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

February 28-March 1, 2017
St. John's, NL

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Foreword

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

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SUMMARY

A Regional Peer Review Process on the status of Atlantic Salmon in Newfoundland and Labrador (NL) was held February 28-March 1, 2017 in St. John's, NL. Its purpose was to provide the most recent 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 written and reviewed during the meeting. It includes overall and SFA summaries for Atlantic Salmon, which were drafted, revised and accepted at the meeting. Detailed rapporteur notes of discussions pertaining to presentations at the Regional Peer Review meeting were produced.

Compte rendu de l'examen régional par les pairs sur la mise à jour de la situation du saumon de l'Atlantique à Terre-Neuve-et-Labrador

SOMMAIRE

Un processus régionale d’examen par les pairs sur la situation du saumon de l'Atlantique à Terre-Neuve-et-Labrador a eu lieu le 28 février et le 1er mars 2017 à St. John's (Terre-Neuve-et-Labrador). Elle visait à fournir les derniers renseignements sur la situation des stocks de saumon de l'Atlantique dans les zones de pêche du saumon (ZPS) 1, 2 et 14B au Labrador et les ZPS 3 à 14A à Terre-Neuve.

Un avis scientifique a été rédigé et examiné au cours de la réunion. Il comprend des résumés sur le saumon de l'Atlantique (en général et selon la ZPS), qui ont été rédigés et examinés au cours de la réunion du processus de consultation régionale. Des notes détaillées du rapporteur sur les discussions tenues pour présentations à la réunion du processus régionale d`examen par les pairs ont été préparées.

INTRODUCTION

A Regional Peer Review Process was held February 28-March 1, 2017 in St. John's, NL to assess the status of Atlantic Salmon stocks for SFAs 1-2 and 14B in Labrador, and SFAs 3-14A in Newfoundland. Participants included Fisheries and Oceans Canada (DFO) Science and Fisheries Management Branches, Parks Canada, the government of Newfoundland and Labrador, non-governmental organizations and various Indigenous groups. Terms of Reference, agenda, and participant list for the meeting are provided in the Appendices.

A Science Advisory Report (SAR) was reviewed during the meeting. Detailed rapporteur notes of discussions pertaining to the presentations at the meeting were produced. This Proceedings Report includes an abstract and discussion summary for each of the presentations, as well as a list of research recommendations suggested by meeting participants.

PRESENTATIONS: ABSTRACTS AND DISCUSSIONS

ATLANTIC SALMON REGIONAL ASSESSMENT PROCESS - INTERIM TRIGGERS AND FISHERIES MANAGEMENT UPDATE

E. Dunne, DFO Fisheries Management and G. Veinott, DFO Science

Abstract

In 2014, criteria were developed to assist fisheries managers in determining whether the current 5-year Atlantic Salmon management plan would need to be reviewed earlier than the planned 5 years. Criteria included triggers that would indicate a widespread decline in the number of returning adult salmon. Seven of 14 (50%) monitored rivers recorded declines in total returns of greater than 30% in 2016 compared to their previous five-year mean. Declines of this magnitude over a wide geographic range are highly unusual for the NL Region and resulted in the triggering of a full regional peer-review assessment meeting.

Discussion

One participant asked for clarification on the Atlantic Salmon decline in total returns that triggered a regional advisory process. It was stated that seven out of 14 indicator rivers had declines greater than 30% compared to the previous 5-year mean. One participant asked for clarification on the 5-year average. The response was that the 5-year average refers to the previous 5 years (e.g. for 2016, the average would be 2011-15). There was a discussion on the number of monitored rivers that were used in the assessment. It was noted that three monitored rivers were not used. Northeast River, Placentia and Garnish River have not been in operation long enough to have a 5-year mean and the adult count was incomplete in 2015 and 2016 at Rocky River due to disruptions caused by ongoing improvements at the fishway.

Participants deliberated about the validity of incorporating angling statistics to estimate total population size. Angling data is used in conjunction with monitored river data for the International Council for the Exploration of the Sea (ICES) scientific process. It was stated that there is more confidence in the monitored rivers as it is a direct count. It was also stated that angling data can be influenced by external factors such as change in water temperature that can result in river and area closures. This can cause the angling data not to correlate with the index of abundance. It was also noted that the correlation between monitored rivers and angling data may not be as good in rivers with less fishers and hence less data. The participants discussed developing an integrated model that includes closures and catch per unit effort

(CPUE) data. A participant questioned the underlying assumptions of using monitored rivers to represent all other rivers in each SFA. A response was given that there is uncertainty regarding whether a river is representative of all other rivers in a pareticular SFA.

There was a discussion about the use of triggers and the regional advisory process. A question was asked whether the Department will continue to use triggers to determine when a full regional peer-review process will be held. A representative from DFO responded that Atlantic Salmon will move to a 2-year management cycle commencing this year. The participants deliberated on the requirement of keeping triggers for the interim years. Some participants expressed that salmon populations are variable and that it was not necessary to keep triggers in a 2-year management cycle. Other participants provided the rationale that a large fluctuation could potentially indicate a precipitous decline in one year. A participant inquired if the triggers would have been activated in the past. The response was that simulations were conducted for the past 20 years and a 30% decline in 50% of rivers had not occurred, which indicates this current decline is a significant event.

There was consensus to continue to use the current triggers. There were no objections from participants.

