Report of the September 2018 Joint Groundfish Plan Team meeting

NOAA FISHERIES
Alaska Fisheries Science Center

Grant Thompson

October 1, 2018

Meeting overview

- Dates: September 18-19
- Place: AFSC Seattle lab
- Leaders: Jim Armstrong (GOA coordinator), Jim Ianelli (GOA co-chair), Chris Lunsford (GOA co-chair), Diana Stram (BSAI coordinator), Grant Thompson (BSAI chair)
- Participation: 23 Team members present, plus numerous AFSC and AKRO staff and members of the public
  - Plus 1 individual nominated for Team membership
- File containing minutes includes Joint, BSAI, GOA
  - Bookmarked, and with “clickable” Table of Contents
- Documents and presentation files available on the Team agenda site
  - Link provided on Council agenda site (under item C2)

Agenda (1 of 2; action items in red)

- Administration
- Report from the June BSAI Team workshop
- ABC < maxABC
- ESP process update
- SSC generic assessment requests (no action, but please read anyway)
- Dialogue on OK-ness of ESR and assessment information
- SSC assessment prioritization requests
- Rationales for requests to authors
- Ecosystem climate update
- BS bottom trawl survey
- Use of model-based estimates

Agenda (2 of 2; action items in red)

- AI bottom trawl survey
- Longline survey
- Sablefish
- Sharks
- Observer Program update (see separate presentation)
- Halibut DMRs
- Economic SAFE report (SSC will review in February)

Report from the June BSAI workshop (1 of 9)

- Topics:
  - Ensemble modeling
  - ABC adjustments
- Personnel:
  - Co-chaired by A. Haynie, A. Hicks, D. Stram, G. Thompson
    - D. Stram also served as rapporteur
    - D. Hanselman also played a major role before moving to SSC
  - At least 46 participants
    - BSAI, GOA, and Crab Teams were all represented
- Purpose: To develop recommendations for the two topics, to be considered by the Joint Teams at their September meeting
- Ambitious agenda, including several items requested by the SSC

Report from the June BSAI workshop (2 of 9)

- Over 20 presentations (available online—see link in workshop report)

3. ENSEMBLE MODELING	
3.1. Brief descriptions of ensemble modeling and model averaging	Thompson
3.2. The dividing line between statistics and machine learning	Thompson
3.3. Examples of ensemble modeling in fisheries stock assessment: the American experience	Hicks
3.4. Examples of ensemble modeling in fisheries stock assessment: the ICES experience	Johnson
3.5. Examples of ensemble modeling in other disciplines	Bond
3.6. Lessons from the 1998 NRC study	Thompson
3.7. Review the 2017 SSC ensemble modeling workshop	Hicks
3.8. Review the NSAW on ensemble modeling	Hanselman
3.9. Choosing models in an ensemble	Thompson
3.10. Combining models and assigning weights	Thompson
3.11. Calculating statistics and uncertainty	Thompson
3.12. Pros and cons of implementation in NPFMC system	Ianelli/Thompson
3.13. Communicating and using results	Co-chairs
3.14. Workload and logistics for assessment authors	Thompson
3.15. Identifying assessments amenable to ensemble modeling	Co-chairs
4. DETERMINING ABC	
4.1. Review how maxABC and ABC are determined in NPFMC system	Stram
4.2. Examples of reductions from maxABC in the past	Hanselman
4.3. How can ensemble modeling inform maxABC and ABC	Hicks
4.4. Other methods of accounting for uncertainty when determining ABC	Thompson/Hanselman
4.5. Potential tools/metrics for guiding reductions	Haynie
4.6. The role of ecosystem or socio-economic considerations in reductions from maxABC	Haynie

Report from the June BSAI workshop (3 of 9)

- The Teams endorsed the workshop's ensemble modeling recommendations (with minor modification), as shown below:

1. Assuming that some sort of model averaging is involved, an ensemble model should be treated the same as any other model (i.e., an ensemble is a "model" and should be treated as such in reference to the existing language in the FMP and SAFE report guidelines)
2. Continue efforts on ensemble modeling, including approaches that could be used in this year's assessment cycle

- (continued on next 3 slides)

Report from the June BSAI workshop (4 of 9)

3. Resolve the following critical issues:
   a. Choosing and justifying members of the ensemble model
   b. Choosing among a number of available weighting schemes
   c. Justify the benefits of the added complexity resulting from moving to an ensemble model
   d. Because there are potentially many ways to determine "overfished" status with ensemble models, the specific details of determining status need to be specified
4. Identify criteria for stocks amenable to ensemble modeling (e.g., fully-exploited, high model result variability)
5. BS Pacific cod and northern rock sole and/or yellowfin sole assessments should move forward with ensemble modeling options in the upcoming assessment cycle

- (continued on next 2 slides)

Report from the June BSAI workshop (5 of 9)

6. Ensemble modeling seems appropriate for consideration in some NPFMC assessments but not necessarily for all assessments
7. For example, a good use of an ensemble model (at high levels of inclusion and complexity) would be to test current assessment methods and harvest control rules, which would help with:
   a. supporting a simple model for management purposes by showing that it compares favorably with the ensemble and
   b. improving transparency and alleviating review and model selection process at the Plan Team/SSC meetings
8. Candidate stocks for an ensemble model should be chosen judiciously because it will add significant workload to both assessment authors and reviewers

