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Proceedings of the Regional Peer Review meeting of the Assessment of Atlantic Mackerel in Subareas 3-4

March 5-7, 2019
Mont-Joli, QC

Chairperson: Mathieu Desgagnés
Editor: Sonia Dubé

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December 2019

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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SUMMARY

This document outlines the proceedings of the regional peer review meeting on the assessment of the Atlantic Mackerel in Subareas 3-4. This meeting, was held on March 5-7, 2019 at the Maurice Lamontagne Institute in Mont-Joli, brought together more than forty participants from science, management, industry, academia, provincial government and environmental non-governmental organisations. These proceedings detail the essential parts of the presentations and discussions held during the meeting, as well as the recommendations and conclusions made.

CONTEXT

The Quebec Region of Fisheries and Oceans Canada (DFO) is responsible for assessing several stocks of fish and invertebrate species harvested in the Estuary and Gulf of St. Lawrence. Most of these stocks are periodically assessed as part of a regional advisory process conducted at the Maurice Lamontagne Institute in Mont-Joli. This document outlines the proceedings of the meeting on the assessment of the Atlantic Mackerel in Subareas 3-4 held on March 5-7, 2019.

The last assessment of Atlantic mackerel in Canada took place in March of 2017. The Fisheries Resource Management Branch has requested scientific advice on Atlantic Mackerel in Canadian waters for the 2019 and 2020 fishing seasons and to support the development of management measures for a Rebuilding Plan under the Precautionary Approach Framework.

These proceedings report on the main points discussed in the presentations and deliberations stemming from the activities of the regional stock assessment committee. The regional peer review meeting is a process open to all participants who are able to provide a critical outlook on the status of the assessed resources. Accordingly, participants from outside DFO are invited to take part in the committee's activities within the defined terms of reference for this meeting (Appendices 1 and 2). The proceedings also list the recommendations made by the meeting participants.

INTRODUCTION

Meeting Chair Mathieu Desgagnés welcomed the participants. He went over the peer review's objectives and agenda. He noted the presence of two reviewers, Sean Cox from Simon Fraser University in Vancouver and Fan Zhang from Memorial University in St. John's. Following a round table introduction of the participants, Andrew Smith, the stock assessment biologist, opened the meeting by highlighting the contributions of the collaborators. He provided a brief summary of the most recent assessment of the Atlantic mackerel (in winter 2017) and the agenda for the following three days (Appendix 3). The objective of the review was to assess the current stock status in terms of the precautionary approach framework and the potential effects of various management measures on the Atlantic mackerel stock in subareas 3 and 4.

UPDATE OF KNOWLEDGE

POPULATION STRUCTURE AND BIOLOGY

Andrew Smith presented the distribution of blue mackerel and the outcomes of population structure studies (otolith chemistry and genetics). The Northwest Atlantic population is genetically distinct from the European population. This population is a transboundary stock, which means that some individuals born in Canada are likely getting caught in the American fishery. However, based on the available information, fish born in the United States do not contribute to the Canadian fishery.

The outcomes of a recent genetic study presented by Geneviève Parent corroborate the data from previous tagging studies. Genetic analysis of mackerel caught in northeastern Newfoundland (3KL), the Gulf of St. Lawrence and Europe suggested that almost all genotyped adult mackerel caught in northeastern Newfoundland had a genetic signature from the Northwest Atlantic.

- It was noted that future outcomes would help determine whether individuals from the Western and Eastern Atlantic were interbreeding.
- In addition, the preliminary outcomes pointed toward some differentiation between the Northern and Southern contingents, but this remained to be confirmed.
- Mackerel in the Central Atlantic (Iceland and Greenland) appeared to constitute a recent extension of the European population.
- The participants also considered anticipated changes in the distribution of Northwest Atlantic mackerel in relation to global warming. Knowledge of the species suggested a northward shift, as this species is highly sensitive to water temperature.

Andrew Smith briefly reviewed some components of the species' biology (habitat, diet, predation and natural mortality). Safouane Khamassi presented the results of a study on the Northern Gannet as a sampler of juvenile Atlantic mackerel in order to estimate the age at which recruitment was established according to the larval growth trajectory. Based on the conclusions of this study, cohort strength was established at about three months of age, and the Northern Gannet appeared to be a good sampler.

- The participants agreed that a longer-term database could be useful as an indicator of cohort strength to serve as a predictor of recruitment in stock assessments.