GENETIC ANALYSIS OF MIXED STOCK ATLANTIC SALMON FISHERIES IN THE NORTHWEST ATLANTIC

I. Bradbury, DFO Science

Abstract

Stock composition of Atlantic Salmon harvested in three fisheries in the northwest Atlantic was examined using genetic mixture analysis and individual assignment with a microsatellite baseline (15 loci, 12,409 individuals, 12 groups) encompassing the species western Atlantic range. 353 individuals collected from the St. Pierre et Miquelon fishery (2004, 2011-14) were analyzed and estimates of stock composition showed consistent dominance of three regions, Gulf of St. Lawrence, Gaspe Peninsula, and Newfoundland. In the West Greenland harvest (2011-14, n=2336), North American contributions were largely from Labrador, the Gulf of St. Lawrence, and the Gaspe Peninsula. No evidence of spatial or temporal trends in mixture composition was apparent in the fishery. Finally in the coastal Labrador fishery (2012-14, n=771) mixture estimates suggest the harvest is dominated by a single region, central Labrador (95.3%). Minor components were also allocated to Northern Labrador/Ungava and Newfoundland (<4%). In all three fisheries, estimates of stock composition appear stable over time and assigned individuals show the expected trend of increasing river age with latitude of home region. The NL Region specific estimates of fishery exploitation integrating across all three fisheries were generally <10% for large salmon and <5% for small salmon. Estimation of stock composition in all three fisheries is underway for 2015 and 2016 and will continue in 2017.

Discussion

Migration

During the presentation, there was a question about a figure that depicted migration routes of fish from southern Labrador to Greenland. The response was that it was anticipated that salmon use two migratory routes, one through the Strait of Belle Isle and another moving around the island of Newfoundland. There is no evidence to suggest that the majority of salmon choose one route over the other. During the question period, a participant asked if the changes in the proportion of North American salmon in the West Greenland harvest can be attributed to changes in migration routes. The response was that at this time it is unknown.

Faroese Fishery

There was discussion about the proportion of Newfoundland fish in the Faroe Island test fishery. It was noted that there were some large salmon from Newfoundland in the Faroese fishery and that the fish were most likely from the southwest coast. There was a suggestion to use the commercial fishery salmon samples from the Faroe Islands in the 1990s to compare with the Faroese test fishery. A point was made that the commercial fishery would cover a wider geographic area than the test fishery. In the end, it was suggested that ICES reported that the commercial fishery samples had deteriorated and the genetic information is no longer available. A question was asked if the scales were analysed to determine continent of origin. The response indicated that the proportion of North American fish was relatively low, approximately 25%. It may have been higher in the test fishery; however, it also may have been the technique used at the time as scale identification techniques have since advanced.

Assigning to River/Groups

The participants discussed the potential scale of assignment that could be achieved with future research. It was indicated that the Single Nucleotide Polymorphism (SNP) panel will increase the power of the analysis, however, it is not anticipated that river scale assignment will be achieved. Nearby rivers may not have the level of differentiation required for an assignment. It was explained that data is acquired through several sources, and genotyping is currently taking place. Once data are received, a cluster analysis will be used to reveal the groups that will be expected and the type of spatial scale.

Data Sources

A participant asked if angling data were included in the analysis. The response was that the data were taken at sea and there is no angling exploitation included.

Greenland Composition

A participant asked if the 20% of salmon caught in the West Greenland fishery were from central or southern Labrador. The response was that the salmon were from central Labrador. A participant asked for clarification on the composition of North American fish caught in the Greenland fishery that were bound for Labrador. The response was that 20% of fish caught in the Greenland fishery are of Labrador origin. There was concern expressed by a participant that the 20% may be coming from rivers that may be underseeded. It was clarified that contributions from single rivers cannot be identified at this time; however, there is a Natural Sciences and Engineering Research Council of Canada (NSERC) funded project that is proposing to identify river specific contributions to the fishery within Lake Melville.

Composition and Location of Labrador Fishery

Participants discussed the locations in which the salmon samples were taken for genetic analysis. A participant explained that people tend to fish near their communities in the bays and do not fish on the outside islands similar to the commercial fishery prior to the moratorium. The participant said this could explain the high contribution of Labrador salmon. It was noted that the samples were taken to be representative of the harvest, which mainly takes place in the estuary. According to ICES, 93% of the harvest occurs in rivers and estuaries; therefore, the potential for intercepting migratory individuals is low. A participant asked if the sex bias in the catches were analysed. The response was that there is a marker available to be used to identify sex; however, the analysis has not been completed to date.

Portfolio Effect

A participant asked the meaning of ‘portfolio effect’. It was explained that ‘portfolio effect’ is a concept that draws a parallel between a stock portfolio and the populations of a species. The

more diverse a salmon portfolio, the more stable the salmon returns. Species genetic diversity can potentially buffer the impacts from climate change and regime shifts.

Aquaculture

A participant asked if there were aquaculture fish found in the St. Pierre et Miquelon fishery. It was explained that one fish was suspected of being farmed; however, upon genetic analysis, it was determined to be from a wild salmon population.

Timelines and Reports

There were several questions about the availability of background papers, and timelines for this particular program completion. The SNP analysis is expected to be completed for the next Committee on the Status of Endangered Wildlife in Canada (COSEWIC) update.

SPATIAL AND TEMPORAL DISTRIBUTION AND SURVIVAL OF FARMED ATLANTIC SALMON AFTER EXPERIMENTAL RELEASE FROM SEA CAGE LOCATIONS

D. Hamoutene, DFO Science

Abstract

Abstract not provided.

Discussion

Sex and Maturity

A participant asked about the sex and maturity of the fish that were used in the study. The response was that a fin clip was taken for every fish that was tagged. It was estimated that one third were immature (males and females), one third females, and one third mature males. A participant asked if behaviour from these groupings could be interpreted, for example, the assumption that immature fish are more likely to stay in the bay. The response provided was that the number of fish may be too small to confidently conduct that analysis.