- (continued on next slide)

Report from the June BSAI workshop (6 of 9)

9. The process may need to be modified to allow for adequate review of model selections and weighting schemes (e.g., a CIE review may be required or additional Plan Team meeting for model selection)
10. Selection of models for the ensemble should be made no later than the September/October time frame and preferably earlier
11. If the SSC wishes to entertain ensemble models, they may need to devote more time for model review (e.g., during the February meeting)

Report from the June BSAI workshop (7 of 9)

- The second major topic of the workshop was ABC adjustments
- During the workshop, it became apparent that developing clear and transparent rules for ABC adjustments was too large a task to be completed in the available time
- Therefore, the workshop's recommendations pertaining to ABC adjustments are of a general nature only, and the task of developing clear and transparent rules was assigned to a subcommittee that would report separately to the September Joint Team meeting (see next agenda item)
- The Teams modified some of the workshop's general ABC adjustment recommendations, to make them less prescriptive and more succinct
  - Teams' general recommendations are shown on the next 2 slides
  - Teams' specific recommendations appear in the next agenda item

Report from the June BSAI workshop (8 of 9)

- Any reductions of ABC should be transparent and clearly described. Plan Teams will include a section in the Introduction to the SAFE report outlining extraordinary circumstances and major uncertainties, which could feature discussion of:
  - What are potential direct and indirect biological, ecosystem, and/or socioeconomic implications of choosing an ABC below the maxABC?
  - What are the current hypotheses and empirical support related to how this extraordinary circumstance has impacted the stock?
  - What are possible current research priorities, including data needs and knowledge gaps to better understand the circumstances and uncertainties?
- (continued on next slide)

Report from the June BSAI workshop (9 of 9)

- Clarify, with the SSC, the issue of the extremely high bar set for reducing the ABC for EBS Pacific cod:
  - “unequivocal information justifying a further reduction”
- The Joint Teams recommend that AFSC task staff to continue to work on P* and decision theory approaches to develop uncertainty-based buffers, for example:
  - Update the previous analysis using survey uncertainty to define the uncertainty to consider in a P* approach
  - Determine the P* implied by a single “best model” approach and determine how different the buffer would be when using that P* with an ensemble approach
  - Consider an increase in the buffer if the estimated uncertainty from the assessment model does not capture structural uncertainty that could be estimated when using an ensemble approach

ABC < maxABC (1 of 9)

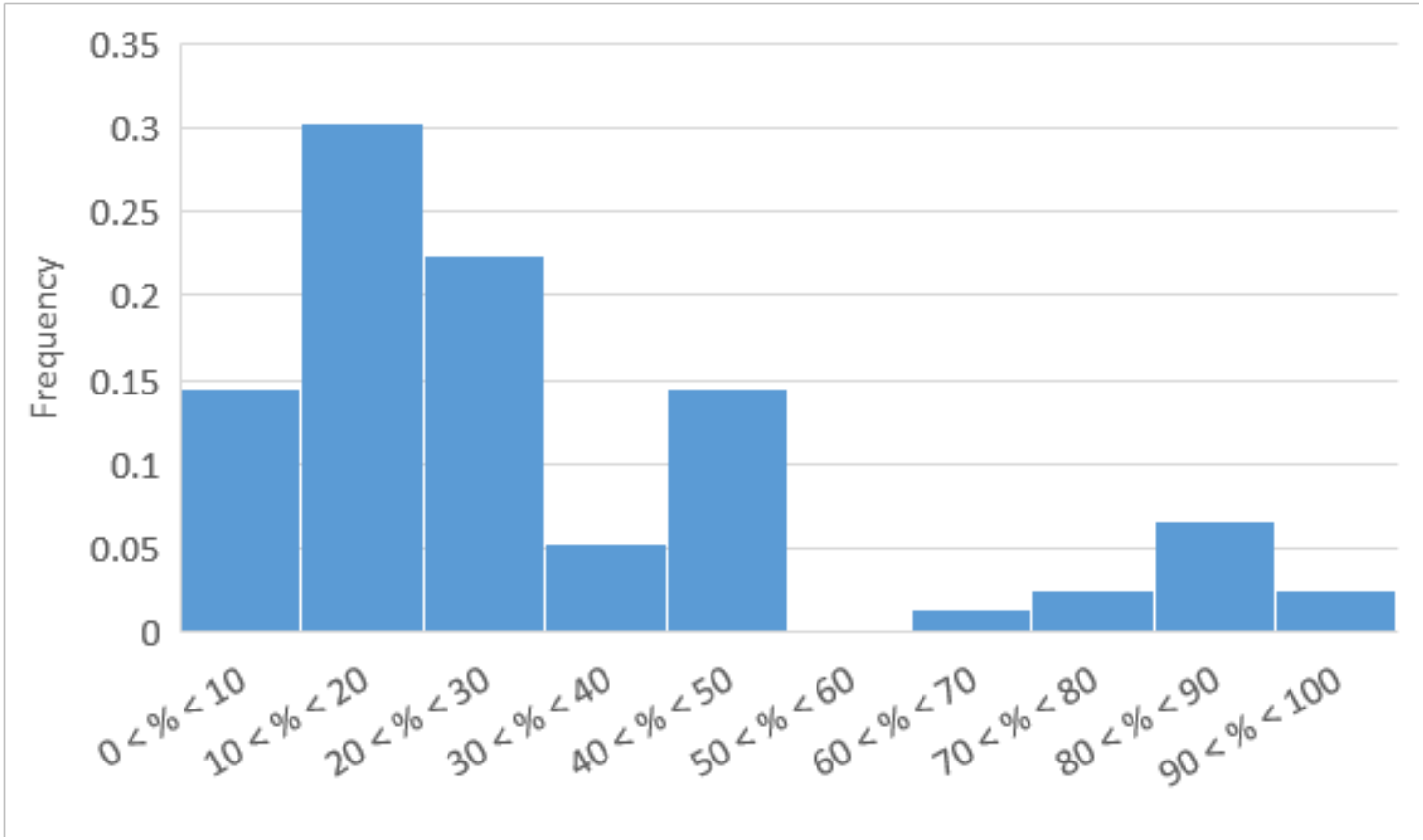
- SSC minutes (2/18): “The SSC recommends identification of clear and transparent rules for defining the specific criteria to be used when adjusting the recommended ABC. Stock assessment uncertainty relative to levels upon which the Tier system was constructed, atypical data availability or usage (e.g., reliance on only catch-per-unit-effort vs. a survey index), ecosystem considerations, and other factors are potential candidates.”
- Subcommittee established during June BSAI workshop (M. Dorn, chair)
- Two background documents prepared for subcommittee consideration:
  - Multivariate logistic approach
    - Filename “Reverse-engineering previous ABC reductions 3”
  - Risk classification approach
    - Filename “When to set ABC less than Max ABC 4”

