Minutes of the Joint Plan Teams for the Groundfish Fisheries of the Gulf of Alaska (GOA) and Bering Sea Aleutian Islands (BSAI)

September 20-23, 2010

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

The Joint meeting of the BSAI and GOA groundfish Plan Teams convened Monday, September 20th at 9:00 am at the Alaska Fisheries Science Center in Seattle, Washington.

Members of the Plan Teams present for the meeting included:

Loh-Lee Low	AFSC REFM (BSAI chair)	Jim Ianelli	AFSC REFM (GOA co-chair)
Mike Sigler	AFSC (BSAI Vice chair)	Diana Stram	NPFMC (GOA co-chair)
Kerim Aydin	AFSC REFM	Sandra Lowe	AFSC REFM
Lowell Fritz	AFSC NMML	Chris Lunsford	AFSC ABL
David Carlile	ADF&G	Jon Heifetz	AFSC ABL
Alan Haynie*	AFSC REFM	Mike Dalton	AFSC REFM
Jane DiCosimo	NPFMC (Coordinator)	Kristen Green***	ADF&G
Yuk. W. Cheng	WDFW	Tom Pearson	NMFS AKRO Kodiak
Brenda Norcross	UAF	Nick Sagalkin	ADF&G
Mary Furuness	NMFS AKRO Juneau	Paul Spencer	AFSC REFM
Grant Thompson	AFSC REFM	Leslie Slater	USFWS
Dave Barnard	ADF&G	Nancy Friday	AFSC NMML
Leslie Slater	USFWS	Yuk. W. Cheng	WDFW
Dana Hanselman	AFSC ABL	Ken Goldman	ADF&G
Bill Clark	IPHC	Bob Foy**	AFSC Kodiak
		Sarah Gaichas	AFSC REFM
		Steven Hare*	IPHC

* present for first day; ** absent; *** pending appointment

Introductions

The Teams welcomed two new members, Chris Lunsford (ABL) on the GOAPT and Kristen Green (pending appointment), who is also joining the GOAPT.

Agenda

The Teams adopted the proposed agenda with some modifications. The Teams clarified that the HAPC/skate proposals would be addressed on Wednesday afternoon under the EFH agenda item. The Teams agreed to change the order of the GOA Team agenda items to allow AFSC staff to participate in discussions of pollock with both Teams at this and future meetings.

Assignments

The Teams assigned rapporteuring responsibilities for preparation of the minutes by agenda item. Mike Sigler distributed proposed assignments for all Team members prior to the meeting. The first draft of the minutes would be prepared by the assigned person by the morning following completion of the agenda item. Jim Ianelli set up an online editing program to facilitate editing during and after the meeting.

Council actions

Jane DiCosimo provided the status of two Council actions on management of BSAI skates and Annual Catch Limits (ACLs). The final rule for both FMP amendments was submitted to NMFS HQ, and publication of both final rules is expected by the end of September. Therefore, the Secretary is expected to approve removal of the other species category from the Groundfish FMPs and require separate ACLs for sharks, skates, sculpins, squids, and octopuses for 2011/2012; this would require adoption of proposed ACLs for these groups by the Plan Teams at this meeting, and by the SSC in October, in order to comply with the Administrative Procedure Act for informing the public of potential action for final specifications. Final ACLs will be adopted in November/December 2010. More Plan Team discussion on these issues is addressed under a separate agenda item.

Diana Stram reviewed the status of a Council analysis to consider stock-specific crab bycatch limits in groundfish fisheries. Currently there is no explicit link between OFLs under the Crab FMP and bycatch of crab species under the BSAI Groundfish FMP. The Council also will take action in 2010 on the rebuilding plan for Pribilof Islands blue king crab. One of the alternative measures includes potential PSC limits for PIBKC in the BSAI groundfish fisheries.

Lowell Fritz summarized an August 2010 Council action on the Steller sea lion draft biological opinion (BiOp). The BiOp concluded that current groundfish fisheries result in both adverse modification and jeopardy findings. These findings then require modification of current groundfish fisheries to mitigate the adverse effects and allow for recovery of the western stock of Steller sea lions. Currently, reasonable and prudent alternatives (RPAs) are proposed but not yet finalized. NMFS proposed RPAs, and the Council proposed a modification to the NMFS RPAs. A final decision by NMFS is anticipated by the end of October and NMFS is expected to inform the Council of its intent at the October Council meeting. Both RPA recommendations include proposed reductions in catch for Atka mackerel and Pacific cod in the AI due to continued precipitous declines of sea lions in these regions. Proposed measures include proportional reductions from area-specific ABCs.

Research priorities (tasking)

Jane DiCosimo will coordinate Joint Plan Team recommendations for proposed revisions to the Council's 2009 research priorities/5 year research plan, which is required annually under the MSA. All Plan Team members were requested to review these priorities from last year and provide revised priorities as needed. In recent years the Teams have made minor modifications to the comprehensive list of annual priorities. The SSC will use the Teams' recommendations for developing its revisions for adoption by the Council at their October meetings. The 5 year research plan is annually revised by the SSC at its October meetings, and is used to inform federal and state resource management agencies, NPRB, and academia of Council research priorities each year. The recommendations for revised research priorities are attached as an appendix.

Groundfish bycatch estimation in the halibut fisheries

Cindy Tribuzio summarized potential approaches for estimating incidental catch of groundfish in the unobserved Pacific halibut IFQ fishery. A multi-agency working group was convened in January 2010 to examine alternative approaches for catch estimation in this fishery to track groundfish catch under ACLs which require estimates of mortality from all fisheries (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/halibut_IFQ_nontarget_estimation.pdf).

The proposed approach would use IPHC longline survey data to estimate groundfish discards in the halibut IFQ fishery (as had been done previously by various methods in GOA shark, skate, and demersal shelf (yelloweye) rockfish stock assessments). The group outlined the following alternative methods for three aspects of catch estimation:

1. bootstrap variance estimation for non-halibut catch in IPHC longline surveys
2. filtering methods for survey data to better approximate fishery catch patterns
    a. no filter (use all survey stations)
    b. top third of legal halibut CPUE filter
    c. proportional to catch filter
3. extrapolation methods from survey to commercial fishery
    a. hook-based ratio estimator
    b. halibut catch weight-based ratio estimator

It was noted that both extrapolation methods in (3) require an average weight for the discarded species, as the IPHC survey records numbers of non-halibut species rather than weights.

The working group sought Plan Team feedback on these proposed methods so that in November 2010 example catch estimates for multiple species across a spectrum of common to rare occurrence and average weight data quality can be presented using Plan Team recommended methods. After Plan Team and SSC review in November/December 2010, the group anticipates providing catch estimates for use in stock assessments beginning in 2011.

The Plan Teams commented that the best method for estimating groundfish catch in halibut target fisheries is *direct observation of the fishery*. Extending observer coverage to currently unobserved fisheries is proposed under all options for NMFS Groundfish Observer program restructuring, to be taken up by the NPFMC in October.

Lacking current observer coverage in the halibut fishery, the proposed methods would serve in the interim to meet catch accounting requirements under ACLs; they also would provide historical catch estimates for multiple groundfish species. Therefore, it is important to settle on a reasonable method for catch estimation using information available now.

The Plan Teams recommended that the working group refine the methods as follows:

1. Consider alternative methods for bootstrap variance estimates that can accommodate non-independence between hooks caught within a skate and/or non-spatially random processes determining catch of non-halibut species on the IPHC longline survey.
2. Use the proportional to catch filtering method, which was considered most likely to reflect spatial differences in species composition while sacrificing little survey data compared with the top-third method.
3. Present estimates of catch using both the hook based and weight based ratio estimators, as there was no strong argument for one method over the other based on first principles.

The Plan Teams also suggested that these methods could be compared with observer data in future years (assuming that an observer program extends to this fleet) so that historical catch estimation methods might be re-evaluated and improved if necessary.

Sablefish workshop and index analysis

Sablefish workshop in response to CIE review

Dana Hanselman presented results from a workshop held in January, 2010 in response to the CIE review (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/sablefish_index_and_workshop_report.pdf). Key suggestions from the workshop:

1. Model separate areas in one integrated model that shares parameters and uses tagging data for estimating movement rates.
2. Account for whale depredation. The stock assessment model does not include estimates of sperm whale depredation. The CIE review recommended testing GLMs and zero-inflated models.
3. Configure SS3 model similar to current model. Use to explore future modeling options e.g. spatial etc.
4. Current fishery catch rates appear hyperstable (i.e., don't change much even when abundance seems to be changing). Model only IFQ fishery (1995 and on). Develop from core fleet that fished in most years.
5. Other recommendations: use RPN only – remove RPW (weight vs. numbers). Explore use of gully stations – not utilized now. Come up with new survey index – rebalance variance assumptions. CIE, industry, and working group agreed.

Sablefish index model development

Dana discussed results from different approaches to modeling the longline survey data and found that killer whale effects were highest in the Aleutians followed by the Eastern Bering Sea and western GOA which were similar. Relative to sperm whale depredation, the impact of killer whale corrections was greater. In general, the need to correct for depredation effects was considered important. Results are still preliminary--variance needs work and it was suggested that ways of incorporating covariance for year-effects might be worth examining.

Discussion on whether whale depredation should be accounted as a catch correction deducted from ABC ensued. It was noted that in the IPHC assessment whale depredation is considered part of natural mortality.

The Teams inquired on the status of sperm whale stock assessment/abundance trends. Funding is unavailable for work in this area and the Teams again recommended that a sperm whale assessment be conducted. The role of sperm whale abundance on depredation rates may be an important factor in modeling survey results.

It was noted that a research program (http://www.seaswap.info/index.html) (sperm whale and longline fisheries interactions study lead by Jan Straley) is doing sperm whale work by monitoring "creaks" made by sperm whales when interacting with fishing gear. Analysis of these data is underway. Work is also proceeding in developing methods to deter depredation.

Dana will continue to investigate area-specific models through the use of tagging data. This may be useful to estimate movements between areas and ascertain the potential for alternative stock structure hypotheses. Length and age composition information from the survey and fishery is available.

Anecdotal evidence suggests that there are some signs of recruitment from the survey and from comments by fishermen.

Dana outlined future plans as follows: For the November 2010 model the authors plan to accept one of the CIE review and workshop recommendations, viz., switch to RPN only without the RPW data in the model and attempt to obtain more realistic variances. Since removing this series affects the relative weights of indices, Dana also will investigate the influence of different variance assumptions.

In 2011 the authors plan to complete work on modeling the survey index (via peer review publication). In 2012 they plan to revisit apportionment and present an experimental, spatially explicit model.

Tier 6 workshop

Jane DiCosimo summarized the general recommendations from a NPFMC workshop on Tier 6 approaches, specifically requested by the Council to occur after final action to incorporate ACLs in the BSAI and GOA Groundfish FMPs (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/Tier%206%20Workshop%20Summary%2016Aug10.pdf). This workshop was attended by SSC members, Plan Team members, Tier 6 assessment authors, and other invited participants.

The working group noted that the SSC can choose to adopt alternative approaches under current Tier 6 specifications. It was unclear whether the original intent of Tier 6 was to prevent the SSC from adopting approaches beyond modifications to the time period of catch, although nothing in the FMP precludes other approaches *per se*. The Plan Team and SSC Fall 2010 meetings will result in proposed specifications for publication in the proposed rule, which forms the basis for informing the public prior to potential actions that could be implemented by the Secretary in the subsequent final rule, which comes after the final assessments and December specifications. A major change in this assessment cycle is the break-out of "other species" into separate components for the 2011-2012 specifications cycle. This necessitates OFL and ABC recommendations for each of the component groups of what previously comprised the "other species" complex for each FMP.

The Teams discussed what documentation would be necessary in order to set specifications for the first time for "other species" groups in November. The Teams recommended that the authors prepare full assessments for each of the groups for Plan Team and SSC review in November/December, which is consistent with AFSC direction to the authors.

The Teams received overviews of each species and discussed to what extent the Tier 6 methodology employed was recommended to be used in the full assessment in November. Tier 6 currently establishes ABC and OFL based upon some consideration of catch history, or other approach approved by the SSC. The Teams agreed that any alternatives based upon something other than average catch from the standard time period should be presented and recommended at the September meeting to allow for their use in the final assessment. The authors followed with presentations on potential new Tier 6 approaches, which the SSC could recommend in October for incorporation into the October 2010 stock assessments.

Case Study: *BSAI and GOA skates*

Although skates are not tier 6 stocks, lead author Olav Ormseth provided an update on assessment plans for November. Olav noted that some catch-accounting system errors had been found in at-sea discards which mainly affected GOA skates. This will be taken into account in the assessment for the November Plan Team meeting.

In the GOA, skate assessments have been through a number of iterations due to the development of a directed fishery in 2003. Therefore, they are not really a part of "other species". They are managed under Tier 5 and are separated into big, longnose, and other skates. In the BSAI, skates will officially be broken out of the "other species" complex this year. The complex is dominated by Alaska skate which has an age-structured model (Tier 3), while other skates are classified as Tier 5. ABC and OFL are well above historical catch. The PT did not recommend changes in the current methods.

Case Study: *BSAI and GOA sculpins*

Sculpins are a Tier 5 species. Based on recent life history work, BSAI sculpins have species-specific estimates of M which are used to obtain species-specific proto-ABCs which are then summed, while GOA sculpins use a proxy M for the entire complex (the M used is for GOA great sculpin). Based on SSC guidance, the PTs use a best estimate of M (among possible estimation methods) for each species in the BSAI, while using a most conservative single M estimate for the GOA. It was asked whether it was more appropriate for the GOA to use BSAI M values (same species/different ecosystem) or the single GOA value (same ecosystem/different species). The author said he would investigate. The PTs highlighted that life history research (aging) should be performed for the GOA species similar to that previously done for the BSAI. GOA samples may have already been collected so this might be a matter of prioritizing the ageing.

Case Study: *BSAI and GOA squids*

BSAI squid have traditionally been managed as a separate category (Tier 6), where OFL is set equal to average catch. The OFL was in danger of being exceeded in one year and the fleet changed its behavior to avoid closure. Horne and Parker-Stetter tested survey methods for *B. magister*, which they found mainly below 200m depth.

GOA squid uses a Tier 6 approach using maximum catch as the OFL. The author suggested using a "reliable *minimum* biomass" (i.e., the lower bound of an estimate) along with an estimate of M, rather than "reliable biomass" estimate, to make a "Tier-5"-like estimate (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/BSAIskate.pdf; ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/GOAskate.pdf). While this would not qualify as Tier 5, it could be used as an alternate Tier 6 method.

The Plan Teams recommended retaining the current Tier 6 approaches in the respective areas. It was noted that the BSAI assessment uses average catch whereas the GOA assessment uses maximum catch because the BS has a past history of targeted fishing.