EGG SURVEYS

Egg surveys in the southern Gulf help determine annual spawning peaks. These surveys are also used to estimate an index for spawning stock biomass (SSB). Since 2005, this index has declined to about one-twentieth of the levels observed in the 1980s.

- According to the survey, a reduction in spawning area was observed between 2015 and 2018. The peak spawning period has remained fairly constant over time despite the environmental changes observed.
- The participants suggested that annual egg production be used directly as an index for model calibration instead of SSB.

Analysis of environmental influence on the distribution of spawning areas indicated that optimal temperature, salinity, depth and preferred prey conditions were present in June and July in the southern Gulf.

- It was noted that no spawning habitats had been identified in northeastern Newfoundland. Additional surveys indicated that the southern Gulf remained the main spawning area. Southern Newfoundland, on St. Pierre Bank, may be a potential future site.
- According to this model, new colonization toward the northern Gulf and extinctions in the south could occur in the future.

FISHERY

Mackerel are fished commercially in the Atlantic Provinces and Quebec. This is a primarily inshore fishery where a variety of gear types are used (gillnets, mechanical jiggers, seines, weirs and traps), which vary by region and time of year. While each fishery has its own regional harvest control rules, mackerel are managed on a national level. The minimum legal size is 26.3 cm. Mackerel are also harvested for bait as well as for recreational fishing.

Commercial Atlantic mackerel landings reported in NAFO subareas 3 and 4 have declined sharply in recent years. Between 2005 and 2013, they fell from 54,726 t to 8,674 t before reaching a record low of 4,272 t in 2015. Preliminary landings in 2017 and 2018 were 9,430 t and 10,499 t respectively. The total allowable catch (TAC) was reached for the first time in 2016. The TAC was then increased from 8,000 t to 10,000 t in 2017 and exceeded in 2018. Total landings in U.S. waters (commercial fishing plus recreational fishing and discard estimates) have also declined significantly in recent years. In 2016 and 2017, landings were 10,277 t and 11,230 t. According to the 2017 U.S. Northwest Atlantic stock assessment, it was determined that mackerel were over-fished, and the overfishing was ongoing.

Preliminary otolith stable isotope analysis and synthesis of tagging data suggested that a large proportion of mackerel catches in the U.S. fishery were made up of mackerel from the Northern contingent. Estimates of mackerel removals from the Northern contingent in U.S. waters were now explicitly incorporated into this stock assessment.

- There were major deficiencies in the availability of data in some areas. Participants found these deficiencies regrettable and wanted them to be corrected. They also noted a lack of consistency in the accounting of catches between regions.
- Although there was no joint Canada-United States assessment, active collaboration between scientists was reported.

Total Canadian mackerel catches appeared to be significantly underestimated, because some of the bait fishery catches were not reported, Dockside Monitoring Program coverage varied by province, and sport fishing catches were not quantified. Additionally, discards of mackerel (including fish under legal size) were not known. This issue had been studied using summaries of available data on bait requirements, recreational fishing, sampler reports, the literature and fisher surveys (2016, 2018).

- It was noted that the proportion of mackerel from the Canadian contingent caught in the U.S. fishery had been taken into account in the assessment model along with uncertainty relating to unaccounted Canadian catches. This aspect would be discussed again during presentation of the model.
- A new survey conducted in 2018 indicated that the proportion of unreported catches varied widely from region to region. The total unreported catch was estimated at about 6,000 t. Several participants said that this quantity was probably exaggerated in light of efforts in recent years to improve the situation. This comment was repeated numerous times. Several industry representatives expressed interest in collaborating in order to more accurately document this source of uncertainty, which would better inform the model.
- It was explained that the outcomes mainly provided a general idea of the magnitude of the unreported catch in Canada. A participant said that various options would be explored during the modelling.
- For future surveys, participants emphasized the importance of properly formulating the question to determine the activity targeted by fishers.

The presentation continued with a description of work suggesting that mackerel migration toward northeast Newfoundland (3KL) or further north corresponded to years of warmer temperatures. Biological factors (e.g., the presence of copepods) had also been identified to explain these northward movements. A dependency density phenomenon had also been observed.

- It was noted that the model that took physical and biological (prey) variables into account appeared to be more robust.

- It was recalled that the objective of this work was to confirm that the mackerel in 3KL were from the Canadian contingent.