ABC < maxABC (2 of 9)

- Multivariate logistic approach (1 of 4)
  - Statistical analysis identified a set of 25 variables that resulted in an R^2 of 0.82 for the 76 instances in which either the BSAI Team or the GOA Team recommended an ABC reduction over the course of the preceding 15 years
  - The model, with coefficients constrained to be positive, forces all ABC reductions to fall within the 0-to-1 range, and the amount of the reduction always varies directly with the number of variables that apply in any given situation
  - Variables are defined to be binary
  - The initial lists of variables and coefficient variables are those that gave the best fit to the historical data and are not necessarily those that should guide reductions in the future, although they may provide a useful starting point for developing lists for future use

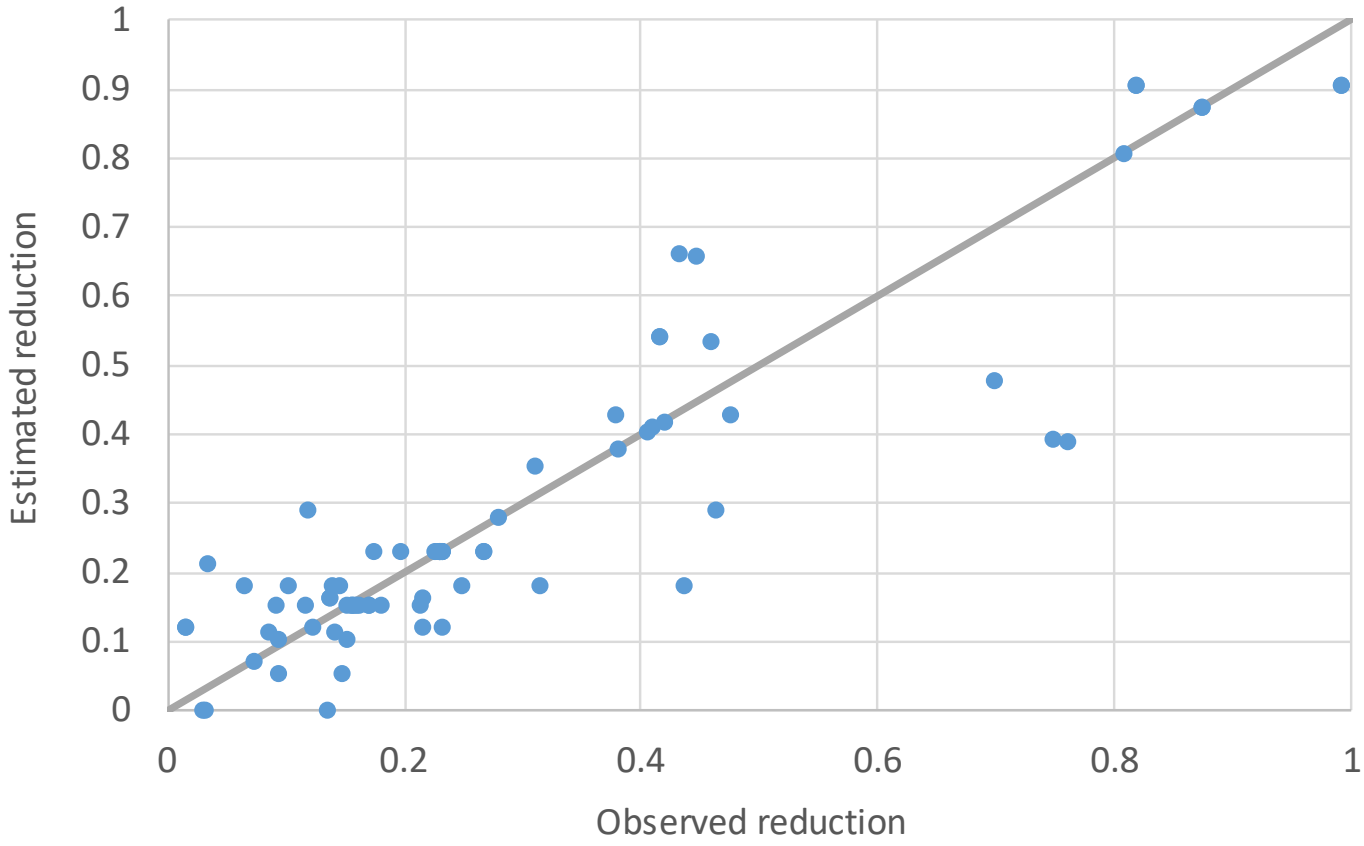
ABC < maxABC (3 of 9)

