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Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2024/028

Maritimes Region

Proceedings of the Maritimes Regional Peer Review of the Stock Assessment of Northwest Atlantic Spiny Dogfish

Meeting dates: December 11, 2018 and February 13, 2019
Location: Dartmouth, NS

Chairperson: Jennifer Ford
Editor: Jennifer Ford and Lottie Bennett

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Bedford Institute of Oceanography
1 Challenger Drive, PO Box 1006
Dartmouth, Nova Scotia B2Y 4A2

June 2024

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings may include research recommendations, uncertainties, and the rationale for decisions made during the meeting. Proceedings may also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Published by:

Fisheries and Oceans Canada
Canadian Science Advisory Secretariat
200 Kent Street
Ottawa ON K1A 0E6

http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca

ISSN 1701-1280
ISBN 978-0-660-71728-9 Cat. No. Fs70-4/2024-028E-PDF

Correct citation for this publication:

DFO. 2024. Proceedings of the Maritimes Regional Peer Review of the Stock Assessment of Northwest Atlantic Spiny Dogfish; December 11, 2018, and February 13, 2019. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2024/028.

***Aussi disponible en français**)*

*MPO. 2024. Compte rendu de l'examen par les pairs régional de l'évaluation de l'état des stocks d'aiguillat commun de l'Atlantique Nord-Ouest; le 11 décembre 2018 et le 13 février 2019. Secr. can. des avis sci. du MPO. Compte rendu 2024/*028.

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SUMMARY

A regional peer review of the Stock Assessment of Northwest Atlantic Spiny Dogfish was held on December 11, 2018, at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia, and subsequently reconvened by teleconference on February 13, 2019. This meeting followed the Northwest Atlantic Spiny Dogfish Framework Part I: Review of Data Inputs (September 19-20, 2017) and Part II: Review of Modelling Approaches and Assessment (June 27-28, 2018). An approach to setting proxy reference points based on solely the adult female abundance of the US spring survey was presented, as requested at the previous meeting. Information related to the US stock assessment for Spiny Dogfish was also presented, and meeting participants agreed that relying on the US stock assessment to inform our understanding of stock status and provide advice to management had several advantages. There was agreement that until a Canadian modeled approach could be developed, relying on the US model would be more informative than reviewing solely the US survey index.

The meeting was subsequently reconvened to discuss how elements of the US Spiny Dogfish stock assessment could be used to meet the requirements of the Canadian Fishery Decision-Making Framework Incorporating the Precautionary Approach (DFO 2009), including to determine reference points and stock status, and to draft advice to fisheries managers. The SSB_{target} was recommended as the Upper Stock Reference (USR), 159,288 mt. The Lower Stock Reference (LSR) would be the $SSB_{threshold}$ value, calculated as 50% of the USR, with a value of 79,644 mt. This would put the biomass estimates in the Cautious Zone since 2015.

Analyses were also presented related to the US Spring survey catch-at-length, survey timing, and the use of adult females versus demersal females as indices of abundance.

INTRODUCTION

The last Department of Fisheries and Oceans Canada (DFO) Framework Review and assessment of Northwest Atlantic Spiny Dogfish occurred in 2014, using data up to 2010 (Fowler & Campana, 2015). The accepted model was a forward-projecting, stage-based, spatially explicit population dynamics model with two time steps. Efforts to update the assessment with more recent data became progressively more difficult and by 2015 abundance estimates for Spiny Dogfish had become implausibly high (DFO, 2016). A new framework assessment for Spiny Dogfish was needed to provide updated management advice. The new framework was organized into two components, Data Inputs (Part I) and Modelling and Assessment (Part II).

At the Northwest Atlantic Spiny Dogfish Framework Part I: Review of Data Inputs (September 19-20, 2017), fishery-dependent and fishery-independent data sources from the US and Canada were reviewed and the factors affecting dogfish catchability in the US spring survey were evaluated to develop an approach for standardization of the time series. The Northwest Atlantic Spiny Dogfish Framework Part II: Review of Modelling Approaches and Assessment (June 27-28, 2018) had the following objectives: (1) review the consequences of Part I recommendations on the assessment model for Northwest Spiny Dogfish, (2) review updated biological reference points and evaluate the status of the population relative to these reference points, (3) explore the consequences of different harvest levels on abundance and exploitation rate using the assessment model, and (4) recommend an assessment schedule that includes decision rules to trigger a new framework. The assessment model was not accepted as a basis for advice for a number of reasons. In the absence of an accepted population model, it was agreed that DFO should work to provide advice based on the calibrated US spring survey index for mature females as the primary indicator of stock status in future stock assessments.

