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Proceedings of the Regional Advisory Meeting on the Assessment of the Estuary and Northern Gulf of St. Lawrence Snow Crab Stocks

February 16-18, 2021
Virtual meeting

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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

This document outlines the proceedings of the regional peer review meeting on the assessment of the Estuary and northern Gulf of St. Lawrence snow crab stocks. This meeting, which was held via Zoom platform (virtual meeting), on February 16–18, 2021, brought together more than 50 participants from science, industry and management. These proceedings detail the essential parts of the presentations and discussions held during the meeting, as well as the recommendations and conclusions made.

INTRODUCTION

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 that is conducted at the Maurice Lamontagne Institute in Mont-Joli. This document consists of the proceedings of the meeting held on February 16-18, 2021 via the Zoom platform (virtual meeting), on the assessment of the Estuary and northern Gulf of St. Lawrence snow crab stocks.

The objective of the meeting was to determine whether there were any changes in the resource's status and whether management plans need to be adjusted based on the chosen conservation approach, with the ultimate goal being to provide a science advisory report on the management of Estuary and northern Gulf of St. Lawrence snow crab stocks for the 2021 fishing season.

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 framework for this meeting (Appendices 1 and 2). The proceedings also list the recommendations made by the meeting participants.

ASSESSMENT

The meeting chair, Mr. Denis Chabot reviewed the objectives, the meeting rules and the terms of reference of the peer review meeting. The participants introduced themselves. Stock assessment biologist Cédric Juillet noted the contributions made by his collaborators and presented the agenda of the meeting. He provided a general overview of landings on the Atlantic coast and by fishing area (17, 16, 12A, 12B, 15, 16A, 12C, 14, 13). In 2020, landings totalled 4,852 t, a decrease of about 24% compared with 2019 (6,386 t).

The conservation principle that applies to these areas seeks to protect reproductive potential. Management measures include limits imposed on catches via a Total Allowable Catch (TAC), effort controls (number of traps, number of licences and fishing season), and a minimum legal carapace size set at 95 mm. In addition, an area's fishery is closed when catches in it include more than 20% white crab.

The data used in the assessment are mainly from the fishery (ZIFF and logbooks, commercial sampling) and independent sources (post-season survey, trawl survey). Environmental data completes the information (thermal habitat index).These data provide the key stock status indicators, including the commercial catch per unit of effort (CPUE), post-season number per unit of effort (NPUE), combined CPUE and NPUE index, carapace condition at landing, the relative abundance of adult crab left by the fishery, new adult crab (recruits) and adolescents in post-season surveys, distribution of fishing effort, long-term recruitment (trawl surveys), size frequencies and spermatheca load.

The stock assessment biologist then provided a brief overview of the various carapace conditions and crab categories mentioned during the meeting. Categories 1 and 2 are recruits, and categories 3 to 5 are crabs left by the fishery. The biologist explained the CPUE standardization method (since 2009), as well as the approach to determine the combined index

based on the average of the two commercial biomass indices (standardized commercial CPUE and NPUE of adults ≥ 95 mm in the post-season survey).

Additional information about how the outlooks were developed using the method validated by peers the previous year is presented. These include three possible harvesting scenarios (high, intermediate, low) for each area. These are based on the results of the combined index analysis and modulated as necessary on the basis of related indicators of stock health and population dynamics of the species, with the objective of sustainable management of the resource.

Before going into the details of the assessment, area by area, certain environmental considerations were introduced, including seafloor temperature conditions in 2020. A warming of the Gulf of St. Lawrence deep waters has been observed since 2012. A thermal habitat index, based on the snow crab's thermal preferences (large crabs: -1 to 3°C; small crabs: 0 to 2°C), was briefly presented. In 2020, an overall trend of erosion of the favourable thermal habitat was observed for large crab in the western and central areas (12A, 12B, 12C, 16 and 17,) whereas a slight increase in the availability of favourable thermal habitat was observed in areas 13 and 14. For small crabs, a downward trend in the area of favourable thermal habitat was seen in area 17, but an increasing trend was observed in areas 16A, 14 and 13.

RESULTS

For each fishing area, a review of key indicators is conducted by the biologist. He then presented an overview of the area, along with wording for three possible scenarios (high, intermediate, low) for harvesting in 2021. Participants asked questions and made comments. As part of this meeting, participants have to agree on the scenarios, but the preferred option will be discussed at the Advisory Committee meeting.

AREA 17

Review of indicators: Area 17

The TAC decreased by 42.7% between 2019 and 2020 to 1,277 t and was reached. The commercial fishery CPUE increased from 2019 to 2020 (+12.0%), but is below the historical average of the time series, at a value similar to the lowest values observed since 1991. No indicators based on dockside or sea sampling data are available for the 2020 fishing season due to the impacts of health measures taken in response to the COVID-19 pandemic ((COVID-19 will be used in the remainder of this document to refer to such impacts).

