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Proceedings of the Newfoundland and Labrador Regional Peer Review of the Assessment of Sea Scallop on the St. Pierre Bank (Subdivision 3Ps), and the 2HJ3KLNOP4R Snow Crab Assessment

Meeting dates: February 25-26, 2020
Location: St. John's, NL

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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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SUMMARY

The Regional Peer Review process to assess Sea Scallop (*Placopecten magellanicus)* in Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps and Snow Crab (*Chionoecetes opilio)* in Divisions 2HJ3KLNOP4R was held February 25-26, 2020 in St. John's, Newfoundland and Labrador. This Proceedings Report includes abstracts and discussion summaries of all presentations at the meeting.

In addition to these Proceedings, other publications to be produced from this meeting include a Science Advisory Report and two Research Documents for each of the two species. All publications will be made available online by the Canadian Science Advisory Secretariat (CSAS).

INTRODUCTION

The status of Sea Scallop in the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps was last assessed in 2016. The status of Snow Crab in Divisions 2HJ3KLNOP4R was last assessed in 2019. The current assessments were requested by Fisheries Management to provide information on the status of the resources.

The Regional Peer Review processes to assess Sea Scallop (*Placopecten magellanicus)* in Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps and Snow Crab (*Chionoecetes opilio)* in Divisions 2HJ3KLNOP4R were held February 25-26, 2020 in St. John's, Newfoundland and Labrador. This Proceedings Report includes abstracts and discussion summaries of all presentations at the meeting.

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PRESENTATIONS

SEA SCALLOP ON THE ST. PIERRE BANK (SUBDIVISION 3PS)

Presenter: Elizabeth Coughlan

Abstract

The directed fishery for Sea Scallops (*Placopecten magellanicus*) started on the St. Pierre Bank in the late 1970s. Populations on St. Pierre Bank are mainly found in three beds at depths of 40-100 m. They are usually found on hard bottom, with variable substrate composition, consisting largely of sand, gravel, shell fragments, and stones. The Sea and Iceland Scallop distributions overlap to varying degrees with complete overlap in the Middle bed, and a high degree of overlap in the North bed. A large area in the southern portion of the South bed, with a sandy substrate, is inhabited only by Sea Scallops.

Prior to 2006 the fishery was managed by Total Allowable Catch (TAC), and meat count regulations applied to the offshore fleet, but not to the inshore fleet. In 2006, following the recommendations of the Hooley Report, specific fishing areas and TACs were applied to each fleet. From 2006 to 2015 the offshore fleet did not fish on the St. Pierre Bank and started fishing again in 2016, while fishing has been consistently prosecuted in the North bed by the Newfoundland and Labrador (NL) inshore fleet since 2006. In the last three years landings have averaged 720 t, round in the North bed, and averaged 90 t, meat weight in the Middle and South beds.

A DFO research vessel survey in September 2019 resulted in a minimum dredgeable biomass (MDB) estimate of 12,725 t, round. This point estimate is associated with high variability and a subsequent high level of uncertainty. In addition, the abundance in the North bed is currently dominated by a modal group of scallops 75 mm while in the Middle and South beds the modal group is 120 mm and 130 mm respectively. The natural mortality index for Sea Scallop has decreased from 0.13 in 2015 to 0.02 in 2019.

Discussion

Meeting attendees asked for clarification in terms of the rule of five, where information on buyers, harvesters and processers cannot be presented in detail if there are less than five participants in any of those categories. Some voiced frustration that this leads to a lack of data required to properly assess the stock.

A question was asked regarding the number of meats by weight. The measure represents the number of individual scallops needed to reach a certain predetermined weight, which is an indicator for the average size of scallops. For example; for scallops around 80-90 mm in length, the yield would be roughly 33 meats per 500 grams, however there is no condition of number of meats per 500 grams for inshore boats, only for the offshore fleets. It was revealed that there are some difficulties in comparing inshore and offshore catches since one sector relies on round weights and the other relies on meat weight.

Concerns were raised during the presentation about the allocation of survey sets in 2019. The presenter explained that STRAP would usually account for areas that were not covered by the survey. However, due to the reduced number of sets in 2019, it was suggested that sets be removed from previous years to determine if set allocation in 2019 was problematic. Although the allocation may have been problematic, some participants thought that the areas that were not sampled would not have been different from the sampled areas. The DFO survey had some sets with high catches while the rest were more variable, keeping in mind the lower sample size. It was agreed that the results of the 2019 survey would be considered as presented, keeping in mind the caveat related to set allocation. Another concern highlighted by participants was the smaller size of sea scallops caught in 2019. This could lead to more individual scallops being caught to fill quotas, possibly having a negative effect on the stock. There is a number of meats per 500 grams condition on offshore fleets, but not on inshore fleets, meaning that inshore fleets may retain smaller scallops.

