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Proceedings Series 2015/061

Maritimes Region

Proceedings of the Regional Peer Review of the Northwest Atlantic Spiny Dogfish (*Squalus acanthias*) Framework and Assessment

January 20-21, 2014
Dartmouth, Nova Scotia
Chairperson: Christie Whelan

May 29, 2014
Dartmouth, Nova Scotia
Chairperson: Tana Worcester

Editor: Lottie Bennett

Bedford Institute of Oceanography
Fisheries and Oceans Canada
1 Challenger Drive, PO Box 1006
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January 2016

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.

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TABLE OF CONTENTS

SUMMARY

A Maritimes Regional Science Advisory Process to review the Northwest Atlantic Spiny Dogfish Framework and Assessment was held from January 20-21, 2014, at the Bedford Institute of Oceanography, in Dartmouth, Nova Scotia, and was reconvened on May 29, 2014 (a 2011 meeting was terminated after the first day due to recognition that US landings data that had been provided were incomplete for analysis purposes). The meeting was attended by Fisheries and Oceans Canada (DFO) staff from Science, Resource Management, Policy and Economics, as well as non-government organizations, Aboriginal organizations and the fishing industry.

The model developed and accepted for assessment of Northwest Atlantic Spiny Dogfish in Canada is a forward-projecting stage-based (juveniles and adults, males and females), spatially explicit (two regions: Canada and United States (US)) population dynamics model with two time steps (November-April and May-October) in each year. For the 2014 assessment, this model was updated with data to 2013. There were no substantive changes to parameter estimates or temporal patterns in abundance estimates when the 2010 framework model was updated to 2013, and the fit remained reasonable. Population estimates from the model indicate a dramatic increase in abundance during the 1980s, peaking about 1992, and then declining. The updated model demonstrates increased abundance since 2009, especially of juveniles, with a total population abundance of 789.2 million Spiny Dogfish for 2013. Adult females have remained at relatively high abundance since 2006.

Projections to evaluate the consequences of various catch levels indicate that a total catch (US and Canada, landings and dead discards) of Spiny Dogfish in the vicinity of 47,350 metric tonnes (varies with assumed proportions of catch by region) would result in a 50% risk of decline in adult female biomass after 40 years. Abundance of adult females (SSN) at Maximum Sustainable Yield (SSN_{MSY}) and Fishing Mortality on adult females (F_{SSN_MSY}) were proposed for use to evaluate stock status. Given the low productivity and associated recovery time of Spiny Dogfish, 65% of SSN_{MSY} (21.3 million) is proposed as a Lower Reference Point (LRP) for Spiny Dogfish and SSN_{MSY} (32.8 million) is proposed as the Upper Stock Reference (USR). F_{SSN_MSY} is 0.0723. Spiny Dogfish is currently above the USR; that is, in the healthy zone.

This proceedings report summarizes the relevant discussions and presents the key conclusions reached at the meetings. A Science Advisory Report (SAR) and a Research Document resulting from the meeting will be published on the DFO Canadian Science Advisory Secretariat website as they become available.

Compte rendu de la réunion d'examen par les pairs liée à l'aiguillat commun (*Squalus acanthias*) dans l'Atlantique Nord-Ouest – Cadre et évaluation

SOMMAIRE

Un processus d'avis scientifique régional des Maritimes, qui visait à examiner le cadre et l'évaluation relatifs à l'aiguillat commun dans l'Atlantique Nord-Ouest, a été lancé les 20 et 21 janvier 2014 à l'Institut océanographique de Bedford, à Dartmouth, en Nouvelle-Écosse, et il a été repris le 29 mai 2014. Des employés de Pêches et Océans Canada issus des secteurs des sciences, de la gestion des ressources, des politiques et de l'économie, de même que des organisations non gouvernementales, des organisations autochtones et des représentants de l'industrie de la pêche, ont participé à la réunion.