On December 11, 2018, a stock assessment meeting was held to review the survey index-based approach to determining stock status and providing catch advice that was requested at the Framework Part II. The most recent US stock status update for Northwest Atlantic Spiny Dogfish was also circulated as a background document. The meeting objectives were to: (1) review and update proxy biological reference points, evaluate the status of the stock up to 2018, and comment on the uncertainty and relative informative value of the candidate reference points, and (2) provide recommendations on the schedule for ongoing assessment of Northwest Atlantic Spiny Dogfish and outline a process and guidelines for the monitoring of indicators and other events (e.g., decision rules) that could trigger an earlier than scheduled assessment.

During the meeting on December 11, participants agreed that until a Canadian (or joint) approach to a modelled stock assessment could be developed, it would be preferable to rely on the US stock assessment as the basis for understanding stock status than to use the survey index-based approach proposed in June 2018. A second part to the assessment meeting was convened on February 13, 2019, to describe how the US assessment might be used to provide advice that is consistent with DFO's Fishery Decision-Making Framework Incorporating the Precautionary Approach (DFO 2009).

The meeting Chair, Jennifer Ford thanked meeting participants for attending the DFO Regional Peer Review Process (Appendix 1). The Chair provided a brief overview of the Canadian Science Advisory Secretariat (CSAS) peer review process and invited participants to review the meeting Terms of Reference (Appendix 2) and Agenda (Appendix 3). This Proceedings report is the record of the discussion of the meeting. A Science Advisory Report will also be produced.

To guide discussions, a working paper had been prepared. The meeting Chair noted that the meeting Working Paper is for the purpose of meeting discussion, and is not to be distributed,

cited or used in any other forum. This Proceedings document constitutes the record of meeting discussions and conclusions, and any statements within should not be attributed as being consensus-based.

A list of the Participants is shown in Appendix 1. The Terms of Reference are shown in Appendix 2. The meeting agenda is shown in Appendix 3.

PRESENTATIONS AND DISCUSSION

DECEMBER 11, 2019 FOLLOW UP FROM THE FRAMEWORK REVIEW AND ASSESSMENT OF SPINY DOGFISH, PART II: MODELING AND ASSESSMENT

Working paper: Interim Update Assessment of Spiny Dogfish. CSAS Working Paper 2018/18.

Science Lead: G.M. Fowler
Rapporteur: L. Bennett

A number of follow-up analyses related to Harvest Control Rule inputs were also requested during the Framework review in June 2018.

Spring Survey Catch at Length

The potential utility of estimates of pups (dogfish under 31 cm) as a recruitment index was raised at the Framework meeting. In reviewing the National Marine Fishery Service(NMFS) Spring Survey data, two distinct pulses of pups are apparent, in 1985 and 2012 (Figure 1). The first pulse occurs an appropriate length of time before the record peak abundance of our time series, based on the growth and maturity determined from spring survey sampling conducted by Nammack et al (1985) during 1980-1981. The same deterministic expectation does not work with the second pulse in 2012, which should have begun to show in the adult indices by 2017. A possible explanation for this discrepancy is slower growth and maturation, and the succession of pelagic length abundances since 2012 appears to reflect this. M. Fowler commented that while reductions in maturation rates in recent decades have been contended for a number of species, for dogfish there is no evidence of a change in the length-weight relationship over time (Figure 2), although a truncation of lengths over time is evident, likely due to fishing.

