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Proceedings of the regional peer review of the status of Divisions 3KL and Subdivision 3Ps Herring in 2017

January 31-February 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 assessment of Newfoundland East and South coast herring (*Clupea harengus*) was held January 31-February 1, 2017, in St. John's, Newfoundland and Labrador (NL). The objective of this meeting was to assess the stock status of herring in Northwest Atlantic Fisheries Organization (NAFO) Divisions 3K, 3L and Subdivision 3Ps. This proceedings report includes an abstract and summary of discussion for each presentation, and a list of research recommendations. The meeting terms of reference, agenda, and list of attendees are appended.

The meeting included participation from Fisheries and Oceans Canada (DFO) Science, Fisheries and Aquaculture Management, Newfoundland and Labrador Department of Fisheries, Forestry and Agrifoods, the Fish Food and Allied Workers Union, and the fishing industry.

In addition to these proceedings, publications to come from the meeting include a Science Advisory Report and a comprehensive Research Document, both of which will be available online on the DFO Canadian Science Advisory Secretariat Website.

Compte rendu de la réunion du processus régional d'examen par les pairs sur l'état du hareng des divisions 3KL et de la sous-division 3Ps en 2017; du 31 janvier au 1 février 2017

SOMMAIRE

Une réunion du processus régional d'examen par les pairs a eu lieu du 31 janvier au 1er février 2017 à St. John's (Terre-Neuve-et-Labrador) pour évaluer le hareng (*Clupea harengus*) des côtes est et sud de Terre-Neuve-et-Labrador. Cette réunion avait pour but d'évaluer l'état du stock de hareng dans les divisions 3K et 3L ainsi que dans la sous-division 3Ps de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO). Le présent compte rendu comprend un résumé et un sommaire des discussions liées à chaque présentation de même qu'une liste des recommandations de recherche. Le cadre de référence, l'ordre du jour et la liste des participants de la réunion sont joints.

Les participants à la réunion comprenaient des représentants du Secteur des sciences et du Secteur de la gestion des pêches et de l'aquaculture de Pêches et Océans Canada (MPO), du ministère des Pêches, des Forêts et de l'Agroalimentaire de Terre-Neuve-et-Labrador, de la Fish Food and Allied Workers Union, et de l'industrie de la pêche.

En plus du présent compte rendu, les publications émanant de la réunion incluent un avis scientifique et un document de recherche exhaustif. Le tout sera disponible en ligne sur le site Web du Secrétariat canadien de consultation scientifique du MPO.

INTRODUCTION OF HERRING STOCK STRUCTURE AND DISTRIBUTION

Presenter: C. Bourne

ABSTRACT

Atlantic herring in NAFO Divisions (Divs.) 3K and 3L and Subdivision (Subdiv.) 3Ps are divided into five stock complexes:

1. White Bay-Notre Dame Bay (WBNDB);
2. Bonavista Bay-Trinity Bay (BBTB);
3. Conception Bay-Southern Shore (CBSS);
4. St. Mary's Bay-Placentia Bay (SMBPB); and
5. Fortune Bay (FB).

Of these, a stock status update is currently available for BBTB, SMBPB and FB, while biological updates are provided for the remaining two stock complexes. Each stock complex is composed of both spring and fall spawners, and when possible, updates were provided for both spawning components. Spring spawners historically dominated the stock, but after a shift in the early 2000s, fall spawners became dominant in all areas except FB. During this time, summer spawning also increased. Additionally, herring have been more widely dispersed offshore during the spring in area 3Ps. Stock structure and distribution is currently being investigated through both genetics and otolith shape studies.

DISCUSSION

The question was raised what the definition of spring, summer and fall spawning is in regards to herring stock components. The date of July 1 is the cut off for spring spawners; herring that spawn before July 1 are spring spawners and after July 1 are considered fall spawners. Also, otolith center characteristics and maturity stage are used to classify each fish as a spring or fall spawner. It was then discussed whether the otolith characteristics can contradict the July 1 cut off. Yes sometimes it does, but only a small percentage.

