



Fisheries and Oceans
Canada

Pêches et Océans
Canada

Ecosystems and
Oceans Science

Sciences des écosystèmes
et des océans

Canadian Science Advisory Secretariat (CSAS)

Proceedings Series 2023/034

Newfoundland and Labrador Region

Proceedings of the Regional Peer Review of the Stock Assessment of American Lobster in Newfoundland

Meeting dates: October 17–18, 2022

Location: St. John's, NL

Chairpersons: Katherine Skanes and Paul Regular

Editor: Gillian Forbes

Science Branch
Fisheries and Oceans Canada
PO Box 5667
St. John's, NL, A1C 5X1

Foreword

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

Published by:

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

[http://www.dfo-mpo.gc.ca/csas-sccs/
csas-sccs@dfo-mpo.gc.ca](http://www.dfo-mpo.gc.ca/csas-sccs/csas-sccs@dfo-mpo.gc.ca)



© His Majesty the King in Right of Canada, as represented by the Minister of the
Department of Fisheries and Oceans, 2023
ISSN 1701-1280

ISBN 978-0-660-49714-3 Cat. No. Fs70-4/2023-034E-PDF

Correct citation for this publication:

DFO. 2023. Proceedings of the Regional Peer Review of the Stock Assessment of American Lobster in Newfoundland; October 17–18, 2022. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2023/034.

Aussi disponible en français :

MPO. 2023. Compte rendu de l'examen régional par les pairs de l'évaluation du stock de homard d'Amérique à Terre-Neuve-et-Labrador; du 17 au 18 octobre 2022. Secr. can. des avis sci. du MPO. Compte rendu 2023/034.

TABLE OF CONTENTS

SUMMARY.....	IV
INTRODUCTION	1
PRESENTATIONS.....	1
OCEAN CLIMATE AND VARIABILITY ON THE NEWFOUNDLAND AND LABRADOR SHELF	1
Abstract.....	1
Discussion.....	1
MONITORING LOBSTER SETTLEMENT IN NL.....	1
Abstract.....	1
Discussion.....	2
AN ASSESSMENT OF NEWFOUNDLAND AMERICAN LOBSTER (<i>HOMARUS AMERICANUS</i>).....	2
Abstract.....	2
General Discussion.....	3
Stock Assessment Status Updates Discussion.....	3
Stock Status Assessment (Method Changes) Discussion	4
Standardized CPUE Discussion.....	5
Trap Selectivity Discussion	6
Natural Mortality Discussion.....	6
Biomass Comparison Discussion.....	7
Biomass Calculations Clarifications Discussion.....	7
Yield Per Recruit (YPR) Discussion	8
Egg and Spawner Per Recruit Discussion	8
Next Steps and Data Collection Discussion.....	9
Discussion on Precautionary Approach (PA) Development.....	9
SAR BULLETS DRAFT	10
Introductory Bullet and Assessment Areas Discussion.....	10
Landings Bullet Discussion	10
Exploitation Rate Bullet.....	11
Biomass Bullet Discussion	11
Environmental Bullet Discussion.....	12
Short Term Recruitment Bullet Discussion	12
General Discussion.....	12
REVIEWER REPORTS.....	12
Discussion.....	12
RESEARCH RECOMENDATIONS.....	12
APPENDIX I: TERMS OF REFERENCE	14
APPENDIX II: AGENDA.....	15
APPENDIX III: LIST OF PARTICIPANTS	16

SUMMARY

A Regional Peer Review Process for the Stock Assessment of American Lobster (*Homarus americanus*) in Newfoundland was held October 17–18, 2022 in St. John's, Newfoundland and Labrador (NL). The purpose of the meeting was to assess the status of the American Lobster resource in four regions: the Northeast Region (Lobster Fishing Areas [LFAs] 3–6), the Avalon Region (LFAs 7–10), the South Coast Region (LFAs 11–12), and the West Coast Region (LFAs 13–14) and provide data to be used in the updated Integrated Fisheries Management Plan (IFMP).

Participation included Fisheries and Oceans Canada (DFO) Science, Ecosystems Management, and Fisheries Management Branches, fishing industry, academia, Indigenous groups and the Provincial Government of Newfoundland and Labrador.

Detailed rapporteur's notes of the discussion that followed each presentation were produced. This Proceedings Report includes abstracts and summaries of meeting presentations, as well as a list of research recommendations. The meeting's Terms of Reference, agenda, and list of participants are appended.

INTRODUCTION

A Regional Peer Review Process for the Stock Assessment of American Lobster (*Homarus americanus*) in Newfoundland was held October 17–18, 2022 in St. John's, Newfoundland and Labrador (NL). The purpose of the meeting was to assess the status of the American Lobster resource in four assessment regions: the Northeast Region (Lobster Fishing Areas [LFAs] 3–6), the Avalon Region (LFAs 7–10), the South Coast Region (LFAs 11–12), and the West Coast Region (LFAs 13–14) and provide data to be used in the updated Integrated Fisheries Management Plan (IFMP).

Participation included Fisheries and Oceans Canada (DFO) Science, Ecosystems Management, and Fisheries Management Branches, fishing industry, academia, Indigenous groups and the Provincial Government of Newfoundland and Labrador.

This Proceedings Report includes abstracts of presentations and summaries of meeting discussions. Additional information can be found in the Science Advisory Report (SAR) or from references cited therein.