Le modèle mis au point et accepté pour l'évaluation de l'aiguillat commun de l'Atlantique Nord-Ouest au Canada est un modèle prévisionnel de la dynamique des populations axé sur les étapes (juvéniles et adultes, mâles et femelles) et spatialement explicite (deux régions – le Canada et les États-Unis) avec deux étapes de temps (de novembre à avril et de mai à octobre) chaque année. Pour les besoins de l'évaluation de 2014, ce modèle a été mis à jour avec les données jusqu'en 2013. Il n'y a pas eu de changements majeurs aux estimations des paramètres ou aux tendances temporelles dans les estimations de l'abondance lorsque le modèle de cadre de 2010 a été mis à jour jusqu'en 2013, et l'ajustement est demeuré raisonnable. Les estimations de la population inhérentes au modèle indiquent une augmentation spectaculaire de l'abondance durant les années 1980, celle-ci atteignant un sommet vers 1992, puis diminuant par la suite. Le modèle mis à jour montre une augmentation de l'abondance depuis 2009, et plus particulièrement de l'abondance des juvéniles, avec une abondance de la population totale d'aiguillats communs de 789,2 millions d'individus en 2013. L'abondance des femelles adultes est demeurée relativement élevée depuis 2006.

Les projections pour évaluer les conséquences de différents niveaux de captures laissent à penser que des captures totales (au Canada et aux États-Unis, débarquements et rejets de poissons morts) d'aiguillats communs d'environ 47 350 tm (chiffre pouvant varier selon les proportions supposées des prises par région) entraîneraient un risque de 50 % d'un déclin de la biomasse des femelles adultes au bout de 40 ans.

On a proposé d'utiliser les valeurs de l'abondance des femelles adultes (ESR) au rendement maximal soutenu (ESR_{RMS}) et de la mortalité par pêche des femelles adultes (F_{ESR_RMS}) durant l'évaluation de l'état du stock. Compte tenu de la faible productivité et du délai de rétablissement connexe de l'aiguillat commun, 65 % du ESR_{RMS} (21,3 millions) est proposé comme point de référence limite pour l'aiguillat commun, et le total du ESR_{RMS} (32,8 millions) est proposé comme point de référence supérieur. Le taux de F_{ESR_RMS} se chiffre à 0,0723. L'aiguillat commun est actuellement au-dessus du point de référence supérieur, c.-à-d. dans la zone saine.

Le présent compte rendu résume les discussions pertinentes et présente les conclusions importantes tirées de la réunion. En outre, dès qu'ils deviendront accessibles, un avis scientifique et un document de recherche découlant de la réunion seront publiés sur le site Web du Secrétariat canadien de consultation scientifique du ministère des Pêches et des Océans.

INTRODUCTION

A Canada-United States (US) Transboundary Resources Assessment Committee (TRAC) assessment meeting was held in early 2010 to develop a joint assessment framework (benchmark) for Northwest Atlantic Spiny Dogfish. However, this meeting was unable to reach consensus on an assessment model at that time. Both the US and Canada have continued development of Spiny Dogfish stock and population models independently since 2010.

A Maritimes Regional Science Advisory Process to review a Northwest Atlantic Spiny Dogfish framework and assessment approach to be used in Canada was held from January 20-21, 2014, at the Bedford Institute of Oceanography, in Dartmouth, Nova Scotia (a 2011 meeting was terminated after the first day due to recognition that US landings data that had been provided were incomplete for analysis purposes). Due to time constraints, the assessment was not finalized during the meeting in January 2014. The meeting was reconvened on May 29, 2014, at the Bedford Institute of Oceanography, to complete the assessment and finalize the Science Advisory Report.

This proceedings report is the record of these discussions.

NORTHWEST ATLANTIC SPINY DOGFISH FRAMEWORK (JANUARY 20-21, 2014)

INTRODUCTION

The Chair of the meeting, Christie Whelan, welcomed participants. Meeting participants introduced themselves (Appendix 1A), and the Chair thanked them for attending the DFO Science Advisory Process to review a proposed assessment framework for Northwest Atlantic Spiny Dogfish.