Predation

There was a discussion about the potential of increased predation of fish with temperature tags. It was presented that 50 out of 60 fish were likely consumed by predators as suggested by changes in temperature profiles and swimming patterns. A participant suggested that the data be fine-tuned to deduce the type of predator based on the temperature profile. Another comment from a participant suggested that the data may be tracking predators, rather than showing the distribution of fish after a release from sea cages. It was clarified for participants that it is likely that many individuals unaccounted for in the study were consumed by predators, and subsequent movements, at least until the remaining tags were expelled, reflect predator behavior.[1]

[1] Soon after the meeting had concluded, additional information became available. The information was provided by David Cote (DFO Science). Gastric evacuation rates are relatively fast in sharks and tuna (~12-60 h; Medved 1985; Olson and Boggs 1986; Shurdack and Gruber 1989; Cortes and Gruber 1992) and the primary study conclusions are likely to be robust to such events. For example, consumption of tagged salmon by large migratory and mobile predators might be expected to artificially increase dispersal distances and increase the likelihood of migration rates to areas beyond Fortune Bay. Instead, movement rates were greatest during spring, when cold waters exclude many of these temperate ocean predators from our study area.

Receiver Locations

A participant asked why receivers were not placed in rivers considering there is genetic evidence of interbreeding. It was suggested that this study could have provided an estimate of the percentage of escaped salmon that move into rivers. The response was that the receiver array was only placed in the estuary due to funding limitations; but, that would be a valuable study as well. Collaborations with the Salmonids Section to address this issue will be explored in future work.

Map Discussion

Participants discussed the map that depicted fish detections based on the receiver array in a 400 m x 600 m square grid. A participant asked if the map was based on detection, potential movement, probabilities, etc. It was explained that the map was a simple representation of coarse dispersal patterns, assuming that salmon followed the shortest paths in water between detecting receivers. The number of intersections of these paths with the underlying grid cells were tallied and presented spatially. A participant reviewed the map of receivers and suggested that such fine scale of detection could not be achieved based on the placement of receivers. It was clarified that the intent of the map was not to represent fine scale movements but rather the more general coarse scale movements so as to infer regions of frequent occupation. Alternate representations of the shortest path movements between receivers were examined but overlap of paths in areas of high use made it difficult to visualize cumulative densities.Participants deliberated about the assumption that the fish did not leave the bay based on the figure provided in the presentation. The presenter indicated that several fish were detected on the Fortune Bay line at the mouth of the bay, but the vast majority of fish were last detected by inner bay receivers, suggesting that they did not leave Fortune Bay. A participant explained that the receivers only detect a fish in a particular range, therefore, unless there were receivers in the bay, one could not assume that no fish moved out into the bay. It was explained that the receiver has a range of 500 m to 1 km. A participant stated that there were no final detections of fish at the line in question. It was clarified for participants that the Fortune Bay line was spaced so as to provide a strong probability of detecting salmon leaving or entering the bay. While the line could not provide direction of movement, the fact that most salmon were last detected in the inner part of Fortune Bay suggests that most individuals did not leave for the open ocean.

Aquaculture Escapes in Newfoundland

A participant described a program where DFO asked anglers to provide samples of suspected farmed fish. It was requested that a report be provided from that program which may show that fish dispersed much further than the findings in this study. Participants did not recall that particular program for Atlantic Salmon; however, there was a request for rainbow trout. DFO technicians at counting facilities are asked to sample suspected escaped fish. The response was that data are being summarized for salmon escape reports, however, reports are mainly from the Bay d'Espoir and Fortune Bay areas and not throughout the island of Newfoundland. A participant requested a report on the rainbow trout escapes. It was stated that a paper was published as a part of ICES in the early-2000s based on otolith analysis in Bay d'Espoir, among others. A participant stated that their organization's research on a river with an established population of rainbow trout suggested that there is evidence that escapes can travel long distances after they escape.

Timeframe of Receivers

A participant inquired about the total timeframe that the fish were monitored. The presenter explained that the fish were released in August and October in 2014 and 2015, resulting in a

range of detection periods from several months to two years. It was suggested that a map be completed to show temporal movement.

GENETIC INTERACTIONS AMONG WILD AND FARM ESCAPED ATLANTIC SALMON IN SOUTHERN NEWFOUNDLAND

I. Bradbury, DFO Science

Abstract

The consequences of a single large aquaculture escape event in 2013 for wild populations of Atlantic Salmon in a southern Newfoundland fiord were examined using targeted genomic tools. We report for the first time the unambiguous, widespread detection of first- and second-generation hybrid salmon, as well as feral offspring in the wild following this event (i.e. 35% hybrids, 17/18 rivers within 75 km). Results indicate that levels of hybridization were higher in wild populations with smaller population sizes, that hybridization had pre-dated this escape event, and that some hybrids are reproductively viable. In response, monitoring for aquaculture escapees was conducted in 2015 and 2016 in Fortune Bay and Bay d'Espoir. In 2015 a total of 159 escapees were detected contrasting with none in 2016. Monitoring of levels of hybridization and the presence and abundance of escapees will continue in southern Newfoundland in 2017.

Discussion

Farmed Fish Characteristics

Regarding the detection of farmed fish, a participant asked if there are defining biological characteristics between wild and aquaculture salmon. The response was that it depends on the size of the fish when they escape. A market size farmed fish may have fin and nose wear, a shorter operculum and be football shaped. Farmed smolts or younger adults may not exhibit these visible traits. If a fish is suspected to have originated from an aquaculture site at a counting facility, a fin clip is taken to determine its origin genetically.