Case Study: *BSAI and GOA sharks*

Cindy Tribuzio presented the approach to setting shark ABC and OFLs (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/GOA_BSAI_sharks_Tier_6_options.pdf). The Teams discussed the tradeoffs of using average catch compared to other methods. The minimum biomass estimate approach was seen as being desirable. There are differences between the GOA and BSAI assessments; the GOA assessment apparently has more consistent and "reliable" minimum biomass estimates compared to the BSAI assessment (due primarily to dogfish being more common in the GOA).

The Teams recommended presenting the Tier 6 approaches for both the BSAI and GOA including the minimum-biomass-based approaches (e.g., method 4 in the working paper). The peak catch in the BSAI was unidentified sharks, which may have been spiny dogfish. The Teams recommended that the authors examine the pattern of the "unidentified" and "other shark" categories. The Teams discussed whether the SSC could consider using a multiplier greater than 1 for average catch to obtain an OFL under Tier 6.

Case Study: *Octopus*

Octopus is managed as a Tier 6 species group. Lead author Liz Conners presented percentiles of the catch history rather than percentages of the average catch and recommended that using percentiles is better than using the average, as it will give information on how often a fishery will exceed a given level (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/AKocto.pdf). The Teams recommended using the maximum of incidental catch as the OFL, and the average as the ABC, rather than a lower percentile, as no specific guidance or justification could be pointed to for picking a lower percentile. This is different than the recommended procedure for sharks, as there is information (detailed in previous assessments) indicating that the maximum catch for octopus is likely to be an order of magnitude below MSY.

Survey biomass is considered unreliable as there is a size difference between those caught in the survey and those caught in the fishery. Future methods may include diet-based minimum biomass estimates.

Stock Structure Working Group

Paul Spencer presented the recommendations of the Stock Structure Working Group (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/stockstructure.pdf).The working group made the following recommendation: "*allocate the Acceptable Biological Catch (ABC) across subsets of NMFS areas within the BSAI and GOA management areas as a precautionary measure even in the absence of specific scientific information.*" The Teams debated this language and indicated that distinct oceanographic and ecosystem characteristics (e.g., between BS and AI regions) would be a more defensible rationale for default division of quotas between regions than an *a priori* preference for dividing any given quota into at least two parts. The Teams concurred with the Working Group's recommendation to divide quotas as a default measure in general but modified the recommendation as follows: "*allocate the Acceptable Biological Catch (ABC) across subsets of NMFS areas within the BSAI and GOA management areas as a precautionary measure* ***to the extent practicable***".

The Working Group also proposed two potential processes for determination of stock structure for groundfish stocks. To identify priorities for stock structure evaluation, the group suggested two options: 1) ID only species of highest concern or 2) develop a schedule for evaluating spatial management for all stocks. The group also suggested two options for the evaluation at the Plan Team level (final determination would be made by the SSC): 1) joint PT review each September or 2) separate (non-PT) committee review, which would report to the joint Plan Teams each September.

The Teams discussed: 1) the proposed default policy of ABC allocation by area; 2) ID of stocks for stock structure evaluation; and 3) review of stock structure evaluation report. The Teams discussed the differences in OFL/ABC management between GOA and BSAI. The Teams discussed whether there are valid reasons for these differences or if consistency between FMP areas would be desirable.

The Teams discussed the extent to which a default approach of ABC allocation by area would be recommended. If data are uncertain, it could be possible to allocate stocks inappropriately in some areas and therefore disproportionately concentrate fishing effort. There was some discussion of the differences between the GOA and BSAI in the extent of management areas and the appropriate size for managing ABC by area (different issues in BSAI vs GOA).

Case Study: *BSAI rougheye/blackspotted rockfish*

Paul Spencer described the distribution and species composition of the two-species complex. The stock structure template was applied and possible management implications were discussed (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/BSAIbspot.pdf).

Four studies have been published that describe the distribution of blackspotted rockfish and rougheye rockfish in the North Pacific. Blackspotted rockfish are found throughout federally managed Alaska waters, whereas rougheye rockfish are found in the Gulf of Alaska and EBS slope but are rare in most of the Aleutian Islands. There is a high error rate for distinguishing blackspotted from rougheye rockfish in the Gulf of Alaska. There is about an order of magnitude difference in rougheye/blackspotted rockfish abundance between the Aleutian Islands and Bering Sea (higher in the Aleutian Islands). These species are long-lived with low fecundity (generation time of 53 years, based on the standard definition). Some Aleutian passes and along-shore currents may physically limit connectivity between regions of the Aleutian Islands. Some size at age differences occur between the BS and AI rockfishes, which Jon Heifetz pointed out, is a typical finding for between-area differences for rockfish species; the challenge then is determining the biological significance of the differences. Younger fish typically are observed on the Bering Sea slope. Within the BSAI, an isolation by distance test is statistically significant for genetic data. From this data, an estimate of dispersal distance was calculated to be 550 km (maximum of all of the estimates). The author concluded that this information indicates structuring within the BSAI area for blackspotted rockfish. Fish that are located farther apart are less related to one another (isolation by distance).

Paul then provided a table to address the risk (biological and fishery) under alternative hypotheses concerning stock structure (i.e., management implications). The structuring of the population implies that rockfish ABCs should be allocated by area. Given the current management practices (bycatch status, low MRAs), area allocations of ABC appear to be non-limiting to the fishery (recent catch has been less than potential AI and BS ABCs).

Paul also explored the implication of area ABCs within the AI. In this case, however, the catch has exceeded potential ABC in the western AI but not in the central and eastern AI.

Case Study: *GOA rougheye/blackspotted rockfish*

Dana Hanselman reviewed the stock structure template for GOA blackspotted/rougheye rockfishes (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/GOA_RE-BS_Stock_Structure_Report.pdf). There appears to be extensive overlap of the two species in the GOA and difficulty in field identification persists with a mis-identification rate of about 29% in field. An examination of harvest and trends indicates that catch in the WGOA is increasing, but remains below TAC. The survey and fishery distribution are similar. The abundance is greater in the central and eastern areas based on the longline survey. These species are long-lived with a generation time of at least 19 yrs (based on the age at 50% maturity as a proxy). Eggs and larvae have a high dispersal potential. There are significant differences in mean length and age by area and the distributional patterns in species could be contributing to these differences. For example, a lack of recruitment in the WGOA could be contributing to the higher mean age observed there. Some naturally occurring "tags" (parasites) indicate differences by area but isolation by distance is not apparently significant for both species. Hence there is no overarching pattern, but small scale homogeneity tests suggest distinct populations roughly on the scale of NMFS management areas (WGOA, CGOA, and EGOA).

In summary, there are signs of population structure by management areas for these stocks. Hence, the current GOA management by areas for ABCs and Gulf-wide OFLs seems appropriate. Differential growth between the western GOA and the eastern GOA could result from a combination of effects, including poorer recruitment in the west and different species proportions between the regions.

Case Study: *BSAI Atka mackerel*

Sandra Lowe provided an evaluation of stock structure for BSAI Atka mackerel following the stock structure template (ftp://ftp.afsc.noaa.gov/afsc/public/plan_team/Atka%20stock%20structure%20table.pdf). The fishery catch has averaged about 3/4 of the ABC. The fishery is highly concentrated. Abundance and recruitment patterns are similar among areas. The generation time is about 10 years due to a short life span and early age at maturity. The patterns of currents through passes and alongshore currents may provide physical barriers to connectivity. There are significant and consistent differences between areas in size compositions and growth rates, with smaller fish in the western and central areas of the AI. Sandra stated that there is evidence that regional growth differences are due to lower prey quality in the western and central areas.

No significant differences in maturity at age are apparent between areas. Tagging results indicate that adults are not highly migratory. Spawning site fidelity is unknown at small scales. Genetic studies found no evidence of discrete stocks, although genetic analyses are generally uninformative due to a recent bottleneck/expansion that removed most of the genetic diversity.

Features with implications for stock assessment and management include an extended pelagic phase (~2 years) during which a large amount of mixing occurs. No large-scale movements are evident after the demersal stage begins (~3 years). Differences in regional growth patterns are accounted for in the stock assessment model. The catch is allocated across areas within the AI (the EBS is combined with the eastern AI).

Summary of stock structure discussions

- To what other stocks should this method be applied and what is the process for adding stocks to that list?
- How long does the process take? For some studies, it has been in excess of 2 years but this depends on the level of detail included in the available studies.
- The list for future stocks should be prioritized first by stocks that have a region-wide ABC/OFL and are close to full utilization (i.e., catch is close to ABC).
- It was cautioned that if ACLs are exceeded more than once in 4 years then the entire system of ACLs and accountability measures (which are triggered when an ACL is exceeded) should be re-evaluated and modified if necessary to improve its performance and effectiveness. If multiple spatial ABCs are inappropriately constructed (e.g., if spatial allocation is based on a single highly variable survey estimate) then the likelihood of exceeding an ACL may increase.
- It was recommended that the Working Group synthesize a comprehensive table of area management of all stocks and the criteria for prioritizing stock structure analyses for presentation to the Teams next September. The current specifications tables contain this information. Consideration of this information should aid in development of a Plan Team recommendation regarding appropriate spatial management for these stocks.
- The GOA Team discussed evaluating the current spatially-explicit management of GOA pollock. Also, GOA skates might be considered, since area-specific ABCs are specified and the Team has debated whether area-specific OFLs would be justified.
- Rockfish and flatfish were highlighted as the most likely candidates for future evaluations.
- Once an analysis has been completed, it may be revisited if new information becomes available.
- Schedule and work-load should be considered when making requests of authors (e.g., an "off-year" assessment would be most appropriate, if possible).

Pacific cod models

Grant Thompson presented the background of the public process for Pacific cod model selection for 2011. The groups of models were:

1. last year's model: cohort-specific K growth parameter, standard deviation of length at age estimated externally, age data included, aging error bias correction, fixed survey catchability, fishery selectivity a function of length by blocks of years, trawl survey selectivity a function of age with annual variation.
2. "data and data structure" (e.g., excluding IPHC data, finer bin structure, seasonal structure)

3. Selectivity and catchability evaluations (informative prior on selectivity, estimate catchability internally)
4. - 6. Age and growth data (exclude mean length-at-age data, age composition data, maturity as a function of length not age, estimate standard deviation of length at age internally, estimate annual values of all three von Bertalanffy growth parameters).

A number of other model features were considered by the Plan Teams and SSC but rejected.

For Model 2 Grant noted that IPHC CPUE observations were inversely correlated with estimated values from all 14 models in last year's BSAI assessment, hence the SSC's suggestion to exclude it. He also evaluated bin structure in part to increase the potential to reliably estimate growth and length-based selectivity parameters.

He then reviewed seasonal structure and his approach to developing refinements to the models. For both the BSAI and GOA, the season structure that gave the best tradeoff between number of parameters and fit to the data was a 5-season partition. This criterion was chosen so as to minimize the variation in F among months within season.

In the GOA, excluding the 2008 fishery data had the surprisingly large effect of lowering estimated 2009 spawning biomass by 30%, and estimated recent recruitment was quite sensitive to the season schedule. In the BSAI, nearly all of the incremental data changes tended to lower estimated present biomass.

Comparisons of all 6 models showed similar fits to survey numbers and similar estimates of commercial selectivities. Estimates of mean length at age differed considerably among models. Estimates of abundance and recruitment were similar in the BSAI but not the GOA.

Decision points relative to Pacific cod models:
1. Keep age data?
2. Keep setting input std dev vectors iteratively?
3. Keep new season, bin structures?
4. Keep tying catchability estimates to Nichol et al. (2007)?

Discussion of new season and bin structure: Bin structure causes models to run slower, but presumably uses all of the information in the data. New seasonal structure was considered appropriate and reflective of the current fishery pattern. The Teams discussed the expectation that the finer bin structure may improve the ability to estimate selectivity parameters.

Convergence issues were discussed relative to the length bins and in general (i.e., whether a global minimum was attained). One suggestion was to compromise and employ small bins for small fish and larger bins for larger fish, to increase speed of model computation. Also, limiting models per region would simplify analyses for the assessments. Generally the Teams recommended retaining the fine scale bin structure of the models despite the time consuming runs and recommended paring down of the number of models considered in each area assessment.

A discussion of tying Q to the point estimate from Nichol et al. resulted in the conclusion that it is not a really precise estimate but it is the only data-based way to constrain the catchability estimate. Since the number is reasonable, the Teams favor continuing to use it in some fashion.

Choosing between different forms of growth variability: The use of AIC may be inappropriate since the likelihood is penalized (i.e., the effective number of parameters is different than the actual number). Mark Maunder suggested doing a cross-validation approach for model selection. His preliminary attempts at cross-validation indicated that constant growth performed better than allowing either cohort-specific growth or annually varying growth parameters. Grant acknowledged that AIC is not an ideal measure for comparing models with different numbers of *dev* vectors. However, cross-validation methods may be very time consuming.

After hearing Craig Kastelle's report on a study of stable isotope variation in cod otoliths (see below), the Team returned to the question of whether to use age data in the assessment. Mark Maunder noted that ageing error consists of bias and variance. Different assumptions about the pattern in both produce corrections that perform better and worse than Grant's, especially if the fit to the reader-tester agreements is ignored. In particular, Mark found that a bias correction based on an erroneous assignment of 40% of age 1 fish to age 2 performed well. Mike Sigler said that because the ageing study is incomplete the age data should be retained in at least one of the models. The Teams discussed options for applying growth corrections based on the new information presented and it was noted that last year's correction was new and something else could certainly be tried. Mark asked where Grant got the variances and he replied it was from paired readings. The variances are therefore probably underestimated. Mark said the bias was the important effect. Bill Clark said that questions about the age data were still unresolved so it would be best to limit the suite of models to the ones that did not use any age data.

The recommendations made by the Plan Teams were as follow:
1. Do not iterate to obtain estimates for penalties associated with *dev* vectors (see also next paragraph below);
2. Use finer (1-cm vs. 3 to 5-cm) length bins and seasons (5 rather than 3) as done for Models 2-6;
3. Continue to apply the catchability values (Q) derived by Dan Nichol (based on archival tag data on Pacific cod depth distribution);
4. Use constant growth rather than annually-varying or cohort-specific growth.

Several quantities have traditionally been estimated iteratively in the Pacific cod assessments, for example, the catchability coefficient and the input standard deviations for all deviation ("*dev*") vectors. To make the process of tuning the models less cumbersome, the Teams encouraged the authors to consider external weighting (i.e., setting such quantities on the basis of common sense) or one-time reweighting of likelihood components.

Prior to the 2009 assessment, constant growth was assumed in the model. Cohort-specific growth was estimated in the 2009 model and Models 1-5 and annually varying growth was tested in Model 6. The Plan Team recommends returning to a constant growth assumption for this year's assessment until there is evidence for either time-varying or cohort-specific growth in the Pacific cod age or length data.

The Team recommended that the author prepare two models for November, with these features: one with, and one without, age data, along the lines of Model 2 and Model 4.