Industry commented on how they are now seeing summer spawners which has not been seen in the past. They also commented that it is not that the fish are absent from the bays, the fish are just returning later. Industry also suggested that Science do an experimental research gill net program (RGN) in August. The RGN program is fixed, happening yearly from April-July. The RGN program has not been done any later due to potential overlapping with Salmon migration.

There was discussion on the knowledge of herring distribution and whether telemetry had been explored, and if acoustic tags could be used in the future. Telemetry was explored during the 1980s but tags were too big, and acoustics tags could be explored in our area but they are quite expensive. It was noted that herring began increasing in number in the DFO multi-species spring offshore surveys back in 2004. It would be of interest to see if herring are also offshore in the more northern areas during the spring, but ice is preventing a survey in most areas.

PHYSICAL OCEANOGRAPHIC ENVIRONMENT ON THE NEWFOUNDLAND AND LABRADOR SHELF IN NAFO DIVISIONS 3KL AND 3PS

Presenter: E. Colbourne

ABSTRACT

The North Atlantic Oscillation (NAO) Index, a key indicator of the direction and intensity of the winter wind field patterns over the Northwest Atlantic, remained in a positive phase during 2016; however, it was lower than in 2015. In addition, the spatial patterns of the associated atmospheric pressure fields resulted in a reduced arctic air outflow in the northwest Atlantic during the winter months. This resulted in higher than normal winter air temperatures in many areas. Sea ice extent, although above normal during March and April, was below normal overall during 2016.

Annual sea-surface temperature (SST; based on infrared satellite imagery) trends on the northeast and south coasts of Newfoundland have increased by about 1^{o}C since the early 1980s. During the past 2 years SST was below normal on the northeast Newfoundland Shelf but remained above normal on the south coast. The annual average water column (0-176 m) temperature/salinity at the inshore monitoring station (Station 27) was above/below normal by +0.6/-0.6 SD, respectively in 2016. The cold-intermediate layer (CIL; volume of < 0°C) during 2016 was above normal on the northeast Newfoundland Shelf (Divs. 3KL) but at very low values off southern Newfoundland (Subdiv. 3Ps), where warmer than normal water column temperatures prevailed. The spatially averaged bottom temperature in Div. 3K shows an increasing trend since the early 1990s by about 1°C, reaching a peak of > 2 SD above normal in 2011 and remaining slightly above normal in 2016. On the south coast, bottom temperatures have also increased since the early 1990s and were above normal by 1.2°C (+1 SD) in 2016.

A standardized composite climate index for the Northwest Atlantic derived from meteorological, ice and ocean temperature and salinity time series since 1950 reached a record low value in 1991. Since then it shows an increasing trend with mostly above normal values except for 2014 and 2015, the latter being the 7th lowest in 67 years and the lowest value since 1993. Data from 2016 show a return to above normal conditions.

DISCUSSION

It was asked where the decrease in salinity has been coming from since the 1990s. Although there is no direct study the source is coming from up north, presumable from melting ice. A decrease in salinity along Newfoundland is showing up everywhere out to the Grand Banks.

The seasonality of the oceanographic surveys was discussed. Seasonality is quite variable throughout spring, summer and fall. In regards to herring stock components spring time is quite cool compared to fall, which is warmer due to increased temperatures in the summer months. Station 27 seems to give a yearly picture, but the rest of the oceanographic data is limited in the northern stock areas (Div. 3K) as there is no sampling up north in the spring (mainly due to ice coverage), and only one survey up north in the summer. It was noted that the mid-July survey, which has sampled the cold indeterminate layer for 50 years, is now a good index to use for climate variability.

It was noted that not all oceanographic surveys will benefit the assessment of the herring stock as they are conducted offshore and herring are usually inshore. Satellite temperature data can depict temperatures accurately for inshore areas. Station 27 is a few km offshore so this is an inshore index. The spring multi species survey comes inshore but the fall survey does not.

