Center for Independent Experts Independent Peer Review Report on the 2016 the Alaska Sablefish assessment

Prepared by

Neil Klaer

Prepared for

Center for Independent Experts

Review Meeting
Alaska Fisheries Science Center, Auke Bay Laboratories
Ted Stevens Marine Research Institute, 17109 Pt. Lena Loop Rd.
Juneau, Alaska
10-12 May 2016

Contents

Executive Summary

The 2016 CIE Review of assessments of Alaska sablefish (*Anoplopoma fimbria*) stock in the Bering Sea (BS), Gulf of Alaska (GOA) and Aleutian Islands (AI) met in Juneau, Alaska, from Tuesday to Thursday, 10-12 May 2016. The meeting was chaired by Mike Sigler from the Alaska Fisheries Science Centre. The review panel (the Panel) was composed of Noel Cadigan, Tom Carruthers and Neil Klaer from the Center for Independent Experts (CIE). The meeting generally followed the draft agenda and included presentations by the stock assessment team and others mixed with questions and open discussion. Additional analyses were requested by the Panel and the results of those were also subsequently presented. It was made clear that a purpose of the Terms of References (ToRs) was to give full consideration to scientific aspects of research effort outside of the stock assessment – primarily depredation, apportionment and ecosystem aspects. While this was achieved to some extent, the Panel noted that the assessment is still central to management advice and also required full consideration.

Findings for Alaska Sablefish

Available catch, CPUE, age composition, length composition and abundance indices for Alaska sablefish generally cover relatively long time-periods and enable the development of a robust stock assessment for this species. Assessment authors have generally carefully considered the data inputs regarding error and bias, and have appropriately processed them for inclusion in the assessment. It would be an advantage if a data document could be developed that, in particular, explains in detail what processing had been applied to each source (i.e. filtering methods, standardization and scaling procedures). Available information from tagging and similarity of abundance trends by area strongly indicates that Canadian (particularly northern BC) catches are being taken from the same mixed sablefish stock as Alaskan catches. Inclusion of the Canadian catches as another region for the stock assessment requires serious consideration. For assessment model sensitivity testing, bounds on catch uncertainty from each source should be developed. Efforts to derive a model-based fishery CPUE index should continue. Additional sources of unsexed composition data are available and could be used. Consideration should be given to inclusion of the IPHC and gully station indices. Improved use of available age-at-length data may be made by inclusion as a model input.

The development of the Alaska sablefish assessment has followed a philosophy of making progressive but minimized changes to the methodology through time, mainly to avoid creating unwarranted variability through to the management process. I agree with the minimal change philosophy to some degree, and see that the authors have considered previous recommendations and made good progress on many of them. The current assessment, while appearing to be rather precise given the restrictive assumptions made external to the model, does provide a good base case for the provision of management advice. No major flaws in the approach have come to light that would require a substantial adjustment to the base case. Some technical changes to the final model have already been recommended by the assessment authors.

My main issue with the assessment is the under-representation of uncertainty, and the current lack of a standard procedure that might be used to convey that uncertainty to management. I believe that management decisions would potentially be improved if made in light of a good representation of the true uncertainty in stock status provided by the assessment.

The current base assessment excludes depredation from abundance indices and uses landed catches only. Recent indications of increases in depredation suggest that the need to include depredation estimates in the assessment and apportionment is also increasing, so it would be prudent to develop means to do so using existing data in the short-term if possible. I understand the problem of gaining estimates of true fishery losses, but observer data are available and information collection has commenced for the logbook. Given the likely relatively low impact of accounting for depredation on the landed portion of future quotas that potentially include depredation loss, the current process for dealing with depredation is acceptable. Best estimates of depredation adjustments to abundance indices and

catches should be included in the assessment, providing ABC recommendations that include depredation losses. These could potentially be treated in the same manner as dead discards.

Available evidence mainly from tagging shows that the stock is highly mixed across all areas and that spawning on the slope is also widely distributed across areas. Compared with many other stocks that are likely to be sub-structured but generally treated as one for management purposes, this is favorable for the Alaska sablefish assessment. If localized depletion of particular areas is unlikely to cause biological issues as the high level of mixing suggests, then apportionment does not have strong biological implications. The more important apportionment objectives are therefore likely to be socio-economic. An industry representative at the review stated that industry priorities for apportionment include minimization of volatility, stakeholder buy-in, and the effects of changes by area (e.g. in size compositions). He also stated that there is a need for answers in the short-term, not necessarily by MSE. This provides a good starting list of objectives that may be formally evaluated. I do not see a means for quantitatively attempting to answer the question of what trade-offs are made among competing objectives other than by some form of simulation testing, with the best known being MSE. It is important to define MSE performance measures that better indicate sociological and economic performance of the fishery including regional CPUE, catch/area of habitat, TAC variability, TAC underages, dollar yield, etc. In the short-term, it would be possible to continue to make mostly qualitative judgments based on observations.

