variance estimates for the longline survey and the new area sizes (Echave et al. 2013) for the longline survey. The remaining models will address imprecision as recommended by the CIE review. Model B2 will involve tuning the standardized deviation of the normalized residuals (SDNRs) of the longline survey to 1. Models B3 and B4 will address estimating M within the model, one with a prior distribution and one without. A fifth model, B5, will estimate maturity inside the model.

Dana then addressed whale depredation, beginning with the longline survey abundance index. There is an increasing trend of presence and evidence in the central and eastern Gulf of Alaska. A generalized linear mixed-effects model was recommended to address depredation by station. The model indicated a 12% CPUE reduction across areas based on evidence alone and a 9% CPUE reduction across areas based on presence. It was decided that evidence was a better measure of depredation than presence.

New this year, Dana presented absolute estimates of whale depredation in the longline fishery. Estimation of depredation in the commercial fishery is challenging because of limited observer coverage and the fact that marine mammal interactions may not always be observed (e.g., the observer is in the factory). For observed sets, depredation has had a decreasing trend in western Alaska since the late 1990s but the trend is more variable in eastern Alaska. Several types of area-specific models to estimate the effect size of depredation were tried and a generalized additive mixed-effects model (GAMM) was chosen as the best. Data were gridded into $1/3^\circ$ by $1/3^\circ$ areas and fishery characteristics averaged or summed per grid. A zero-inflated Poisson GAM was used to model the number of sets depredated per grid. Sets depredated by killer whales had 45% - 70% declines in CPUE, while sets depredated by sperm whales had reductions in CPUE between 24% and 29%. This represents between 200 t and 600 t per year. Dana then outlined incorporating whale depredation into the stock assessment model. Building on model B1 are three additional models: W1 will correct for sperm whales in the survey, W2 will add additional catch in the fishery, and W3 will do both. The result is a 7.5% increase in ABC for W1, a negligible ABC increase for W2, and about an 8% increase in ABC for W3. In general, the impacts of depredation on sablefish stock assessment and fishery operations is increased uncertainty and a 5%-7% higher ABC (if included in the longline survey index), which translates to about \$6 million. The impact of additional catch (fishery depredation) to the ABC is small, a +/- 1% lower ABC. Complicating factors, should

sperm whale depredation be included in the assessment, are the facts that pre-1998 survey depredation is not known, accounting for additional mortality in the commercial fishery is challenging, and the variability in killer whale depredation is high. Any adjustments should probably be made at the stock assessment level rather than in catch accounting or the regulatory process.

Ideas that Dana intends to bring to the November meeting include models which further address uncertainty. One model with the maintenance updates (B1), a model with the SDNRs tuned (B2), M estimated within the model (B3 and B4), a model that addresses whale depredation, or a model that contains all of these (BW.3). The CIE recommends seeking further input on the objectives, but were not concerned with static apportionment. Dana believes it is best to stay put since no new alternatives are prepared at this time. Work will continue on MSEs and the spatial issues. A new hire is starting to help with this work. Some longer term ideas include estimating growth within the model, spatial modeling, continuing work on recruitment/environmental relationships to improve projections, considering alternative recruitment regimes, and continuing work on maturity.

The Plan Teams wanted to know how many models to expect in November. Dana indicated he was still exploring, but to expect the base (B0) and maintenance updates model (B1) with perhaps three additional models to investigate what had been discussed in the presentation. He suggested it was a lot of changes to a model that has been stable for some time, so he intended to test his preliminary models, including a model with all the changes (BW.3).

The Teams recommend that Dana carry out his choice of models and look forward to seeing them in November.

Observer Program Update

Craig Faunce of the North Pacific Observer Program presented the draft 2017 Annual Deployment Plan (ADP) to the Joint Plan Teams. The objective for 2017 ADP is stability over the next two years, both financially and in terms of maintaining total sample size. Two years is also the duration of the current observer provider contract. Assumptions made for the 2017 analysis included previous vessel participation (including vessels volunteering in electronic monitoring and BSAI Pacific cod trawl fishery) as well as a stable budget generated from the 1.25% fee on fishery landings with no additional federal funds anticipated.

Based on NMFS' and the Council's recommendation in 2015, two additional sampling strata were evaluated for the 2017 ADP: vessels delivering to tenders, and partial coverage catcher processors as well as the three gear-based strata of hook and line, pot, and trawl. The 2017 ADP also recommends to continue using the trip selection method to assign and deploy groundfish observers to vessels logging trips in ODDS.

To develop the 2017 ADP, four stratification schemes and three allocation schemes were evaluated to determine the optimum sampling design for observer deployment. After comparing the different designs by simulating observer deployments and evaluating the designs using sample gap analysis, the gear and tender/non-tender stratification scheme was found to be preferable to the gear and partial coverage catcher processor stratification scheme in terms of reducing gaps in observer data.

For 2017, NMFS recommends six sampling strata: hook and line vessels \geq 40 ft LOA, hook and line vessels \geq 40 ft LOA delivering to tenders, pot vessels \geq 40 ft LOA, pot vessels \geq 40 ft LOA delivering to tenders, trawl vessels \geq 40 ft LOA, and trawl vessels \geq 40 ft LOA delivering to tenders. NMFS also recommends that the zero selection stratum be composed of vessels $<$ 40 ft LOA, vessels fishing with jig gear, and vessels volunteering in the 2017 electronic monitoring cooperative research program.

The preliminary coverage rates recommended by NMFS for the 2017 ADP are:

- Hook and line vessels = 11 %
- Hook and line vessels delivering to tenders = 27%
- Pot vessels = 3%
- Pot vessels delivering to tenders = 6%
- Trawl vessels = 18%
- Trawl vessels delivering to tenders = 14%
- No selection = 0%

The total number of sea days available in 2017 is estimated to be 3,505 days based solely on the 1.25% fishery landing fee, and no federal funding, which is 31% below the 2013-2016 average of 4,581 days. The reduction in the number of at-sea deployment days will likely result in both spatial and temporal biases.

The author also presented a recommendation for an alternating year cycle beginning in 2017, where potential deployment designs evaluating alternative stratifications and allocations to develop deployment rates would be evaluated in the on-year followed by adjusting deployment rates only in the off-year. The Council's Plan Teams, Observer Advisory Committee, Advisory Council and the Council would review these proposed deployment results in the on-year with a presentation of the deployment rate adjustment to the Council in the off-year.

The Teams recommend supporting the draft 2017 ADP deployment rates and the proposed alternating year schedule for developing the deployment rates in an on-year, followed by potential adjustments to the rates in the off-year.

Squid

Diana Stram presented an update on moving squid to the ecosystem component of each FMP versus leaving squid as a target species, as discussed at the June 2016 Council meeting. In order to evaluate the alternatives, the SSC recommended using biomass estimates for the analysis of these alternatives. However, no biomass estimate has been deemed acceptable for stock assessment purposes, so it is questionable whether a method could be found that would suffice for this analysis. The SSC requested the author to explore several means of providing an estimate and describing whether or not these methods would be acceptable. Four methods were identified: (1) redefining the time period over which catches are averaged; (2) biomass estimation using ecosystem models; (3) biomass estimation using hydroacoustic surveys such as shown in the BSAI squid SAFE for 2016; and (4) methods used in a recent analysis of global increases in cephalopods using survey and fishery data.

Olav Ormseth presented several objections to using ecosystem models to quantify squid biomass. First, "squid" are comprised of multiple species and size classes. Second, predators are finding different species and sizes than the surveys and fisheries. From diet samples, small species and juvenile *B. magister* are the focus of predators, while the fishery catches adult *B. magister*. Third, squid are consumed across a range of predators, such as birds and mammals, for which adequate quantitative diet and ration data do not exist. Therefore, he recommended that consumption-based estimates should not be used. Olav further presented initial explorations of historical catch patterns in the BSAI foreign fisheries, with the aim of determining whether the sharp decrease that began in about 1982 was due primarily to a decrease in effort or a decrease in biomass.

The Team recommends that consumption-based estimates of OFL not be used for squid. The Team also recommends that the author evaluate the methods the SSC has suggested for estimating squid biomass in this year's assessment.

Economic SAFE

Ben Fissel presented an overview of the current “Economic Status of the Groundfish Fisheries off Alaska, 2015” (i.e., economic SAFE report) and proposed plans to revise economic data tables in future reports. A separate “market profiles” glossy report is available from the Economic and Social Sciences Research Program (ESSRP) at the Alaska Fisheries Science Center (AFSC) that explains what happens to Alaska fisheries products after processing, including conditions in global markets. The presentation briefly summarized economic data for Alaska fisheries in 2015, identified new additions to the current economic SAFE report (e.g., ex-vessel price projection, Amendment 91 data, and revisions to the “communities” section), and for discussion by the joint plan team, proposed some major revisions to data tables in future economic SAFE reports.

