Joint BSAI/GOA Plan Team Minutes

The meeting of the Bering Sea and Aleutian Islands and Gulf of Alaska Groundfish Plan Teams convened on November 13th at 1pm at the Alaska Fishery Science Center, Seattle, WA.

Members of the Plan Teams in attendance 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
David Carlile	ADF&G	Jeff Fujioka	AFSC ABL
Bill Clark	IPHC	Jon Heifetz	AFSC ABL
Jane DiCosimo	NPFMC	Robert Foy	UAF
Theresa Tsou	WDFW	Nick Sagalkin	ADF&G
Brenda Norcross	UAF	Tory O'Connell	ADF&G
Andy Smoker	NMFSAKRO	Tom Pearson	NMFS AKRO
Grant Thompson	AFSC REFM	Sarah Gaichas	AFSC REFM
Ivan Vining	ADF&G	Bill Clark	IPHC
Dan Lew	AFSC	Theresa Tsou	WDFW
Kathy Kuletz	USFWS	Kathy Kuletz	USFWS
Lowell Fritz	NMML		

Ken Goldman (ADF&G, member of the GOA Team) was unable to attend but participated by telephone. Ward Testa was absent.

Members of the public and state and agency staff present included: Tom Wilderbuer (AFSC), Chris Rooper (AFSC), Jennifer Boldt (AFSC), Chris Lunsford (AFSC), Kalei Shotwell (AFSC), Dana Hanselman (AFSC) Phil Rigby (AFSC), Paul Spencer (AFSC), Pat Livingston (AFSC), Anne Hollowed (AFSC), Doug Demaster (AFSC), Mike Guttormsen (AFSC), Chris Wilson (AFSC), Mark Wilkins (AFSC), Beth Stewart (AEB), Mary Furuness (NMFS-AKR), Buck Stockhausen (AFSC) Jennifer Ferdinand (AFSC), Lisa Butzner (NPLA), Dave Benson, Liz Conners (AFSC),Todd Tenbrink (AFSC), Theresa A'mar, Gary Stauffer, Julie Bonney (AGDB), Ben Muse (NMFS-AKR), John Gauvin, Dave Fraser, Cleo Brylinkski (ADF&G), Ed Richardson (ASPA), Farron Wallace (WDFW), Jackie King, Martin Dorn (AFSC), Jack Tagart (Tagart Consulting), Tom Casey and Mike Symanzski.

Introductions

Changes were made to the agenda as attached.

Council update, pending actions, BSAI/GOA dark rockfish amendment

Jane DiCosimo and Diana Stram updated the teams on recent Council actions. Some items of interest for the teams for the February 2007 Council meeting include: a combined BSAI/GOA dark rockfish amendment and two SSC special topic (TBD) workshops to review the CIE review of rockfish management and the AFSC response and Pacific cod genetics for February. Team members requested additional information on the process for preparing the fishery ecosystem plan (FEP) for AI and how the existing plan teams will fit into the review process of for the FEP. David Witherell updated the teams on the how the FEP will fit under the existing framework for the current fishery management plans and act as a policy/ecosystem guiding document to evaluate broader scale interactions both ecologically and among different political entities in the AI FEP area.

The Teams discussed the adequacy of the current review process for assessment documentation. As they have noted previously, the plan team review process remains the same but documentation increases. Team members commented that having only one week to critically review up to 20 documents prior to meetings is insufficient, but also recognize that the timing is necessarily short to maximize the time available for development of the assessments once the trawl survey data are available. There appears limited ability to change this. The CIE seems to be filling a role for critical review of assessments. The Teams acknowledged that it would be useful to get some SSC and Council feedback on how to improve the review process for documents. Should the Teams adopt an SSC-like process whereby a Team member focuses on one assessment per year? Team members commented that the focus on individual species at September Joint Team meetings was useful, although this does not replace the November review. Biennial cycles for some assessments has served to lighten the review burden in those years. Theresa Tsou suggested that specific panels review full assessments with the Plan Team review focused on updated assessments. Team members noted that there used to be a similar system with the North Pacific stocks where one assessment was reviewed on an annual basis in more detail. Grant Thompson noted that the CIE is no longer filling this role specifically for assessments due to the necessity of CIE review of other non-assessment issues recently (EFH, Crab overfishing). Loh-Lee Low questioned what role should the plan team play in the Council process in general, and should this role be broadened? Team members reiterated concerns from last year that the review process of assessments by plan team is not as adequate as it ought to be and could be improved. Ivan Vining suggested that if some documents could be made available earlier (i.e., as they are completed), that this would ease the burden of needing to read all assessment in the week prior to the meeting. Sarah Gaichas suggested rotating through assessments by plan team members so that the focus for each has been critically reviewed by at least one member who will have questions, comments etc. and rotate responsibilities annually.

Team members approved of this approach, but noted potential problems with different levels of expertise by members. This could be alleviated however by assigning several people to each assessment. This was noted to be similar to the SSC's breakout of responsibilities and leaders. It was also clarified that there is an additional in-house review. Team members suggested that there be one extensive plan team review per year of a single assessment, or perhaps a group of assessments (e.g., rockfish, in general). Timing of this is a problem as the review of a single assessment, e.g. pollock, could take up an entire September meeting. Phil Rigby noted that the in-house review process includes assessment authors and tends to be during the same crunch time for writing assessments. Comprehensive reviews could occur if they was scheduled outside of the normal of the plan team schedule, such as in January as an additional scheduled meeting.

