Center for Independent Experts Report

External Independent Peer Review by the Center for Independent Experts (CIE) - Benchmark stock assessments of Pacific coast Longnose and Big skates (STAR Panel 2)

June 3 - 7, 2019

Dr. Henrik Sparholt
Email: henrik.sparholt@gmail.com

Contents

Executive Summary 3
Background 5
Description of the Individual Reviewer's Role in the Review Activities 6
Summary of Findings for each ToR for longnose skate 6
Conclusions and Recommendations in accordance with the ToRs for longnose skate 14
Summary of Findings for each ToR for Big skate 14
Conclusions and Recommendations in accordance with the ToRs for Big skate 21
The NMFS review process 21
Appendix 1. List of material provided 23
Appendix 2. Statement of work 27
Appendix 3. List of participants 38

Executive Summary

The National Marine Fisheries Service (NMFS) and the Pacific Fishery Management Council (PFMC) held a stock assessment review (STAR) panel meeting for Longnose Skate and Big Skate stocks along the U.S. West Coast in June 3-7, 2019 in Seattle, Washington. Assessments for these two stocks will provide the basis for the management, by providing the scientific basis for setting Overfishing Limits (OFLs) and Acceptable Biological Catches (ABCs) as mandated by the Magnuson-Stevens Act. The technical review took place during a formal, public, multiple-day meeting of fishery stock assessment experts. I participated as an external, independent reviewer.

Longnose skate was last assessed as a benchmark assessment in 2007. The species is modeled as a single stock, as there is currently no biological and genetic data supporting the presence of multiple stocks. However, it seems unlikely that the biological borderline of the stock follows the borderline at sea between Canada and USA. This is more likely a consequence of practicalities. Longnose skate historically have not been a prized catch. Commercially, they are caught incidentally in the trawl groundfish fishery and often discarded. Skate landings remained low through the mid-1990s, but increased after 1995, when the fishery started to retain skates following the appearance of a market for whole skates. Landed catch for longnose skate is reported from 2009 forward. Prior to that, the species was reported mostly as a combined-skate category. Since 2007 a large effort has been put on reconstructing the historical time series of landings and discards of longnose skate. Data on age by size have become available since 2007 but are still not sampled every year. The annual West Coast Bottom Trawl Survey (WCGBT) in the area, which covers the spatial distribution of the stock very well, started in 2003 and now has more than 12 years of data. In recent years the observer programs cover almost the entire fishery and therefore, recent discard data are quite reliable.

The data situation for this stock is not as poor as for many other skate stocks, and it seems reasonable to try a more complex assessment modelling of the stock. A Stock Synthesis (SS) model was used. This was done in a very skillful and competent way. The critical points in the model were discussed heck and several new runs were requested by the review panel in the course of the meeting. Because fishing mortality (F) is much lower than natural mortality (M), a major uncertainty in the assessment is the potential variation in M over time. As is normal in fish stock assessment, there is almost no information in the data available to estimate M. Thus, as is also normal, M is assumed to be constant. The constant value is deduced from available science on meta-analysis of the relation between M and life history parameters. Also, the steepness factor in the stock-recruitment relationship was fixed. Various analyses done at the meeting showed that some biological reference points like Fmsy were very dependent on this steepness value. However, all in all it was possible to fit the model reasonably well to the data on landings, discards, length composition, age by length, maturity by size, and survey indices. It was concluded that the assessment – with some minor changes (e.g., using another weighting of the basic data) can be used for the management approach it is intended for, and that the probabilities that the stock is overfished and that overfishing is taking place are both low. It is less certain how much the fishing can be increased if the goal is to get Maximum Sustainable Yield (MSY) in the sense that the upper confidence limit of MSY (and OFL and ABC) is not as well estimated as the lower limit.

Big skate has not been previously assessed but is an important and growing composition of the west coast groundfish fishery. The species is modeled as a single stock, as there is currently no biological and genetic data supporting the presence of multiple stocks. However, it seems unlikely that the biological borderline of the stock follows the borderline at sea between Canada and USA. This is more likely a consequence of practicalities.

Landed catch for big skate is reported from 2015 forward. Prior to that, this species is reported mostly as a combined-skate category. As for longnose skate, big skate is taken as by-catch in other fisheries and many are discarded due to low market demand. A large effort has in recent years been put on reconstructing the historical time series of landings and discards of big skate. Data on age by size have become increasingly available but are still not sampled every year. The annual West Coast Bottom Trawl Survey (WCGBT) in the area, which covers the spatial distribution of the stock relatively well, started in 2003 and now has more than 12 years of data. A certain proportion of the stock occurs in ,,depths shallower than 55m and is not covered by the survey. An analysis of what proportion was done during the panel meeting and used in the setting of the catchability prior. It would help if the survey in the future is extended to cover the depths between 20m and 55m. In recent years the observer programs cover almost the entire fishery and therefore, recent discard data are quite reliable. As for longnose skate natural mortality, steepness, and catchability in the survey are the dominant uncertainties in the assessment. The assessment is more uncertain than that of longnose skate. Various analyses done at the meeting showed that some biological reference points, like Fmsy, were very dependent on the steepness value. However, all in all it was possible to fit the model reasonably well to the data on landings, discards, length composition, age by length, maturity by size, and survey indices. It was concluded that the assessment can be used for the management approach it is intended for, and that the probabilities that the stock is overfished and that overfishing is taking place are both low. It is less certain how much the fishing can be increased if the goal is to get Maximum Sustainable Yield (MSY) in the sense that the upper confidence limit of MSY (and OFL and ABC) is not as well estimated as the lower limit.

The inability of the assessment software (Stock Synthesis) to include density dependence in individual fish growth, maturity and mortality was discussed. These density dependence factors are very important for the estimation of some of the classical biological reference points like Fmsy and Bmsy. Missing any of the four density dependent factors will give biases in both Fmsy (underestimation) and Bmsy (overestimation). It seems worthwhile to include these three density dependent factors in the Stock Synthesis software, along with the one (recruitment) already included. Maybe some of the statistical features could be exchanged with these fundamental density dependent factors, if there is a wish to not further increase the complexity of the SS software.

The review panel recognized the tremendous amount of effort by the staff in preparing the assessment and the excellence of the documentation. The presentations were of the same high quality. The additional analysis requested by the panel during the meeting were done very competently and quickly.

The Panel thanked the NWFSC staff for effectiveness in providing new analysis as requested and making the whole review a very positive and constructive process.

Background

The National Marine Fisheries Service (NMFS) is mandated to conserve, protect, and manage USA's marine living resources based upon the best scientific information available (BSIA).

NMFS science products, including scientific advice often require scientific peer reviews that are strictly independent of all outside influences.

The present STAR meeting was such a review process.

Benchmark stock assessments were conducted for Longnose and Big skates. Both stocks were identified as strong candidates for assessment during the Pacific coast groundfish regional stock assessment prioritization process. This analysis was based on the national stock assessment prioritization framework.

The National Marine Fisheries Service (NMFS) and the Pacific Fishery Management Council (PFMC) will hold four stock assessment review (STAR) panels during the summer of 2019 and this one was number 2. The goals and objectives of the groundfish STAR process are to:

- ensure that stock assessments represent the best available scientific information and facilitate the use of this information by the Council to adopt OFLs, ABCs, ACLs, (HGs), and ACTs;
- meet the mandates of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements;
- follow a detailed calendar and fulfill explicit responsibilities for all participants to produce required reports and outcomes;
- provide an independent external review of stock assessments;
- increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;
- identify research needed to improve assessments, reviews, and fishery management in the future; and
- use assessment and review resources effectively and efficiently.

Assessments for these stocks will provide the basis for the management of the groundfish fisheries off the U.S. west coast by providing the scientific basis for setting Overfishing Limits (OFLs) and Acceptable Biological Catches (ABCs) as mandated by the Magnuson-Stevens Act. The technical review took place during formal, public, multiple-day meetings of fishery stock assessment experts, and participation of an external, independent reviewer was an essential part of the review process.

Longnose skate was last assessed as a benchmark assessment in 2007. The spawning stock biomass was estimated to be at 66 percent of its unfished biomass at the start of 2007. Based on that assessment, a constant catch strategy (OY = 1,349 mt) was implemented in 2009 based on a 50 percent increase in the average 2004-2006 landings and discard mortality. The constant catch strategy was revised in 2013 by implementing an Annual Catch Limit (ACL) of 2,000 mt to provide greater access to the stock and to limit disruption of current fisheries. This level of harvest was projected to maintain the population at a healthy level as projected in the 10-year forecast for longnose skate in the 2007 assessment. The Council adopted the default harvest control rule for longnose skate by recommending a 2019 and 2020 ACL of 2,000 mt. A new assessment was judged important to inform both current status as well future projections.

Big skate has not been previously assessed but is an important and growing composition of the west coast groundfish fishery. Big skate were managed in the Other Fish complex until 2015 when they were designated an Ecosystem Component (EC) species. Large landings indicate targeting of big skate has occurred and an EC designation was not warranted. Based on this evidence, the Council decided to re-designate big skate as an actively-managed species in the fishery. Big skate were managed with stock-specific harvest specifications starting in 2017.

CIE Reviewers were appointed to serve as panel members and conduct an impartial and independent peer review. The CIE review panel consisted of Dr. Robin Cook (UK, Scotland), Dr. Henrik Sparholt (Denmark), and Dr. Coby Szuwalski (USA). The meeting was chaired by Dr. David Bruce Sampson, Oregon State University (USA).

All relevant documentation was made available on an FTP drive two weeks before the meeting. The first two days were spent going through presentations by the data and assessment scientists. The panel recognized the tremendous amount of effort by the scientists in preparing the assessment and by fishers, observers, managers, and scientists regarding data collection and filtering. Both the documentation and the presentations were of very high quality. The additional analysis requested by the panel during the meeting were done very competently and quickly.

The meeting followed the timetable given in Appendix 2, except that all time was spent in plenary. The two main stock assessment staff, Dr. Vladlena Gertseva and Dr. Ian Taylor, went in and out of the plenary for working with the requests put forward by the panel. Almost all answers were presented during the meeting and only a very few shortly after by email.

The panel discussed the assessment materials in the context of the terms of reference provided for this review.

Description of the Individual Reviewer's Role in the Review Activities

I read the material posted before the meeting and prepared my key questions to the assessments. I participated in all the plenary meetings from Monday morning 8:30 to Friday afternoon 15:00. Here, there were good opportunities to discuss the questions as well as the questions from the other panel members. I put forward a few requests to the assessors as did the other panel members, and we agreed a final list of requests each day. Next day we got the answers back from the stock assessment staff, and these were then discussed and concluded upon. After the meeting I prepared the present report. I also will participate in drafting the Chairs report of the meeting following the deadline of the present report, 21 June 2019.

Summary of Findings for each ToR for longnose skate.

The ToRs were similar for both stocks.

TORs:

1. *Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.*
2. *Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.*
3. *Evaluate model assumptions, estimates, and major sources of uncertainty.*
4. *Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.*
5. *Determine whether the science reviewed is considered to be the best scientific information available.*
6. *When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modelling approaches and technical issues, differentiating between the short-term and longer-term time frame.*
7. *Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.*

Ad 1. Prior to the panel meeting I became familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel reports when available).

Ad 2. During the open review panel meeting, discussion of the technical merits and deficiencies of the input data and analytical methods used took place. These were presented by Dr. Vladlena Gertseva.

The stock definition was discussed. There seems to be an exchange of individuals across the Canadian and USA border, and in the future a combined assessment with Canada seems prudent based on a more biologically based stock definition approach.

The fishery has increased recently and landings data quality by species has increased as well. Number-at-length data from surveys and discard data from observers onboard fishing vessels have also improved. Still however, there are age-at-length by year only for a few years.

Previously the assessment has been of the “data poor” type, but it seems appropriate to try now to make a more “data rich”- type assessment to make full use of the “extra” data now available.