Size of River vs. Impacts of Escape Event

The presentation stated that smaller rivers in comparison to larger rivers may be more adversely impacted by escaped aquaculture salmon. A participant inquired about the definition of a small river. It was stated that a river is considered small if the wild population is a fraction of the number of escaped farmed salmon present in that river. For example, if the wild salmon population in a river is similar or smaller in number to that of the escaped fish, then one would expect significant impacts.

Impact to Fitness

A participant inquired about the impacts of genetic introgression to the fitness of wild salmon populations. The presenter responded that aquaculture fish are selected by industry to do well in a cage culture and not the wild environment. Therefore, one would expect that wild populations experiencing significant interbreeding with farm escapes would decline.

Solutions/Recommendations

A participant inquired about the recommended solutions to address the impacts of farmed fish on wild salmon populations. The participant inquired about the stocking of sterile fish at aquaculture sites. It was stated that sterile fish may still cause indirect impacts to wild salmon population through mechanisms such as disease. A participant commented that current cage designs and husbandry practices are not sufficient to prevent escapes of farmed salmon as there is evidence of farmed salmon in rivers. It was stated that the wild salmon populations on

the south coast of Newfoundland have significantly declined and may be listed under the *Species at Risk Act* (SARA).

Hybridization in Conne River

Regarding the Conne River area, it was stated that the river had a moderate to low level of hybridization. It was also noted that the tailrace was a hotspot for hybrids, which may indicate that farmed salmon have been there for some time.

Parr Sampling

A participant asked if it would be beneficial to sample smolt or parr to detect farmed fish. The response was that there are projects, including within Conne River, that involve looking at hybrids in fry, parr, smolts and returning adults. A participant asked if parr samples collected throughout the province have been reviewed for evidence of hybrids. The presenter said that this has been partially completed for Newfoundland and the Maritimes. In particular, there is evidence to suggest that the amount of genetic material from farmed fish declines as you move further away from aquaculture operations. The Maritimes and Newfoundland data suggests a decline within 100 km from the aquaculture sites. A participant felt this was an indication that impacts may be localized. It was noted, therefore; that wild salmon populations in places such as the west coast of Newfoundland may not be significantly affected by hybridization.

Marking

A participant recommended that farmed fish should be marked as it would allow fishers to readily identify farmed fish and potentially remove them from the wild. It was stated that fishers find it difficult to distinguish between a farmed or wild salmon, and that current regulations only require industry to report escapes of more than 100 fish per day. It was stated that there are currently traceability programs in Maine, and Nova Scotia will soon be requiring traceability for new licences.

DEVELOPMENT OF REFERENCE POINTS FOR ATLANTIC SALMON THAT CONFORM TO THE PRECAUTIONARY APPROACH

G. Veinott, DFO Science

Abstract

The NL Region currently uses a single reference point (conservation egg requirement) to assess the status of its Atlantic Salmon populations. The use of a single reference point does not comply with the current policy for the conservation of wild Atlantic Salmon. The policy requires that the status of salmon populations be assessed based on a lower and an upper reference point. This produces three status zones for any monitored population. Populations below the lower limit reference (LRP) point would be assessed as critical and according to the WASCP would require "*immediate consideration of ways to protect the fish, increase their abundance, and reduce the potential risk of loss*." Biological status would be the main consideration of any management action. Cautious status implies management with caution. Stable populations within the cautious zone can be managed with broader considerations beyond the biological such as social and economic factors. Populations above the upper stock reference point would be assessed as healthy and available for exploitation at some predetermined maximum exploitation rate. It has been proposed by DFO Science that the current conservation egg requirement (i.e. 100% conservation) be used as the lower limit reference point and treated as a limit below which the population should not fall. The upper stock reference point would also be based on the conservation egg requirement and be set at

150% of the current egg requirement. This value would be treated as a target to be aimed for on all rivers in NL.

Discussion

Enhanced River

A participant asked if Northeast River Placentia is considered an enhanced river. It was clarified that Northeast River is an enhanced river. It was explained that a river is considered enhanced if previously unavailable habitat has been made available through the construction of an artificial fish passage (e.g. fish-way or fish ladder). A participant indicated that it is important not to confuse enhanced rivers with normal rivers, as it could infer that a river is experiencing higher returns than it is.

Model

There was discussion on the model used to develop the suggested Precautionary Approach (PA) reference points. A participant asked if having only three smolt counting facilities impacted the model. The response was that the model used six rivers in Newfoundland. A hierarchical Bayesian process was used. A participant questioned the fit of the Beverton Holt curve, and it was explained that the fit is reasonable for a Beverton Holt curve. It was stated that the data over the past 50-years continues to point to conservation egg requirements of 240 eggs per 100 m^2 for a river in Newfoundland and 190 eggs per 100 m^2 in Labrador. On the contrary, a participant suggested that the conservation egg requirement has not changed over the 50-year time period because the quality of the data has not improved.

There was discussion about how the model assessed Harry's River to be in the cautious zone of the PA framework. It was explained that the cautious zone means management should be cautious in a manner that ensures the river continues to build up to 150% conservation. It was clarified that a river being in the cautious zone does not necessarily preclude harvest. It was further explained that rivers in the critical zone means no-human induced mortality. It was clarified that no-human induced mortality has been a consistent recommendation by DFO Science for rivers that do not achieve 100% conservation. There was discussion about the definition of human induced mortality. It was stated that it meant no retention of Atlantic Salmon and would include catch and release. There was debate about whether it included release of salmon from trout and char bycatch fisheries, and it was clarified that it was for directed salmon fisheries only.