Grant asked for clarification concerning the estimation of the standard deviation of length at age: internal or external. The Team favored external estimates because the internal estimates (Model 5) appeared to be too high.

Pacific cod age validation

Craig Kastelle reported on a project in which microsamples were milled from transects across the growth zones of 10 otoliths and concentrations of Oxygen-18 (O18) and Carbon-13 (C13) were measured.

Cod otoliths are difficult to age because it is hard to identify translucent zones that are really annuli. The seasonal cycle of ocean temperature should produce a corresponding cyclical pattern of O18 across the otolith. Preliminary results are available from 9 fish that had archival tags with temperature records. Otoliths were thin sectioned, read in standard fashion, then micro-sampled and concentrations of O18 and C13 were measured by mass spectrometry. Fish chosen were from the Kodiak area and Bering Sea, moved little from their release location and all were younger fish that had been at liberty for 1-2 years.

Location and number of translucent zones counted were compared with number and location of O18 peaks. Also compared were O18 at otolith edge with archived temperature. The expected negative relationship was observed but not very tight.

Seven otoliths showed a seasonal pattern, and in 4 of them the annulus counts agreed with the number of O18 peaks. The O18 patterns are not always clear, so the counting of peaks is subjective. The 3 otoliths where the counts were different were from Kodiak. The otoliths with no O18 pattern were from the Bering Sea.

A number of things can affect the O18 pattern on an otolith besides the seasonal cycle of ocean temperature including migration, salinity, and water mass (e.g., Bering Sea colder than Gulf of Alaska). Further work is planned. The work is very labor-intensive.

Effect of "curdling" (irregular otolith shapes) inquiry: This did not occur for the samples analyzed.

Mark Maunder observed that 4 otoliths had a translucent zone counted as an annulus between O18 peaks, consistent with the apparent over-ageing of young fish suggested by the survey length modes. Craig said that may be the case, but it may also be the result of an anomalous O18 pattern, as all 4 of these otoliths were from the Kodiak area. Kodiak fish are harder to age. Deposition of translucent zones may vary regionally.

The Teams asked why C13 was measured since it was not carried forward in the analysis. The response was that these data are collected as part of the mass-spectrometry readings and should also follow temperature and track with O18 but in some samples the correlation appeared to be weak. It was noted that perhaps this may be a sign that certain specimens had sampling issues (on the micro-scale of otolith surfaces).

The Teams welcomed the preliminary results and look forward to the results of work in progress, including the bomb radiocarbon analysis

NMML report

Lowell Fritz presented activities undertaken by NMML relevant to groundfish and the Steller sea lion (SSL) draft biological opinion (BiOp) and an August 2010 Council action on the BiOp (see above). Consultations on the BiOp began in 2006 and a draft was released for public review in August 2010. NMFS is considering its RPA recommendations and those recommended by the Council in August. Both RPA recommendations include proposed fishery management measures for Atka mackerel and Pacific cod in the AI (regions 543, 542, and 541) due to continued declines of sea lions throughout much of this region; RPAs are region specific with the strongest conservation measures in region 543 where sea lion declines are greatest and statistically significant. The Council's proposed RPAs are less stringent than the NMFS draft RPAs with the biggest difference being in region 543 where NMFS proposes closing the Atka mackerel and Pacific cod fisheries. Another change in the RPAs is that the proposed Atka mackerel season dates would no longer enforce a break between seasons.

Once the BiOp is finalized at the end of October, an Environmental Assessment (EA) will be scheduled for Council review. The RPAs are planned to be in effect for 2011. They can be re-evaluated at any time, and are typically reassessed when new data are available. The SSL recovery plan includes criteria for delisting or down-listing the western stock.

Lowell also reported on current SSL and fur seal research being conducted by NMML. Analysis is underway of a new SSL aerial survey that was conducted this year, including an adult and juvenile count and an examination of movement between the eastern GOA and Southeast Alaska. Western AI SSL pup counts are down in 2010. Pups were branded at Marmot Island and Sugarloaf (central GOA) to examine vital rates; juvenile survival rates in the eastern AI through eastern GOA are high.

Northern fur seal pup production was examined at the Pribilof Islands; preliminary indications are that St George is relatively stable but there are declines at St Paul. Adult female summer foraging ecology was studied at the Pribilof Islands comparing rookeries on either side of St Paul with different spatial overlap with fisheries and examining foraging times and pup growth rates. Fur seal vital rates were studied at the Pribilof Islands using pup tagging. Fritz noted that this is a subset of the research being conducted at NMML which includes other species such as killer whales and belugas. Of note is that a killer whale survey in 2010 found no transient killer whales in the Western AI.

Loh-lee Low noted that the US-Russia Intergovernmental Consultative Committee has discussed research programs in respective areas in which Vladimir Burkanov is involved. Steller sea lions in Russian waters of the western Bering Sea are in decline, but sea lions in the Sea of Okhotsk and the Kuril Islands are increasing. Fritz commented that Russians have an active program including a small project that places observers in some Western Bering Sea fisheries. Lowell mentioned a study of seasonal movement from the Sea of Okhotsk into Japan, where the SSL become vulnerable to hunting (the limit is about 100 animals). The Sea of Okhotsk populations appear to be increasing. Genetic studies indicate that there may be a stock boundary at the tip of Kamchatka peninsula. A central group connecting AI with Commander Islands appears to be distinct.

Groundfish Catch Accounting

Mary Furuness summarized efforts by NMFS to account for total removals in groundfish stock assessments as required under ACL management in 2011. All removals must be accounted for in assessments. AKFIN has an Oracle Dashboard which can house these data when they become available. Numerous datasets have been provided by the State and NMFS. One issue to deal with is choosing an appropriate average weight calculation when only numbers are available. Choosing appropriate data to use is also an issue when considering State surveys and catches from State fisheries. For standardizing data, the easiest approach would be to apply an average weight calculation. Sarah Gaichas provided an example of how average weights in prohibited species are calculated. Current estimates of crab removals use average weight by gear type and year. The IPHC longline survey only has counts and lacks average weights for many species. A straightforward, simple, and consistent approach to account for these removals is needed. It was noted there are similar issues in accounting for bycatch in halibut fisheries. The database is intended to be ready for use during the 2011 assessment cycle. There was considerable discussion of how to account for catch in State waters. A good example is the State-managed Southeast sablefish fishery. Sablefish research catch is a significant proportion of the total catch.

The Plan Teams' discussion centered on additional sources of groundfish mortality not included in the NMFS Catch Accounting System (CAS), which needs to be accounted for by the stock assessment authors in making their ABC recommendations in the annual SAFE reports. Many of the sources of this mortality have been identified, some of which are presently unreported (NMFS, State of Alaska, and IPHC surveys and research activities; personal, subsistence, and sportfishing takes; experimental fishing permits; use of Pacific cod as bait in the crab fisheries), and other sources may yet be identified. NMFS intends to develop a single database that stock assessment authors can access through a single source such as AKFIN. The development of this database will require the cooperation of several agencies including NMFS, the Alaska Department of Fish and Game, and the IPHC.

The Joint Plan Teams recommended the formation of a total catch accounting working group to assist NMFS in develop methodologies to estimate total catch of groundfish. While much of the information is currently available from different sources this is still a work in progress and not ready for use in the 2010 SAFE reports in its entirety. NMFS hopes to have the information available for the 2011 assessment cycle. The working group will need to make several decisions in deciding upon the best methodology.

Bering Sea Integrated Ecosystem Research Program and Gulf of Alaska Integrated Ecosystem Research Program

Mike Sigler provided an update on the Bering Sea and Gulf of Alaska Integrated Ecosystem Research Programs (BSIERP and GOAIERP). The BSIERP is a $52M program funded by the National Science Foundation, North Pacific Research Board, NOAA, and USFWS that involves about 100 principal investigators. The objectives of the Bering Sea Project are to determine the controls of primary and secondary production, recruitment of commercial species, competition among consumers, the spatial and temporal aspects of these factors throughout the EBS, and how these factors may be affected by climate change (warming). Bering Sea field work began in 2007 and continued through fall 2010; the program is expected to produce its final reports in late 2012 following two years of synthesis and modeling. All of the Bering Sea field work was conducted in the relatively cool years of 2007-2010, which followed the warm years of 2001-2005; retrospective analyses and modeling include data available from all years. Some results presented were: 1) large zooplankton abundance is lower in warm years; 2) euphausiid abundance increased in cold years, but pollock abundance has also decreased so the euphausiid increase could be due in part to release from predation; 3) seabirds shifted their foraging location year to year depending on availability of young pollock; and 4) overwinter survival of age 0 pollock is highest in years with moderate temperatures and is related to energy density in fall. With respect to how a warmer climate may affect the EBS, it was estimated that because of a reduction in mean recruitment, average catches of pollock could drop from about 1.2-1.3 M tons to about 0.9 M t by 2050. Furthermore, even as the EBS warms, the northern BS may remain an Arctic system and not necessarily be available for northerly movement of gadids. For more information, see http://bsierp.nprb.org/.

The Gulf of Alaska Project is ~$9M program with about 20 principal investigators. The primary objective of this research is to describe the pelagic, demersal, and spatial linkages in the Gulf of Alaska (GOA), and how competition, predation, and environmental variability affect recruitment and diversity of the groundfish community, with specific emphasis on Pacific cod, pollock, sablefish, Pacific ocean perch, and arrowtooth flounder. The Gulf of Alaska Project began with a pilot field program in 2010. Directed field work will occur in 2011 and 2013, with modeling and synthesis to occur in 2011-2014. This study will compare lower, middle (zooplankton, fish) and upper (seabirds, sea lions, and fish) trophic level processes in the central (Kodiak area) and eastern (Southeast Alaska) GOA. Major objectives are to create habitat suitability models for groundfish species life stages, nutritional assessment of recruits to determine growth potential, and to develop physical (ROMS) and biological (NPZ) oceanography models and IBM-transport models to predict groundfish species recruitment.

Ecosystem assessment

Sarah Gaichas presented changes to the ecosystem assessment sections.

Introductory remarks

- Note that new contributions to this year's report are marked with an asterisk to improve readability.
- Old contributions (i.e., contributions that were new last year) will not be noted as such, but are linked to the website.
- The document now follows a new format with a regional emphasis (for assessments); there is also a section for topics common to all areas.
- The SSC requested that the ecosystem assessment include a synthesis of the "big picture" perspective that will help in making management decisions. The synthesis should focus on status, trends, and interactions (and if appropriate, emphasizing physical/climate datasets, primary and zooplankton production indices, etc.).
- EBS indices will be focused upon in the upcoming winter for the next report.

New Contributions

1. Late summer/fall large zooplankton abundance in EBS. Significant difference found between north and south EBS, especially for copepod *Calanus marshallae*, which were more abundant in cold years. More cnidaria in north in warm conditions and polychaetes in south (nearly absent in north during warm years).
2. Fall YOY condition predicts age-1 EBS pollock recruitment: "average energy content" was the parameter examined in 2010 (not "energy density" as previously). Temperature change index (incorporating juvenile salmon growth*) showed that cool summer temperatures followed by a warm spring resulted in "good" conditions in EBS for pollock and cod, and in Gulf of Alaska (GOA) for sablefish and pollock.
   * = systems studied were Naknek (sockeye), Fish Creek (chum), and Karluk (sockeye)

Trends and Summaries

Physical Parameters

1. Sea Surface Temperature (SST) - El Niño was predicted and occurred in central Pacific (normally develops in eastern Pacific); little effect in Alaskan waters, though.
2. Lots of ice in EBS, relatively cool weather in 2010. Ice cover stability resulted from persistent high arctic high pressure system.
3. La Niña developed in EBS in June-August 2010; fairly cool farther south and southeast.
4. Sea Level Pressure – extremely anomalous in whole GOA between December 2009-February 2010.
5. In the North Pacific, the Arctic Oscillation dropped to a historic low (which is also an indicator of the location of the Aleutian Low).
6. Models predict the La Niña conditions will occur in 2011 (and subsequently, a weaker Aleutian Low). Alternatively, weather will include milder storms in the Aleutians during the upcoming winter.

EBS Ecosystem Trends

Graphs were shown to illustrate patterns among parameters; regression done for latest 5 years and is 1± SD of long-term mean. Highlights follow (refer to chapter for more details):

1. Winter spawning flatfish recruitment correlated with wind forcing: Onshore winds result in better recruitment; opposite result for offshore winds (this is especially true for rock sole). Weaker association found for arrowtooth flounder and flathead sole since 1992; 2010 difficult to classify.
2. Survey and recruitment of EBS groundfish index (from bottom trawl survey): 8 stocks included to evaluate species richness and diversity; environmental signal indicated. Richness highest around 100m contour; diversity highest along mid-shelf.
3. EBS trawl surveys indicated that bottom temperatures appear to affect the spatial distribution of pollock (it was also noted that bottom temperature is currently used to model survey catchability of yellowfin sole and arrowtooth flounder). Spatial distribution of EBS groundfish shifting to north and to shallower water in 2000s (even when accounting for temperature changes).
4. Mixed signals from seabirds and northern fur seals.
5. Southeast Alaska Pacific herring – both increasing and decreasing trends at 9 monitored sites; '05 and '08 highest spawning biomass in 25-year time series. Age at maturity increasing.

6. Essentially no forage catch so impossible to detect a trend therein.
7. HAPC – no trend but there is more benthic habitat present in Aleutian Islands (AI).
8. Discards down in AI.

AI Ecosystem Trends

In spite of attention given to the Aleutian Islands in terms of developing an Ecosystem Management Plan and specific conservation concerns such as the Steller Sea Lion Biological Opinion, very little data exists in terms of time series or collection efforts for the Aleutian Islands; this makes it difficult to track developing trends in the Aleutian Islands and improving effort here should be a research priority.

GOA Ecosystem Trends

1. CPUE – fish and invertebrates combined. No significant trends in western GOA, but significant upward trend in eastern GOA (due mostly to increases in arrowtooth, rockfish, and hake).
2. Surplus production and exploitation rates show a lot of variability. Exploitation rates lower than in EBS; explained arrowtooth flounder abundance (which are currently considered under-exploited).

Trends in Both Ecosystems

1. Survey and Recruitment (evaluating 11 groundfish stocks) data show Bering Sea conditions lag the GOA by 2 years.
2. Eddy Kinetic Energy –much higher in general in AI, especially around passes than in Gulf. Kinetic energy relatively low in '08, high in '09-10, coming back down. Results in increasing water volume, heat, salt, and nutrient fluxes.

Discussion topics/Questions/Comments

The Teams inquired about whether there are criteria to include any particular time series (i.e., is there a standard for including/excluding any time series)? Presently there are no such criteria.

It was noted that grenadiers should probably be categorized as non-FMP species rather than included with HAPC.