Participants commented that there appeared to have been a decrease in mortality rate. The reason for the decrease in mortality rate is unclear, although a participant explained that some larger catches from the survey were sub-sampled which may have reduced the number of cluckers sampled.

Some participants showed interest in the new data presented on the average meat weight by length, which can be considered an index of condition for sea scallops. This data suggests a decline in sea scallop condition in the north bed and a less clear trend in the south bed. There does not seem to be a clear trend between average meat weight by length and the biomass of sea stars. The sea scallops condition may instead be related to the amount of food available to sea scallops.

OCEAN CLIMATE IN NEWFOUNDLAND AND LABRADOR WATERS

Presenter: Frédéric Cyr

Abstract

An overview of physical oceanographic conditions in the Newfoundland and Labrador Region during 2019 is presented. The winter North Atlantic Oscillation (NAO) index, a key indicator of the direction and intensity of the winter wind field patterns over the Northwest Atlantic was positive for a 6th consecutive year (since 2012, only 2013 was negative). The large majority of the environmental parameters presented in this report were however close to normal (average of 1981-2010). The sea ice volume across the Newfoundland and Labrador shelf was slightly below normal, characterized by a large negative anomaly in March-April, which also led to an

early retreat on Newfoundland shelf. Annual sea surface temperature across the NW Atlantic was about normal, but characterized with slightly warmer than normal temperature in the north and colder than normal temperature in the south, especially during the first half of the year. Observations from the summer AZMP oceanographic survey indicate that after a predominance of colder than average conditions since 2012, the volume of the cold intermediate layer (CIL, <0°C) reduced along Bonavista and Flemish Cap section in 2019 (CIL along Seal Island section was normal this year but was reduced in 2018). The spatially averaged bottom temperature in 3LNOPs during the spring was close to normal, except along the slopes of the Grand Banks where it was above normal. For the fall, bottom temperature in 2HJ3KLNO was also above normal, especially in 2J (+1.1 SD) and 3K (+1.0 SD). The NL climate index was normal in 2019.

Discussion

No discussion took place.

OVERVIEW OF THE CHEMICAL AND BIOLOGICAL OCEANOGRAPHIC CONDITIONS ON THE NL SHELF

Presenter: David Belanger

Abstract

Biogeochemical oceanographic conditions on the NL Shelf and the Grand Banks in 2019 are reviewed in the context of large-scale spatial and temporal observed since the beginning the Atlantic Zone Monitoring Program (AZMP). Spring bloom magnitude (total production) was mostly below normal (average of 1998-2015) on the Grand Banks in 2019 although blooms started earlier and lasted longer than usual. Nitrate and chlorophyll *a* inventories were mostly above normal (average of 1999-2015), continuing a trend that started two to four years ago. Total zooplankton abundance has been increasing across the NL shelf and the Grand Bank since the start of the monitoring program in 1999. Zooplankton biomass decreased during the early 2010s but has been increasing since the 2015 to reach near to above-normal levels across the region in 2018. Limited data availability of at the time of the assessment did not allow the calculation of reliable zooplankton abundance and biomass estimates for 2019. The abundance of large *Calanus finmarchicus* copepods has remained mostly below normal on the eastern Canadian Shelf since 2014, which contrasts with the increase in the abundance of the small copepod taxa (*Pseudocalanus* spp., *Oithona* spp. and *Temora longicornis*) during the same period. The AZMP data indicate a change in zooplankton community size-structure observed over the past ~5 years characterized by an overall decrease in the average size of zooplanktonic organisms, and an important increase in the abundance of small copepods in the fall.

Discussion

No discussion took place.

NL ECOSYSTEM OVERVIEW

Presenter: Mariano Koen-Alonso

Abstract

No abstract provided.

Discussion

At the end of the presentation, the presenter clarified that the models presented were all static in time, meaning that factors such as the F ratio were constant. Someone asked for clarification on the species included in the shellfish group. The shellfish group only included commercial species (i.e. *Pandalus* shrimp and Snow Crab) since those are the species that are usually well identified in the surveys. Another question posed was how biomass was calculated. Biomass estimates were calculated with STRAP by using core strata that had been selected for ecosystem work. Strata were selected based on how consistently they were sampled across time.

It was pointed out that the DFO multi-species survey was not fully completed in 2019 and participants were wondering how that impacted the analyses. The presenter ensured that all of the Grand Bank was covered as well as the core strata that were chosen for the analysis. However, in some cases the coverage was sparse due missing survey sets. The presenter was fairly confident in the results of the analysis, remembering that there may be more variation due to the incomplete 2019 survey.