Historical landings and discards were reconstructed from catch statistics aggregated over several skate species. A major data compilation effort had been undertaken to create catch statistics for this particular skate species. It is one of the dominant two skate species in the aggregated skate group. A time series back to the early 1900s was created. At that early time the overall fishery in this sea area was very light and the stocks are regarded to be in an almost pristine level. The US west coast has a very long time series of catch statistics. These two issues make it sensible to try to create catch statistics for this stock far back in time. Using the link between the catch of longnose skate and Dover sole and the better statistics for Dover sole, to estimate the catch and discards of longnose skate, is innovative and was convincing. Clearly, however, a lot of assumptions and uncertainties are attached to the overall catch and effort data, and further improvements can still be implemented in the compilation, but it seems that they have reached a sensible quality level now.

The Stock Synthesis software was used. This seems appropriate. The only issue in this context discussed was the lack of options in the software to include density dependence (DD) in growth, maturity and natural mortality. Only DD in recruitment is possible (and this was used). It is a well-known fact that ignoring any of these four DD will give a biased estimate of some important biological reference points (e.g., underestimating Fmsy and overestimating Bmsy). There are many references in the scientific literature showing that all four DD effects are widespread in fish stocks, but for skates there are not many, probably because there are not many time series of size-at-age vs stock size. However, one pointed to by the reviewers was on the Barndoor Skate on Georges Bank by Coutré et al. (2013). It has ever since Baranov 1918 been known that sustainable catches can only be extracted from fish stocks because of the DD mechanism, and that it is a fundamental functioning of any ecosystem. To embed all four DD effects in the stock-recruitment relationship is a possibility seen from technical side, and can mimic some of the population dynamic effects, but why not do it the right way and address it in the right life history parameters directly? The panel recommended to do so on a general level. Sometimes it is argued that the data on DD in growth, maturity and mortality do not exist, but this is a weak argument because the same can be said about S-R data, and for instance in the present assessment the S-R model was "guesstimated" (a Beverton and Holt model with a fixed steepness) and not based on data, and this model includes DD in recruitment.

The scientific knowledge about spawning time and area is not well known, but spawning seems to take place year- round and in all areas. Mating season and time seem to be unknown. All this gives uncertainties about what age and year-class actually are.

It would be nice to have uncertainty about the catch data by year – even rough ones. That would give a better sense about the real uncertainties in the assessment.

Four scientific surveys are used, and this seems well justified. Especially the ongoing NWFSC West Coast Groundfish Bottom Trawl Survey (WCGBT Survey) seems to cover the spatial distribution of the stock well. Also, the ongoing International Pacific Halibut Commission Longline Survey (IPHC) seems to be good for larger longnose skates and thus a good index to have in the assessment should large changes to the spawning component of the stock occur sometime in the future. The two other surveys are historical and are included in the model in a sensible way.

Ad 3. All the modelling and sensitivity analysis made it clear that there is information in the data to extract stock status and exploitation pressure that are useful for management in the sense that it can be concluded that the stock is not overfished and overfishing is not taking place. However, there is greater uncertainty as to the other side of the confidence interval, how much the stock is larger than the biological reference point and how much the fishing pressure is under the biological reference point. This is probably less important for management at present when there is only limited market for longnose skate and therefore limited interest in increasing the exploitation of the stock.

The major uncertainties of the assessment are:

a. Historical catch and effort data.
b. Catchability (q) in surveys.
c. Steepness of the S-R (which relates mostly to fishing pressure reference point estimations).
d. Weighting of data in the model.

Regarding a) the present data collection is good with observers onboard every vessel, but further back in time the data has been constructed – see above.

Regarding b), a good analysis was done to reach a prior q for the WCGBT survey. The upper bound of the prior q was well determined, but the lower bound was difficult to determine. If longnose skate are able to escape under the trawl gear, the lower bound of q could be much lower than given by the analysis. Experience from the North Sea in Europe (Sparholt and Vinther, 1991) showed that 90% of starry ray escapes under the ground rope (or rather that there are 10 times as many individuals caught in a beam trawl gear than in the ordinary bottom trawl gear by area swept). This is why the present assessment might have greater uncertainty regarding the upper bound of the stock biomass than the lower bound. Thus, according to this assessment, management need not be concerned about the current fishing pressure, but the assessment is more uncertain about how much the catch can be increased in the future and still be sustainable. This asymmetry in the conclusion is a difficulty when the goal of the science is to make "neutral" statements about the status of the stock and its potentials.

Various sensitivity runs were performed at the meeting by the stock assessor about the q. One run with no prior on q resulted in a very low q (even lower than in Sparholt and Vinther 1991). Other runs with shifts in the mean of the priors were done to see what the effect would be on the posterior and it was clear that it had a large effect. Thus, the data are not very informative about the precise value of q. Table 1 and Figure 1 below show the resultant q, where, as described above the low state of nature is better determined than the high state of nature. The biomass varies quite a lot between the runs, but all runs indicate a stock above management reference levels.

Table 1. *Longnose skate. Model results with different priors to catchability q on the WCGBT survey.*

	Low state	Base	High state
LnQ_WCGBT	0.72	0.45	0.18
Catchability (q)	2.06	1.50	1.19
SSB_Virgin_thousand_mt	10.81	12.25	14.40
SSB_2018_thousand_mt	5.05	6.89	9.33
Bratio_2019	0.47	0.57	0.65
SSB_unfished	10,809	12,252	14,400
Totbio_unfished	64,008	75,400	91,086
SmryBio_unfished	62,305	73,298	88,471
SSB_Btgt	4,324	4,901	5,760
SSB_MSY	4095.14	4631.63	5434.96
SPR_MSY	0.611793	0.611261	0.610892
Fstd_MSY	0.0277629	0.0278747	0.0279785
Dead_Catch_MSY	869.609	1029.77	1249.38
Ret_Catch_MSY	796.899	939.249	1135.08

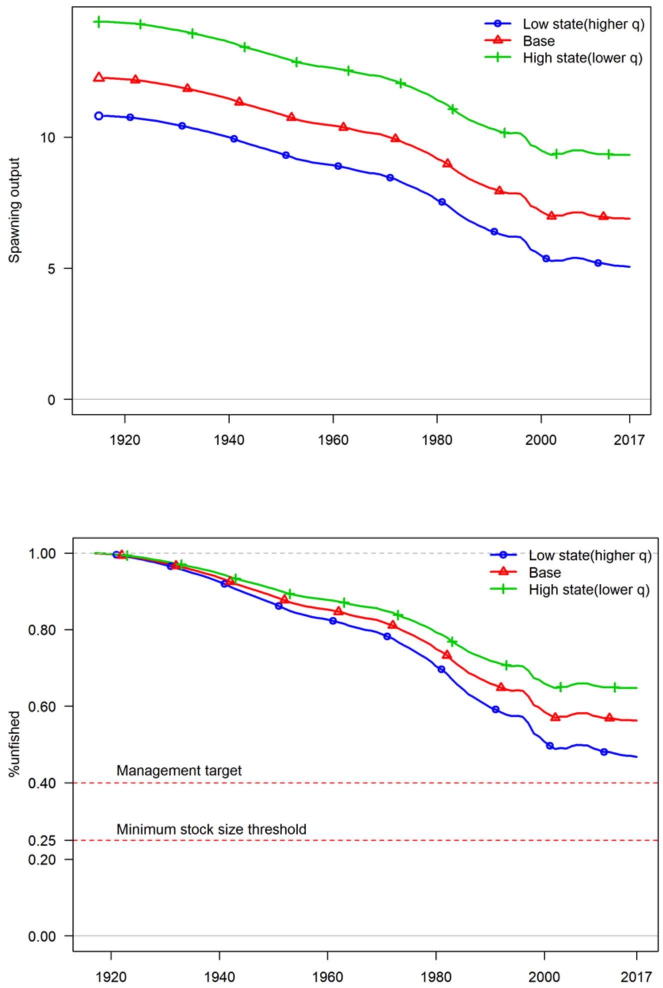


Figure 1. *Longnose skate. Model results in terms of spawning stock biomass estimates with different priors to catchability q on the WCGBT survey.*

Regarding c), S-R steepness, was discussed quite a bit. It is fixed to 0.4 in the assessment. This is based on the notion that longnose skates are vulnerable to overfishing and is a low fecund species. However, the available science on this is limited, and there are very few time series, if any, about stock and recruitment for skates. It was, however, the impression that 0.4 was very low. A value of 0.2 means that there is a linear relationship between S and R going through (0,0) and consequently, no fishing is sustainable (when DD in growth, maturity and natural mortality are ignored as it is in the present assessment). The value chosen is close to that value. The panel requested some sensitivity analyses and these are shown in Table 2.

Table 2. *Longnose skate. Model output for different steepness values.*

Steepness	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
SSB_unfished	38,832	36,087	35,098	34,685	34,499	34,414	34,378	34,367
Totbio_unfished	186,662	171,837	166,330	163,936	162,789	162,210	161,916	161,772
SmryBio_unfished	185,379	170,678	165,222	162,853	161,720	161,150	160,861	160,722
Recr_unfished	11,207	10,109	9,673	9,469	9,361	9,299	9,262	9,238
SSB_Btgt	15,533	14,435	14,039	13,874	13,800	13,766	13,751	13,747
SPR_Btgt	75%	63%	55%	50%	46%	44%	42%	40%
Fstd_Btgt	0.016	0.026	0.033	0.038	0.042	0.046	0.048	0.051
SSB_MSY	16,959	13,956	12,048	10,501	9,058	7,557	5,765	3,506
SPR_MSY	0.765308	0.61671	0.507444	0.418964	0.341579	0.268378	0.190806	0.102004
Fstd_MSY	0.0145	0.0263	0.0373	0.0482	0.0600	0.0742	0.0946	0.1326
Dead_Catch_MSY	1,299	2,108	2,787	3,414	4,030	4,675	5,418	6,548
Ret_Catch_MSY	1,171	1,882	2,462	2,984	3,479	3,971	4,491	5,160
B_MSY/SSB_unfished	0.44	0.39	0.34	0.30	0.26	0.22	0.17	0.10

From this table, it is clear that Fmsy (the parameter named Fstd_MSY in the table) increases about ten-fold when steepness increases from 0.3 to 1.0. Also, SPR_MSY, B_MSY/SSB_unfished, Dead_catch_MSY and Ret_Catch_MSY are very sensitive. Thus, as expected, steepness is a very important parameter for the catch level like OFC and ABC. The historical time series of biomass, recruitment and fishing pressure are, on the other hand, insensitive to steepness.

Evidence from the Northeast Atlantic shows that most skate stocks can survive very heavy fishing pressure (probably several times the fishing pressure on longnose skate), but some skate stocks cannot. Now that fishing pressure in the Northeast Atlantic on a general scale is reduced, skate stocks have rebounded to some extent. Thus, this can be regarded as an indirect evidence that the steepness of the S-R curve is not as low as 0.4 but rather is about 0.5 – 0.7. A proper and relevant meta-analysis of the situation in the Northeast Atlantic is, however, not yet conducted.

Regarding d), weighting of data in the model, this turned out to be a larger issue than expected. The original Francis weighting was expected to deal sufficiently and properly with the issue, but a test run with Dirichlet weighting requested by the panel turned out to give a better model fit to the data and a more realistic natural mortality estimate (increasing from 0.13 to 0.22). Furthermore, the Linf increased from 118cm to 146cm, which seems more in line with the observations of many individuals much larger than 118cm. The fit to the length data got a little bit worse. WCGBT q increased from 0.83 to about 1.5 (thus implying a herding effect from the trawl doors) and the stock biomasses decreased by a factor of about three, and F, increased by a factor of about three. The q parameter was however very sensitive to the prior used, so the data did not really contain information to determine its value. The panel judged the weighting Dirichlet to be preferable compared to the Francis weighting.

Uncertainties of moderate importance in the assessment:

e. Inability to mimic the apparent increase in WCGBT survey index.
f. Inability of the assessment software to include density dependence in individual fish growth, maturity, and natural mortality.
g. Growth cessation model.