Sarah invited participation in a series of ecosystem synthesis workshops. The purpose of this effort is to reduce the number of EBS indicators to 5-10 data sets to better assist evaluation by the assessment authors, the Plan Teams, and the SSC. The next workshop is scheduled for September 29. The process of evaluating the quality of data sets is intended to ultimately develop "threshold" criteria for management actions.

The ecosystem chapter will continue to include all current data sets. A third workshop scheduled for mid-October will synthesize information from the selected indicators and these will be presented in the EBS ecosystem assessment. Next year (February?) the plan is to conduct a workshop comprised of assessment authors to refine these indicators and to develop species/stock-specific ecosystem indicators.

Economic analysis

Michael Dalton presented key results from the Economic SAFE Report of the 2009 fisheries. He summarized the primary recent contributions of the AFSC Economic and Social Science Research Group and listed several research topics to be investigated during the coming year. The format of the report included catch, value, prices, prohibited species bycatch, discard total and discard rates, number of vessels operating, total registered net tonnage, crew size and weeks of effort, weeks spent fishing, number of vessels and plants with observers, US per capita consumption of fish and shellfish, fillets and steaks, and fish sticks and portions. Future SAFE reports will include product descriptions, market shares and international shares of pollock, cod, sablefish, yellowfin and rock sole, and arrowtooth flounder. Michael also summarized papers and projects that addressed a variety of topics: 1) markets and trade, 2) data collection and synthesis, 3) recreational fisheries and non-market valuation, 4) model of fishermen behavior, management and economic performance, 5) regional economic modeling, and 6) socioeconomic, cultural, and community analyses. There was a 13% drop in 2009 commercial groundfish catch. Groundfish accounted for 48% of total Alaska ex-vessel value.

The AFSC Economic and Social Science Research Group also investigated the economic decomposition of changes in first-wholesale revenues for the BSAI and GOA commercial groundfish fisheries in 2007-2009. Michael presented the results modeled by a "complete decomposition model". Positive price effects prevailed in 2007-08 in both BSAI and GOA revenues. The decrease in BSAI and GOA pollock TACs in 2008 contributed to a global whitefish shortage in that year, which along with competition for fillet products, put pressure on surimi markets that responded by roughly doubling the market price. In 2008-2009, negative price effects appeared in both the BSAI and GOA.

Michael reported on the 2/23/10 meeting of the Plan Team Economics Working Group. Brian Garber-Yonts introduced the purpose of the Crab SAFE. Time Series models, specifically a Vector Autoregressive Model, has been used to model the golden king, red king, and snow crabs annual price data. It may possible to extend the model to forecast groundfish prices in the future. In addition, the Working Group also discussed a size-structured snow crab bioeconomics model. The estimated parameters will be useful for spatial oceanographic model simulation in the future. Alan Haynie is leading a nationwide project that will provide improved tools to analyze and predict how fishermen respond to area closures and other spatial management actions. FishSET is currently being developed and will be available for use within two years.

Members of the public and Plan Teams asked several questions. Why there was a 25% drop of wholesale value in 2009? How vulnerable is the surimi price? Why did the price of Pacific cod not have a significant change like the surimi price in recent years? Is there a relationship between the Atlantic cod and Pacific cod prices? There was a big drop in surimi price in 2009 compared with 2008. Seasonal festivals may affect the Japan surimi price. The economics team will attempt to investigate the data and answer these questions in the future.

Essential fish habitat/HAPC proposals

Olav Ormseth summarized a NMFS proposal to the Council that would designate six skate nursery areas along the eastern Bering slope as Habitat Areas of Particular Concern (HAPC). Skates have low population growth rates, and deposit their eggs in localized nursery areas where development of embryos can take as long as three years. HAPC designation would prohibit commercial fishing with bottom contact gear. Providing some protection for these nursery areas is intended to reduce the mortality of skate eggs due to fishing activity, as well as limiting the disruption of spawning. The proposed HAPC areas are intended to provide protection to Alaska skate (*Bathyraja parmifera*), Aleutian skate (*Bathyraja aleutica*), and Bering skate (*Bathyraja interrrupta*), although other skate species may also benefit from these areas. The six proposed HAPC areas constitute 280 km^2, which is 0.05% of the estimated area of the eastern Bering Sea. The proportion of skate egg cases protected by the proposed HAPC areas is estimated to be 10-20% for Alaska skate, and potentially larger for Aleutian skate and Bering skate, depending on their distribution. The joint Plan Teams found ecological merit to the proposal due to the low population growth rate of skates, the long development time for skate embryos during which they are vulnerable to fishing gear, and the relatively high level of production provided by a small area of the eastern Bering Sea. Should these HAPC areas be approved, the joint Plan Teams encourage the allocation of research funds to monitor the effectiveness of the protection measures for skate embryos.

Attendance: Mike Szymanski, Anne Vanderhoeven, Tom Wilderbuer, Dave Witherell, Phil Rigby, Craig Faunce, Brent Paine, Dave Benson, Jim Hubbard, Rhonda Hubbard, Kenny Down, Jennifer Calahan, Olav Ormseth, Jan Jacobs, Neil Rodriguez, Patrick Ressler, Donna Parker, Todd Loomis, Lori Swanson, John Hocevar, Taina Honkalehto, Ruth Christiansen.

GOA GROUNDFISH PLAN TEAM

September 23, 2010

Jim Ianelli	AFSC REFM (GOA co-chair)	Nick Sagalkin	ADF&G
Diana Stram	NPFMC (GOA co-chair)	Mike Dalton	AFSC REFM
Sandra Lowe	AFSC REFM	Leslie Slater	USFWS
Chris Lunsford	AFSC ABL	Paul Spencer	AFSC REFM
Jon Heifetz	AFSC ABL	Ken Goldman	ADF&G
Nancy Friday	AFSC NMML	Bob Foy**	NOAA AFSC RACE
Kristen Green*	ADF&G	Steven Hare**	IPHC
Tom Pearson	AKRO		

* Pending SSC confirmation
** Absent

Rockfish Maturity Discussion

Plan Team requested updates on maturity studies in November, 2009. ABL rockfish staff prepared a document which outlines the difficulties of determining rockfish maturity and discusses several new studies that have recently come out. Maturity at age is important because it has direct effects on F40% calculations. The problem posed to GOA rockfish authors is that several estimates are now available for individual rockfish species and choosing the appropriate estimate is troublesome.

Determining maturity can be difficult. Ideal field sampling would include macroscopic and microscopic analyses preferably through an entire year of sampling to help address maturity staging determinations most notably abortive maturation issues. Length stratified sampling is preferred to get more samples in the size/age range that is in question as fine resolution is often needed between just a couple length bins due to the slow growth/long lived life history exhibited by rockfish. The optimum time to sample is when embryos are present which generally occurs in late winter/early spring for Alaska rockfish species. An example from Oregon was presented where a study showed mature eggs are reabsorbed and the fish did not actually give birth even though at the time of sampling the female is carrying embryos. This illustrates the need for multiple sampling periods and shows that defining "mature" is problematic. There are alternative definitions for mature when comparing reproductive biology to stock assessment. The re-absorption of embryos is not desirable for stock assessment since the main concern is whether that fish will spawn in that year. A fish that is technically mature in reproductive biology terms in April or May is probably not mature in stock assessment terms because it should have spawned in the spring.

Current estimates for GOA rockfish were provided. There is a wide range of age at 50% maturity (A50%) for some species depending on the study. And, recent studies which provide new estimates are now available for dusky and northern rockfish. A50% is very important when looking at the F40 rate which is our harvest strategy. GOA POP were shown as a case example and illustrated that a change in A50% will almost linearly affect F40 and the ABC.

Some strategies exist for determining the best A50% to use. One is to use an alternative to F40% which is comparable to going with a Tier 5 approach; the most recent published estimates could be used; results from numerous studies could be averaged; or if available all raw data could be pooled and reanalyzed.

Using some type of Bayesian average scheme was presented and a simulated example was presented. Data for northern rockfish was also presented with a potential method for averaging the estimates from the two studies. A weighted average based on weighting by variance was suggested which provides an alternative estimate based on the certainty of the estimates.

In the discussion that ensued, it was noted that a Bayesian approach appears reasonable but also one should consider how maturity may be changing over time. Also the data quality of each individual study is difficult to understand so temporal changes in the population may be impossible to discern. It is challenging to incorporate or represent the uncertainty through the model and associate F40 values so we need to understand how to represent uncertainty surrounding A50% estimates. The main issue is choosing what value to use for point estimates and then how do you capture the uncertainty associated with that point estimate. One option was rather than providing a specific point estimate for A50%, maturity could be presented as a range of uncertainty and point estimate choices would be influenced by this uncertainty. Another suggestion was to have the author use their discretion to choose the best study and/or estimate. It's evident the best approach is to choose a point estimate that does not have a lot of controversy associated with it or provide the level of uncertainty associated with it. To help capture the uncertainty, a potential is to have an author recommended F that is below the max F base on their concern for the A50% value being used. Incorporating historical data with new data that becomes available makes sense but how to do it is potentially contentious. Trying to express the uncertainty was endorsed but was pointed out that all studies should be carefully considered and that getting more data is obviously preferred but likely not possible.

Further discussion centered on whether to incorporate the uncertainty within the model or externally. Doing it internally is best since it has an effect on other point estimates and projections within the model and how they would propagate out can only be captured if incorporated internally. A point was made to have a Center-wide approach to collecting maturity data so that a standardized plan is followed for determining A50%. It was also pointed out that with Rockfish Pilot Project there is more chance to get fishery data from earlier in the year when fish are spawning, which may be beneficial for numerous species.

The Team made three recommendations. One is to refine the available data to get the best estimates. This most likely will be at the author's discretion. A suggestion for helping authors in this was to pursue having a standardized checklist among species which will help in making the best choice. Two, pursue an approach which captures the uncertainty associated with A50% estimates. In reference to the uncertainty this will play a bigger role in terms of ACLs and is a worthy exercise to pursue. Three, a more coordinated effort should be encouraged to pursue better data and results to help alleviate this issue in the future. It was suggested to contact

Kodiak staff to better coordinate these studies between assessment authors and AFSC staff doing the research. It was highlighted that "standardized" maturity studies should be pursued.

Stock assessment model specification for northern and southern rock sole

Teresa A'mar presented the model specification for GOA Northern (N) and Southern (S) rock sole stocks. Separate N and S stocks were identified beginning in 1996. The model has 3 types of fish: N, S, and unidentified (U). Growth and maturity parameters are not estimated in the model and are taken from a previous study. The statistical catch-at-age population dynamics model has survey catchability fixed, q = 1.0, for both species. Natural mortality was also fixed, M = 0.2, for both sexes and species. A small amount (1-2%) of the Shallow Shelf Flat Fish (SWFF) catch was observed and most of that catch (60-90% depending on the year) is rock sole. Results from the model showed upward trends in biomass, especially for the Southern stock. There was no visible trend in recruitments, though the model estimated large recent recruitment events for the Southern stock. Error bars for recruitments were very wide. Currently, the model has separate selectivity curves for 3 time-periods based on information in the ecosystem considerations chapter. Whether to use 2 time-periods, change the range of years for each selectivity curve, etc., can be considered in future work. Results from the model show fits to survey data are relatively poor in early years and better in the more recent time-period. Fits to survey age and length compositions are generally good. The model does not fit very well to some patterns in the survey age compositions, and tends to overestimate survey mean length at age.

The Team discussed the use of observer data to partition the unidentified fish, and in particular, whether that approach was adequate for this purpose because such a small fraction of the SWFF is observed and there could be effects of different geographic distributions for each species. The survey could cover different area than the fishery. A plot of spatial distribution of each species, and the SWFF complex overall, could be informative to see, for example, if the southern stock is an area not accessible to the fishery.

The Team recommended considering sex/stock-specific natural mortality parameters, and to look at the spatial distribution of N/S catch in the survey. Overall conclusion was that nothing major appears to prevent this assessment from going into Tier 3. There is still the open question of how to account for uncertainty in the N/S determination for unidentified (U) fish. The Team's recommendation was that no major revisions be made to the model/document at this time so that the SSC sees the same model. The Team commended Dr. A'mar for developing this new assessment model under a tight schedule.

This model if accepted next year would need to be considered (results on ABC and OFL) in proposed specifications this time next year and would be included in the SWF chapter as a separate Tier 3 assessment within the complex. This chapter structure (and particularly the maps of spatial evaluation of the complex as a whole) should be consistent with the PSR chapter (and treatment of the dusky rockfish assessment within the complex).

GOA Pollock EIT survey results

Mike Guttormsen provided an overview of the winter EIT survey results. The Shumagin Islands were surveyed in late February, followed by Sanak. Timing of the survey was a little later than usual. Biomass in Shumagin Islands was about 1/3 of what was observed last year and dominated by age 3 and age 4 fish. Sanak biomass similar to last year and dominated by ages 9-11.

The group surveyed the Kenai Peninsula and Prince William Sound region, which has not been done in some time. No spawning or spent fish detected in survey – 97% mature. A large biomass was found throughout the area. Estimated biomass was 111kt in Kenai and 112kt in PWS. It was noted that the fishery opens Jan 20 – March 3, although fishing does not usually occur until February and apparently was only limited amount of roe targeted. In the survey, most fish encountered in the Kenai region were ages 5-6.

Marmot Bay was surveyed again this year. This area has been surveyed every year since 2007 except 2009. Most fish were age 4 and 5

Similar to previous years very little biomass was detected in Chirikof and they were all adult fish (ages 10 and 11). Shelikof estimates increased from last year, from 266 last to 429 (close to Martins prediction).

There is a summer survey planned for 2011 in addition to the winter survey. Survey is planned for the entire Gulf of Alaska and will attempt to estimate biomass of POP, northern rockfish, and capelin in addition to pollock. The Team looks forward to seeing the results from this long-awaited survey.

Specifications

In conformance with Council policy since 2007, the Team recommended that proposed specifications for ABC and OFLs for all GOA species should be based upon a roll-over of the 2011 specifications with the individual other species categories broken out. The Team felt that using the 2011 specifications as the basis for the proposed specifications would account for the increases projected for some species in 2011(as opposed to 2010). OFLs and ABCs that contributed to the aggregate other species specifications are used to propose those group-specific specifications. Final specification recommendations from the Team will be based on the November assessment reviews. Recommendations for proposed specifications for 2011/2012 are attached.

Team assignments

The Team distributed draft summary assignments for the November SAFE report introduction. Tom Pearson will distribute the final catches by area in 2009 as well as catch to date in 2010 one week prior to the meeting for use in updating the catch information in the introduction.

Meeting adjourned at 2:10pm.