Mark Wilkins, RACE, updated the teams on the workgroup meeting held to discuss the review of untrawlable grounds and some ideas to expand the working group to include representatives from other agencies and other centers. The group's focus is on the necessity of delineating untrawlable grounds, estimating fish density within these grounds, and taking these estimates and integrating them in a rationale way with the density estimates from trawlable grounds into the assessments.

Martin Dorn noted that there will be a workshop held in mid-December on alternative ways of approaching reference points. The teams were also apprised of the annual Inter-agency Crab Research meeting in December.

Response to SSC requests (e.g., Off-year assessment issues)

The Plan Teams reviewed the criteria established at the September meeting. The SSC approved this criteria but also noted that some consideration should be given to stocks approaching an overfished condition. The Teams recommend that if stocks are approaching an overfished condition then an additional criteria be added to recommend a full assessment. The revised criteria for off-year assessments is the following:

1) Authors **must** do a full assessment in "off" years if the Plan Team or SSC requests them to.
2) Authors **may** do a full assessment in "off" years if they choose to.
3) Anytime the assessment model is re-run and presented in the SAFE Report, a full assessment document **must** be produced.
4) The single-species projection model **must** be re-run and the results reported in a one-page SAFE Report summary if current-year catch differs by more than 10% from the expected value.
5) The single-species projection model **may** be re-run using new catch data without re-running the assessment model.
6) One-page SAFE Report summaries **do not** count as assessment "updates" for the purpose of the Species Information System.
7) Authors **must** do a full assessment in "off " years if the stock is approaching an overfished condition.

PSEIS implementation

Diana Stram provided an overview of the current groundfish management objectives in the BSAI and GOA FMPs as they relate to the Council's workplan. The management objectives were incorporated into the FMP's following the comprehensive PSEIS. This workplan is updated and reviewed by the Council at each meeting to evaluate progress towards meeting each of these objectives and how specific Council actions (current and forthcoming) relate to these goals.

Harvest specifications process

Ben Muse updated the teams on the status of the EIS for the harvest specifications. An issue which was problematic regarding this in October was the projection of EBS Pollock using a tier 3 approach rather than a tier 1 approach as suggested by the SSC. The SSC made EIS-suggestions to modify the document as well as changes to the seabird section and noted that it is likely the SSC would utilize a tier 1 approach for EBS Pollock and notification should be given to the public accordingly. Ben summarized actions by the Council with regards to preliminary specifications and the proposed rule process. The agency is currently in the process of summarizing comments received on the draft EIS and responding to the comments in the draft

Ecosystem Assessment

Kerim Aydin reviewed the Ecosystem Assessment (first section of the Ecosystem Considerations report) changes since the September plan team review.

Decreasing production trends were noted, specifically with larger older fish in the Bering Sea leading to less surplus production. Arrowtooth flounder predation in the Bering Sea appears to be increasing. Team members questioned the size classes in the prey. Kerim noted that the size of arrowtooth as well as their prey (pollock) appear larger. Direct diet data indicate that total consumption of pollock seems to have decreased. There was a sharp drop in cannibalism on age-1 pollock. Age -0 pollock information from the BASIS program indicates cannibalism of age-0s on age-0s. Forage fish biomass estimates from BASIS program indicate a possible bottom up control on production. Estimates of forage biomass were made by assumed biomass consumption methods given that trawl survey estimates of forage fish biomass are notably poor. The purpose of this being to estimate forage fish biomass necessary to support the level of production.

Lower biomass of forage fish has been observed in recent years. It is unclear what this indicates, possibly a regime shift or some other control mechanism. Salmon diets appear to be shifting to age-0 pollock.

Bob Foy questioned whether all species exhibit similar trends as forage fish. Kerim discussed a general peak in production of forage fish in the early 1990s that was similar for all species, and appeared to follow through in pollock. This may indicate some sort of prey-release mechanism.

Kerim provided an overview of the GOA food web and modeling efforts which are underway to examine this. Reconstruction analyses of production trends indicate a decline in forage fish currently as compared to historical levels. The observed increase in predators is primarily attributed to arrowtooth flounder. This raised questions, such as: are enough forage fish being left in the ecosystem for predators or are there management issues (juvenile pollock removals, forage fish removals) that are affecting this?

The discussion reviewed trends in pollock as well as major predators on pollock. Current analyses are evaluating indicators such as predation and fishing mortality to evaluate which is more dominant. This has implications for single species management as it indicates that we should be examining management actions in a broader multi-species context. Team members question to what extent this could be useful for a diagnostic for management system? Kerim noted that this type of analysis is useful in terms of highlighting relative risk and then evaluating the appropriate management measures that could be taken. Many of the concerns that are highlighted by this type of analysis are being discussed in the single species management context already, but if not, this could call attention to species which warrant additional discussion.

Kerim noted that there are issues left to be resolved in order to apply this to a management context, specifically in fitting confidence limits to results, as well as the necessity of a review process and peer-review body to evaluate and discuss to what extent this would be useful.