- Multivariate logistic approach (2 of 4)
  - Frequency of previous ABC reduction proportions (10% bins)



ABC < maxABC (4 of 9)

- Multivariate logistic approach (3 of 4)
  - Model fit (R^2 = 0.82)



ABC < maxABC (5 of 9)

- Multivariate logistic approach (4 of 4)
  - Final non-zero parameter estimates

Round 3 variables	beta	univariate reduction
Reduce ABC to account for State GHL	0.08	0.04
Dramatic increase in catch or increasing catch on a declining stock	0.11	0.06
Prevent B<B20%	0.14	0.07
Projected biomass decline	0.21	0.10
Long-term poor recruitment	0.22	0.11
Dorn's buffer	0.23	0.11
None	0.24	0.12
Late-breaking analysis (not included in assessment)	0.25	0.12
Yield variability	0.31	0.15
Precedent	0.33	0.16
Some concerns unique to various EBS pollock and Pacific cod assessments	0.37	0.18
Uncertain recruitment estimates, including recent large estimates	0.40	0.20
Model uncertainty	0.43	0.21
Some concerns unique to most GOA demersal shelf rockfish assessments	0.47	0.23
Uncertainty surrounding Q	0.47	0.23
Uncertainty surrounding M and Q	0.60	0.29
Some concerns unique to the 2008 BSAI Greenland turbot assessment	0.80	0.38
Low or long-term declining biomass	0.82	0.39
Significant probability of exceeding FMSY	0.86	0.40
Hedge against future regime shift	0.87	0.41
Reliable minimum biomass estimate available for Tier 6 stock	0.89	0.42
Large survey CV	0.91	0.43
No new survey	1.81	0.72
Some concerns unique to the 2003 and 2004 GOA Atka mackerel assessments	2.69	0.87
SSC's rule for Bogoslof pollock ABC	2.99	0.90

ABC < maxABC (6 of 9)

- Risk classification approach (1 of 3)
  - Three types of considerations that could be used to support a recommended reduction were identified:
    - Assessment-related considerations—
      - Data-inputs: biased ages, skipped surveys, etc.
      - Model fits: poor fits to fits to fishery or survey data, etc.
      - Model performance: poor model convergence, etc.
      - Estimation uncertainty: poorly-estimated but influential cohorts
    - Population dynamics considerations—decreasing biomass trend, poor recent recruitment, inability of the stock to rebuild, etc.
    - Environmental/ecosystem considerations—adverse trends in environmental/ecosystem indicators, ecosystem model results, decreases in ecosystem productivity, etc.

ABC < maxABC (7 of 9)

- Risk classification approach (2 of 3)
  - Table 1: overall risk = highest level of concern across columns

	Assessment-related considerations	Population dynamics considerations	Environmental/ecosystem considerations
Level 1: Normal 😐	Typical to moderately increased uncertainty/minor unresolved issues in assessment	Stock trends are typical for the stock; recent recruitment is within normal range.	No apparent environmental/ecosystem concerns
Level 2: Substantially increased concerns 😕	Substantially increased assessment uncertainty/ unresolved issues.	Stock trends are unusual; abundance increasing or decreasing faster than has been seen recently, or recruitment pattern is atypical.	Some indicators showing an adverse signals but the pattern is not consistent across all indicators.
Level 3: Major Concern 😟	Major problems with the stock assessment, very poor fits to data, high level of uncertainty, strong retrospective bias.	Stock trends are highly unusual; very rapid changes in stock abundance, or highly atypical recruitment patterns.	Multiple indicators showing consistent adverse signals a) across the same trophic level, and/or b) up or down trophic levels (i.e., predators and prey of stock)
Level 4: Extreme concern 😮	Severe problems with the stock assessment, severe retrospective bias. Assessment considered unreliable.	Stock trends are unprecedented. More rapid changes in stock abundance than have ever been seen previously, or a very long stretch of poor recruitment compared to previous patterns.	Extreme anomalies in multiple ecosystem indicators that are highly likely to impact the stock. Potential for cascading effects on other ecosystem components

ABC < maxABC (8 of 9)

- Risk classification approach (3 of 3)
  - Table 2: alternative responses to risk (*examples for discussion only!*)

	Specified buffer, restrained response	Specified buffer, robust response	Suggested ranges for buffer	Increase SPR in HCR	Change the tier level
Level 1: Normal	No buffer	No buffer	No buffer	F40%	Tier 3
Level 2: Substantially increased concerns	5%	10%	5%-10%	F45%	Tier 4
Level 3: Major concerns	10%	20%	10%-25%	F50%	Tier 5
Level 4: Extreme concerns	15%	30%	15%-40%	F60%	Tier 6