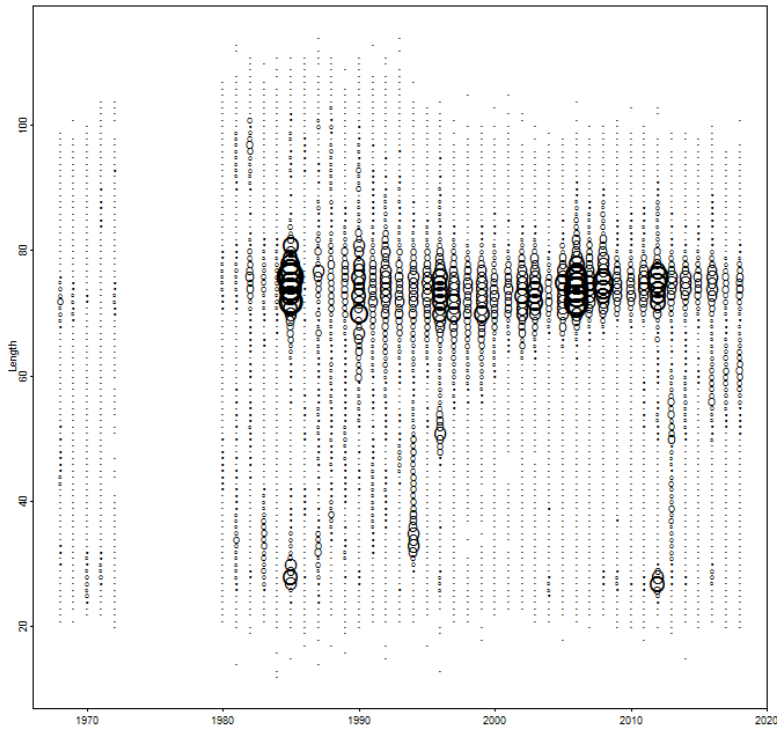

Figure 1. Bubble plot of stratified numbers at length from the NMFS Spring survey, sexes combined. Estimates from the Bigelow survey vessel (2009-2018) are calibrated to the Albatross survey vessel estimates used in the earlier years.

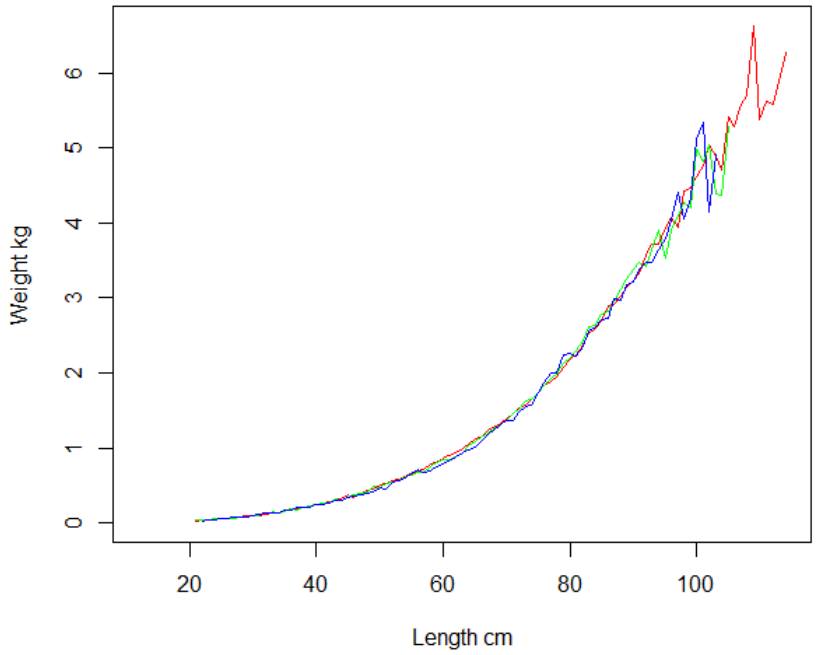

Figure 2. Decadal mean length-weight relationships for female dogfish since 1992. Red indicates the 1990's; green indicates the 2000's; and blue indicates the 2010's.

Survey Timing

One possible source of process error that has not been addressed is the role of variability in Spring survey timing. During 1988-2008, the survey was typically completed by the first week of May. During 1968-1987 and from 2009 onward, the survey could still be underway as late as June. Years in which the survey continued into June tend to be characterized by lower annual stratified abundance estimates for adult females (Figure 3), suggesting availability may be a concern for surveys that sample key strata too late. This issue was raised during the 2018 update of dogfish stock status in the US, where anomalously low survey estimates for 2017 motivated a call for a new framework (benchmark in US terminology) and investigation of dogfish availability to this survey.