Recent and on-going ecosystem work was presented at the review demonstrating the building of knowledge regarding oceanographic conditions favorable to recruitment and early life survival of sablefish larvae. As it has been noted that the amplitude of strong year classes has diminished in the recent time period since perhaps 2000, such work is important for understanding why such a change seems to have occurred, and implications for the future. More specifically, ecosystem work particularly directed towards sablefish recruitment dynamics (e.g. Shotwell et al. 2014 polar front, and Gibson et al. IBM, EFH work) does have potential tactical fisheries management application in the definition of recruitment regimes, improved precision of short term recruitment forecasts (those last few years not estimated by the assessment model), incorporation of environmental variables in long-term recruitment forecasts, and identification of essential fish habitat. Efforts to develop a sablefish report card that includes potentially important environmental time-series that may influence the sablefish stock are commendable and in line with ecosystem-based fishery management objectives.

1 Introduction

1.1 Background

The 2016 CIE Review of assessments of Alaska sablefish (*Anoplopoma fimbria*) stock in the Bering Sea (BS), Gulf of Alaska (GOA) and Aleutian Islands (AI) met in Juneau, Alaska, from Tuesday to Thursday, 10-12 May 2016. The meeting was chaired by Mike Sigler from the Alaska Fisheries Science Centre. The review panel (the Panel) was composed of Noel Cadigan, Tom Carruthers and Neil Klaer from the Center for Independent Experts (CIE).

The draft stock assessment report, as well as associated background documents, were made available via a sablefish review website to the Panel on 27 April prior to the review meeting. During the meeting, all documents were available electronically via the same website and meeting presentations and additional documents were also posted there.

The meeting generally followed the draft agenda and included presentations by the stock assessment team and others mixed with questions and open discussion. Additional analyses were requested by the Panel and the results of those were also subsequently presented.

1.2 Review Activities

As the meeting was only three days, the first two and a half were devoted to presentations and question periods. The last half day was set aside for work on the meeting summary report coordinated by the Chair. Initial draft comments for the summary report were assigned to different reviewers on the first day, with Noel Cadigan for data issues, Neil Klaer on the assessment, and Tom Carruthers on depredation and apportionment. Those summary comments were compiled on the night of the second day and provided as an initial draft report for refinement on the last day. There was limited time for requests for additional analyses, but some were made mostly on the first day and results provided as the meeting progressed. In anticipation of requests for model sensitivity runs and results, many that might have been requested were also provided on the first day of the meeting.

The meeting was attended by a number of observing scientists and fishery managers as well as industry members. With the assistance of the Chair, an orderly progression through the agenda and Terms of Reference (ToRs) was achieved. It was made clear that a purpose of the ToRs was to give full consideration to scientific aspects of research effort outside of the stock assessment – primarily depredation, apportionment and ecosystem aspects. While this was achieved to some extent, the Panel noted that the assessment is still central to management advice and also required full consideration.

Many thanks in particular to Dana Hanselman for assembly of documents and additional work on meeting requests. The venue for the meeting was excellent.

2 Stock assessment

2.1 Terms of reference

The Panel considered the assessments in light of the terms of reference provided as follows:

a. Evaluation, findings, and recommendations on quality of input data and methods used to process them for inclusion in the assessment.
b. Evaluation, findings, and recommendations of the analytical approach used to assess stock condition and stock status.
c. Evaluation, findings, recommendations on estimation and strategies for accounting for whale depredation
    a. Are the data and methods used in estimating depredation effects sufficient?
    b. Should depredation estimates be used in the assessment model, and if so, how?
d. Evaluation, findings, recommendations of areal harvest apportionment strategy as related to movement and optimizing spawning stock biomass
    a. Are there biological reasons to adjust apportionment by area?
    b. Is stability more important than close alignment to annual areal abundance changes?
e. Recommendations for further improvements

2.2 Findings by term of reference

The comments below refer to aspects that were discussed during the review, but include my own additional commentary for preparation of this CIE report.

2.2.1 Evaluation, findings, and recommendations on quality of input data and methods used to process them for inclusion in the assessment.

Available catch, CPUE, age composition, length composition and abundance indices for Alaska sablefish generally cover relatively long time-periods and enable the development of a robust stock assessment for this species. Assessment authors have generally carefully considered the data inputs regarding error and bias and have appropriately processed them for inclusion in the assessment. I agree with the specific comments in the summary report and elaborate or add to those comments here.

Data documentation

Although key features of individual data sources were explained during review presentations, it would be an advantage if a data document could be developed that in particular explains in detail what processing had been applied to each source (i.e. filtering methods, standardization and scaling procedures). Ideally, it would be updated as required and be provided as an assessment support document. Such a document has obvious use for reviewers, but also to anyone invited to examine the stock assessment. It would also provide an archive to ensure that future assessors understand the process, and would allow simplified comparison of procedures with those used for other associated stocks.

Catch history

Available information from tagging and similarity of abundance trends by area strongly indicates that Canadian (particularly northern BC) catches are being taken from the same mixed sablefish stock as Alaskan catches. Inclusion of the Canadian catches as another region for the stock assessment requires serious consideration. Although BC catch remained comparatively stable and low historically, in recent years it forms what may be a considerable portion of the overall catch from the stock, given Alaskan catch reductions. As a first step, northern BC catch could be included in the assessment added to an existing fleet with the most appropriately matched selectivity as a sensitivity to examine the potential extent of change to assessment results.

Certain periods of catch history (e.g. late 1980s Japanese catches) are uncertain within the current GOA/BS/AI boundaries of the stock. For assessment model sensitivity testing, bounds on catch uncertainty from each source should be developed, and alternative plausible catch scenarios created from them, or catch uncertainty could be directly included in the assessment.