The commercial abundance index of the post-season survey remained steady throughout the 2018–2020 period, with the lowest values seen since 2000. Values from both the North Shore and South Shore indicate low commercial abundance levels in 2019 and 2020. Abundance indices of the post-season survey for adolescents with a carapace width of between 78 and 95 mm and of 95 mm and above decreased over the 2018–2020 period. For adolescents under 95 mm in 2020, the index was the lowest in the time series (2000–2020), while the index value was slightly below the historical average for adolescents measuring 95 mm and over. No increase in recruitment to the fishery is expected in 2021. The decrease in the mean weight of the spermathecal load of primiparous females between 2019 and 2020 suggests an increase in the number of primiparous females.

The two favourable thermal habitat indices for both large and small snow crabs present a downward temporal trend over the 1985–2020 period .

The combined index increased by 7.3% between 2019 and 2020. The 2019 and 2020 values are among the lowest in the time series. As a whole, stock status indicators do not suggest an

increase in the biomass available to the fishery in 2021. Scientific survey data indicate an upturn in recruitment to the fishery in the medium term.

Meeting participants made the following comments:

- Given the impact that pandemic-related health measures (COVID-19) have had in several areas, it would be relevant to address this in the introduction of the science advisory report.
- It was noted that the landing data from logbooks were provided to Science by Management and linked with the Resmar data.
- The definition of white crab will need to be clarified, due to the difference in perspectives that currently seems to exist between Industry and Management.
- For 2019, a discrepancy in the abundance of > 95 mm adults was noted between the trawl survey and other sources of data (fishery and post-season surveys).
- According to Science, the species appears to be fairly tolerant of hypoxia, although it would not feed at dissolved oxygen levels below 20% saturation. This factor could limit its presence in deeper areas of the Estuary.
- Strong recruitment to the fishery is not expected in the next few years, at least not before 2023, according to some participants. We are currently at a low point. It is important to keep enough males in the system to ensure sufficient spermathecal loads for a large number of females.
- It appears that the lower TACs in 2020 helped to stabilize yields.

Summary and outlook: Area 17

Participants discussed the summary and the scenarios presented:

- For the first key point, a suggestion was made to present the variation in landings between 2019 and 2020 as well as the variation in the TAC during the same period.
- For the key point on the post-season survey, Area 17 will be discussed as a whole, without distinguishing between north and south.
- In the key point on the decrease in the average weight of spermathecal contents in primiparous females between 2019 and 2020, it should be noted that this points to an increase in the number of primiparous females.
- A suggestion was made to add a bullet point about the positive outlook for recruitment to the fishery in the medium term, even though the indicators as a whole do not suggest improvement in the short term.
- For the key point on the combined index, the composition of the index does not need to be specified, as this can be done in the preamble of the advisory report.
- With respect to the wording of the scenarios, after a lengthy discussion last year, a decision was made to apply the decrease to total landings, even if some industry participants would be more comfortable with wording based on the TAC.
- Regarding the three scenarios suggested for Area 17 (-5%, -15%, > -15%), some participants felt that smaller decreases would be more appropriate, which would result in a status quo in the first scenario. Other members at the meeting felt that, overall, the indicators warrant caution (poor prospects for recruitment to the fishery in the short term,

indices that are the lowest of the series, the protection of spawning potential by conserving males, erosion of thermal habitat).

- Questions about the risk associated with maintaining the status quo were raised, in terms of the possible impact on the sex ratio and spawning potential (spermathecal load). This risk will need to be expanded upon in the premise.

Therefore, after several discussion, the participants agreed on the following wording:

The combined index increased slightly between 2019 and 2020 (+7.3%), but was among the lowest values in the time series because of the low commercial biomass in the post-season survey. As a result, no increase in the biomass available to the fishery is expected in 2021. Given the increase in primiparous female density, these indicators suggest a decrease in harvesting in 2021 in order to prevent an excessively biased sex ratio towards females during primiparous female recruitment

1. *Higher scenario*: A status quo compared to total landings in 2020.
2. *Intermediate scenario:* A 15% decrease applied to total landings in 2020.
3. *Lower scenario*: A more than 15% decrease applied to total landings in 2020.

AREA 12A

Review of indicators: Area 12A

The TAC decreased by 23.7% between 2019 and 2020 to 80.5 t, and was not reached for socio-economic reasons. Landings totalled 69 t in 2020. The commercial fishery CPUE decrease between 2019 and 2020 (-12.3%) and is among the lowest values observed since 1995. No indicators based on sea sampling data are available for the 2020 fishing season due to COVID-19. Dockside data are limited but indicate that landings consisted of a strong majority of intermediate-shell crabs

Other than crabs with a carapace width between 78 and 95 mm (adults and adolescents), which increased between 2018 and 2020 to near the historical average, all abundance indices from the 2020 post-season survey remained rather stable compared with those in 2018 and were among the lowest values observed across their historical series. An increase in the abundance of primiparous females and small males was observed in 2020.

The favourable thermal habitat index for large crabs showed a downward temporal trend over the 1990–2020 period .

The combined index decreased by an average of 2.75% per year in comparison with the 2018 value, and the 2020 value was the lowest in the time series. All available indicators suggest that the biomass available to the fishery in 2021 should not be greater than that available in 2020.