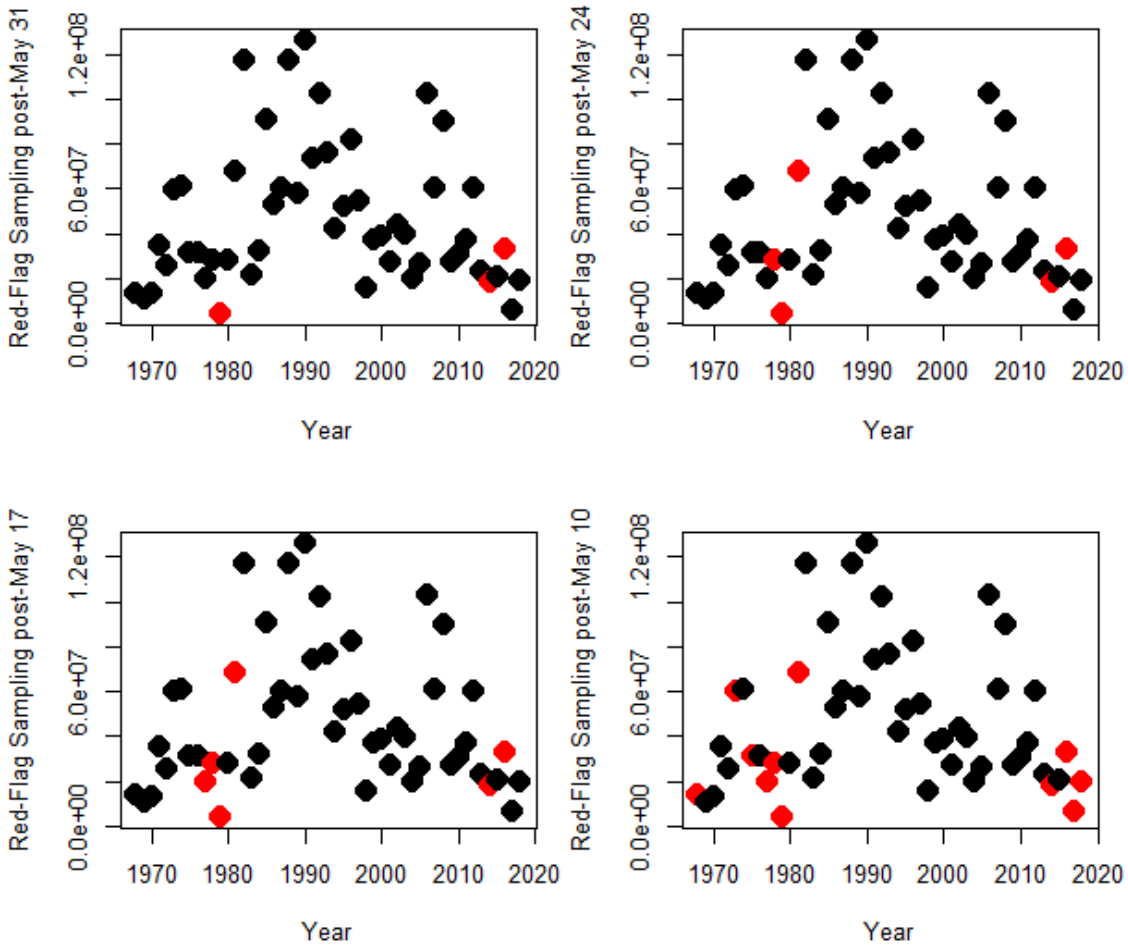

Figure 3. Annual NMFS Spring survey estimates of adult female dogfish abundance. The red dots indicate years in which the survey ended after the date noted on the y-axis.

Adult Versus Demersal Females

During the framework review, several non-model based approaches for interim updates were discussed. Substituting female abundances at demersal lengths for survey-derived adult female abundance was suggested in case the two indices differed with respect to trends. However, the two indices are essentially mirror images (Figure 4), offering no differences in interpretation of trajectories.