BIOLOGICAL INDICATORS

Andrew Smith went over the biological indicators. Length at 50% maturity (L_{50}) had been recalculated for the 1973-2018 period and corresponded to 267 mm. The current age structure was truncated, compared with the period before 2000 and was now dominated by the 2015 year class, which accounted for 75% of reported landings by weight in 2018.

- Questions were asked about how the proportion of mature individuals had been determined, because wide year-over-year variability was noted, and about the origin of the sample.
- Questions were also asked about the impact of missing data for some sectors on the calculation of biological indicators.

Preliminary analysis suggested that mackerel recruitment and conditions were negatively affected by warming temperatures and the reduced availability of their prey of choice.

- A participant pointed out that the analysis covered the good 2015 cohort; so the outcomes might be biased. However, it was noted that the same outcomes were obtained using other years.
- A participant said that there was still work to be done, because the model did not anticipate recruitment peaks.

The arrival of *Scomber colias* in the Gulf had been observed in 2017 and 2018.

- Participants wondered how to estimate each species in the future. It was noted that this was not yet a significant issue, because any observations to date had been marginal.
- Questions were asked about potential competition between the two species (*Scomber scombrus* and *Scomber colias*).

ASSESSMENT OF THE RESOURCE STATUS

ASSESSMENT FRAMEWORK: DESCRIPTION AND RESULTS

Elisabeth Van Beveren provided a brief overview of the approaches used in previous assessments. From 1986 to 2012, indices had been derived mainly from the fishery and an egg survey. From 2012 to 2014, Atlantic mackerel abundance had been assessed through integrated catch-at-age analysis (ICA). This analysis had been calibrated using an abundance index calculated from the egg survey. These assessments used only reported catches and were therefore suspected of underestimating the actual size of the stock. To consider the uncertainty associated with missing catches, the 2017 assessment incorporated so-called “censored” models. Since the exact value of the additional catches was unknown, the available information was used to document an upper limit (ceiling). This statistical catch-at-age model, calibrated with the abundance index from the egg survey and taking into account the uncertainty due to unreported catches, confirmed that mackerel spawning biomass had declined.

As part of this assessment (2019), the mackerel SSB was calculated using a censored statistical catch-at-age model based on data collected during the annual egg survey in the southern Gulf of St. Lawrence, catch and weight-at-age data, and the proportion of adult individuals sampled in the population. The uncertainty of unreported catches (Canadian unaccounted catches and U.S. catches of mackerel from the Northern contingent) was explicitly taken into account when defining lower and upper total catch limits.

Information was provided on the model structure, input data and configuration as well as model quality (residues, retrospective patterns, sensitivity). The participants made a few comments.

- Some participants questioned the natural mortality (M) value of 0.27. Some industry representatives found that it should be higher, especially considering the level of predation.
- Questions were also asked about whether to use the Beverton-Holt stock-recruit relationship, including environmental effects, or to go with a random walk, which appeared to yield similar outcomes. Beverton-Holt was selected in the end, because it supported future projections.
- It was explained that the model did not take into account foreign catches (other than the U.S. catches of Northern contingent mackerel), as they were considered irrelevant.

Dr. Van Beveren presented the modelling outcomes. According to the consensus model, the current estimate of SSB in 2016 was 59% of the limit reference point (LRP), compared with 77% in 2018. Estimated fishing mortality in 2018 was 1.13 (harvest rate of 68%). Recruitment levels in 2017 and 2018 were at their lowest. The model included the best possible estimates of unreported catches and therefore provided a more realistic estimate of spawning biomass than in 2016. Although the estimated absolute value of SSB was highly variable, depending on the assumptions incorporated into model adjustments, SSB in relation to LRP was not significantly influenced by these assumptions.

- Participants noted that the stock was well within the critical zone.
- Questions were asked about calculation of the LRP and other methods of determining it (e.g., fixed or variable value; 35-year mean). The limit reference point (LRP) for this stock was based on an approximation of 40% B_{msy} based on F40% as obtained through a yield-per-recruit analysis.

MANAGEMENT STRATEGY EVALUATION

The objective of the working group on management strategy evaluation (MSE) for rebuilding the mackerel stock was to validate the performance of various management approaches, while considering the uncertainties associated with assessing the resource status. Closed-loop simulations supporting the MSE had been conducted. The simulation framework was consequently presented along with the various scenarios for operational models, options in relation to missing catches, harvest control rules and management objectives.