Several comments were made:

- Some participants said that the TAC had not been reached for socioeconomic reasons, but that this did not reflect a scarcity of the resource. It was suggested that the reasons for the failure to reach the TAC be mentioned where possible (e.g. inactive licences).
- Some participants felt that it would be useful to obtain information on spermathecal loads.

Summary and outlook: Area 12A

Participants provided comments on the summary and agreed on the scenarios:

- In the key point on the TAC, it should be specified that some licences have remained inactive.
- A decision was made to remove the information on the average size of landed crabs, given the small sample size.
- For the key point on the post-season survey, it should be noted that the number of primiparous females and smaller males increased in 2020.
- It was agreed that all of the available indicators show that the biomass available to the fishery in 2021 should not be higher than it was in 2020.
- Regarding the three scenarios suggested for Area 12A (-5%, -15%, > -15%), participants felt that they should be more aligned with the scenarios for Area 17 (status quo, -15%, > -15%), where the situation is fairly similar. Participants were reminded that Area 17 is an overflow area.
- Questions were raised about how a decrease applied to total landings would translate to a lower TAC, particularly when the TAC was not reached due to socioeconomic reasons (inactive licences). According to Industry, active fishers are penalized. Some participants felt that this issue should be considered and discussed with Fisheries Management at the advisory committee meeting.
- To take this concern into account in the assessment, a suggestion was made to state in the premise of the scenarios that the TAC had not been reached for socioeconomic reasons.

Finally, the assembly agreed on the following scenarios:

The combined index decreased by 2.8% per year on average between 2018 and 2020 to reach the lowest value in the time series, and performance during the commercial fishery in 2020 was among the lowest in 25 years. In addition, the increase in the abundance of primiparous females in 2020 suggests that a sufficient abundance of males is needed to avoid obtaining a sex ratio that is overly biased towards females during primiparous female recruitment. These indicators suggest a decrease in harvesting in 2021.

1. *Higher scenario*: A status quo compared to total landings in 2020.
2. *Intermediate scenario:* A 15% decrease applied to total landings in 2020.
3. *Lower scenario*: A more than 15% decrease applied to total landings in 2020.

AREA 12B

Review of indicators: Area 12B

In light of the pandemic, there were no participants in the index fishery in 2020. Although advice from Science had placed priority on the post-season survey, it could not be conducted in 2020. As a result, the data presented for this area by the biologist were from 2019.

For socio-economic reasons and in order to allow monitoring of yields in the area, the TAC was set at 125 t in 2018 and 2019. Fishing effort was low in 2019, with landings of 30 t. From 2016 onwards, the commercial fishery CPUE is at the lowest values observed since 1995.

The average size of legal crab caught in the commercial fishery had remained similar to that of 2017 and 2018, and was below the historical average. Landings consisted mostly of crab with intermediate shell condition.

The commercial abundance index of the post-season survey has been decreasing since 2013 and was close to 0.

Participants made the following comments:

- The situation in Area 12B appeared to be worrisome. Participants were reminded that Area 12B is an overflow area. Questions were asked about the connectivity with adjacent areas, which needs to be considered when assessing and finding solutions.
- Additional resources are desired to gain a better understanding of what is happening in this area. It was suggested that this research concern be added to the science advisory report, and it will be given priority consideration in the work on the precautionary approach and the ecosystem approach.

Summary and outlook: Area 12B

Given the lack of data for 2020, it is suggested that the outlook issued last year be repeated.

The outlook is worded as follows:

The non-attainment of the TAC, low catch rates, small size and low recruitment of snow crab suggested that stock status had not improved in 2019. The short-term outlook was not favourable.

According to all indicators available in 2019, the biomass was very low and may not be able to support a commercial fishery.

AREA 16

Review of indicators: Area 16

The 2020 TAC of 2,326 t decreased by 25% from 2019 and was reached (landings of 2,300.3 t). The CPUE for the commercial fishery increased slightly (+16%) in 2020 despite decreasing over the 2016–2019 period. Despite this increase, the 2019 and 2020 values are the lowest observed since 1991. No indicators based on sea sampling data are available for the 2020 fishing season due to COVID-19. Dockside data are limited but indicate that landings primarily consisted of recruits and that the proportion of intermediate-shell crabs decreased between 2019 and 2020.

All the abundance indices (adults and adolescents) in the post-season survey decreased between 2019 and 2020, and 2020 values are among the lowest observed since at least 2007.

Based on monitoring of the Baie Sainte-Marguerite snow crab population, the biomass available to the fishery is expected to increase beginning in 2023–2024. The density of primiparous females rose sharply in 2020.

The favourable thermal habitat index for large crabs showed a downward temporal trend over the 1985–2020 period.

The combined index shows similar values in 2019 and 2020 (-1.2% between 2019 and 2020). The 2019 and 2020 values are the lowest in the time series that begins in 1995.

All available indicators suggest that the biomass available to the fishery in 2021 will not be greater than that available in 2020.

Several comments were made by participants:

- The graph on carapace width in males shows a bimodality, which reflects growth by moulting. Moreover, the data seem to indicate a recruitment fishery.