PRESENTATIONS

OCEAN CLIMATE AND VARIABILITY ON THE NEWFOUNDLAND AND LABRADOR SHELF

F. Cyr

Presenter: A. LeBris

Abstract

Upper-ocean temperature has increased in most areas of the Northwest Atlantic over the last century, consistent with anthropogenic climate change. Oceans surrounding Canada are also projected to continue to warm over the 21st century, consistent with a northern shift in subtropical waters. For the Lobster Fishing Areas (LFAs) around Newfoundland, this translates into an overall Sea Surface Temperature (SST) warming over the recent decades. For all 4 LFAs (Avalon, South, West and Northeast coasts), this signifies longer and warmer ice-free seasons and warmer maximum temperature of the warmest week of the year. For Avalon, South and West coasts, summer average SST are also now regularly above the 12°C threshold believed to be the lower bound of the ideal lobster temperature range.

Discussion

There were no questions following this presentation. There was a comment from a participant about whether SST could be coupled with bottom temperature.

MONITORING LOBSTER SETTLEMENT IN NL

Presenter: A. LeBris

Abstract

There is no abstract for this presentation.

Discussion

There was a question from a participant regarding the depth of collectors for juvenile lobster, asking if there was evidence of green crab at any of the collection sites. It was clarified that the collectors were set at 3–5 fathoms, and that there was no sign of green crab at any sites during the three year time series of the study. Absence of green crab was likely because the collectors were set just outside the estuary where they are typically found, and not inside. It was noted that rock crab was found at all sites surveyed.

There was a question from a participant about the historical lobster landings that were presented, specifically the landings in the 1870s, asking if it was thought that water temperature played a role in the historically high landings from that time. It was mentioned that the waters are warming in the Gulf of St. Lawrence and around NL. It is thought that the high landings in the 1800s can be likely attributed to a lack of controlled fishery and not environmental factors or increased abundance.

It was asked if landings related to water temperature are being tracked. It was mentioned anecdotally that reports from Maine and south of Maine indicate water temperatures are warming even more than this region. It was clarified that work has been conducted on studying the relationship between landings and water temperatures in other regions for a number of years, and that the NL Region is hoping to do its own temperature research relating to relative abundance. There has been a correlation between these two factors for the last 3–4 decades and forthcoming work will examine this connection. It is thought that NL waters will not warm too much for lobster for quite some time, and that irregular 18–20°C days will not have much cumulative effect. Average temperature from June–September is of more concern and the main factor to consider. There has been a decline in juvenile lobster, but there has not been a decline observed in other lobster sizes. Data from the United States (US), Gulf of St. Lawrence and Prince Edward Island (PEI) in recent years has shown high juvenile lobster settlement. It is thought that larvae are unlikely to come to NL from more southern regions, and that connectivity between these regions is questionable.

There was a question about age structure, asking if 1–3 year old lobster would be useful as a predictor of population growth, like they use in the cod fishery. It was noted that in NL, juveniles might be in the water column longer than is currently thought.

Another participant questioned why collectors in Fortune Bay did not capture “young of the year” (lobster <1 year old). It was explained that work in Fortune Bay is usually conducted first because it is closest to St. John’s. It was clarified that last year the work was conducted in December, so this would address the theory that the area was sampled too early to miss the young of the year juveniles. Dive surveys have been conducted in those areas and have found juveniles. More information on modified (ventless) traps has been collected in Newfoundland, and the collectors in this study did catch 1–3 year old lobster in Fortune Bay, but in lower number than bays that were surveyed on the west coast of Newfoundland.

AN ASSESSMENT OF NEWFOUNDLAND AMERICAN LOBSTER (*HOMARUS AMERICANUS*)

K. Lefort, K. Baker, S. Quilty, K. Charmley, E. Coughlan, D. Mullowney

Presenters: E. Coughlan and D. Mullowney

Abstract

The American Lobster (*Homarus americanus*) is distributed near shore around the island of Newfoundland and along the Strait of Belle Isle portion of the Labrador coast. Major life-history

events (i.e., molting, mating, egg extrusion, and hatching) generally take place during mid-July to mid-September, following the fishing season.

The fishery is localized and prosecuted from small open boats during an 8–10 week spring fishing season. Traps are set close to shore, at depths generally less than 20 m. Fishing effort is controlled through restrictive licensing and daily trap limits. Regulations prohibit the harvest of undersized (<82.5 mm carapace length [CL]) and ovigerous (egg-bearing) lobster. In addition, there is a voluntary practice called v-notching, which involves cutting a shallow mark in the tail fan of an ovigerous female. The mark is retained for multiple molts and notched females cannot be retained in the fishery. The practice serves to protect mature females from harvest even when they are not brooding eggs externally. The number of licenses is currently around 2,300 and trap limits range from 100 to 300 depending on the LFA.

This stock was last assessed in 2019 and is currently assessed every three years. The present assessment of this stock was requested by DFO Resource Management to provide current information on the status of the resource to be used in an updated IFMP. The LFAs were assessed based on four Assessment Regions: Northeast Coast (LFAs 3–6), Avalon (LFAs 7–10), South Coast (LFAs 11–12), and West Coast (LFAs 13–14). The key indicators for the assessment are reported landings, fishery catch per unit effort (CPUE), exploitation rate and total mortality in legal-sized lobster, and biomass indices. Preliminary total reported landings in 2022 were at their highest level in a century (5,780 t); this reflects increasing trends in the South coast, West coast and Northeast coast Regions while reported landings in the Avalon Region have remained low.