ABC < maxABC (9 of 9)

- This agenda item received lots of attention
  - Team minutes span 5 pages, of which 2 describe Team discussion
  - Too many comments to list here, but they are referenced in the Teams' recommendation, so please take note of the minutes
- The Teams recommend that the SSC consider the two general approaches reviewed by the subcommittee, along with the above comments made by individual Team members and members of the public during discussion, and determine whether there are aspects of either or both approaches that should be further pursued, particularly Table 1 of the risk classification document; noting that the percentage reductions in Table 2 of the risk classification document are just intended to be starting points for discussion and refinement
- The Teams commended Martin for a job well done

ESP process update (1 of 3)

- Kalei Shotwell presented an overview of the ecosystem and socio-economic profile (ESP) and related projects
- Development of ESPs involves a 4-step process that uses data collected from various national initiatives to create:
  1. a priority list of stocks for which ESPs should be developed
  2. a set of metrics to grade stock vulnerabilities
  3. a set of indicators to monitor
  4. a set of reporting templates to include in the SAFE reports and provide to fishery managers.
- Where applicable, the ESP may replace the existing ecosystem considerations section of the individual SAFE report chapter
- Stock assessment authors are encouraged to use indicators from the ESR to assist with stock-specific analyses for this section

ESP process update (2 of 3)

- Beginning in 2019, three annual workshops will be conducted to inform and coordinate the ecosystem, economics, and stock assessment communities at the AFSC so that ESPs can be created and maintained
- The authors are in the process of developing two new web pages:
  - The first webpage will provide an overview of the ESP process
  - The second webpage will be designed to allow quick access to indicators specifically intended for use in the ESPs
- Members of the public noted that the ESPs and discussions seem to be missing a critical link to industry knowledge
  - Kalei clarified that the socio-economic indicators are part of this whole development and will be incorporated
  - A suggestion was made to include this as a fourth node in the process (equivalent with assessment, ecosystem, and management)

ESP process update (3 of 3)

- The following items were noted in discussion and the Teams recommended that they be referred to at the planned workshops for consideration, coordination, and development:
  - Continued coordination with ESR and ESP development
  - Incorporating ROMS output into this framework in coordination with existing national initiatives and delivery of these outputs
  - ACLIM project coordination on projection modeling trends and defining appropriate time frames
  - Upcoming discussion papers on skipper surveys and ongoing socio-economic work
  - Continue to keep ecosystem information in context for stock assessment authors and keep the larger ecosystem context in mind
  - Continue to coordinate the myriad of individual efforts for ESR, ESP, and ongoing economic work

Dialogue on OK-ness of information (1 of 2)

- In a series of minutes from its 10/17, 12/17, and 6/18 meetings, the SSC requested that "ESR information" be rated as "OK" or "not OK" for each ecosystem and that "stock assessment information" be rated as "OK" or "not OK" for each stock or complex, and that these ratings be provided at the December Council meeting in each year
  - Note that this request is distinct from an accompanying SSC request for use of the previous year's ESR to determine whether a severe decline in biomass, unanticipated in last year's stock assessment, is now anticipated (to be provided each October)
    - See Request 4a under "SSC generic assessment requests"
- SSC minutes (10/17): Ratings will "aid in identifying areas of concern"
- SSC minutes (6/18): "Implementation of these stock and ecosystem determinations will be an iterative process and will require a dialogue between the stock assessment authors, Plan Teams, ecosystem modelers, ESR editors, and the SSC"

Dialogue on OK-ness of information (2 of 2)

- Initial Team discussion revolved around what terms should be used to describe the things being rated, to avoid confusion with other ecosystem or stock status metrics
- Team members noted that rating the "information" contained in the ESR and stock assessments as "OK" or "not OK" could be done, but seemed inconsistent with the example criteria given by the SSC:
  - "Ratio of how close a stock is to a limit or target reference point"
  - "Thresholds for action concerning broad-scale ecosystem changes"
- The Teams recommend that the terms "current and future ecosystem condition" and "current and future stock condition" be used in place of "ESR information" and "stock assessment information"
- Alternatives to "OK" and "not OK" also discussed, without consensus
- Although the dialogue has begun, this step in the iterative process failed to produce any agreed metrics for the OK-ness determinations

SSC assessment prioritization requests (1 of 5)

- In the minutes of its 2/17 meeting, the SSC requested that:
  - The authors and the Plan Teams develop guidelines for when an off-year assessment should be developed
    - The SSC also provided a list of example factors to consider
  - Three analyses related to assessment frequency be conducted:
    1. A framework for evaluating the costs and benefits of changing the target frequency for the affected stocks and complexes
    2. A more quantitative evaluation of potential risks of changing the target frequency of GOA flatfish to a four-year cycle
    3. An evaluation of how projected OFL-to-ABC buffers should increase in the intervening years between full assessments

SSC assessment prioritization requests (2 of 5)

- In the minutes of its 12/17 meeting, the SSC clarified that the request for a cost-benefit analysis is intended to produce an evaluation framework to be used *after* a full 4-year assessment cycle is completed, but that the specific costs and benefits used in the framework should be identified *right away*, so that they can be recorded for use in the analysis
  - Several indicators of benefits and costs were suggested by the SSC
- The two immediate tasks for the Teams were:
  - Adopt guidelines for conducting an off-year assessment
  - Identify the quantities to be recorded annually for use in the requested cost-benefit analysis
- The longer-term tasks for "somebody" are:
  - Develop the methods to be used in all three requested analyses
  - Conduct the three requested analyses