TRENDS IN PLANKTON INDICES ON THE NL SHELF

Gary Maillet and Pierre Pepin

Presenter: G. Maillet

ABSTRACT

Ocean colour satellite imagery and derived metrics indicate changes in the extent and phenology of the spring phytoplankton bloom across the northwest Atlantic which may alter production dynamics and trophic energy transfer in the ecosystem. Large-scale ocean colour imagery over the North Atlantic indicates a general reduction in the magnitude of the spring bloom since 2011. The timing metrics also generally indicate later onset in peak timing and reduced duration of the spring production cycle since 2010. A preliminary examination of ocean colour imagery in conjunction with anomaly maps indicates limited change in the extent and timing of autumn blooms on the Grand Bank and NE Shelf. In general, trends in the timing indices indicate a potential link to ice dynamics for certain regions, but the overall intensity and magnitude of blooms is likely regulated by local physical processes. Changes in standing stocks of cold/warm water copepods do not appear to be a simple response to annual thermal conditions but one that reflects the combined effects of transport, trophic interactions and physiological response to changing environment. Greater and earlier occurrence of late stage copepodites of two key copepod taxa at the high frequency sampling inshore Station 27 may be an indication of changes in overall productivity. There has been a general downward trend in zooplankton biomass since the early 2000s with the lowest biomass in 2015, compared to the long-term average. Exploratory relationships between lower trophic indices and ocean climate conditions have not detected any significant relationships.

DISCUSSION

It was discussed that the decline in overall biomass of zooplankton in recent years may be due to the shift in size of species in the zooplankton assemblage. For example, a decrease in the abundance of *Calanus finmarchicus,* which weighs more than *Pseudocalanus spp*., but which appear to be increasing abundance. There are limitations to the overall biomass measure but there is a potential that the decline in biomass could be due to a shift in size composition.

It was suggested to use two years rather than one year when comparing trends in the environmental indices to the biological composite.

It was discussed how the biological oceanography fits into the herring assessment. Sampling is conducted mainly offshore but a lot of these species are being advected into the bays where herring spawn. While there is no sampling of zooplankton inside the bays, the nearshore indices (i.e. Station 27) can be used to predict the overall trend. Modelling is used to fill in the gaps, reducing bias.

Grazing and seasonality were discussed. While it was assumed that grazing is greater during the summer season, it was asked how much of the zooplankton assemblage is consumed by pelagic predators such as capelin, sandlance and herring. Although grazing pressure would be very useful information, it would be quite a challenge to quantify. Station 27 covers all seasons and is sampled regularly, and the overall trend in zooplankton abundance is the same for all seasons. Grazing has an impact but seems to be similar throughout the year.

NEWFOUNDLAND-LABRADOR BIOREGION: ECOSYSTEM SUMMARY

Mariano Koen-Alonso, Pierre Pepin, Gary Stenson, Fran Mowbray, Nadine Wells, Jennifer Mercer, and Denise Holloway

Presenter: M. Koen-Alonso

ABSTRACT

The ecosystem structure of the NL Bioregion can be described in terms of four Ecosystem Production Units (EPUs): the Labrador Shelf (Divs. 2GH), the Newfoundland Shelf (Divs. 2J3K), the Grand Bank (Divs. 3LNO), and southern Newfoundland (Subdiv. 3Ps). Changes in the fish community and trends in the Newfoundland Shelf, the Grand Bank, and southern Newfoundland EPUs were analyzed on the basis of DFO Research Vessel (RV) surveys during fall and spring. Trends were summarized in terms of fish functional groups defined in terms of general fish size and feeding habits: small, medium, and large benthivores, piscivores, plank-piscivores, planktivores, and shellfish (only commercial species, recorded since 1995). In the early 1990s, this large marine ecosystem underwent important changes associated with a history of overfishing and a regime shift.

In Divs. 2J3K, the collapse in the 1990s involved the entire fish community, and also involved a decline in fish size. After the collapse, the system was highly dominated by shellfish. The changes observed have a coherent internal structure; increases in small fish and shellfish are associated with declines in forage and large fishes. Consistent signals of rebuilding of the groundfish community appeared in the mid-late 2000s; this signal is also associated with an increase in fish size. In 2010-15 the overall biomass remained relatively stable, but the dominance of groundfishes increased, and shellfish decreased. However, the last couple of years have started to suggest a declining trend in total RV biomass. Although this apparent trend has been mainly driven by the declining biomass of shellfish, finfish biomass also showed a hint of a decline in 2016. The last two years have been characterized by a joint low availability of key prey fish functional groups like planktivores and shellfish.