- Industry representatives felt that the data presented were more pessimistic than what they have observed.
- It was acknowledged that the data may be affected by weather conditions. This effect will be further studied in the future.
- According to the trawl survey in Sainte-Marguerite Bay, more males have reached legal size since 2006–2007, which may be related to warming waters. However, the sharp decline in males of legal size in 2020 could affect reproductive success.

Summary and outlook: Area 16

Participants discussed the summary and the scenarios presented:

- A decision was made to remove the key point on size, as this information will be presented in the advisory report.
- In the key point on the Sainte-Marguerite Bay survey, it should be noted that the biomass available to the fishery will increase beginning in 2023–2024.
- Regarding the three suggested scenarios (-5%, -15%, > -15%), some participants thought that the situation in Area 16 was riskier than in Area 17, since there seems to be a recruitment fishery in Area 16. Moreover, the stock is among the lowest values in the series. It is also important to leave enough males to protect spawning potential, considering the arrival of primiparous females.
- Other participants believed that the next wave was more likely to be in Area 16 than in Area 17. A majority of the industry participants felt that the suggested decreases were too large. They proposed maintaining the status quo for the high scenario and a 10% decrease for the intermediate scenario. In their opinion, several factors affect fishing yields.
- The participants agreed on the high scenario (status quo) and the low scenario (> -15%), but it seemed difficult to reach a consensus on the intermediate scenario.
- As pointed out by the assessment biologist, developing the precautionary approach might facilitate the process.

For the second consecutive year, the combined index has remained at the lowest level in the series (-1.2% since 2019), and no increase is expected in the biomass available to the fishery in 2021. Given the increase in primiparous female density, these indicators suggest a decrease in harvesting in 2021 in order to prevent an excessively biased sex ratio towards females during primiparous female recruitment.

1. *Higher scenario:* A status quo compared to total landings in 2020.
2. *Intermediate scenario:* A 15% decrease applied to total landings in 2020.
3. *Lower scenario:* A more than 15% decrease applied to total landings in 2020.

Some industry participants felt that smaller reductions would be more appropriate, especially for the intermediate scenario. Consequently, a consensus on Area 16 was not reached.

AREAS 12C – 16A – 15

Review of indicators: Area 12C

The TAC decreased by 50% to 96 t between 2019 and 2020 and was not reached in the context of COVID-19. Landings in 2020 totalled 78.9 t, which corresponds to a 47.2% decrease

compared with 2019 landings. The beginning of the 2020 fishing season was delayed by three weeks compared to 2019. The CPUE of the commercial fishery increased (+35.6%) in 2020 but was still among the lowest observed in 25 years. No indicators based on sea sampling data are available for the 2020 fishing season (COVID-19).

The commercial abundance index for the post-season survey increased after declining for five consecutive years. All indicators from this survey (adolescents or adults, legal size or sublegal size) rose between 2019 and 2020. An increase in the abundance of primiparous females was also observed in 2020. The biomass available to the fishery should continue to increase in the medium term with the arrival of new cohorts.

The favourable thermal habitat index for large crabs showed a downward temporal trend over the 1990–2020 period.

The combined index increased for the first time since 2014 (+64.8% between 2019 and 2020). This increase suggests that the biomass available to the fishery in 2021 will be greater than that available in 2020.

Several comments were made by participants:

- The TAC values and total landings for 2020 will be validated, since a slight discrepancy in the values was raised by Industry in connection with a small tonnage landed in Newfoundland. While this does not cast any doubt on the analyses, it could impact the scenarios applied to total landings.
- Participants were reminded that Area 12C is small, which accounts for the range of values in the NUE graph. What is important is the trend observed.
- Concerning the use of small and large traps, a decision was made to keep both series.
- Despite an increase, the CPUE remains among the lowest values recorded, which is reflected in the table of anomalies.
- Industry participants felt that some of the elements added to the assessment, such as the final summary table with the anomalies of related indicators, complicate understanding and make it harder to achieve consistency with previous assessments. However, all the related indicators presented have been used in the past to calibrate the combined index and assess stock status.

Summary and outlook: Area 12C

Participants discussed the summary and outlook:

- For the key point on the CPUE, it was agreed that the percent increase in 2020 (35.6%) should be presented, even though the CPUE remains among the lowest values observed in the last 25 years.
- A suggestion was made to include information on the delayed opening of the 2020 fishing season among the key points. Industry members emphasized that the COVID-19 health measures in Area 12C were especially restrictive, which doubtless affected fishery yields.
- Reference should be made to the arrival of new cohorts in areas located to the east, which represents a lag of about one year in the cycle, compared to areas farther to the west, which are at a low point. It was agreed that the increase in the biomass available to the fishery should continue over the medium term with the arrival of new cohorts.
- For the outlook, it was agreed that the increase in the combined indicator in 2020 points to an increase in the biomass available to the fishery in 2021.