The most commonly used tables in the economic SAFE report cover catch, ex-vessel value, and first-wholesale value. All data tables are online (www.afsc.noaa.gov/REFM/Socioeconomics/SAFE/groundfish.php). Data tables in the economic SAFE document typically cover the past 5 years, although longer time series are available in the online versions of the tables. The summary for 2015 included total catch of 2.2 million t (which was not a significant change from 2014), first-wholesale value of \$2.26 billion (down 6.9% from 2014), and ex-vessel value of \$896 million (down 4.1% from 2014). Price changes for most species were not substantial and therefore the decrease in total value is attributed to changes in the composition of the catch (e.g., higher- to lower-valued species). For example, value decreased in 2015 (relative to 2014) for sablefish, flatfish, and Pacific cod, while value increased for Atka mackerel. Flatfish catch and value decreased significantly in 2015 due to a mid-year bycatch closure for non-rockfish/non-pollock fisheries. The observed increases in value of Atka mackerel and rockfish (primarily Pacific Ocean Perch and northern rockfish may reflect redirected effort from flatfish fisheries. Globally, a significant increase in the U.S. “real effective exchange rate index” signaled an increase in the foreign currency (i.e., import) price of Alaska seafood products, which caused decreases in export quantities with little change in the price (in dollars) received by Alaska seafood exporters.

Planning for revisions to data tables in the economic SAFE reports was motivated by objectives to (i) avoid duplication and potential conflicts with other data sources, (ii) reduce the overall size of the economic SAFE report by making data available via the internet, and (iii) include tables with more detailed stratification by disaggregating “flatfish” and “rockfish” categories to provide species level data. In general, the economic SAFE report is intended to be an initial “go-to” data resource, a citable source of data for fishery analysts and researchers, and an authoritative record of economic information for Alaska groundfish fisheries at a point in time. The proposed changes were outlined in a hand-out that divided into “version 1” and “version 2”. Version 1 changes include (1) remove tables that present discards and prohibited species catch (PSC); (2) focus on retained catch rather than total catch; and (3) present species-specific economic data for flatfish and rockfish. Version 2 changes include (4) improving online data availability and (5) restructuring data tables to be based on regional stratification. In addition, Council staff have requested economic data disaggregated by fishing fleet instead of vessel length, for example.

Team members who expressed an opinion generally supported the proposed revisions, and in particular, removal of discard/PSC data tables from the economic SAFE report, replaced with links to the definitive source (i.e., Alaska Regional Office).

The Teams discussed some problems involved with navigating the economic SAFE report.

The Teams recommend including a glossary of terms at the beginning of the report to help guide use of the tables and provide a better understanding of the differences between tables (e.g., ex-vessel vs. first-wholesale measures of fishery value and prices). In addition, the Teams recommend including more data on employment in Alaska fisheries.

The discussion of economic data concluded with a response to a suggestion made at last year's September Joint Team meeting. The suggestion was for the ESSRP to prepare a short (1-2 pages) economic performance report for stock assessment authors to include in each stock assessment chapter. An example was presented for sablefish that applied to both BSAI and GOA areas. In addition to sablefish, another 9 reports were proposed, stratified by species X region (pollock, Pacific cod, flatfish, and rockfish in BSAI; pollock, Pacific cod, arrowtooth, and rockfish in GOA). A question was raised about including information for more species of rockfish (e.g., Dusky) beyond the proposed Pacific ocean perch and northern rockfish. In general, the format of the introduction to the economic performance reports is envisioned to include a mix of stock status, regulations, market conditions, and economic value. There was also a question about how to incorporate performance reports that apply to aggregate categories for rockfish and flatfish into individual chapters for rockfish and flatfish. By way of analogy, it was noted that portions of the Ecosystem Considerations section are duplicated in individual stock assessment chapters. Questions regarding economic data for individual fisheries can be forwarded to the ESSRP staff. The Teams commended the authors on the new 2 page economic performance report, but, the Teams were not able to fully review the content of the example report for sablefish to provide further guidance.

The Teams recommend continued development of the 10 proposed economic performance reports.

Octopus

Three issues were discussed related to octopus. First, Kerim Aydin presented an updated BSAI Pacific cod consumption estimate with new stomach data. The new estimate shows an increase in the long-term average consumption rate from 3,452 t to 4,770 t. These estimates are a full order of magnitude higher than the current fishery catch of octopus. Kerim asked the following questions:

The Teams recommend that the new stomach data be used to report two estimates of the consumption rate in this year's BSAI assessment, one based on harmonic means and the other based on medians. The Teams also recommend that the new estimates be updated with data for the years 2012, 2013, and 2016 in the next full BSAI assessment after 2016.

Kerim also addressed why the consumption estimate works for octopus, but not squid. The octopus species is the same in the Pacific cod diet and Pacific cod fishery. The Pacific cod stock and fishery are at the same locations and depths. Pacific cod is well-monitored for biomass and a large proportion of the Pacific cod diet is octopus, compared to squids that are consumed by many predators including birds and mammals. Also, the disadvantage for both octopus and squids are that the consumption is of smaller juveniles and the fishery targets adults.

Second, Liz Conners presented a summary of recent octopus research including final results of the discard mortality rate (DMR) research and the octopus tagging study.

The Teams recommend status quo of 100% mortality for octopus discards instead of pursuing DMRs. The reasons discussed were that using DMRs would be a big change and might lead to requests to pursue DMRs for several other species.

Third, Liz presented a description of a theoretical population model for giant Pacific octopus, *Enteroctopus dofleini*. This is not a stock assessment model and is not fitted to any data. It allows simulation of an octopus population under different assumptions and may be useful for exploratory analysis, including which input data would be most useful in tracking changes in population biomass.

Stock Structure and Spatial Management (BSAI BS/RE)

Diana Stram presented the report of the Stock Structure and Spatial Management workshop that was held in July. The report includes a PowerPoint presentation by Paul Spencer that provided an overview of

BSAI blackspotted/rougheye (BS/RE) rockfish stock structure and spatial harvest, and the background for the recommendations for the maximum subarea species catch (MSSC) beginning in 2014. The report also includes a proposed timeline of actions related to stocks where the Team(s)/SSC have expressed “strong concern” regarding stock structure, and a summary of the benefits and drawbacks to the two main approaches considered at the workshop: 1) subarea ABC and TAC, and 2) MSSC (including a multi-year average MSSC). Diana listed the following “Plan Team considerations:” and comments on following the spatial management process:

- Ad hoc approach for BSAI BS/RE
- Lacks analytical impact assessment
- What type of additional analyses needed before or after management recommendations
- What are the specific recommendations for BSAI BS/RE in 2017
- Other stock implications:
 - Spatial issues as with northern rockfish (catch and assessment structure)
 - Is localized depletion an issue if longer lag times between assessments (possibly off-cycle considerations?)

Paul Spencer then gave a presentation describing analyses that were prompted by some issues raised during the July workshop, including:

1. possible complication of the TAC-setting process caused by subarea management;
2. possible reductions in flexibility caused by subarea management;
3. possible effects of managing one particular subarea (specifically, the western AI) on the remainder of the stock; and
4. the distribution of fishing effort relative to the border between the western and central AI.

His main conclusions were, respectively:

1. The number of stocks for which TAC has been set lower than ABC has increased in recent years, although the number of species/area combinations has barely changed. If simplicity in TAC-setting is the goal, this could be achieved by setting $TAC=ABC$ for more of the small stocks, which would require only small (in proportionate terms) changes in TAC for the large stocks.
2. Substantial flexibility exists whenever $TAC < ABC$, because TAC can be exceeded as long as ABC is not exceeded. Also, precedents exist for in-season reallocation of TACs between sectors or even between species.
3. Even if a subarea ABC in the western AI were to result in shifting some effort into the central AI, it appears unlikely that this would have a deleterious impact on the portion of the stock in the central AI, as catches for the last 10 years in that subarea have averaged only 49 t, compared to this year’s MSSC of 324 t.
4. Between 2008 and 2015, the percentages of observed BS/RE catch in Atka mackerel hauls and rockfish hauls near the border between the western and central AI have never exceeded 2.8% and 16.2%, respectively.

The 2016 BS/RE catch in the western AI through September 3 was 34 t, compared to the 2016 MSSC of 58 t. Unless catch in the remainder of the year increases unexpectedly, it appears that 2016 catch will not exceed MSSC.

Representatives from the fishing industry commented that they were appreciative of the work on stock structure and spatial management, and because of their ongoing efforts to reduce incidental catch with the MSSC they did not see the need for subarea ABCs/TACs. Alternatively, some Plan Team members noted that because the subarea ABC would be equal to the MSSC, the recent catches below the MSSC could be obtained under the subarea ABC/TAC framework without expected regulatory discards or resorting to an alternative management structure. This led to a discussion of the benefits and drawbacks of the two

alternatives (both in general and for BSAI BS/RE in particular), as tabulated in the report from the July workshop.

Comments related to subarea ABCs include:

1. Transparency and familiarity with a well-established management system and a clear disincentive to harvest fish when the subarea ABC is reached
2. Potential for regulatory discards if the bycatch species cannot be avoided by the target fishery.

Comments related to use of the MSSC include:

1. It provides flexibility to exceed subarea harvest goals without requiring discarding,
2. It may be less transparent since the MSSC does not appear in the harvest specification table or the Federal Register, but is readily available online
3. Requires additional work to maintain separate category of management advice
4. An MSSC has could be removed at any time by the PT and SSC

Other general Plan Team comments included:

Perhaps MSSC should be the default tool for subarea management rather than subarea ABC/TAC, given the bullets above. Use of MSSC for BSAI BS/RE does not imply that MSSC would automatically be the preferred tool for all future applications of subarea management. It would be good to determine whether the costs associated with subarea ABC/TAC exceed the costs associated with MSSC. The Council policy is now working better than in previous years. The Teams have previously identified GOA skates and BSAI BS/RE as the only stocks or stock complexes where “strong concern” regarding stock structure is warranted, but it is unclear that this conclusion was appropriate in the case of GOA skates.