The Chair noted that this was a Science peer review and advisory meeting, meaning the primary goals were to: 1) provide an objective review of the Working Paper to ensure information was complete; and 2) review the Science Advisory Report based on this information.

The Chair provided a brief overview of the Canadian Science Advisory Secretariat (CSAS) science advisory process and invited participants to review the meeting Terms of Reference (Appendix 2) and Agenda (Appendix 3A). No revisions or corrections were made to the Terms of Reference or Agenda.

To guide discussion, a Working Paper had been prepared and was distributed for review prior to the meeting.

FRAMEWORK

Presentation: Stage-based population model for Northwest Atlantic Spiny Dogfish. G. M. Fowler and S. Campana. CSA Working Paper 2014/01.

Presenter: Mark Fowler
Rapporteur: Lottie Bennett

Presentation Highlights

During the 2010 Transboundary Resource Assessment Committee (TRAC) Spiny Dogfish Benchmark and Assessment meeting, Canada and the US failed to reach an agreement on a population model for the Northwest Atlantic Spiny Dogfish and subsequently proceeded to independently develop Spiny Dogfish stock and population models.

Following the 2010 TRAC meeting, Canada developed a stage-based model, representing population dynamics by sex and maturity stages. Model inputs and assumptions associated with population components, seasonal migrations, growth and maturity rates, pupping rates, recruitment, mortality, and carrying capacity were presented and discussed.

Discussion

Staged Based Model

Currently, estimates of the number of Spiny Dogfish that move between Canada and the US waters are uncertain. Timing of seasonal migrations is known; however, the magnitude of movement is unclear since population surveys in the Canada and US occur during time periods that migrants from the other region are present. Thus, estimates of population component migrations are obtained through model fitting.

Although the Spiny Dogfish population is considered one metapopulation, with migratory and resident components, the population model also provides regional stock abundance estimates for the Canadian and US components of the population. Stock abundance estimates for one region include any migrants from the other region. The Canadian stock is defined as Spiny Dogfish in Canadian waters during the summer, corresponding to the timing of the Canadian DFO Summer Research Vessel (RV) survey. The US stock is defined as Spiny Dogfish in US waters during late winter/early spring, corresponding to the timing of the US National Marine Fisheries Service (NMFS) Spring RV survey.

Since a formal data sharing agreement does not currently exist between Canada and the US, the framework model could not be updated beyond 2010. To achieve an update of the assessment to 2013, it was recommended that the Canadian inputs be completed and a Canadian stock abundance model be used. This could be accomplished by not including migration of Spiny Dogfish between Canada and the US (i.e., migration component turned off in model). This allows for stock abundance estimates by region and enables a Canadian stock abundance model to be used when US data is unavailable.

The stage-based model follows the pattern of survey estimates during periods of low abundance, but does not fit survey peaks well. Most of the Canadian survey abundances are predicted as migrants from the US population component. As a result, the abundance estimates from the Canadian Summer RV survey are more jagged in appearance than the US Spring RV survey abundance estimates.

It was noted that the lack of mature females collected in the Canadian Summer RV survey is a shortcoming of the use of Canada-only data. As a result, Canadian stock abundance is greatly under-estimated by the Canadian stock abundance model relative to the population model.

Pupping

Region-specific pupping rates are available from Canadian and US studies. These were applied to the length frequencies of mature females collected during the Canadian Summer and US Spring RV surveys to estimate pupping by region.

Even without fishing, simulations of the Canadian component of the population, with pupping rates derived from Canadian sampling, resulted in local extirpation of Spiny Dogfish in the absence of migration. It was, therefore, recommended that pupping rates based on US studies be used for both regions.

Poor representation of the size composition of adult females in the Canadian Summer RV survey would likely distort estimates of pupping rates of Spiny Dogfish in Canadian waters.

Thus, it was recommended that pupping rates derived from the US Spring RV survey be used for the Canadian and US components of the population.