- To form a comprehensive perspective, a decision was made to review the indicators for Areas 16A and 15, then the summaries and outlooks, before moving forward with the scenarios for the three areas: 12C – 16A – 15

Review of indicators: Area 16A

The TAC decreased by 12.3% between 2019 and 2020 to 272 t, and was nearly reached. Landings totalled 256.7 t in 2020, which is a 17% decrease from 2019 landings. The beginning of the fishing season in 2020 was delayed by 4 weeks compared to 2019. The CPUE for the commercial fishery was comparable between 2019 and 2020 (-4.2% between 2019 and 2020) and the 2020 value is the lowest in the series over the 2002–2020 period. No indicators based on sea sampling data are available for the 2020 fishing season (COVID-19). Dockside data are limited but indicate that landings consisted of a slight majority of recruits and that the proportion of intermediate-shell crabs increased between 2019 and 2020.

The commercial abundance index for the post-season survey declined over the 2014–2020 period, with a decrease in the average size of adults observed in 2020. However, indicators from this survey for adolescents or adults with a carapace width under 95 mm increased sharply between 2019 and 2020. An increase in the abundance of primiparous females was also observed beginning in 2019. The biomass available to the fishery should increase in the medium term with the arrival of new cohorts.

The favourable thermal habitat index for small crabs showed an upward temporal trend over the 1990–2020 period.

The combined index is declining over the 2014-2020 period (-11.1% between2019 and 2020). This decline suggests that the biomass available to the fishery in 2021 will not be greater than in 2020.

Only one comment was made:

- Similar to Area 12C, a lag was observed in Area 16A in comparison with areas farther to the west, although the arrival of new cohorts was smaller than in Area 12C.

Review of indicators: Area 15

The TAC decreased by 29.9% between 2019 and 2020 to 310 t, and was not reached. Landings totalled 262.2 t in 2020, which is a 36.5% decrease from 2019 landings. The beginning of the fishing season in 2020 was delayed by 3 weeks compared to 2019. The CPUE of the commercial fishery in 2020 was similar to that recorded in 2019 (+4.3% between 2019 and 2020) and was among the lowest values observed over the 1985–2020 period. No indicators based on sea sampling data are available for the 2020 fishing season (COVID-19). Dockside data are limited but indicate that landings primarily consisted of recruits with a similar proportion of intermediate-shell crabs.

All abundance indices for the post-season survey for both adolescent and adult males increased between 2019 and 2020, and, with the exception of the commercial portion of adults, were above their respective historical averages for the 2014–2020 period. The biomass available to the fishery should continue to increase in the medium term with the arrival of new cohorts. Data on spermathecal load weight in the 2020 post-season survey—and on the abundance of primiparous females during the previous post-season survey in 2019—suggest that the abundance of primiparous females was high in 2019–2020.

The combined index increased by 56.7 % between 2019 and 2020, after 4 consecutive years of decline. Available indicators suggest that the biomass available to the fishery in 2021 will be greater than that available in 2020

Several comments were made by participants:

- Some clarification was provided to explain why the TAC had not been reached, e.g. pandemic-related restrictions.
- The situation in this area is very similar to that in Areas 12C and 16A. Everything has been very consistent. A lag of about one year in the cycle, compared to areas farther to the west, was also observed.

Summary and outlook: Area 16A

Comments were raised regarding the key points in the Area 16A summary:

- Management was asked to review the first key point on the TACs and landings for all areas to ensure the accuracy of the data.
- It was agreed that the percent change between 2019 and 2020 (-4.2%) be presented in the key point on the CPUE.
- According to Industry, the late start to the fishery would have affected the fishery results and should be mentioned in the summary.
- The assessment biologist said that it may eventually be possible to examine the impact of COVID-19 by re-evaluating the CPUE standardization method.
- The arrival of new cohorts should be referenced by stating that the biomass available to the fishery is expected to increase over the medium term as new cohorts arrive.
- For Areas 12C, 16A and 15, it would be useful to include information on the decline in the average size of adults in 2020 in the key point on the post-season survey.

Summary and outlook: Area 15

Participants made several comments on the summary for Area 15:

- Information on the late start to the fishing season was added.
- Reference was also made to the increase in the biomass available to the fishery, which is expected to continue as new cohorts arrive, as is the case in Areas 12C and 16A.

Scenarios: Area 16A

Participants discussed the potential scenarios for Area 16A:

- A primary stakeholder suggested a status quo for the intermediate scenario.
- To some participants, this suggestion seemed to be inconsistent with the outlook presented. A 10% decrease for the intermediate scenario and the status quo for the high scenario were proposed instead.

The assembly agreed on the following scenarios:

The combined index decreased for a sixth consecutive year (-11.1% since 2019), and no increase is expected in the biomass available to the fishery in 2021. In the presence of an

increase in primiparous female density, these indicators suggest reducing the harvest in 2021 in order to prevent an excessively biased towards females during primiparous female recruitment.

1. *Higher scenario*: A status quo compared to total landings in 2020.
2. *Intermediate scenario:* A 10% decrease applied to total landings in 2020.
3. *Lower scenario*: A more than 10% decrease applied to total landings in 2020.