Abundance indices

There has been progress on GLM-style models applied to the longline fishery abundance index, particularly in relation to depredation. However, the process of filtering by target sets and scaling is unchanged for the current base model. Efforts to derive a model-based fishery CPUE index should continue.

There are at least two available abundance indices that are not currently used in the assessment. The IPHC longline survey sablefish abundance requires a desktop examination to determine whether this index may be biased in relation to sablefish, and if a bias is not evident then it should be considered for inclusion (with appropriate additional variance weighting). Data from longline gully stations continues to accumulate and may be considered for inclusion as an index of smaller sized fish than generally found on the slope (while recognizing that there are many fewer gully compared to non-gully stations).

There is a strong difference in the size of fish found on the shelf and slope and there is potential to filter small numbers of samples either shallower or deeper than the 200m slope edge for indices that may improve selectivity curve fits for those indices.

Age and length data

The current assessment has a preference for the inclusion of age and length composition data that are available by sex. Additional sources of unsexed composition data are available that could be used in the model, that does have the capability to produce expected combined sex compositions. I agree that there may be questions about the reliability of some of those and do not see the inclusion of additional data sources as a major issue – just one worth noting.

Age-at-length data are not used explicitly within the assessment model in fitting growth, which is carried out external to the model to create age-length conversion matrices (one for each period before and after 1995 where growth appears to have differed).

2.2.2. Evaluation, findings, and recommendations of the analytical approach used to assess stock condition and stock status.

The development of the Alaska sablefish assessment has followed a philosophy of making progressive but minimized changes to the methodology through time, mainly to avoid creating unwarranted variability through to the management process. As I was present at the previous 2009 CIE review for this species, I am in a good position to comment on assessment progress at least since then. I agree with the minimal change philosophy to some degree, and see that the authors have seriously considered previous recommendations and made good progress on many of them. The current assessment, while appearing to be rather precise given the restrictive assumptions made external to the model, does provide a good base case for the provision of management advice. No major flaws in the approach have come to light that would require a substantial adjustment to the base case. Some technical changes to the final model have already been recommended by the assessment authors.

I agree with the “no brainer” assessment improvements as suggested in the presentations - i.e. use of analytical estimates of the longline survey CV, application of updated GIS-derived area sizes wherever area size is used, and the use of smoother rather than GOA trends to fill missing years for the BS/AI survey.

My main issue with the assessment is the under-representation of uncertainty, and the current lack of a standard procedure that might be used to convey that uncertainty to management. I believe that management decisions would potentially be improved if made in the light of a good representation of the true uncertainty in stock status provided by the assessment. I also acknowledge that there is an interaction here with the Tier system, which was developed in principal to account for the true uncertainty of the status of stocks within each Tier, and that Tier 3

reference points for this stock were developed accordingly (specifically Tier 3b for Alaska sablefish).

Progress since last review

There have been no changes to the assessment model framework since the last review. However, a standardized deviation of normalized residuals re-weighting procedure was applied to length (those without associated age data) and age compositions in the assessment which is analogous to such procedures becoming standard for many assessments. I agree with this approach and also believe that it should be extended to abundance indices as well (which were calculated but not applied). I do not understand how *a priori* knowledge of sampling variance for an abundance index can account for additional process error (e.g. inter-annual variability in movement of fish in and out of survey areas).

Work in progress

I have perhaps in particular made the recommendation at the previous CIE review that a Stock Synthesis (SS) model be constructed at least in parallel with the current assessment. This has been done to the extent that an SS model was provided that did show the same total and spawning biomass trends (both relative and absolute) and similar current depletion as the base model using comparable data inputs. This provides a certain degree of validation of the base case that would be absent otherwise. I think this is particularly necessary for a purpose-built ADMB base model that has not recently been the subject of simulation testing or other procedures to ensure that the code does not contain inadvertent bugs that I believe inevitably arise as code becomes more complex. I also believe that the SS model provides an opportunity to more easily test potential enhancements of the base model such as the introduction of area-specific selectivity, estimation of growth within the model using age-at-length data, investigation of the usefulness of additional unsexed composition data, and testing the utility of length-based selectivity as an alternative to the current sex and age-based ones.

Work has commenced on the development of a spatial model to investigate the effects of more explicit accounting of spatial stock distribution and fleet effort on biomass estimates, management reference points and potentially apportionment. Sensitivity of model results has, in particular, been examined to alternative movement scenarios. Catch in this model is fitted by area allowing for some error, and movement rates from the recent 2014 tag study have been incorporated. Such work is commendable and should be continued. To date the work has shown that accounting for spatial structure may lower the entire time series of estimated total and spawning biomass compared to the model currently used by management in the order of 15% - having some, but not substantial flow-on effects on potential ABCs. Such a model would likely benefit from the improved alignment of management with biological regions, inclusion of a Canadian region, and exploration of growth change through time (as in the base assessment model) and by region.

Selectivity patterns

Aggregated summary observed versus expected age compositions by fleet and survey from the model are acceptable, but do indicate that there is room for further improvement through selection of alternative selectivity functional shapes or adjustment of the value or fixed or number of estimated selectivity parameters.