Regarding e), the inability to mimic the apparent increase in WCGBT survey index, Figure 2 shows that the alternative model did not change that much unless recruitment was allowed to vary by year (the red line in the plot). However, because of the limited amount of age data in the model this was probably more of a reaction to noise and it did not improve the fit to survey data much.

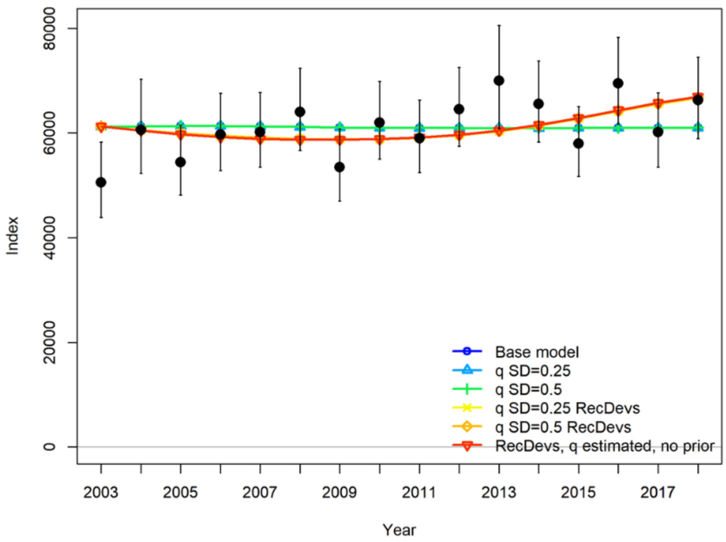


Figure 2: *Longnose skate. Runs with survey q estimated with diffuse (CV = 0.25 & 0.5) priors and recruitment deviations estimated.*

Changes in natural mortality could also be an explanation of the lack of fitting to the survey data. Relatively minor changes in M over the recent about 10 years could give a better fit to the survey data as the model assumes constant M and deterministic recruitment.

Regarding f), the inability of the assessment software (Stock Synthesis) to include density dependence (DD) in individual fish growth, maturity and natural mortality, is not a major problem for the estimation of the historical stock trends and fishing pressure trends. However, for estimating of the classical biological reference points Fmsy and Bmsy, as well as e.g. the fishing mortality corresponding to e.g. SRP40%, it is very important. It seems prudent to add that option to this very flexible and sophisticated piece of fish stock assessment software, which at present only includes one of the four density dependent factors in fish population dynamics, namely recruitment. Missing any of the four density dependent factors will cause bias in both Fmsy and Bmsy, namely an underestimation of Fmsy and an overestimation of Bmsy. It was mentioned at the panel meeting that DD in the S-R model could be increased to take into account the DD in the other three factors and this is probably right in some cases, but maybe not in other cases. It would be more straight forward, more transparent and in better agreement with good modelling practice to model DD in the parameters where it occurs. Maybe some of the statistical features could be exchanged with these fundamental density dependent factors, if there is a wish to not further increase the complexity of the SS software.

Regarding g) growth cessation model, this was tested and gave a better fit to the age-at-size data, see Figure 3.

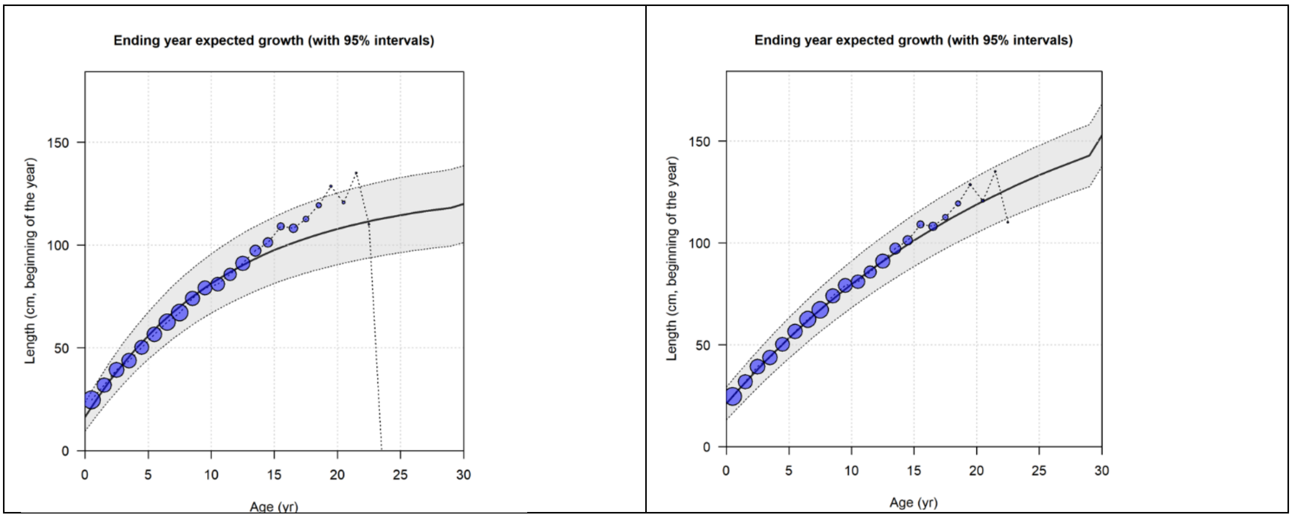


Figure 3. *Longnose skate. Left panel without growth cessation. Right panel with growth cessation.*

In addition, various other sensitivity runs were done and for instance catch multipliers were explored but did not improve the fit of the model substantially.

Ad 4. It seems that the Dirichlet-weighting is preferable. A growth cessation model might also be worth pursuing.

Ad 5. The science reviewed is considered to be the best scientific information available for the assessment of the longnose skate stock. The data compilation behind the assessment is very well done. The modelling using Stock Synthesis software is conducted in a very skillful and competent way.

Ad 6. Specific suggestions for future improvements in aspects of data collection and treatment, modelling approaches and technical issues.

In the short term:

- Include a density dependent option in SS for individual fish growth, maturity and natural mortality.
- A literature study of steepness in skates could help improve the value used in the model. Here the experience from the Northeast Atlantic in over the past decade, where fishing pressure has reduced substantially, could be useful to consider and analyze.
- The Dover sole model used to estimate discards of longnose skate could be further elaborated.
- Further work is needed on the annual landing and discard data, including estimates of uncertainties.
- Use the current Harvest Control Rule in the estimation of Fmsy, because this is a more realistic scenario (managers are likely to reduce F in the future when the stock is low) and it will make the Fmsy estimate less sensitive to the steepness factor, at least if stochasticity around the S-R model is allowed for.
- Given that the stock fluctuations are driven by natural mortality to a large extent, it might be useful to try models with age varying natural mortality, for instance based on Charnov et al. (2013).

In the long term:

- More age and maturity data should be collected, e.g. every second year on the survey. This will help estimate density dependent growth, which can be very important (Coutré et al. 2013). It will also help estimating recruitment.

- Survey catchability can be investigated by underwater video of escapement behavior.
- Traditional tagging experiments need to be considered to estimate fishing mortality and in that way stock size and survey catchability.
- Satellite tagging can be used to get information about migration distance and routes, to learn about stock and sub-stock structures.

Conclusions and Recommendations in accordance with the ToRs for longnose skate

The overall conclusion was that the assessment is useful for management, especially if the points mentioned above are considered. The probabilities that the stock is overfished and that overfishing is taking place are both low. It is less certain how much fishing can be increased if the goal is to get MSY.

Summary of Findings for each ToR for Big skate

The ToRs for this review are similar to those for longnose skates.

Ad 1. Prior to the panel meeting, I became familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel report when available).

Ad 2. During the open review panel meeting, discussion of the technical merits and deficiencies of the input data and analytical methods used took place. These were presented by Dr. Ian Taylor.

The stock definition was discussed. There seems to be an exchange of individuals across the Canadian and USA border, and in the future a combined assessment with Canada seems prudent based on a more biological approach to stock definition.

The fishery has increased recently and landings data quality by species as well. Number-at-length data from surveys and discard data from observers onboard fishing vessels have also improved. Still, however, there are age-at-length by year only for a few years.

Previously the assessment has been of the “data poor” type, but it seems appropriate to try now to make a more “data rich”- type assessment to make full use of the “extra” data now available.

Historical landings and discards were reconstructed from catch statistics aggregated over several skate species. A major data compilation effort had been undertaken to create catch statistics for this particular skate species. It is one of the dominant two skate species in the aggregated skate group. A time-series back to the early 1900s was created. At that early time, the overall fishery in this sea area was very light and the stocks regarded to be in an almost pristine level. The US west coast has a very long time series of catch statistics. These two issues make it sensible to try to create catch statistics for this stock far back in time. Clearly, however, a lot of assumptions and uncertainties are attached to the overall catch and effort data, and further improvements can still be implemented in the compilation, but it seems that they have reached a sensible quality level now.

The Stock Synthesis software was used. This seems appropriate. The only issue in this context discussed was the lack of options in the software to include density dependence (DD) in growth, maturity and natural mortality. Only DD in recruitment is possible (and this was used). It is a well-known fact that ignoring any of these four DD will give a biased estimate of some important biological reference points (e.g., underestimating Fmsy and overestimating Bmsy). There are many references in the scientific literature to all four DD effects being widespread in fish stocks, but for skates there are not many, probably because there are not many time series of size-at-age vs stock size. However, one pointed to by the reviewers was on the Barndoor Skate on Georges Bank by Coutré et al. (2013). It has ever since Baranov 1918 been known that sustainable catches can only be extracted from fish stocks because of the DD mechanism, and that it is a fundamental functioning of any ecosystem. To embed all four DD effects in the stock-recruitment relationship is a possibility seen from the technical side, and can mimic some of the population dynamics effects, but why not do it the right way and address it in the right life history parameters directly? The panel recommended to do so on a general level. Sometimes it is argued that the data does not exist to do so, but this is a weak argument, because the same can be said about S-R data, and for instance in the present assessment the S-R model was an expert judgement (a Beverton and Holt model with a fixed steepness) and not based on data.

The scientific knowledge about spawning time and area is not well known, but it seems to take place year-round and in all areas. Mating season and time seem to be unknown. This gives uncertainties about what age and year-class actually are.

It would be nice to have uncertainty about the catch data by year – even rough estimates would be helpful. That would give a better sense about the real uncertainties in the assessment.

Three scientific surveys are used, and this seems well justified. Especially the ongoing NWFSC West Coast Groundfish Bottom Trawl Survey (WCGBT Survey) seems to cover the stock spatial distribution relatively well, except that Big skate is also distributed on shallow waters (less than 55 m) where the WCGBT does not go. Also, ignoring the International Pacific Halibut Commission Longline Survey (IPHC) seems to be prudent because of the lack of spatial overlap with the stock. The two other surveys are historical and are included in the model in a sensible way.

During the present meeting, an analysis was performed on the amount of the stock distributed in the shallow water (less than 55m deep). In order to evaluate the effect of the un-surveyed nearshore (depths less than 55m) on estimates of biomass, catch data provided by the WCGOP program was used. The ratios of hauls containing Big Skate to all hauls in each of four depth bins: (0-25], (25-55], (55-75], and (75-100] meters were calculated. These ratios were normalized to the (55-75] meter bin. The median biomass in hauls in those same depth bins were calculated. The ratios among the first three bins were applied to the catch rates in the survey for the 55-75 bin for extrapolation into the shallower water. Extrapolated catch rates are shown in the top panel in Figure 4, with the grey region representing the extrapolation depths.