Despite showing signs of high exploitation rates in most areas, all key indicators are consistent in showing sustained signs of growth throughout all Assessment Regions. Short-term recruitment prospects appear steady in the Northeast and Avalon Regions and at the highest levels in the time series in the South and West coast Regions. Recent improvements in recruitment appear to be associated with increasing sea surface temperature in the Assessment Regions.

General Discussion

There was a question from a participant about the Stock Assessment Regions and how and why they were divided and managed as such. It was clarified that the reason is because some areas have more data available, and prior assessments were focusing on those areas where more data was being collected. It was decided in 2013 to combine some of these areas to get an idea of trends for catch rates and landings and extrapolate the information using data from adjacent LFAs.

During presentation of the DFO trap survey data, there was a comment about the scale in the survey length frequency-relative abundance graph changing from 0.06 to 0.1. It was also mentioned that there was a lot going on in one graph and suggested that the figure needs to be reworked.

Stock Assessment Status Updates Discussion

There was a clarification question from a participant asking if the CPUE for the Fish, Food and Allied Workers Union (FFAW) harvesters logbook data on modified traps was also not standardized. It was clarified that the FFAW data is not standardized.

There was a question from a participant about the discrepancy in the data from at sea observer sampling versus logbook data. It was noted that the CPUE is 0.5 times higher in logbooks than at sea observer data, but they have similar trends. The participant suggested that this could be

from a vessel effect, and asked if there could be a way that the overall mean is calculated over days fished, etc. It was also mentioned that these discrepancies are seen in other areas in the world.

There was a clarification regarding the topic of “Proportion of female categories over size range”, asking if the graph was a proportion of ovigerous females out of just the female population or the total population (including males). It was clarified that the proportion of ovigerous females presented was out of the female population and not the total population (comparing ovigerous to non-ovigerous).

A participant requested that the group come back to talk about the Avalon Region. The Avalon Region had more variation of size at ovigerous according to one participant, and another participant disagreed and stated that it wasn't varied and that there was patterns in that region, showing a shift in size at ovigerous.

A participant clarified that when there is a no negative slope on the depletion curves you cannot use the Delury method to estimate biomass, but in some cases even when there is a negative slope on those regressions it is not very useful. It was requested to come back to the South Coast 2021 and the West Coast 2019 for discussion points later in the assessment.

There was a question about the “Rule of 5” (5 fishers, vessels or buyers), asking if it was possible for buyers to sign a waiver to allow the information to be released if there was fewer than 5. It was suggested that this may have happened in other regions, and was confirmed by another participant that data release waivers have been used for 3NO whelk in the past. Waivers could help separate Zones 11 and 12, which are combined together, but are very different fisheries and environments. It was noted that this is a Government of Canada rule and not just regional.

There was a question about gear modification in the last 5 years. It was mentioned that most harvesters are using Nova Scotia or Prince Edward Island style traps (which are larger), and wondering if this has increased landings. It was clarified that DFO Science NL Region is aware that harvesters are using larger pots and they are asked to reflect this in the logbook, which could help with the unstandardized CPUE indices. There has been consultation with the DFO Maritimes Region, where the larger gear mentioned is used.

Stock Status Assessment (Method Changes) Discussion

A participant asked for clarification on how the data points were delineated on the depletion curves based on DFO Logbook data. It was clarified that the points are binned by week.

There was discussion about sex ratios, looking for insight about Placentia Bay from participants. In undersized lobsters the sex ratio was skewed to 60% female, then dips to 20% (just after legal size) and then increases to 80–90% in the larger sizes. The higher proportion of females in larger sizes makes sense due to prohibition of harvesting egg bearing females, as well as v-notching. A participant suggested that it could be due to fisher behavior avoiding areas with known berried females, based on anecdotal reports in regions outside Placentia Bay. Another participant stated that they did not think harvesters would shift traps based on an area being known for mature females. One participant mentioned the oil refinery possibly being a factor, as well as water temperature and pollution. It was also mentioned that every 10 years there appears to be a decent fishery for Placentia Bay (not compared to other areas). It was suggested that water conditions may cause different movements between the two sexes. The west side of the bay was historically better lobster fishing ground; however, the lobsters are not coming back in that area where the islands are and where the habitat would appear to be better suited for them.

A participant asked for clarification on if “ovigerous females” constituted eggs on the outside of the tail and that there was no term for mature females without eggs on the outside of the tail, but had them inside the body. It was confirmed that the term “ovigerous” referred to females with external eggs only, and that females with eggs inside the body would be considered “mature”.

Standardized CPUE Discussion

A participant mentioned vessel effects on logbooks and trying to standardize CPUE. It was noted that the standardization helps correct the bias in FFAW data. It was clarified that the residual pattern against vessels was not examined. The participant mentioned that in their work, they found these variables to be very significant because they target different fishing areas, and that there is high CPUE variability among them. It was noted that this suggestion should be explored as a random effect for “vessel” or “fisher” in the model, and might help even more with the model fit, though the model fit already looks good. It was also suggested to compare gear types and catchability, and it was suggested to include gear types in the logbooks. It was noted that there is a gear type delineation between wooden and wire type in the logbooks currently, but logbook categories are needed stating if gear is the “NS” style trap or the traditional NL trap type.