In Divs. 3LNO the collapse in the 1990s also involved the entire fish community, and a decline in fish size. The collapse was not as severe as in the northern area. This EPU shows a higher dominance of benthivores, and it was never dominated by shellfish. The groundfish community has shown signals of rebuilding, but piscivores have not regained their dominant role. Overall build-up of groundfishes was initially led by medium benthivores and more recently by plank-piscivores. Although there was an upward trend in fish size in the late 1990s and early 2000s, fish size has declined since, and oscillated around the post-collapse average since the late 2000s; the 2016 Fall RV survey suggests a further decline in overall fish size. In recent years, an increase in Silver Hake (warm water species) has been observed among piscivores (western portion of the bank, Div. 3O). In the early 2010s the overall biomass remained relatively stable; however, over the last couple of years, total biomass has shown important declines, with current estimates around 30-40% of the early 2010s values. The 2016 Fall RV Survey also indicates reduced availability of planktivores and shellfish.

In Subdiv. 3Ps, the declines in the 1990s also involved the entire fish community, and included declines in fish size. The overall decline appears less severe than other ecosystem units in this bioregion. Since the mid-1990s, the overall biomass of the fish community has not increased significantly, and the last couple of years have shown below average biomass levels across most functional groups. Overall fish size did not improve after the decline, but has shown a clear decline in the mid-2000s, and a further decline in 2016. Ongoing warming trends, together with the increasing dominance of warm water species (Silver Hake), and the reduced fish sizes

across fish functional groups suggest that this ecosystem is undergoing structural changes, and potentially experiencing reduced productivity conditions.

Overall, the collapse in the 1990s involved the entire fish community, and included declines in fish size across all EPUs. The collapse was more severe in the north, and less in the southern Newfoundland region. There have been signals of rebuilding in the groundfish community, but current levels are still well below pre-collapse levels. After the initial build-ups, finfish biomass has been relatively stable in 2010-15, but recent surveys are suggesting a downward trend. This is clearly evident on the Grand Bank (Divs. 3LNO) EPU. Overall, it appears that the conditions that led to the start of a rebuilding have declined. This may be linked to the simultaneous reductions in capelin and shrimp availability (the 2016 capelin acoustic survey couldn't be conducted, but the lower levels found in the RV bottom trawl surveys are consistent with the low recruitment indices derived from inshore samples), as well as other changes in ecosystem conditions (e.g. declines in zooplankton levels in recent years).

Also, increases of warm water species like Silver Hake, which has been increasing its dominance among piscivores in Subdiv. 3Ps and the Grand Bank, may be a hint of the changes to be expected under warming conditions; the full extent of these kinds of impacts on the ecosystem remains largely unknown.

Among marine mammals, Harp Seals have rebuilt from the very low levels observed in the 1970s, but their numbers have been relatively stable since the mid to late-2000s.

In terms of predation on herring, diet compositions of key predators like cod and Harp Seals have been examined on the basis of stomach contents. In the Newfoundland-Labrador bioregion, herring has an inshore distribution. It has been an important prey for Harp Seals in inshore areas in the past (1990s), and only occasionally appears in the Atlantic Cod diet, most notably in southern Newfoundland (Subdiv. 3Ps). This low importance in the diet of cod has been interpreted, in part, to the more inshore distribution of herring, but also to timing of the surveys. Under current conditions of reduced availability of capelin and shrimp in the offshore, there is potential for an increase in predation pressure on herring if predators like cod increase their foraging/residence in inshore waters.

DISCUSSION

It was noted that the multi-species survey uses a bottom trawl for sampling and therefore does not directly sample herring, but some are caught in the trawl. The capture of herring could indicate population movement offshore or inshore.

There was some discussion about how large pelagics (such as tuna and swordfish) are being encountered more frequently in inshore Newfoundland waters. The diet of these large piscivorous fish is unknown as they are not captured in the multi-species survey. It was noted that the abundance of eastern Bluefin Tuna is increasing and the swordfish stock is very healthy. These large pelagics seem to be moving north so it may have implications for herring stocks and should be monitored.