A participant asked why it seemed like there was no consumption of Snow Crab by predators from 1990s until recent times. There was consumption during this time, but that it was at a much lower scale. This is partly due to two separate time periods where predator stomach content was collected. Each period had its own calculated averages, which causes both periods to be on two very different scales. The consumption numbers presented were derived from model outputs that take into account the amount of food a predator will eat based on its body weight (1-2% of body weight per day for most fish species). Another type of model used for the analyses were models based on metabolic theory. No evacuation models were integrated into the analyses. The theory behind evacuation models is that with warmer waters, predators would digest faster and would therefore have less weight in their stomachs compared to colder conditions. The presenter concluded that we are possibly seeing the opposite, where there is an increase in stomach weights during times of warmer climate.

The presenter was asked if they had considered environmental modulators (e.g., NAO, bottom temperature, etc.) in the ecosystem models that were presented. No such environmental variables were incorporated into the models. The reason for not including those types of variables was that the models are static and do not track changes over time. Instead, the models track time through changes in total biomass and should be integrating the environmental effects through these changes in biomass. There were systematic drops in diet composition across a few divisions and participants asked to what they were attributed. The presenter explained that they were due to differences in diet composition.

OBSERVATIONS RELATED TO REPRODUCTIVE HEALTH OF FEMALE SNOW CRAB

Presenter: Krista Baker

Abstract

No abstract provided.

Discussion

A participant asked if the small brown spots detected in the spermatheca of female Snow Crab could be attributed to seismic activity offshore, referencing a study that had taken place recently looking at the impacts of seismic on Snow Crab. The presenter explained that they do not know

what could be causing the brown spots, and more work is required to determine what they are. The results from the study on the impact of seismic on Snow Crab should be made available soon and the presenter suggested they would get in contact with the author of that study.

Clarification was asked regarding how the sex ratio in Snow Crab populations affects egg clutches in females. Under normal circumstances, egg clutches should almost always be full. If the sex ratio is skewed towards females, the egg clutches will not be as full. If the sex ratio is skewed towards males, we would expect to see more eggs. However, the lack of males may cause females to be sperm limited, which could cause some females to die, which would be difficult to detect in the surveys or in the fishery data.

Questions were asked during the discussion about the reproductive trends of female Snow Crab in the Newfoundland region. A comment was made that there has been a swaying between multiparous and primiparous female Snow Crab. Females in the Newfoundland region have a mix of 1 to 2 years of egg retention. Regardless of if it is a 1 or 2 year cycle, female Snow Crab should always be full in terms of eggs under normal circumstances. Participants asked for clarification as to the relationship between egg and spermatheca load in the Gulf region. It was explained that although the relationship is not 100%, it is very close to that number. It would be problematic if there was a deviation from that 100% number. It is difficult to determine if the results from the Newfoundland region are consistent with other regions without having more data. Future work will involve looking at how Snow Crab sex ratios, in relation to the amount of residual crab in the population, affects clutch size and sperm load. Someone commented that one of the components of the proposed DFO Precautionary Approach (PA) Framework includes clutch size but this new work as presented is too preliminary to determine its implications for the framework. Harvesters voiced their appreciation for taking a broader approach rather than only looking at egg clutch size, taking into consideration other factors that may be affecting Snow Crab.

Participants were wondering why spermatheca data collected in the Northern Gulf could not be compared with the data collected from the NL region. It was explained that the Northern Gulf Snow Crab are subject to different environmental conditions, resulting in differences in the timing of fertilization and egg release. This makes comparing results from the two regions difficult. Another possible difference between the two regions is that Snow Crab may have longer migrations to undertake for reproduction in the NL region, which results in differences in energy invested into reproduction. It is difficult to determine how the difference in energy use by Snow Crab in the two regions affects sperm load in female Snow Crab since the NL Region data time series is still too short and there is no reference values for comparison. It is important to note that research experts in this field were surprised by these results from the NL Region. Following this discussion, a participant asked if other regions have data and results that could be compared to the NL region. The presenter mentioned that the southern Gulf may have some data, although more patchy and opportunistic.

The sampling for this work did not include 2HJ and meeting participants from that area were curious if future work will involve samples from that area. The challenge with getting samples from 2HJ is that female Snow Crab need to be alive during sampling. DFO could collaborate with the Torngat Joint Fisheries Board to train individuals to conduct the live female Snow Crab sampling to collect spermatheca from 2HJ. The Torngat Joint Fisheries Board representatives at the meeting expressed interest in the collaboration.