Uncertainty

While model results appear rather precise, a number of additional choices made external to the model better characterize true model uncertainty. These include: (a) fixed M 0.1, (b) fixed catches, (c) fixed maturity, (d) choice of 1979-2013 recruitment regime for reference point calculations, and (e) no density-dependence in stock-recruitment. Projections, in particular, rely on the true size of the relatively larger 2008 recruitment event. Retrospective analyses, however, did demonstrate that the size of that recruitment is robustly estimated by the model. A likelihood profile on M demonstrated that the current fixed value of 0.1 is central and at the minimum, but also gives an indication of the range of uncertainty for that parameter. Recent work showing skip-spawning suggests that the maturity ogive may require revision.

2.2.2. Evaluation, findings, recommendations on estimation and strategies for accounting for whale depredation

Killer whale depredation affects fishery and survey catches primarily in the BS, AI and WGOA and more recently in CGOA. Currently, depredated sets are excluded from the observed fishery longline catches used in CPUE analyses and depredated stations are removed from the AFSC longline survey. Generally, the number of depredated survey stations are annually variable but reasonably stable through time, therefore not creating a general bias for relative abundance indices (although specific area/times have required bias correction, and there has been an increase in depredation in the AI since the late 1990s and WGOA since the mid-2000s). The Peterson 2013 study found that the portion of annual catch loss in the WGOA was -10.5%, AI -23.6% and BS -28.9%. This study used both GAM and negative binomial GLM methods to examine spatial and temporal trends and factors affecting depredation occurrence as well as the effect on catches.

The recent Hanselman et al. study used fixed and mixed-effects GLMs to estimate sperm whale effects on the sablefish survey abundance index and evaluated the impact of accounting for whale depredation on the stock assessment. Sperm whale depredation occurs at a lower level than for killer whales with an estimated annual effect on the all-Alaska longline survey abundance in the order of 1-5% (data only available since 1998). The effect on the stock assessment was estimated as a 3% increase in estimated female spawning biomass in the terminal year, and a 6% higher quota recommendation. Sperm whale depredation is generally estimated to be increasing.

The current base assessment excludes depredation from abundance indices and uses landed catches only. Recent indications of increases in depredation suggest that the need to include depredation estimates in the assessment and TAC apportionment is also increasing, so it would be prudent to develop means to do so using existing data in the short-term if possible. I understand the problem of gaining estimates of true fishery losses, but observer data are available and information collection has commenced for the logbook.

2.2.3a Are the data and methods used in estimating depredation effects sufficient?

Given the likely relatively low impact of accounting for depredation on the landed portion of future quotas that potentially include depredation loss, the current process for dealing with depredation is acceptable. An examination of the relationship between the magnitude of survey CPUE and

depredation by killer whales regarding the efficacy of deleting depredated sets is warranted to demonstrate the robustness of the current procedure. Available depredation adjustments to abundance indices and estimates for catches should be applied to the assessment, and alternative plausible depredation scenarios should be developed for sensitivity testing.

2.2.3b Should depredation estimates be used in the assessment model, and if so, how?

Best estimates of depredation adjustments to abundance indices and catches should be included in the assessment, providing ABC recommendations that include depredation losses. These could potentially be treated in the same manner as dead discards.

2.2.4 Evaluation, findings, recommendations of areal harvest apportionment strategy as related to movement and optimizing spawning stock biomass

2.2.4a Are there biological reasons to adjust apportionment by area?

Available evidence mainly from tagging shows that the stock is highly mixed across all areas and that spawning on the slope is also widely distributed across areas. Compared with many other stocks that are likely to be sub-structured but generally treated as one for management purposes, this is favorable for the Alaska sablefish assessment. If localized depletion of particular areas is unlikely to cause biological issues as the high level of mixing suggests, then apportionment does not have strong biological implications. The more important apportionment objectives are therefore likely to be socio-economic. I do not understand the effect of apportionment on the relative proportion of fishing effort directed towards the shelf (juveniles) and slope (mature fish), but have seen for other stocks that even this may also be a minor effect given that catch is allocated by weight. It is known that remote areas of the fishery have larger available fish, so some fish do remain relatively locally resident. Apportionment has the potential to protect more important spawning areas, but studies showing disproportional contribution by spawners in certain areas do not currently exist.

2.2.4b Is stability more important than close alignment to annual areal abundance changes?

An industry representative at the review stated that industry priorities for apportionment include minimization of volatility, stakeholder buy-in, and the effects of changes by area (e.g. in size compositions). He also stated that there is a need for answers in the short-term, not necessarily by MSE. This provides a good starting list of objectives that may be formally evaluated. I do not see a means for quantitatively attempting to answer the question of what trade-offs are made among competing objectives other than by some form of simulation testing, with the best known being MSE. It is important to define MSE performance measures that better indicate sociological and economic performance of the fishery including regional CPUE, catch/area of habitat, TAC variability, TAC underages, dollar yield, etc. In the short-term, it would be possible to continue to make mostly qualitative judgments based on observations.

2.2.5 Recommendations for further improvements

Recent and on-going ecosystem work was presented at the review demonstrating the building of knowledge regarding oceanographic conditions favorable to recruitment and early life survival of sablefish larvae. As it has been noted that the amplitude of strong year classes has diminished in the recent time period since perhaps 2000, such work is important for understanding why such a

change seems to have occurred, and implications for the future. More specifically, ecosystem work particularly directed towards sablefish recruitment dynamics (e.g. Shotwell et al. 2014 polar front, and Gibson et al. IBM, EFH work) does have potential tactical fisheries management application in the definition of recruitment regimes, improved precision of short term recruitment forecasts (those last few years not estimated by the assessment model), incorporation of environmental variables in long-term recruitment forecasts, and identification of essential fish habitat. A number of specific recommendations regarding the continuation of this research are given in the summary report and I agree with those.