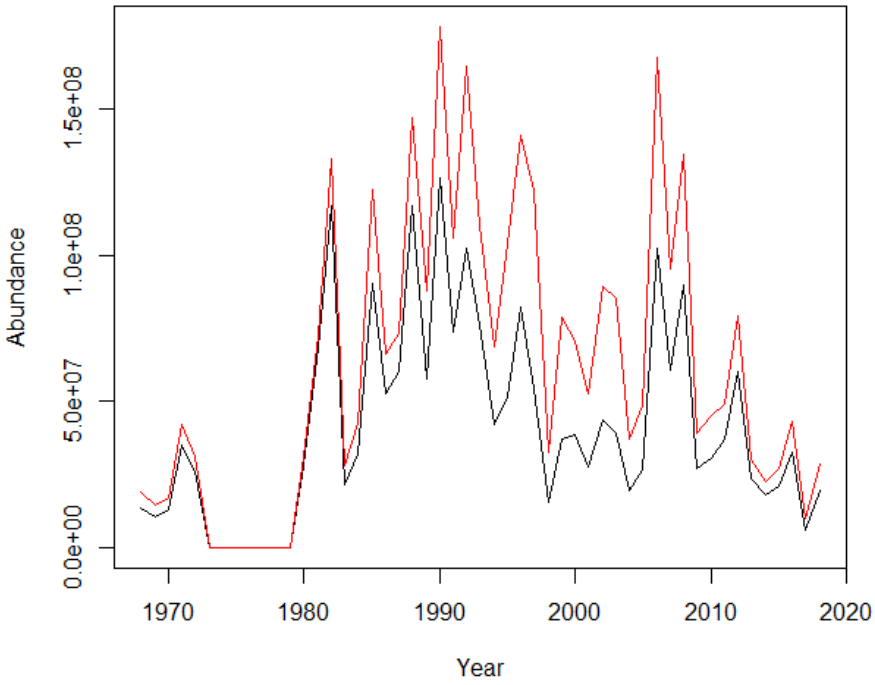

Figure 4. NMFS Spring survey estimates of female dogfish abundance at adult and demersal lengths.

Interim Reference Points and Harvest Control Rule

In the absence of a population model, an approach to setting proxy reference points based on solely the adult female abundance of the US spring survey was proposed at the Northwest Atlantic Spiny Dogfish Framework Part II: Review of Modelling Approaches and Assessment (June 27-28, 2018). The mean of the five years of spring survey adult female estimates encompassing the observed abundance peak in 1990 (1988-1992) was proposed as the Upper Stock Reference (USR) (treating this as the abundance at Maximum Sustainable Yield, MSY) and 40% of the USR as the Lower Stock Reference Point (LSR). Stock status is determined by the taking a bootstrapped median of the last three years in the time series, rather than in the terminal year, to smooth out the variability in survey estimates and reduce the impact of extreme values. We have applied this method here (Figure 5), using 10,000 iterations for the bootstrapping, and the values at +/-25% of the median to represent uncertainty. The USR becomes 95.5 million and the LSR becomes 38.2 million adult females. This approach does not require modelling, so can be applied to any years for which the Spring survey has been completed, allowing us to include 2018. The bootstrapped stock status metric for 2016-2018 is 19.0 million adult females (+/- 25% 15.2 to 23.4 million), which would be in the critical zone.

The Framework review also considered using 80% of the peak abundance as the USR, in which case the USR becomes 76.4 million and the LSR 30.6 million.