DIVISIONS 2HJ3KLNOP4R OVERVIEW – STANDARD ASSESSMENT (SNOW CRAB)

Presenter: Julia Pantin

Abstract

The status of the Snow Crab (*Chionoecetes opilio*) resource surrounding NL NAFO Divs. 2HJ3KLNOP4R is assessed using a variety of metrics. Data from multi-species bottom trawl surveys conducted during fall in Divs. 2HJ3KLNO and spring in Divs. 3LNO and Subdiv. 3Ps provide information on trends in biomass, recruitment, production, and mortality over the time series. Multi-species trawl survey indices are compared with other relevant indices toward inferring changes in resource status for 2020 and beyond. These other indices are derived utilizing data from harvester logbooks, at-sea observers, the dockside monitoring program, and inshore and offshore trap surveys, as well as oceanographic surveys. Snow Crab landings remained near 50,000 t from 2007 to 2015, but have since steadily declined to a 25 year low of 26,400 t in 2019. Overall effort decreased in 2019 to under 3 million trap hauls per year which is the lowest level in two decades. Overall CPUE was at a time-series low in 2018, but increased back to historical lows in 2019. Despite modest increases in the past three years and a further increase in 2019, the trawl survey exploitable biomass index has remained at a low level. Meanwhile, the trap survey index declined by nearly 60% in 2017 and 2018 to a time-series low. It increased slightly in 2019, but remains near the time-series low. Overall recruitment into the exploitable biomass has been very low in recent years and will remain low in 2020. Total mortality in exploitable crab is estimated to be near time-series' averages in most assessment divisions, with the exception of Assessment Division (AD) 3LNO where it is at a time-series low. It has declined from very high levels in most divisions during the past 1-3 years. In 2019, exploitation rates remained high in ADs 2HJ and 3K, declined in ADs 3LNO and 3L Inshore (but was still at a high level in 3L Inshore), and remained at low levels in ADs 3Ps and 4R3Pn. Elements of the proposed PA Framework presented in this assessment are tentative. LRPs defining the critical zone have been established by a peer-reviewed Science process, but USRs defining the cautious and healthy zones remain under development. In 2020, most divisions are projected to fall within the cautious zone of the proposed PA Framework; however, AD 3LNO is projected to fall in the healthy zone. These projections assume status-quo landings. The thermal habitat index (defined as the areal extent of <2°C bottom water) returned to near-average conditions in all assessment divisions in recent years, however decreased in ADs 2HJ and 3K in 2019 indicating warming conditions. Broad-scale climate indices appear favourable for improved recruitment to occur in most major areas of the stock range over the next few years.

Discussion

It was pointed out during the discussion that Assessment Division (AD) 2J did not get a lot of coverage in 2014-16 due to important core stations being missed during the surveys. Some of the lack of coverage in 2J may be attributed to a lack of at sea observers in that division. There has been issues getting the a good amount of observers for 2J in the last few years. Another participant asked if the observer coverage in AD 3L inshore was low this year. Although the worst observer coverage during this last year was in 2HJ and 4R3Pn, 3L inshore had a very low percentage of the landings measured.

Someone asked why there seemed to be large differences in kg/trap in 2HJ prior to 2018 and if that could be attributed to low sample sizes in previous years. The response was that the sampling was not as low in 2018 compared to other years, however it was still low. There was consensus during the meeting that more observer coverage is required. Suggestions were given to increase coverage and data availability in 2HJ by training northern Labrador residents as observers. However, observers are hired through a private contractor and would therefore be out of DFO's jurisdiction. The lack of observer coverage and the difficulty in finding an adequate number of observers is an ongoing issue for most if not all ADs.

The post season trap survey is moving towards a more random distributed survey compared to the historic surveys that concentrated on fishing areas. This allows for a better understanding of the Snow Crab population as a whole. It is important to remember that although new random stations are being included in the post season survey, the analyses presented focused on the core stations to maintain consistency with previous assessments. The hope is to integrate the random stations collected in the last few years when sufficient data has been collected.

A participant commented that there seems to be a difference in the distribution of offshore catches in 2016 and 2019. The 2019 catches are possibly more spread out than in 2016, resulting in the 2019 catches seeming lower than in 2016 based on the map presented during the assessment. Someone clarified that the reason why there were no catches in recent times in the most southern portions of assessment division 3Ps was that CMA 10B used to be separated into 10B and 10B extended but that there is no longer any fishing in the farther area. A similar situation happened in 2H where most of the fishing was pulled down to 2J as a response to a management decision.