The Teams recommend that MSSC-based management of BS/RE continue in the western AI during 2017 and that catch continue to be monitored relative to the MSSC.

The Teams also recommend that the Region prepare a white paper discussing the details of the management and regulatory implications of subarea ABCs/TACs using BS/RE or other relevant case in the BSAI as an example for illustration.

Essential Fish Habitat (EFH)

Steve MacLean, John Olson, and Pete Hulson presented methods and criteria to evaluate the effects of fishing on EFH. John Olson presented an overview of the models used, Pete covered the core EFH area example for POP and pollock and some example correlations. Pete noted that neither POP nor pollock exceeded the threshold for 10% habitat reduction but the correlations were run as examples regardless. The Plan Teams noted that habitat reduction estimates are likely influenced by the relatively rapid recovery rates used in the model configuration. Recovery rates for habitats in the models were all less than 10 years. The Plan Teams noted that cold water corals and sponge habitats in Alaska are slow growing and long lived and thus have recovery rates greater than 10 years. John Olson noted that future model runs will have longer recovery rates.

Stock indices include: time trends in growth/maturity, spawning success (recruitment), breeding success (spawning distributions), and feeding success (feeding distributions). For POP and pollock examples there were no correlations indicated therefore there were no stock assessment concerns. If correlations had been indicated and there seems to be a plausible connection to habitat there could be a population level effect associated with habitat reduction and the next steps would be to raise these to the Plan Teams (and SSC and Council) to evaluate needs for mitigation.

Steve described the hierarchical impact assessment that would be used if correlations indicate that there are reasons for examining mitigation. Team members questioned to what extent the 50% population quantile is correct. Team members expressed concern that use of a 50% cut-off might make it difficult to

see a signal. Discussion included suggestions that a higher percentile would be more likely to detect impacts, but would exclude much of the potential habitat; whereas a lower percentile would include more habitat, but spread out the possible impact of fishing in areas with concentrated fishing. Team members questioned if this method has been run for all areas, or evaluated over a range of species and, in particular, how localized areas will be addressed (e.g. cod alley).

The analysts had several questions for Plan Team input. These are summarized below with feedback and recommendations from the Teams as applicable.

1. Are the assessment cutoffs correct?

- Core area = upper 50th percentile of predicted abundance or suitable habitat
- Impact threshold for further impact assessment: 10% reduction in habitat
- P-value of 0.1 for significance of correlation with time trend in habitat disturbance in core area

The Teams recommend that the analysts consider alternatives to using the 50th percentile to define the core area, including use of higher or lower percentiles and also dispensing with the core area concept altogether by weighting the location-specific impacts by the relative density of fish in each location. The Teams also recommend that P-values be corrected for multiple comparisons, or that guidelines be established for the number of comparisons to evaluate.

2. Should assessments be based on regional boundaries for the stock/species?

The Teams recommend that the analysts consider evaluating GOA for only those regions open to trawling. For example, the Eastern Gulf of Alaska trawl closure area could be removed from the analysis for certain species such as rockfish that have subarea-based stocks.

The Teams also recommend that the analysts evaluate the extent to which their methodology addresses the concern raised in the CIE report on EFH that the previous EFH impact analyses did not give adequate consideration to localized (versus population level) habitat impacts.

Team members also inquired about how best to analyze impacts on stocks whose distribution is shifting.

3. What seasons should be used for the analysis?

Three options for habitat maps were presented by the analysts. These were:

- Summer only – best data, broadest distribution
- Seasonal based on MaxEnt for non-summer + GAMs for summer
- Average cumulative impacts over seasons by converting GAMs to MaxEnt for summer

Team members noted that summer data are the best data for distributional analysis. Team members also suggested that, if only one map is required, then it is not advisable to add maxent with GAM modeling. The analysts indicated that the comparison of impacts is not intended to be assessed seasonally. Analysts would like to know if it is an important comparison to look at seasonally or how best to include information (e.g., highest values) from both seasons. Steve noted that a single map is not an MSA requirement but rather per Council direction. Other discussion: Is there utility in combining information into one map? Are assessment authors supposed to evaluate impacts to habitat on a seasonal basis? Annual maps would cover the entire distribution of EFH for the species. Seasonal maps are only as good as the underpinning data and the data are best for summer. Anne Hollowed noted that seasonal changes are most important for stocks that spawn somewhere other than where they feed.

The Teams recommend use of a single universal map which aggregates seasonal information. The Teams recommend that stock assessment authors provide feedback to the EFH analysts as to how best to compile seasonal information for each of their stocks into single maps.

In the event that an EFH analyst or an assessment author identifies a possible adverse impact to EFH, the respective Plan Team(s) would be alerted and would discuss to what extent it appears to be an issue. The intent of this is to try to move the full responsibility for making an adverse call off of the stock assessment author. Analysts will alert assessment authors who in turn will raise the potential issue to the Plan Teams. The Teams recognize that a process will need to be developed to address next steps moving forward following an indication of an adverse impact.

The Joint Groundfish Plan Teams will review EFH definitions and descriptions in March 2017. Depending upon the status of these changes, the Teams can likely do this review by teleconference or webex.

Minutes of the Bering Sea and Aleutian Islands Groundfish Plan Team

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

September 13 - 16, 2016

Northern rock sole recruitment

Tom Wilderbuer presented work that Dan Cooper, Lauren Rogers, and he are preparing as an appendix to the November northern rock sole assessment. The appendix deals with estimating northern rock sole recruitment in the last (most recent) 6 years of the assessment using environmental covariates.

The problem is that we do not have much information on incoming year classes until they reach about age 5. The hypothesis examined in the appendix is that environmental covariates can be used to estimate recruitment at earlier ages.

Previous work compared recruitment and 80s and 90s surface currents. Recruitment in the 80s was good, driven by the right currents; 90s not so good. In 2006, the relationship is more complicated than just using a wind covariate, however.

Dan examined juvenile densities in previous work; warm years are good for nursery productivity.

Recruitment is good when its mean latitude is further north. The authors evaluate 3 questions:

1. Do onshore winds and the size of the cold pool (as a percentage of the nursery area) affect recruitment of northern rock sole?
2. Does the effect of the cold pool on recruitment depend on the presence of favorable winds? (i.e. is there a significant interaction?)
3. Does including wind and cold pool covariates in the stock-recruitment model improve predictions of age-4 recruitment?

13 models of different complexity were of three types (1) some Ricker with covariates etc., 2) log-linear regression models, and 3) autoregressive (AR) models on previous year recruitment or running mean recruitment.

Models are compared with 5 metrics: 1) AIC, 2) MSE (leave-one-year-out (LOYO), log-scale), 3) MSE (one-step-ahead, log-scale), 4) MSE (leave-one-year-out, real scale), and 5) MSE (one-step-ahead, real scale).

The AR model based on previous year recruitment works quite well in out-of-sample prediction (it was by far the best model in all MSE categories except real-scale LOYO, where its MSE was only 16% higher than that of the best model).

Regression models with both winds and cold pool index work better than models with winds or cold pool alone.

Ricker models do much more poorly. Models that included Ricker dynamics in addition to winds and the cold pool index generally perform more poorly in terms of prediction relative to models with only the environmental covariates.

The Plan Team appreciates the different metrics of model skill including out-of-sample prediction. One Team member pointed out that you could use the cold pool and other covariates as a survey of recruitment in the model in SS. Another member noted that the authors could use Beverton-Holt since it does not curve down at high biomasses. Another noted that the AR models might not do as well if SSB drops significantly.

The Team recommends that the appendix be included in the November assessment.

Northern rockfish stock structure

Last November, the Team had requested Paul Spencer to examine the northern rockfish catch data in August 2016 and, if it appeared that the 2016 catch in the Eastern AI was likely to be much higher than what would be expected under an area-specific ABC for 2016, to present a stock structure template update at the September meeting. This request was motivated by the fact that the 2015 catch in the Eastern AI was much higher than an area-specific ABC would have been. Although the catch data as of August did not suggest that the year-end catch would be likely to exceed the hypothetical area-specific ABC, Paul provided the Team with additional information on stock structure and the fishery for northern rockfish. Paul noted that the Team's earlier (2012) determination of little or no stock structure concern had been predicated on the understanding that there would be no directed fishing for northern rockfish. However, directed fishing for northern rockfish was open for a portion of each year from 2009-2016 to reduce regulatory discards, and much of Paul's analysis focused on quantifying the amount of directed fishing. Paul noted that the directed fishery closure likely results in an economic cost.

The Team recommends that the assessment author provide a figure comparing area-specific catches to the corresponding hypothetical area-specific ABCs (as in Figure 3 of this year's document) as part of the assessment during "on" years. Additional updates to the template are not necessary unless the assessment author becomes aware of new stock structure information that he wants to provide to the Team.

BSAI Pacific cod CIE review

Grant Thompson presented an overview of the CIE which occurred in February 2016 and the comments made by the reviewers. The comments were reviewed in detail during the Joint Team Subcommittee meeting in May 2016, and the comments prioritized. The result of the JTS and CIE meetings was a list of candidate models, presented here. Details of the CIE and JTS are provided in the JTS minutes.