SSC assessment prioritization requests (3 of 5)

- Discussion on the criteria for conducting an off-year assessment focused on the example criteria from the SSC, with priority given to criteria that are based on information readily accessible to stock assessment scientists without requiring additional model runs
- The Teams recommend that the following two criteria focused on catch and estimated survey abundance require an off-year assessment:
  1. A substantial and unexpected change in total catch, the spatial concentration of catch (i.e., the potential of overharvesting a subpopulation), or changes in targeting of a stock or member of a stock complex
  2. An unexpected major change in survey biomass

SSC assessment prioritization requests (4 of 5)

- Additionally, the Team recommends that a non-exhaustive list of criteria that *may* prompt off-year assessments include:
  1. Evidence of a new environmental link to time trends in growth, recruitment, or mortality that substantially alters the estimation of biological reference points or stock status;
  2. Evidence of a marked change in retrospective bias or residuals that would indicate a change in productivity;
  3. Availability of new information on vital rates (M, maturity, growth) that alters estimation of biological reference points or stock status;
  4. Availability of new information on survey performance (selectivity, Q);
  5. Evidence of stock structure;
  6. Change in management regulations that would alter fishing behavior such as rationalization of GOA groundfish fisheries;
  7. Distributional shifts that would change catchability or types of fleet targeting the resources.

SSC assessment prioritization requests (5 of 5)

- The Team recommends that indicators of benefits to a reduction in frequency in assessments include:
  - Substantive improvements to the assessment.
  - Substantive improvements to the review and consideration of alternative treatment of the input data.
  - Environmentally linked assessments based on the ESP.
  - Development of methods for tracking progression of uncertainty.
- The Team also recommends that costs to a reduction in frequency in assessments include:
  - Number of abrupt changes in the biological reference points and harvest specifications due to prolonged periods between assessments.
  - Reductions in annual productivity indices ... for use in evaluating environmental linkages or global productivity assessments.

BS bottom trawl survey

- (Reference presentation from Bob Lauth)
- Given recent and projected warm conditions and recent distributional trends, the Teams recommend that the NBS survey extension is conducted again in 2019 (and future years as needed) in order to support assessment estimates of fish biomass

Use of model-based estimates

- Workshop scheduled for 9/26 to coordinate progress on delivering model-based estimates of survey biomass for use in assessments
- The Teams discussed whether the estimates will be available for use in assessments during this cycle, and whether there is a point at which delivery would be too late for use during this cycle
- The GOA Team will consider their use in the northern rockfish assessment (they are already being used for dusky rockfish)
- The Teams recommend that the appropriate use, or non-use, of new model-based estimates in this assessment cycle be left to individual authors' discretion
- The Teams further recommend that, if an author chooses to incorporate these into the assessment, the assessment should also contain appropriate comparative models and a full set of diagnostics

Sablefish (1 of 9)

- Kari Fenske presented the sablefish report (D. Hanselman, lead author)
  1. Alternative modeling approaches for fishery selectivity
  2. Explorations for developing a prior distribution for natural mortality
  3. Update on ongoing apportionment analyses
- Part 1: selectivity
  - Selectivity was last explored in 2008
    - Since then, fits to some compositional data have degraded
  - 19 models with different selectivity assumptions were presented
  - Four criteria were used for comparison of selectivity models:
    1. Data likelihood
    2. Improvement of fit to the plus group
    3. Parsimony and plausibility
    4. Retrospective performance

Sablefish (2 of 9)

- Selectivity, continued: List of models (scale: teal < blue < purple < red)

Model #	Selectivity form	Time-varying	Years	Blocks	Const-rained	Smooth Penalty	Dome-shaped Penalty	M
16.5	Logistic	No	1995-2017	--	No	--	--	0.098
16.5a	Logistic	No	1995-2017	--	No	--	--	0.097
16.5b	Gamma	No	1995-2017	--	No	--	--	0.138
16.5c	Exponential -logistic	No	1995-2017	--	No	--	--	0.086
16.5d	Coefficients	No	1995-2017	--	No	1	1	0.097
16.5e	Coefficients	No	1995-2017	--	Yes	10	10	0.095
16.5f	Coefficients	No	1995-2017	--	Yes	50	10	0.091
16.5g	Coefficients	No	1995-2017	--	Yes	10	50	0.090
16.5h	Coefficients	No	1995-2017	--	Yes	50	50	0.094
16.5i	Logistic	Yes	1995-2017	Annual	No	--	--	0.097
16.5j	Gamma	Yes	1995-2017	Annual	No	--	--	0.136
16.5k	Coefficients	Yes	1995-2017	Annual	Yes	10	10	0.088
16.5l	Coefficients	Yes	1995-2017	Annual	Yes	50	50	0.096
16.5m	Coefficients	Yes	1995-2017	Annual	Yes	1	1	0.086
16.5n	Coefficients	Yes	1960-2017	Annual	Yes	1	1	0.078
16.5o	Coefficients	Yes	1960-2017	Annual	Yes	20	100	0.089
16.5p	Coefficients	Yes	1960-2017	5 year	Yes	3	10	0.083
16.5q	Coefficients	Yes	1960-2017	2-year	Yes	5	5	0.080
16.5z	Coefficients	Yes	1960-2017	2-year	Yes	3	3	0.073