Harvesters stated that within the last three years they have seen an increase in large pelagics in Conception Bay (inshore), Bonavista Bay and Trinity Bay. However, harvesters from St. Mary's Bay reported they have not been observed there. Additionally, they stated that the lack of forage fishes has resulted in birds abandoning their chicks in the nests.

It was discussed how Subdiv. 3Ps is showing low productivity with the ecosystem seemingly under a large amount of stress. Cod in 3Ps are consuming Snow Crab instead of their preferred prey of capelin or shrimp. Productivity in 3Ps has increased since the 1990s but is still nowhere near pre-1990s levels.

Harvesters commented on the increase in mackerel observed during the fall of 2016. In recent years very few, if any, mackerel were seen in the bays. It was asked if mackerel could be having an impact on adult spawning herring or preying on the larvae. It was suggested that both are possible but it is unknown to what extent, however, it would be interesting to investigate should samples of mackerel be obtained.

Another observation noted by harvesters in Bonavista Bay and Trinity Bay last year (2015-16) was the abundance of squid in numbers that have not been seen for about 20 years. Historically Newfoundland did have more squid. Some of the large pelagics being observed in recent years are known to feed on squid and the abundance of this food source in the Bays could be a factor favoring the migration of these large pelagics into NL waters.

HERRING FISHERY

Presenter: C. Bourne

ABSTRACT

There are both commercial and bait fisheries for herring in all stock areas, with the highest removals currently occurring in BBTB. Purse and tuck seines account for most landings, with bar seines being prevalent on the south coast (FB). There are spring and fall fisheries in most areas. There has been an exploratory fishery in southern Labrador since 2013 with relatively low landings. Commercial landings in WBNDB increased in both 2015 and 2016 to some of the highest levels in 20 years; similarly landings have been relatively high in BBTB for the past several years. In both WBNDB and BBTB the fall 2008 year class accounts for a large portion of the catch, recruitment of the spring 2013 year class in the commercial fishery was strong, and fall spawners continue to dominate the catch. Fishing activity has increased in CBSS and SMBPB over the past several years, with landings occurring largely via purse seine in Conception Bay and Placentia Bay. Fall spawners dominate these stock areas as well. Landings in FB have been declining since 2013 and the age structure of the catch is highly skewed toward age 11+ herring (largely the spring 2002 year class). During telephone surveys, purse seiners from all stock areas (except FB where there is no purse seine fishery) attributed discards to undersized herring. Landings in the bait fishery continue to decrease over time, though there was a significant increase in estimated bait removals in SMBPB in 2016. When asked about their perception of abundance in 2015, purse and bar seine fishers in all areas, as well as gillnet fishers in BBTB, reported increasing trends; in contrast, gillnet fishers in WBNDB, SMBPB, and FB reported declines.

DISCUSSION

The question was asked why the total allowable catch (TAC) is high (much higher than the amount being taken by fish harvesters). On the north coast of Newfoundland low catches are most likely due to little effort but in Fortune Bay it is more likely due to low herring abundance. Fish harvesters commented that in Fortune Bay it might also be due to gear restrictions; if they could use certain gear they could target more fish. As well the catch is driven by the amount of bait needed and how much buyers want to purchase.

The question was raised why White Bay and Notre Dame Bay age distribution skips ages 8, 9, and 10. The age distribution has young ages (4-6) and older age classes (11 +), which is a factor of sample size. It was stated that the sample size effect would be resolved when looking at the RGN program results, whereas the samples presented are those sampled from the commercial catches. The fish harvesters of the tuck and purse seine fishery commented that they usually provide large fish for samples, which is not representative of all fish sizes.

Harvesters commented that they do not like the word discards; when the fish are released it is under the assumption that a percentage of the fish will survive. Harvesters suggested logbooks should be made user friendly, and asked if logbooks are made mandatory will there be enforcement? It was stated that it is uncertain how the mandatory logbook will be enforced and that the phone survey will still continue should there be a low logbook return rate.