To summarize, the Terms of Reference consisted of two general areas of focus: 1) data, and 2) model structure and assumptions. Seventeen new models were presented for the BS assessment and 10 new models for AI. There was no attempt to write a consensus CIE report, but the individual authors each wrote a report and 135 comments were condensed from them. Recommendations included investigating the weighting of the composition data, using the IPHC and NMFS longline survey data, and introducing as little variation as needed for time-varying selectivity. Reviewers were skeptical of the survey Q fixed at 0.77. Some concepts left by the JTS to be decided by the analyst include how to: 1) weight abundance indices more heavily than sizecomps, 2) use the simplest selectivity that gives a reasonable fit, 3) not allow strange selectivity patterns, and 4) estimate Q with a fairly non-informative prior. Grant developed some very creative measures to address these concepts.

Bering Sea Pacific cod assessment

Grant Thompson presented the base model and the other candidate models requested by the JTS and SSC for this year's specifications.

Models

Model 11.5: BS, the final model from 2015 (same as the final models from 2011-2014)

Model 16.1: Like BS Model 15.6, but simplified as follows:

- o Weight abundance indices more heavily than sizecomps.
- o Use the simplest selectivity form that gives a reasonable fit.
- o Do not allow survey selectivity to vary with time.
- o Do not allow survey catchability to vary with time.
- o Force trawl survey selectivity to be asymptotic.
- o Do not allow strange selectivity patterns.
- o Use empirical weight at age.

Model 16.2: Like BS Model 15.6, but including the IPHC longline survey data and other features, specifically:

- o Do not allow strange selectivity patterns.
- o Estimate catchability of new surveys internally with non-restrictive priors.
- o Include additional data sets to increase confidence in model results.
- o Include IPHC longline survey, with 'extra SD.'

Model 16.3: Like Model 16.2 above, but including the NMFS longline survey instead of the IPHC longline survey.

Model 16.4: Like Models 16.2 and 16.3 above, but including both the IPHC and NMFS longline survey data and two features not included in either Model 16.2 or 16.3, specifically:

- o Start including fishery agecomp data.
- o Use empirical weight at age.

Model 16.5: Like Model 16.4 above, but including two features not included in Model 16.4, specifically:

- o Use either Francis or harmonic mean to determine weightings.
- o Explore age-specific M (e.g., using Lorenzen function).

The data used in this preliminary assessment are identical to those used in last year's final assessment (Thompson 2015), except for:

- the addition of "empirical" weight-at-age data in Models 16.1, 16.4, and 16.5;
- the addition of IPHC survey data (abundance index and size composition) in Models 16.2, 16.4, and 16.5; and
- the addition of NMFS longline survey data (abundance index and size composition) in Models 16.3, 16.4, and 16.5.

The author expressed the following concerns regarding using the empirical weight-at-age data:

1. No smoothing was applied to the estimates, even though they exhibit a fair amount of variability. For example, in the set of mid-year survey estimates, 18% of the cells differ from their respective age-specific time series average by 20% or more (not counting age 0); and in the set of fishery estimates, 34% of the cells differ from their respective age-specific time series average by 20% or more (not counting ages 0 or 1).

2. Age data exist for only 17 of the 34 years in the survey time series and only 4 of the 39 years in the fishery time series. Long-term averages were used for all years with no age data.
3. The fishery age data come primarily from the longline fishery, and may not be representative of the overall fishery.
4. Because the trawl survey takes place in summer, beginning-of-year population weights at age were calculated by averaging mid-year weight(age,year) and mid-year weight(age-1,year-1), implying that weight at age changes linearly within each one-year interval.

The author responded to the JTS acknowledging the subjective terms: “weight”, “reasonable fit” and “strange” as follows:

- The relative “weight” assigned to abundance indices and size composition data was determined by comparing the average spawning biomasses from three models: one with both biomass and sizecomp data “turned on,” and two others with one of these data components “turned on” and the other “turned off” (Model 16.1).
- To focus on the ability of a particular functional form to fit the data, independent of the absolute values of the sample sizes specified for the associated multinomial distribution or λ values, weighted coefficients of determination (R^2), computed on both the raw and logit scales, were used to measure goodness of fit (Model 16.1).
- In general, a “strange” selectivity pattern was defined here as one which was non-monotonic (i.e., where the signs of adjacent first differences changed), particularly if the first differences associated with sign changes were large (in absolute value), and particularly if sign changes in first differences occurred at relatively early ages. Specifically, an index of “strangeness” was defined (Model 16.1-16.5).

Results

The candidate models produced a wide range of 2016 female spawning biomass (133,000 t to 457,000 t) and depletion estimates (0.09 to 0.61). In particular Model 11.5, with survey catchability fixed at a low value, produced high biomass estimates, with the lowest model CV. Models that estimated survey catchability mostly produced higher estimates of catchability (0.64 to 1.59) and correspondingly lower biomass estimates. Natural mortality was also estimated in models 16.1 to 16.5 and was typically less than the fixed M (0.34) in Model 11.5. Model 16.1 estimated a Q of 0.64 and an M of 0.373. It was noted that the ageing error bias for age 20 varied across runs, but Grant explained that the ageing error bias at ages with more observations is not as variable as it may seem.

Fits to the surveys varied with the trawl survey showing better fit and correlation than the IPHC and NMFS longline surveys. The IPHC longline survey was negatively correlated with the model expectations. A question on how many Pacific cod are caught by the NMFS longline surveys revealed about 6,000 to 10,000 in the Bering Sea.

Model 16.5 used the harmonic mean of the effective sample size to determine weightings for length and age composition data. In general, survey length compositions were upweighted, and survey age comps as well as fishery age comps were down-weighted compared to the input sample sizes.

Model 16.1 showed the best retrospective behavior, followed by Model 16.2. The status quo model (Model 11.5) showed a generally poor retrospective behavior.

Overall, three models estimated low current female spawning biomass and exploitation rates above targets (16.3, 16.4, and 16.5).

Discussion and Issues

A discussion about the models that Grant will bring forward in November followed. The Plan Team can expect to get two models at most, but may suggest additional ones. One comment suggested that 16.1 is the only model that is reasonably fitting the observations of an increasing survey and increasing catches.

There was some discussion about forcing the trawl survey selectivity to be asymptotic, and it was pondered if there are a lot of cryptic older fish. Anecdotal evidence suggests that the fishery catches older fish than the survey observes. Weinberg et al. (2016) suggest that survey selectivity is asymptotic. It is a possibility that larger fish are caught by the fishery later in the year, after the survey is complete. An industry representative explained that the fishery primarily takes place around 70 fathoms, but they do catch fish beyond 200 m. It may be possible to look at bycatch in the sablefish fisheries or the NMFS longline survey to determine if predominantly older fish occur beyond the maximum depth surveyed by the trawl survey.

There was also a discussion about the use of empirical weight-at-age. Many caveats were presented with regard to weight-at-age data: few years of fishery observations are available, only half of the survey years have weight-at-age, and a paucity of data can result in large inter-annual changes. Smoothing may help address some of these concerns. Additionally, Team members did not fully understand how Stock Synthesis uses empirical weight-at-age and estimates a growth curve to fit length observations. A side conversation between Grant and Allan Hicks concluded that SS is capable of doing this with the biomass determined from weight-at-age and growth estimation fitting length data. However, the consequences are not completely understood and it may be worth investigating (i.e., what are the imputed annual length-weight relationships?). The Plan Team discussed the empirical weight data, but did not reach a specific conclusion. One Team member asked how much data we would need in order to be comfortable using empirical weight-at-age?

Time-varying selectivity was not used in Model 16.1, but it may help explain some of the mis-fitting of the composition data.

The Team recommends bringing forward as many of the following six models, listed in prioritized order, as time permits, but Models 11.5 and 16.1 at a minimum:

- A. Model 11.5**
- B. Model 16.1**
- C. Model 16.1 without empirical weight-at-age**
- D. Model 16.1 without empirical weight-at-age and including NMFS LL survey**
- E. Model 16.1 with time-varying survey selectivity**
- F. Model 16.1 with time-varying fishery selectivity**

Aleutian Islands Pacific cod assessment

Aleutian Islands Pacific Cod is currently a Tier 5 stock, using the random effects biomass. The author presented age-structured models in an effort to move the assessment to Tier 3. The presentation here focused primarily on potential age-structured models. A request to examine weight-at-age by area was not completed due to an oversight, but will be addressed at a later date.

Models

The model used for stock specifications in 2015, the base model for this year's discussions, is named Model 13.4. In addition, Model 16.1-16.5 are presented in response to requests by the JTS and the SSC comments.

Model 13.4, the final model from 2015 (Tier 5 random effects model)

Model 16.1: Like AI Model 15.7, but simplified as follows:

- o Weight abundance indices more heavily than sizecomps.
- o Use the simplest selectivity form that gives a reasonable fit.
- o Do not allow survey selectivity to vary with time.
- o Do not allow survey catchability to vary with time.
- o Do not allow strange selectivity patterns.
- o Estimate trawl survey catchability internally with a fairly non-informative prior.

Model 16.2: Like AI Model 15.7, but including the IPHC longline survey data and other features, specifically:

- o Do not allow strange selectivity patterns.
- o Estimate trawl survey catchability internally with a fairly non-informative prior.
- o Estimate catchability of new surveys internally with non-restrictive priors.
- o Include additional data sets to increase confidence in model results.
- o Include IPHC longline survey, with “extra SD.”