There was a question from a participant about the adjusted landings (real landings are not reflected in the reported data due to unreported sales) that were being used, asking if there was data to back up the assumptions being made. It was clarified that the assumption is that if one slip from one buyer is present, is it assumed that fisher is reporting all of their other sales. It was noted that the two areas where the reported and adjusted landings diverge the most are the areas with the lowest CPUEs (Northeast Coast and Avalon Assessment Regions).

There was discussion regarding non-participation in the fishery by license holders. There was a question asked if there are harvesters not using their licenses. It was clarified that license holders with no reported sales had not been looked into at this time. A participant clarified that there is non-participation with many license holders in the Northeast Coast Region for the lobster fishery. The Northeast coast area is a low volume fishery (low CPUE) and is also at the same time as the snow crab fishery, which is the higher landing fishery. There is small scale participation for personal use. There is an active group for licensed buyers, but not as much directed activity for Northeast coast and reliance on this fishery in the area. Another participant agreed with the previous participant about harvesters not actively using licenses in certain areas and mentioned that for 3Ps and 4R they are using them and put in effort, but some senior harvesters are just holding on to licenses. A participant mentioned that 20% of harvesters participate in the fishery in their area (3Ps Placentia Bay, Area 10), and that many of these people just catch a few for personal consumption. A participant mentioned that in 3Pn all licenses were used in 2022. It was expressed that more weight should be given to the observer data, which is thought to be more reliable. The observer’s sole job is to collect data, whereas the harvester has more responsibility and data might be approximated. It was noted that there will never be 100% observer coverage, and there will always be a mismatch in those data sets.

A participant suggested considering other biomass estimate approaches than the Delury method.

A participant questioned whether assumptions (of the model) hold true, because the same effort was given to harvesters fishing less than others putting in more effort. It was explained that there was a different approach to adjust landings. It is understood that there are a proportion of fishers not as active in the fishery. The participant felt that the adjusted landings were too high without further information or anecdotal reports. A discussion took place about what is worse, overestimate or underestimate. It was suggested to explore risks in one direction and the other.

In the Avalon and Northeast Coast Regions, there is a range of values that are possible, and it is not known what is true. It was noted that for other plots in the assessment, both the adjusted and reported values will be presented.

A discussion occurred about how there is less risk in using the adjusted values as they may still be underestimated. The adjusted values in some regions are very close to reported values, based on the model. The South and West coasts hardly had a change between the adjusted and reported values, and the adjusted landings are likely an underestimate, whereas the adjusted values on the Avalon and Northeast Coasts are likely an overestimate.

A participant suggested getting data from the FFAW for tags, and mentioned that fees have to be paid to retain their licenses, and harvesters must pick up the tags and logbooks.

A participant mentioned that if there are issues with the reliability of the landings data, there are frameworks to which you can tune the uncertainty around a time series of landings, and see if with increasing uncertainty based on your CPUE indices, biomass estimates hold or not. A discussion occurred about using the R package “spict” or super prediction model. It was explained that this was attempted, but it didn’t have a sensible starting point in the data, and was unsuccessful as the starting point to estimate Maximum Sustainable Yield (MSY), among other starting parameters.

Trap Selectivity Discussion

A participant mentioned that there was a selectivity study done in the Gulf Region in 2008 (Comeau 2008 framework document) where they also did a test on 44.5 mm (1.75 in) vents, and the curves are very similar to what was presented only with a different approach.

A participant mentioned they have used the function “mixedtools” in R in the past and have never been very successful with it, and remarked that it was nice to see such clear modes presented in the data. It was asked if it was possible to track these cohorts over time and wanted clarification if a plot was one year of data, or grouped together. It was clarified that data is lumped together, but subsequent data will be presented by year. It was noted the survey times were the end of June (end of the season) for the West Coast, beginning and end of season for Conception Bay, after the season for Comfort Cove and right before the season in Harbour Breton. It was noted that the waters around Harbour Breton were quite cold at the time and could have affected the catch rates. Seasonality could explain the modes in the data, but there could be other factors.

A participant mentioned that surveys in all areas were after the fishing season, except Harbour Breton (before the season), and asked what the rationale was. It was clarified that factors such as logistics, weather and personnel played a role as to when areas were surveyed. There was an attempt to cover all the sites before the season as to not survey in season (when harvesters are on the water) or in summer (a sensitive time period biologically for molting, mating and reproduction). DFO Science is looking at shifting the survey timing in Fortune Bay from April to sometime in the fall.

Natural Mortality Discussion

There was discussion about if there was a package or code in R to track modes through time. The “elephan” function was suggested if there were clear modes in the data. The “tropfish” package in R was suggested if there were no time series of consistent modes. It was explained that there was not a broad enough distribution to use “elephan”. It was expressed that hopefully the Z curve on linear regressions will become consistent enough moving forward to give an idea of natural mortality.

There was a clarification on the Length Converted Catch Curve (Z) about excluding the “hockey stick” part of the data, and it appears that it was not excluded. It was clarified that data over 25 years old excluded outliers in order to exclude the “hockey stick” portion of data. It was noted that the “hockey stick” could not be excluded this time due to not having as much control, as the growth function was not flat, and they did not want to make up the growth function. It was noted that working towards getting an improved length-age relationship should be included in the Research Recommendations.