Someone asked why the TAC was not taken in some divisions and years, assuming it was due to a lack of Snow Crab availability. The reasons depend on the area. For example in 2HJ they deliberately catch less than the TAC, while in 4R the fishery tends to be opportunistic depending on other fisheries. Some other reasons mentioned were weather condition (e.g., ice cover) and the available biomass of Snow Crab. Another participant asked if there was a target exploitation rate for the species. The answer was no, as there are no strict harvest control rules or guidance on how they are set across years and divisions.

Participants commented that the biomass estimates for areas along the slopes in deeper waters seemed low and that it could be due to multi-species sets being removed in the deeper areas. The presenter confirmed that the deep sets along the slope are usually the first ones to be dropped when the survey is behind schedule due to weather or mechanical issues. It was also mentioned that these areas are not Snow Crab habitat and should possibly be removed from the analysis as it gives the allusion that the survey did not cover the entirely of the Snow Crab area. Someone asked if the lack of the DFO multi-species survey coverage only affected the exploitable biomass or did it also affect the other population groups such as females and pre-recruits. The presenter explained that keeping in mind that the lack of coverage was limited to 2HJ and 3K, it did affected the other population groups as well. Retroactive analyses were conducted for all the population groups to determine how the lack of coverage influenced their biomass estimates. The main impact of the lack of coverage was an over estimation of the biomass, since the multi-specie survey missed areas where there was historically less Snow Crab. Based on this, a participant asked how it was possible that there would be an over estimation of the biomass but the catchability was lower than one. The response was that although there is some uncertainty around the biomass, it is only one part of the proposed DFO Precautionary Approach and would therefore not be a major concern. The purpose of showing these results is primarily to clearly demonstrate how the lack of coverage this year is affecting the overall estimates of the biomass. It was also pointed out looking at 2HJ, the confidence intervals seem fairly small, which suggests that although there was a lack of coverage, the estimates must be fairly close to the actual values.

Looking at the multi-species trawl data, a participant asked when the multi-species survey started including data on Snow Crab and if the spring survey has timing issues with the Snow Crab fishing season. The multi-species survey data on Snow Crab started in 1996 and there are timing issues around the spring survey and the fishing season as both generally take place during the same time period. Participants noticed that there was a difference in the trends of the multi-species and trap surveys in assessment division 3Ps in 2019. Possible reasons for this is that the post season trap survey missed some core stations while the multi-species survey

missed a few areas in the northwest portion of the bank. In general, both surveys seem to follow similar trends. Some participants believe that the trap surveys have a higher catchability compared to trawl surveys when Snow Crab move into deeper waters.

Looking at figures depicting the proportion of new shell and old shell Snow Crab, a participant asked why there were more new shell crab in the north compared to the south. Snow Crab in the north (Divisions 2HJ and 3K) were in relatively warmer waters, resulting in less skip molting. Snow Crab in Divisions 3LNO had a moderate amount of skip molting while Snow Crab in Subdivision 3Ps were found in cold pools of water with nowhere else to go, resulting in more skip molting. Discussion arose around the classification of old shell Snow Crab. A participant asked if old shell signified very old crab that were becoming foul or crab that were not pristine. It was clarified that there are two separate definitions of old shell in the current system. There is the at sea observer shell classification which includes three stages ; soft, new and old. The DFO classification system for shells on the other hand includes 5 stages which are soft, new, intermediate, old and very old. The observer data would therefore group the DFO classifications from intermediate to very old. For example, a crab with a barnacle that is intermediate shell for the DFO surveys would be classified by observers as old shell. A participant pointed out that old shell crab were miss identified by observers in 2HJ due to using the observer scale versus the more detailed DFO scale. Any legal sized crab, new or old shelled are considered retained. Looking at the proportion of exploitable biomass, the DFO data showed more new shell crab while the fishery data showed more old shell crab. This discrepancy is again due to the difference in shell classification between DFO and at sea observers. The time of year the surveys take place may also affect these results, since the DFO multi-species survey take place in the fall after recruitment. We would therefore expect to see more new shell crab in the fall surveys compared to the spring fishery.

Questions were asked about why there were gaps between the distribution of crab sizes in figures shown during the presentation. The presenter explained that prior to 2019, the size bins used in the figures were larger, meaning that bins would be less likely to not have any crab in them. Using smaller bins in the size distributions creates gaps due to some size bins having fewer crab. The lower value of Q in 3Ps can also contribute to gaps between size bins. Another participant asked why there was a sharp knife edge shape around the legal size point in the distribution of Snow Crab sizes. The probable reason behind that is the exploitation of legal sized Snow Crab. Another question was asked about the definition of pre-recruits, which are crab that would be recruited into the fishery in 2-4 years. A comment was made that in 2013-14, there was a large amount of softshell crab and the participant was wondering if a similar thing took place in 2003 but was missed. The presenter replied that there was indeed a similar large amount of softshell crab in 2003. Some participants suggested that the drastic changes seen in 2013-14 could have been due to Snow Crab moving into Division 3K or that a large proportion of the Snow Crab died as softshell crab.