Model 16.3: Like Model 3 above, but including the NMFS longline survey instead of the IPHC longline survey.

Model 16.4: Like Models 3 and 4 above, but including both the IPHC and NMFS longline survey data.

Model 16.5: Like AI Model 15.7, except:

- o Use the post-1994 AI time series (instead of the post-1986 time series).
- o Do not allow strange selectivity patterns.
- o Estimate trawl survey catchability internally with a fairly non-informative prior.

The data used in this preliminary assessment are identical to those used in last year’s final assessment (Thompson and Palsson 2015), except for:

- The addition of IPHC survey data (abundance index and size composition) in Models 16.2 and 16.4; and
- The addition of NMFS longline survey data (abundance index and size composition) in Models 16.3 and 16.4.

As with the EBS Pacific Cod presentation, the author responded to the JTS acknowledging the subjective terms: “weight”, “reasonable fit” and “strange” (see above), but also “fairly non-informative prior”. The phrase “fairly non-informative prior” was interpreted as meaning a non-constraining uniform prior distribution.

Results

Models 16.1 and 16.3 produced the lowest estimates of present female spawning biomass, ~85,000, with the lowest CVs. In contrast, Model 16.2 estimated present female spawning biomass at ~450,000 with a CV=0.45. Catchability estimates ranged from 0.161 (Model 16.4) to 0.527 (Model 16.1.), and it is not strongly believed that survey catchability should be close to 1 or even 0.77.

Models 16.2-16.4 fit the IPHC and NMFS LL survey fairly well, and less so with the trawl survey data, although the correlation of observations and expected values was highest for the trawl survey. The survey selectivity was dome shaped, which is likely not appropriate for the longline surveys. None of the age-structured models showed improved retrospective patterns over the status quo, Model 13.4, Mohn’s rho showed better values for some of the models than the the figures might suggest because it is based on the final predicted year.

All of the models predicted that the fishing mortality was below the target with the exception of about six years in Model 16.1 and the rare year in Models 16.5 and 16.3.

Discussion and Issues

It appears that none of the models are performing exceptionally well, and the possibility of moving forward with only the old model (13.4) was discussed. The Plan Team was not sure if the SSC would be OK with this. Endorsing Model 16.1 may be a useful move forward for this stock, and the Plan Team could request some changes such as asymptotic selectivity, although Grant noted that he could not get reasonable fits without dome-shaped selectivity.

The inclusion of all surveys may be useful due to a paucity of data, and it was debated (without a definitive conclusion) whether or not the longline surveys should have asymptotic selectivity.

A lengthy discussion was had on the strategy of focusing on what we can learn by focusing on the BS stock and not spending a lot of time on the AI stock at this time. Those lessons learned could then be applied to both stock assessments to improve them. It was determined that we could learn about 1) the use of empirical weight-at-age data for Pacific cod, 2) the benefit and best practices of including longline surveys, 3) more exploration of new data sources, and 4) new concepts that may need more investigation (such as weightings, for example).

It was also noted that the SSC will comment on this draft document, and may make their own recommendation.

The Team recommends staying with the status quo model (Model 13.4), allow the SSC to comment on this draft document, and to focus more on developing and improving models for the Bering Sea stock. However, Model 16.1 is the Team's preferred age-structured model, and the Team appreciates the progress made. However, the Team sees a benefit of spending more time on developing age-structured models and methods using the EBS stock.

It is recognized by the Plan Team that per SSC comments and the author's discretion, that the author may bring forward a better model than 16.1. The Plan Team has concerns regarding the form of the selectivity and the new data sources. **We feel that these issues cannot be fully examined by November, but the Team recommends that they be addressed in the next cycle (2017).**

Mid-year review of Pacific cod assessment models

The Plan Team discussed the importance and usefulness of a spring review of Pacific cod models, as has been done in the past. These workshops have been appreciated by industry because the forum allows for additional comments and they feel that the models are not in a settled state. However, the Plan Team feels that at some point we will have to stop the mid-year review because we cannot keep treating Pacific cod differently than other stocks and it was proposed that a mid-year review not occur in 2017. The SSC has stated that they would prefer to not be involved, but do appreciate the mid-year review.

A concern is that the mid-year review results in many comments that may distract from the most important comments. There was recently a CIE review that provided more than 100 comments, so there may be enough work to be done without invoking another review. However, the stock assessment authors may appreciate a mid-year review and the feedback provided, and without a meeting may be forced to make many decisions on their own. However, there will still be opportunity for informal workgroups to discuss model issues.

The Team recommends that the mid-year meetings cease unless exceptional circumstances necessitate such a meeting.

BSAI Arrowtooth Flounder

Ingrid Spies presented recent arrowtooth flounder model developments, which included data weighting and an improved length-age conversion matrix. As the BSAI arrowtooth flounder model is based on the BS shelf survey, BS slope survey, and AI survey, all of which have different sampling frequencies and numbers of hauls, she explored methods to weight the survey index data and the size composition data. In the current model, sizecomp data are weighted the same for all survey and fishery years, with a multinomial sample size of 200 for the survey sizecomp data and 25 for the fishery sizecomp data, and all likelihood components are assigned a multiplicative weight (“lambda,” or “emphasis”) of 1.0.

The exploration of data weighting was conducted according to the two-step process described by Francis (2011), where step 1 involves using information about the data by themselves (e.g., number of samples, number of hauls from which data were taken, etc.), and step 2 involves tuning the weights based on the model’s fits to the data. Final multiplicative weights are the product of the respective step 1 and step 2 multiplicative weights.

Five weighting approaches were explored:

- Model A: step 1 multinomial sample sizes and multiplicative weights were left as in the current model; step 2 multiplicative weights were set on an *ad hoc* basis for the survey index data and fixed at 1.0 for the sizecomp data.
- Model B: step 1 was the same as in Model A; step 2 multiplicative weights were set at 1.0 for all data components.
- Model C: step 1 multinomial sample sizes were set equal to the number of hauls from which data were taken and multiplicative weights were set at 1.0 for all data components; step 2 multiplicative weights were set on an *ad hoc* basis for the survey index data and set at 1.0 for all sizecomp data components.
- Model D: step 1 was the same as in Model C; step 2 multiplicative weights for the index data set by tuning the standard deviations of normalized residuals and multiplicative weights for the sizecomp data set by Equation TA1.8 of Francis (2011).
- Model E: step 1 was the same as Models C and D; step 2 was the same as in Model D, except that the multiplicative weight for the fishery sizecomp data was multiplied by 0.1.

The following table shows the resulting step 2 multiplicative weights for all models and data components:

Model	Biomass data			Size composition data			
	Shelf	Slope	AI	Shelf	Slope	AI	Fishery
A	12	3	5	1	1	1	1
B	1	1	1	1	1	1	1
C	12	3	5	1	1	1	1
D	3.3	1.3	2.4	0.46	0.28	0.16	0.11
E	3.3	1.3	2.4	0.46	0.28	0.16	0.011

Model A is Ingrid’s preferred model. Although the standard deviations of normalized residuals for the survey index data are all somewhat high, she felt that they were reasonable, and the smaller sizecomp weights from Models D and E did not improve the fits to the index data appreciably. She noted that the Francis paper suggests that *ad hoc* weighting in step 2 (as in Model A) can be an acceptable method in some cases.

The Team recommends examining the length at age data to determine if they came from a length stratified or a random sample. If two different sampling methods were used, the results are not directly comparable. For November, the Team recommends that the length-age conversion matrix

be corrected if needed. The Team recommends bringing forward the original (2014) model and Model A with the new weightings in November.

BSAI Alaska Skate

Olav Ormseth presented a follow-up analysis of the Alaska skate age-structured models he presented in 2014 (the last year for a full assessment). The Alaska skate is the primary species in the BSAI skate complex, and is managed under Tier 3. All other skates are considered Tier 5 and there is a single aggregate OFL for the BSAI skate complex. In 2014 Olav presented a new model (14.2) that was substantially improved relative to the existing model (13.1) and was accepted by the Plan Team and SSC for use in harvest recommendations. However, the Plan Team raised questions regarding the fact that in Model 14.2 OFL increased while both spawning biomass and F35% decreased, and Olav was asked to explore the reasons for these changes. No document was provided.

Models

There were 5 models presented for this preliminary assessment to address concerns about dramatic changes between Model 13.1 and Model 14.2. There are two major changes examined between the different models: adjusting the dome-shaped selectivity; and fixing weight-at-age/length parameters that were misspecified in Model 13.1. The new alternatives are in essence a sensitivity analysis to examine how fixing the errors in Model 13.1 impacted the results.

- Model 13.1.p: projection model using data from SS Model 13.1
- Model 14.2.p: projection model using data from 14.2, the new SS model accepted in 2014
- Model 13.1.sw: projection model using data from a new SS run of 13.1 but with the updated weight parameters used in 14.2
- Model 13.1.pw: Re-ran projection model only for Model 13.1 but with weight at age from Model 14.2, i.e., identical to 13.1.p except for the weight-at-age data
- Model 14.2.ps: Re-ran projection model only for Model 14.2, but with selectivity from Model 13.1, i.e., identical to 14.2.p except using the selectivity from 13.1

There were no changes to the input data for these models.

