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 2024/012

Newfoundland and Labrador Region

Proceedings of the Regional Peer Review for the Stock Assessment of Atlantic Salmon in Newfoundland and Labrador

Meeting dates: February 28–March 2, 2023
Location: Virtual

Chairpersons: Hannah Murphy and Harry Murray
Editor: Michelle Fitzsimmons

Science Branch
Fisheries and Oceans Canada
P.O. Box 5667
St. John's, NL A1C 5X

March 2024

Canada

Foreword

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

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

ISSN 1701-1280
ISBN 978-0-660-70421-0 Cat. No. Fs70-4/2024-012E-PDF

Correct citation for this publication:

DFO. 2024. Proceedings of the Regional Peer Review for the Stock Assessment of Atlantic Salmon in Newfoundland and Labrador; February 28–March 2, 2023. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2024/012.

Aussi disponible en français:

MPO. 2024. Compte rendu de l'examen par les pairs régional sur l'évaluation du saumon atlantique à Terre-Neuve-et-Labrador; du 28 février au 2 mars 2023. Secr. can. des avis sci. du MPO. Compte rendu 2024/012.

TABLE OF CONTENTS

SUMMARY

A Regional Peer Review Process on the status of Atlantic Salmon in Newfoundland and Labrador (NL) was held February 28–March 2, 2023 in St. John's, NL and online via Microsoft Teams. Its purpose was to provide the most recent scientific information concerning the status of Atlantic Salmon stocks for Salmon Fishing Areas (SFAs) 1–2 and 14B in Labrador and SFAs 3–14A in Newfoundland.

A Science Advisory Report (SAR) was drafted at the meeting that contains the conclusions of the science review. A Research Document will also be produced. This proceedings report includes abstracts, discussion summaries, and research recommendations. The terms of reference, agenda, and list of attendees for the meeting are appended. All publications produced from the meeting (SAR, Research Document, Proceedings) will be available on the DFO Canadian Science Advisory Secretariat Website.

INTRODUCTION

There are 15 Atlantic Salmon (*Salmo salar*) management areas, known as Salmon Fishing Areas (SFAs) 1–14B, in Newfoundland and Labrador (NL). Within these areas there are approximately 407 rivers with reported Atlantic Salmon populations characterized by differences in life history traits including freshwater residence time, age at first spawning, and the extent of ocean migrations. The last full stock assessment of Atlantic Salmon in NL was completed for 2020 returns in March 2021 (DFO 2022). During March 2022, a stock status update was completed for Atlantic Salmon in NL. The objective of the current Regional Peer Review Process, as outlined in the Terms of Reference (Appendix 1) is the assessment of Atlantic Salmon in NL (Salmon Fishing Areas 1–14B). Resource Management will use the information from this Regional Peer Review Process to inform salmon management plans.

PRESENTATIONS

OCEAN CLIMATE IN NEWFOUNDLAND AND LABRADOR WATERS

Presenter: Frédéric Cyr

Abstract

An overview of physical oceanographic conditions in the NL Region during 2022 was presented. The sea-ice index based on season duration and maximum area was at normal values. While the summer cold intermediate layer area metrics couldn't be derived for the first time since 1948, the seasonal sea surface and bottom temperatures on the NL shelf in 2022 were at record warm and second warmest levels, respectively. Temperatures from a coastal thermograph network were also at record highs in 2022. Overall, using a newly developed climate index for NL, 2022 ranked as the 9th warmest year on record since 1951.

Discussion

A participant asked why temperatures were not collected throughout the year at sampling sites. The presenter responded that it was not logistically feasible due to the potential for buoys being dragged by fish harvesters in the area.

There was a discussion of whether there is a positive correlation between warm ocean temperatures over winter and marine survival of salmon. The oceanographic data for the Region show a positive correlation between ocean temperatures over winter and kelt survival, and a weak but positive relationship with smolt survival. However, the literature suggests that an overall trend of warm winter/spring temperatures is positive for smolt survival.

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

Presenter: David Bélanger

Abstract

Biogeochemical oceanographic conditions on the NL Shelf are presented and interpreted against long-term (2003–20) satellite data, and 1999–2020 for Atlantic Zone Monitoring Program *in situ* observations) mean conditions in the Region. Satellite observations of ocean colour indicated early onsets of the spring phytoplankton bloom over the past 3 years on the NL Shelf (Northwest Atlantic Fisheries Organization [NAFO] Divisions 2HJ3K), and over the past

5 years on the Grand Banks (3LNOPs). Mean nutrient and chlorophyll a (chl-*a*) inventories have been increasing from below normal during the early/mid 2010s, to near (chl-*a*) or above normal (nitrate and silicate) in recent years. Ongoing changes in the zooplankton community composition include an increase in the abundance of larger, more energy-rich *Calanus* copepods (*C. finmarchicus, C. glaciale,* and *C. hyperboreus*) since the mid-2010s with a positive impact on total zooplankton biomass. Overall conditions over the past three years are indicative of improved productivity at lower trophic levels with a potential positive impact on energy transfer to higher trophic levels and on overall ecosystem productivity.