This review had led to suggestions to incorporate some trade-offs into the management objectives, better document missing catches, improve operational models, calibrate control rules according to the priority objective, and develop quantitative metrics for strategy evaluation. These steps were expected to provide a better basis for selecting management procedures to achieve specific objectives (including recovery) for the stock subject to key uncertainties.

PROJECTIONS FOR 2020-2021

Short-term projections under different catch control rules indicated that with the increase in TACs from 0 to 10,000 t, the probability of exceeding the LRP by 2021 had dropped from 68% to 48%, while the probability of stock growth by 2021 had dropped from 78% to 49%.

IMPACT OF OTHER MANAGEMENT MEASURES

Steps had been taken to evaluate various management measures. A brief overview of the conclusions was presented.

- With respect to a change in hook size, no significant differences had been observed. However, broader sampling appeared necessary, and the funds seemed to be available.
- As for the different mesh sizes tested, overall, all mesh sizes had shown selectivity for individuals smaller than 30 cm.
- Science did not support reducing the legal size, given the increase observed in length at 50% maturity (L_{50}). However, increasing the legal size could lead to more discards, as noted by some participants.
- With regard to recreational fishing, Science supported any measures that enabled the counting of unreported catches.
- It appeared difficult to quantify any changes observed in recent years in unreported commercial catches in the Gulf Region. Any measures that could increase our knowledge about unreported catches were strongly encouraged. A participant said that increasing observer coverage could help to better inform the model. The need to standardize databases across the provinces was also noted.
- With respect to changes to the fishing season, peak spawning data should be considered.

CONCLUSION

INTERIM YEARS

The participants agreed to assess the status of the Atlantic mackerel stock for two years (Science Advisory Reports for the 2019 and 2020 fishing seasons). The next scientific review was scheduled for winter 2021. No indices would be reviewed for the interim year.

RESEARCH

Various future research projects were described.

- Update fecundity data;
- Explore the possibility of a survey on St. Pierre Bank as a spawning site;
- Study the possibility of using annual egg production as a calibration index for the model rather than mature biomass index/SSB;
- Improve sampling of ages 1 and 2 (already being implemented in the Maritimes);
- Improve sampling of mackerel caught in the Nova Scotia and Newfoundland regions by targeting individuals smaller than 20 cm;
- Continue analyzing the influence of the physical environment and available prey on mackerel recruitment, condition and migration patterns;
- Continue genetic studies and otolith readings to get a better idea of the population structure of the Northern contingent;
- Examine changes in the distribution of *Scombridae* in the context of global warming;
- Explore the issue of selectivity of capture gear;
- Study predation on mackerel for more accurate estimates of natural mortality;
- Collect better data, including data on unreported catches, through a survey of fishers.

- Re-evaluate the possibility of joint Canada-United States assessment and management.

HIGHLIGHTS AND RECOMMENDATIONS

The highlights were presented, and the participants commented on them. Comments having to do with stylistic rewording were not reported.

- With respect to reported Canadian landings, it was important to focus on the significant decrease in landings without going into detail. Information on the TAC was presented in the following highlight.
- With regard to total U.S. landings, it was noted that the Northwest Atlantic stock had been over-fished and that overfishing remained ongoing, according to the 2017 U.S. stock assessment.
- In the highlight about the proportion of mackerel from the Canadian contingent caught in the U.S. fishery, the participants agreed that this proportion was significant.
- With regard to genetic analysis, it is appropriate to talk about preliminary results. A participant said that these outcomes were consistent with the tagging studies.
- With respect to the mature biomass index, it was not considered necessary to specify that it was based on the egg survey. It was important to refer to the high levels in the 1980s when examining where the index had stood since 2005. It was decided not to mention either the 2017 increase related to the 2015 cohort or the subsequent decrease in 2018.
- As for the highlight concerning the current age structure, it was agreed that the age structure was truncated, compared with the period before 2000, and was now dominated by one year class (2015). Reference was made to the proportion of that year class in the 2018 landings.
- With regard to the statistical catch-at-age model, it was noted that updating this model allowed for the inclusion of unaccounted Canadian catches as well as American mackerel catches from the Northern contingent.
- It was decided to present the spawning stock biomass in terms of the limit reference point and compare the situation in 2018 with that in 2016. Reference was also made to the low recruitment levels in 2017 and 2018.
- It was agreed to have a smaller committee review the highlight concerning projections.