Results

Model 14.2 resulted in lower F_{OFL} and biomass than Model 13.1, but a higher OFL, which prompted the requests by the Plan Team and SSC to examine the model in more detail. Within the SS model, the changes resulted in a maturity ogive that is more consistent with empirical data and the spawning stock is younger and faster-growing. Of note is that the maturity ogive is shifted younger in that the new model never reaches 100% maturity at age. Maturity is modelled based on length, which gets converted to age, so the conversion may force the asymptote less than 100%, however, it was also pointed out that the standard error around length at age impacts the maturity curve. The purpose of Models 13.1.sw, 13.1.pw, and 14.2.ps was to examine which changes influenced the model results. Correcting the misspecification in the length-weight relationship inside SS (i.e., Model 13.1.sw) reduced the biomass estimates relative to 13.1, and correcting the same misspecification inside the projection model (i.e., Model 13.1.pw) reduced the biomass estimates even more, while substituting the selectivity from 13.1 into 14.2 (i.e., Model 14.2ps) resulted in higher F_{OFL} but little change in biomass relative to 14.2.

Discussion

The Plan Team discussed the model results and requested that the author bring forward Model 14.2 for the November assessment, and include the work presented here as an appendix. Within the appendix the Plan Team suggested showing exploitation at age using F_{OFL} , selectivity, and biomass at age to show changes, just as a simple spreadsheet, to make it easier to discern the changes between models.

The Team recommends that the author bring forward Model 14.2 for the November assessment, and include the work presented here as an appendix. Within the appendix the Team recommends showing exploitation rate (at age and overall) using FOFL, selectivity, and biomass at age, just as a simple spreadsheet, to make it easier to understand why OFL went up while spawning biomass and FOFL both went down.

The Team also recommends that the author revisit the list of recommendations made by the Team and the SSC in 2014/2015 to ensure that all recommendations are addressed in the November assessment. The author can bring forward new models in November at his discretion, as a result of any previous recommendations not addressed during this presentation.

EBS Acoustic trawl pollock survey

Taina Honkalehto presented results from the Acoustic Trawl survey of EBS pollock. She noted that the 2016 survey biomass estimate was the highest since the 1980s.

Since 1994 the surveys have extended into the Russian EEZ. However, permits in 2016 were not granted in time so only the U.S. zone was covered. Jellyfish appeared to be more prevalent than normal. As usual, a number of additional projects were conducted including euphausiid target strength estimation, and conducting experiments using a Saildrone.

Alex DeRobertis presented information about estimating the abundance between 0.5 and 3 m off bottom (Lauthenberger in press at CJFAS). There are acoustic data collected on the bottom trawl survey that can be compared with the trawl catches. The trawl stations were restricted to the area that the acoustic trawl operates. The trawl hauls and acoustic data collected on the survey were compared with a linear model that estimates the contribution of each species to the backscatter. In discussion, it was noted that the new time series would have an accompanying new age composition series as well. The CIE review panel recommended using the new time series (see next topic below).

The winter 2016 spawning survey in the Bogoslof area was presented. The preliminary biomass estimate (506 kt) was substantially higher than the 2014 estimate of 110 kt and the highest in 20 years. Visual maturities of pollock are conducted and it appeared that, unlike 2014, the majority were in post-spawning condition even though the survey occurred earlier than in 2014. The length composition showed some 3 year olds (~35 cm fish).

EBS pollock assessment

Jim Ianelli presented some preliminary analyses in response to the May 2016 CIE review. He evaluated the issues raised by the review and selected a set that could be accomplished reasonably well in the current assessment cycle.

The first issue was to further develop the weight-at-age estimation method presented in recent assessments. A step in this was recompilation of all observer data to cross check the two-stage bootstrap method used to estimate catch-at-age and body weight-at-age. The data were stratified by A season (all areas combined), B Season west of 170W, and B-season east of 170W. Violin plots (in appendix) showed the variability of each age class over time relative to the global mean. This was an alternative way to show anomalies and estimation precision (based on data). A secondary component of this task was to re-compute sample sizes based on the bootstrap results. This was done using Francis' method for sample sizes and results shown in Table 3 of the document indicated effective sample sizes in excess of 2,000 for most years. He suggested that rescaling these might be appropriate (but retain their relative annual values).

The Team discussed how size-at-age varies from year to year in the fishery and the extent to which there are sampling artefacts or environmental factors in play. Fishing location was also noted as a likely factor, and that seemingly small errors can have big impacts on ABC and biomass estimates.

The method proposed for weight-at-age models growth increments by cohort, with the year effects treated as random (with variance terms estimated). The parameterization of the von Bertalanffy curve followed Schnute and Fournier (1980) and the base increment was computed from that form. The predicted weight is a function of last year's weight at the previous age plus a positive growth increment.

Methods evaluated for mean-weight-at-age estimation included 3 mean values (1 year, 3 year, and 10 year), with just year-effects for prediction, with year and cohort effects included, and with the addition of survey data (which include the current year, unlike fishery data) to help with the estimation. Model selection was based on a scoring system using a weighted out-of-sample prediction error from 2000 onwards. The weights were based on importance to the fishery so that errors in rarely caught ages have less influence. The model that uses the survey scaling performed well and will likely be selected for the 2016 model estimation. Some Team members expressed support for this approach.

The second issue was the CIE reviewers' recommendation to fit survey indices as biomass instead of numbers. The fits (after standardizing on design-based estimates instead of the Kotwicky index to make things comparable) were contrasted over 6 models (5 used in comparisons):

Model	Description
Model 0.0	The 2015 model used for management advice
Model 0	As Model 0.0 but using the design-based trawl survey estimates (and likelihoods) instead of the Kotwicky index
Model 1	As Model 0 but tuned to acoustic survey biomass instead of AT numbers
Model 2	As Model 0 but tuned to bottom trawl survey biomass instead of bottom trawl survey numbers
Model 3	As Model 0 but tuned to both acoustic and bottom trawl survey biomass estimates instead of numbers
Model 4	As Model 3 but using the acoustic trawl survey data covering the water column extended to 0.5 m from bottom instead of the traditional 3 m.

The differences between any of the models in terms of qualitative fit were relatively minor. The model that included the 2.5 meters (Model 4) resulted in slightly higher SSB than the comparable model that did not include that 2.5 m (Model 3). Model 4 appears to fit survey numbers quite well even though the model is fit to survey biomass. It was clarified that models extending down to 0.5 m would drop the first 5 years of AT surveys. This was because the data from those are unavailable at the appropriate resolution (different equipment and processing was used).

A third general area of investigation prompted by the CIE reviews involved evaluating the components of variability in the PDF of F_{MSY} . Whereas the document provided did not include these results due to time constraints, Jim pointed out that one component of the PDF has to do with weight-at-age uncertainty (which has been included in the PDF for several years). He also looked at sensitivity to selectivity uncertainty and to alternative stock recruitment relationships. He compared tradeoffs between relying more on the prior distribution and less on the "data" (the stock and recruits estimated internally). He also showed a Beverton-Holt version, but it wants to default to a steepness of 1. There was a suggestion to try fitting a regression to connect from the origin to the first set of points and use this as a prior on steepness for the Beverton-Holt curve.

Another recommendation from the CIE review was that M should be estimated internally. Jim noted that the recent data on the 2008 year class, showing continued increases in abundance in the bottom trawl survey, affect M estimates differently than when it was estimated in the past. He noted that guidance from

the multispecies model and time-varying M might be worth evaluating in a model for this November meeting.

The Team recommends that the authors develop a better prior for steepness, or at least a better rationale, and perhaps consider a meta-analytic approach. The Team recommends using biomass in the AT and BTS (his Model 4 in the presentation), which also includes the bottom 2.5 m of the acoustic biomass. In the long term, the Team recommends evaluating the sample sizes used for the data weighting and pursuing other CIE suggestions.

Multi-species stock assessment model (CEATTLE)

Kirstin Holsman presented results from a multi-species trophic interactions model for walleye pollock, Pacific cod, and arrowtooth flounder in the Eastern Bering Sea. The research focused on how such a multi-species model might be used in a stock assessment application, noting that some of this has recently been published:

Holsman, K. K., Ianelli, J., Aydin, K., Punt, A. E., Moffitt, E. A. (in press). Comparative biological reference points estimated from temperature-specific multispecies and single species stock assessment models. *Deep Sea Res. II*. doi:10.1016/j.dsr2.2015.08.001.

Ianelli, J. N., Holsman, K. K., Punt, A. E., Aydin, K. *In press*. Multi-model inference for incorporating trophic and climate uncertainty into stock assessments. *Deep Sea Res. II*

The model presented has been updated from this earlier work and includes new fishery, survey, and bottom temperature data (previous data extended only to 2012). Model estimates and projections with and without trophic interactions were presented. The largest differences were in the natural mortality for age 1 fish of all species in the multi-species model compared to the single-species model (and consequently higher age-1 recruitment). Kirstin showed alternative model projections through 2103 and contrasted two alternative ways that ABCs and reference points might be estimated.

The Team discussed the additive property of the natural (residual) and predation mortalities in the multispecies model. Some Team members felt that the single species model should already incorporate the main components of natural mortality, so there was concern about using these values as base levels in the multispecies model. They felt that the “residual” mortality should be specified at a lower value than the single species assessment, since predation mortality will be explicitly accounted. The Team also discussed future plans and what other species might best be added. It may be useful to outline short- and long-term utilities of the multi-species approach. The Team discussed whether the predator-prey interaction between fur seals and pollock might be a logical next step for the multi-species approach. There was also a discussion about the possible short-term utility of the model to provide a potential mechanism (predation) to explain why certain cohorts that are initially predicted to be large may fail to materialize in subsequent years.