Discussion

A participant asked if salmon diets are being examined, in particular the offshore diet of smolts. Another participant indicated that no work has been done on salmon diets in Newfoundland waters in recent years. Another participant reported that historical data from the 1960's and 1970's indicate that salmon feed on capelin and sand lance and a variety of other marine organisms. The presenter suggested that the main prey (capelin and sand lance) of salmon is directly impacted by changes in the community structure of copepods and it would be interesting to investigate any correlations between the zooplankton community structure and the status of salmon populations.

BRIEF RECAP OF THE STATUS AND TRENDS OF THE ECOSYSTEMS IN THE NEWFOUNDLAND-LABRADOR BIOREGION

Presenter: Hannah Munro

Abstract

The ecosystem structure of the NL bioregion can be described in terms of four Ecosystem Production Units (EPUs): the Labrador Shelf (2GH), the Newfoundland Shelf (2J3K), the Grand Bank (3LNO), and southern Newfoundland (3Ps). These EPUs coarsely represent functional ecosystems and are the units typically used to summarize ecosystem status and trends.

The sustainability of total fisheries catches at the ecosystem level can be assessed using a framework based on Ecosystem Production Potential models. Using these models in conjunction with research vessel (RV) total biomass information it is possible to estimate the current fisheries production potential for an ecosystem, and derive from it an indicator to inform on the risk of ecosystem overfishing. This indicator is the Total Catch Index (TCI). TCI is estimated for functional guilds and inform on the upper limits for sustainable catches. In 2022, NAFO adopted this framework as part of the implementation of its ecosystem approach to fisheries, and 2 times TCI (2TCI) as an ecosystem reference point to indicate a high risk of ecosystem overfishing. Catches above 2TCI are associated with declining biomass trends of the functional guilds. The 2J3K and 3LNO EPUs experienced significant ecosystem overfishing prior to the collapse of the groundfish community in the early 1990s. During 1998-2015, total catches in 2J3K for the benthivore guild were mostly between TCI and 2TCI, corresponding to an intermediate risk of ecosystem overfishing. While catches of benthivores in 3LNO have been mostly below TCI since the mid-1990s, which corresponds to a low risk of ecosystem overfishing, fishing levels for other functional guilds (piscivores) during the early 2000s had the potential of eroding ecosystem functionality. Current exploitation levels indicate a low risk of ecosystem overfishing in 2J3K, and an intermediate level of ecosystem overfishing in 3LNO.

The ecosystem structure of the Newfoundland Shelf and Grand Bank changed in the 1990s with the collapse of the groundfish community, and the increase in shellfish. Even with increases in shellfish, total biomass never rebuilt to pre-collapse levels. Starting in the mid 2000s there were

consistent signals of rebuilding across the groundfish community which coincided with modest improvements in capelin, and the beginning of a decline in shellfish. Finfish biomass in the 2010s was relatively stable until 2014–15, when it showed signals of decline. This may be linked to the simultaneous reductions in capelin and shrimp availability, as well as other changes in ecosystem conditions. While available RV survey information in 2018–21 seem to suggest that condition could be improving, the incomplete nature and/or lack of RV surveys during 2020–22 prevents an evaluation of how these signals evolved.

Capelin and shrimp are key prey items for many predators throughout the NL bioregion. Additionally, sand lance and Arctic cod are important in southern (3LNO, 3Ps) and northern (2H) EPUs, respectively. The dominance of shrimp in diets has generally declined as the shrimp stock declined and is often associated with increases of capelin in the diet. In recent years, the dominance of these two key prey items in diets has declined. Average stomach content weights for cod and turbot have also declined since the mid-2010s and track well with the general trends observed in the finfish community. This supports the idea that declines in total biomass observed in recent years are associated with bottom-up processes, but also indicates that food availability has been an important driver of ecosystem changes in the bioregion. Current results suggest that NL ecosystems continue to experience low overall productivity conditions. While these conditions may benefit shellfish stocks, the prospects for fish predators are concerning.

Discussion

There were questions regarding whether data were available for 2022. The presenter indicated that data were collected for comparative fishing and that conversion factors would need to be applied before the data are presented.