Scenarios: Area 12C

Participants discussed the possible scenarios for Area 12C:

- On the one hand, some participants suggested a 20% increase for the intermediate scenario. On the other, some would be comfortable with a larger increase. However, a variety of factors argue against exceeding 20% of the intermediate scenario (e.g. avoiding catching white crab, ensuring spawning potential, a CPUE that remains low).
- A 30% increase for the high scenario and a 10% increase for the low scenario were proposed, which seemed to achieve a consensus among the participants.

The assembly agreed on the following scenarios:

After declining over the 2015–2019 period, the combined index rose in 2020 (+64.8% since 2019), which suggests an increase in the biomass available to the fishery in 2021. Nevertheless, the yields from the commercial fishery in 2019 and 2020 are the lowest observed over the 1994–2020 period, and the TAC was not reached for the third consecutive year. Given the increase in primiparous female density, these indicators suggest more caution in establishing the total landings allowed in 2021 to avoid obtaining a sex ratio that is overly biased towards females during primiparous female recruitment.

1. *Higher scenario:* A 30% increase applied to total landings in 2020.
2. *Intermediate scenario:* A 20% increase applied to total landings in 2020.
3. *Lower scenario:* A 10% increase applied to total landings in 2020.

Scenarios: Area 15

Participants discussed the possible scenarios:

- Some participants were of the opinion that the situation in Area 15 permits an increase similar to the increase suggested for Area 12C. As a result, a 20% increase for the intermediate scenario, a 30% increase for the high scenario and a 10% increase for the low scenario were proposed and promptly agreed upon.

The assembly agreed on the following scenarios:

The combined index increased between 2019 and 2020 (+56.7%), foreseeing a greater biomass available to the fishery in 2021. However, given the still purportedly high densities of mature females, it would be a good idea to limit any increase of catches in 2021 to avoid obtaining a sex ratio that is overly biased towards females during primiparous female recruitment.

1. *Higher scenario:* A 30% increase applied to total landings in 2020.
2. *Intermediate scenario:* A 20% increase applied to total landings in 2020.
3. *Lower scenario:* A 10% increase applied to total landings in 2020.

AREA 13

Review of indicators: Area 13

The TAC decreased by 19.9% between 2019 and 2020 to 244 t, and was not reached. Landings totalled 213 t in 2020, which is a 29.5% decrease from 2019 landings. The fishing season started late for a good part of the fleet. The CPUE of the commercial fishery in 2020 was similar to that recorded in 2019 (+0.3% between 2019 and 2020) and was among the lowest values observed over the 1988–2020 period. No indicators based on dockside or sea sampling data are available for the 2020 fishing season due to COVID-19.

All abundance indices from the post-season survey for the northern portion of the area increased sharply between 2019 and 2020 and were above their respective historical averages. The 2020 commercial abundance consisted primarily of recruits. Conversely, all indices from the survey conducted in the southern portion of the area remained stable between 2019 and 2020 and were below their historical averages. The observed increase in the biomass available to the fishery should continue in the medium term with the arrival of new cohorts.

No scientific trawl survey was conducted in 2020 (COVID-19), but the 2018 survey reported recruitment to the fishery in the medium term .

Data on spermathecal load weight during the 2020 post-season survey—and on the density of primiparous females during the trawl survey in 2018—suggests that the abundance of mature females will remain high following a peak in 2018–2019.

The favourable thermal habitat index for large and small crabs showed an upward temporal trend over the 1990–2020 period.

The combined index is up sharply in 2020, after 3 consecutive years of decline (+44.7% between 2019 and 2020). Indicators suggest that the biomass available to the fishery in 2021 will be greater than that available in 2020

Participants made the following comments:

- In the post-season survey, the northern and southern parts of Area 13 showed a starkly contrasting picture. Some participants suspected that this was due to the impact of cold waters in the Mecatina Trough, in contrast to the warm and hypoxic waters of the Esquiman Channel.
- Various factors, such as a late fishery and limited economic interest in crab (versus capelin), may also have affected the fishery results.

Summary and outlook: Area 13

Participants discussed the summary and proposed scenarios:

- Participants were reminded that there will be a general preamble to highlight the COVID-19 context.
- The late start to the fishing season was mentioned in the first key point.
- In the key point that underlines the absence of the scientific trawl survey in 2020, a suggestion was made to add that the 2018 trawl survey indicated recruitment to the fishery in the medium term.
- Given the stark contrast between the northern and southern parts of Area 13, a distinction was made between them only in the key point on the post-season survey. It was also noted

that the increase in the biomass available to the fishery is expected to continue with the arrival of new cohorts.

- In the outlook, it should be noted that the expected abundance of recruits (coupled with the density of mature females, which is still purportedly high) suggests limiting the increase in removals in 2021 to promote spawning potential.
- Participants proposed a 15% increase for the intermediate scenario, but a 20% increase for the high scenario. The low scenario was set at 5%. A consensus was quickly reached.