Biomass Comparison Discussion

It was noted that this is the first time that the biomass will be included in the SAR document and that the figure using the adjusted landings would be included, as it was decided that the adjusted values are closer than the reported values. A participant wanted clarification on the Delury method and what parameters were used. It was clarified that the Delury method requires CPUE (logbooks [kg/trap]) and the number of trap hauls, which is only from active fishers that fill out logbooks. There was an adjustment factor done to bump up the CPUE (logbooks and traps) over the season to come to a true level of effort in the fishery. This is based on landing comparisons between logbooks, the total landings, and the adjusted landings in the Adjusted Landings Index. It was confirmed that adjusted landings are used in both calculations. Landings are not needed in the Delury method, and they are used to adjust the true expenditure of the effort. Landings are required in the catch curve to obtain a biomass, as estimates of biomass come from the landings plus an adjustment for natural mortality over the A (total annual mortality). It was previously mentioned that some fishers are not using their licenses, and that consideration needs to be given to what effect this may be having on your data.

A participant asked if there was a length converted catch curve for unadjusted landings, and if there was a difference in exploitation rate between adjusted and unadjusted values. It was clarified there was no difference between the exploitation rate in adjusted versus unadjusted landings and the end result is the same.

A question was asked by a participant on whether there has been any work done on food source for lobsters. It was clarified that no specific studies on diet, food limitations or predator-prey relationships have been conducted in recent years. It was mentioned that anecdotally, harvesters have observed numbers going down in sea urchins, possibly due to otters and limitations on kelp. It was mentioned that in the late 1980s, a five year study was conducted by Dalhousie University on the relationship between lobster, kelp, sea urchins and rock crab.

Biomass Calculations Clarifications Discussion

A participant had a question about the “logprop” function in R used to estimate biomass in the Delury method, asking if it was on an annual basis and how the adjustment was done. It was clarified that the adjustment applies evenly on all weeks and is done on an annual basis. There was an additional question asking if the adjustment varies much across years and it was clarified that that was unknown. It was suggested that this should be looked into and could show if there was persistent underreporting in particular areas.

A participant suggested looking at the adjustment every year to see the magnitude of the impact. It was noted that there is a need to better capture uncertainty and be more explicit about adjustment and scale of the correction and to capture better data on these sales that contribute to underreporting. It was noted that there will be a “Sources of Uncertainty” section in the SAR.

Yield Per Recruit (YPR) Discussion

A participant mentioned that the anecdotal indicator of exploitation rate is the landings over the full season, specifically in Area 12. It was explained that the season is 69 days, and that after the first few days of high landing rates, they level off from day 4–5 to day 69. This is possibly due to trap selectivity, and traps not fishing at the optimum level they could be. It was confirmed that what was described is observed in the data. Another participant commented that CPUE is remaining steady through the season, explaining it is the result of how the fishery is controlled and not indicative of abundance.

It was noted that there is more stable effort in the fishery throughout the season and that flat depletion is problematic for the model/method (Delury). As biomass is increasing, there may not be depletion seen in season moving forward. If effort stays constant and biomass increases, the exploitation rate does come down. It was noted that the data is simulated, and that exploitation rates will not necessarily be high going forward, or that if the biomass increases that the exploitation rate would not be taken down. Rather, probably getting closer to an F_{msy} level, and will be more stable in the fishery throughout the season.

A participant asked a question about the sensitivity of analysis to the natural mortality value (M) of 0.05, and it was clarified that the model is very sensitive to the M value. M was previously tried at 0.15 in the working paper that was distributed to meeting participants. The yield scale was set at 900 for the males, so it is very sensitive to the M value.

A participant asked if YPR was tried on real data and not just simulated, as alternative for biomass estimation and exploitation rate as an alternative to Delury, and suggested that data are at a good starting point for this as an option. It was clarified that this has not yet been examined.

Egg and Spawner Per Recruit Discussion

A participant asked for clarification on if the data were simulated. It was explained that the YPR comes from simulated data and that the maturity proportions (size at ovigerous) applied are real, which explains where the difference in Avalon data comes from.

A participant commented that the ovigerous lobster size data in the Avalon Region does not behave like the other regions. It was requested if there is an explanation for this, if the data can be trusted and also the sample size and measurement accuracy were questioned. It was explained that the data fits were good in the model, they could be a bit scant for population size or sample size, but are acceptable. It was noted that other DFO Regions were consulted about the data trends from the Avalon Region, and they reported they had not seen data like it before.

It was explained that there has been a depleted population in Placentia Bay, and it appears to be real. There has been a systematic shift over the time series to a larger size at ovigerous, and it is unclear what the underlying issues are or why this is occurring. It is thought that this shift is real, and the model fits are acceptable.

There was a question as to whether there has been a change when sampling occurred and if the data is a product of low sample size over two years. It was clarified that the sampling is done while the fishery is happening. There has not been as much coverage in Avalon Region since 2020 compared to other regions, but it is not thought that the sample size is too low, as most data points represent 100 individuals sampled. Possibilities of measurement, processing error or timing were discussed. However, it was noted that it could also be a real biological phenomenon, which could be related to persistent low population due to low egg production. An increase in at-sea sampling in the coming years to monitor the pattern was suggested as a possible research recommendation for moving forward.