Maturity

Region-specific values for theta (i.e., juvenile to adult transition) were based on proportions mature-at-length determined from the same studies that provided pupping rates. These were applied to survey length frequencies and treated as observed values in the model. Predicted thetas were fitted to observed thetas with large assumption errors, but with the maximum estimated value for the proportion of juveniles maturing in a given year being capped at 0.04.

It was noted that juvenile Spiny Dogfish favour pelagic habitat, while the spring and summer surveys sample benthic habitat and, as a result, juvenile catchability in the surveys is low.

As mentioned above, simulations indicated that a Spiny Dogfish population would not survive with estimates of pupping and maturity based on Canadian sampling. It was recommended that US maturity estimates be used for both Canadian and US components of the population.

Reference Points

To derive maximum sustainable yield (MSY) based reference points, carrying capacity (K) is assumed to be at or above the estimated peak in population abundance during the observed period. Noting that the peak abundance of Spiny Dogfish was followed by a large drop in abundance that could not be attributed to fishing, suggesting the possibility of density-dependent processes, it was recommended that the highest estimated abundance be used as the estimate for carrying capacity.

The range of estimates for intrinsic growth rate (*r*) suggested for the Northeast Atlantic and Pacific Spiny Dogfish populations were deemed reasonable, with Northwest Atlantic Spiny Dogfish considered to be within a range of 0.042-0.062. Intrinsic growth rates of 0.042, 0.052, and 0.062 were used when estimating fishing mortality at MSY (F_{MSY}) during the assessment.

It was noted that estimates of carrying capacity do not change greatly with different intrinsic growth rate values.

During the meeting, estimates of biomass under varying fishing mortality scenarios were not presented. It was, therefore, unclear what values should be used for the lower reference point (LRP) and the upper stock reference (USR) point. It was recommended that simulations and projections be completed to evaluate reference points; however, until those simulations and projections were completed, values of 40 and 80% biomass at MSY (B_{MSY}), as outlined in the precautionary approach, were used as default LRP and USR values.

Fishing Mortality

Estimates of fishing mortality (F) are derived from the model with removals based on catch data. Estimates of discards came from observer data that was prorated by fishery and year. It was recommended that fishing removals, derived as abundance, be converted to biomass (tonnes) for interpretation as catch levels.

It was noted that fishery discard catches-at-length were converted to the numbers of dead fish by assuming discard mortalities (primarily for longline, otter trawl, and gillnet fisheries). The assumed mortalities were derived from a 2010 TRAC meeting.

Next Steps

Based on discussion during the meeting and in preparation for the Spiny Dogfish assessment, the Science team were asked to complete the following tasks:

- run a Canada-only stock abundance model with data up to 2013;

- model F_{MSY} and B_{MSY} to estimate MSY under various regimes;
- include quantitative diagnostics of model;
- restrict *r* to range of 0.04 to 0.06 for different MSY scenarios;
- determine length of time to rebuild population based on B_{MSY} to define LRP, USR and Removal Reference (RR);
- include phase plots to present relationship between fishing mortality and changes in biomass;
- summarize discards;
- examine survey for day and night differences that might affect estimates of abundance and model fit;
- evaluate the consequences of different harvest levels on stock abundance and exploitation rate [added by DFO Resource Management after the meeting]; and
- evaluate the current status of the stock relative to candidate reference points [added by DFO Resource Management after the meeting].

CONCLUSIONS

At the end of the meeting, consensus was reached on the framework model and data inputs. The model developed and accepted for assessment of Northwest Atlantic Spiny Dogfish in Canada was a forward-projecting, stage-based (juveniles and adults, males and females), spatially explicit (two regions: Canada and US) population dynamics model with two time steps (November-April and May-October) in each year. However, due to time constraints, the assessment of current stock status was not completed. It was agreed that the meeting would be reconvened to complete the Spiny Dogfish assessment and finalize the SAR. A number of follow-up tasks were proposed. The proposed task list was intended to provide guidance for deriving reference points from the model and updating the assessment model to 2013.