Thus, the assembly agreed on the following scenarios:

The combined index increased sharply in 2020 (+44.7% between 2019 and 2020) after decreasing for three consecutive years. The biomass available to the fishery in 2021 will be greater than that available in 2020. Given the expected large abundance of recruits, associated with the still purportedly high densities of mature females, it would be a good idea to restrict any increase in catches in 2021 to avoid obtaining a sex ratio that is overly biased towards females during primiparous female recruitment.

1. *Higher scenario:* A 20% increase applied to total landings in 2020.
2. *Intermediate scenario:* A 15% increase applied to total landings in 2020.
3. *Lower scenario:* A 5% increase applied to total landings in 2020.

AREA 14

Review of indicators: Area 14

The TAC decreased by 14.7% between 2019 and 2020 to 395 t, and was not reached. Landings totalled 348 t in 2020, which is a 20.7% decrease from 2019 landings. The beginning of the fishing season in 2020 was delayed by 2 weeks compared to 2019. The CPUE of the commercial fishery in 2020 was similar to that recorded in 2019 (-1.59% between 2019 and 2020) and was among the lowest values observed over the 1985–2020 period. No indicators based on dockside or sea sampling data are available for the 2020 fishing season due to COVID-19.

All abundance indices for the post-season survey for both adolescent and adult males increased between 2019 and 2020, except for males left by the fishery, which decreased. The 2020 commercial abundance consisted primarily of recruits. The biomass available to the fishery should continue to increase in the medium term with the arrival of new cohorts.

No scientific trawl survey was conducted in 2020 (COVID-19), but the 2018 survey reported an increase in recruitment to the fishery in the medium term.

Data on spermathecal load weight during the 2020 post-season survey—and on the density of primiparous females during the trawl survey in 2018—suggests that the abundance of mature females will remain high following a peak in 2018–2019.

The favourable thermal habitat index for large and small crabs showed an upward temporal trend over the 1990–2020 period.

The 2020 combined index was similar to those in 2018 and 2019 (+5.4% between 2019 and 2020) and was among the lowest values observed over the 1998–2020 period.

Indicators suggest that the biomass available to the fishery in 2021 should be similar to that available in 2020.

Only one comment was made.

- Again, it was noted that the opening of the fishing season was delayed, which may have affected the fishery results.

Summary and outlook: Area 14

Participants discussed the summary and the potential scenarios:

- The delayed opening of the fishing season was mentioned in the first key point.
- In the key point on the post-season survey, it was noted that the increase in the biomass available to the fishery is expected to continue over the medium term with the arrival of new cohorts.
- As was stated for Area 13, it was pointed out that despite the absence of a scientific trawl survey in 2020, the 2018 survey indicated recruitment to the fishery in the medium term.
- In the outlook, it was noted that the available biomass in 2021 should be on par with that of 2020.
- For the intermediate scenario, two options were proposed: status quo or a 10% increase. To several participants, the situation in Area 14 seemed somewhat less promising than in the other eastern areas. Ultimately, no objection was raised to the status quo. A 10% increase for the high scenario was agreed upon, while a decrease in landings in 2020 was suggested for the low scenario.

Thus, the assembly agreed on the following scenarios:

For a second consecutive year, the combined index has remained at among the lowest values in the series (-5.4% since 2019). The biomass available in 2021 should be comparable to that available in 2020. Given the expected large abundance of recruits, associated with the still purportedly high densities of mature females, suggest limiting the increase in removals in 2021 in order to limit white crab mortality and prevent an excessively biased sex ratio towards females during primiparous female recruitment.

1. *Higher scenario:* A 10% increase applied to total landings in 2020.
2. *Intermediate scenario:* A status quo compared to total landings in 2020.
3. *Lower scenario:* A decrease compared to total landings in 2020.

RESEARCH IDENTIFICATION AND PRIORITIZATION

With respect to research priorities, brief reference was made to the following issues:

- Development of a precautionary approach (important for eco-certification) and the ecosystem approach;
- Collection and analysis of demographic (e.g., crab size, tagging and telemetry) and environmental (biodiversity, oceanography) data to inform these approaches.

APPENDIX 1 – TERMS OF REFERENCE

Assessment of the Estuary and northern Gulf of St. Lawrence Snow Crab stocks

Regional Peer Review – Quebec Region

February 16-18, 2021
Virtual meeting

Chairperson: Denis Chabot

Context

The snow crab fishery in the Estuary and the northern Gulf of St. Lawrence began in the late 1960s. Landings have varied depending on the adjusted Total Allowable Catches (TACs) based on the recruitment waves and troughs. In 2019, landings have totaled 6,386 t, down by 25% from 2018.

The Estuary and northern Gulf of St. Lawrence are divided into nine management areas (13 to 17, 16A, 12A, 12B and 12C). The effort is controlled by a fishing season as well as a limited number of licences and traps and catches are limited by quotas. A limitation of fishing for male crabs with a legal size of 95 mm is also in place.

The resource is assessed each year to determine whether changes that have occurred in the stock status necessitate adjustments to the conservation approach and management plan.