There was a question from a participant asking if there was interest in doing the same study they did post-season in Fortune Bay, but in Placentia Bay. It was clarified that there was possible interest, and it could be discussed after the meeting. It was noted that the Avalon Region has 5 years of data from Conception Bay.

A participant mentioned that since 2017 it has been a May 1 season start. Prior to 2017 the season start was mid-April, and they were wondering if this is affecting the data? It was thought that this could affect the data, but not a significant amount as it was 5 years ago. There are more spawning lobsters later in the season, so there could be a bit of an effect, but not full effect. It was noted that there has been a decade and a half gradual shift in the ovigerous egg production.

A participant suggested conducting future research on pelagic species diets, stating that the biggest predator on lobster is pelagic herring and mackerel because they feed on larvae. It was mentioned that anecdotally there have been higher levels of mackerel seen lately.

There was a suggestion by a participant to look at size at maturity in areas and see if there was a difference in the Avalon and the other regions, and to look at egg bearing and try to tease out the two. It was noted that the index is eggs (driving factor) based on the Precautionary Approach (PA) Fisheries Resource Conservation Council (FRCC) philosophy, not early stage maturity.

Next Steps and Data Collection Discussion

There was discussion around the current data collections not being efficient and that there is little in terms of data, redundancy in logbooks, and inefficient or poorly run trap series in at sea sampling. In an ideal world, modified traps would be used, but there is not enough. Modified traps are spatially too sparse to get indicators for pre-recruits to make a relationship with forecast landings. If the number of modified traps is not increased, then it does not make sense to continue. The modified trap program needs to either be improved, or another plan needs to be implemented for the resources.

There are two sources of logbooks – DFO and FFAW logbooks, they show similar trends and collect similar data under the FFAW and DFO collaboration program. The logbooks validate data for CPUE; however, the time series is long enough currently that there is a redundancy in the two sets of logbooks. Expanding the modified logbooks with harvesters, can be discussed further for monitoring, and would have to be integrated into resource management because of extra fishing.

Discussion on Precautionary Approach (PA) Development

There was a question posed regarding what the PA framework in other regions looks like. Egg production is the main management objective set by DFO currently, based on the FRCC report. It was noted that large females and CPUE (some standardized and some not) are used in Maritimes. In the southern Gulf of St. Lawrence they have previously used a multi-indicator approach and it is also based on landings as a proxy for abundance. Some regions have bottom trawl surveys and multi-indicator approach.

A participant mentioned the potential to develop maximum sustainable yield (msy) reference points to help set biomass limits and removal limits. It was mentioned that Ireland uses spawning potential ratios based on some assumptions in fertility and egg production, based on the different sections of the populations of lobsters.

There was further discussion regarding the focus on egg production. There was debate about whether or not harvesting mature, egg bearing females was creating larger lobsters that were

destroying smaller lobsters when in the same trap. Anecdotally, when large lobsters were allowed to be harvested, this reversed this effect 5–6 years later in area 4R, and that there hasn't been a detrimental effect seen. It was noted that large female abundance is used as an indicator of how heavily the stock is being exploited. The prohibition on >127 mm carapaces was lifted in 2015 or 2016, which was recommended against by Science, because it helps to have more larger females in the system. There was an increase of the minimum legal size carapace from 81–82.5 mm. Larger females increase the number of eggs produced, and survivability of eggs is known to be higher than ones coming from smaller sized lobster. A participant commented that it might be more important what happens to eggs upon release, and they question focusing only on eggs going forward. However, eggs and female abundance are however a controllable element, which is important for a meaningful PA, which is why they are number one on the multi-indicator approach.

A participant highlighted egg production and suggested rotating closures, exploring genetics tools and population differentiation, connectivity and finding critical source populations for lobster egg production. Not all individuals and populations contribute evenly to future generations. This would allow shifting focus from sink populations without worrying about egg supply.

There were suggestions made by participants that v-notching was creating large lobsters. It was noted that v-notching stems from FRCC recommendations, and there was also an increase in minimum legal size. A participant mentioned that there is also v-notch and maximum landing size in Ireland and their research shows that the v-notching does increase the small scale reproductive potentials.

A participant brought up landings in competing fisheries, stating that landings don't necessarily reflect abundance if people are not fishing that resource. Socioeconomic factors come into effect if people are not fishing for reasons unrelated to the abundance. If people stop fishing, there is no data, and it is more difficult to do an assessment.

There was discussion on using the multi-indicator approach and the group agreed upon using the following three indicators: eggs, landings and CPUE. A participant brought up ecosystem indicators also and the importance of moving toward an ecosystem approach.

SAR BULLETS DRAFT

Introductory Bullet and Assessment Areas Discussion

There was a comment by a participant about the wording on the first bullet about the 4 geographical regions into which the assessment areas were grouped. It was decided to keep the existing bullet text as is, and be consistent with previous assessments. It was noted that assessment and geographical regions were different, and wording was added to ensure clarity.

Landings Bullet Discussion

There was a question if the 2019 assessment included landings in the bullets. It was noted that the reported landings were included up to the month of October in the catch and effort, and for the other data sources its only based on what was collected in the fishery up to last year (2021). It was noted that the landings are always preliminary and are subject to change sometimes up to years later based on stats entry, and that 2021 landings would be more reliable than 2022 landings. It was suggested and agreed upon to add the word "preliminary" to the bullet regarding the landings. Since reported landings are not real and are underreported, it was suggested to have an introduction clause stating that reported landings are underestimated. This statement was added to the bullet. There was a question from a participant about the

statement “highest landings in a century”, asking if this implied that over a century ago that the landings were higher, and that they didn’t think that this was the case. There were questions about the large landings in the 1800s being real or not. There was discussion on this being the case because there were no fishing quota restrictions at the time. It was agreed upon that the statement “highest in a century” would be the most accurate, as 100 years ago there was a fisheries collapse, and prior to that there was record landings.