UPDATE ON RECENT RESEARCH EXAMINING GENETIC INTERACTIONS BETWEEN WILD AND FARM ESCAPED ATLANTIC SALMON IN SOUTHERN NEWFOUNDLAND

Presenter: Ian Bradbury

Abstract

Despite continued improvements in containment, aquaculture escape events continue to be a regular occurrence and represent a significant threat to the persistence of wild Atlantic Salmon across the North Atlantic. Data from a variety of sources suggest escapees are present in the wild in Atlantic Canada on a yearly basis. Evidence to support the annual presence of escapees is available from reported escape events, detections at counting fences, and genetic screening of juvenile salmon sampled in the wild. Throughout Atlantic Canada, significant gains have been made over the last decade documenting the scale and extent of hybridization with escapees. This work suggests that hybridization and introgression with escapees are genetically changing wild salmon populations throughout the Region. Furthermore, evidence suggests that diploid European aquaculture salmon or their offspring have escaped from sea cages and hybridized with wild salmon both in southern Newfoundland and the Bay of Fundy. Although the presence of these genetic interactions is well documented in the Region, the magnitude of the resulting negative impacts remains uncertain. Population modeling and predictions of escapee dispersal suggest salmon populations near the aquaculture industry are experiencing both genetic and demographic impacts from interbreeding with aquaculture escapees. Experimental comparisons both in the laboratory and field suggest farmed salmon significantly differ from wild populations and as such, support the conclusion that interbreeding in the wild will have negative consequences for wild populations. Ultimately, these interactions between aquaculture escapees and wild populations are occurring against a backdrop of declining wild populations

and the Designatable Units (DUs) encompassing the aquaculture industry in Atlantic Canada are of significant conservation concern and currently meet the criteria for endangered status under the Committee on the Status of Endangered Wildlife in Canada (COSEWIC).

Discussion

A participant asked for clarification on whether the re-evaluated COSEWIC structure for DUs was different for northern Labrador and southern Labrador. The presenter confirmed that there would be three separate DUs for Labrador consisting of northern Labrador, the Lake Melville area, and southern Labrador.

ENVIRONMENTAL STUDIES RESEARCH FUND (ESRF) ATLANTIC SALMON MIGRATION AT SEA PROJECT UPDATE

Presenter: Martha Robertson

Abstract

Of the Atlantic Canadian fish species, Atlantic Salmon has one of the most complex life histories and migration patterns. Research has highlighted the importance of the Eastern Canadian offshore regions (Grand Bank) to the marine phase of the salmon's life cycle. It is used as a migration corridor for mature salmon and as a feeding area for post-spawned adults (kelt) and juveniles (post-smolt at sea). This region also supports a large offshore oil and gas industry, and the potential effects of this activity on Atlantic Salmon was raised as a research priority by Indigenous groups in Eastern Canada. As such, this project engages Aboriginal Aquatic Resources and Oceans Management (AAROM) organizations in Eastern Canada, who are the knowledge mobilizers and advisors to Indigenous-rights organizations and member communities. The Atlantic Salmon migration project (funded by Environmental Studies Research Fund) uses telemetry techniques (acoustic and satellite tags) to obtain migration and marine habitat data on salmon from various populations throughout Eastern Canada, with the ultimate goal of determining when, where and for how long Atlantic Salmon from three different life stages (juvenile post-smolt, post-spawned kelt, and multi-sea winter adults) are in the Eastern Canadian offshore regions. Numerical oceanographic models are also being used to determine the physical and biological oceanographic processes influencing migrations, and how interannual variability in oceanographic conditions affect migrations. To date, 2,314 salmon (kelt and smolt) have been tagged on 38 rivers throughout Eastern Canada, and 279 adult salmon have been tagged in West Greenland. Preliminary results indicate that a proportionally higher number of salmon from rivers in southeastern Newfoundland and the Southern Upland region of Nova Scotia utilize the offshore area of interest. This research approach will contribute significantly to our currently limited understanding of how Atlantic Salmon use the marine areas off Eastern Canada and support evidence-based decision making and co-development of best operational practices to minimize potential adverse impacts of oil and gas activities on Atlantic Salmon.

Discussion

The discussion was focused on the effectiveness of tagging methods and the quality of the data received. The presenter indicated that fish were tagged in multiple locations last year. As more information becomes available with regards to where the fish are migrating to while offshore, the tagging locations will be more strategic and the tracking will focus more on migration routes. There is concern about at-sea mortality; however, both the quantity and quality of data received so far have been good, especially from Conne River smolt which have a low survival rate.

Previous studies suggest nearshore mortality is uncommon; however, the presenter emphasized that the current study is not designed to calculate survival estimates.

A participant asked what the size limit was for putting out PSAT (satellite) tags on kelt. The presenter indicated that they need to be at least 60 cm, and the kelt tagged at Conne River are fairly small. Based on previous research, satellite tags are strategically placed on fish that are more likely to go offshore and migrate to Greenland, whereas the acoustic tags are put on fish that stay inshore.