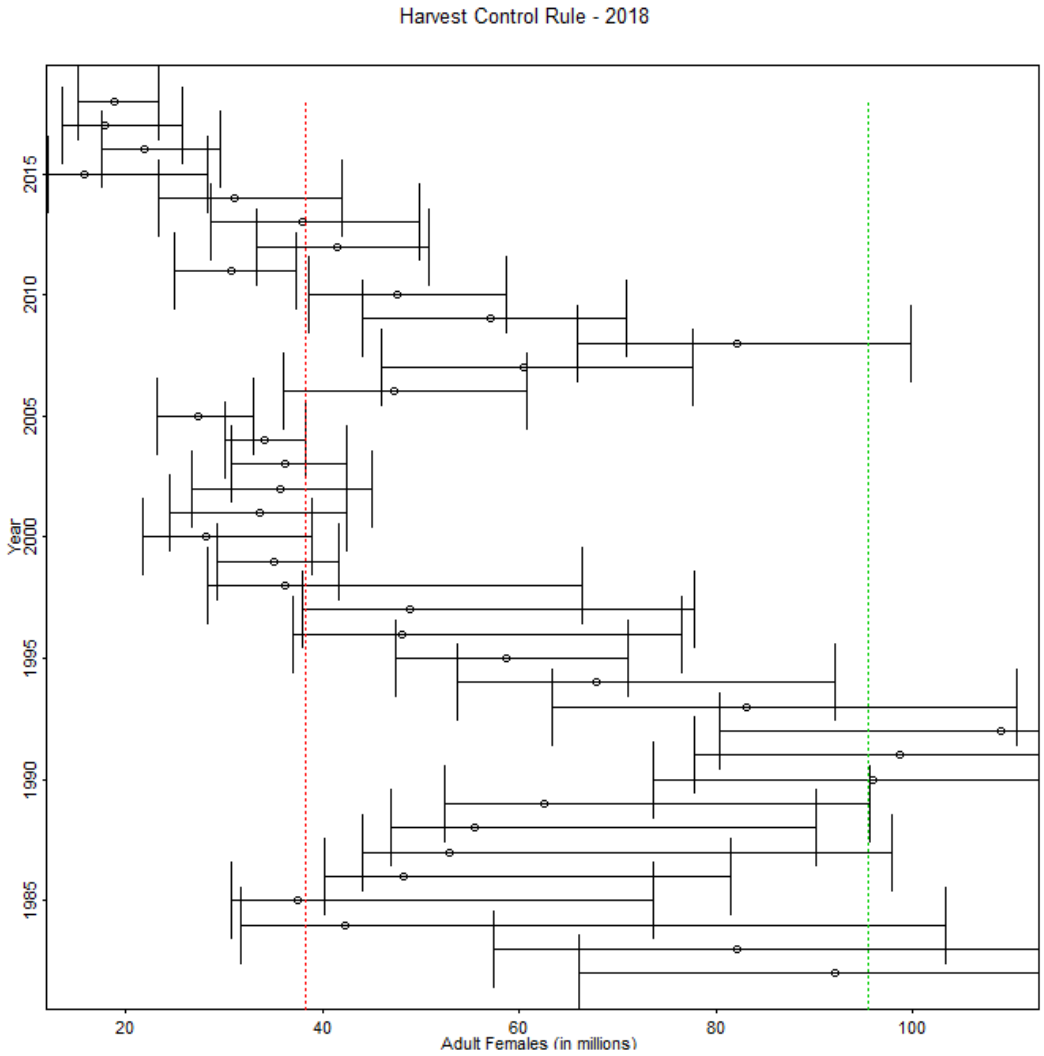

Figure 5. Interim updated Harvest Control Rule based on NMFS Spring survey estimates of adult female abundance, assuming MSY is determined from the observed peak in abundance of adult females in 1990.

DISCUSSION OF THE US NORTHWEST SPINY DOGFISH STOCK ASSESSMENT

The unpublished working paper *Update on the Status of Spiny Dogfish in 2018 and Projected Harvests at the F_{MSY} Proxy and Pstar of 40%* (Sosebee and Rago 2018) was also circulated as a background document for the assessment. The assessment lead, Katherine Sosebee, agreed to summarize some key points related to the assessment.

The structure of how dogfish is assessed has changed. There is now a management track and a research track, where the research track develops the assessment methods, which are applied through the management track, on a 4 year schedule (for dogfish). The assessment approach will be updated via the research track, planned for 2022. The most recent assessment update (2018) included projections at various harvest levels for the next 4 years, and during that time survey-based biomass estimates will be provided annually (likely in September) but they do not plan to rerun the model or do new projections. K. Sosebee noted that it has been difficult to fit a population model to the dogfish time series.

During the 2017 dogfish assessment, there was a call for investigation of availability of dogfish in the US spring survey. Catchability and other questions about data inputs will be looked at

through the research track. It was suggested that it might be possible to have a Canadian participant in the working group for the research track, which would be a good way to start collaborating on this assessment. There was agreement that this should be pursued if possible.

In addition to the type of model, a number of differences between the US and recent Canadian assessment approaches for dogfish were noted. The threshold for pup sizes, for example, differs between the two approaches and the US model is biomass-based while the Canadian approach models abundance. The US assessment approach does not incorporate the size-based calibration between the U.S. survey vessels the Albatross and Bigelow that was recommended at the September 2017 (Canadian) review of data inputs, which leads to a different interpretation of adult female abundance. Appropriate calibration between US survey vessels may be reviewed through the research track for dogfish.

Meeting participants agreed that relying on the US stock assessment to inform our understanding of stock status and provide advice to management had several advantages over simply reporting on the US spring survey index of abundance (i.e., the empirical approach):

- the majority of commercial catch is from the US directed fishery and up to date catch composition information has not been available for Canadian stock assessments, making stock assessment very challenging;
- information needed to interpret US survey indices on an annual basis may be more available to US stock assessors;
- an assessment model that includes biological and commercial catch information presents a more complete picture than relying solely on survey indices.