Efforts to develop a sablefish report card that includes potentially important environmental time-series that may influence the sablefish stock are commendable. Such work was commenced for Commonwealth fisheries in Australia some years ago, but was not as comprehensive and has not had recent resources to support it. A firm commitment to ecosystem-based fishery management requires that such approaches be developed and used. A challenge is in finding factors that appear to demonstrate patterns that need to be considered when making management decisions.

Appendix 1: Bibliography of materials provided for review

NOAA. 2009. Independent review reports, N. Klaer, M. Armstrong, and J. Casey.

https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Armstrong%20Alaska%20sablefish%20assessment%20review%20report.pdf

https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Klaer%20Alaska%20sablefish%20assessment%20review%20report.pdf

https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Casey%20Alaska%20sablefish%20assessment%20review%20report.pdf

Fenske, K., D.H. Hanselman, and T.J. Quinn II. In prep. A spatial assessment model for Alaska sablefish and the implications for the apportionment strategy.

Hanselman, D.H., C. Lunsford, and C. Rodgveller. 2009. Appendix 3C. Responses to CIE recommendations for the Alaska sablefish assessment. In Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D.H., C. Lunsford, C. Rodgveller, and M. Peterson. 2014. Appendix 3C. Alaska sablefish research update. In Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D.H., C. Lunsford, and C. Rodgveller. 2015. Assessment of the sablefish stock in Alaska. In Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D.H., B. Pyper, and M. Peterson. In prep. Effects and implications of sperm whale depredation on longline surveys for Alaskan sablefish.

NPFMC 2015. Minutes from the November Groundfish Plan Team and the December Scientific and Statistical Committee relevant to sablefish.

Peterson, M.J. and D.H. Hanselman. In prep. Estimation of the relative and absolute impacts of whale depredation on the Alaska longline fishery.

Hanselman, D.H., J. Heifetz, K.B. Echave, and S.C. Dressel. 2015. Move it or lose it: Movement and mortality of sablefish tagged in Alaska. Can. J. Fish. Aquat. Sci. 72(2): 238-25.

Heifetz, J., J. T. Fujioka, and T. J. Quinn II. 1997. Geographic apportionment of sablefish, Anoplopoma fimbria, harvest in the northeastern Pacific Ocean. In M. Saunders and M. Wilkins (eds.). Proceedings of the International Symposium on the Biology and Management of Sablefish. pp 229-238. NOAA Tech. Rep. 130.

Peterson, M.J., F. Mueter, D.H. Hanselman, C.R. Lunsford, C. Matkin, and H. Fearnbach. 2013. Killer whale (Orcinus orca) depredation effects on catch rates of six groundfish species: Implications for commercial longline fisheries in Alaska. ICES J. Mar. Sci. 70: 1220-1232.

Shotwell, S. K., D. H. Hanselman, and I. M. Belkin. 2014. Toward biophysical synergy: investigating advection along the Polar Front to identify factors influencing Alaska Sablefish recruitment. Deep-Sea Research Part II Topical Studies in Oceanography 107:40–53.

Additional documents

Coutré, K. M., A.H. Beaudreau, and P.W. Malecha. 2015. Temporal Variation in Diet Composition and Use of Pulsed Resource Subsidies by Juvenile Sablefish. Transactions of the American Fisheries Society, 144(4), 807-819.

Echave, K. B., D. H. Hanselman, M. D. Adkison, M. F. Sigler. 2012. Inter-decadal changes in sablefish, Anoplopoma fimbria, growth in the northeast Pacific Ocean. Fish. Bull. 210:361-374.

Echave, K. B., C. Rodgveller, and S. K. Shotwell. 2013. Calculation of the geographic area sizes used to create population indices for the Alaska Fisheries Science Center longline survey. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-253, 93 p.

Hanselman, D.H., W. Clark, J. Heifetz, and D. Anderl. 2012. Statistical distribution of age readings of known-age sablefish (Anoplopoma fimbria). Fish. Res. 131: 1-8.

Heifetz, J., D. Anderl, N.E. Maloney, and T.L. Rutecki. 1999. Age validation and analysis of ageing error from marked and recaptured sablefish, Anoplopoma fimbria. Fish. Bull. 97: 256-263.

Heifetz, J. and J. T. Fujioka. 1991. Movement dynamics of tagged sablefish in the northeastern Pacific Ocean. Fish. Res., 11: 355-374.

Kimura, D. K., A. M. Shimada, and F. R. Shaw. 1998. Stock structure and movement of tagged sablefish, Anoplopoma fimbria, in offshore northeast Pacific waters and the effects of El Niño-Southern Oscillation on migration and growth. Fish. Bull. 96: 462-481.

Kimura, D. K., and H. H. Zenger. 1997. Standardizing sablefish (Anoplopoma fimbria) longline survey abundance indices by modeling the log-ratio of paired comparative fishing cpues. ICES J. Mar. Sci. 54:48-59.

Lunsford, C. and C. Rodgveller. 2016. Cruise report OP-15-01. Longline Survey of the Gulf of Alaska and Eastern Bering Sea May 26-August 28, 2015.