Comments around Snow Crab possibly moving from one assessment division to another led to discussions around the scale at which the Snow Crab population should be assessed. The presenter explained that based on the data, Snow Crab in the NL should be assessed as one stock. Someone suggested that the assessment use a scale similar to the one used in the ecosystem overview presentation since although there is genotypic similarity throughout Snow Crab in the region, there is a lag in phenotype between the north and the south. The current Snow Crab management system was built around co-management and conducted at a small scale using CMAs (crab management areas). This system was convenient for co-management but is not necessarily relevant in terms of Snow Crab biology. This creates tension between trying to analyses the species at a relevant scale and providing advice at the smaller CMA scale. It was suggested that there may be an intermediate scale which could be used to be at

once more in line with the biology of the species and yet still relevant to co-management and CMAs. Someone commented that it is important to remember that there can be a clear distinction between the scale at which the species is operating and the scale at which management takes place. The scale of CMAs was chosen based on the best available information at the time and it is with more data and research that we are seeing signs of larger scales being needed to assess the stock.

Based on the portion of the presentation focusing on the impact of the North Atlantic Oscillation (NAO) on the Snow Crab population, someone asked what was the purpose of lagging the NAO values by a certain amount of years and if averages were taken. Lagging the data by a number of years allows for the model to focus on 2 year old Snow Crab. The NAO data is collected every month and are averaged by year. Observations were made that some ecosystem shifts may be happening differently in the different assessment divisions. For example, some participants noticed an increase in groundfish populations in division 2J. Other factors such as predators (e.g., groundfish and seals) may be affecting Snow Crab other than the exploitation rate from the fishing industry.

A participant voiced their concern about implementing new models to forecast changes in Snow Crab populations. They are comfortable using the post-season survey and indexes from the trawl and DFO surveys, but are cautious about including new variables and models into the assessment. Another participant asked if retrospective analyses are ever conducted to attempt to hone in on a more accurate value of q. The analysis now has over 20 years of data and with every new year of data, the value of q changes very slightly, suggesting the estimate is close to the true value. Someone asked how the different types of survey data used were controlled for since some areas (i.e., Division 2HJ) do not have DFO trap surveys. Although true that the type of data collected by division is uneven, factors such as year and gear type are taken into account to control for the differences. Looking at the egg clutch component of the proposed DFO PA, participants asked why there was a sharp drop and recuperation of the 3 year egg clutch average in 3LNO. The reason is still unclear and work is being done to explore factors impacting egg clutch size. However, this is not a deterrent to using egg clutch as a component of the proposed DFO precautionary approach. Certain participants mentioned that they are not as confident in the results of the DFO multi-species surveys due to catchability issues and the fact that conditions where the multi-species surveys are able to take place differ from when Snow Crab harvesters are able to fish. Someone replied that the DFO multi-species vessels sometimes cannot fish due to weather conditions so the difference there between the multi-species and post season trap survey are not as pronounced. However, the multi-species survey does sample different areas than the post season trap survey and there is a difference in catchability. Knowing this, there are attempts to try and scale the multi-species results up to those of the post season trap survey.

Precautionary Approach

In June 2020, DFO Science held a CSAS Regional Peer Review process to develop a Precautionary Approach Framework for Snow Crab in the NL Region. The key objective of the meeting was to define Limit Reference Points (LRPs), consistent with the PA, for Newfoundland and Labrador Snow Crab, based on the best scientific information available. DFO Science proposed a PA Framework for the NL Snow Crab resource and fishery (Mullowney et al. 2018b). The adopted parts of the framework include the LRPs, differentiating the Critical from Cautious Zones, and the Upper Removal Reference (URR). Harvest Control Rules (HCRs) and Upper Stock References (USRs) have been proposed but not adopted into the framework. Accordingly, proposed USRs presented in this assessment are tentative. The overarching HCR for the framework is that the stock is considered to be in the lowest zone of the three metrics examined, which include female egg clutches, fishery CPUE, and fishery discards. The

framework uses generalized additive models, peer-reviewed in a previous assessment, to project forward one year anticipated fishery CPUE and discard rates.

In 2020 most ADs are projected to fall within the provisional cautious zone of the DFO Science proposed Precautionary Approach Framework (Fig. 22), however, AD 3LNO Offshore is projected to be in the healthy zone. These projections assume status quo landings.