The participants concluded that since the stock was in the critical zone at the time, the priority should be reconstruction, and total catches should be limited in order to encourage an increase in spawning biomass and help the population reach the limit reference point.

APPENDIX 1 – TERMS OF REFERENCE

Assessment of Atlantic Mackerel in Subareas 3-4

Regional Peer Review - Quebec Region

March 5-7, 2019
Mont-Joli, QC

Chairperson: Mathieu Desgagnés

Context

Atlantic mackerel (*Scomber scombrus*) from the Northwest Atlantic are a highly migratory transboundary population with two distinct spawning contingents. The Southern contingent has historically spawned in the Mid-Atlantic Bight from April to May whereas the Northern contingent spawns primarily in the Southern Gulf of St. Lawrence from June to July. Both contingents overwinter in deeper waters on the continental shelf. The U.S. fishery takes place during the winter along the New England coast and catches both Northern and Southern contingents, whereas catches in Canadian waters are thought to consist entirely of mackerel from the Northern contingent. Canada evaluates the northern contingent every two years, and as of the last assessment in 2017 this stock was still in the Critical Zone according to the Precautionary Approach.

Mackerel are fished commercially throughout the Atlantic Provinces and Québec. This is a primarily inshore fishery where a variety of gear types are used (gillnets, mechanical jiggers, seines, weirs, and traps) which vary by region and time of year. Mackerel are also harvested through bait as well as recreational fisheries. While each fishery has its own regional harvest control rules, mackerel are managed on a national level. There is a minimum legal size in place of 26.3 cm. In 2017 and 2018, the commercial Total Allowable Catch (TAC) was 10 000 t. However, total Canadian catches of mackerel are grossly underestimated, as not all catches from the bait fishery are reported, dockside monitoring program coverage varies among the provinces, and catches from the recreational fishery are not quantified. In addition, the discards of mackerel (including undersized fish) are not known.

The mackerel fishery in the USA occurs primarily in the winter months in the Gulf of Maine. In contrast to Canada, the USA assesses both contingents. Their last full stock assessment occurred in 2017 and DFO scientists were in attendance to contribute to their peer review process. Based on their commercial landings, estimated recreational catches, estimated discards, egg survey and other biological indicators the American mackerel stock assessment model showed that the stock was overfished with overfishing occurring. This is in concordance with the Canadian model and there is consensus that an unknown proportion of mackerel belonging to the Northern contingent are captured in the American fishery.

The spawning stock biomass of the Northern contingent of mackerel is calculated using a censored statistical catch-at-age model with input from data collected from an annual egg survey in the Southern Gulf of St. Lawrence, catch- and weight-at-age data, as well as the proportion of mature individuals sampled in the population. The uncertainty in undeclared catches is explicitly accounted for by providing a lower and upper limit to the total catches. Closed loop simulations in support of a Management Strategy Evaluation (MSE) approach are currently being developed within the framework of a mackerel stock Rebuilding Plan Working Group with members from Fisheries and Oceans Canada Management and Science, provincial governments, First Nations, commercial mackerel harvesters, and environmental non-governmental organisations.

The last assessment of mackerel in Canada took place in March of 2017. The Fisheries Resource Management Branch has requested scientific advice on Atlantic Mackerel in Canadian waters for the 2019 and 2020 fishing seasons and to support the development of management measures for a Rebuilding Plan under the Precautionary Approach Framework.

The objective of the review is to evaluate the current stock status under the Precautionary Approach Framework and the potential effects of a range of management measures on the Atlantic mackerel stock in subareas 3 and 4.

Objective

Provide scientific advice on the management of the Atlantic mackerel in NAFO Subareas 3-4 (Canada's East coast) for the 2019 and 2020 fishing seasons and to support the development of a Rebuilding Plan.