The Team recommends using a lower (residual) M in the multi-species model for comparisons with the single-species stock assessment values.

The Team also recommends working with MML staff to include fur seals as part of the multi-species model.

Finally, the Team recommends including the multi-species stock assessment as an Appendix to the EBS Pollock stock assessment in November.

Tier 3 rockfish assessments

Paul Spencer presented some ideas for looking at the rockfish models in the BSAI for November. One idea is to incorporate the BS slope survey into the rockfish models. The current BS/RE model considers only the AI survey and the area of the AI. The availability of the stock is modeled from the smoothed estimates of the relative proportions in each area.

He showed some modifications to the survey catchability equations. The new approach would have a parameter that modifies the catchability parameter. The ratio of POP in the AI to BS has been pretty steady (i.e. increasing in all areas at about the same rate). The proportion for BS/RE in AI has been decreasing slowly.

Paul did some reweighting using the Francis (2011) method of looking at a first stage sample size such as number of hauls, or number of ages that were read. The second stage sample size is iterated until certain goals are achieved. He tried the inverse of residual variance (TA1.2, the method currently used), the McCallister and Ianelli method (TA1.1), and the Francis method which is TA1.8 in Francis (2011). He ran some models for POP, BS/RE, and northern rockfish. BS/RE models had the full suite, northern had fewer model runs. Northern rockfish are not commonly caught in the slope survey, so inclusion of this data set was not considered for this preliminary assessment. All the reweighting examples for BS/RE and POP pertain to models with the slope survey data included.

The re-weightings for BS/RE were generally similar except for the one using the method TA1.8. The model is consistent with the slope survey biomass estimates even when these estimates are not being fit. The slope survey seems to better index younger fish than the AI survey. The fits to the AI survey biomass were pretty similar except for the Francis TA1.8 weighting, which fit slightly better. All models fit the slope survey about the same.

The reweighted sample sizes show that the Francis method substantially down-weights most of the composition data, but particularly the fishery age composition data. Paul was not reweighting the survey abundance variance assumptions at the same time.

He then showed POP models. All the models looked similar except for the TA1.8 weighting scheme. That method fits the AI survey biomass a little better, and the fits to the slope survey biomass estimates were similar. Like BS/RE, the TA1.8 weighting substantially down-weights some composition data, in this case the fishery length composition data.. The Model 3 TA1.1 weights were pretty similar to the 2014 reference model (which did not include the EBS slope survey data).

Composition data types with a small number of years may require pairing with other compositional data in order to obtain reliable estimates of residual variance for the Francis method (TA1.8), because each year produces only a single residual. This issue may be especially problematic for the BS/RE model, because most composition data types have a small number of years.

Paul thought that using TA1.8 did not really improve the fits to survey biomass much, so Paul suggested that we stick with either the currently used reweighting method (TA1.2) or the McAllister-Ianelli method (TA1.1).

Andre Punt has a current paper that suggest not using McAllister-Ianelli because it tunes to the arithmetic mean, when it should be using the harmonic mean or something else.

The Team recommends that Paul review the new Punt paper on data weighting and investigate the methods for BSAI rockfish, if time allows.

Stock structure template

The Team inventoried completed stock structure documents to date and recommends that the template be completed for Greenland turbot and sculpins for September 2017.

2017 and 2018 harvest specification recommendations

The Team recommends rolling over the final 2017 BSAI harvest specifications for OFLs and ABCs (as published in the Federal Register in March 2016) for the proposed 2017 and 2018 OFLs and ABCs.

Minutes of the Gulf of Alaska Groundfish Plan Team

North Pacific Fishery Management Council
605 W 4th Avenue, Suite 306
Anchorage, AK 99501
September 13 - 16, 2016

GOA Stock Structure Template

The Team inventoried completed stock structure documents to date and recommended that the template be completed for shortraker rockfish for November 2016.

GOA Shark assessment research

Dogfish catchability

The GOA Plan Team heard from Pete Hulson (Cindy Tribuzio co-author) on research they have published that can improve our knowledge on the availability of spiny dogfish to the bottom trawl survey and how that might inform the catchability coefficient (q). Data come from satellite tags that collect temperature, salinity, depth, and light levels. Data from 46 tags spanning 2010-2013 were evaluated. The light levels can be used to infer geolocation for each day (local noon) with uncertainty. Tag locations could then be matched to bottom depth using bathymetry observations. When combined, these data in turn can be used to determine how close to the bottom the organism was at local noon each day the tag was at large.

Two methods were used to determine availability: in the Nichol et al. method, the maximum depth of a tag for a 24hrs was considered the bottom, and the geolocation method uses the bathymetry and tag depth information. Even when data were pooled across years, the two methods had poor agreement (however provide 'bookend estimates'). Nichol et al method produced the largest q estimate but have uncertainties that span 0-1. Geolocation is more robust, but uncertainty is still present in this dataset. Historical values of q from the NWFSC (west coast) resulting from alternative surveys range from approx. 0.04 to 0.55 whereas other surveys have lower estimates. These compare nicely to the pooled data across years from the two methods (0.03 to 0.61). Unfortunately this still represents a large range of potential values. Tag data indicate that spiny dogfish occupy waters shallower than 300 and generally inhabit waters less than 100m, with most time spent less than 50m.

Given that this species is infrequently inhabiting the bottom, this species may be only incidentally caught by the bottom trawl survey and when encountered, the author opines that this occurs during deployment and retrieval of the gear. Consequently, the biomass estimates of dogfish (B) from the bottom trawl survey are likely underestimates. This is important since this species is managed by $OFL = F \times B$, $ABC = 0.75 \times OFL$.

The Plan Team recommended continuation of research on this issue, and specifically recommended binning tag data into the depth strata from the survey. This may help homogenize the results from the two methods.

Spiny Dogfish Demographic Model

The Team received a presentation from Cindy Tribuzio on a recently published demographic model that could potentially be used to assess GOA spiny dogfish. Spiny dogfish are managed under Tier 6*, but uses Tier 5 methods even though the biomass estimates are considered unreliable. The remaining species in the shark complex are standard Tier 6. The Tier 6* method calls for $F=M$, which is not ideal for elasmobranchs given higher relative B_{MSY} for sharks so a demographic model was explored (and has been peer-reviewed and published). The model is a female-only Leslie matrix. Two versions were evaluated, an age-based model with many (120) age classes, and a stage-based model with 5 life stages. This is a data-limited approach, and thus the model relies on many assumptions. Stochasticity was included through probability functions on parameters.

Sustainable F was estimated at 0.02, and 0.04 for the age-based and stage based approaches, respectively. Status quo is $F_{MSY}=M$ (0.097). This method recommends a decreased OFL/ABC relative to status quo. Tier 4 calculations were explored (F_{40} & F_{35}), resulting in F rates of 0.025-0.029. The plan for future work is to keep exploring options/assumptions in the methods (density dependence, length composition, tagging data, etc.) as well as continued work to improve biomass estimates from the survey (e.g., catchability). For developing catch recommendations in the next full assessment cycle (2017), the presenter suggested $F=F_{MAX}$ from the demographic model rather than the status quo ($F=M$), because there is more of a scientific basis for the demographic model.

Discussion

It is likely that the biomass is underestimated by the trawl survey, so it is important to both reconcile biomass uncertainty and decide on whether to use a new approach to recommending F . This decision will need to be made in the 2017 cycle, which will allow more time for improving biomass estimates.

The Team asked if these analyses could be converted to biomass and the response noted that there is large uncertainty in size at age data, due to various challenges with ageing this species. The author noted that it could be done, but would introduce substantial uncertainty.

Uncertainties in estimates of fishing mortality rates were available from the study. The comparison to F_{40} and F_{35} estimates requires further analysis given the assumptions made in generating these comparative estimates.

The Team recommended continued work on this alternative approach to developing an F recommendation (demographic model) as well as continued work on improving biomass estimates to be considered during the 2017 cycle (this will be presented at the September 2017 Team meeting).

GOA Demersal shelf rockfish

Kray van Kirk and Ben Williams presented an update of the current stock assessment for Demersal Shelf Rockfish. An age-structured model for yelloweye rockfish in Southeast Alaska Outside waters that was presented last year continues to be developed, and the DSR stock complex is not yet ready to be moved to Tier 3. Updates on the groundfish staff in Southeast Alaska include Andrew Olson filling Southeast Alaska Groundfish Project Leader position, previously occupied by Kristen Green.

Multiple density estimates exist for three of the four Southeast Alaska Management Areas: CSEO, EYKT, and SSEO that have been incorporated into the model. Next year NSEO will have another data point and will be incorporated into the model.

Data for the model was updated through 2015 and includes:

1. Total annual catch comes from: commercial fishery, sport fishery, and halibut fishery bycatch.
2. Age composition includes information from the commercial fishery and halibut fishery bycatch.