In early-2020, members of the harvesting sector submitted an alternative PA Framework for Snow Crab to be reviewed by DFO Science. It was noted during the 2020 Snow Crab assessment that several participants from the harvesting sector do not support DFO Science's current proposed PA framework for use in decision-making.

RESEARCH RECOMMENDATIONS

SEA SCALLOP

- Look at factors influencing size and condition of Sea Scallop (food availability, predation and environmental factors).
- Applications of meat weight / shell height for a conversion factor.
- Look into meat weight count as an index of fishing efficiency.

SNOW CRAB

- Extend spermathecae collection to 2HJ in conjunction with Torngat Joint Fisheries Board post-season survey and other under sampled areas.
- Keep expanding on the sperm load and clutch size research.
- Investigate scales of connectivity relevant to stock assessment.

APPENDIX I – TERMS OF REFERENCE – SEA SCALLOP

Assessment of Sea Scallop on the St. Pierre Bank (Subdivision 3Ps)
Regional Peer Review Process - Newfoundland and Labrador Region

February 25, 2020
St. John's, NL

Co-Chairs: Christina Bourne and Travis Van Leeuwen

Context

The status of Sea Scallop in the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps was last assessed in 2016 (DFO 2016). The current assessment was requested by Fisheries Management to provide current information on stock status and to provide the science advice that will be used in the management of the resource.

Objectives

- To assess the status of Sea Scallop resource on NAFO Subdivision 3Ps; and
- To determine the impact of maintaining the current harvest level.

Expected Publications

- Science Advisory Report
- Proceedings[1]
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Province of Newfoundland and Labrador Department of Fisheries and Land Resources
- Government of Nunatsiavut
- Indigenous groups
- Fishing Industry
- Academia
- Other invited experts

References

DFO. 2016. An Assessment of Sea Scallop on the St. Pierre Bank (Subdivision 3Ps). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2016/032.

[1] Joint Proceedings with the February 25-27, 2020 2HJ3KLNOP4R Snow Crab Assessment.

APPENDIX II – TERMS OF REFERENCE – SNOW CRAB

2HJ3KLNOP4R Snow Crab Assessment

Regional Peer Review Process - Newfoundland and Labrador Region

February 25-27, 2020
St. John's, NL

Co-Chairs: Christina Bourne and Travis Van Leeuwen

Context

The status of Division 2HJ3KLNO, Subdivision 3Ps and Division 4R Snow Crab was assessed in 2019 (DFO 2019). The current assessment was requested by Fisheries Management to provide current information on the status of the resource and to provide the science advice that will be used in the 2020 Snow Crab Management Plan.

Objectives

- To assess the status of Snow Crab in Divisions 2HJ3KLNOP4R; and
- To determine the impact of maintaining the current harvest levels.

Expected Publications

- Science Advisory Report
- Proceedings[2]
- Research Document

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Province of Newfoundland and Labrador Department of Fisheries and Land Resources
- Government of Nunatsiavut
- Indigenous Groups
- Fishing Industry
- Academia
- Other invited experts

References

DFO. 2019. Assessment of Newfoundland and Labrador (Division 2HJ3KLNOP4R) Snow Crab. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2019/041.

[2] Joint Proceedings with the February 25, 2020 Assessment of Sea Scallop on the St. Pierre Bank (Subdivision 3Ps)

APPENDIX III – AGENDA

Regional Peer Review Process: Stock Assessments of Sea Scallop on the St. Pierre Bank (Subdivision 3Ps) and 2HJ3KLNOP4R Snow Crab

Memorial Meeting Room, Northwest Atlantic Fisheries Centre, St. John's
February 25-27*, 2019

Chairpersons: Christina Bourne and Travis Van Leeuwen

Tuesday, February 25 (0900-1700)

Activity	Presenter
Opening, Terms of Reference and Introductions	Co-Chairs
Sea Scallop on the St. Pierre Bank (Subdivision 3Ps) Assessment	
Presentation: Sea Scallop on the St. Pierre Bank (Subdivision 3Ps)	E. Coughlan
Science Advisory Report Bullets	ALL
Snow Crab Assessment	
Presentation: Ocean climate in Newfoundland and Labrador waters	F. Cyr
Presentation: Overview of the chemical and biological oceanographic conditions on the NL shelf	D. Belanger
Presentation: NL ecosystem overview	M. Koen Alonso
Presentation: Observations related to reproductive health of female Snow Crab	K. Baker

Wednesday, February 26 (0900-1700)

Activity	Presenter
Presentation: Divisions 2HJ3KLNOP4R overview – standard assessment (Snow Crab)	J. Pantin
Reviewer Report	S. Boudreau
Science Advisory Report Bullets	ALL
Research Recommendations (Scallop & Snow Crab)	ALL
Upgrading of Scallop & Snow Crab working papers to research documents	ALL
ADJOURN	Co-Chairs

Thursday, February 27 (0900-1700)

* February 27 has been added in the event of winter weather related delays, NAFC building closure due to a storm, and/or extra time is required for discussion.