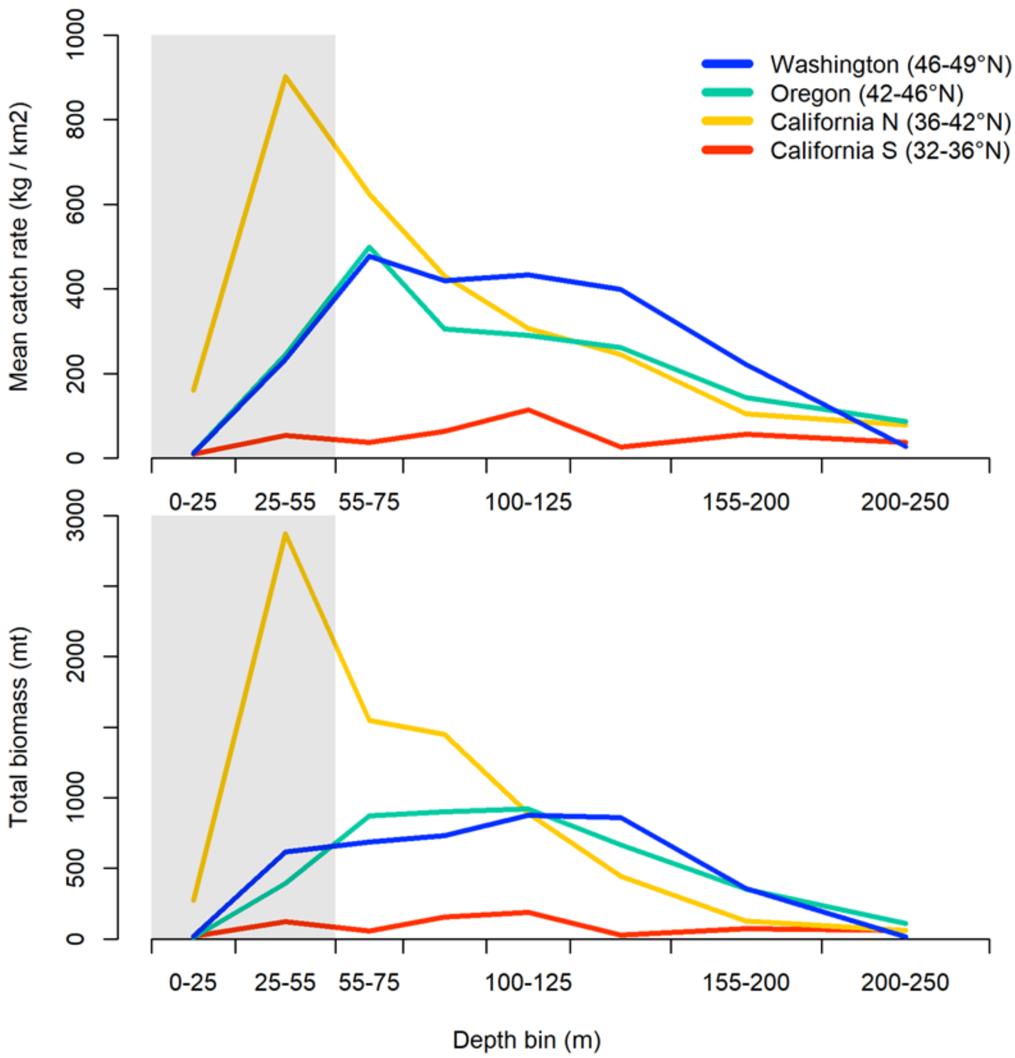


Figure 4. *Big skate. Extrapolated WCGBT catch rates are shown in the top panel, with the grey region representing the extrapolation depths. Biomass in the low panel.*

The lower panel shows the estimated biomass after adjustment for area of each bin. The biomass in the unfished area was equal to 25.8% of the total biomass.

This gave the basis for revising the prior to the catchability of the survey as shown in the Table 3. This whole exercise was judged by the panel to be an improvement of the assessment.

Table 3. *Big skate. Revising of the prior to the catchability of the WCGBT survey.*

Calculations related to the new REVISED catchability prior

2007 Longnose table					
factor	minimum	best guess	maximum		
Depth availability	0.95	0.975	1		
Latitudinal availability	1	1	1		
Vertical availability	0.75	0.85	0.95		
Probability of capture given in net path	0.75	1	1.5		
Product of all factors	0.53	0.83	1.43		
2019 Big Skate revision					
factor	minimum	best guess	maximum		
Depth availability	0.6	0.75	0.9		
Latitudinal availability	1	1	1		
Vertical availability	0.75	0.85	0.95		
Probability of capture given in net path	0.75	1	1.5		
Habitat availability (extrapolation into untrawable areas)	1	1.1	1.2		
Product of all factors	0.338	0.701	1.539		
values on a normal scale	-1.086	**-0.355**	0.431		Bold value is mean of normal prior on log(Q)
distance between normal mean and quantiles	0.731		0.786	0.759	avg. difference between mean and quantile
standard deviation assuming min and max are the 10% and 90% quantiles				**0.592**	SD based on 10% and 90% quantile
standard deviation assuming min and max are the 1% and 99% quantiles				**0.326**	SD based on 10% and 90% quantile

NOAA FISHERIES

U.S. Department of Commerce | National Oceanic and Atmospheric Administration | NOAA Fisheries | Page 5

The panel requested runs with different q prior means and that indicated that the estimated q values closely follow the prior. This is expected given the likelihood profile indicated that the best total likelihood occurred at the minimum q values among those considered. Thus, the q prior is very important for the model results. Both the model and the experience from the Northeast Atlantic indicate that q could be much lower than 0.70 used here, and that is why there are some extra uncertainties about the upper confidence limit of the stock biomass estimates.

Various other sensitivity runs were requested by the panel. The most important were a set of time-varying M models. Under different assumptions about the variability in M and the correlation among years, these models had small or large changes in M. They were often better able to fit the various data, but the additional complexity was seen by the panel as insufficiently supported by the data. Figures 5 and 6 show M in the various models, the resultant spawning stock biomass estimates, recruitment estimation and the fit to the survey data.

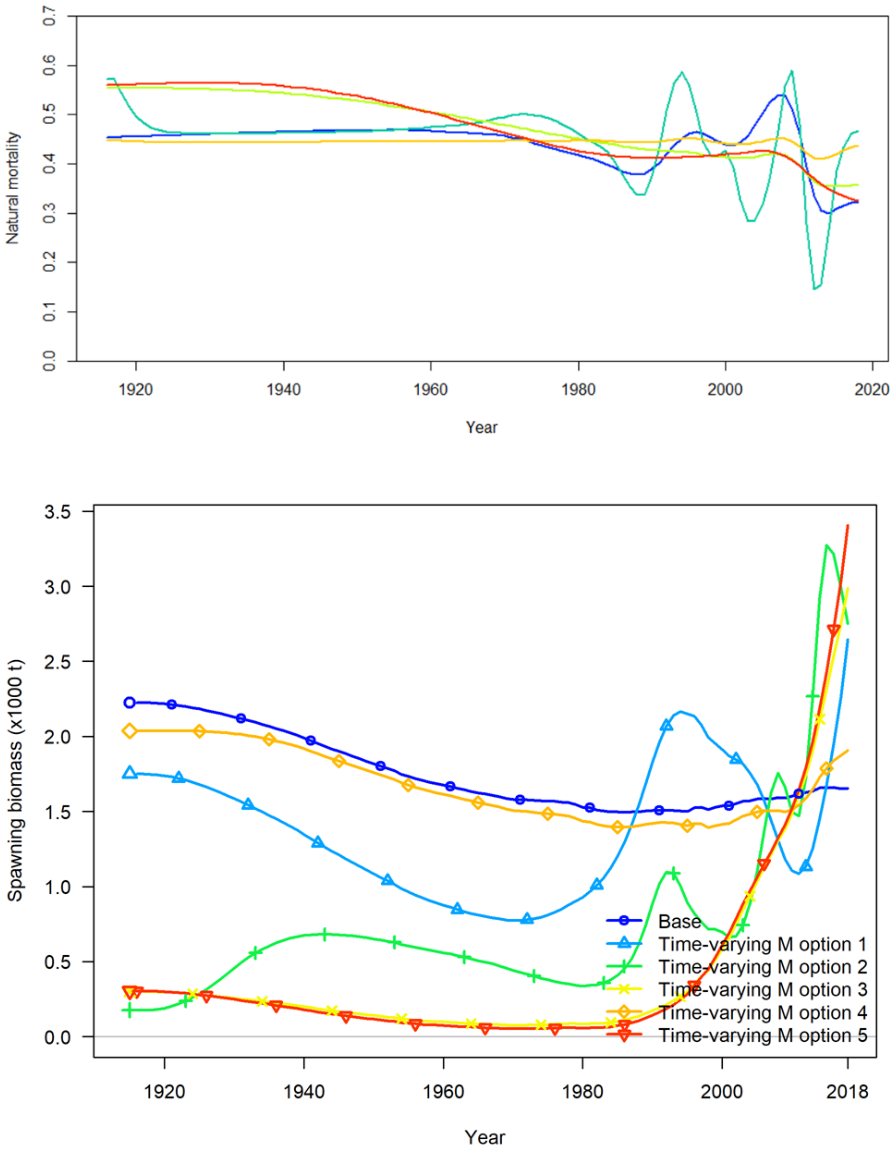


Figure 5. *Big skate. Sensitivity runs with different assumption on M. Upper panel the M assumption and the lower panel the resultant spawning stock biomass estimates.*

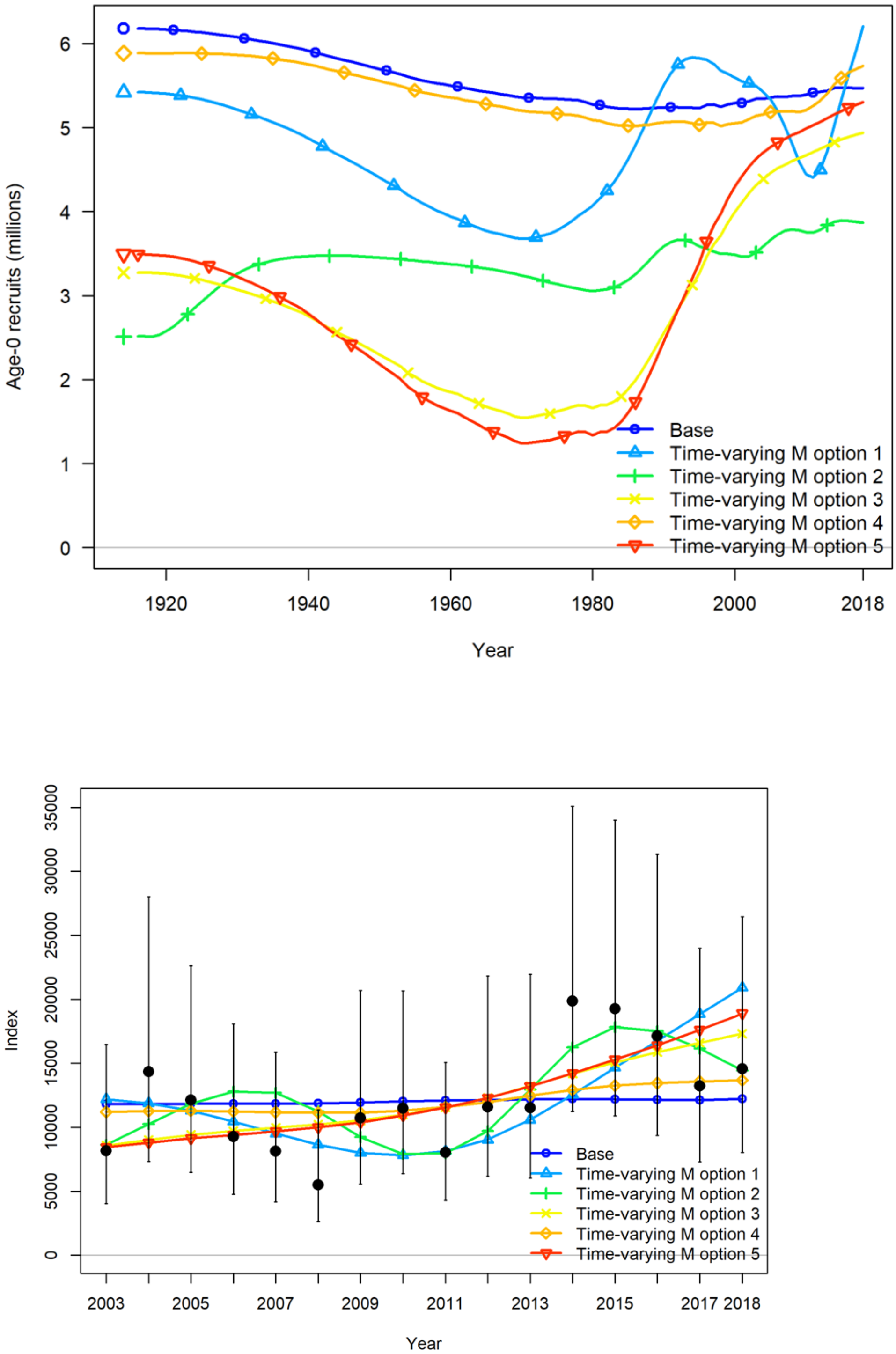


Figure 6. *Big skate. Same as above with recruitment over time estimates (upper panel) and fit to the WCGBT survey in the lower panel.*

.