A participant asked what happened to the tagged fish going to Greenland as all the tracks ended before June 1. The presenter explained that satellite tags rarely stay on for the duration of the migration and data are only received when the tags pop off. Tags pop off when the fish has died or when the tag is programmed to be released. The presenter was not satisfied that using satellite tags for tracking is the best method, and therefore would like to double tag fish (both acoustic and satellite), as the fish can return to the river the following year with the acoustic tag. They are also investigating the use of a quick genetic test to detect fish origin, so fish that are not returning to Newfoundland won't be tagged, as these fish are not useful for the current Environmental Studies Research Fund (ESRF) study. Another participant asked about the quality of refurbished PSAT tags, but the presenter indicated there is not enough data yet to identify if there are any difference in the quality of the data received. The same participant questioned the detection efficiency of the gliders, as there is a lot of effort in deploying these receivers, but little data are being returned. The presenter explained that the Ocean Tracking Network (OTN) is responsible for the gliders, but they are putting more effort into the timing of surveys and are also getting good data from fixed receivers.

A participant asked if they have detected any straying of salmon returning to different rivers than what they were originally tagged on. The presenter indicated that all detected salmon returned to the same rivers they were tagged on, but that the study is not designed to accurately capture this information.

EXAMINING THE DECADAL DECLINE OF THE CONNE RIVER ATLANTIC SALMON POPULATION IN NEWFOUNDLAND, CANADA

Presenters: Brian Dempson and Travis Van Leeuwen

Abstract

Species extinction and population extirpation are now widespread across aquatic ecosystems, increasingly prompting examination of potential causes and possible mitigation actions. However, large scale geographic analyses can obscure what is happening at local scales and hinder conservation efforts. Here we examined long-term trends in abundance of Atlantic Salmon at Conne River, Newfoundland, Canada, and found that over a period of almost four decades the Conne River salmon population has declined by 90%. We present a synopsis of potential factors impacting survival and productivity of this population using a semi-quantitative two-dimensional classification system, based on expert opinion, to rank the factors most likely contributing to changes in abundance. Our analysis identified that factors associated with salmon aquaculture, particularly genetic introgression between wild and escaped farmed salmon, sea lice, and disease, were considered contributors to the decline. Additional factors included the influence of both climate change and predation in freshwater and marine habitats. As various Atlantic Salmon populations across the native range approach extirpation, our analysis further highlights the benefit of long-term monitoring and fine-scale demographic and threat information in the prioritization of research necessary for conserving or restoring endangered populations.

Discussion

A participant asked if residency time in freshwater could also be considered a risk factor for survival. The presenter indicated that a previous study (Dempson et al. 2011) concluded that over a three year period, smolts tagged in the Bay d'Espoir fjord had a moderately high survival rate to the outer fjord. There was some discussion about repeating the study, as it has been several years since the study was done (2006–08). Environmental conditions have changed and the aquaculture industry has since expanded in the area. Another participant indicated that redoing the 2006 study would be valuable because the tracking technology has advanced and there are more resources within DFO. The presenter confirmed that the study is being redone this year.

There was a discussion concerning the environmental impacts on the survival of salmon in Conne River. A participant asked if individual components of the climate index had been examined to see if specific factors might be influencing survival. The presenter agreed that deconstructing the climate index to investigate individual components would be a good next step, but there are limitations to this as you would need to overlap the climate information with the location and timing of the salmon migration. Another participant asked if there was something unique about the south coast environment that could be impacting salmon survival. The presenters agreed that it was a possibility and welcomed any suggestions of factors to investigate, as the population is drastically declining and the number of years left to explore these declines could be limited. Another participant added that even if there was an isolated stressor, removing this stressor from the environment wouldn't necessarily help the population recover, especially when the population levels are already so low. It was agreed by participants that it is not likely a large scale climate factor impacting Conne River salmon because the impacts are likely localized and rivers in the rest of Newfoundland are doing considerably better. If there were risk factors related to the climate index of the Northwest Atlantic then other nearby rivers would also be impacted. A participant commented that Garnish River counts are also low, and the historic angling data suggest the population is declining. There have been some aquaculture fish caught and identified on Garnish River, suggesting that these declines might be related to aquaculture interactions or something else in the environment during the post-smolt phase.