Objectives

Provide scientific advice to determine TACs for the snow crab stocks in the Estuary and northern Gulf of St. Lawrence: management units 13 to 17, 16A, 12A, 12B and 12C for the 2021 fishing season. The advice shall include:

- Description of the biology of the snow crab in the Estuary and northern Gulf of St. Lawrence;
- Description of the fishery including landings, fishing effort, carapace condition and changes in size structure over time;
- Analysis of catches per unit effort from the fishery;
- Analysis of data from post-season trap surveys conducted annually in collaboration with fishers. Indicators: number per unit of effort (NPUE) of legal-size and sub-legal-size crabs, changes in size structure over time and spermatheca load when available;
- Analysis of data from trawl survey(s) conducted annually in certain sectors or areas. Indicators: abundance index of legal-size and sub-legal-size males, changes in size structure over time and maturity of both males and females;
- Identification and prioritization of research projects to be considered for the future;
- Perspectives and/or recommendations on management measures in effect for the 2021 fishing season, among others, harvest levels and their possible effects on the abundance and maintenance of the reproductive potential, based on a combined indicator (CPUE and NPUE) and a summary table of main indicators for the precautionary approach and short- and medium-term predictions.

Expected Publications

- Science Advisory Report on snow crab of the Estuary and Northern Gulf of St. Lawrence;
- CSAS Proceedings summarizing the discussion.

Expected Participation

- Fisheries and Oceans Canada (DFO) (Science, and Ecosystems and Fisheries Management sectors)
- Fishing industry
- Provincial representatives
- Aboriginal Communities / Organizations

APPENDIX 2 – LIST OF PARTICIPANTS

Name	Affiliation	Feb. 16	Feb. 17	Feb. 18
Beaulieu, Jérôme	DFO – Fisheries management	x	x	x
Bernier, Denis	DFO – Science	x	-	-
Bouchard, Donald	Essipit First Nation	x	-	-
Boucher, Jean-René	RPPNG-OPCN area 16	x	x	-
Boucher, Larry	Fisher area 16	-	x	-
Bourassa, Luc	Consultant	x	x	x
Bourbonnière, Jean-Patrick	DFO – Science	-	x	-
Bourdages, Hugo	DFO – Science	x	x	x
Bourdages, Yan	Fisher area 12B	x	x	-
Brulotte, Sylvie	DFO – Science	x	x	x
Bruneau, Benoit	DFO – Science	x	x	x
Burnsed, Christina	Micmacs of Gesgapegiag band	x	x	-
Chabot, Denis	DFO – Science	x	x	x
Couillard, Catherine	DFO – Science	x	x	-
Cyr, Charley	DFO – Science	x	x	x
Denis, Marcel	ACPG	x	x	-
Desgagnés, Mathieu	DFO – Science	x	x	-
Dionne, Harold	Fisher area 17	x	-	-
Doucet, Marc	Fisher area 17	x	-	-
Dubé, Sonia	DFO – Science	x	x	x
Duplisea, Daniel	DFO – Science	x	-	-
Dupuis, Mario	RPPNG	x	-	-
Émond, Kim	DFO – Science	x	x	-
Fequet, Gareth	Fisher area 13	-	-	x
Gauthier, Sylvain	Fisher area 16	-	x	-
Gosselin, Claude	Fisher area 17	x	-	-
Huard, Georges	Fisher area 17	x	-	-
Joncas, Jean-Richard	Fisher LNS	-	-	x
Juillet, Cédric	DFO – Science	x	x	x
Lacasse, Olivia	DFO – Science	x	-	-
Landry, René	Chair Area 17	x	x	x
Langelier, Serge	AMIK	x	x	x
Lavallée, Dean	Fisher area 12C	-	-	x
Léonard, Pierre	Essipit First Nation	x	x	-
Lévesque, Isabelle	DFO – Science	x	x	x
Loboda, Sarah	DFO – Science	x	x	x
Méthot, Chantal	DFO – Science	x	-	-
Monger, Marc	Fisher area 14	-	-	x
Morin, Mathieu	DFO – Fisheries management	x	x	x
Munro, Daniel	DFO – Science	x	-	-
Myles, Geneviève	ACPG	x	x	-
Nadeau, Paul	APBCN	x	x	x
Pinette, Majoric	Pessamit	x	x	x
Pomerleau, Corinne	DFO – Science	x	-	-
Ransom, Glen	Fisher area 13	-	-	x
Rowsell, Austin	Fisher area 12C	-	x	x
Roy, Virginie	DFO – Science	x	-	-
Sainte-Marie, Bernard	DFO – Science	x	x	x
Sandt-Duguay, Emmanuel	AGHAMM	x	x	-
Senay, Caroline	DFO – Science	x	-	x
Spingle, Jason	FFAW	-	-	x

Name	Affiliation	Feb. 16	Feb. 17	Feb. 18
Stubbert, Curtis	Fisher area 15	-	x	x
Tamdrari, Hacène	DFO – Science	x	x	x
Tremblay, Yan	Pêcherie Uapan	-	x	-
Vigneault, Guy	Fisher area 16	-	x	-
Weiner, Guy-Pascal	Wolastoqiyik Wahsepikuk First Nation	x	-	-