It is clear that small changes in M can give a quite different picture of the stock situation. For this stock (and for longnose skate) M is much larger than F, and, therefore, the stock biomass is likely to be driven more by fluctuations in M than by fluctuations in fishing pressure. This of course casts doubt about the usefulness of the assessment as a whole. The survey data, therefore, becomes very important for the reliability of the assessment.

Steepness was also expected to be a critical point in the assessment for this skate species. Figure 7 shows the probability profile for steepness. A value of 0.3 is clearly too low judged from the low log likelihood, but any values between 0.4 and 0.7 are almost equally likely. As for longnose skates, this has important implications for the estimates of Fmsy and Bmsy, but not so much for the historical stock trends.

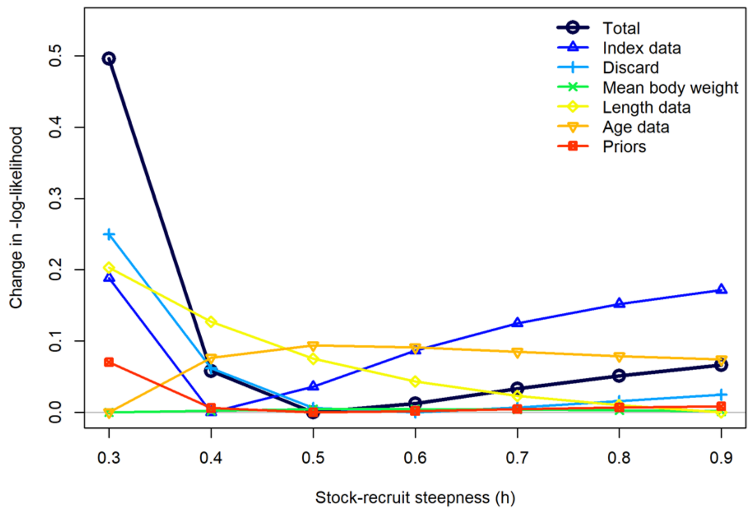


Figure 7. *Big skate. Probability profiles for steepness.*

Ad 4. It seems that the Francis weighting is working fine for this assessment, and the Dirichlet-weighting gave very similar results. It was not quite clear to the panel why the weighting should be different between the two species, but, judged from the diagnostics, this seems fair enough.

Ad 5. The science reviewed is considered to be the best scientific information available for the assessment of the big skate stock. The data compilation behind the assessment is very well done. The modelling using Stock Synthesis software is conducted in a very skillful and competent way.

Ad 6. Specific suggestions for future improvements in aspects of data collection and treatment, modelling approaches and technical issues.

In the short term:

- Include a density dependent option in SS for individual fish growth, maturity and natural mortality.
- A literature study of steepness in skates could help improve the value used in the model. Here, the experience from the Northeast Atlantic in over the past decade, where fishing pressure has reduced substantially, could be useful to consider and analyze.
- A “Dover sole” type model used to estimate discards of longnose skate could be considered for big skates as well, maybe based on the estimates of discards of longnose skates.

- Further work is needed on the annual landing and discard data, including estimates of uncertainties.
- Use the current Harvest Control Rule in the estimation of Fmsy, because this is a more realistic scenario (managers are likely to reduce F in the future when the stock is low) and it will make the Fmsy estimate less sensitive to the steepness factor, at least if stochasticity around the S-R model is allowed for.
- Given that the stock fluctuations are driven by natural mortality to a large extent, it might be useful to try models with age varying natural mortality, for instance based on Charnov et al. (2013).

In the long term:

- More age and maturity data should be collected, e.g. every second year on the survey. This will help estimate density dependent growth, which can be very important (Coutré et al. 2013). It will also help estimating recruitment.
- Survey catchability can be investigated by underwater video of escapement behavior.
- Traditional tagging experiments need to estimate fishing mortality and that way the stock size and survey catchability.
- Satellite tagging can be used to get information about migration distance and routes, to learn about stock and sub stock structures.

Conclusions and Recommendations in accordance with the ToRs for Big skate

The overall conclusion was that the assessment is useful for management, especially if the points mentioned above are considered. The probabilities that the stock is overfished and that overfishing is taking place are both low. It is less certain how much the fishing can be increased if the goal is to get MSY.

The NMFS review process

The review process worked very well. Documentation and presentation were of a very high quality. Documentation was sent out two weeks before the meeting using FTP Drive. The meeting was conducted in an efficient, engaged and positive atmosphere.

The guidelines to the reviewers from the CIE secretariat were clear and to the point.

The exchange of knowledge between the reviewers and the scientific staff was very fruitful, it seemed for both parties.

The panel put quite a few requests to the two assessors. These were very efficiently answered, although they had to work hard and had long days during the meeting.

The presentations of all the important aspects relevant for the review were very much appreciated by the panel.

The facilities were very good, although the projector could have been clearer and sharper.

I tried hard to think of possible improvements to suggest but could not come up with any. The NMFS review process have evolved over time and seems now to have reached a very high standard in my opinion.

All in all, a very good process seen from the reviewer's perspective, for doing a comprehensive and in-depth review.

References:

Charnov, E.L., H. Gislason, J.G. Pope. 2013. Evolutionary assembly rules for fish life histories. Fish and Fisheries, **14:** 213-224.

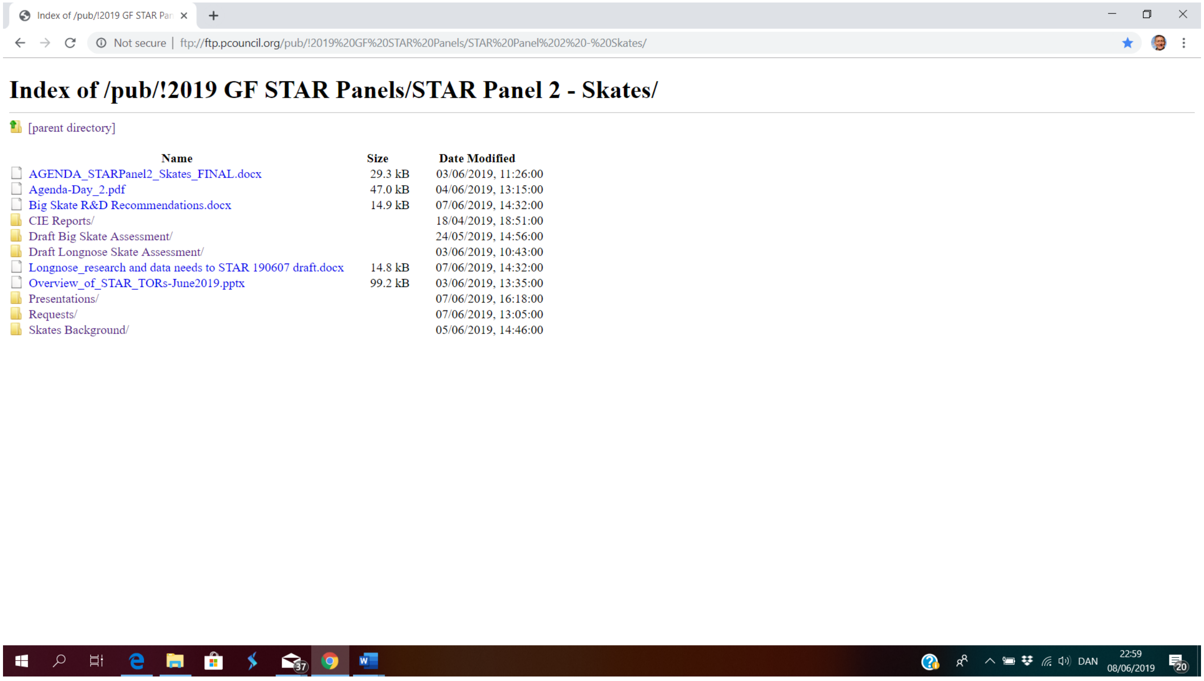
Francis, R.I.C.C. (2011). Data weighting in statistical fisheries stock assessment models. Can. J. Fish. Aquat. Sci. **68**: 1124-1138.

Coutré, Karson, Todd Gedamke, David B. Rudders, William B. Driggers, David M. Koester, et. al. 2013. Indication of Density-Dependent Changes in Growth and Maturity of the Barndoor Skate on Georges Bank. Marine and Coastal Fisheries: Dynamics, Management, and Ecosystem Science, (5) : 260-269. Published By: American Fisheries Society. URL: https://doi.org/10.1080/19425120.2013.824941.

Sparholt, H., and Vinther, M. 1991. The biomass of starry ray (Raja radiata) in the North Sea. - J. Cons. int. Explor. Mer, 47: 295-302.

Appendix 1. List of material provided

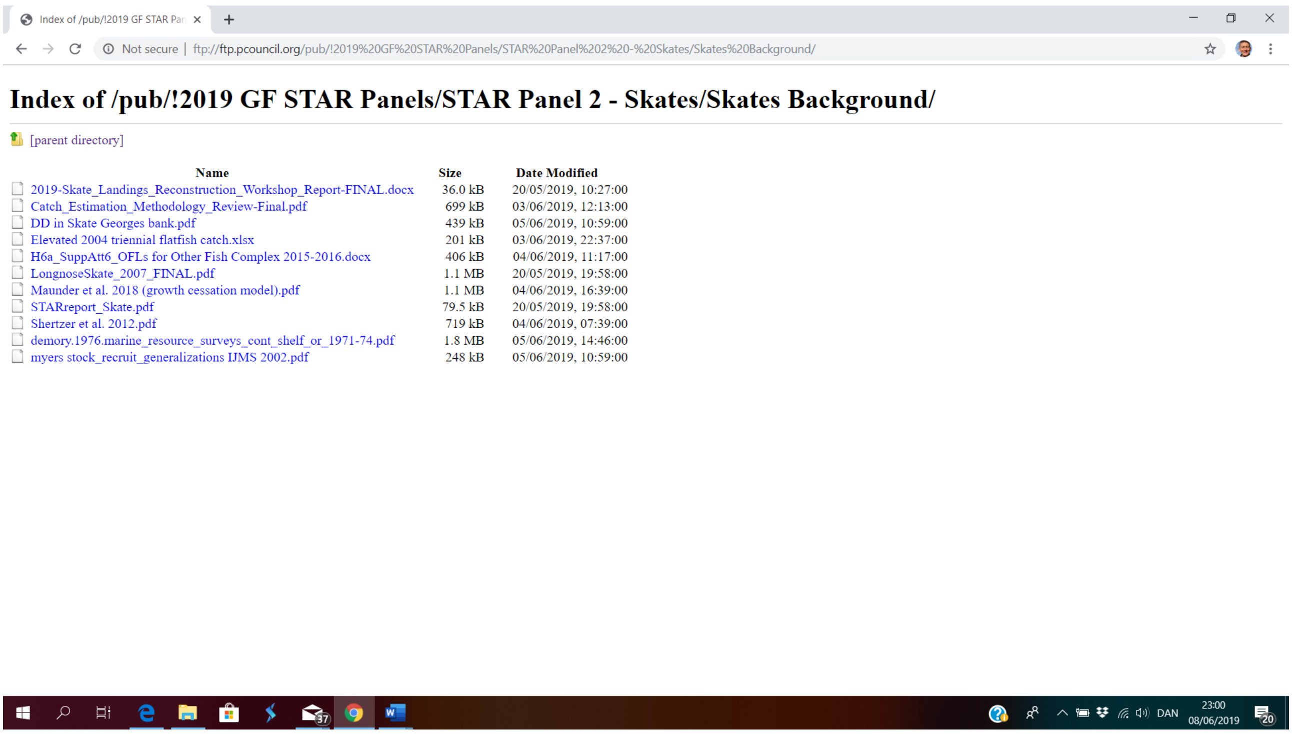
Material were provided at an FTP drive as shown below.



Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/

[parent directory]

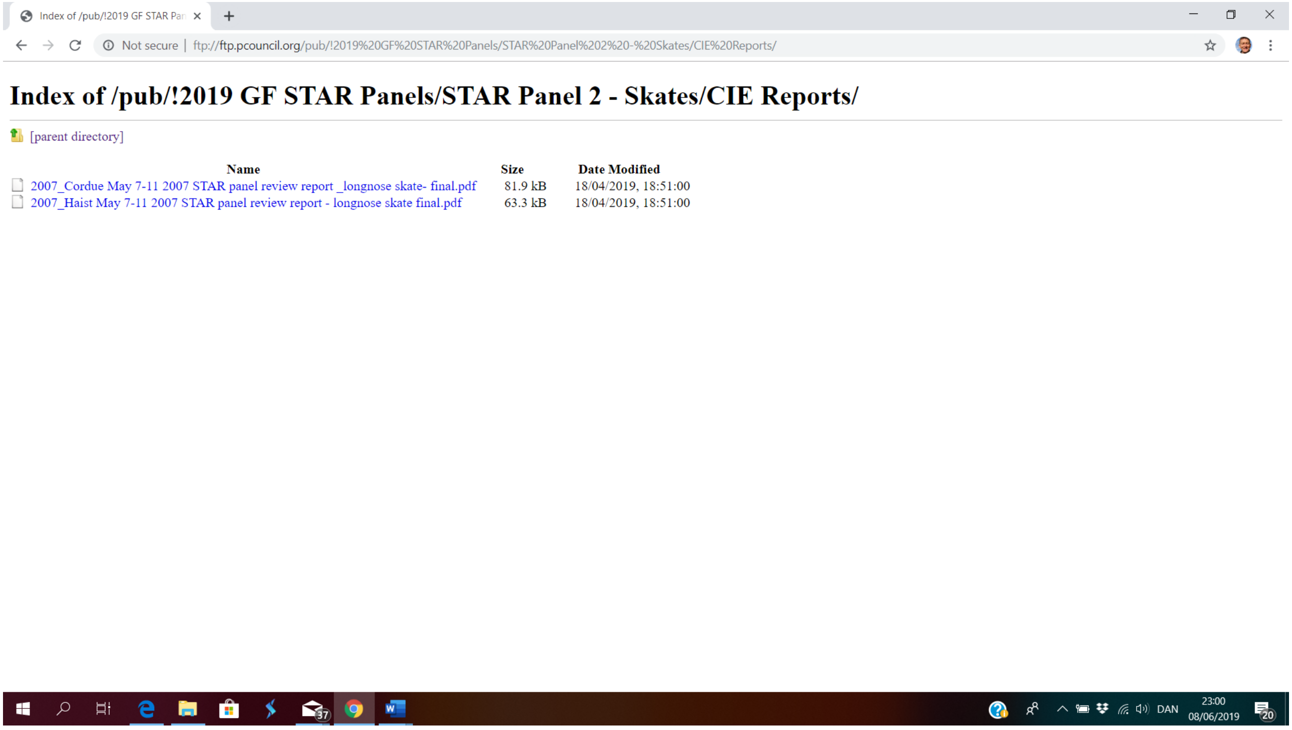
Name	Size	Date Modified
AGENDA_STARPanel2_Skates_FINAL.docx	29.3 kB	03/06/2019, 11:26:00
Agenda-Day_2.pdf	47.0 kB	04/06/2019, 13:15:00
Big Skate R&D Recommendations.docx	14.9 kB	07/06/2019, 14:32:00
CIE Reports/		18/04/2019, 18:51:00
Draft Big Skate Assessment/		24/05/2019, 14:56:00
Draft Longnose Skate Assessment/		03/06/2019, 10:43:00
Longnose_research and data needs to STAR 190607 draft.docx	14.8 kB	07/06/2019, 14:32:00
Overview_of_STAR_TORs-June2019.pptx	99.2 kB	03/06/2019, 13:35:00
Presentations/		07/06/2019, 16:18:00
Requests/		07/06/2019, 13:05:00
Skates Background/		05/06/2019, 14:46:00



Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/Skates Background/

[parent directory]

Name	Size	Date Modified
2019-Skate_Landings_Reconstruction_Workshop_Report-FINAL.docx	36.0 kB	20/05/2019, 10:27:00
Catch_Estimation_Methodology_Review-Final.pdf	699 kB	03/06/2019, 12:13:00
DD in Skate Georges bank.pdf	439 kB	05/06/2019, 10:59:00
Elevated 2004 triennial flatfish catch.xlsx	201 kB	03/06/2019, 22:37:00
H6a_SuppAtt6_OFLs for Other Fish Complex 2015-2016.docx	406 kB	04/06/2019, 11:17:00
LongnoseSkate_2007_FINAL.pdf	1.1 MB	20/05/2019, 19:58:00
Maunder et al. 2018 (growth cessation model).pdf	1.1 MB	04/06/2019, 16:39:00
STARreport_Skate.pdf	79.5 kB	20/05/2019, 19:58:00
Shertzer et al. 2012.pdf	719 kB	04/06/2019, 07:39:00
demory.1976.marine_resource_surveys_cont_shelf_or_1971-74.pdf	1.8 MB	05/06/2019, 14:46:00
myers stock_recruit_generalizations IJMS 2002.pdf	248 kB	05/06/2019, 10:59:00



Index of /pub/!2019 GF STAR Par

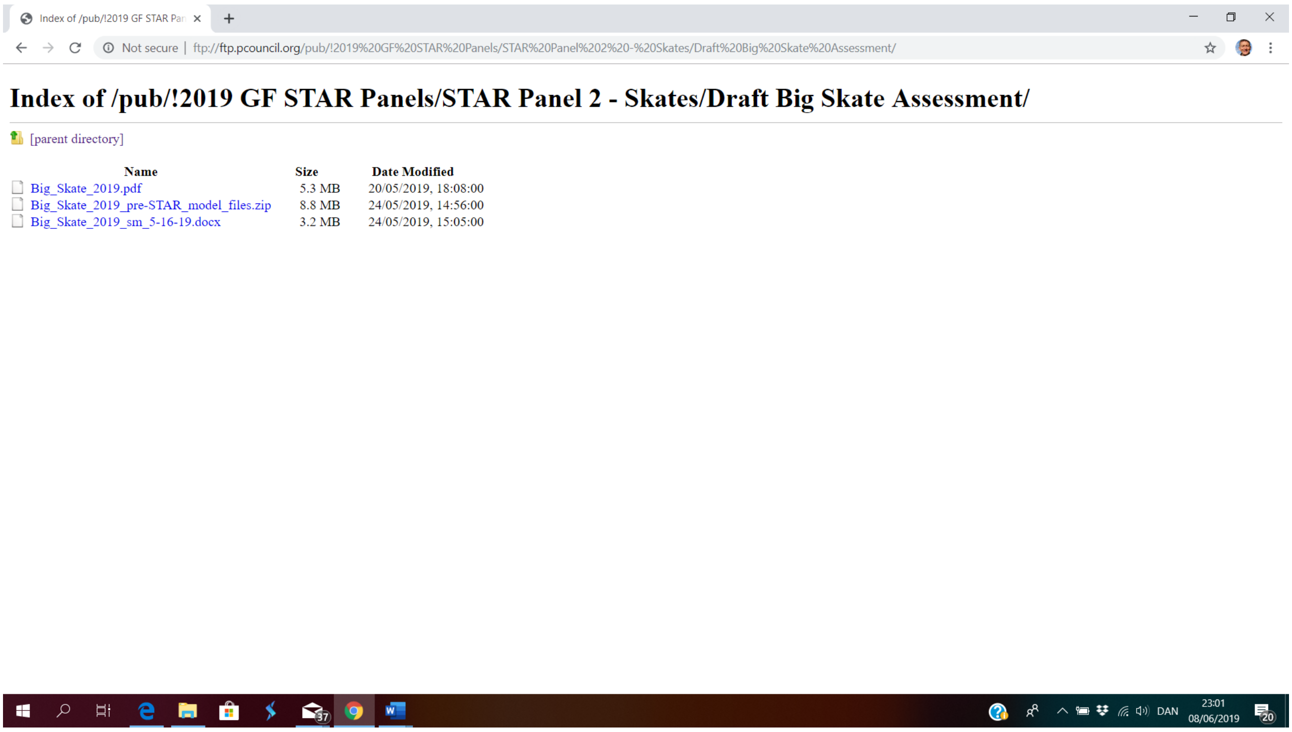
Not secure | ftp://ftp.pcouncil.org/pub/!2019%20GF%20STAR%20Panels/STAR%20Panel%202%20-%20Skates/CIE%20Reports/

Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/CIE Reports/

[parent directory]

Name	Size	Date Modified
2007_Cordue May 7-11 2007 STAR panel review report _longnose skate- final.pdf	81.9 kB	18/04/2019, 18:51:00
2007_Haist May 7-11 2007 STAR panel review report - longnose skate final.pdf	63.3 kB	18/04/2019, 18:51:00

DAN 23:00 08/06/2019



Index of /pub/!2019 GF STAR Par

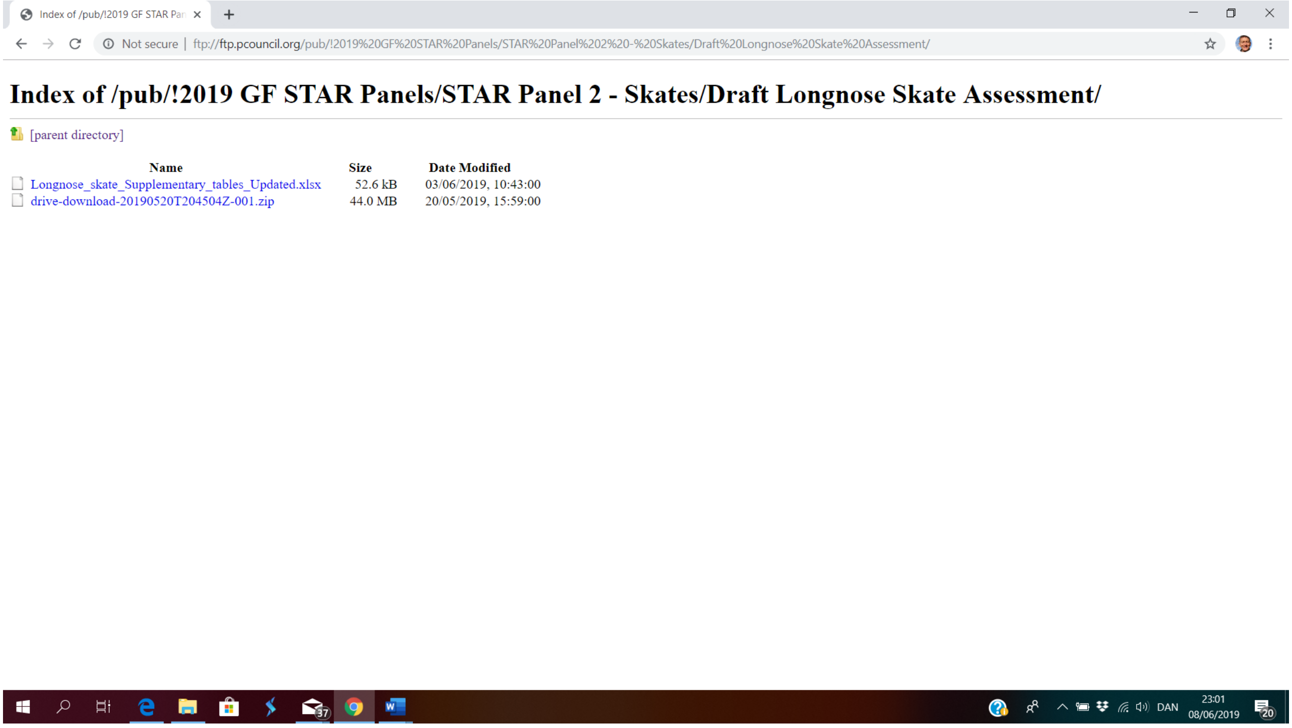
Not secure | ftp://ftp.pcouncil.org/pub/!2019%20GF%20STAR%20Panels/STAR%20Panel%202%20-%20Skates/Draft%20Big%20Skate%20Assessment/

Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/Draft Big Skate Assessment/

[parent directory]

Name	Size	Date Modified
Big_Skate_2019.pdf	5.3 MB	20/05/2019, 18:08:00
Big_Skate_2019_pre-STAR_model_files.zip	8.8 MB	24/05/2019, 14:56:00
Big_Skate_2019_sm_5-16-19.docx	3.2 MB	24/05/2019, 15:05:00

DAN 23:01 08/06/2019



Index of /pub/!2019 GF STAR Pa

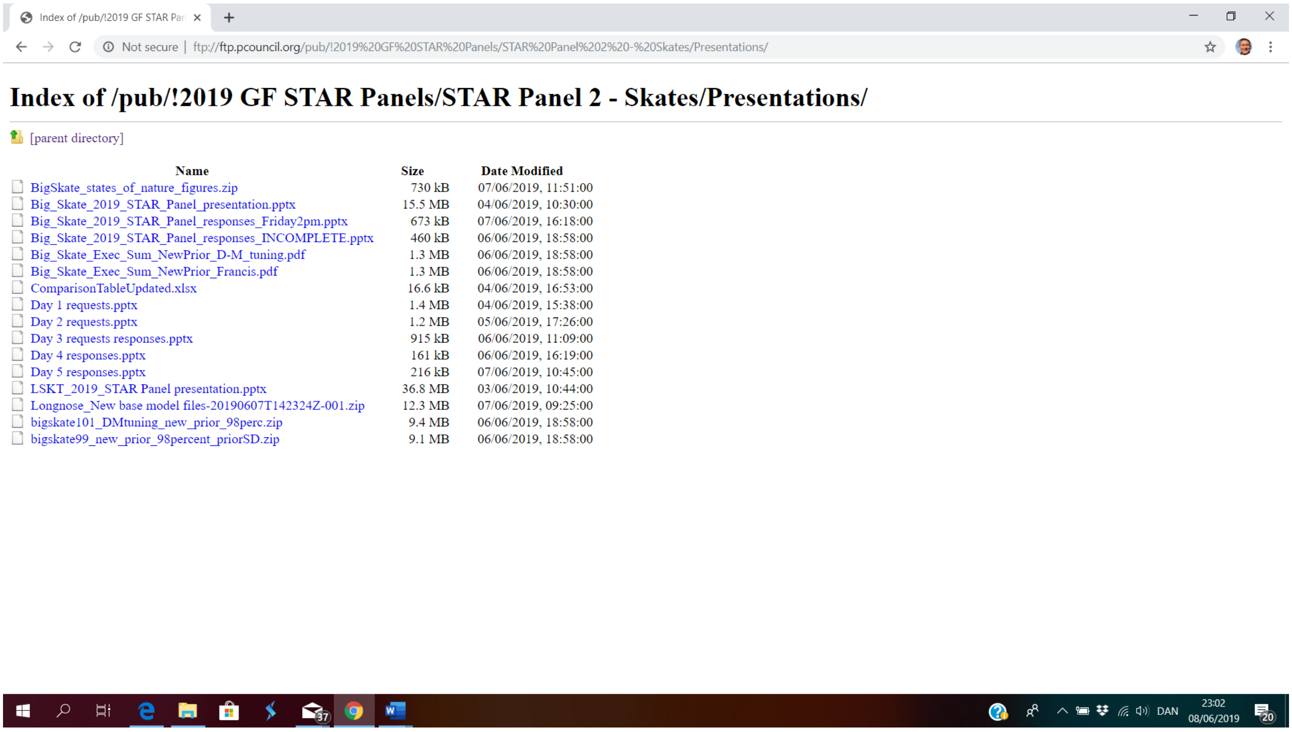
Not secure | ftp://ftp.pcouncil.org/pub/!2019%20GF%20STAR%20Panels/STAR%20Panel%202%20-%20Skates/Draft%20Longnose%20Skate%20Assessment/

Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/Draft Longnose Skate Assessment/

[parent directory]

Name	Size	Date Modified
Longnose_skate_Supplementary_tables_Updated.xlsx	52.6 kB	03/06/2019, 10:43:00
drive-download-20190520T204504Z-001.zip	44.0 MB	20/05/2019, 15:59:00

DAN 23:01 08/06/2019



Index of /pub/!2019 GF STAR Pa

Not secure | ftp://ftp.pcouncil.org/pub/!2019%20GF%20STAR%20Panels/STAR%20Panel%202%20-%20Skates/Presentations/

Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/Presentations/

[parent directory]

Name	Size	Date Modified
BigSkate_states_of_nature_figures.zip	730 kB	07/06/2019, 11:51:00
Big_Skate_2019_STAR_Panel_presentation.pptx	15.5 MB	04/06/2019, 10:30:00
Big_Skate_2019_STAR_Panel_responses_Friday2pm.pptx	673 kB	07/06/2019, 16:18:00
Big_Skate_2019_STAR_Panel_responses_INCOMPLETE.pptx	460 kB	06/06/2019, 18:58:00
Big_Skate_Exec_Sum_NewPrior_D-M_tuning.pdf	1.3 MB	06/06/2019, 18:58:00
Big_Skate_Exec_Sum_NewPrior_Francis.pdf	1.3 MB	06/06/2019, 18:58:00
ComparisonTableUpdated.xlsx	16.6 kB	04/06/2019, 16:53:00
Day 1 requests.pptx	1.4 MB	04/06/2019, 15:38:00
Day 2 requests.pptx	1.2 MB	05/06/2019, 17:26:00
Day 3 requests responses.pptx	915 kB	06/06/2019, 11:09:00
Day 4 responses.pptx	161 kB	06/06/2019, 16:19:00
Day 5 responses.pptx	216 kB	07/06/2019, 10:45:00
LSKT_2019_STAR Panel presentation.pptx	36.8 MB	03/06/2019, 10:44:00
Longnose_New base model files-20190607T142324Z-001.zip	12.3 MB	07/06/2019, 09:25:00
bigskate101_DMtuning_new_prior_98perc.zip	9.4 MB	06/06/2019, 18:58:00
bigskate99_new_prior_98percent_priorSD.zip	9.1 MB	06/06/2019, 18:58:00

DAN 23:02 08/06/2019

Index of /pub/!2019 GF STAR Par ×

Not secure | ftp://ftp.pcouncil.org/pub/!2019%20GF%20STAR%20Panels/STAR%20Panel%202%20-%20Skates/Requests/

Index of /pub/!2019 GF STAR Panels/STAR Panel 2 - Skates/Requests/

[parent directory]

Name	Size	Date Modified
1st Round of Requests to the Longnose Skate STAT.docx	14.9 kB	03/06/2019, 19:28:00
1st round of big skate requests.docx	14.6 kB	05/06/2019, 19:24:00
2nd round of big skate requests.docx	14.9 kB	05/06/2019, 19:24:00
2nd round of longnose requests.docx	14.9 kB	04/06/2019, 20:42:00
3rd round of big skate requests.docx	14.7 kB	07/06/2019, 13:05:00
3rd round of longnose requests.docx	14.9 kB	05/06/2019, 17:27:00
4th round of longnose requests.docx	14.7 kB	06/06/2019, 12:46:00
5th round of longnose requests.docx	14.8 kB	07/06/2019, 11:34:00

DAN 23:02 08/06/2019

Appendix 2. Statement of work

Performance Work Statement (PWS)

National Oceanic and Atmospheric Administration (NOAA)

National Marine Fisheries Service (NMFS)

Center for Independent Experts (CIE) Program

External Independent Peer Review

Stock Assessment Review (STAR) Panel 2

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

The National Marine Fisheries Service and the Pacific Fishery Management Council will hold stock assessment review (STAR) panels and potentially one mop-up panel (if needed), to evaluate and review benchmark assessments of Pacific coast groundfish stocks. The goals and objectives of the groundfish STAR process are to:

1) ensure that stock assessments represent the best scientific information available and

facilitate the use of this information by the Council to adopt Overfishing Limits (OFLs), Acceptable Biological Catches (ABCs), Annual Catch Limits (ACLs), harvest guidelines (HGs), and annual catch targets (ACTs);

2) meet the mandates of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements;
3) follow a detailed calendar and fulfil explicit responsibilities for all participants to produce required reports and outcomes;

4) provide an independent review of stock assessments;
5) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;
6) identify research needed to improve assessments, reviews, and fishery management in the future; and
7) use assessment and review resources effectively and efficiently.

Benchmark stock assessments will be conducted and reviewed for Longnose and Big skates. Both stocks were identified as strong candidates for assessment during the Pacific coast groundfish regional stock assessment prioritization process, with Longnose skate being ranked as second of all considered stocks. This analysis was based on the national stock assessment prioritization framework (http://www.st.nmfs.noaa.gov/Assets/stock/documents/PrioritizingFishStockAssessments_FinalWeb.pdf.

Longnose skate was last assessed as a benchmark assessment in 2007. The spawning stock biomass was estimated to be at 66 percent of its unfished biomass at the start of 2007. Based on that assessment, a constant catch strategy (OY = 1,349 mt) was implemented in 2009 based on a 50 percent increase in the average 2004-2006 landings and discard mortality. The constant catch strategy was revised in 2013 by implementing an Annual Catch Limit (ACL) of 2,000 mt to provide greater access to the stock and to limit disruption of current fisheries. This level of harvest was projected to maintain the population at a healthy level as projected in the 10-year forecast for longnose skate in the 2007 assessment (Gertseva and Schirripa 2008). The Scientific and Statistical Committee (SSC) recommended changing the proxy F_{MSY}[1] rate for longnose skate and other elasmobranchs from a Spawning Potential Ratio (SPR) of 45 percent to an SPR of 50 percent beginning in 2015. This recommendation, driven primarily by conservation concerns for spiny dogfish, was heeded by the Council when they adopted 2017 and 2018 OFLs consistent with this lower harvest rate. The Council adopted the default harvest control rule for longnose skate by recommending a 2019 and 2020 ACL of 2,000 mt. A new assessment is extremely important to inform both current status as well future projections.

Big skate has not been previously assessed, but is an important and growing composition of the west coast groundfish fishery. Big skate were managed in the Other Fish complex until 2015 when they were

[1] F_{MSY} The fishing mortality rate that, if applied constantly, would result in maximum sustainable yield (MSY). Used as a biological reference point, F_{MSY} is the implicit fishing mortality target of many regional and national

fishery management authorities and organizations.

designated an Ecosystem Component (EC) species. When the Council considered designating all skates except longnose skate as EC species, the Groundfish Management Team (GMT) estimated that catches of big skate averaged 95 mt from 2007–2011 with large landings of Unspecified Skate (see Table 4-33 in the 2015-2016 Harvest Specifications and Management Measures Final Environmental Impact Statement). Subsequent analysis of Oregon port sampling data not available when the Council considered the EC designation indicated about 98 percent of the recent Unspecified Skate landings in Oregon were comprised of big skate. The GMT revised the total mortality estimates of big skate coastwide using these new data (Table 1-10). Such large landings indicates targeting of big skate has occurred and an EC designation was not warranted. Based on this evidence, the Council decided to re-designate big skate as an actively-managed species in the fishery. Big skate were managed with stock-specific harvest specifications starting in 2017.