There was discussion about what data were readily available related to aquaculture sites, with regards to sea lice treatments and other environmental and health related factors. A participant asked if environmental data had been collected at the aquaculture sites and if these data were available. It was noted by a participant that they were likely available and the presenter could ask for the data. A participant disagreed with the high number reported for the 2017 data regarding sea lice treatments at the aquaculture facilities and that the publicly available DFO Aquaculture Public Reporting database indicates lower numbers. They also indicated that the lower numbers in 2020 and 2021 are likely due to a decrease in production at the facilities. The presenter indicated that they were presenting data from a published paper by another DFO researcher, but they would verify the data with the public portal. The participant also suggested that the production numbers by farm site would give a better indication of where the sea lice treatments were occurring, and that the majority of production is not taking place in the Bay d'Espoir estuary. The presenter acknowledged that the production numbers by farm site would be more representative. However, they also emphasized that this presentation outlined the potential threat factors commonly indicated from literature reviews and expert opinions and the aim was to identify priority areas that require more research, specifically the driving factors contributing to the declines in Conne River salmon. The participant raised concerns that the data presented on the slides were incorrect as there are no salmon farming sites in the upper Bay d'Espoir estuary. The participant agreed that redoing the 2006–08 smolt tracking study

would be valuable because the number of aquaculture sites in the outer bay area has decreased. Another participant commented that they could provide the presenters with data for individual farming sites and annual production numbers. The presenter agreed that they would further examine the individual farming site data and update their information.

A participant asked whether it was worthwhile to put all the risk factors into a single model to partition out the variance and rank the factors. The presenter indicated although they were presented individually, they were all placed in the same model and only aquaculture production showed a significant negative effect.

A participant commented that with regards to health screening, it would be useful to compare gene expression in Conne River salmon to salmon from other NL rivers for changes associated with temperature, immune function, starvation, and other factors. The presenter indicated that collaborations are planned this year for studies examining some of these factors.

IMPROVING REAL-TIME WATER LEVEL AND TEMPERATURE DATA COLLECTION IN REMOTE ATLANTIC SALMON RIVERS IN NEWFOUNDLAND AND LABRADOR REGION

Presenters: Curtis Pennell and Emilie Geissinger

Abstract

Water temperature and level are significant environmental factors affecting ecology of anadromous fish. The purpose of this project is to provide near real-time environmental data (i.e., water temperature and depth, air temperature, and rainfall) and increase spatial and temporal coverage for salmon rivers province-wide. The three objectives of this study are:

1. to provide accurate near real-time water temperature and depth data over larger spatial scales,
2. improve spatial and temporal coverage of temperature data across the province, and
3. consolidate historical data for future research.

In 2022, we deployed 10 near real-time stations, 118 water temperature loggers, and 19 water level loggers. Water temperatures varied across regions from June to the beginning of September, with a high percentage of hours (18.9 to 58.9%) above 20°C in Newfoundland compared to Labrador (<2%). August was the warmest month recorded, with 7.5% of hours above 24°C in Newfoundland rivers. These results highlight the importance of continued water temperature and level monitoring across NL. Temperature is an important environmental indicator to further understand growth, survival, and distribution and is a highly important scientific metric since NL is experiencing climate change impacts.

Discussion

A participant was concerned with how the sensors were installed and the calibrations, as some of the temperatures indicated on the graphs were above the maximum air temperatures for Newfoundland. The presenters indicated that some of the data shared had not yet undergone a quality control check. However, the equipment used to collect their own data was calibrated. Some sensors had solar radiation shields, while others did not, in an effort to collect temperatures in both indirect and direct sunlight.

A participant asked if there were any indications of colder thermal refuges for salmon. The presenters indicated that they are working this year to have improved logger placement and increased spatial coverage to better detect if these exist. Some loggers came out of the water

and had to be repositioned to capture more accurate water temperatures. A participant asked if real-time temperature data was available. The presenters indicated that the data are not publicly available but can be accessed by project partners by contacting the presenters. There was some discussion regarding various thermal tolerance studies and how the temperature data will be useful for determining which populations to investigate further. A number of participants indicated that they were also collecting water temperature data and could share this information. There was also discussion amongst participants and the presenters regarding sharing information, whether it be historical river temperature data or standardized protocols for collecting the data. Participants agreed that better communication between DFO and outside organizations regarding collecting and sharing data was needed.