Reference Points

A participant suggested that the conclusion of the regional advisory process meeting pertaining to reference points for Atlantic Salmon held in Moncton, New Brunswick on February 11-13, 2014 (DFO 2015) was that the Gulf, Maritimes and Newfoundland and Labrador Regions would use the Lower Limit LRP and there would be flexibility in establishing the Upper Limit Reference Point (URP) for each region. It was clarified that there was no conclusion pertaining to the mandatory usage of a LRP made at that meeting and the Maritimes Region has opted not to use the lower LRP. It was noted that the reference points concluded at the Moncton meeting did not consider lacustrine habitat, therefore resulting in a value that is less conservative than the NL Region's current egg conservation requirements. A comment was made that there is large uncertainty with the proposed reference points and that work is ongoing in the Gulf Region. A participant asked if simulation work has been completed to compare the trade-off between the uncertainties of the recruitment curve and the uncertainties of the LRP. The response was that the analysis was completed.

Labrador LRP

Participants discussed the recommended LRP for Labrador. Several participants felt that the current egg conservation requirement should not be lowered from 190 to 120 eggs per 100 m^2. It was asked what range in egg conservation numbers were considered for Labrador when it was decided to establish the 190 reference point. It was stated that there was little available data, and included only the Sandhill River dataset which was incomplete. A participant suggested there should be a recommendation to develop a better data set in Labrador. It was noted that there is a plan in place to generate an annual smolt count in Labrador. A participant stated that it would be important to use a model that included lacustrine habitat as there is productivity in the lakes. It was stated that the original 190 egg deposition requirement was developed based on 20 years of spawner to adult returns and angling data from two local lodges on Sandhill River. However, the participant felt there should be a caveat with applying the number derived from Sandhill River to other rivers that may not have the same proportion of lacustrine to river habitat.

Angling

There was debate about improving the utility of angling data, such as establishing a way to use angling statistics for a group of data poor rivers. It was stated that there may be biases in reporting of angling data as individuals will not report if they released more fish than allowed. There was a comment that most angling data from Labrador are from camps; however, certain rivers in Newfoundland, such as the Exploits River, have angling data that can provide a good indicator of abundance. A participant suggested analyzing angling data for one month, such as July, when most of the fish are caught. There was discussion on using CPUE data from angling returns and assessing if data from monitored rivers can be extrapolated to nearby rivers. It was stated that an analysis has been conducted on exploitation rates of monitored rivers and applied to unmonitored rivers; however, a good correlation can only be found on larger rivers. There was a discussion about improving the quality of angling data. It was suggested to encourage anglers to return catch logs. A participant recommended that logs should also include observations by anglers. A participant commented that there is very little science in Labrador and that they are concerned about applying reference points from one counting facility (English River) to all of SFA 1.

A participant inquired if there have been studies that incorporated individual random effect for the angling data. The response was that this has been contemplated; however, they have done a similar exercise to look at the reports from anglers that send in their logs without a prompt in comparison to those that do not submit their logs. The assumption is that the first responders are more avid anglers; however, there was very little difference. A participant suggested that accuracy of an angler's response could be checked by having a Fisheries Officer check licences and observe anglers in the field, which then can be compared to their logs. It was noted that an angler bias survey was conducted to investigate differences in reports. The results indicated that later responders reported differences in the amount of effort, but the amount of catch did not change.

Muskrat Falls

A participant shared a concern for the impact of the Muskrat Falls project on the central Labrador Atlantic Salmon stock because it poses an impassible barrier to the Churchill River. It was indicated that salmon caught above Muskrat Falls could be sampled to see if they are searun. It was also stated that it is not uncommon for salmon to spend time congregating below dams before going to a nearby river to spawn.

Recommended Bullet

A recommended bullet regarding reference points was presented to participants. The bullet proposed the current LRP of 100% conservation and an URP of 150% conservation be adopted. A participant inquired how the adoption of PA reference points would change the current process. It was explained that adopting PA reference points would result in prescribed management actions. Participants had mixed opinions on the PA framework. A participant inquired if the reference points would replace or change the river classification system. The response was that it may complement the river classification system, rather than change it. It was suggested that the participants review the SAR on the development of PA reference points for Atlantic Salmon (DFO 2015) and revisit the recommended bullet again during the meeting.

NEWFOUNDLAND AND LABRADOR ASSESSMENT OF ATLANTIC SALMON ON MONITORED RIVERS

M. Robertson, DFO Science

Abstract

Abstract not provided.

Discussion

Kenamu River

There was a discussion on the Kenamu River project in Lake Melville. A participant inquired how adult fish were being captured for tagging at Rigolet. It was stated that gillnets will be used during the Kenamu River project. A participant asked about the project's funding source, and it was stated that DFO received funds based on a recommendation of the Ministerial Advisory Committee on Atlantic Salmon.

A participant asked what this project will contribute to the overall stock assessment in NL. Firstly, it will provide information on stock status in Lake MelvilleIt was stated that the project will result in several applications such as providing marine survival estimates in Lake Melville (an area in Labrador where DFO currently has no monitored rivers and where a lot of recreational and subsistence fishing occurs). It will also provide estimates of marine survival in Lake Melville and identify migration routes. A participant asked how many fish would be tagged in Rigolet. The response was 70 salmon. A participant asked about the expected number of salmon that would go to the Kenamu River. It was stated that the Nunatsiavut Government tagged fish with floy tags in Rigolet for three years and approximately 80% of the fish were recaptured near the mouth of the Kenamu River. Completed otolith work also suggests that the Kenamu River is a major salmon producing river. A participant inquired where the fishery occurs. It was explained that fishing mainly takes place a quarter mile within the mouth of the river; however, there is a 10 day closure in that area and many people also fish in North West River or in Kenamish.