Ecosystem Considerations

Jennifer Boldt presented an overview of the Ecosystem Indices and Ecosystem management indices and information (second and third sections of the Ecosystem Considerations report) with particular focus upon areas that have been updated since the presentation to the plan teams in September. Ice Cover data was updated for the winter of 2006. Biological indices were updated. AI HAPC biota indices updated. Prince William Sound herring biomass remains low (no fishery), while Southeast herring is variable by region. Overall salmon catch in Alaska was updated and shows generally high catch by species in 2005 relative to the long-term means; however this varies spatially. The large mesh survey results were updated and indicate higher catches of Tanner crab and arrowtooth flounder. A question from the public requested clarification on why the GHL then decreased for Tanner crab. Nick Sagalkin explained that the abundance was noted to be primarily juvenile crabs. Pribilof Islands Northern fur seal pup production counts for 2006 were updated; St. Paul and show a continual linear decline.

Team members questioned why whale data was not updated. Jennifer indicated that there was no new data available at present from which to update this section. Jackie King noted that from the Canadian perspective, a general overview of trends shows a preliminary drop in sablefish CPUE, mixed signals in fish stocks, some southerly species moving northward, changes in zooplankton composition but a mixed bag of climate indices. Gary Stauffer noted that southeast pink salmon runs were a failure in 2006, but Kodiak had the highest pink salmon runs on record. Southeast feeding conditions for salmon species are currently poor but on the western side of the Pacific, Russian pink salmon biomass is increasing. Loh noted that 2005 was the second highest catches of salmon species overall. Team members questioned Canadian Pacific cod status. Jackie noted that the Hackett Strait Pacific cod population declined. This is a low quota fishery which is limited to bycatch only sufficient to maintain other groundfish trawl fisheries.

Economic SAFE report

Ron Felthoven provided an overview of the Economic SAFE report. He noted that the tables had not been updated since his last presentation at the September meeting. Therefore, he requested feedback on how much and when the Economic SAFE report is utilized in order to improve upon the economic SAFE and to gear it more towards the information needs of the users of the report. Ron stated that additional descriptive information on individual fisheries, by species, will be included in the future. Sarah Gaichas requested that, if possible, it would be useful to separate the BS and the AI for other species and for rockfish. Ron noted that things will be broken out to the extent possible, and that plans had been made to further delineate the current “other species” category to break out species for which new stock assessments will be conducted. Since no more questions or comments were posed, Ron asked that any requests or comments that the team thought of be sent to to Terry Hiatt.

Jim Ianelli posed a question about how or if economic impacts should be treated in plan team discussions when making stock assessments. The teams decided that plan team discussions could include TAC and economic considerations, and potentially list them without making recommendations on specific numbers. Ron commented that the importance of providing advice regarding economic impact is when incentives are such that the industry may act in such a way that is logical at the individual level, but bad for the overall industry (e.g., highgrading). In such situations, economists may be able to suggest management measures that could mitigate negative repercussions on the value or efficiency of the fishery.

Ed Richardson suggested that one piece of information that would be useful is to develop and report upon a standardized measure of fishing effort. Ron noted that they are evaluating measurements of fishing capacity and refining metrics that could be used to measure potential fishing effort and how much is applied each year.

Sablefish

Dana Hanselman presented an overview of the Sablefish assessment. He summarized major changes to the model this year which included: making it completely sex-specific, using females only for spawning biomass, and using sex-specific maturity and weight at age data. The authors also responded to a Council request for additional information on pot fishery data in the BSAI. So far, the pot fishery data is too limited to include as a relative abundance index and cannot be presented due to confidentiality reasons but research on pot gear catch rates continues. The authors also responded to Council requests to evaluate particular questions about pot gear and related management concerns (e.g., escapement panels). The assessment authors continue to evaluate impacts of whale depredation on fishery and surveys.

The new (2005) longline survey age data indicate that the 2000 year class appears to be larger than estimated in previous years. Preliminary estimates of the 2001 year class in the Bering Sea indicate that this may become an above-average year class.

The team discussed the use of the GOA trawl survey data. The author clarified that the trawl survey data in the GOA were isolated for depths <500m. The model predictions of GOA trawl survey biomass estimates were quite good.

New data indicate that growth and maturity at age may have changed. The author recommended that further investigations are needed before the model uses the new growth information. The teams questioned if growth variability could be due to spatial differences in catch over time.

The author responded that they need more time to investigate this, and that it is likely to be more than a simple spatial shift since the apparent change also coincides with a change in sample design for age collections.

The teams discussed the new model configuration. The authors investigated multiple model configurations and recommended model 3 since it fits the data better than model 1 and provides a more realistic depiction of the stock. The fits are similar to model 2 but model 3 uses the bottom-trawl survey estimates. Bill Clark questioned the extent that model 2 is improved by including the trawl survey data. The author noted that the fits to the existing data components are similar in model 3 and model 2, but the precision of recruitment estimates is improved. The Plan Teams and the SSC had requested that trawl survey data be included. The new model configuration provides better information on incoming year classes since the trawl survey tends to cover the younger portion of the population that is not well sampled by the longline survey.