It was suggested to clarify reasons for the reported landings being underreported. It was brought up that it should be kept brief and encourage people to read the Science Advisory Report (SAR) document. It was mentioned that if the underreported landings were mentioned that it should be quantified by how much. It was noted that this would be difficult as it varies by region. It was agreed upon that the statement would mention underreported landings throughout the time series as a precursor to the statement about the landings being the highest in a century. There was discussion on the wording “underestimated”, as the landings are not estimated, but based on reported numbers. It was mentioned that it is only in Avalon and Northeast Regions that areas are really underreported and that the rate of reporting is different.

Exploitation Rate Bullet

It was mentioned that the bullet does not have fishing mortality, only exploitation rate, and it was suggested to clarify. The “fishing mortality” wording was changed to “exploitation rate”. There was a question from a participant on whether the statement “high” explains the fishing mortality. It was clarified that “high” referred to the abrupt knife edge at legal size.

There was a clarification question on fishing mortality and natural mortality in the model, and it was clarified that it is almost all assumed to be fishing mortality. Biomass is calculated with only a slight natural mortality of 0.05 (only for legal sizes, does not account for predation on sub-legal sizes). Legal size large lobsters have a very low natural mortality, and most would be fishing mortality, as the assumption is little predation.

There was discussion around using the term “high” in regards to exploitation rate. It was suggested to put a range of values for 2021 and add the time series, as all four values were too much wording for a bullet. There was discussion about whether to include these details in the bullets or not and whether the bullets should be streamlined as much as possible, and direct the reader to refer to the body of the SAR if they wanted the information. It was agreed upon by the group to leave the details in for clarity.

Biomass Bullet Discussion

It was noted that increasing biomass was mentioned in bullet, but there was nothing mentioned as to why there was a rapid increase. A participant mentioned that it was partially explained by previous bullet. There was discussion about how biomass and exploitation rates are different. It was brought up that text regarding environmental changes that are likely contributing to biomass changes should be included. It was suggested to put the environmental bullet before the biomass bullet, to serve as an explanation as to what is occurring. It was noted that the Northeast and Avalon Regions were not really mentioned in the biomass bullet, and that the South and West Regions are highlighted. It was suggested to take out the word “rapidly” for the three Regions increasing and word it as “remained steady” in the Avalon Region and remove the word “low”. It was suggested to put “gradually” or “rapidly” and delineate regions and not lump together. There was discussion as to whether the Avalon Region is increasing, and it was mentioned that it is a gradual increase, and every region is currently at its highest point in the time series. Anecdotal reports on the Avalon Region from fishers are that landings are up and possibly doubling in the last few years. It was mentioned that graphs for regions are at different

scales and if they were single graphs, some regions would also look like a dramatic upswing in recent years. The Avalon Region is close to double in the last three years. It was suggested to list it as an increase for all regions, instead of describing the increase rate in each. It was highlighted that biomass is doubling in most cases in the past three years and that the text should read that there are “time series highs in all assessment Regions”.

Environmental Bullet Discussion

There was discussion around the order of bullets, and it was agreed upon by the group to put the environmental bullet as the second bullet, as it sets the stage for the other statements and is consistent with previous assessments.

There was a question asking if environmental information will be in the SAR. It was confirmed that environmental information will be in the SAR and the Research Document, but it was not in the original Working Paper.

Short Term Recruitment Bullet Discussion

There was discussion on whether the word “steady” meant flat, and that the numbers in biomass do not suggest that. There was discussion about biomass being flat in the Avalon and Northeast and at highest levels in the South and West coast Regions.

General Discussion

There was discussion around defining the time series in a single bullet rather than every bullet. This was agreed upon and completed.

There was a question on whether there would be a bullet about the management consideration slides. It was mentioned that the next assessment might be ready to include this information, as presently the commitment for the PA approach has not been met.

REVIEWER REPORTS

Presenters: N. Asselin and G. Martin

Discussion

The Reviewers stated that they felt that the science was robust considering data available. The data had been taken much farther than the previous assessment and was making good use of fisheries dependent data, and that they agree and support the work. Suggestions for future research were made regarding a standardization model, YPR for non-simulated data, scale of impacts from assumptions made and potential issues with the Delury method regarding depletion due to increasing biomass. It was noted that this assessment was a significant improvement from the last report.

RESEARCH RECOMENDATIONS

Potential Research Recommendations

- Investigate trends in ocean temperatures versus Lobster landings. Is specifically the northern range for lobster distribution expanding (i.e., into LFA 3, southern Labrador) due to increasing temperature trends.
- Continue the lobster settlement research in Newfoundland, including further spatial coverage in previous study sites (i.e., Fortune Bay), and examine the timing of settlement. In

addition, determine the utilization of juvenile lobster (age 1–3) settlement as a predictor of trends in lobster landings.