There was agreement that until a Canadian modeled approach could be developed, relying on the US model would be more informative than reviewing solely the survey index. The most likely mechanism for providing advice to management would be via regular updates prepared by DFO Science including the most recent Canadian catch and discard estimates, the Canadian summer survey catch, and the results of the US update or assessment. The DFO Summer Research Vessel survey would continue to be treated as an index of migration.

Meeting participants agreed to adjourn the meeting to allow participants and the assessment lead time to review the US assessment and determine how to use the information provided to meet Canadian fisheries management needs under the Fishery Decision-Making Framework Incorporating the Precautionary Approach (DFO 2009).

FEBRUARY 13, 2019 – REFERENCE POINTS DISCUSSION AND SCIENCE ADVISORY REPORT

The Assessment was reconvened on February 13, 2019, to discuss how elements of the US Spiny Dogfish stock assessment could be used to meet the requirements of the Fishery Decision-Making Framework Incorporating the Precautionary Approach (DFO 2009), including to determine reference points and stock status, and to draft advice to fisheries managers.

A brief summary of the US stock assessment, reference points, and harvest advice was prepared and added to the draft Science Advisory Report (SAR). Biological reference points are based on a Ricker stock-recruitment model, where SSB_{target} (159,288 mt) is a proxy for adult female SSB_{msy} (the biomass that results in the maximum projected recruitment) and $SSB_{threshold}$ is 50% of the target (79,644 mt) (Rago and Sosebee, 2010). Status relative to reference points and the effects of various future harvest levels are estimated with a stochastic model that incorporates uncertainty in survey sampling and variation in the trawl footprint when calculating swept-area biomass.

After discussion, adopting the US reference points was considered to be appropriate under the Precautionary Approach Framework. The SSB_{target} was used as the USR given that SSB_{target} represents a proxy for adult female biomass at MSY under the US assessment model. The USR becomes 159,288 mt under this approach. The LSR would be the $SSB_{threshold}$ value, calculated as 50% of the USR, with a value of 79,644 mt. This would put the biomass estimates in the Cautious Zone since 2015.

This was noted to be more cautious than the default approach to setting reference points outlined in the Decision-Making Framework Incorporating the Precautionary Approach, in which 80% of SSB_{MSY} is used as the USR and half that value is used as the LRP. However, the guidance also notes that "actual reference points for a stock may use other metrics and be set lower or higher than these references." Choosing more conservative reference points will also mean that the stock will be determined to be in the critical zone at a higher biomass, and will have to increase to higher level to be considered healthy.

Further discussion related to the outcomes of the Northwest Atlantic Spiny Dogfish Framework Part I: Review of Data Inputs (September 19-20, 2017). In this meeting, new calibration methods were adopted to account for the switch in US research vessels to the RV Bigelow. If these calibration methods are applied, recent adult female biomass estimates are considerably lower than using the current US estimates, and the stock would be considered to be in the critical zone. However, DFO does not expect to produce calibrated estimates in the near future for stock status updates. There was agreement to add a figure showing these calibrated biomass estimates to the SAR, although advice on stock status is being provided based on the US biomass estimates, which do not use this calibration approach.

No specific catch advice could be provided, although current levels of removals are low and no directed fishery is occurring. There was agreement that total removals should be kept below the Overfishing Limit as defined in Sosebee and Rago (2018), although subsequent discussions by email suggested that this limit might not be sufficiently precautionary. There was agreement that if a fishery were to be developed or if overall removals increased substantially relative to recent levels, the approach to developing advice for this stock should be revisited.

REFERENCES CITED

DFO. 2009. A fishery decision-making framework incorporating the precautionary approach. Accessed April 2019.

DFO. 2016. Northwest Atlantic Spiny Dogfish Stock Status Update Report. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/019.

Fowler, G.M. and Campana, S.E. 2015. Framework assessment and 2013 update using a stage-based population model for Spiny Dogfish (*Squalus acanthias*) in the Northwest Atlantic. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/065. v + 134 p.

Nammack, M.F., Musick, J.A., and Colvocoresses, J.A. 1985. Life History of Spiny Dogfish off the Northeastern United States. Trans. Am. Fish. Soc. 114: 367–376.