The teams compared models 1 and 3 noting that there have been concerns regarding the fit to the data in the 1990s under model 1, with these problems likely related to growth and selectivity issues. The same assumptions on selectivity are also used in model 3. In some model runs, selectivity was allowed to be dome-shaped. The question was raised whether the selectivity patterns in the longline survey appear to be biologically unrealistic since male selectivity tended toward dome- shapedness while female selectivity was asymptotic. Bill Clark commented that a similar pattern is observed in the tag-recapture data for halibut, but not in the survey data and suggested that this could be related to higher natural mortality. The author concurred that there remains work to be done to understand these selectivity patterns. Team members questioned the degree to which population movement (i.e., younger fish in the BS and older fish in the western AI and in Southeast) would affect fishery selectivity patterns. Team members further questioned the growth data and to what extent there are indications of older smaller fish. Dana noted that fish of the same age tend to be smaller at deeper depths, so a depth shift of the population could affect growth.

The team noted that the precision in estimates of recruitment increases for the split-sex model and with the inclusion of the trawl survey data. However there does seem to be a change in the estimates of the early recruitment pattern.

The author noted several issues to be evaluated in the future including growth and maturity, pot fishery issues, migration modeling and the related impact on apportionment, as well as further recruitment studies. BASIS information in 2002-4 indicated small young-of-year sablefish in surface sampling along the Bering Sea shelf. The extent these juvenile sablefish contribute to the population is unknown. The author intends to pursue this line of investigation, particularly since the pre-recruit survey (conducted in conjunction with the longline survey) has been abandoned. The pre-recruit survey (based on gillnet sets at night) were conducted over a ten year period (ending in 2004) but were found to be highly variable and difficult to include in assessments.

The teams commended the author on the careful development of the model and the clear explanations of model differences. These are considered improvements over past assessment models.

The spatial aspects of the assessment were discussed and it was posed if a split assessment could be done by population proportions between the BSAI and GOA with separate selectivities? The author noted that it would be difficult given the limited data (especially age specific data). The resolution of results in the GOA may be feasible but would be more difficult for the BSAI. Estimates of the relative movement of the population between regions would be required.

The teams discussed growth data and whether growth has changed or if there has been a methodological change in aging techniques which might account for the observed differences.

The teams noted that this needs to be understood. There has not been an obvious shift in growth so this has complicated the ability to interpret changes.

The teams made additional suggestions for the next assessment:

- Evaluate the CVs assumed for survey and fishery abundance indices
- Devise an approach that evaluates the impact of different data components affect results
- Examine growth issues, examine residuals for consistency

Kerim Aydin noted that the sablefish assessment could benefit from additional ecosystem considerations. Time could be devoted next year to expanding upon this section of the assessment in coordination with the REEM.

A member of the public also requested that additional life history and habitat information be more explicitly included in the future.

The teams commented on the ability to track similar year classes in the eastern GOA. The authors noted that sometimes these year classes do not track in EGOA and there could be some environmental mechanisms controlling this. Team members questioned to what extent the model could be over-predicting RPWs. The teams suggested that the author evaluate growth data from matching periods. However, more data is available from recent time periods than from earlier time periods.

The teams endorse the use of model 3 given the authors presentation. The teams considered additional modifications premature. The teams noted that other models tended to indicate lower stock biomass levels, but additional investigation is necessary. Growth data, if substantially changed, should be discussed further at the September 2007 plan team meeting. The teams expressed concern regarding the GOA trawl survey potentially dropping deeper stations in the future since trawl survey data is now being included. The author noted that without the deeper stations the trawl data would cease to be useful in this assessment. It was noted that changing survey protocol should account for the species that would be impacted. Budget cuts affecting surveys that limit deeper depth strata impact some assessments more than others. The teams noted that if budget and survey protocol decisions need to be made, reducing the number of stations within areas should be considered.

The plan teams approved of the 2007-2008 authors recommended ABCs and OFLs noting that apportionments also need to be annually calculated.

The teams discussed the apportionment scheme and the extent improved fishery data should be used (currently it is down-weighted compared to the survey data). Members of the public have commented that the precision of these data has improved and should be used more fully. The industry noted that they would like to see more attention to this as they are concerned about potential over-harvesting in some areas, which could lead to a biological issue. The author noted that logbook data has improved, but that the apportionment scheme is a Council decision. The apportionment scheme can be investigated in different ways, and should be done so if there is a potential biological concern. The teams discussed the basis for the current allocation and noted that it is based on the relative variability in abundance observations. Jeff Fujioka noted that it is inappropriate to compare survey and fishery CVs absolutely because the fishery data is coming from best depth strata and then expanded to entire area. Chris Lunsford noted that fishery data have been examined seasonally and resulted in no apparent trends. Trends in Bering Sea would be more difficult to detect due to the sparser and more variable data. In general, the quality of the data is improving in the GOA but still remains relatively poor in Bering Sea. It was noted that cooperative research funding is currently being used to collect fishery logbook data. The current funding situation (e.g. budgetary cuts) may also impact this cooperative research project. If this information becomes more important, the quality and availability of the data should be ensured.