3. Density: ROV survey

Structural changes to the model for this year include:

1. Terminal plus-class changed from 97+ to 75+
2. Natural mortality estimated
3. CPUE scaled
4. Lower 90% CI for model-estimated biomass, alternative rates of fishing mortality (F), and ABC used when evaluating potential harvest levels
5. Additional sigma parameter for density from last year's assessment removed due to confounding with estimating natural mortality

In particular, 4 model structures were considered:

- Model 1: regionally distinct data and likelihood, asymptotic fishery selectivity at age
Model 2: Model 1 plus common parameters: natural mortality, commercial fish catchability, IPHC survey catchability
Model 3: Same as 2 but instead of asymptotic fishery selectivity a dome-shaped fishery selectivity at age option
Model 4: Global model with data and likelihood merged over regions.

Results from the models listed above were similar in terms of estimates of regional density, total density (global model estimates were lower in the early years), regional recruitment, total recruitment, and regional biomass. However differences among models were observed in early years for estimates of total spawning biomass and results for full recruitment fishing mortality exhibited high F rates in EKYT. All of the models estimated catch-at-age similarly for CSEO and SSEO but EYKT was a little different. None of the models fit the CPUE from the commercial fishery well but did fit the CPUE from the IPHC survey, most likely because the IPHC survey methods are standardized over a long period of time. The model results for shared parameters (natural mortality, commercial fishery CPUE catchability, full recruitment, and IPHC survey CPUE catchability) were calculated. Natural mortality results were very similar for all models. Both CPUE estimates had similar results except for Model 4 (global model) which had much lower estimates. Full recruitment model estimates were for Models 1, 2, and 3 were similar by area but estimates from Model 4 (the global model) were pooled for all areas. Model results were pooled using deviance information criteria (DIC) with 2,000,000 MCMC iterations. A result common across models was a negative number of effective parameters for all of the models. The global model performed best. An evaluation of the global model was conducted with 20,000 parametric bootstrap draws. The full parameter space was explored with no bound constraints. A self-test was performed on the global model and the results were the same. A retrospective analysis was performed going back 10 years. Density, recruitment, and spawning biomass estimates were examined. Spawning biomass curves were very similar over time.

Previous Team recommendations included adjustments to estimating natural mortality which included evaluating root mean-squared error (RMSE) for density surveys inside model structure with no extra variance term, and using the fixed RMSE as additional variance term. The natural mortality estimates for the Global and the Global + RMSE were very different, 0.0791 and 0.0467, respectively. The model fits for density for these density retrospective for these two models was similar. RMSE global model retrospective density has trouble fitting 1999 to 2000 but the rest fits well. Spawning biomass projections show declines for all F, but these results should be examined further. A scenario with F55 (F=0.041) was presented with a catch level for yelloweye rockfish of 216 mt, which is very close to the current ABC.

Priorities for further model development include:

1. Determine best approach for incorporating density uncertainty;

2. Re-analyze ADF&G survey data for global model;
3. Explore alternative methods for ROV survey – adaptive-cluster sampling for relative density zones across habitat – may improve the estimates

Groundfish Plan Team recommendations include:

1. **Explore the use of the GSTAT (geostatistical modeling) program for estimation of biomass. This method is especially good for species with patchy distributions.**
2. **Examine abundance bubble plots.** Plan Team asked if there is any indication of recent strong recruitment. There is recruitment in EYT but do not see that in the regional models.
3. **Try to stratify by abundance.**
4. **Use a fixed M** with a global model; many other models have done this.
5. **Try to iteratively reweight the variance on the surveys.**
6. **Examine age composition plots.**

For the upcoming year, an executive summary will be provided, no new biomass estimates will be presented, and there may be an update to the NSEO.

GOA Pollock

Winter acoustics-trawl survey

Sarah Stienessen provided a summary of the GOA winter acoustics-trawl survey. This year the Chirikof shelf break was not sampled. Biomass estimates were lower in most areas; Sanak Trough was the lowest estimate in the time series. The Marmot Bay estimate was the highest of the time series but there is increased uncertainty because of limited sampling coverage in the Outer Bay. Despite lower numbers of fish encountered, maturity scans from trawl caught fish indicated the majority of females were in pre-spawning condition indicating sampling timing was appropriate. The population is comprised primarily of fish from one year class 35-45 cm in length (2012 year class). Few small fish (<35 cm) were encountered in any of the areas sampled indicating very low recruitment in recent years. Additionally, the weight-at-length of fish sampled in 2016 was on the lower bounds of the time series suggesting smaller fish on average. The Team expressed concern the population is comprised mostly of one year class, weight at age is low especially for the year class recruiting to the fishery, and overall abundance may be trending down in the future.

A brief update was provided on the use of moored echosounders which can be deployed on the seafloor for up to one year. The moored echosounders deployed in 2015 are providing very similar abundance estimates to what's seen from ship sampling on the Oscar Dyson in the same area. It's possible a small number of moorings may be able to provide a representative index of abundance. However, without ship based effort biological sampling isn't possible. An ideal use of the moored echosounders are they can be used to determine time of peak spawning and can help determine when most of the fish are on the spawning grounds.

For 2017, the winter survey hopes to expand efforts to the Kenai Bays and Prince William Sound regions.

GOA pollock assessment

Martin Dorn provided an update on GOA pollock assessment plans. Results of the GOA acoustic survey raised concern because of the apparent lack of recruitment in recent years resulting in the population being comprised primarily of one year class. Also the observed weight at age is indicating fish being below average weight, especially in the 2012 year class that should have recruited to the fishery. Small fish were encountered in the winter fishery, especially in management area 620. Weight at age will be

examined in more detail for November's assessment and alternative analyses explored since this year the predicted weight at age may have been set too high. Additional research includes the exploration of the geo-statistical method for estimating bottom trawl survey biomass as an alternative to the design-based method and may be presented in November.

The Team recommended maintaining the 2017 pollock ABC and rolling this same ABC value forward for 2018. However, the Team cautions that there may be a notable decrease in pollock biomass and associated 2017 and 2018 ABCs.

GOA Pacific cod

Steve Barbeaux presented modeling updates for the GOA Pacific cod assessment. A re-analysis of the modeling methodology was motivated by the 2014 and 2015 assessments, which were outside of the range of models used since 2003. Twenty different models were developed. A base model was developed, with many simplifications from the 2015 model including (but not limited to): 1) aggregating catch data over seasons; 2) use of time-invariant fishing mortalities; 3) reducing the age plus group from 20+ to 12+; 4) removing the estimation of age bias from the model; and 5) including age and length composition data, and removing conditional length at age data. Alternative models/data sets included 1) use of the AFSC longline survey estimates of relative abundance and length composition; 2) evaluation of iteratively re-weighting the age and length composition using the "Francis" method that accounts for correlations among residuals across age/length bins; 3) estimation of natural mortality, bottom trawl survey selectivity, and dome-shaped selectivities (except the longline fishery selectivity); estimating time-varying fishery selectivity in blocks; 4) modeling the pre-1993 trawl survey separately from the post 1996 surveys; 5) removing the pre-1990 surveys (due to sampling with different methodology), and removing age 1 fish (≤ 27 cm) from the bottom trawl survey data.

The Francis method of weighting the age and length composition data resulted in the fishery length composition data being discounted in favor of the bottom trawl survey abundance. The early years of the bottom trawl survey (when it was a cooperative U.S.-Japan effort) may be less reliable than the recent, NMFS-only trawl surveys.

The models runs indicate that either increased mortality (i.e. "kill them") or lowered selectivity at older ages (i.e., "hide them") may explain the a lack of older/larger fish in the data. Estimation of either natural mortality or survey catchability results in biomass estimates outside of perceived reasonable bounds and poor retrospective patterns.

The author suggested a set of models worth pursuing for the November SAFE, including 16.6.11, 16.6.20, 16.6.22, and 16.7.3. These models either remove the 1984 and 1987 cooperative U.S. – Japan trawl survey (or consider the earlier surveys as a different time series), consider iterative re-weighting of the composition data sample sizes with the McAllister-Ianelli method, and explore the "hide them" vs "kill them" tradeoffs via estimation of survey selectivity, catchability, and natural mortality. In addition, models that either restrict time-varying selectivity to the older fishery data, or otherwise using different selectivity blocks to model the foreign and domestic fisheries, were also proposed to be evaluated. Finally, the inclusion of catch at length data was proposed to be evaluated as a general modeling issue.

New data to be included in the November SAFE include longline survey abundance and length compositions, ages from the 2015 GOA trawl survey, and updated catch data.

The Plan Team recommended moving forward with the set of models above proposed by the assessment author. The Plan Team also recommended a comparison of the author's preferred model with the 2015 model when applied to a consistent data set (i.e., data used in the 2015 assessment). The Plan Team further recommended that a model with age-specific natural mortality

be evaluated, as it may provide more insight to the “hide them” vs “kill them” modeling approaches.

A decline in the mean size in the catch of every fishery since the 1990s has been noticed (despite the length-at-age remaining relatively stable), along with declines and estimated abundance and increased estimated fishing mortality. **The Plan Team recommended comparing time series of mean size in survey data to the observed declines in fishery data.** The authors also state that age reading of archived fishery otoliths, and genetic evaluations of population connectivity between the GOA, AI, and EBS areas are research priorities. **The Plan Team recommended consideration of these topics for long-term research priorities.**

2017 and 2018 harvest specification recommendations

The Team recommended rolling over the 2017 GOA final harvest specifications for OFLs and ABCs (as published in the Federal Register in March 2016) for the proposed 2017 and 2018 OFLs and ABCs.