Assessments for these two stocks will provide the basis for the management of the groundfish fisheries off the West Coast of the U.S. including providing scientific basis for setting Overfishing Limits (OFLs) and Acceptable Biological Catches (ABCs) as mandated by the Magnuson-Stevens Act. The technical review will take place during a formal, public, multiple-day meeting of fishery stock assessment experts. Participation of external, independent reviewer is an essential part of the review process. The specified format and contents of the individual peer review reports are found in **Annex 1**. The Terms of Reference (ToRs) of the peer review are attached in **Annex 2**. The tentative agenda of the panel review meeting is attached in **Annex 3**.

Requirements

Two CIE reviewers will participate in the stock assessment review panel. One CIE reviewer shall conduct an impartial and independent peer review of the assessments described above and in accordance with the Performance Work Statement (PWS) and ToRs herein. Additionally, one “consistent” CIE reviewer will participate in all STAR panels held in 2019 and the PWS and ToRs for the “consistent” CIE reviewer are included in **Attachment A**.

The CIE reviewers shall be active and engaged participants throughout panel discussions and able to voice concerns, suggestions, and improvements while respectfully interacting with other review panel members, advisors, and stock assessment technical teams. The CIE reviewers shall have excellent communication skills in addition to working knowledge and recent experience in fish population dynamics, with experience in the integrated analysis modeling approach, using age-and size-structured models, use of Markov Chain Monte Carlo (MCMC) to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. The CIE reviewer’s duties shall not exceed a maximum of 14 days to complete all work tasks of the peer review described herein.

Tasks for Reviewers

The CIE reviewer shall complete the following tasks in accordance with the PWS and Schedule of Milestones and Deliverables herein.

Pre-review Background Documents: Two weeks before the peer review, the NMFS Project Contact will send (by electronic mail or make available at an FTP site) to the CIE reviewers the necessary background information and reports for the peer review. In the case where the documents need to be mailed, the NMFS Project Contact will consult with the CIE on where to send documents. CIE reviewers are responsible only for the pre-review documents that are delivered to the reviewer in accordance to the PWS scheduled deadlines specified herein. The CIE reviewer shall read all documents in preparation for the peer review.

Documents to be provided to the CIE reviewers prior to the STAR Panel 2 meeting include:

- The current draft stock assessment reports;
- The Pacific Fishery Management Council's Scientific and Statistical Committee's Terms of Reference for Stock Assessments and STAR Panel Reviews;
- Stock Synthesis (SS) Documentation
- Additional supporting documents as available (including previous stock assessments and STAR panel reports).
- An electronic copy of the data, the parameters, and the model used for the assessments (if requested by reviewer).

Panel Review Meeting: The CIE reviewers shall conduct the independent peer review in accordance with the PWS and ToRs, and shall not serve in any other role unless specified herein. Modifications to the PWS and ToRs cannot be made during the peer review. Each CIE reviewer shall actively participate in a professional and respectful manner as a member of the meeting review panel, and their peer review tasks shall be focused on the ToRs as specified herein. The NMFS Project Contact is responsible for any facility arrangements (e.g., conference room for panel review meetings or teleconference arrangements). The NMFS Project Contact is responsible for ensuring that the Chair understands the contractual role of the CIE reviewers as specified herein. The CIE can contact the Project Contact to confirm any peer review arrangements, including the meeting facility arrangements.

Contract Deliverables - Independent CIE Peer Review Reports: The CIE reviewers shall complete an independent peer review report in accordance with the PWS. Each CIE reviewer shall complete the independent peer review according to required format and content as described in **Annex 1**. Each CIE reviewer shall complete the independent peer review addressing each ToR as described in **Annex 2**.

Other Tasks – Contribution to Summary Report: The CIE reviewers may assist the Chair of the panel review meeting with contributions to the Summary Report, based on the terms of reference of the review. The CIE reviewer is not required to reach a consensus and should provide a brief summary of the reviewer's views on the summary of findings and conclusions reached by the review panel in accordance with the ToRs.

Timeline for CIE Reviewers

The following chronological list of tasks shall be completed by each CIE reviewer in a timely manner as specified in the Schedule of Milestones and Deliverables.

1) Conduct necessary pre-review preparations, including the review of background material and reports provided by the NMFS Project Contact in advance of the peer review.
2) Participate during the STAR Panel 2 review meeting in scheduled in Seattle, WA during the dates of June 3-7, 2019 as specified herein, and conduct an independent peer review in accordance with the ToRs.
3) No later than June 21, 2019, each CIE reviewer shall submit their draft independent peer review report to the contractor. Each CIE report shall be written using the format and content requirements specified in **Annex 1**, and address each ToR in **Annex 2**

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 in Seattle, WA.

Period of Performance
The period of performance shall be from the time of award through August 2019. The CIE reviewers' 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
At least two weeks prior to the panel review meeting	Contractor provides the pre-review documents to the reviewers
June 3-7, 2019	Each reviewer participates and conducts an independent peer review during the panel review meeting

June 21, 2019	Contractor receives draft reports
July 10, 2019	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 in **Annex 1**; (2) The reports shall address each ToR as specified **Annex 2**; and (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.

Restricted or Limited Use of Data

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

NMFS Project Contacts:

Stacey Miller, NMFS Project Contact
National Marine Fisheries Service,
2032 SE OSU Drive
Newport, OR 97365
Stacey.Miller@noaa.gov
Phone: 541-867-0535

Jim Hastie
National Marine Fisheries Service,
2725 Montlake Blvd. E,
Seattle WA 98112
Jim.Hastie@noaa.gov
Phone: 206-860-341

Annex 1: Format and Contents of CIE Independent Peer Review Report

1. The CIE independent report shall be prefaced with an Executive Summary providing a concise summary of the findings and recommendations, and specify whether the science reviewed is the best scientific information available.

2. The main body of the reviewer's report shall consist of a Background, Description of the Individual Reviewer's Role 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 should describe in their own words the review activities completed during the panel review meeting, including providing 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, and especially where there were divergent views.

   c. Reviewers should elaborate on any points raised in the Summary Report that they feel 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 CIE independent 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 CIE independent report shall be an independent peer review of each ToRs, and shall not simply repeat the contents of the summary report.

3. The reviewer's report shall include the following appendices:

   Appendix 1: Bibliography of materials provided for review

   Appendix 2: A copy of the CIE Performance Work Statement

   Appendix 3: Panel Membership or other pertinent information from the panel review meeting.

Annex 2: Terms of Reference for the Peer Review

Stock Assessment Review (STAR) Panel 2

8. Become familiar with the draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g. previous assessments and STAR panel report when available) prior to review panel meeting.
9. Discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting.
10. Evaluate model assumptions, estimates, and major sources of uncertainty.
11. Provide constructive suggestions for current improvements if technical deficiencies or major sources of uncertainty are identified.
12. Determine whether the science reviewed is considered to be the best scientific information available.
13. When possible, provide specific suggestions for future improvements in any relevant aspects of data collection and treatment, modeling approaches and technical issues, differentiating between the short-term and longer-term time frame.
14. Provide a brief description on panel review proceedings highlighting pertinent discussions, issues, effectiveness, and recommendations.

Annex 3: Tentative Agenda

Final Agenda to be provided two weeks prior to the meeting with draft assessments and background materials.

Stock Assessment Review (STAR) Panel 2

Longnose and Big Skate

Seattle, Washington

NWFSC

2725 Montlake Blvd, NE

Seattle, WA 98112

June 3-7, 2019

June 3-7, 2019

Monday, June 3

Meeting at NWFSC Auditorium

8:30 a.m. Welcome and Introductions

8:45 a.m. Review the Draft Agenda and Discuss Meeting Format (Chair)

- Review the Terms of Reference (TOR) for assessments and STAR panel responsibilities
- Assign reporting duties
- Agree on time and method for accepting public comments

9:15 a.m. Presentation of the Longnose Skate Assessment

- Overview of data and modeling

12:30 p.m. Lunch (Onsite)

1:30 p.m. Presentation of the Longnose Skate Assessment (continued)

3:30 p.m. STAR Panel Discussion

- Panel develops written requests for first set of model runs / analyses

5:30 p.m. Adjourn for day

Tuesday, June 4

Meeting at NWFSC Auditorium

8:30 a.m. Review of Agenda Topics for the Day

8:45 a.m. Presentation of the Big Skate Assessment

- Overview of data and modeling

12:15 p.m. Lunch on your own

1:30 p.m. STAR Panel Discussion of Big Skate Assessment

- Panel develops written request for first set of model runs / analyses

3:30 p.m. Presentation of the First Set of Requested Model Runs for Longnose Skate

- Q&A session & Panel discussion
- Panel develops request for second round of model runs / analyses

5:30 p.m. Adjourn for day

Wednesday, June 5

Meeting at NWFSC Auditorium

8:30 a.m. Review Agenda for the Day

8:45 a.m. Continue Presentation of the First Set of Requested Model Runs for Longnose Skate

- Q&A session & Panel discussion
- Panel develops request for second set of model runs/analyses

10:00 a.m. Presentation of First Set of Request Model Runs for Big Skate

12:15 p.m. Lunch on your own

1:30 p.m. Continue Presentation of First Set Requested Model Runs for Big Skate

- Q&A Session and Panel discussion
- Panel develops request for second set of model runs / analyses

3:30 p.m. STAR Panel Discussion / Begin Drafting Report

5:30 p.m. Adjourn for day

Thursday, June 6

Meeting at Seattle Yacht Club

8:30 a.m. Review Agenda for the Day

8:45 a.m. Presentation of the Second Set of Model Runs for Longnose Skate

- Q&A session & panel discussion
- Panel develops request for third set of model runs / analyses

10:30 a.m. Presentation of the Second Set of Model Runs for Big Skate

- Q&A session & panel discussion

- Panel develops request for third set of model runs / analyses

12:15 p.m. Lunch on your own

1:30 p.m. STAR Panel Discussion / Continue Drafting STAR Report

3:00 p.m. Presentation of the Third Set of Model Runs for Longnose Skate

- Q&A session & panel discussion
- Agreement of the preferred model and model runs for the decision table
- Panel continues drafting the STAR report.

4:15 p.m. Presentation of Third Set of Model Runs for Big Skate

- Q&A session & panel discussion
- Agreement of the preferred model and model runs for the decision table
- Panel continues drafting the STAR report.

5:30 p.m. Adjourn for day

Friday, June 7

Meeting at NWFSC Auditorium

8:30 a.m. Consideration of Remaining Issues

- Review decision tables for all assessments

11:00 a.m. Review First Draft of the STAR Panel Report

- Panel Agrees to Process for Completing the Final STAR Report for Council's September Meeting Briefing Book (Requested by August 15th)

12:00 p.m. Lunch on your own

1:30 p.m. Continue Drafting Report as needed

4:00 p.m. Review Panel Adjourns

Appendix 3. List of participants

1) Stacey Miller, NMFS, NWFSC
2) Jim Hastie, NMFS, NWFSC
3) Theresa Tsou, WDFW
4) Shallin Bush, NMFS, NWFSC
5) Corey Niles, NMFS, NWFSC
6) Owen Hamel, NMFS, NWFSC
7) Melissa Haltuch, NMFS, NWFSC

List of CIE reviewers:

8) Robin Cook
9) Henrik Sparholt
10) Coby Szuwalski

List of other in-person participants

11) John DeVore
12) David Brice Sampson (Chair)