Jane DiCosimo briefed the teams that the Council is examining potential changes to pot storage and that this information is included in the assessment at the Council's request. The stock assessment author noted that information included in assessment responds to the Council requests but that the regulatory issues currently have limited application for the stock assessment process. In a letter to Dr. Doug DeMaster dated December 28, 2005, the Council requested that AFSC Auke Bay Laboratory (ABL) scientists investigate a number of issues related to sablefish management in the Bering Sea and Aleutian Islands. The Council requested that ABL staff conduct experimental research in 2006 to determine the effectiveness of different size escape rings, soak times, and biodegradable panels, in conjunction with ongoing efforts to develop catch-per-unit-effort indices, for sablefish pot gear. The requested research would address three potential changes to sablefish pot gear regulations based on research results: 1) escape rings; 2) changes to required biodegradable panels; and 3) banning at-sea storage of pots. In a separate action, the Council initiated an analysis for an amendment to the BSAI Groundfish FMP. This amendment would allow the Council flexibility in setting the sablefish fixed gear/trawl allocations in the Bering Sea and Aleutian Islands management areas to allow for maximizing catch in the IFQ and CDQ fixed gear sectors, without leaving fish unharvested.

The authors responded to some of these requests in the sablefish assessment, and deferred the remaining research and management requests to those with specific expertise related to those broader issues. Earl Krygier encouraged further response to requests regarding pot gear regulatory issues. The Teams agreed but felt that this was something better dealt with at the Council rather than the Plan Team level. BSAI Plan Coordinator Jane DiCosimo offered to coordinate any further response.

Pacific cod

Dr. Grant Thompson preceded a summary of the BSAI Pacific cod assessment, with additional discussion of survey catchability in response to public comments at the October 2006 Council meeting. This review is summarized as follows.

Catchability Is there a difference between catchability and selectivity? Does estimation of one affect estimation of the other? Selectivity addresses the ratio of the survey abundance at age and the true abundance at age, conditional on the convention that the age where that ratio is maximized is defined as selectivity equal to 1.0. The product of catchability and selectivity at age determines what is observed in the survey. In practice, we know survey numbers at age, then we estimate catchability and selectivity at age to infer true abundance at age. What if we set catchability at the wrong value? Suppose we set $q = 1.0$ when, in fact, $q = 0.5$? Then, the model tries to estimate selectivity at age so that the estimated product of catchability and selectivity at age is close to the true product "on average" (across ages). The values for numbers at age are then incorrectly estimated, with estimated numbers at some ages perhaps being too high and estimated numbers at other ages perhaps being too low. After applying the weights at age to compute biomass, the estimated total biomass may be lower than, equal to, or higher than the true total biomass. Therefore, cutting catchability in half will not necessarily lead to a doubling of estimated biomass. Catchability and selectivity are different quantities, but their estimates are interdependent. Changing an assumed value of Q by some proportion may not result in the same proportional change in estimated biomass.

Why is Q (shelf bottom trawl survey) such an issue for cod? For the last 20 years, trawl survey Q has been fixed at 1.0 in the assessment model. Trawl survey biologists have concluded that this number is reasonable based on their studies. Unfortunately, this has resulted in a trawl survey selectivity at age schedule with a pronounced “kink.” As a result, the abundances of smaller and larger sizes (to the left and right of the “kink”) appear to be underestimated by the survey. This means that model biomasses have usually been much higher than survey biomasses. If the model is wrong, ABCs have been too high. If the model is right, this does not mean that we can then double ABC. That is, changing an assumed value of catchability (Q) by some proportion does not necessarily result in the same proportional change in estimated biomass, unless estimated selectivity under both values of Q is close to 1.0 for a broad range of ages.

So why not just estimate Q? This was tried often during the late 1990s under stock synthesis (SS1), but was not successful (tried to estimate M too).The resulting estimates of Q were very high and the resulting estimates of M were very low. Last year, the author tried again to estimate Q by applying a revised model (SS2 - ADMB version), but it was not successful either at estimating Q or M. The only way to get both Q and M to converge was to place very narrow priors on both Q and M (cv = 0.05). In reviewing last year’s assessment, the Plan Teams and SSC recommended that the author try again, but for Q only (with and without use of a prior distribution). The author assumed the same prior used in earlier attempts to estimate Q: Mean of 1, cv of 30%. The author also spent considerable time investigating the possibility that archival tags might provide sufficient information to calculate an “empirical” prior. However, a number of issues arose during this investigation. One of the key difficulties is that the tags record only the depth of the fish, not the location of the fish, meaning that bottom depth must be inferred somehow. To date, two methods for inferring bottom depth have been explored. The first is to examine only those fish retrieved in a flat area, where bottom depth was reasonable to estimate. If we look only at tags from a flat bottom area, then perhaps we can interpret up-and-down movement of the tag as vertical movement of the fish and not change in bottom depth. Unfortunately, only 11 tags meet the necessary criterion (retrieved from an area of homogeneous bottom depth). Dan Nichol is continuing to work on this approach, including possible influence of tides. The second approach is more computationally intensive, involving a hierarchical Bayesian approach based on a Kalman filter model of changes in bottom depth and fish depth. More time is necessary to perform all the data processing required for the second approach. Even if either of these two approaches proves successful in estimating the vertical distribution of fish relative to the bottom, a number of other issues remain: 1) The resulting estimates may not be an accurate description of vertical distribution when fish are encountered by an approaching vessel or net, 2) the hypothesis that fish may be able to out-swim the survey trawl also requires further investigation, and 3) it will still be necessary to disentangle the roles of catchability and selectivity before the resulting estimates can be used in the stock assessment model.