The Chair thanked all the participants for a productive meeting and for their helpful comments and suggestions throughout. She specifically thanked the science team and reviewers for their contributions to the process. The meeting was adjourned.

NORTHWEST ATLANTIC SPINY DOGFISH ASSESSMENT (MAY 29, 2014)

INTRODUCTION

The Chair of the meeting, Tana Worcester, welcomed participants (Appendix 1B) to the conclusion of the Northwest Atlantic Spiny Dogfish framework and assessment. The Chair provided a brief overview of the Canadian Science Advisory Secretariat (CSAS) science advisory process and invited participants to review the meeting Terms of Reference (Appendix 2) and Agenda (Appendix 3B). No revisions or corrections were made to the Terms of Reference or Agenda.

Since the framework meeting in January 2014, a number of internal DFO meetings had been held to address issues that arose when attempts were made to update the assessment model to 2013 using the approach agreed to previously (i.e., running a Canada-only stock abundance model). Proposed solutions would be presented at this meeting for review.

The Working Paper had been revised for this meeting and distributed ahead of time for review.

ASSESSMENT

Presentation: Framework Assessment and 2013 Update Using a Stage-based Population Model for Spiny Dogfish (*Squalus acanthias*) in the Northwest Atlantic. M. Fowler. CSA Working Paper 2014/13.

Presenter: M. Fowler
Rapporteur: L. Bennett

Presentation Highlights

The Canadian stock abundance model presented at the Spiny Dogfish framework meeting held on January 20-21, 2014, and the list of tasks originating from that meeting were reviewed. Several approaches to update the 2010 framework model through 2013 were presented and discussed. Results from the updated 2013 Canadian stock abundance model and an updated 2013 population model were presented. The 2013 population model was used to conduct simulations to estimate the consequences of various exploitation scenarios on stock status, which provided a foundation for deriving reference points. Harvest Control Rule charts for two indicators (total biomass with F_{MSY} and adult female abundance (SSN) at MSY (SSN_{MSY}) with fishing mortality on adult females (F_{SSN_MSY})) were presented. Projections of various exploitation scenarios that were used to estimate consequences of harvest strategies relative to reference points were presented.

Discussion

Model Update

To monitor stock status of Spiny Dogfish in Canadian waters, in the absence of US data, there was consensus during the framework meeting on January 20-21, 2014, to update the Canadian data by not including migration of Spiny Dogfish between Canada and the US (i.e., migration component turned off in model) in the 2010 population model to obtain an updated Canadian stock abundance model.

This approach was evaluated by using both US and Canadian stocks with the 2010 population model data. This enabled a direct comparison between population and stock abundance models using the same data. During the evaluation, it was noted that the carrying capacity for the population is inflated by using independent stock abundance models for the regions, and Canadian stock abundance is underestimated by 50% relative to the population model. As a result, this approach was not recommended for future use.

As an alternative, updated Canadian data and assumptions made on summary information from US survey abundance and catch data were used to update the population model. This included the assumptions that 2010 US catch composition and dead discard proportion remained appropriate and that the 2013 US total allowable catch represent total landings for 2013. In comparison to the 2010 population model, the updated model produced comparable parameter estimates and temporal patterns in abundance estimates and the fit remained reasonable. The updated model also preserved trends in population components, and the 2011-2013 survey results, portraying increased abundance of the remaining components, are compatible with previous model predictions. For these reasons, it was recommended that the updated 2013 population model be used to complete the Spiny Dogfish assessment.