Maloney, N. E. and J. Heifetz. 1997. Movements of tagged sablefish, Anoplopoma fimbria, released in the eastern Gulf of Alaska. In M. Saunders and M. Wilkins (eds.). Proceedings of the International Symposium on the Biology and Management of Sablefish. pp 115-121. NOAA Tech. Rep. 130.

Mateo, I., and D. H. Hanselman. 2014. A comparison of statistical methods to standardize catch-per-unit-effort of the Alaska longline sablefish. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-269, 71 p.

Rodgveller, C.J., J.W. Stark, K.B. Echave, and P-J. F. Hulson. 2016. Age at maturity, skipped spawning and fecundity of female sablefish (Anoplopoma fimbria) during the spawning season. Fish. Bull. 115: 89-102.

Rutecki, T.L. and E.R. Varosi. 1997. Distribution, age, and growth of juvenile sablefish, Anoplopoma fimbria, in Southeast Alaska. In M. Saunders and M. Wilkins (eds.). Proceedings of the International Symposium on the Biology and Management of Sablefish. pp 45-54. NOAA Tech. Rep. 130.

Sasaki, T. 1985. Studies on the sablefish resources in the North Pacific Ocean. Bulletin 22, (1-108), Far Seas Fishery Laboratory. Shimizu, 424, Japan.

Sigler, M. F. and J. T. Fujioka. 1988. Evaluation of variability in sablefish, Anoplopoma fimbria, abundance indices in the Gulf of Alaska using the bootstrap method. Fish. Bull. 86: 445-452.

Sigler, M. F. and C. R. Lunsford. 2001. Effects of individual quotas on catching efficiency and spawning potential in the Alaska sablefish fishery. Can. J. Fish. Aquat. Sci. 58: 1300-1312.

Sigler, M.F., C.R. Lunsford, J.M. Straley, and J.B. Liddle. 2007. Sperm whale depredation of sablefish longline gear in the northeast Pacific Ocean. Mar. Mammal Sci. doi:10.1111/j.1748-7692.2007.00149.

Sigler, M. F. 2000. Abundance estimation and capture of sablefish, Anoplopoma fimbria, by longline gear. Can. J. Fish. Aquat. Sci. 57: 1270-1283.

Appendix 2: Statement of Work

Statement of Work

National Oceanic and Atmospheric Administration (NOAA)
National Marine Fisheries Service (NMFS)
Center for Independent Experts (CIE) Program
External Independent Peer Review

Alaska Sablefish Assessment

Background

The National Marine Fisheries Service (NMFS) is mandated by the Magnuson-Stevens Fishery Conservation and Management Act, Endangered Species Act, and Marine Mammal Protection Act to conserve, protect, and manage our nation's marine living resources based upon the best scientific information available (BSIA). NMFS science products, including scientific advice, are often controversial and may require timely scientific peer reviews that are strictly independent of all outside influences. A formal external process for independent expert reviews of the agency's scientific products and programs ensures their credibility. Therefore, external scientific peer reviews have been and continue to be essential to strengthening scientific quality assurance for fishery conservation and management actions.

Scientific peer review is defined as the organized review process where one or more qualified experts review scientific information to ensure quality and credibility. These expert(s) must conduct their peer review impartially, objectively, and without conflicts of interest. Each reviewer must also be independent from the development of the science, without influence from any position that the agency or constituent groups may have. Furthermore, the Office of Management and Budget (OMB), authorized by the Information Quality Act, requires all federal agencies to conduct peer reviews of highly influential and controversial science before dissemination, and that peer reviewers must be deemed qualified based on the OMB Peer Review Bulletin standards. (http://www.cio.noaa.gov/services_programs/pdfs/OMB_Peer_Review_Bulletin_m05-03.pdf). Further information on the CIE program may be obtained from www.ciereviews.org.

Scope

Potential changes to the Alaska sablefish assessment have been proposed. These changes include development of a new fishery catch per unit effort (CPUE) index, incorporation of estimates of whale depredation, and alternatives to the methods for apportionment of catch by area. These changes could have a significant impact on the assessment and on stakeholders. The authors request a review of these potential new changes to the assessment and guidance on best practices for implementation. The Terms of Reference (TORs) of the peer review and the tentative agenda of the meeting are below.

Requirements

NMFS requires three reviewers to conduct an impartial and independent peer review in accordance with the SOW, OMB Guidelines, and the TORs below. The reviewers shall have working knowledge and recent experience in the application of 1) Stock assessment/Population Dynamics; 2) Generalized Linear Mixed Modeling/Generalized Additive Modeling/Generalized Linear Modeling; 3) Fisheries Management, and 4) Spatially-explicit assessment modeling

Tasks for reviewers

- Review the following background materials and reports prior to the review meeting:

  NOAA. 2009. Independent review reports, N. Klaer, M. Armstrong, and J. Casey.

  https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Armstrong%20Alaska%20sablefish%20assessment%20rev iew%20report.pdf

  https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Klaer%20Alaska%20sablefish%20assessment%20rev iew% 20report.pdf

  https://www.st.nmfs.noaa.gov/Assets/Quality-Assurance/documents/peer-review-reports/2009/2009_04_02%20Casey%20Alaska%20sablefish%20assessment%20r eview %20report.pdf

  Fenske, K., D.H. Hanselman, and T.J. Quinn II. *In prep.* A spatial assessment model for Alaska sablefish and the implications for the apportionment strategy.