UPDATE ON FISH PASSAGE MIGRATION STUDIES AT FISHWAY STRUCTURES AND GRAND FALLS HYDROELECTRIC FACILITY IN CENTRAL NEWFOUNDLAND

Presenters: Curtis Pennell and Emilie Geissinger

Abstract

Fish bypass systems provide migrating kelt and smolt an alternate route to navigate through anthropogenic structures. The Grand Falls hydroelectric facility uses a fish guidance louvre system in the power canal to guide fish towards the bypass system. However, the louvre system does not redirect all fish, and Atlantic Salmon smolts and kelts move downstream of the bypass in the attraction flow, near the turbine intake trash racks. Over the last 22 years, the mean number of fish counted at the Grand Falls fishway was 66.5% of the total count at the Bishops Falls fishway. However, from 2018 to 2020, the percentage of the count was higher than normal at the Grand Falls fishway in comparison to the Bishops Falls fishway at 111%, 104%, and 94%, respectively. One potential source of this higher count at Grand Falls is fish falling back over the flashboards and having to traverse the fishway a second time. To further investigate this, fish were captured both in the fishway and downstream and implanted with radio transmitters to track their movement through the fishway in 2021 and 2022. Although fallback did occur with some of the tracked fish, the percentage of fallback was low. Overall, percentages of total fish counts in 2021 and 2022 also improved compared to the previous three years. Improvements to the Grand Falls fishway are planned for 2023 to reduce fallback from the fishway. Closer monitoring of water moving over the flashboards is also key to reducing fish from falling over the flashboards. We also conducted a telemetry study during downstream migration in 2021 and 2022 to better understand if planned generation outages would increase movement out of the power canal. We used 69kHz and 180kHz acoustic telemetry positioning systems to assess movement and canal departures. While fine-scale positioning did not provide definitive exit routes and movement tracks within the canal, we were able to quantify kelt and smolt activity levels before, during, and after generation outages. Our results indicated that generation outages had a limited effect on fish exiting the canal in 2021 and 2022. There was an increase in detected activity during generation outages in 2022, but no change in detected activity during generation outages in 2021. Bypass video data did not show any change in kelt departures between normal operations and generation outages. In 2022, a high percentage of smolt (73%) were detected downstream below the power canal, while a lower proportion of kelt (53%) were detected downstream below the power canal.

Discussion

One participant was concerned that the population in Grand Falls is lower than it has been historically and this is due to the operations at Newfoundland Hydro facilities and the closure of the papermill. There was discussion about potential kelt mortality from being held up in the

power canal. The presenter indicated that fish will be tagged with radio telemetry devices this year to better detect where there is delayed movement and any potential mortality events.

THE ABUNDANCE AND STOCK STATUS OF MONITORED ATLANTIC SALMON POPULATIONS IN NEWFOUNDLAND AND LABRADOR IN 2022

Presenter: Nicholas Kelly

Abstract

Twenty-one populations of Atlantic Salmon were monitored in 2022. Adult salmon were enumerated at monitoring facilities (counting fences and fishways) on four rivers in Labrador and 17 rivers in Newfoundland. Atlantic Salmon abundance was estimated on Harrys River (SFA 13) with a counting fence near Gallants, NL and a late summer snorkel survey below the fence. Atlantic Salmon smolt abundance was counted on five monitored rivers in Newfoundland during their migration to sea. In 2022, nine of 16 monitored rivers with sufficient time series data showed declines in total returns compared to the previous generation average, five of which by >30%. Seven of 13 rivers with sufficient time series data exhibited declines in 2022 total returns compared to the previous three generation average, four of which by >30%. Above average returns were observed on Exploits River and Western Arm Brook in Newfoundland, and on three of four monitored rivers in Labrador. Returns to English River set a record high and were far above average. In contrast, several monitored rivers in Newfoundland had below average returns in 2022, particularly Conne River and Salmon Brook. A stock status zone was designated for 19 of 21 monitored populations in 2022. Just over 50% of the assessed populations across the province were in the Limit Reference Point (LRP) Critical Zone. Estimated egg depositions were below the river-specific Critical Zone on one of four assessed rivers in Labrador and nine of the 15 (60%) assessed rivers in Newfoundland. Two of 19 rivers (one in Newfoundland and one in Labrador) were in the Cautious Zone, and seven rivers were in the Healthy Zone (two in Labrador and five in Newfoundland). Marine survival is considered to be a major factor limiting the abundance of returning adult Atlantic Salmon within the NL Region. Smolt to adult survival of the 2021 smolt class ranged from 1.2% for Conne River to 10.7% for Western Arm Brook.

Discussion

A participant asked what was different about Southwest Brook compared to other rivers in Labrador, as it was the only river in the Critical Zone. The presenter indicated that Southwest Brook was in close proximity to Paradise River (also considered a tributary of Paradise River by some) so there could be variation in the number of fish going up each system from year to year. There was further discussion about other rivers with low return rates, with some suggesting that salmon may go upstream in adjacent rivers when water levels are too low or may remain downstream until the fall when fish are no longer counted. Both scenarios are difficult to quantify but may influence the results of return rates. Another participant mentioned that there has been a decline in the salmon population of Northeast River in Placentia since 2015 compared to the 1990's. There were changes made to the habitat structure, as well as a holding pool constructed and a participant inquired whether this might have had an impact. The presenter was unsure, but indicated that the data suggest it might just be natural variation in the abundance for this river, as there are similar high and low years in both decades.