Stock Assessment

A participant requested an update on the trends in biological characteristics of smolts, including size, age composition and maturity. This may be used to deduce a change in return rate based on changes in the environment. It was stated that the sizes of smolts have not drastically changed since they have been monitored; however, a figure could be provided at the next science meeting.

A participant asked if there was value in conducting parr counts as well as smolt counts. The response was that electrofishing for parr is a technique commonly used in the Maritimes

Region, as they do not have as many monitoring facilities and it is considered a valuable method. It was stated that there is a study that will commence shortly that will model salmon life history.

A participant inquired about the research that is conducted in other countries. It was stated that DFO research scientists in the NL Region currently work with other countries on various Atlantic Salmon models, studies and programs.

There was a discussion on the ecosystem approach. A participant asked if ice coverage could cause poor returns. The response was that research has been completed on the connection of environment to salmon returns; however, more research could be valuable. Sea surface temperature and ice have been shown to affect the spring phytoplankton bloom. Research has also shown an association of timing of smolt runs to temperature (late runs and lower returns); however, it has not been consistent throughout the time series.

A participant recommended that research be conducted to understand the variability of freshwater survival.

NORTHWEST RIVER RECREATIONAL SALMON FISHERY, TERRA NOVA NATIONAL PARK

K. Tulk, Resource Conservation Manager - Terra Nova National Park, Parks Canada

Abstract

The lower 1.9 km of the Northwest River was gazetted into Terra Nova National Park in 1989. At that time the recreational fishery was regulated by Parks Canada under the *National Park's Act*. In 1996 the recreational salmon fishery was closed as salmon returns were well below the predicted conservation target. Subsequently, a salmon fence was installed to monitor salmon returns. In 2002, Parks Canada and DFO, working with local residents and stakeholders, helped establish the Northwest River Working Group to promote stewardship and assist with salmon restoration and conservation. In 2003, the recreational salmon fishery re-opened at Northwest River. In the beginning, a three-year interim conservation target of 500 salmon (escape to spawn) and a long term target of 700 salmon (escape to spawn) were established. If these targets were met then a recreational retention salmon fishery could occur. Threshold based conservation was discontinued in 2012 with the removal of the counting fence. Conservation measures applied from 2012-16 included a maximum retention limit/quota of 150 salmon per year. In 2017, the salmon counting fence will be re-established to assess returns. A modified threshold system will be in place to allow retention if conservation targets are met.

Discussion

There was discussion about the information that could be provided to DFO by Parks Canada regarding Terra Nova National Park (TNNP) to aid future stock assessments. It was noted that all data, including biological characteristics, could be used by DFO if provided.

During a discussion regarding the retention-only fishery on the Northwest River, a participant asked if there was angling upstream from the TNNP. It was noted that the portion of Northwest River outside of the park boundaries is closed for the season. Another participant inquired if large fish were released in TNNP. The response was yes; however, there are stakeholders that request retaining large salmon. A participant asked if anglers report the number of large salmon that are released. The response was that there was a survey completed several years ago, and would need to review the questions to see if that was included.

There was discussion on the type of licences required to fish in TNNP. It was explained to participants that TNNP and Gros Morne National Park have different establishment agreements and the decisions on licences are specific to each area. Although a participant from Gros Morne National Park could not attend the meeting, salmon counts from Gros Morne National Park were made available to meeting participants.

A participant commented that there was a potential conservation concern with Northwest River and a management plan was developed with the community in an effort to rebuild the stock. Illegal fishing was suspected as the main issue. Presently, the feedback received from local groups indicates that the salmon stocks are improving in TNNP.

SCIENCE ADVISORY REPORT FOR ATLANTIC SALMON

Discussion

Bay St George Salmon Stewardship Group

A report titled “Bay St George Salmon Stewardship Group Analysis for DFO Science Regional Advisory Process February 28 to March 1, 2017” was distributed to participants for information purposes, but it was not presented and reviewed at the regional peer-review meeting. Participants briefly discussed decadal percentages of conservation achieved by Harry’s River, and total returns to Harry’s River from 2003-12.

Management Advice Bullets

There was discussion about the management advice bullets in the SAR. A participant suggested that the current terminology for ‘conservation egg requirement’ should be changed to a ‘limit reference point’.

Predation

There was discussion about the concern for southern Newfoundland stocks in relation to potential increased predation near aquaculture sites based on the presentation given on the preliminary analysis of tracking released farmed salmon. It was noted that the ongoing tracking work has shown a high percentage of predation which may be a concern for marine survival of wild fish near aquaculture cages. It was stated that DFO Science will conduct a tagging project in the summer of 2017 on wild salmon near aquaculture cages. There was debate on the inclusion of the presented tracking study within the SAR. There were objections to the project’s inclusion due to the preliminary nature of the presented data. It was concluded that understanding increased predation near aquaculture sites would be a research recommendation in this Proceedings report.