Discussion and concerns were raised about the change in net orientation for the bait fishers; if you are fishing for bait, gill nets must be placed parallel to the shoreline, while if you are fishing commercially you can place your gillnets perpendicular to the shore. Past practice for both bait and commercial fixed gear harvesters was to set perpendicular to the shoreline but the change was made to decrease by-catches of salmon. Fishers felt that setting the nets parallel is likely decreasing the catch rates. It was questioned whether 2016 bait fisher perceptions of change in abundance should be included in the stock assessment. It was agreed to leave this year out until this was further investigated, as the change in net orientation could bias the perception of abundance. It was suggested that the phone survey ask what the catch from gillnets is being used for. In the past commercial license holders have used gillnets even though catch has been used for bait. When asked why the bait landings are not included in the catch, it was stated that bait fishers keep the herring for personal use. The fish are still being caught so the phone survey helps to capture the bait fishers' landings and can be added to the commercial landings for the assessment.

Concerns were raised that the discards are not included in the landings. It was discussed that a large percentage of the discarded fish could not survive and this should be taken into account. Harvesters commented that the phone or logbook surveys should question the percentage of the catch that was under the length limit and therefore discarded.

Poor weather and sea conditions during the fall resulted in herring returning to Bonavista Bay in early December (3-4 weeks later than usual). If asked about their perception of fish abundance, harvesters would say low (or zero) but it was explained that the abundance is not low, but rather the herring did not come into the bay while they were fishing. Therefore, the abundance is unknown. It was reiterated that we need to be careful with the interpretation regarding perceptions of abundance.

Seine fishers noted that herring seemed to be staying closer to the bottom of the water column in Bonavista Bay and Trinity Bay, and that the fish remained near the bottom even when they employed the lights they use to draw herring to the surface.

When asked if samples from the processing plants and bait depots are sampled it was explained that both are sampled but the bait depots to a lesser degree as the RGN program is conducted during the same time of year.

RESEARCH GILLNET PROGRAM

Presenter: C. Bourne

ABSTRACT

The spring research gillnet program historically took place in all stock areas, but due to budgetary reductions over the past number of years it is currently only prosecuted in BBTB and FB. This program provides the only fishery-independent index of abundance and is the basis for the stock status index calculated for these stocks. Overall catch rates in BBTB were above average in 2015 but declined substantially in 2016, well below average. Fishers indicated this was likely due to the late arrival of herring in the area. Fall spawners continue to comprise the majority of the catch in BBTB and the fall 2008 year class dominates the age distribution, which is stable. Recruitment of the 2011 year class was average for spring spawners and above

average for fall spawners. An analysis of year classes showed that catch rates do track year classes through time in the program, indicating good internal consistency for both spring and fall spawners. In FB overall catch rates have been well below the time series average since 2004, and declined to historically low levels since 2011. The age distribution has been dominated by age 11 + spring spawners for the past several years, but there were indications of good recruitment of the 2012 spring year class in 2016 – however the age distribution is still not well distributed. Spring spawners are still dominant in this stock area. Recruitment has been below average since 2004, with the exception of the most recent 2012 year class. The analysis of internal consistency for this stock area demonstrated a good correlation from year to year for spring spawners, but not fall spawners, indicating that the spring RGN program does not provide an adequate index of recruitment for fall spawners in FB.

DISCUSSION

Tracking of the year classes was discussed and for all areas except FB both spring and fall cohorts can be tracked reliably through the RGN program. In FB, year classes tracked consistently for the spring but not fall spawners. It is believed that fall spawners are not being tracked as they comprise only 10% of the catch, thereby providing a very small sample size. It was asked to include significance levels (p-values) in the graphs for the next assessment. The RGN is made up of five different mesh sizes so should it be possible to detect recruitment.

Serious concerns were raised that only two areas are being assessed with the RGN survey and inferences are being made for the other areas. It was recommended to push for more funding for the research to provide the data needed for a complete assessment. The assessment is getting to the point where nothing is known about what is occurring in three of the areas, and making inferences about these three areas may not be prudent.