A participant commented that the LRPs are an assessment of the maximum potential of the populations and although Exploits River is performing poorly in terms of its potential, the population is still quite high. The participant suggested that the assessment of the health of these rivers may not be accurate. The presenter indicated that the designated stock status of

each of these populations is determined by the precautionary approach. However, the information provided to resource management focuses on the trends in total returns to guide regulatory decisions, not just the LRP status.

There was some discussion on the information necessary to determine an LRP, in particular for Parkers Brook. A participant mentioned that habitat estimates may be available from another organization working on habitat restoration for that system. The presenter indicated that spawning habitat estimates have not been updated recently for any river due to limited resources, but it is worthwhile to do. Fecundity estimates have also not been updated, due to the involvement of sacrificing a large number of spawners. As stated in the CSAS Research document, there is a degree of uncertainty when estimating egg depositions due to the use of historical biological data for rivers. There were questions about using fish from anglers or the Food, Social and Ceremonial (FSC) fishery, but there are logistical constraints with this, such as unknown origin river and time of year.

There was a discussion about why all salmon were not sampled on Garnish River, considering there is a risk for aquaculture impacts with escaped farmed fish in the river. The presenter stated that due to the number of fish that go through the fence, as well as the high temperatures this past summer, it was not logistically feasible to sample all fish. As well, the contractors working the fence are experienced at identifying farmed salmon and will sample any suspected farmed fish. Another participant commented that the fence was set up to fill a gap in the assessment of SFA 11, as well as monitor farmed escapees from local aquaculture sites.

There was a discussion about the Harry's River snorkel survey, and whether the count might have been an underestimate of the number of salmon in the river, as not all the pools and tributaries were examined. However, it was agreed that this was the best survey done in years, with clear visibility and good survey personnel.

A participant was interested in seeing the daily counts for large salmon to see if there was a binomial distribution of first time versus repeat spawners. The presenter indicated these data are available and could be shared.

A participant commented that almost all salmon caught in the FSC fisheries are of Labrador origin.

A participant suggested that it would be more efficient to break the assessment up into several sections so that comments and questions regarding the rivers in each region could be discussed in a timely manner. The presenter agreed that this could be done.

RESEARCH RECOMMENDATIONS

- Expand spatial and temporal data collected on water temperatures in rivers
- Collect diet samples of post-smolts and adult salmon
- Continue further studies examining the variation in temperature adaptation across populations of Atlantic Salmon
- Expand and improve monitoring (e.g., counting, assessment) in all SFAs and prioritize SFAs with little to no coverage (1, 3, 6, 7, 8, 12 and 14b).
- Further investigation into declines in SFA 11 and exploration of impacts of aquaculture on wild Atlantic Salmon (e.g., sea lice, disease, hybridization and genetic impacts, and increased predation in the vicinity of aquaculture cages) and compare to other areas across Newfoundland

- Investigate improvements for collecting and incorporating all angling data for future stock assessments in collaboration with Department of Fisheries, Forestry, and Agriculture.
- Continue further studies to determine various levels of both freshwater and marine survival across the NL Region (increase monitoring/tagging program).
- Continue investigating potential impacts of European introgression into farmed salmon on wild salmon, and mitigation measures.
- Collect biological characteristics data and re-evaluate available habitat on monitored rivers that are limited to improve conservation egg requirement achieved.

REFERNCES CITED

Dempson, J.B., Robertson, M.J., Pennell, C.J., Furey, G., Bloom, M., Shears, M., Ollerhead, L.M.N., Clarke, K.D., Hinks, R., and Robertson, G.J. 2011. Residency time, migration route and survival of Atlantic salmon *Salmo salar* smolts in a Canadian fjord. J. Fish Biol. 78(7): 1976–1991.

DFO. 2022. Stock Assessment of Newfoundland and Labrador Atlantic Salmon in 2020. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2022/031.

APPENDIX I: TERMS OF REFERENCE

Stock Assessment of Atlantic Salmon in Newfoundland And Labrador

Regional Peer Review - Newfoundland and Labrador Region

February 28–March 2, 2023
Virtual Meeting

Chairpersons: Hannah Murphy and Harry Murray, DFO Science

Context

There are 15 Atlantic Salmon (*Salmo salar*) management areas, known as Salmon Fishing Areas (SFAs) 1–14B, in Newfoundland and Labrador (NL). Within these areas there are approximately 407 rivers with reported Atlantic Salmon populations characterized by differences in life history traits including freshwater residence time, age at first spawning, and the extent of ocean migrations.