New data for 2006: The 2006 EBS shelf survey biomass was 519,000 t, down 14% from 2005. The 2006 AI survey biomass was 93,000 t, down 19% from 2004. In converting outputs from the EBS-only stock assessment model to BSAI equivalents for harvest specification purposes, estimates of biomass for the EBS have been inflated to account for the AI using the ratio 84:16, similar to the value previously used of 85:15. Historic fishery and survey length frequencies were recomputed and were found to not have changed much from the previous estimates. Three new years of survey age compositions for the years of 1994, 2004, and 2005 were added, so that a complete time series is available for 1994-2005, except for 1995. Longline survey data were provided by Chris Lunsford and Cara Rodgveller, and were incorporated into several of the alternative models, but not all. Potential problems with the longline survey data include: 1) few stations (some dropped due to killer whale depredation; only 32 EBS stations were successfully sampled each year by the Japanese survey, and only 11 by the U.S. survey), 2) most cod were caught in shallow strata where area expansion coefficients do not yet exist, and 3) the average catch per station from the Japanese longline survey showed extreme year-to-year variability. Japanese longline surveys, designed to assess sablefish, ran annually from 1982-1994. Japanese surveys also had P. cod stations, so Mike Sigler suggested that these stations might be used in the model as a third longline survey index. However, the level of variability in fitting Japanese summer longline survey may be better for sablefish than for cod (the latter being much more variable). US surveys (EBS) occurred biennially from 1997-2005.

This year's models: The authors reviewed the assessment to answer the questions: 1) What model should be used? 2) What OFL and ABC should be adopted? and 3) should ecosystem considerations adjust the ABC?

Model 0 is last year's preferred model (Q = 1.0). Eight alternative models are also analyzed. In common are: 1) estimated trawl survey catchability (prior mean = 1.0, CV = 0.3); 2) other priors are the same as used last year; 3) the EBS shelf trawl survey catchability was estimated separately for the years 1979-1981 and 1982-2006; and 4) almost all selectivity parameters were estimated. One exception is the set of priors for the locations of the peaks for selectivity, which, because they are based on the average of the length composition peaks for the respective fishery or survey component, were re-estimated this year to take advantage of new data. Differences between models are: 1) inclusion of longline surveys; 2) functional form of the selectivity curve; and 3) priors given full (1.0) or partial (0.5) weight. Model enumeration forms a factorial design. A concern that selectivity may be overparameterized continues.

All models converged successfully, but models with down-weighted priors had to be started from the converged parameters from "full prior" runs. Model fits were similar regardless of the model configuration. For length data, fits were really good (comparing input (sample) and output (effective) sample sizes) for commercial fisheries, adequate for post-1981 shelf trawl survey, adequate for Japan longline survey, and really good for the US longline survey. Fits for age data were nearly identical across models, but not great for any model. Fits to shelf survey abundance were good, except that no model matches the huge 1994 increase and Model 0 has a consistent bias for pre-1982 years (does not separate time series of trawl survey data). Fits to the longline survey abundance index were poor, probably because the value fluctuates greatly.

Major assessment results are presented in Tables 16 and 17. Post-1981 trawl survey Q ranged from 0.55-0.70, except Model 0, in which Q was fixed at 1.0. Spawning biomass in 2007 is at 33-44% of the unfished value. All models except one find the stock to be in Tier 3b. The abundance trend is downward for all models, so that spawning biomass for 2008 ranges from 30-34% of the unfished value. The 2006:2007 ABC decrease ranges from 0-33%, depending on the model. The 2007:2008 ABC decrease ranges from 17-30%. Qualitatively, all models show similar trends for recruitment and spawning biomass. In all models, the 2000-2004 year classes are below average. The shapes of all of the female spawning biomass trends are similar, although the scale is different. Model A2 has the highest value, B1, B2, and A1 are together in a second, middle group, and the remaining models are in a third, lowest group, which includes Model 0. The difference between the A and B models are that the latter have a lower number of selectivity parameters. Version 1 and 2 differ by weight on priors (1.0 vs. 0.5, respectively). The last group of models includes the longline survey data and provides a similar picture to the last half of the time series for last year's model (Model 0).

In previous assessments, shelf trawl survey selectivity has been sharply kinked and lower for older ages. The same result holds this year for Model 0. In contrast, selectivity is only mildly dome-shaped for Models A1 and A2 and asymptotic and very similar for Models B1 to D2. Model projections indicate that female spawning biomass will decline because the 2000-2004 year classes all are below average.

Sarah Gaichas and Kerim Aydin contributed results from ecosystem models to the Pacific cod assessment. Sarah briefly summarized the model results, which are included as an attachment to the Pacific cod SAFE report chapter. The point of the attachment was to provide ecosystem information as the Plan Team considers separate BS and AI specifications. Patterns of lower productivity and low recruitment are consistent with ecosystem analyses for other species.