Aquaculture

Participants deliberated about the science advice regarding the impacts of aquaculture on Atlantic Salmon in the NL Region. One participant commented on the expansion of the aquaculture industry in southern Newfoundland and felt that advice should recommend a moratorium on future expansion and that the adverse effects of current aquaculture sites be mitigated. Another participant commented that the aquaculture industry is an accepted risk on Atlantic Salmon and the focus should be mitigating impacts on wild populations such as developing better containment measures. Regarding the management advice in the SAR, there were suggestions that effort should be made to mitigate effects of escaped salmon on wild populations based on the evidence provided at this meeting. A participant suggested that the impacts of aquaculture should be minimized if it is in a river system below 100% conservation. It was recommended to change the terminology from ‘aquaculture’ to ‘finfish aquaculture’.

A participant inquired if a baseline could be established to help measure the potential impacts of aquaculture on wild salmon populations. The response was there is a proposal submitted to continue ongoing work and set up a three to four year baseline to look at both direct and indirect impacts of aquaculture.

DU4

A participant felt that Designable Unit 4 is too large to be representative of all of the rivers on the south coast of Newfoundland. It was stated that DU4 is deemed threatened by COSEWIC.

Summary SAR Bullets

Participants discussed the bullet which describes the magnitude of declines in total returns to indicator rivers. A participant felt that the decline could be explained because of poor smolt returns in 2015.

There was a discussion on the bullet describing marine survival. A participant felt that the south coast would have a lower survival than 7.2%. It was clarified that it was averaged over three monitored rivers. A participant inquired if poaching was an issue included in marine survival. The response was that mortality is not divided into natural or fishing mortality. It was stated that numbers from known violations are provided to ICES, however, there is no increase from known violations to unknown violations.

Regarding the subsistence fishery bullet, a participant inquired how the harvest was estimated from 70% log book returns. The response was that the additional 30% is inferred. A participant suggested that the number should have confidence intervals as it is an estimated number. It was decided to add that number of salmon harvested was 7% less in 2016 than 2015, thus the salmon were larger and weighed more in 2016. The percentage of logbook returns was added to the bullet upon a recommendation by a participant. A participant made a comment that they are working to increase logbook returns in their communities. It was stated that 70% is considered a good return rate for logbooks.

Participants requested clarification on the mixed stock fishery genetic analysis. It was suggested to provide percentages of Labrador salmon exploited by each mixed stock fishery.

There was discussion about a bullet on hybridization between wild and farmed salmon. It was stated that the bullet suggests that hybridization only occurred after the 2013 escape event; however, the information presented detected two levels of backcrosses. The section of the bullet that mentioned the 2013 event was removed. A participant recommended that the bullet include a comment that the approved expansion of finfish aquaculture might provide a greater risk. It was stated that this might not be appropriate for the SAR bullet as there could be other factors that are being considered for the new cages, such as better containment measures that have not been presented and discussed at this meeting. It was suggested that a statement should be made that hybrids and offspring are reproductively viable, which was added to the bullet.

Regarding the recreational catch bullet, it was recommended to clarify that total catch was greater by number in 2016 to prevent the misunderstanding that it was greater in weight. It was suggested that a confidence interval be placed on the estimated total catch. During the 2013 regional peer review process, a Research Document (Veinott and Cochrane 2015) was published on the accuracy of the total catch and it was around plus or minus 5%.

Regarding the reference points bullet, it was proposed to continue with the current conservation limit as the LRP and have the URP of 150% in the interim. In general, there was support for the continuation of the current conservation limit. There were mixed opinions on the adoption of the

URP; however, it was concluded to use the URP in the interim and review the reference points at the next regional peer review process.

RESEARCH RECOMMENDATIONS

- Develop an understanding of wild and farmed salmon interactions:
  - Movements/distribution of escapees in marine and freshwater environments;
  - Effects of hybridization and introgression on productivity of wild salmon stocks;
  - Disease (ISA) and parasites;
  - Impacts of foreign strain triploids;
  - Develop methodology to mitigate negative effects on wild salmon by farmed salmon;
  - Incidence of predation near aquaculture sites.
- Develop an understanding of at-sea mortality of Atlantic Salmon, including smolt fitness.
- Delineate mixed stock fisheries to river(s) of origin.
- Continue research into validating status of indicator rivers.
- Develop an understanding of Atlantic Salmon total returns using the ecosystem approach.
- Develop the utility of parr surveys for freshwater production.
- Conduct research on smolt biological characteristics through time.
- Develop an understanding of freshwater survival.
- Further an understanding of smolt production on all monitored rivers.
- Further evaluate limit reference points.

REFERENCES CITED

Cortes, E. and S.H. Gruber. 1992. Gastric evacuation in the young lemon shark, Negaprion brevirostris, under field conditions. Environmental Biology of Fishes. 35: 205-212.

DFO. 2015. Development of reference points for Atlantic salmon (*Salmo salar*) that conform to the Precautionary Approach. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2015/058.

Medved, R.J. 1985. Gastric evacuation in the sandbar shark, Carcharhinus plumbeus. Journal of Fish Biology 26: 239-253.

Olson, R.J. and C.H. Boggs. 1986. Apex predation by yellowfin tuna (*Thunnus albacares*): independent estimates from gastric evacuation and stomach contents, bioenergetics, and cesium concentrations. Canadian Journal of Fisheries and Aquatic Sciences. 43: 1760-1775.

Schurdak, M.E. and S.H. Gruber. 1989. Gastric evaluation of the lemon shark Negaprion brevirostris (Poey) under controlled conditions. Experimental Biology. 48: 77-82.

Veinott, G., and N. Cochrane. 2015. Accuracy and Utility of the Atlantic Salmon Licence Stub (Angler Log) Return Program in Newfoundland and Labrador. DFO Can. Sci. Advis. Sec. Res. Doc. 2014/035. v+ 14 p.