Notes:

- This agenda is fluid and may change.
- Breaks will occur at 10:30 and 2:30.
- Lunch will occur from 12:00-1:00 and is not provided. Food and beverages can be purchased from the cafeteria.

APPENDIX IV – LIST OF PARTICIPANTS

2HJ3KLNOP4R Snow Crab Stock Assessment – February 25-26, 2020

Name	Affiliation	Day 1: Feb. 25, 2020	Day 2: Feb. 26, 2020
Andrew Careen	Harvester	X	X
Ben Davis	DFO Science, NL	X	X
Brian Careen	Harvester	X	X
Brittany Keough	DFO Science, CSAS NL	X	X
Calvin Young	Harvester	X	X
Christina Bourne	DFO Science, NL	X	X
Connie Dobbin Vincent	DFO RM	X	X
Craig Taylor	TJFBD	X	X
Dale Richards	DFO Science, CSAS NL	X	X
Darren Sullivan	DFO Science, NL	X	X
David Small	DFO, RM	X	X
Derek Butler	ASP	X	X
Dwight Russell	Harvester	-	X
Elizabeth Coughlan	DFO Science, NL	X	X
Erika Parrill	DFO Science, CSAS NL	X	X
Erin Carruthers	FFAW	X	X
Frédéric Cyr	DFO Science, NL	X	X
Hannah Munro	DFO Science, NL	X	X
Jody Manning	Nunatsiavut Gov.	X	X
Julia Pantin	DFO Science, NL	X	X
Katherine Skanes	DFO Science, NL	X	X
Krista Baker	DFO Science, NL	X	X
Krista Tucker	DFO Science, NL	X	X
Laurie Hawkins	DFO RM	X	X
Mariano Koen-Alonso	DFO Science, NL	X	X
Martin Henri	DFO RM	X	X
Miranda McGrath	FFAW	X	X
Nelson Bussey	Harvester	X	X
Rob Coombs	Nunatukavut Community Council	X	X
Rod Drover	DFO Communications	X	X
Ron Johnson	Torngat Fish Producers Co-op.	X	X
Sana Zabihi-Seissan	DFO Science, NL	X	X
Stephanie Boudreau	DFO Science, Gulf	X	X
Tony Doyle	Harvester	X	X
Travis Van Leeuwen	DFO Science, NL	X	X
Trevor Jones	Harvester	X	X
William Coffey	DFO Science, NL	X	X
Tyler Eddy	MUN	-	X
David Bélanger	DFO Science, NL	-	X
Nancy Pond	Gov. of NL - FLR	X	X
Darrell Mullowney	DFO Science, NL	X	X

3Ps Sea Scallop Stock Assessment – February 25, 2020

Name	Affiliation
Alan Reeves	DFO Resource Management, NCR
Brittany Keough	Center for Science Advice
Chris Strowbridge	Harvester
Christina Bourne	DFO Science, NL
Connie Dobbin Vincent	DFO Resource Management, NL
Craig Taylor	Torngat Wildlife, Plants and Fisheries Secretariat
Darrell Mullowney	DFO Science, NL
Darren Sullivan	DFO Science, NL
David Belanger	DFO Science, NL
David Small	DFO Resource Management, NL
Elaine Hynick	DFO Science, NL
Elizabeth Coughlan	DFO Science, NL
Erika Parrill	Center for Science Advice
Erin Carruthers	Fish, Food, and Allied Workers Union
Frédéric Cyr	DFO Science, NL
Gary Maillet	DFO Science, NL
Hannah Munro	DFO Science, NL
Jody Manning	Nunatsiavut Government
Julia Pantin	DFO Science, NL
Katherine Skanes	DFO Science, NL
Krista Baker	DFO Science, NL
Krista Tucker	DFO Science, NL
Laurie Hawkins	DFO Resource Management, NL
Mariano Koen-Alonso	DFO Science, NL
Martin Henri	DFO Resource Management, NL
Michael Hurley	DFO Science, NL
Nancy Pond	NL Department of Fisheries and Land Resources
Rob Coombs	Nunatukavut Community Council
Roger Stirling	Harvester
Roland Hedderson	Fish, Food, and Allied Workers Union
Sana Zabihi-Seissan	DFO Science, NL
Stephanie Boudreau	DFO Science, Gulf
Travis Van Leeuwen	DFO Science, NL
William Coffey	DFO Science, NL