Sablefish (3 of 9)

- Selectivity, continued: Goodness of fit

Model #	-lnL	Data-lnL	delta -lnL	Parameters	-lnL/par	Fishery Ages	Surv Ages	Fish Size	LL Surv Index	Plus Group	% of base
16.5	1576	1537		231	--	239	219	41	30	0.032	100%
16.5a	1559	1521	0	233	--	240	207	40	29	0.032	100%
16.5b	1610	1558	38	233	--	262	207	63	26	0.033	102%
16.5c	1555	1513	-8	235	-3.87	236	201	38	29	0.033	102%
16.5d	1554	1509	-11	258	-0.46	211	226	35	29	0.032	98%
16.5e	1579	1535	14	258	0.56	223	222	36	29	0.032	98%
16.5f	1617	1572	51	258	2.05	239	221	36	29	0.032	98%
16.5g	1587	1547	26	258	1.06	233	218	38	29	0.032	99%
16.5h	1628	1584	63	258	2.52	251	220	38	29	0.032	100%
16.5i	1541	1501	-19	276	-0.45	207	218	42	30	0.032	98%
16.5j	1561	1506	-14	276	-0.33	182	218	62	27	0.020	60%
16.5k	1517	1474	-47	603	-0.13	162	202	35	28	0.025	76%
16.5l	1599	1548	27	603	0.07	209	207	39	28	0.027	85%
16.5m	1460	1416	-105	603	-0.28	125	199	33	27	0.023	71%
16.5n	1430	1385	-136	1111	-0.15	118	173	31	15	0.022	68%
16.5o	1580	1536	16	1111	0.02	201	198	41	30	0.027	85%
16.5p	1515	1472	-49	436	-0.24	168	197	36	27	0.026	80%
16.5q	1500	1456	-65	691	-0.14	155	191	33	27	0.028	87%
16.5z	1481	1435	-86	691	-0.19	142	185	33	26	0.022	69%

Sablefish (4 of 9)

- Selectivity, continued: Retrospective analysis

Model #	Mohn's ρ	Wood's Hole ρ	RMSE	ϕ
16.5	0.068	0.063	0.412	1.079
16.5a	0.047	0.066	0.427	0.712
16.5b	0.228	-0.245	2.016	-0.931
16.5c	0.598	0.446	1.318	1.341
16.5d	0.006	-0.006	0.186	-1.000
16.5e	0.054	-0.007	0.460	-7.714
16.5f	0.055	-0.009	0.423	-6.111
16.5g	0.136	0.181	0.692	0.751
16.5h	0.025	-0.041	0.472	-0.610
16.5i	0.105	0.104	0.411	1.010
16.5j	0.282	-0.160	1.379	-1.762
16.5k	0.213	0.142	0.505	1.500
16.5l	0.063	-0.045	0.496	-1.400
16.5m	0.274	0.195	0.611	1.405
16.5n	0.160	0.091	0.367	1.758
16.5o	0.226	0.124	0.434	1.823
16.5p	0.191	0.157	0.522	1.217
16.5q	0.228	0.159	0.544	1.434
16.5z	0.244	0.195	0.676	1.251

Sablefish (5 of 9)

- Selectivity, continued:
  - Time varying models all fit the data better overall and improved the plus group fit to varying degrees
  - However, retrospective performance for time-varying models was poor relative to the base model
  - The authors concluded that the inclusion of time-varying selectivity may be premature and of minimal benefit to the overall performance of the sablefish stock assessment
  - The Teams discussed the apparent trends in selectivity over time and highlighted that there seem to be patterns which support time block changes in selectivity, which could be investigated further
  - It was noted that the effective number of parameters may be fewer than the nominal number of estimated parameters because of constraints

Sablefish (6 of 9)

- Selectivity, continued:
  - The Teams recommend continued investigations on selectivity
    - There was concern about moving forward with time-varying or alternative selectivity forms if the models have poor retrospective performance, but it was noted that eliminating models based solely on retrospective performance is not recommended
    - The several potentially large incoming year classes may have an effect on fishery selectivity and result in temporary biases in estimates of mortality-at-age
    - If the authors can identify selectivity functions that make improvements over the base model, they should present new models at that time

Sablefish (7 of 9)

- Part 2: natural mortality
  - Kari also provided information for developing a more informative prior distribution on natural mortality using life history-based methods and a mark-recapture estimate from the sablefish movement model
  - Life history estimators gave a broad range of M values and a wide empirical density, whereas the tag-recapture estimator was much more precise and similar to the current M estimated by the assessment model
  - The authors concluded that this new prior had a negligible effect on the stock assessment model but support its inclusion in the 2018 assessment because it is a more rigorous approach to implementing a prior on natural mortality than past practice

Sablefish (8 of 9)

- Natural mortality, continued
  - Model 16.5 used a prior with a mean of 0.10 and a CV of 10%
  - Model 16.5r fixed M at the new prior mean
  - Model 16.5s used the new prior distribution developed in this analysis
  - Model 16.5t used the new prior mean and a CV of 10%

Model #	M estimation (mean, CV)	-lnL	Data -lnL	delta-lnL	# Pars	**M**
16.5	0.1, 0.1	1575.64	1536.76	--	231	**0.098**
16.5r	0.116	1577.96	1540.16	3.4	230	**0.116**
16.5s	0.116, 0.206	1575.93	1537.04	0.28	231	**0.100**
16.5t	0.116, 10	1575.65	1535.37	-1.39	231	**0.102**