  Hanselman, D.H., C. Lunsford, and C. Rodgveller. 2009. Appendix 3C. Responses to CIE recommendations for the Alaska sablefish assessment. *In* Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

  Hanselman, D.H., C. Lunsford, C. Rodgveller, and M. Peterson. 2014. Appendix 3C. Alaska sablefish research update. *In* Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D.H., C. Lunsford, and C. Rodgveller. 2015. Assessment of the sablefish stock in Alaska. *In* Stock assessment and fishery evaluation report for the groundfish resources of the GOA and BS/AI. North Pacific Fishery Management Council, 605 W 4th Ave, Suite 306 Anchorage, AK 99501.

Hanselman, D.H., B. Pyper, and M. Peterson. *In prep.* Effects and implications of sperm whale depredation on longline surveys for Alaskan sablefish.

NPFMC 2015. Minutes from the November Groundfish Plan Team and the December Scientific and Statistical Committee relevant to sablefish.

Peterson, M.J. and D.H. Hanselman. *In prep.* Estimation of the relative and absolute impacts of whale depredation on the Alaska longline fishery.

Hanselman, D.H., J. Heifetz, K.B. Echave, and S.C. Dressel. 2015. Move it or lose it: Movement and mortality of sablefish tagged in Alaska. Can. J. Fish. Aquat. Sci. 72(2): 238-25.

Heifetz, J., J. T. Fujioka, and T. J. Quinn II. 1997. Geographic apportionment of sablefish, *Anoplopoma fimbria*, harvest in the northeastern Pacific Ocean. *In* M. Saunders and M. Wilkins (eds.). Proceedings of the International Symposium on the Biology and Management of Sablefish. pp 229-238. NOAA Tech. Rep. 130.

Peterson, M.J., F. Mueter, D.H. Hanselman, C.R. Lunsford, C. Matkin, and H. Fearnbach. 2013. Killer whale (*Orcinus orca*) depredation effects on catch rates of six groundfish species: Implications for commercial longline fisheries in Alaska. ICES J. Mar. Sci. 70: 1220-1232.

Shotwell, S. K., D. H. Hanselman, and I. M. Belkin. 2014. Toward biophysical synergy: investigating advection along the Polar Front to identify factors influencing Alaska Sablefish recruitment. Deep-Sea Research Part II Topical Studies in Oceanography 107:40–53

- Attend and participate in the panel review meeting
- After the review meeting, reviewers shall conduct an independent peer review in accordance with the requirements specified in this SOW, OMB guidelines, and TORs, in adherence with the required formatting and content guidelines; reviewers are not required to reach a consensus
- Each reviewer may assist the Chair of the meeting with contributions to the summary report, if required by the TORs
- Deliver their reports to the Government according to the specified milestone dates

Foreign National Security Clearance
When reviewers participate during a panel review meeting at a government facility, the NMFS Project Contact is responsible for obtaining the Foreign National Security Clearance approval for reviewers who are non-US citizens. For this reason, the reviewers shall provide requested information (e.g., first and last name, contact information, gender, birth date, passport number, country of passport, travel dates, country of citizenship, country of current residence, and home country) to the NMFS Project Contact for the purpose of their security clearance, and this information shall be submitted at least 30 days before the peer review in accordance with the NOAA Deemed Export Technology Control Program NAO 207-12 regulations available at the Deemed Exports NAO website: http://deemedexports.noaa.gov/ and http://deemedexports.noaa.gov/compliance_access_control_procedures/noaa-foreign-national-registration-system.html. The contractor is required to use all appropriate methods to safeguard Personally Identifiable Information (PII).

Place of Performance
The place of performance shall be at the contractor's facilities, and at the NOAA Fisheries Alaska Fisheries Science Center in Juneau, Alaska.

Period of Performance
The period of performance shall be from the time of award through June 30, 2016. Each reviewer's duties shall not exceed 14 days to complete all required tasks.

Schedule of Milestones and Deliverables: The contractor shall complete the tasks and deliverables in accordance with the following schedule.

Within two weeks of award	Contractor selects and confirms reviewers
No later than April 26, 2016	Contractor provides the pre-review documents to the reviewers
May 10-12, 2016	Panel review meeting
May 27, 2016	Contractor receives draft reports
June 10, 2016	Contractor submits final reports to the Government

Applicable Performance Standards

The acceptance of the contract deliverables shall be based on three performance standards: (1) The reports shall be completed in accordance with the required formatting and content (2) The reports shall address each TOR as specified (3) The reports shall be delivered as specified in the schedule of milestones and deliverables.

Travel

All travel expenses shall be reimbursable in accordance with Federal Travel Regulations (http://www.gsa.gov/portal/content/104790). International travel is authorized for this contract. Travel is not to exceed $23,000.

Restricted or Limited Use of Data

The contractors may be required to sign and adhere to a non-disclosure agreement.

Peer Review Report Requirements

1. The report must be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether or not the science reviewed is the best scientific information available.