APPENDIX A – TERMS OF REFERENCE

Assessment of Atlantic Salmon in Newfoundland and Labrador

Regional Peer Review Process - Newfoundland and Labrador Region

February 28-March 1, 2017
St. John's, NL

Chairperson: Dale Richards

Context

The last full stock assessment of Atlantic Salmon (*Salmo salar*) in the Newfoundland and Labrador (NL) Region was completed for 2013 returns (Fisheries and Oceans Canada [DFO] 2015). An annual update of stock status is prepared in interim years to provide data and information to DFO Fisheries Management and the general public (DFO 2016).

Declines in total returns (>30%) on more than half of monitored rivers in 2016 warranted conducting a stock assessment. Fisheries Management will use information from this Regional Peer Review Process as the basis for revising the current salmon management plan.

Objectives

- Assessment of Atlantic Salmon in NL (Salmon Fishing Areas 1- 14B).
- Review the Science triggers/indicators used by Fisheries Management to determine if a Regional Peer Review Process is warranted earlier than planned.

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Participation

- DFO (Ecosystems and Oceans Science, and Fisheries Management sectors)
- Government of Newfoundland and Labrador – Department of Fisheries, Forestry and Agrifoods
- Aboriginal communities/organizations
- Academia
- Non-governmental organizations

References

DFO. 2015. Stock Assessment of Newfoundland and Labrador Atlantic Salmon – 2013. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2014/023.

DFO. 2016. Atlantic Salmon (*Salmo salar*) Stock Status Update in Newfoundland and Labrador for 2015. DFO Can. Sci. Advis. Sec. Sci. Resp. 2016/020.

APPENDIX B – AGENDA

Assessment of Atlantic Salmon in Newfoundland and Labrador
Chair: Dale Richards

February 28-March 1, 2017

Memorial Room - Northwest Atlantic Fisheries Centre
80 East White Hills Road, St. John's

Tuesday, February 28

Time	Topic	Presenter
09:00	Opening remarks and overview of Regional Peer Review Process	*Dale Richards*
-	Atlantic Salmon Regional Assessment Process – Interim Triggers and Fisheries Management Update	*Geoff Veinott/ Erin Dunne*
-	Genetic analysis of mixed stock Atlantic Salmon fisheries in the Northwest Atlantic	*Ian Bradbury*
-	Spatial and temporal distribution and survival of farmed Atlantic Salmon after experimental release from sea cage locations	*Dounia Hamoutene*
-	Genetic interactions among wild and farm escaped Atlantic Salmon in southern Newfoundland	*Ian Bradbury*
12:00	*LUNCH*	-
-	Lake Melville assessment (Kenamu River) and telemetry project	*Martha Robertson*
-	Development of Reference Points for Atlantic Salmon that Conform to the Precautionary Approach	*Geoff Veinott*
-	Newfoundland and Labrador assessment of Atlantic Salmon on monitored rivers	*Martha Robertson/ Julie Whalen*
-	Northwest River Update (Terra Nova National Park)	*Kirby Tulk*
-	Review of draft Science Advisory Report	*All*

Wednesday, March 1

Time	Topic	Presenter
09:00	Review of draft Science Advisory Report	*All*
12:00	*LUNCH*	-
-	Review of draft Science Advisory Report	*All*
-	Discussion of Research Recommendations	*All*
-	Upgrading of Working Paper to Research Document	*All*
-	Closing remarks and *ADJOURN*	*Dale Richards*

Notes:

- Health breaks will occur at 10:30 a.m. and 2:30 p.m. Coffee and tea can be purchased from the cafeteria.
- Lunch (not provided) will normally occur 12:00-1:00 p.m.
- Agenda remains fluid – breaks to be determined as meeting progresses.
- This agenda may change.

APPENDIX C – LIST OF PARTICIPANTS

Name	Affiliation
David Meerburg	Atlantic Salmon Federation
Don Ivany	Atlantic Salmon Federation
Geoff Giffin	Atlantic Salmon Federation
Sid Styles	Bay St. George Salmon Stewardship Group
Erika Parrill	Centre for Science Advice – NL Region
Melissa Burke	Department of Fisheries, Forestry and Agrifoods
Erin Dunne	DFO – Resource Management
Dave Reddin	DFO – Retired
Rex Porter	DFO – Retired
Brian Dempson	DFO – Science
Carole Grant	DFO – Science
Dounia Hamoutene	DFO – Science
Geoff Veinott	DFO – Science
Ian Bradbury	DFO – Science
Kristin Loughlin	DFO – Science
Martha Robertson	DFO – Science
Nick Kelly	DFO – Science
Harvey Garrett	Freshwater-Alexander Bay Ecosystem Co.
Tom Brown	Marine Institute
Dale Richards	Meeting Chair
Craig Purchase	Memorial University
Ian Flemming	Memorial University
Ross Hinks	Miawpukek First Nation
Cory Foster	Newfoundland and Labrador Outfitters Association
Andrew Bouzan	Newfoundland and Labrador Wildlife Federation
Rick Bouzan	Newfoundland and Labrador Wildlife Federation
Carl McLean	Nunatsiavut Government
Todd Broomfield	Nunatsiavut Government
George Russell	NunatuKavut Community Council
Patricia Nash	NunatuKavut Community Council
Kirby Tulk	Parks Canada – Terra Nova National Park
Jonathan Strickland	Qalipu Mi'kmaq First Nation Band
Julie Whalen	Rapporteur
Graham Roome	Salmon Preservation Association for the Waters of Newfoundland
Christoph Konrad	Salmonid Association of Eastern Newfoundland
Don Hutchens	Salmonid Council of Newfoundland and Labrador