The last full stock assessment of Atlantic Salmon in NL was completed for 2020 returns in March 2021 (DFO 2022). During March 2022, a stock status update was completed for Atlantic Salmon in NL.

Resource Management will use information from this Regional Peer Review Process to inform salmon management plans.

Objectives

- Assessment of Atlantic Salmon in NL (Salmon Fishing Areas 1–14B).
- Consider ecosystem status where the assessed Atlantic Salmon stocks occur based on an overview including relevant summaries of oceanographic conditions, biological community structure and trends, and pertinent knowledge of ecological interactions (e.g., predator, prey) and stressors (e.g., anthropogenic impacts).

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Expected Participation

- Fisheries and Oceans Canada (Ecosystems and Oceans Science, Ecosystems Management, and Fisheries Management sectors)
- Parks Canada
- Government of Newfoundland and Labrador – Department of Fisheries, Forestry and Agriculture
- Indigenous groups
- Academia
- Other invited experts

References

DFO. 2022. Stock Assessment of Newfoundland and Labrador Atlantic Salmon in 2020. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2022/031.

APPENDIX II: AGENDA

CSAS Regional Peer Review Process: Stock Assessment of Atlantic Salmon in Newfoundland and Labrador

Co-Chairs: Hannah Murphy and Harry Murray

February 28–March 2, 2023

Day 1: Tuesday, February 28

Time	Topic	Presenter
10:00 am	RDS Opening Remarks	A. Mansour
-	Introduction/Review Terms of Reference	Co-Chairs
-	Presentation: Ocean climate in Newfoundland and Labrador waters	F. Cyr
-	Presentation: Overview of the chemical and biological oceanographic conditions on the NL Shelf	D. Bélanger
-	Presentation: Brief recap of the status and trends of the ecosystems in the Newfoundland-Labrador bioregion	H. Munro
-	Break	-
-	Presentation: Update on recent research examining genetic interactions among wild and farm escaped Atlantic Salmon in southern Newfoundland	I. Bradbury
-	Presentation: ESRF Atlantic Salmon migration at sea project update	M. Robertson
-	Presentation: Examining the decadal decline of the Conne River Atlantic Salmon population in Newfoundland, Canada.	T. Van Leeuwen/B. Dempson

Day 2: Wednesday, March 1

Time	Topic	Presenter
10:00am	Presentation: Improving real-time water level and temperature data collection in remote Atlantic Salmon rivers in Newfoundland and Labrador region	C. Pennell/E. Geissinger
-	Presentation: Update on fish passage migration studies at fishway structures and Grand Falls hydroelectric facility in central Newfoundland	C. Pennell/E. Geissinger
-	Presentation: The abundance and stock status of monitored Atlantic Salmon populations in Newfoundland and Labrador in 2022	N. Kelly
-	Break	-
-	Review of Working Paper	All
-	Conclusions and Drafting of Summary Bullets	All

Day 3: Thursday, March 2

Time	Topic	Presenter
10:00am	Conclusions and Drafting of Summary Bullets Continued	All
-	Research Recommendations	All
-	Upgrading of Working Paper and Next Steps	H. Rockwood
-	ADJOURN	-

APPENDIX III: LIST OF PARTICIPANTS

Name	Affiliation
Hannah Murphy	DFO-NL – Science
Harry Murray	DFO-NL – Science
Hilary Rockwood	DFO-NL – Centre for Science Advice
Victoria Neville	DFO-NL – Centre for Science Advice
Brian Dempson	DFO-NL – Science
Chantelle Burke	DFO-NL – Science
Curtis Pennell	DFO-NL – Science
David Bélanger	DFO-NL – Science
Emilie Geissinger	DFO-NL – Science
Frédéric Cyr	DFO-NL – Science
Hannah Munro	DFO-NL – Science
Ian Bradbury	DFO-NL – Science
Kristin Loughlin	DFO-NL – Science
Martha Robertson	DFO-NL – Science
Michelle Fitzsimmons	DFO-NL – Science
Nick Kelly	DFO-NL – Science
Rebecca Poole	DFO-NL – Science
Rex Porter	DFO-NL – Science (Retired)
Sarah Lehnert	DFO-NL – Science
Travis Van Leeuwen	DFO-NL – Science
Jackie Kean	DFO-NL – Resource Management
Terry Bungay	DFO-NL – Aquatic Ecosystems
Shawn Gerrow	Parks Canada
Elizabeth Barlow	Mi'kmaq Alsumk Mowimsikik Koqoey Association / Miawpukek First Nations
Todd Broomfield	Nunatsiavut Government
Jon Carr	Atlantic Salmon Federation
Craig Purchase	Memorial University of Newfoundland
Ian Fleming	Memorial University of Newfoundland