This advice will include:

- An update of knowledge on Atlantic mackerel, including:
    - A review of the population structure in the North Atlantic, migratory patterns, habitat preferences, and biology.
    - An analysis of the environmental variables that could explain mackerel recruitment, condition, and the distribution of catches in the Northwest Atlantic.
    - An analysis of the commercial fishery statistics following the 2014-2018 fishing seasons (Distribution of landings, breakdown by date, province, NAFO subarea, fishing gear, etc.).
    - Genetic analyses comparing Atlantic mackerel caught in Northeast Newfoundland with those caught in the Gulf of St. Lawrence.
    - A discussion on the quality of the fishery statistics and a review of the main sources of uncertainty, particularly unreported, undeclared or otherwise missing catches, and updated estimates of missing catches from 2015-2018.
    - A presentation of updated U.S. catches since their latest egg survey, model outputs, and management decisions.
    - Impact of U.S. catches on the northern contingent biomass.
    - An analysis of the biological data collected by port samplers, at sea observers, and samples collected by fishery independent surveys (size structure, catch-at-age, and calculation of biological indicators).
    - An analysis of the egg survey index up to 2018 including the timing of spawning.
    - An analysis of spawning habitat suitability across the Northwest Atlantic.
    - An analysis of larval and young-of-the-year growth and survival in the face of predation as a predictor of recruitment strength.

- An assessment of the status of Atlantic mackerel, including:
    - A presentation on the results of operating models (censored statistical catch-at-age model). These results will include fishing mortality, abundance and spawning biomass, stock trajectory, and projections over 3, 5, 10 and 20 years.
    - Identification or updates of a limit reference point, potential upper stock and target reference point(s), the stock status in relation to the reference points, and fishing rates in relation to a removal reference (F_{msy}), taking uncertainty into account.

- An evaluation of the performance of different candidate management strategies (MSE), that set commercial TACs under feedback simulation, through:
  - The identification of different sources of uncertainty in the base operating model (including both model fitting and projections).
  - Evaluation of candidate management procedure performance against rebuilding and stock objectives over 3, 5, 10 and 20 years.
  - An analysis of the proposed management procedures under the defined uncertainties and management objectives.
- An evaluation of the impact, or potential impact, of other new or potential management measures for Atlantic mackerel apart from Total Allowable Catches, including:
  - Changes to fishing gear (mesh size, hook size)
  - Changes to minimum fish size
  - Changes in recreational bag limits (recreational catches)
  - Changes in monitoring of unreported commercial catches in Gulf region
  - Changes to the timing of the fishing season (over all regions, and for each DFO region)
- Specific elements related to the update of the relevant data to the management of Atlantic mackerel such as:
  - The determination of the process to provide advice during the interim years, including a description of conditions that may warrant a full stock assessment earlier than originally planned
  - Identification and prioritization of research projects to be considered for the future
  - Perspectives and advice for 2019 and 2020 and a Rebuilding Plan based on available information

Expected Publications

- Science Advisory Report
- Proceedings
- Research Documents

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Fishing industry
- Provincial government representatives
- Aboriginal communities/organizations
- Academia
- Environmental NGOs

APPENDIX 2 – LIST OF PARTICIPANTS

Name	Affiliation	March 5	March 6	March 7
Boudreau, Brian	Acadian Marine Inc.	x	x	x
Boudreau, Mélanie	DFO Science	x	x	-
Bourdages, Hugo	DFO Science	x	x	-
Brassard, Claude	DFO Science	x	x	-
Brosset, Pablo	DFO Science	x	x	x
Carruthers, Erin	FFAW	x	x	x
Castonguay, Martin	DFO Science	x	x	x
Cawthray, Jenness	DFO Fisheries management - Ottawa	x	x	x
Collin, Ghislain	RPPSG	-	x	-
Comtois, Sophie	DFO Science	x	-	-
Cook, Jim	PEIFA	x	x	x
Cox, Sean	Simon Fraser University	x	x	x
Curti, Kiersten (tel)	NOAA	x	-	-
Cyr, Charley	DFO Science	x	x	x
Deroba, Jonathan (tel)	NOAA	-	x	-
Desgagnés, Mathieu	DFO Science	x	x	x
Dubé, Sonia	DFO Science	x	x	x
Duguay, Gilles	RPPSG	-	-	x
Duplisea, Daniel	DFO Science	x	-	-
Dunne, Erin	DFO Fisheries management - NL	x	x	x
Ellefsen, Hans F.	DFO Science	-	x	-
Émond, Kim	DFO Science	x	x	-
Giffin, Melanie	PEIFA	x	x	x
Girard, Linda	DFO Science	x	x	x
Huard, Christian	RPPSG	-	-	x
Hurtubise, Sylvain	DFO Science	x	x	x
Kelly, Brianne	WWF - Canada	x	x	x
Khamassi, Safouane	ISMER – UQAR	x	x	x
Krondlund, Allen Rob	DFO Science	x	x	x
Lelièvre, Lauréat	Pêcheur	x	x	x
Lester, Brian	DFO Fisheries management - Ottawa	x	x	x
Mallet, Pierre	DFO Fisheries management - Gulf	x	x	x
Marentette, Julie	DFO Science	x	x	x
Mitchell, Vanessa	MAPC-MAARS	x	x	x
Munden, Jenna	Herring Science Council	x	x	x
MacEwen, David	PEI Dept Fisheries	x	x	x
McQuinn, Ian	DFO Science	x	-	-
Nozères, Claude	DFO Science	x	-	-
Perrin, Geneviève	DFO Science	x	-	-
Richardson, David (tel)	NOAA	x	x	-
Rivierre, Antoine	DFO Fisheries management - Quebec	x	x	x
Robert, Dominique	UQAR-ISMER	x	x	-
Roy, Virginie	DFO Science	x	-	-
Schleit, Katie	Oceans North	x	x	x
Senay, Caroline	DFO Science	x	x	x
Smith, Andrew	DFO Science	x	x	x
Van Beveren, Elisabeth	DFO Science	x	x	x
Veillet, Guillaume	UQAR-ISMER	x	x	x
Waters, Christa	DFO Fisheries management - Maritimes	x	x	x
Zhang, Fan	MI-MUN	x	x	x