BSAI GROUNDFISH PLAN TEAM

September 23, 2010

Loh-Lee Low	(AFSC), Chair	Brenda Norcross	(UAF)
Grant Thompson	(AFSC), SSC liaison	Leslie Slater	(USFWS)
Mike Sigler	(AFSC), Vice-chair	Kerim Aydin	(AFSC)
Jane DiCosimo	(NPFMC), Coordinator	Lowell Fritz	(NMML)
Dave Carlile	(ADF&G)	David Barnard	(ADF&G)
Mary Furuness	(AKRO)	Yuk W. (Henry) Cheng	(WDFW)
Dana Hanselman	(AFSC)	Alan Haynie (1st day only)	(AFSC)

The BSAI Groundfish Plan Team convened on Thursday, September 23, at approximately 9:00 am. The GOA Groundfish Team attended the first agenda item.

CIE review of EBS walleye pollock

The EBS walleye pollock stock assessment was reviewed this year, organized through the Center of Independent Experts (CIE). The CIE organization is run independently from NOAA and coordinates and identifies non-NOAA affiliated experts to conduct stock assessment reviews. The reviewers were Kevin Stokes, Stephen Smith, and Chris Darby. Background materials were provided to the reviewers in May, the review was conducted in June, and the reviewers' individual reports were made available on August 9.

Among the many issues addressed during the review were the following: retrospective patterns in estimates of reference points (*B0*, *BMSY*, and *FMSY*), the extent of annual variations in selectivity, accounting for ageing error, model diagnostics, sensitivity analysis, and patterns in fishing mortality at age.

Analyses conducted during the review included sensitivity runs with penalized variation in selectivity; implementation of ageing error; and *FMSY* estimates based on average selectivities from the most recent 1, 2, 3, and 4 years. These showed very little change in the ratio of the harmonic mean to the arithmetic mean in the pdf of *FMSY*. Two different approaches to retrospective analysis (type 1: plotting the results of successive assessments; type 2: re-running the current model several times, dropping successive years of data each time) showed opposite patterns in estimates of end-year biomass. Type 2 retrospective estimates of *BMSY* ranged from 1.73 to 2.10 million t and retrospective estimates of *FMSY* ranged from 0.5 to 1.1. The reviewers noted that spawning exploitation rate, being a univariate measure, is not always positively correlated with the fishing mortality rate for any given age group.

For this year's assessment, the senior assessment author plans to consider using an ageing error matrix in at least one model, examine how well the model predicts survey biomass one year ahead, include more model diagnostics, and include a discussion of possible impacts stemming from the "B20 rule" in the Steller sea lion protective measures.

The BSAI Plan Team noted that the CIE review did not result in any progress being made on assessing the reliability of the stock-recruitment relationship, which had been identified as a key area of concern in last year's Plan Team review.

EBS shelf bottom trawl survey

Bob Lauth presented a summary of results of the 2010 EBS shelf bottom trawl survey. This year's EBS shelf bottom trawl survey covered the area that has been standard since 1987 (376 stations), plus 145 additional stations in the northern Bering Sea (this is not the same as the northern Bering Sea "research" area). Over the entire time series, the survey has had an average start time in early June and an average end time in late July. This year had typical start and end times. This was another "cold" survey year, the fifth in a row. One new vessel was used this year. Although no calibration experiments *per se* were conducted, standardization was achieved by strict adherence to a detailed and time-tested protocol. Biomass estimates of almost all species were higher than last year's (Alaska plaice was an exception, being down just slightly). For Pacific cod, the 2010 biomass for the standard survey area is 860,000 t, which ranks 11th out of 29 survey biomass estimates and is about 13% above the 760,000 t average for 1982-2009. It was slightly more than twice the biomass for 2009 (421,000 mt). For pollock, the 2010 estimate is 3.75 million t and ranks 23rd out of 29 surveys. The estimate is below average by about 22% (the average is 4.83 million t), but represents a 64% increase from the 2009 value (which was 2.28 million t). Pollock biomass was concentrated in the northwest corner of the standard survey area.

This was the first survey of the northern Bering Sea since 1991. The northern stations were surveyed from the end of July through mid-August. The northern portion of some species' estimated biomasses was substantial. For example about 40% of the Alaska plaice biomass was located in the north, and about 50% of the Bering flounder biomass was in the north.

EBS slope bottom trawl survey

The EBS slope was also surveyed by bottom trawl this year. This was the fourth survey of the slope in the current time series (previous surveys occurred in 2002, 2004, and 2008). The vessel was the same one used in the 2008 survey. The EBS slope survey differs from the EBS shelf survey in several respects: It uses a different net with mud sweep group, slower trawling speed, heavier doors, a more stable (4-point) door attachment, and a stratified random design. A total of 201 stations were sampled (to depths of 1200 m), about 40% of which were in the Bering Canyon area. The predominant substrate is lumpy mud, with a few rocky patches.

Giant grenadier was the dominant species in terms of biomass, as usual, followed by POP, arrowtooth flounder, popeye grenadier (which was the dominant species in terms of numbers), and shortspine thornyhead. Relative to the 2008 survey, biomass estimates of almost all species were up (sablefish being an exception).

There was speculation during Team discussion about the possibility of biomass trends being correlated with temperature, as several species seemed to have lower biomasses during the warm years of 2002 and 2004 than the cold years of 2008 and 2010.

2010 EBS Acoustic Pollock Trawl Survey report

Taina Honkalehto summarized the 2010 acoustic-trawl (AT) survey of pollock on the EBS shelf. This is the fifth consecutive year for the survey. Thirty-one transects were conducted; they were divided between areas east and west of 170 W with a few transects extending into, or wholly within, Russian waters. The survey started in Bristol Bay and proceeded to the northwest and included 68 midwater trawls, 27 euphausiid/larval fish trawls, and temperature and depth profiles. Multibeam and target strength data were collected during the night, along with some non-lethal sampling. One north-to-south example comparison of pollock backscatter data vs. temperature highlighted the association of pollock with warmer water. Mean weight at length data indicated larger pollock east of 170 W. Among the three areas, ~ 7%, 87%, and 5% of the biomass was found east of 170, west of 170, and in Russia, respectively. Trawl catch by weight was 89% pollock, ~10% jellyfish, with the remaining catch divided among many other species, including a large catch of herring. Jellyfish catch was approximately 3 times greater than in 2009. Essentially all juvenile (ages 1-3) biomass was found west of 170 W. Plots of depth below surface and height off bottom indicated adult and juvenile biomass at roughly similar depths (80-140 m) with adult biomass east of 170 W concentrated near the lower end of that range. Juvenile biomass was concentrated somewhat higher off bottom (mode 44 m) than adult (mode 29 m west of 170 W, 0 m east of 170 W). The percentage of the biomass in Russia has varied from 1% (2009) to 15% (1994). Between 2004 and 2009, euphasiid and pollock abundances, as indexed by acoustic backscatter, have varied inversely, with euphasiid abundance increasing and pollock decreasing over this period. Highlights of the AT survey included observations that water on the shelf was relatively cold (as in 2006-2009); 87% of the biomass was found west of 170 W; ages 2, 1 and 4 (in that order) dominated, with relatively few age 5 pollock; the EEZ midwater pollock biomass was 2.3 million t, with 0.13 million t in Russia; there appears to be potential for using euphasiid abundance to help interpret pollock variability.

A question arose about whether there was any acoustic evidence of a strong incoming year class of pollock. It was unknown whether there was any such evidence. Responding to a question about pollock vertical distribution, it was suggested that part of the reason for the observed distributions was that there were more fish off bottom, and therefore susceptible to sampling. This greater proportion off bottom was due partly to the higher abundance of younger pollock, which tend to be distributed higher off bottom. In response to a question about whether the increased abundance indicated by the AT survey was consistent with anticipated change in pollock abundance, Jim Ianelli responded that results from the AT survey were a little greater than expected and the bottom trawl estimate was much higher than expected.

Progress and plans toward using acoustic data collected by bottom trawl survey fishing vessels as an annual index of pollock abundance was reported. Data from 1999-2004 AT surveys were used to define a pollock "index area" over which it was determined that most acoustic backscatter is usually pollock. Acoustic backscatter abundance from bottom trawl and AT surveys was found to be highly correlated as exhibited by data presented for 2008 and 2009. Based on the correlation between the bottom trawl and AT survey backscatter-derived abundance, plans for the future call for the bottom trawl index to be used alone in 2011 and to use the AT survey to check this bottom trawl index every two years.

Aleutian Islands Bottom Trawl Survey

Mark Wilkins reported on the 2010 Aleutian Islands bottom trawl survey. He summarized the structure of the survey (2 vessels, 3 legs each vessel, with surveys in the AI conducted during even years) and the data that were collected (e.g., abundance, spatial distribution, size and age composition). The survey completed 419 of the planned 420 stations, with a high proportion of good tows among the stations. This contrasts with 2008, when the survey was cancelled, and 2006, when the number of stations surveyed was reduced. It was noted that the generally random selection of stations was constrained somewhat by the limited availability of trawlable areas. Mark noted that some changes are made to stations within the 49 strata and that this process was aided this year by application of a GIS program. Standardization of methods among field party chiefs was noted. Status of data review and analysis to date was provided. Haul effort data have received preliminary edit, catch and length data have been edited; specimen length data have received preliminary screening and will be edited over the next month; some age data (Atka mackerel) are available. Mark compared 2006 vs 2010 abundance trends for individual species. Species that remained generally unchanged were Kamchatka flounder, Pacific halibut, other rockfish, shortraker rockfish, thornyheads and octopus. Species that showed slight declines included arrowtooth flounder, Greenland turbot, northern rock sole, rex sole, Pacific cod, dark rockfish and dusky rockfish. Flathead and dover sole, pollock, and Atka mackerel increased slightly; and sculpins, Pacific Ocean perch, and unidentified skate increased markedly. However, the marked increase in unidentified skates was due to the transfer of some skates formerly classified as Alaska skates into unidentified skates.

In response to a question about acoustic data availability from the AI survey, Mark indicated that the acoustic data were collected and available.

BSAI arrowtooth/Kamchatka flounder complex split

Tom Wilderbuer presented information on a potential action to break Kamchatka flounder out of the Arrowtooth/Kamchatka flounder complex due to a change in the fishery. For the fishery time series Kamchatka flounder comprised about 7% of the total biomass for the complex. However, the catch for this species has increased from about 12,000 t in 2007 to 32,000 t in 2010. Most of the BSAI catch for the complex (72%) is in area 541 where Kamchatka flounder make up 73% of the catch. At present Kamchatka flounder would be considered fully utilized. Using Tier 5 methods, Tom calculated a hypothetical ABC of 17,721 t. The 2010 catch through September is 18,291 t. All Kamchatka flounder catch is in the trawl fishery and the two species are identifiable by onboard observers. The Team concurred with the author to break the complex into separate specifications for Arrowtooth flounder and Kamchatka flounder as a precautionary measure.

The Team considered three options:

1. keeping both species in the same chapter with separate ABCs and OFLs;

2. putting Kamchatka flounder in its own chapter with own ABC and OFL; and
3. moving Kamchatka flounder to the "other flatfish" category.

The Team adopted proposed specifications for Kamchatka flounder, and adjusted the 2011/2012 complex specifications for Arrowtooth flounder.

Species	Area	2011 OFL	2011 ABC	2012 OFL	2012 ABC
Arrowtooth flounder	BSAI	167,400	139,300	167,400	139,300
Kamchatka flounder	BSAI	23,600	17,700	23,600	17,700

The Team recommended putting Kamchatka flounder into its own chapter and asked Tom to assemble data averaging survey results for some reasonable number of recent years (between 1 and 10) to determine estimates for Tier 5 ABC and OFL. The Team thanked Tom for raising this issue and agreeing to develop the new chapter for November.

Yellowfin sole and northern rock sole model modification

Tom Wilderbuer presented a proposal for including time-varying selectivity in the assessments of yellowfin sole and northern rock sole. Estimates of female spawning biomass, survey biomass, and recruitment appear similar between the new and old models, but the ratio between the harmonic mean and arithmetic mean of the *FMSY* distribution is larger in the new model. The Team recommended that Tom include time-varying selectivity in this year's yellowfin sole and northern rock sole assessments, at least as one option.

Bering Sea blackspotted and rougheye rockfish stock structure

Jane DiCosimo reminded the Team that the next three agenda items focused on stock structure and that members should recall the stock structure policy it adopted during the joint Team session. Decisions on whether to adopt separate specifications for the next two fishing seasons needs to occur at this meeting so that the public is notified that such an action may be adopted in the final rule (the final specifications need to be a logical outgrowth of proposed specifications).

Paul Spencer presented results of applying the stock structure working group's stock structure template to BSAI blackspotted and rougheye rockfish in the September 2010 joint session, which were similar to information presented to the Plan Team in previous years. He provided new information based on questions he received earlier in the week on relative abundances and catch by area in the Aleutian Islands (AI). Central AI has the highest abundance; the western AI came down in the mid 1990s, where it has remained. The western AI error bars were large. The Central and Eastern abundance estimates are imprecise, but relatively stable. He then showed CVs by area and said they were high but comparable to the Pacific ocean perch CVs, which has area ABCs. One thing to consider when making these subarea calculations is that areas with small abundance often have a high CV. He then showed average survey biomass for recent years (2002-2006) and from 1991-2006 compared to recent catch average. Western GOA had a higher proportion of catch compared to its relative biomass.

The model ABC was apportioned into area ABCs with the different survey biomass series. For each of the AI subareas, the recent catches were compared to the potential subarea ABC based on both of the survey time periods mentioned above. This comparison indicated that the western AI catches would be above the ABC under either of the average survey biomass scenarios.

Most of the fish was caught on trawl gear, mostly rockfish targets (POP) and a little from the Atka mackerel fishery. For the longline fishery, Pacific cod caught most of the RE/BS catch, with a little bit from halibut longlines.

Mike Sigler recommended that the Team consider both the BS v. AI split and the AI subarea splits. The Team discussed the need to identify the species included in the complex. Blackspotted rockfish could be separated from the complex; however, there is no species code for blackspotted in the Catch Accounting System. Some of the boats are 100% observed, but they are not identifying their catch to species. Mary noted that current management is fine as long as the regulations identify what species comprise the complex because the groundfish FMP does not define the complexes. The Teams should be aware that as new species are identified, they may be best managed under the other (flatfish or rockfish) categories. Grant Thompson suggested that a future FMP amendment could clarify existing language regarding the disposition of target species that have been newly identified or split out of existing complexes (i.e., do they necessarily become part of an "other" complex, or can they be managed as individual stocks—the Team has always understood the latter to be the case).

Mike asked about the impacts for commercial fisheries of splitting these stocks, in terms of ACLs and AMs. Mary said that it could result in OFL closures of small areas, if OFLs were also split. In-season management tools allow the agency to first switch to prohibited status and then to shut down the fishery. The POP fishery is already managed in three areas and the fishery is spread; but POP might not be harvested in proportion to the abundance of RE/BS.