- Investigate predator -prey relationships between pelagic species (i.e., mackerel and herring) and lobster at various life stages (i.e., larvae and adult).
- Increased data collection from ventless/modified traps.
- Explore how changes in trap type (i.e., NL commercial trap and NS larger commercial trap) impact CPUE indices. Use vessel or trap type (random effect) as a factor in the CPUE standardization model.
- Use the length frequency modes in data for natural mortality.
- Investigate ways more data on size at maturity can be collected within the Region to support this research.
- Update length- weight and length- age relationships within the Region.
- Explore the change in proportions of females slightly larger than legal size.
- Explore other assessment methods (from other Regions?) that can be applied using available data sources.
- Continue research through fishery independent surveys.

APPENDIX I: TERMS OF REFERENCE

TERMS OF REFERENCE

STOCK ASSESSMENT OF AMERICAN LOBSTER IN NEWFOUNDLAND

Regional Peer Review – Newfoundland and Labrador Region

October 17–18, 2022

Virtual Meeting

Chairpersons: Katherine Skanes and Paul Regular

Context

The status of American Lobster (*Homarus americanus*) in Lobster Fishing Areas (LFAs) 3–14C was last assessed in 2019 (Fisheries and Oceans Canada [DFO] 2021). The present assessment of these stocks was requested by Resource Management to provide current information on the status of the resource and provide science advice that will be used to update the Integrated Fisheries Management Plan.

Objectives

Assessment of American Lobster in four regions: Northeast (LFA 3–6), Avalon (LFA 7–10), South Coast (LFA 11–12), and West Coast (LFA 13–14).

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- DFO - Ecosystems and Oceans Science, and Ecosystems and Fisheries Management
- Government of Newfoundland and Labrador - Fisheries, Forestry and Agriculture
- Indigenous Groups
- Academia
- Fishing Industry
- Other invited experts

References

DFO. 2021. [Assessment of American Lobster in Newfoundland](#). DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2021/008.

APPENDIX II: AGENDA
Regional Peer Review
Assessment of American Lobster in Newfoundland
Co-Chairs: Katherine Skanes and Paul Regular
October 17–18, 2022

Monday, October 17

Time	Topic	Presenter
9:30	RDS Opening Remarks	A. Mansour
9:45	Co-Chair Remarks and Introductions	Co-Chairs
-	Overview of the Physical Oceanographic Conditions on the Newfoundland and Labrador Shelves and Lobster Settlement Study	A. LeBris
-	Lobster Assessment: 1. Northeast (LFAs 3–6) 2. Avalon (LFAs 7–10) 3. South Coast (LFAs 11–12) 4. West Coast (LFAs 13–14)	E. Coughlan & D. Mullowney

Tuesday, October 18

Time	Topic	Presenter
9:30	Reviewer Reports	N. Asselin & G. Martin
-	Conclusions and Summary Bullets	All
-	Research Recommendations	All
-	Upgrading of working paper and next steps	H. Rockwood
-	ADJOURN	-

Notes:

- Agenda remains fluid.
- This agenda may change.
- Microsoft Teams meeting link is at the top of the first page of the agenda.

APPENDIX III: LIST OF PARTICIPANTS

Name	Affiliation
Atef Mansour	DFO-NL – Science
Katherine Skanes	DFO-NL – Science (Co-Chair)
Paul Regular	DFO-NL – Science (Co-Chair)
Gillian Forbes	DFO-NL – Science (Rapporteur)
Hilary Rockwood	DFO-NL – Centre for Science Advice
David Small	DFO-NL – Resource Management
Laurie Hawkins	DFO-NL – Resource Management
Martin Henri	DFO-NL – Resource Management
Megan Lynch	DFO-NL – Ecosystems Management
Annamarie Buchheit	DFO-NL – Ecosystems Management
Brooklin Caines	DFO-NL – Science
Chelsea Malayny	DFO-NL – Science
Cynthia McKenzie	DFO-NL – Science
Danny Ings	DFO-NCR – Science
Darrell Mallowney	DFO-NL – Science
Darren Sullivan	DFO-NL – Science
Dwayne Pittman	DFO-NL – Science
Elizabeth Coughlan	DFO-NL – Science
Erika Parrill	DFO-NL – Science
Frédéric Cyr	DFO-NL – Science
Kate Charmley	DFO-NL – Science
Krista Baker	DFO-NL – Science
Mike Hurley	DFO-NL – Science
Mike Piersiak	DFO-NL – Science
Natalie Asselin	DFO-Gulf – Science (Internal Reviewer)
Will Coffey	DFO-NL – Science
Vanessa Byrne	Fisheries, Forestry and Agriculture NL
Emma Corbett	Fisheries, Forestry and Agriculture NL
Mable McDonald	Qalipu Development Corporation
Renae Butler	Association of Seafood Producers
Dwan Street	Fish, Food and Allied Workers Union
April Wiseman	Fish, Food and Allied Workers Union
Mildred Skinner	Harvester – Fish, Food and Allied Workers Union
Keisha Caines	Harvester – Fish, Food and Allied Workers Union
Kenneth Viscount	Harvester – Fish, Food and Allied Workers Union
Kevin Hardy	Harvester – Fish, Food and Allied Workers Union
Darren Boland	Harvester – Fish, Food and Allied Workers Union
Paul Snelgrove	Memorial University – Marine Institute
Arnault LeBris	Memorial University – Marine Institute
Guillermo Martin	Irish Marine Institute (External Reviewer)