From an ecosystem viewpoint, the authors concluded that the AI and EBS are distinct. Information from the early 1990s was used for modeling (because of a lack of updated AI data). Cod density in the AI is higher than the EBS and both are markedly higher than the GOA. Cod consumes both pelagic and benthic energy. Pollock is dominant in the Bering Sea, whereas the relative importance of cod is greater in the AI. Cod are connected to a lot of other species in both ecosystems. About ¼ of cod diet is pollock in the EBS. Other important prey are shrimp, epifauna, opilio, offal and infauna. In the AI, important prey include shrimp, small demersal species, Atka mackerel, squid, offal, and infauna. Mortality sources for cod in the EBS include "unaccounted" (i.e., fish which die before being eaten by a predator or harvested in the fishery, which accounts for about half of Pacific cod mortality), longline, trawl, then pollock, cod, and halibut. In the AI, "unaccounted" contributes half the mortality, followed by longline, trawl, Steller sea lions, and toothed whales.

Who matters to adult cod in the AI? Juvenile cod, adult cod, small phytoplankton, benthic detritus, large phytoplankton, benthic microbes, shrimp, amphipods, cod longline, polychaetes, etc. In the BS, similar factors are ranked high.

Who do adult cod matter to in the AI? Adult cod, sablefish, cod pots, cod longline, cod trawl, rex sole, arrowtooth flounder, greenlings, sleeper shark, sablefish longline, etc. In the Bering Sea, adult cod, cod pots, cod longline, cod trawl, greenlings, bairdi crab, cod juvenile, king crab, etc.

The BSAI Team reviewed criteria for choosing a model:

1. Reasonable selectivity for a trawl survey (is there a pronounced "kink"?).
2. Data are validated and ready for use (specifically, are we ready to use the longline survey data?).
3. Model converges well (and not dependent strongly on initial values).
4. Model should not depend too strongly on prior distributions (If it does, make sure we agree on priors?).

The Team's evaluation of the models concludes:

1. Model 0 has a pronounced selectivity kink
2. Models using longline survey data (C1-D2) need further investigation (area-expansion factors, small sample sizes for abundance indices, big year-to-year fluctuations in Japan survey index).
3. Models with down-weighted priors (A2, B2, C2, D2) typically had a hard time converging (especially A2), as did models using longline survey (C1, D1, C2, D2). Models using double logistic selectivity (like A1) in the past have tended to converge on unreasonable values with free M and Q.
4. Model A2 is the most sensitive to the prior (going from A1) (16% change in 2006 biomass; versus -3%, 3%, and -2% for B1, C1, D1).
5. The above consideration results in Model B1 as the preferred model
    a. Models A1, B1, and B2 give similar results.
    b. Indicates that reduction in parameters between A1 and B1 may not be missing key factors.

Model results for B1:

1. 2000-2004 year classes are below average and 2005 year class is nearly average (though based on only one year of trawl survey data).
2. Estimated spawning biomass has been similar from 1993 to 2006, though it has been decreasing since about 2004.

3. 2007 ratio is 38% (Tier 3b); 2008 ratio is 33% (Tier 3b)
4. Maximum permissible 2007 ABC under Tier 3b is 176,000 t (down 9% from 2006) and 131,000 t for 2008 (26% down from 2007)

Can we detect a weak cohort? Some public comments have identified model estimates of weak 1985-1987 and 1993-1994 cohorts as proof of the model's inability to estimate year class strength. The stated rationale was that catches were higher in 1990-1992 than 1985-1987 (but ABCs were lower) and that catches and ABCs in 1998-1999 were both slightly higher than in 1993-1994. However, many factors go into setting ABC, not just the relative strengths of 5-7 year-olds, including harvest policy, model structure, parameter estimates, and absolute strengths of all age groups. Likewise many factors affect catch, not just the relative strengths of 5-7 year olds. Same as above, plus other management measures, profitability, and fishing effort. In both SS1 and SS2, the model is constrained to match the catch history exactly, so current cohort strength estimates must be consistent with past catch history.

What about past estimates? The author suggested that a valid test would be to compare earlier model estimates of year class strength (specifically, in the respective SAFE reports when the year classes in question first reached age 3) against recent model estimates. The rankings of three of the five cohorts (1985, 1986, and 1994) were exactly the same in the 2005 assessment (using the model chosen by the Plan Team and SSC) as when they were initially characterized. The rankings of the other two cohorts (1987 and 1993) changed slightly, but went from weak to weaker in both cases.

What about fishery CPUE? The author computed fishery catch rates by gear type (pot, longline, and trawl). Longline CPUE went up a lot in 2006; pot CPUE has increased steadily since 1999; and trawl CPUE decreased slightly this year. For these data, the sample sizes are large and standard errors are small. The longline CPUE showed a 57% increase this year. Is a 57% 1-year biomass increase possible? For the fishery CPUE data, how do you weight the gear types, especially while trawl went down 2% and longline went up 57%. Problems have sometimes arisen elsewhere when fishery CPUE is used as an index of abundance; fishermen are good at finding fish even when populations are declining. These questions and issues do not rule out the possible use of fishery CPUE in future assessments, but they will need to be addressed before such data can be used with confidence

Team recommendations to the author for new modeling efforts:

- The author and others have been concerned that selectivity may be over-parameterized. Previously, a double logistic function with 8 parameters was used. This year, the author proposed using a "double normal" function with 4 parameters instead. The double normal selectivity schedule is based on 2 normal curves (location and scale parameters), whose peaks are connected by a flat line. In contrast, the double logistic function triples the number of shape parameters. Other selectivity curves provided in SS2 besides the double logistic and double normal could also be explored. If available as options in SS2, it may be useful to consider using second-difference penalized line segments or an exponential-logistic selectivity curve.
- Last year, age-at-maturity data were updated. The AFSC has embarked on a 3-year effort to improve maturity data by expanding spatial coverage of samples (e.g. expand outside of "Cod alley" in the Bering Sea).
- The Plan Team requests that the Japanese longline survey data be examined further, as acknowledged by the author. In addition, the Plan Team requests that the shallower cod station and deeper sablefish stations be analyzed separately to create two independent indices. It would be interesting to see differences between the cod (18) and sablefish (14) stations. Bill Clark doubted that the longline survey would ever be useful, as the IPHC rejected that approach for halibut

Team comments:

- The Team concurs with the author's recommendation of Model B1. This year's changes in model structure have resulted in a more successful assessment. We finally have a decent time series of age data (about 10 years) and the model follows the convention of estimating q, with fixed M, and has a simplified selectivity function. The Plan Team recommends testing other simpler functions.
- The Plan Team notes that the 2007 ABC is greater than the 2008 OFL, which is an indicator that the stock abundance is declining.
- The difference in the ecosystem role of cod between the Aleutians and the Bering Sea indicates potential differentiation between cod assessment and management. Predation on cod is fairly low, which implies that single-species considerations are sufficient for determining ABC. Fishing is the most important source of mortality (besides unallocated mortality). The Team drew no conclusion on the advisability of setting subarea specifications based on ecosystem information. The Team noted that the SSC will review genetic information on cod at its February 2007 meeting to further advise the Council on this issue.
- Natural mortality of cod is low in the ecosystem model, but the assessment model says it is high. There may be big sources of juvenile cod mortality.
- Models tend to get more complex over time, making it difficult to communicate results to the public.
- The model previously suffered from lack of age data; inclusion of such data now allows better estimates of recruitment, and potentially natural mortality in the future.
- The Team noted that the author did not provide a retrospective analysis this year, but did in previous years. The results track best when the model does not change.
- The Plan Team agreed to carry its recommendations to authors forward each year, until authors respond to those recommendations. November minutes will collate all team recommendations.
- An external review of the BSAI Pacific cod model was sponsored by an industry group simultaneously with the development of this year's assessment. Timely completion of the BSAI and GOA Pacific assessments was compromised due to the timing of the external review. The Plan Team supports the concept of scientific reviews, both internal and external, and notes that the Pacific cod assessments have been reviewed externally on several previous occasions. The Team recommends that the Council consider adopting a policy whereby external reviews would not be conducted during the time dedicated to preparation of stock assessments (September-December). AFSC scientists are willing to participate in external reviews outside of that time period, but these should be scheduled in coordination with AFSC leadership so as not to conflict with other assignments.
- The Team noted that changing from annual surveys of the EBS shelf to biennial surveys would compromise management and assessment of Pacific cod and other species.

Public comment

Joint Team Chairs Jim Ianelli and Loh-lee Low requested that the BSAI Pacific cod stock assessment and ecosystem model presentations by the authors be allowed to proceed uninterrupted, except for questions of clarification by Plan team members. At the conclusion of the presentation, Plan team members would ask the author questions. At the conclusion of Plan Team questions, the public was invited to pose questions to the author and/or Teams. At the conclusion of public comment, the BSAI Plan Team would deliberate and develop its recommendations on OFL and ABC, and any other comments to the author on requests for next year. A separate review of the GOA Pacific cod assessment would occur later in the week.

Thorn Smith noted that last year's ABC projection for 2007 was 148,000 t, whereas this year's model projects it at 176,000t. Why the difference? The author responded that it was due to all the model differences described above.

Tom Casey noted that the authors' presentations and subsequent Plan Team questioning consumed over 3 hours before the public was allowed to speak. He quoted National Standard 1 from the MSFCMA. Loh-lee Low noted that no one was limiting anyone's opportunity to comment; the only restrictions pertained to <u>when</u> those comments could be offered.

Ed Richardson asked if the reason for the difference between A2 and B1 is simply that A2 does not converge very well and wondered how much risk would be posed if ABC were to be set slightly above the maximum permissible level suggested by Model B1. The author replied that the main arguments against Model A2 were two-fold: First, because Model A2 converged successfully only when it was seeded with the final parameter estimates from Model A1, it may have converged on a local minimum; and second, because Model A2 uses the double-logistic form of the selectivity function, which has been difficult to estimate in the past. To the second question, he replied that the management system is not set up that way – we pick a model and follow the constraints therein. If the Plan Team feels that Model A2 is the best model, that is one thing; but it would be a significant deviation from past policy if the Plan Team were to endorse Model B1 and then recommend an ABC from another model that exceeds the maximum permissible ABC from Model B1.

Dave Fraser asked if the assessment could include a table or figure of estimated numbers at age so that readers can track age classes as they move through the population and fishery? Grant indicated that this could be included in future assessments.