Reference Points

There was a discussion concerning the use of SSN, as opposed to using total biomass, for setting reference points for the population. Despite being the drivers of the population, adult

females rarely exceed 4% of the population yet typically comprise 28% of the catch, making Spiny Dogfish highly vulnerable to overfishing the reproductive component of the population. It was also noted that, due to the longevity of the species, along with the protracted juvenile pelagic stage, there may be an extensive lag period before consequences of overfishing are realized. Thus, adult females could be overfished without reference points based on the whole population providing an early warning. Fishing mortality at MSY was also compromised by being based on historical catch compositions that do not correspond with those of recent fisheries, while F_{SSN_MSY} was determined for current fishery conditions by simulation. Given the demographics of the species and the fishery, the use of SSN as the indicator of stock status, as opposed to total biomass, was considered a more sensitive measure of population resilience. It was, therefore, recommended that SSN_{MSY} and F_{SSN_MSY} be used to estimate the consequences of exploitation both historically and when projecting future catch levels.

A series of projections were applied to the population model to estimate the length of time required for the population to recover to B_{MSY} if fished to a given percentage of B_{MSY}. It was noted when the population was fished from 80 to 40% of B_{MSY}, the time required to recover to B_{MSY} ranged from 8 to 24 years. The age to maturity of female Spiny Dogfish was estimated at 14 years. This corresponds to a recovery time of one generation if the population was fished to 65% B_{MSY}. It was recommended that 65% of B_{MSY} be used as the LRP. Given long expectations for recovery and the low productivity of the population, SSN_{MSY} was recommended as the USR point.

Population Model Projections

Projections were run to determine the annual total catch that would result in 25%, 50%, and 75% probability of decline in SSN at 40 years. These projections required assumptions regarding the allocation of catch between regions, as differences in catch compositions between regions could alter projection results for a given total catch. Two approaches, the catch ratio and K ratio assumptions, were presented. The catch ratio approach applied the historical mean regional catch ratio, as observed during 2002-2006, the most recent period when both regions had active fisheries on Spiny Dogfish. The K ratio approach used a regional catch ratio based on the ratio of peak stock abundances estimated by the population model (not really K, but similar and convenient). Projection results varied little between these approaches. The catch ratio approach was favoured. With this approach, it was estimated that a catch of 47,350 mt could be removed from the population without lowering population abundance, at P = 0.5. It was noted, however, that the 2014 US quota would account for approximately 45,000 mt.

It was noted that annual tracking of catch and discard compositions is critical to monitor stock status, as projection results are very sensitive to the assumed catch compositions. Catch composition and fishing method drive the composition of the population and changes in catch composition will impact the reference points.

Model Diagnostics

There was a discussion concerning a method to quantify how well the population model is working. Since no formal statistical tests for comparing Bayesian models have been developed, a Deviance Information Criterion (DIC) was applied to the population model, with differences over 10 taken to argue for inclusion of model terms and differences under 5 were taken to argue for removal of model terms. These criteria were reported on the AD Model Builder (ADMB) website. All test results were much higher than 10 or much less than 5. These tests indicated that annual deviates on winter migration from Canada to the US were unnecessary. Removing these had no effect on model results.

CONCLUSIONS

For this assessment, the framework model was updated with data to 2013. There were no substantive changes to parameter estimates or temporal patterns in abundance estimates when the 2010 framework model was updated to 2013, and the fit remained reasonable. Population estimates from the model indicate a dramatic increase in abundance during the 1980s, peaking about 1992, and then declining. The updated model demonstrates increased abundance since 2009, especially of juveniles, with a total population abundance of 789.2 million Spiny Dogfish for 2013. Adult females have remained at relatively high abundance since 2006.

Projections to evaluate the consequences of various catch levels suggest that a total catch (US and Canada; landings and dead discards) of Spiny Dogfish in the vicinity of 47,350 mt (varies with assumed proportions of catch by region) would result in a 50% risk of decline in adult female biomass after 40 years.

Abundance of adult females at MSY (SSN_{MSY}) and F on adult females (F_{SSN_MSY}) were proposed for use to evaluate stock status. Given the low productivity and associated recovery time of Spiny Dogfish, 65% of SSN_{MSY} (21.3 million) is proposed as a LRP for Spiny Dogfish and SSN_{MSY}(32.8 million) is proposed as the USR. Fishing mortality at SSN_{MSY} is 0.0723. Spiny Dogfish is currently above the USR; that is, in the healthy zone.