Grant reminded the Team of the "at least two areas to the extent practicable" principle that the Teams adopted during the joint Team discussion of the Stock Structure Working Group report. He asked whether it would be appropriate to create one subarea that included the Bering Sea and Eastern Aleutians and another subarea that included the Western and Central AIs; Atka mackerel provides a precedent for combining the EBS and the Eastern AI. Mary suggested it could increase the risk of reaching the OFL and could be complicated to manage. Grant clarified that he intended for this suggestion to apply to the ABC only, not the OFL. Mike asked what would be the biomass proportions would be implied by that split. Paul said ABC, biomass, and catch were all quite small in the Bering Sea. Bill Clark asked how well NMFS could manage a 50 ton catch. Mary responded that management is difficult at low TAC levels. There is also a

70/30 gear split in the AI-only areas. Mary will look into whether subareas would be prosecutable or legal.

Industry members asked what the biological urgency is for taking the proposed action. It will require managing more, smaller quotas. The smaller TACs also would have to be split among cooperative companies which could make some portions unmanageable.

Jane reviewed that the purpose of the proposed specifications is a public notice of a potential future action. In that context, the Team can propose an area split, and then the public can comment on it to both the Council during its meetings and to the Secretary during the public comment period on the proposed rule. The Council may or may not approve it. Mike suggested that we ask for more information from the author at the November PT meeting on the 3 options that the Team has discussed: 1) Status quo (no split); 2) split WAI/CAI from EAI/EBS; and 3) split BS from AI. If the Team does not indicate an interest in selecting one of the options now, we cannot do it in November. For the purpose of the table, we either stick with status quo, or indicate a potential action on the proposed ABC splits.

Maura Sullivan explained that the public needs to have access to the analysis when they issue the proposed rule which would be in December when the SAFE Report is available for review. It was asked whether the SSC could decide in October to do the split. Jane stated it could, but it might not choose to do so without the Plan Team recommendation.

The Team agreed that the scientific data are sufficient to indicate stock structure within the BSAI area, and thus to consider splitting the complex by subarea. The discussion in November will focus on the feasibility of managing a split ABC. Paul will present the above options (1, 2, and 3 listed above) in November and possibly an option related to a Western AI only area. Paul will describe proposed ABC levels along with estimated biomasses for potential area splits. Mary will report on the management implications of different area splits. Mary noted some implications. After subtraction of reserves, the TAC of shortraker rockfish and rougheye rockfish specified for the Aleutian Islands subarea would be allocated 30 percent to vessels using non-trawl gear and 70 percent to vessels using trawl gear.

The Team adopted proposed specifications for Blackspotted/Rougheye rockfish as follows.

Species	Area	2011 OFL	2011 ABC	2012 OFL	2012 ABC
Blackspotted/Rougheye rockfish	BSAI	567	463	567	463
	BS		40		40
	AI		423		423

BSAI skates

The Plan Team addressed the topic of separate skate categories based on the 2009 stock assessment recommendation that Alaska skates and "other skates" be managed under separate OFLs, ABCs, and TACs (as is done for big and longnose skates in the GOA). The purpose of separate recommendations is to provide increased protection to rare or endemic species in the EBS slope and AI habitat areas, since the Alaska skate constitutes the bulk of the skate biomass in the EBS shelf habitat area. In addition to separating Alaska skates from the BSAI skate complex, the Team discussed whether to recommend retaining the skate complex, but spatially separating the skate complex for the Bering Sea and Aleutian Islands; however, this would not provide the intended increased protection for the skate species of the EBS slope and AI areas, as discussed in the assessment, because subarea management does not cover the slope, per se. The Team noted that it could: 1) take no action; 2) recommend the split in the proposed specifications solely for the purpose of notification of the public and then decide whether or not to adopt the split in the final specifications for 2011/2012 during its November meeting; or 3) recommend the split now. The Team decided to take no action for 2011/2012 and schedule this discussion for September 2011 since specifications for the skate complex would have been implemented for most of a fishing year by then and the need for additional protection of skates was not critical for 2011.

Specifications

In conformance with Council policy since 2007, the Team recommended that proposed specifications for ABCs and OFLs for all BSAI species should be based primarily upon a roll-over of the 2011 specifications. The Team felt that using the 2011 specifications as the basis for the proposed specifications would account for the increases projected for some species in 2011 (as opposed to 2010). Several changes from last year's specifications for 2011 were adopted. The proposed specifications included the following changes from the roll-over values: 1) Kamchatka flounder were separated from the Arrowtooth flounder complex and the arrowtooth specifications reduced accordingly; 2) the blackspotted/rougheye rockfish complex was separated for BS and AI for ABC only; and 3) individual specifications for sharks, skates, sculpins, and octopus replaced those for the "other species" category, pending approval of Amendments 95 (Skates) and 96 (ACLs) to the BSAI Groundfish FMP. Final specification recommendations from the Team will be based on the November assessment reviews. Recommendations for proposed specifications for 2011/2012 are attached.

Team assignments

The Team distributed draft summary assignments for the November SAFE report introduction and minutes. Tom Pearson will distribute the final catches by area in 2009 as well as catch to date in 2010 one week prior to the meeting for use in updating the catch information in the introduction. The Team understands that these catch values may not match those used by the stock assessment authors.

The meeting adjourned at 4 pm.

DRAFT September BSAI Plan Team Proposed OFL and ABC Recommendations (metric tons) for 2011-2012

		2010				2011			2012		
Species	**Area**	**OFL**	**ABC**	**TAC**	**Catch**	**OFL**	**ABC**	**TAC**	**OFL**	**ABC**	**TAC**
Pollock	EBS	918,000	813,000	813,000	787,027	1,220,000	1,110,000		1,220,000	1,110,000	
	AI	40,000	33,100	19,000	976	39,100	32,200		39,100	32,200	
	Bogoslof	22,000	156	50	52	22,000	156		22,000	156	
Pacific cod	BSAI	205,000	174,000	168,780	128,510	251,000	214,000		251,000	214,000	
Sablefish	BS	3,310	2,790	2,790	555	2,970	2,500		2,970	2,500	
	AI	2,450	2,070	2,070	879	2,200	1,860		2,200	1,860	
Atka mackerel	Total	88,200	74,000	74,000	43,008	76,200	65,000		76,200	65,000	
	EAI/BS	n/a	23,800	23,800	13,549	n/a	20,900		n/a	20,900	
	CAI	n/a	29,600	29,600	18,555	n/a	26,000		n/a	26,000	
	WAI	n/a	20,600	20,600	10,903	n/a	18,100		n/a	18,100	
Yellowfin sole	BSAI	234,000	219,000	219,000	94,144	227,000	213,000		227,000	213,000	
Rock sole	BSAI	243,000	240,000	90,000	48,837	245,000	242,000		245,000	242,000	
Greenland turbot	Total	7,460	6,120	6,120	3,201	6,860	5,370		6,860	5,370	
	BS	n/a	4,220	4,220	1,386	n/a	3,700		n/a	3,700	
	AI	n/a	1,900	1,900	1,815	n/a	1,670		n/a	1,670	
Arrowtooth flounder	BSAI	191,000	156,000	75,000	34,267	167,400	139,300		167,400	139,300	
Kamchatka flounder	BSAI					23,600	17,700		23,600	17,700	
Flathead sole	BSAI	83,100	69,200	60,000	18,107	81,800	68,100		81,800	68,100	
Other flatfish	BSAI	23,000	17,300	17,300	2,042	23,000	17,300		23,000	17,300	
Alaska plaice	BSAI	278,000	224,000	50,000	13,402	314,000	248,000		314,000	248,000	
Pacific Ocean perch	BSAI	22,400	18,860	18,860	12,465	22,200	18,680		22,200	18,680	
	BS	n/a	3,830	3,830	873	n/a	3,790		n/a	3,790	
	EAI	n/a	4,220	4,220	3,054	n/a	4,180		n/a	4,180	
	CAI	n/a	4,270	4,270	3,352	n/a	4,230		n/a	4,230	
	WAI	n/a	6,540	6,540	5,186	n/a	6,480		n/a	6,480	
Northern rockfish	BSAI	8,640	7,240	7,240	2,116	8,700	7,290		8,700	7,290	
Shortraker rockfish	BSAI	516	387	387	197	516	387		516	387	
Blackspotted/Rougheye rockfish	BSAI	669	547	547	191	650	531		650	531	
	BS						42			42	
	AI						489			489	
Other rockfish	BSAI	1,380	1,040	1,040	523	1,380	1,040		1,380	1,040	
	BS	n/a	485	485	193	n/a	485		n/a	485	
	AI	n/a	555	555	330	n/a	555		n/a	555	
Squid	BSAI	2,620	1,970	1,970	65	2,620	1,970		2,620	1,970	
Other species	BSAI	88,200	61,100	50,000	17,321						
Shark	BSAI				39	598	449		598	449	
Skates	BSAI				13,080	35,900	30,000		35,900	30,000	
Sculpin	BSAI				4,113	51,300	30,200		51,300	30,200	
Octopus	BSAI				89	311	233		311	233	
Total	BSAI	2,462,945	2,121,880	1,677,154	1,225,204	2,826,305	2,467,797		2,826,305	2,467,797	

Sources: 2010 OFLs, ABCs, and TACs and 2011 OFLs and ABCs from harvest specifications adopted by the Council in December 2009; 2012 OFLs and ABCs equal 2011; individual other species from December 2009 SSC minutes, minor modifications from Council 2009 recommendations to other species and BSAI totals to conform to SSC other species recommendations; 2010 catches through September 11 from AKR Catch Accounting.

TABLE 8A—FINAL 2010 AND 2011 APPORTIONMENT OF PROHIBITED SPECIES CATCH ALLOWANCES TO NON-TRAWL GEAR, THE CDQ PROGRAM, AMENDMENT 80, AND THE BSAI TRAWL LIMITED ACCESS SECTORS

PSC species	Total non-trawl PSC	Non-trawl PSC remaining after CDQ PSQ [1]	Total trawl PSC	Trawl PSC remaining after CDQ PSQ [1]	CDQ PSQ reserve [1]	Amendment 80 sector		BSAI trawl limited access fishery
						2010	2011	
Halibut mortality (mt) BSAI	900	832	3,675	3,349	393	2,765	2,375	517
Herring (mt) BSAI	n/a	n/a	1,974	n/a	n/a	n/a	n/a	n/a
Red king crab (animals) Zone 1 [1]	n/a	n/a	197,000	175,921	21,079	146,920	93,432	5,797
C. *opilio* (animals) COBLZ [2]	n/a	n/a	4,350,000	3,884,550	465,450	2,148,156	2,028,512	1,248,494
C. *bairdi* crab (animals) Zone 1 [2]	n/a	n/a	830,000	741,190	88,810	641,176	331,608	58,285
C. *bairdi* crab (animals) Zone 2	n/a	n/a	2,520,000	2,250,360	269,640	1,479,271	565,966	173,394

[1] Section 679.21(e)(3)(*i*)(A)(*2*) allocates 326 mt of the trawl halibut mortality limit and § 679.21(e)(4)(*i*)(A) allocates 7.5 percent, or 67 mt, of the non-trawl halibut mortality limit as the PSQ reserve for use by the groundfish CDQ program. The PSQ reserve for crab species is 10.7 percent of each crab PSC limit.

[2] Refer to § 679.2 for definitions of zones.

TABLE 8C—FINAL 2010 AND 2011 PROHIBITED SPECIES BYCATCH ALLOWANCES FOR THE BSAI TRAWL LIMITED ACCESS SECTOR AND NON-TRAWL FISHERIES

BSAI trawl limited access fisheries	Prohibited species and area [1]				
	Halibut mortality (mt) BSAI	Red king crab (animals) Zone 1	*C. opilio* (animals) COBLZ	*C. bairdi* (animals)	
				Zone 1	Zone 2
Yellowfin sole	47	4,000	1,176,494	27,285	160,304
Rock sole/flathead sole/other flatfish [2]	0	0	0	0	0
Turbot/arrowtooth/sablefish [3]	0	0	0	0	0
Rockfish April 15–December 31	5	0	2,000	0	848
Pacific cod	275	1,700	50,000	20,000	8,000

TABLE 8C—FINAL 2010 AND 2011 PROHIBITED SPECIES BYCATCH ALLOWANCES FOR THE BSAI TRAWL LIMITED ACCESS SECTOR AND NON-TRAWL FISHERIES—Continued

BSAI trawl limited access fisheries	Prohibited species and area [1]					
	Halibut mortality (mt) BSAI		Red king crab (animals) Zone 1	*C. opilio* (animals) COBLZ	*C. bairdi* (animals)	
					Zone 1	Zone 2
Pollock/Atka mackerel/other species	190		97	20,000	1,000	4,242
Total BSAI trawl limited access PSC	517		5,797	1,248,494	58,285	173,394
Non-trawl fisheries	Catcher processor	Catcher vessel				
Pacific cod-Total	760	15				
January 1–June 10	314	10				
June 10–August 15	0	3				
August 15–December 31	446	2				
Other non-trawl-Total	58					
May 1–December 31	58					
Groundfish pot and jig	Exempt					
Sablefish hook-and-line	Exempt					
Total non-trawl PSC	833					

[1] Refer to § 679.2 for definitions of areas.
[2] "Other flatfish" for PSC monitoring includes all flatfish species, except for halibut (a prohibited species), flathead sole, Greenland turbot, rock sole, yellowfin sole, and arrowtooth flounder.
[3] Greenland turbot, arrowtooth flounder, and sablefish fishery category.

TABLE 8D—FINAL 2010 PROHIBITED SPECIES BYCATCH ALLOWANCE FOR THE BSAI AMENDMENT 80 COOPERATIVES

Year	Prohibited species and zones [1]				
	Halibut mortality (mt) BSAI	Red king crab (animals) Zone 1	*C. opilio* (animals) COBLZ	*C. bairdi* (animals)	
				Zone 1	Zone 2
2010	2,094	118,237	1,461,309	547,715	1,320,277

[1] Refer to § 679.2 for definitions of zones.