Rago, P.J. and Sosebee, K.A. 2010. Biological reference points for Spiny Dogfish . Northeast Fish Sci Cent Ref Doc. 10-06. 52 p.

Sosebee, K.A. and Rago, P.J. 2018. Update on the status of Spiny Dogfish in 2018 and projected harvests at the Fmsy Proxy and Pstar of 40%. Report to Mid-Atlantic Fisheries Management Council Scientific and Statistical Committee, September 11, 2018. 82 p.

APPENDIX 1: LIST OF MEETING PARTICIPANTS

Participant	Affiliation	Dec 11, 2018	Feb 13, 2019
Barrett, Melanie	DFO Science	X	-
Clark, Kirsten	DFO Science	X	-
Bowlby, Heather	DFO Science	-	X
Couture, John	Unama'ki Institute of Natural Resources (UINR)	X	-
Doherty, Penny	DFO Resource Management	X	X
Ford, Jennifer	DFO Science	X	X
Fowler, Mark	DFO Science	X	X
Gillett, Roxanne	DFO Species at Risk Management	X	-
Hart, Dvora	NOAA Northeast Fisheries Science Center	X	X
Karbowski, Chelsey	Oceans North Canada	X	X
McNeely, Joshua	Maritime Aboriginal Peoples Council (MAPC) – IKANAWTIKET	X	-
Miller, Tim	NOAA Northeast Fisheries Science Center	X	X
Sark, Roger	Maliseet Nation Conservation Council	X	-
Sosebee, Katherine	NOAA Northeast Fisheries Science Center	X	X
Stone, Heath	DFO Science	X	X
Vascotto, Kris	Groundfish Enterprise Allocation Council (GEAC) / Groundfish Individual Transferable Quota Association	X	X

APPENDIX 2: TERMS OF REFERENCE

Stock Assessment of Northwest Atlantic Spiny Dogfish

Regional Advisory Process – Maritimes Region
December 11, 2018 and February 13, 2019
Dartmouth, Nova Scotia

Chairperson: Jennifer Ford

Context

The Northwest Atlantic Spiny Dogfish is a transboundary resource with significant catches in Canada and the United States (USA). The last DFO framework review and assessment of Northwest Atlantic Spiny Dogfish occurred in January and May 2014 using data up to 2010 (Fowler and Campana 2015). The accepted model was a forward-projecting stage-based, spatially explicit population dynamics model with two time steps. Efforts to incorporate more recent data into the framework model have not been successful.

DFO Science has determined that a new framework assessment is required to provide catch advice to Fisheries Management. The first part of this framework assessment, a review of data inputs, was held in September 2017. A second meeting addressed modelling approaches in June 2018. The proposed model was not accepted as the basis to provide management advice, and an index-based approach to providing science advice was proposed.

Objectives

The objectives of the Regional Advisory Process are to:

1. Review and update proxy biological reference points for Northwest Atlantic Spiny Dogfish and evaluate the status of the stock up to 2018 in relation to these reference points. Comment on the uncertainty and relative informative value of the candidate reference points.
2. Provide recommendations on the schedule for ongoing assessment of Northwest Atlantic Spiny Dogfish. Outline a process and guidelines for the monitoring of indicators and other events (e.g., decision rules) that could trigger an earlier than scheduled assessment.

Expected Publications

- Science Advisory Report
- Proceedings

Expected Participation

- DFO Science
- DFO Resource Management
- DFO Species at Risk Management
- Indigenous Communities/Organizations
- U.S. National Marine Fisheries Service
- Fishing industry Representatives
- Environmental Non-Governmental Organizations

References

Fowler, G.M., and Campana, S.E. 2015. Framework Assessment and 2013 Update Using a Stage-based Population Model for Spiny Dogfish (*Squalus acanthias*) in the Northwest Atlantic. DFO Can. Sci. Advis. Sec. Res. Doc. 2015/065.

APPENDIX 3: MEETING AGENDA

December 11, 2018

Time	Topic
9:00 - 9:15	Welcome and Introductions
9:15 -10:30	Review survey-based indicators for dogfish (M Fowler)
10:30 -10:45	Break (hospitality provided)
10:45 -11:30	Proxy biological reference points (M Fowler)
11:30 -12:00	Assessment schedule / triggers (M Fowler)
12:00 – 1:00	Lunch (hospitality not provided)
1:00 - 3:00	Review of Science Advisory Report (Chair)