2. The report must contain a background section, description of the individual reviewers' roles in the review activities, summary of findings for each TOR in which the weaknesses and strengths are described, and conclusions and recommendations in accordance with the TORs.

   a. Reviewers must describe in their own words the review activities completed during the panel review meeting, including a brief summary of findings, of the science, conclusions, and recommendations.

   b. Reviewers should discuss their independent views on each TOR even if these were consistent with those of other panelists, but especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the summary report that they believe might require further clarification.

   d. Reviewers shall provide a critique of the NMFS review process, including suggestions for improvements of both process and products.

   e. The report shall be a stand-alone document for others to understand the weaknesses and strengths of the science reviewed, regardless of whether or not they read the summary report. The report shall represent the peer review of each TOR, and shall not simply repeat the contents of the summary report.

3. The report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for
   review Appendix 2: A copy of this Statement of
   Work
   Appendix 3: Panel membership or other pertinent information from the panel review meeting.

Terms of Reference for the Peer Review

Alaska Sablefish Assessment

a. Evaluation, findings, and recommendations on quality of input data and methods used to process them for inclusion in the assessment.
b. Evaluation, findings, and recommendations of the analytical approach used to assess stock condition and stock status.
c. Evaluation, findings, recommendations on estimation and strategies for accounting for whale depredation
    a. Are the data and methods used in estimating depredation effects sufficient?
    b. Should depredation estimates be used in the assessment model, and if so, how?
d. Evaluation, findings, recommendations of areal harvest apportionment strategy as related to movement and optimizing spawning stock biomass
    a. Are there biological reasons to adjust apportionment by area?
    b. Is stability more important than close alignment to annual areal abundance changes?
e. Recommendations for further improvements

Tentative agenda

Review of Alaska Sablefish Stock Assessment

Alaska Fisheries Science Center Auke Bay Laboratories Ted Stevens Marine Research Institute 17109 Pt. Lena Loop Rd. Juneau, Alaska

May 10 –12, 2016 Contacts:

Security and check-in: Cara Rodgveller, Cara.Rodgveller@noaa.gov, 907-789-6052
Additional documents, Dana Hanselman, Dana.Hanselman@noaa.gov, 907-789-6626

Tuesday, May 10:
9:00 AM – 10:30 AM:
Introduction Topics:
Introductions, adoption of the agenda (and it's relation to TOR), industry concerns, overview of sablefish biology, fishery, history of assessment, prior CIE

10:30 AM – Break
10:45 AM – **Input data**
(TOR a) Topics:
Survey data – abundance indices, ages, lengths, growth, ageing error
Fishery data – abundance indices, ages, lengths, logbooks and observer data

12:00 PM – Lunch
1:00 PM -3:00 PM: **Current Assessment model**
(TOR b) Topics:
Model structure, likelihood formulations, data weighting

3:00 PM – Break
3:15 PM – **Discussions**
5:00 PM – Adjourn for day

Wednesday, May 11:
9:00 AM – 10:30 AM: **Spatial issues**
(TOR c) Topics:
Areal apportionment of catch, movement, and spatially explicit models

10:30 AM – Break
10:45 AM –
Discussions 12:00
PM – Lunch
1:00 PM – 3:00 PM: **Whale depredation**
(TOR d) Topics:
Estimates of depredation on the survey, fishery, and the effects on assessment

3:00 PM – Break
3:15 PM – Discussions
5:00 PM – Adjourn for
day

Thursday, May 12:
9:00 AM -10:30 AM: **Recruitment, ecosystem considerations, future work**
(TOR e) Topics:
Ecosystem considerations, recruitment research, others as requested

10:30 AM – Break
10:45 AM –
Discussions 12:00
PM – Lunch
1:00 PM -3:00 PM: **Alternative model runs, further discussion as needed**

3:00 PM – Break
3:15 PM – Further discussions and
summarize 5:00 PM – Adjourn meeting

Appendix 3: List of participants

Participant	Organization	Agency
Noel Cadigan		CIE
Tom Carruthers		CIE
Neil Klaer		CIE
Mike Sigler (Chair)	Alaska Fisheries Science Center	NOAA
Dana Hanselman	**Alaska Fisheries Science Center**	**NOAA**
Chris Lunsford	**Alaska Fisheries Science Center**	**NOAA**
Kari Fenske	**School of Fisheries and Ocean Sciences**	**University of Alaska Fairbanks**
Megan Peterson	**Alaska Fisheries Science Center**	**NOAA - Affiliate**
Kalei Shotwell	**Alaska Fisheries Science Center**	**NOAA**
Jon Heifetz	Alaska Fisheries Science Center	NOAA
Cara Rodgveller	Alaska Fisheries Science Center	NOAA
Pete Hulson	Alaska Fisheries Science Center	NOAA
Cindy Tribuzio	Alaska Fisheries Science Center	NOAA
Katy Echave	Alaska Fisheries Science Center	NOAA
Pat Malecha	Alaska Fisheries Science Center	NOAA
Jodi Pirtle	Alaska Fisheries Science Center	NOAA - Affiliate
Karson Coutre	Alaska Fisheries Science Center	NOAA - Affiliate
Patrick Lynch	Office of Science and Technology	NOAA
Pete Hagen	Alaska Fisheries Science Center	NOAA
Phil Mundy	Alaska Fisheries Science Center	NOAA
Ian Stewart		International Pacific Halibut Commission
James Armstrong	North Pacific Fishery Management Council	
Jon Warrenchuk	Oceana	
Dan Falvey	Alaska Longline Fishermen's Association	