Agenda Item D-2(b)(3)
OCTOBER 2010

September GOA Plan Team OFL and ABC Recommendations for 2011 and 2012

Species	Area	2011 OFL	2011 ABC	2011 TAC	2012 OFL	2012 ABC	2012 TAC
Pollock	W(61)		34,728			34,728	
	C(62)		37,159			37,159	
	C(63)		25,287			25,287	
	WYAK		2,686			2,686	
	Subtotal	135,010	99,860		135,010	99,860	
	SEO	12,326	9,245		12,326	9,245	
	Total	147,336	109,105		147,336	109,105	
Pacific cod	W		34,265			34,265	
	C		60,698			60,698	
	E		2,937			2,937	
	Total	116,700	97,900		116,700	97,900	
Sablefish	W		1,488			1,488	
	C		4,042			4,042	
	WYAK		1,450			1,450	
	SEO		2,320			2,320	
	WYAK+SEO		3,770			3,770	
	Total	11,008	9,300		11,008	9,300	
Shallow water flatfish	W		23,681			23,681	
	C		29,999			29,999	
	WYAK		1,228			1,228	
	SEO		1,334			1,334	
	Total	67,768	56,242		67,768	56,242	
Deep water flatfish	W		530			530	
	C		2,928			2,928	
	WYAK		2,089			2,089	
	SEO		778			778	
	Total	7,847	6,325		7,847	6,325	
Rex sole	W		1,521			1,521	
	C		6,312			6,312	
	WYAK		871			871	
	SEO		888			888	
	Total	12,534	9,592		12,534	9,592	
Arrowtooth flounder	W		34,263			34,263	
	C		144,262			144,262	
	WYAK		22,501			22,501	
	SEO		11,693			11,693	
	Total	250,559	212,719		250,559	212,719	
Flathead sole	W		17,520			17,520	
	C		28,190			28,190	
	WYAK		2,068			2,068	
	SEO		1,508			1,508	
	Total	61,601	49,286		61,601	49,286	

September GOA Plan Team OFL and ABC Recommendations for 2011 and 2012

Species	Area	2011 OFL	2011 ABC	2011 TAC	2012 OFL	2012 ABC	2012 TAC
Pacific ocean perch	W	3,220	2,797		3,220	2,797	
	C	11,944	10,377		11,944	10,377	
	WYAK		1,937			1,937	
	SEO		1,882			1,882	
	E (subtotal)	4,396	3,819		4,396	3,819	
	Total	19,560	16,993		19,560	16,993	
Northern rockfish	W		2,549			2,549	
	C		2,259			2,259	
	E		0			0	
	Total	5,730	4,808		5,730	4,808	
Shortraker	W		134			134	
	C		325			325	
	E		455			455	
	Total	1,219	914		1,219	914	
Other slope rockfish	W		212			212	
	C		507			507	
	WYAK		273			273	
	SEO		2,757			2,757	
	Total	4,881	3,749		4,881	3,749	
Pelagic shelf rockfish	W		607			607	
	C		3,035			3,035	
	WYAK		405			405	
	SEO		680			680	
	Total	5,739	4,727		5,739	4,727	
Rougheye	W		81			81	
	C		869			869	
	E		363			363	
	Total	1,581	1,313		1,581	1,313	
Demersal shelf rockfish	SEO	472	295		472	295	
Thornyhead rockfish	W		425			425	
	C		637			637	
	E		708			708	
	Total	2,360	1,770		2,360	1,770	
Atka mackerel	GW	6,200	4,700		6,200	4,700	
Big skate	W		598			598	
	C		2,049			2,049	
	E		681			681	
	Total	4,438	3,328		4,438	3,328	
Longnose skate	W		81			81	
	C		2,009			2,009	
	E		762			762	
	Total	3,803	2,852		3,803	2,852	
Other skates	GW	2,791	2,093		2,791	2,093	
Sharks	GW	1,276	957		1,276	957	
Squid	GW	1,530	1,148		1,530	1,148	
Octopus	GW	298	224		298	224	
Sculpin	GW	6,328	4,746		6,328	4,746	
Total	GOA	743,559	605,086		743,559	605,086	

AGENDA D-2
Supplemental
OCTOBER 2010

Quantitative Resource Assessment LLC
San Diego, CA
USA.

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Freezer Longline Coalition Report on the September Plan Team Meeting

This document summarizes the current issues in the Pacific cod assessment as discussed at the September Plan Team Meeting 2010.

Aging issue

It has been recognized for several years that there is an inconsistency between modes in the survey length composition data and mean length at age from the aging data (Figure 1). The data suggests that there is an additional year added to fish somewhere between ages two and three (Figure 1). This has been dealt with in the stock assessment model by either 1) including a bias in the aging error matrix (Models 1-3) or 2) excluding the age data (Models 4-6).

A recent study on aging using stable isotopes (Kastelle et al. 2010) was inconclusive due to limited sample size and imprecision in obtaining the required material from the otoliths. Kastelle et al. (2010) found that four of the seven otoliths that were considered to be reliable using the new technique agreed with the age of the individuals using traditional Pacific cod aging techniques. Three of these had very good correspondence (Figure 2). One had poor correspondence, and had a translucent zone that was considered difficult to interpret and not counted as an annuli (the arrow in Figure 3).

Three of the otoliths showed an additional translucent zone between age one and two based on assuming that the $\delta^{18}O$ aging is correct (Figure 4). These were all released in the same area (UGAK). The uncounted translucent zone mentioned for one of the otoliths considered as aged correctly is also somewhat consistent with an additional translucent zone between ages one and two.

Some otoliths show large changes in $\delta^{18}O$ and then the $\delta^{18}O$ becomes stable. This may indicate the individual moved into a different water mass and this change obscures peaks in the $\delta^{18}O$, making aging difficult. $\delta^{13}C$ was also measured and provides additional information. The cases where $\delta^{18}O$ and $\delta^{13}C$ don't match may indicate that the aging from $\delta^{18}O$ is not accurate.

The results discussed above suggest that translucent zones used for aging may occur more often than once a year and this may occur more often between ages one and two. The assessment model assumes that the additional age is added between ages 2 and 3 (Figure 1) and conflicts with the results of this new study. This suggests that the first mode in the survey length composition data (Figure 1) may be age one and not age two.

When age data is included in the model, a constant aging bias of 0.4 years is added to all ages two and older. However, due to the normal distributed aging error assumption and the assigned standard deviations, the proportion of individuals aged one year older changes with the true age (Figure 5). The approach also allows a proportion of individuals to be aged two or more years older and also younger, particularly for old ages. The model does not allow aging error in the age one year olds as indicated by the length frequency and $\delta^{18}O$ data. The current method (Model 3) was modified so 40% of age one year olds were aged as two year olds. The models were compared using the fit to the data (the negative log likelihood for which a lower value is better). The results suggest that allowing age one to be miss-aged (negative log likelihood = 4595.6) fit the data much better than only allowing ages two and above to be miss-aged (negative log likelihood = 4721.6).

The standard deviation used for the aging error in the current assessment is based on reader agreement. This is real variation in aging and suggests that the analyses described above that use constant bias only are unrealistic. Variation due based on reader agreement data is a minimum estimate of the variation in ageing since multiple readers may erroneously misread an otolith in the same way. Therefore, it would probably be best to estimate the aging error (bias and variance) inside the stock assessment model. Functional forms (e.g. linear with age) would probably need to be used. When estimating the aging error, both the age and length data should be included in the analysis (suggested by Bill Clark). Preferably as age conditioned on length, but age and length independently would, despite being dependent, probably be reasonable. This would require adding the survey length data back into the model for the years in which there is age data and removing the mean length at age data. This data was not included in the model used in the analyses presented above.

Analyses were conducted following the above suggestions. The results indicate a similar level of bias, but support the bias occurring starting at age two (Figure 6). However, if the mean size at age data is included in the model, the results suggest that the bias starts at age one (Figure 7). This indicates that the correct aging error may need to be calculated by including the joint age-length data in the assessment model.

Recent commercial age data has been excluded from the stock assessment because the samples were from a limited spatial area and the age composition was different than seen in the survey. This is additional support that there is spatial variation in the formation of multiple translucent bands in the otolith.

In conclusion, aging data is problematic due to the likely formation of additional translucent zones in the otolith. There is probably spatial, temporal, and individual variation in the number of translucent zones formed annually. Until a more accurate method is developed to age Pacific cod either an aging error matrix should be used or the age data should be excluded from the analysis. If an aging error matrix is used it needs to be created appropriately. Currently, a constant bias is used for all ages, but the variation is fixed based on reader agreement, and there is no bias for one year olds. The constant bias is determined based on finding the bias that provides the best fit to the data. A more appropriate method is needed which may require modifying the Stock Synthesis code so that the mean and variance at age used to generate the aging error matrix can be represented by function forms and the parameters estimated inside the model. The age-length data should be included for years that age data is available and the mean length at age data excluded from the analysis. If the aging bias changes annually, the aging data may be completely uninformative. Finally, the $\delta^{18}O$ analysis should be repeated for individuals from different areas and research should be conducted to determine why more than one translucent zone is created each year.

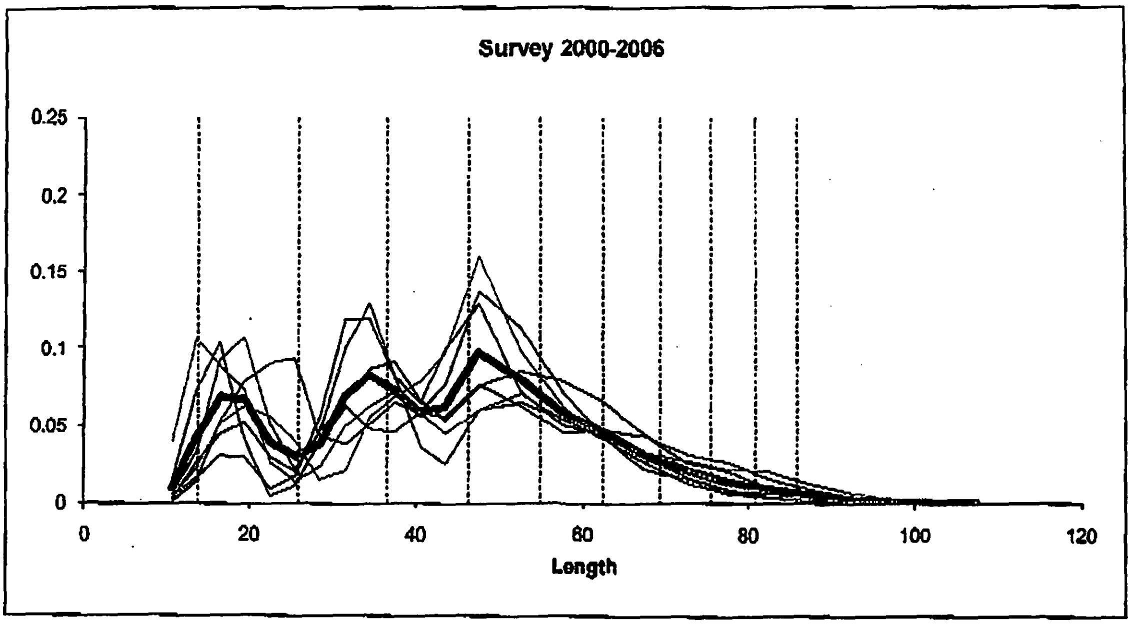

Figure 1. Comparison of modes in the survey length frequency data (lines) compared to mean length at age from the aging data (vertical dashed lines).

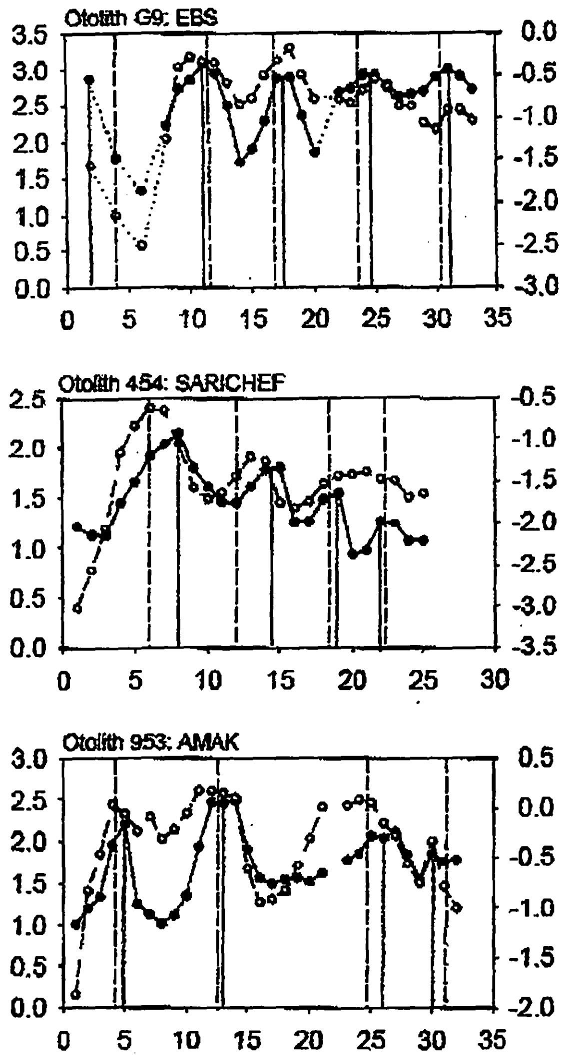

Figure 2. Three otoliths from Kastelle et al. (2010) that show good correspondence between translucent zones and peaks in $\delta^{18}O$. Solid circles are $\delta^{18}O$ and open circles are $\delta^{13}C$. The dotted vertical lines indicate the milling track that captured a specific translucent zone (indicating an age using the traditional Pacific cod aging) and solid lines identify the $\delta^{18}O$ peaks (indicating an age using the new method).

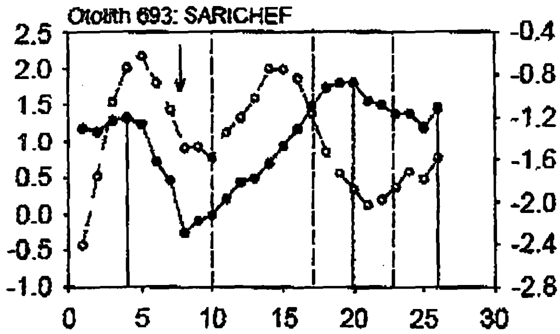

Figure 3. An otoliths from Kastelle et al. (2010) that show poor correspondence between translucent zones and peaks in $\delta^{18}O$, and had a translucent zone that was considered difficult to interpret and not counted as an annuli (arrow), but was considered as correctly representing the age of the otolith. Solid circles are $\delta^{18}O$ and open circles are $\delta^{13}C$. The dotted vertical lines indicate the milling track that captured a specific translucent zone (indicating an age using the traditional Pacific cod aging) and solid lines identify the $\delta^{18}O$ peaks (indicating an age using the new method).