APPENDIX 3 – AGENDA

Review of the assessment framework for Atlantic mackerel in subareas 3-4

Regional Assessment Process Québec Region

March 5-7, 2019
Mont-Joli, QC

Chairperson: Mathieu Desgagnés

Day 1 - Tuesday, March 5, 2019

Time	Subject	Presenter
9:00	Welcome, objectives, terms of reference, and agenda	Mathieu Desgagnés
9:15	Introduction: A review of mackerel biology, population structure, and a summary of previous research	Andrew Smith
10:00	Review of environmental conditions in the NW Atlantic	Andrew Smith
10:15	*Break*	
10:30	An analysis of mackerel egg and larvae habitat suitability	Andrew Smith
11:00	An analysis of genetic data from mackerel samples caught in the NW Atlantic	Geneviève Parent
11:30	Predicting recruitment strength from larval growth indices	Safouane Khamasi
12:00	*Lunch*	
1:00	Analysis of environmental factors to predict recruitment, condition, and the distribution of catches	Andrew Smith
1:30	Commercial data update 2014-2018	Andrew Smith
2:00	U.S. mackerel science and management decisions	Andrew Smith and Martin Castonguay
2:30	Biological data update 2014-2018	Andrew Smith
3:00	*Break*	
3:15	A review of the main sources of uncertainty and quality of the commercial fishery data and an update of a survey to assess bait use in the fishery	Andrew Smith and Elisabeth Van Beveren
3:45	A review of past models used to evaluate the stock and a review of the model used in the last stock assessment	Elisabeth van Beveren
4:30	End of Day 1	

Day 2 – Wednesday, March 6, 2019

Time	Subject	Presenter
9:00	Welcome and agenda	Mathieu Desgagnés
9:15	Summary of the previous days main points	Andrew Smith
9:30	A summary of the stock assessment model: modifications, data input and assumptions	Elisabeth van Beveren
10:15	*Break*	
10:30	Critical analysis of the model (residuals, retrospective patterns, assumptions, etc.) and stock status	All
12:00	*Lunch*	
1:00	MSE: introduction, operating models, objectives and management procedures	Elisabeth van Beveren
3:15	*Break*	
3:30	MSE results	Elisabeth van Beveren
4:30	End of Day 2	

Day 3 – Thursday, March 7, 2019

Time	Subject	Presenter
9:00	Welcome and agenda	Mathieu Desgagnés
9:15	Summary of the previous days main points	Andrew Smith
9:30	MSE Results	Elisabeth van Beveren
9:30	*Break*	
10:15	Other Issues: Selectivity of gear types, Minimum size requirements, Quality of commercial data	Andrew Smith
12:00	*Lunch*	
1:00	Summary of science advice	Andrew Smith / All
3:00	*Break*	
3:15	Summary of science advice	All
4:30	End of Day 3	