Future assessments of Spiny Dogfish will require further consideration of the US data inputs. As such, Spiny Dogfish could be considered for assessment through the TRAC process, as formal data sharing arrangements could assist with data input evaluation for this species.

A SAR was completed, and it was agreed that the Working Paper would be produced as a CSAS Research Document. It was agreed that a final version of the SAR would be circulated to participants of the reconvened meeting for validation of agreed edits.

The Chair acknowledged and commended the Science team for their efforts in preparation and presentation of the assessment.

APPENDICES

APPENDIX 1A. LIST OF PARTICIPANTS: JANUARY 20-21, 2014

Northwest Atlantic Spiny Dogfish Framework
Maritimes Regional Science Advisory Process

Lewis H. King Boardroom
Bedford Institute of Oceanography

20-21 January 2014

Chair: Christie Whelan

PARTICIPANTS

Name	Affiliation
Bennett, Lottie	DFO Maritimes / Centre for Science Advice
Brilliant, Sean	Canadian Wildlife Federation (CWF)
Campana, Steve	DFO Maritimes / Population Ecology
Claytor, Ross	DFO Maritimes / Population Ecology
Docherty, Verna	DFO Maritimes / Resource Management
Fowler, Mark	DFO Maritimes / Population Ecology
Grandy, Robert	DFO Maritimes / Policy & Economics
Jayawardane, Aruna	Maliseet Nation Conservation Council / Fisheries
Kulka, Dave	DFO Science Emeritus
MacDonald, Carl	DFO Maritimes / Resource Management
MacDonnell, Anna	DFO Maritimes / Population Ecology
Maxwell, Judith	Scotia-Fundy Inshore Fishermen's Assn. (SFIFA)
McNeely, Joshua	Maritime Aboriginal Peoples Council (MAPC) - IKANAWTIKET
O'Connor, Michael	Transboundary Mgmt. Guidance Committee (TMGC)
Simpson, Mark R.	DFO Newfoundland / Marine Fish Species at Risk
Wang, Yanjun	DFO Maritimes / Population Ecology (SABS)
Whelan, Christie	DFO Maritimes / Centre for Science Advice
Wimmer, Tonya	WWF-Canada, Atlantic Region
Worm, Boris	Dalhousie University / Biology

APPENDIX 1B. LIST OF PARTICIPANTS: MAY 26, 2014

Reconvened Northwest Atlantic Spiny Dogfish Framework and Assessment
Maritimes Regional Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography

29 May 2014
(Reconvened from 20-21 January 2014)

Chair: Tana Worcester

PARTICIPANTS

Name	Affiliation
Bennett, Lottie	DFO Maritimes / Centre for Science Advice
Brilliant, Sean	Canadian Wildlife Federation (CWF)
Claytor, Ross	DFO Maritimes / Population Ecology
Fowler, Mark	DFO Maritimes / Population Ecology
Jayawardane, Aruna	Maliseet Nation Conservation Council / Fisheries
Joyce, Warren	DFO Science Maritimes Region
MacDonald, Carl	DFO Maritimes / Resource Management
Spence, Koren	DFO Maritimes / Species at Risk
Worcester, Tana	DFO Maritimes / Centre for Science Advice

APPENDIX 2: TERMS OF REFERENCE

Northwest Atlantic Spiny Dogfish Framework and Assessment

Maritimes Regional Science Advisory Process

January 20-21, 2014, and May 29, 2014

Dartmouth, NS

Chairperson: Christie Whelan

TERMS OF REFERENCE

Context

The Northwest Atlantic Spiny Dogfish is a transboundary resource with significant catches in Canada and the United States (US). Although a joint Canada-US Transboundary Resources Assessment Committee (TRAC) assessment was held in early 2010, there was no consensus on the new assessment model. Canada currently has no reference points and no scientifically-based management plan.