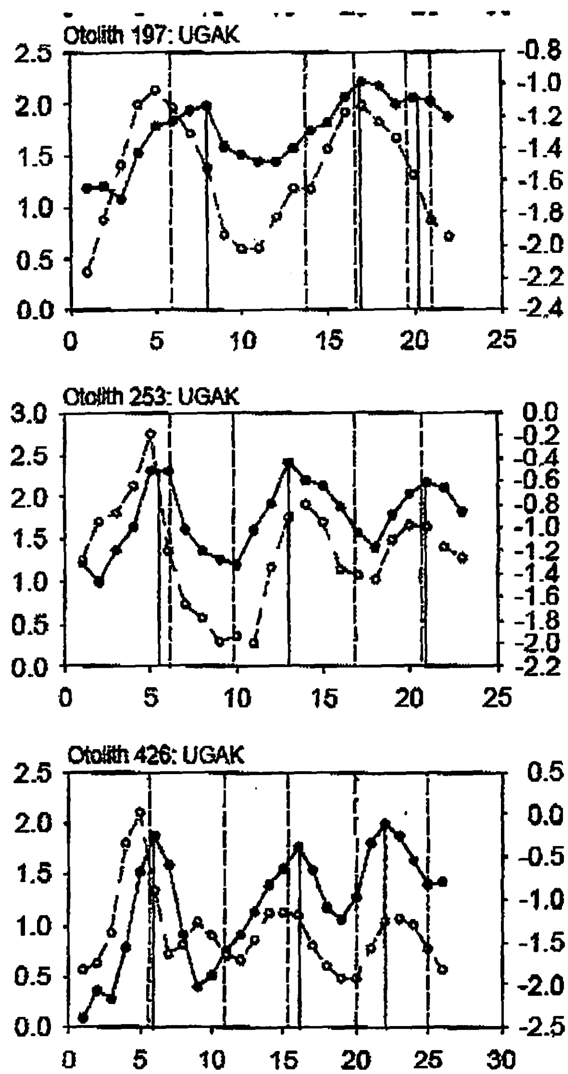

Figure 4. Three otoliths from Kastelle et al. (2010) that show an additional translucent zone found between ages one and two as determined by peaks in the $\delta^{18}O$. Solid circles are $\delta^{18}O$ and open circles are $\delta^{13}C$. The dotted vertical lines indicate the milling track that captured a specific translucent zone (indicating an age using the traditional Pacific cod aging) and solid lines identify the $\delta^{18}O$ peaks (indicating an age using the new method).

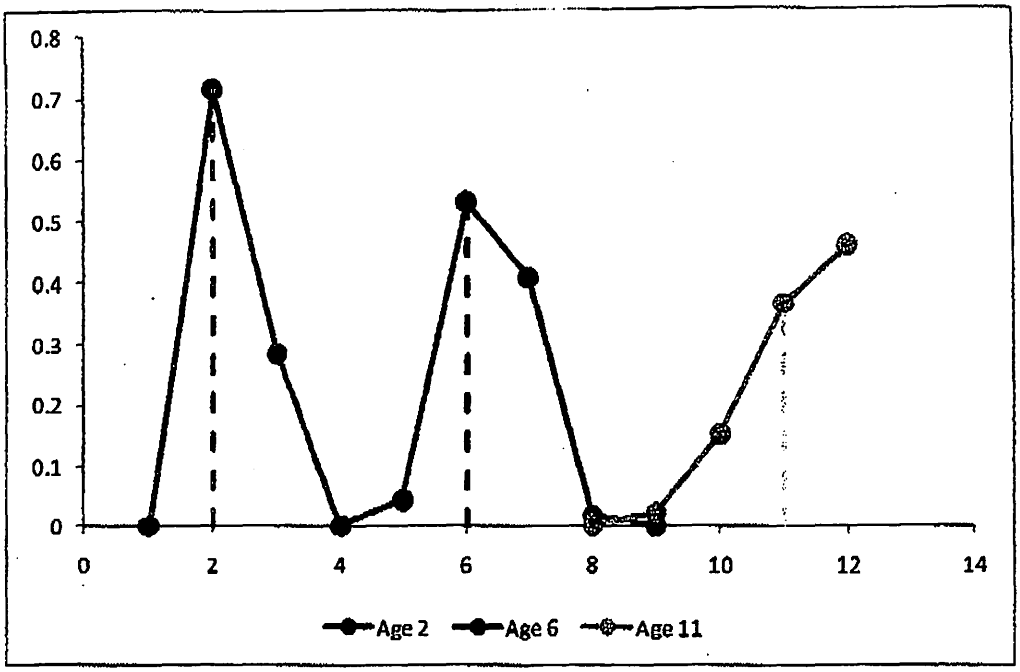

Figure 5. Distribution of true age (vertical dashed line) into the observed age bins based on the aging error for three different true ages.

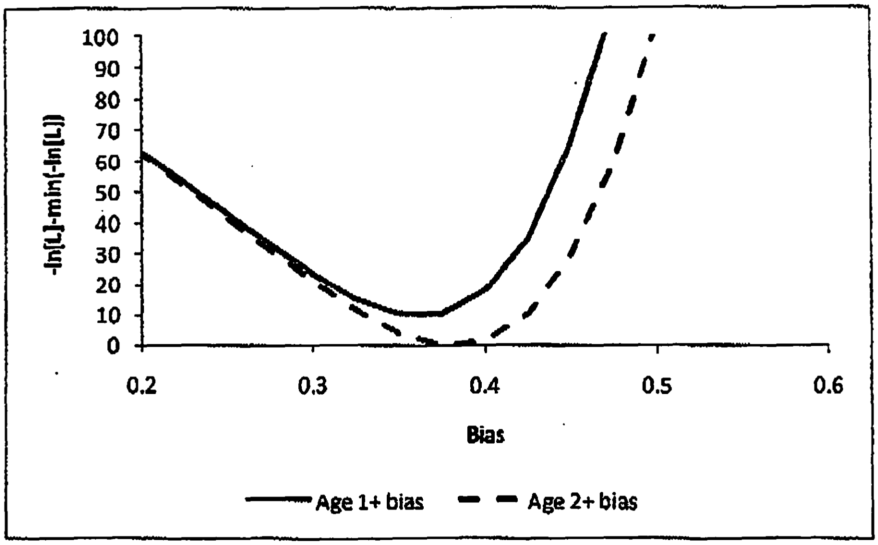

Figure 6. Profile likelihood over different bias added to the aging error matrix. "Ages 1+ bias" refers to all true ages one and older have the bias. "Age 2+ bias" refers to all true ages two and older have the bias. These results maintain the standard deviations based on the age reader agreement, exclude the mean length at age data, and include the survey length composition data for the period for which there is age data.

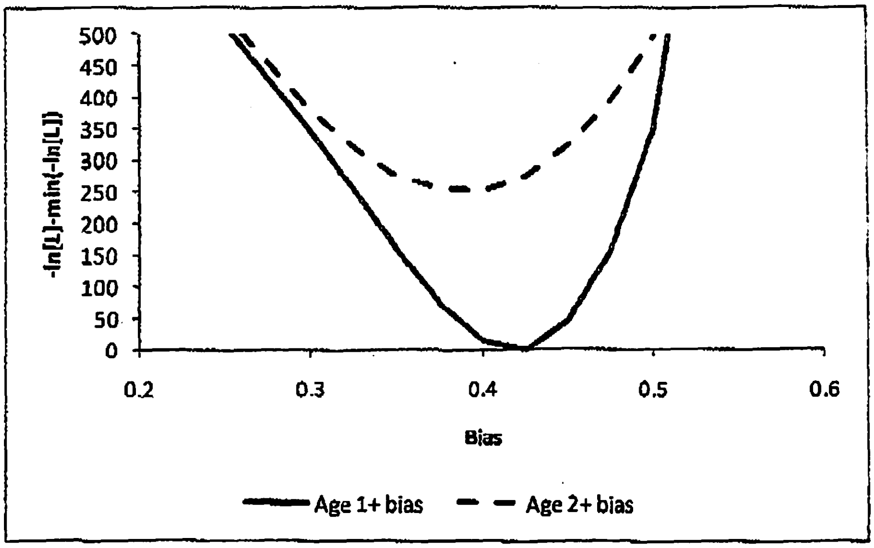

Figure 7. Profile likelihood over different bias added to the aging error matrix. "Ages 1+ bias" refers to all true ages one and older have the bias. "Age 2+ bias" refers to all true ages two and older have the bias. These results maintain the standard deviations based on the age reader agreement, include the mean size at age data, and include the survey length composition data for the period for which there is age data.

Cross-validation to determine the best method to model variation in growth

The current assessment model provides two methods to model variability in growth 1) cohort specific deviates and 2) deviates in the three parameters of the von Bertalanffy growth equation as parameterized in Stock Synthesis (K, length at age one, and Linf; model 6). The standard deviation of the penalty on the logarithm of the multiplicative deviate is estimated by matching it with the variation in the estimated deviates. This approach resulted in standard deviations for the penalties on the von Bertalanffy growth parameters that allowed high variation that was considered unrealistic.

An alternative approach is needed to evaluate which method is the most appropriate to model variation in growth and the standard deviations of the deviate penalties. We applied hold-out cross-validation to the length composition data (a similar approach was used by Maunder and Harley (2003) to estimate smoothing parameters for nonparametric selectivity curves). A random 10% of all the length frequency data was excluded from the model and used as a test data set. This was accomplished in Stock Synthesis by generating a random number with 90% probability of 1 and 10% probability of -1 for all length composition data sets and multiplying the sample size by this number. A negative sample size in Stock Synthesis is ignored, but the (negative of the) multinomial negative log-likelihood is calculated for these samples and this can be used as the cross-validation score. The cross-validation was repeated for models with cohort specific deviates (model 5), deviates for the von Bertalanffy parameters (model6), with only deviates on L2 (Linf) or K, and for a range of values for the standard deviation for the penalty on the deviates for L2 (Linf) or K. A subset of the analyses were repeated three times with a different randomly chosen 20% of the length composition data retained as a test data set.

The results based on using 10% of the data as a test data set conclude that the best model based on predicting the length composition test data set is the model with no variation in growth (Table 1a). This suggests that the variation in growth is just explaining sampling variation or explaining process variation in other processes (e.g. selectivity). The three analyses using 20% of the data as a test data set produced variable results (Table 1b). However, the average of the three analyses supports a model with no growth deviates. A more comprehensive cross-validation approach may be desirable in the future. For example, model selection using k-fold (5 or 10) cross-validation may be a better compromise between bias and variance than the hold-out cross-validation used here.

Table 1a. Negative log likelihood values for the length composition date used in the model (Training) and used to test the model (Test) for a variety of assumptions about variation in growth. A lower value is better. The bold type indicates the best model (the model with no growth deviates).

	Training	Test
Cohort dev	3240.92	234.86
vonB dev	2885.36	247.11
No dev	3503.03	**204.87**
K dev	3212.24	238.55
L2 dev	3111.73	246.13
K dev cv=0.1	3186.03	238.26
K dev cv=0.05	3233.96	229.85
K dev cv=0.005	3452.57	206.41
L2 dev cv=0.05	3129.91	239.67

Table 1b. Results based on using 20% of the length composition data as a test data set. The bold type indicates the best model for that random test data set.

		Training	Test
A	Cohort dev 20%	2625.26	1248.54
	vonB dev 20%	2303.73	**1090.27**
	No dev 20%	2835.94	1112.37
B	Cohort dev 20%	2611.70	1058.10
	vonB dev 20%	2390.09	**949.54**
	No dev 20%	2842.49	1040.24
C	Cohort dev 20%	2691.50	887.17
	vonB dev 20%	2405.25	991.69
	No dev 20%	2930.42	**855.07**

Catchability

Catchability for all models, except model 3, were fixed at the values estimated in model 1. There have been substantial changes in the model assumptions and therefore it is preferable to re-estimate catchability within the new models. This requires matching the combination of selectivity and catchability of the appropriate ages with the estimates of catchability from the tagging data.

Hold-out cross-validation suggests that estimating catchibility for the later part of the trawl survey abundance index is better (Table 2). However, since the cross-validation is applied to composition data only, it may not be appropriate for testing the estimation of catchability.

Mean size at age data

Mean size at age is used in the model to provide information on growth. It is preferable to use age-length data. Alternatively, it is probably reasonable to include both the age and length data independently even though they are not truly independent. Alternatively, don't use age or mean length-at age data.

Selectivity priors

The priors on selectivity are complicated and therefore it is difficult to know if they are appropriate. The resulting selectivity curve from the priors on all the parameters may be inappropriate for some ages. For example, a selectivity of one is outside the prior's inter-quartile range for oldest fish, which may not be appropriate. The cross-validation method could be used to determine if the use of the priors is better than no priors. We applied hold-out cross-validation using 10% of the length composition and 10% of the age composition as test data sets. The results suggest that the priors constrain the selectivity curves too much so that the model provides a worse prediction of the test data (Table 2). However, a more comprehensive cross-validation analysis is needed.

Table 2. Negative log likelihood values for the age and length composition date used in the model (Training) and used to test the model (Test) for models with and without priors on selectivity and estimating or fixing catchability. Model 3 includes priors on selectivity and estimates catchability. A lower value is better.

	Model 3		No priors		Fix q		Fix q no priors	
	training	test	training	test	training	test	training	test
age	115.83	240.36	114.00	232.24	115.58	241.94	113.76	233.54
length	3338.03	908.03	3328.56	887.52	3337.31	910.32	3327.91	889.49

Variation of length at age

The Plan Team preferred a model where the parameters that describe the variation in length at age are estimated externally to the model. The values estimated externally to the model correspond better to the observed variation of length at age in the data. However, this is based on the age data, which is likely to be biased. It is also not clear if the estimates of variation of length at age take the sampling design into consideration (e.g. if the fish are selected by length bins). The model that estimates the parameters representing variation of length at age (model 5) fits the data much better (lower negative log likelihood) than the corresponding model that fixes the parameters based on external calculations (model 4). Therefore, estimating the parameters that represent the variation of length at age inside the model is more appropriate.

Other comments

The standard deviations for the penalties on the parameters that represent annual deviations in population processes (e.g. recruitment and growth) are fixed based on model 1. The other models have a large number of changes and the standard deviations may no longer be appropriate and should be re-estimated.

Suggested model configuration

Eliminate the age data from the assessment model until the aging issue is resolved. Natural mortality should be based on length at maturity to be consistent with assuming that the age data is incorrect. However, it should be recognized that natural mortality based on the relationship with age or length at maturity may not be a good estimate.

If the aging data is retained, the length data (for the years for which age data is available), or preferably the age-length data, for the same years should be included and the aging error matrix should be estimated, including the possibility of a bias at age one. The mean length at age data should be excluded. The standard deviations used in the aging error matrix should be based on the reader agreement data modified for the possibility of both readers being wrong, or estimated in the stock assessment model.

Annual variation in growth (cohort nor von Bertalanffy parameters) should not be modeled.

Estimate the parameters describing variation of length at age inside the stock assessment model.

Recalculate the standard deviations for the penalties on the annual deviate parameters either by matching it with the variation in the estimates or using a cross-validation procedure.

Keep the new season and bin structure. This makes the model take longer to run, but only a few models have been proposed for the next round of modeling. Convergence tests can be conducted without estimating the hessian. The new proposed bin structure may help with convergence.

Priors should not be used on selectivity until further tests are conducted, using, for example, cross-validation or simulation analysis, to see how well the estimation performs with these priors.

References

Maunder, M.N. and Harley, S.J. (2003). Methodological improvements to the EPO tuna stock assessments. SCTB16 Working Paper MWG–2.
(http://www.spc.int/OceanFish/Html/SCTB/SCTB16/mwg2.pdf)