  - The Teams agree with the authors' recommendation to use the newly derived M prior distribution

Sablefish (9 of 9)

- Part 3: apportionment
  - Apportionment investigations included a retrospective apportionment analysis and an update on the ongoing apportionment MSE
  - This analysis helps to show some of the tradeoffs of the alternative options, and this subset of options may be selected for use in the full apportionment MSE that is under development
  - A timeline for the apportionment MSE was provided and preliminary results are anticipated for presentation at next year's September Plan Team meetings
  - The authors continue to recommend the static apportionment method that has been used recently in the sablefish assessment while also presenting the apportionment corresponding to the previously used method for reference
  - The Teams recommend continued development of the apportionment MSE

Sharks (1 of 2)

- Cindy Tribuzio gave a presentation on Pacific Sleeper Sharks (PSS), which are one of the most data-poor/data-limited populations
- Establishing good estimates of catch, particularly by weight, is difficult
- However, there are research projects, either in the pilot stage or currently being implemented, to increase the amount of data available:
  - Pilot study on age determination methods
  - Spatial analysis to examine catch location/time/depth/temp/haul duration, etc., as some hauls can catch hundreds of small PSS
  - Discard mortalities are being examined through tagging and blood work, and data limited analysis methods are being examined
  - An observer special project was started to explore fish size and weight estimates

Sharks (2 of 2)

- More on catch estimation:
  - Most large PSS are not brought over the rail on longline vessels, and are therefore unavailable to be weighed
  - The weights that are assigned to PSS via the CAS are biased
  - One method to alleviate this would be to assess the population based upon numbers, but this has its own issues, one of which is that all other stock assessments are based upon weight
  - Therefore, work continues to try and improve estimates of catch by weight for PSS, particularly as EM becomes more prevalent
- The author expressed a desire for data-limited assessments to be given higher priority so that issues such as these can be further investigated
- The Teams encourage continued exploration of utilizing data limited methods for this assessment

Halibut DMRs (1 of 4)

- Jim Armstrong provided an overview of the Halibut DMR Working Group recommendations for specifying 2019 DMRs
- Starting in 2016, the fishery definitions for DMR estimates and application transitioned from species composition to vessel/gear operational characteristics causatively linked to halibut mortality
- A reduced reference period (2-3 years) is used now in the estimation instead of the longer (10 year) reference period used previously, to incentivize improvement in halibut handling practices
- The estimation process uses weighted averages of halibut mortality (condition data) to expand estimated DMRs from the sample to the haul, trip, and fishery following the sampling hierarchy
- Some improvements since last year include better identifying Rockfish Program trips in the dataset

Halibut DMRs (2 of 4)

- Halibut condition data from the halibut deck-sorting EFP (Amendment 80 CP trawl) were excluded from the data summaries
  - This is due to the lower post-capture mortality of halibut sorted on-deck than halibut recovered during observer sampling in the factory
- EM data are not being used in the estimated DMRs for 2019
- EM data from 2018 may be used in future DMR estimates
  - However, FMA is also considering eliminating assessments of halibut condition (injury and viability) from EM vessels until there are EM-specific condition keys for reviewers
  - Assessment of condition is time-consuming and often still results in an “unidentified” condition because the reviewer cannot see both sides of the fish or cannot determine a key condition criterion
  - EM reviewers would continue to document release method and any mishandling of halibut that would affect their condition

Halibut DMRs (3 of 4)

2018 Operational Group							2019 Operational Group							
Area	Gear	Sector	RPP	Mean Annual $N_{viabilities}$	Estimate DMR?	DMR	Area	Gear	Sector	RPP	Mean Annual $N_{viabilities}$	Estimate DMR?	DMR	
BSAI	POT	None	N	548	Y	9%	BSAI	POT	None	N	380	Y	19%	10%
	HAL	CP	N	9,547	Y	8%		HAL	CP	N	6,886	Y	8%	0%
		CV	N	832	Y	17%			CV	N	360	Y/N ?	4%	-13%
	NPT	CP	N	2,025	Y	84%		NPT	CP	N	2,844	Y	78%	-6%
		CV	N	2,456	Y	60%			CV	N	2,736	Y	59%	-1%
GOA	POT	None	N	602	Y	7%	GOA	POT	None	N	450	Y	4%	-3%
	HAL	CP	N	1,631	Y	10%		HAL	CP	N	1,672	Y	11%	1%
		CV	N	3,286	Y	17%			CV	N	2,367	Y	21%	4%
	NPT	CP	N	132	N	84%		NPT	CP	N	1,300	Y	79%	-5%
		CV	N	755	Y	67%			CV	N	1,106	Y	67%	0.00%
		CV	Y	176	Y	62%			CV	Y	389	Y	49%	-13%

Halibut DMRs (4 of 4)

- Some future directions include completion of an IPHC study on halibut release methods, increased use of EM and understanding the implications thereof, regulatory deck sorting requirements, and improved basis studies for DMRs
- The Teams recommend the use of the current estimation methods, including the combined groupings and the 2-year reference period (2016-2017) as well as the average of the most recent 2 years (2015, 2017) for BSAI hook-and-line CVs for estimating DMRs for the 2019 fishing year