Fisheries Management has asked DFO Maritimes Science to complete a framework and conduct an assessment on the status of the Northwest Atlantic Spiny Dogfish. A combination of a framework and stock assessment will provide DFO with an assessment for the Northwest Atlantic Spiny Dogfish resource and approach upon which to base management advice. The framework should include an evaluation and monitoring of the indicators and other events that could trigger an earlier than scheduled assessment.

The last DFO assessment of Spiny Dogfish occurred in May 2011; however the model was not accepted.

Objectives

- Review and evaluate biological and fishery information on Spiny Dogfish stock status as it relates to Canada and characterize the uncertainty of the results. In particular, provide information on distribution, biomass estimates and age and sex composition, highlighting any trends over the long-term (length of assessment) and most recent period (5 years).
- Review the formulation of an assessment model for the northwest Atlantic stock which takes into account catch and abundance indices in Canada and the US, as well as transboundary mixing.
- Applying the accepted framework assessment model, evaluate the consequences of different harvest levels over a five year time period (2014/15 – 2018/19) on stock abundance and exploitation rate.
- Identify appropriate biological reference points for Northwest Atlantic Spiny Dogfish and evaluate the current status of the stock in relation to these reference points. Comment on the uncertainty and relative informative value of the candidate reference points.
- Report on the level of discards of Spiny Dogfish in the multi-species groundfish fishery and comment on the expected impacts of these discards (e.g. survivorship).
- Report on the bycatch of non-target species in the Spiny Dogfish fishery in 4VWX5 and identify any notable changes in the occurrence of these species relative to previous years.
- Provide recommendations on the schedule for ongoing assessment 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
- Research Document(s)
- Proceedings

Participation

- DFO Science
- DFO Fisheries Management
- Provincial representatives
- Industry
- NGOs
- Aboriginal groups and organizations
- Invited external reviewer(s)

APPENDIX 3A. MEETING AGENDA: JANUARY 20-21, 2014

Northwest Atlantic Spiny Dogfish Framework and Assessment

Maritimes Region Science Advisory Process

Lewis H. King Boardroom
Bedford Institute of Oceanography
Dartmouth, NS

January 20-21, 2014

Chairperson: Christie Whelan

DRAFT AGENDA

January 20, 2014 - Monday

9:00 - 9:30	Introductions and review of Agenda
9:30 – 10:00	Biology and stock structure
10:00 – 10:30	Movements
10:30 – 10:45	BREAK
10:45 - 11:15	Fishery (landings and discards)
11:15 - 11:45	Abundance indices (surveys)
11:45 - 12:45	Lunch (not provided)
12:45 - 1:30	Historical overview of past assessments
1:30 - 2:30	Presentation of current suggested stage-based population model
2:30 – 2:45	BREAK
2:45 – 3:30	Review and comparison with alternative models (surplus production, VPA)
3:30-4:30	Discussion

January 21, 2014 - Tuesday

9:00 - 9:30	Review of Day One
9:30 - 10:15	Discussion and Conclusions
10:15 - 10:30	BREAK
10:30 – 12:00	Review of Science Advisory Report (SAR)
12:00 - 1:00	LUNCH (not provided)
1:00 – end	Review of SAR (continued)

APPENDIX 3B. MEETING AGENDA: MAY 29, 2014

Northwest Atlantic Spiny Dogfish Framework and Assessment

Maritimes Region Science Advisory Process

Hayes Boardroom
Bedford Institute of Oceanography
Dartmouth, NS

May 29, 2014

Chairperson: Tana Worcester

DRAFT AGENDA

May 29, 2014 – Thursday

9:00 – 9:15	Introductions and review of Agenda
9:15 – 10:30	Presentation of Spiny Dogfish Assessment Models
10:30 – 10:45	BREAK
10:45 – 11:15	Presentation of Reference Points and Indicators
11:15 – 12:00	Discussion
12:00 – 1:00	LUNCH (not provided)
1:00 – 2:30	Discussion and development of advice
2:30 – 2:45	BREAK
2:45 – end	Review of Science Advisory Report (SAR)