Harvesters commented that it is frustrating to be fishing an area where there is little to no data. In WBNDB, the abundance of fish seems to be increasing and they would like to catch more herring if this is the case but in the absence of data, it is unlikely that an increase in TAC will be considered.

It was commented that the RGN is done from the middle of April for 45 days and herring are showing up later in middle to end of May. It would be possible to get samples later in the summer if the commercial fishers were fishing later in the season.

It was commented that there are only four RGN fishers in Fortune Bay, and as they are spread out around the bay as much as possible, this should provide an unbiased sample.

BIOLOGICAL AND ECOLOGICAL DATA

Presenter: C. Bourne

ABSTRACT

The length and weight at age of herring declined from the 1980s to 1990s but appears to have remained relatively stable for both spring and fall spawners since that time. The length at 50% maturity (L50) is the basis for the size limit used in the commercial fishery; analysis showed that the L50 decreased through the 1990s and has increased during the 2000s. The L50 was historically based only on spring spawners due to sample size issues, but has been calculated for fall spawners in recent years, showing that L50 is generally slightly higher for fall spawners. The L50 of the 2011 year class was above the current size limit, however size at age for age 4 and 5 herring has decreased in recent years and it is expected that L50 will also go down. Environmental drivers of recruitment are still largely unknown, but a shift from colder to warmer

conditions in the late 1990s/ early 2000s coincided with the increased recruitment of fall spawners. Preliminary analysis shows a positive correlation between mean January sea temperature and fall spawner recruitment, as well as between spring spawner recruitment and the duration of the spring bloom. If these relationships continue going forward, it is expected that fall spawner recruitment may be poor from 2014-16 and spring spawner recruitment may also decline.

DISCUSSION

When asked if there is any information on adult herring diet it was commented that there is little diet information but this could be explored.

It was commented that the length at age in 4WX and in the Gulf Region has been decreasing since the 1970s but for Newfoundland, the decrease appears to have slowed. Whether this is due to temperature, food or other factors is currently unknown. Many of the environmental indices are based on offshore data so caution should be exercised when comparing to inshore indices.

The length at age and weight at age graphs demonstrate a decadal change but north vs south coast in 2010 does not seem to be significantly different and so they could be combined. They are separated because fish in the north are larger than fish in the south. In theory one would think that fish in the north would be smaller at age due to colder temperatures, unless herring are at optimal growth in the northern area. It was suggested that temperature and food abundance should be explored in north vs south areas and that the addition of error bars on the graphs would also be beneficial in future assessments.

STOCK STATUS UPDATE

Presenter: C. Bourne

ABSTRACT

Without a fishery-independent index of abundance (i.e. research gillnet program or acoustic survey), stock status could not be updated for the WBNDB or CBSS stock complexes. In BBTB and FB, where a spring research gillnet program takes place, the stock status index was calculated based on catch rates and year class strength. The index was initially calculated separately for spring and fall spawners, and then combined by weighting each index by the proportion of the catch that each spawning component comprised. The stock status of BBTB has had an increasing trend over the past five years, whereas the FB index has had a declining trend since 2010. Though SMBPB does not currently have a research gillnet program, stock status was updated for 2016 only, as an opportunistic acoustic survey was conducted in Placentia Bay in February, 2016. The results of this survey were compared to a historical time series and showed that abundance in the area was about average.

DISCUSSION

There was discussion on how to compare the recent increase in catch rates in BBTB to the historic catch rates. There is no set rule or guideline and it is important to maintain the baseline. It was suggested to use a fixed reference period for comparing the mean catch rates.

Spring and fall spawning component separation was discussed. Although they spawn at different times the components never separate in the environment. Currently the stock is assessed with the stock components separated out. Separation was not done in the past but it was agreed that the separation is beneficial. There is currently a manuscript under review that

states spring and fall spawning components are genetically distinct. In the BBTB stock, spring spawners are decreasing and fall spawners are increasing which makes assessing the stock status challenging. It was discussed and agreed upon to weight the catches based on the percentage of each stock component.

Comments were made that the traffic light approach is very subjective when assigning a color for a given area in which the stock components disagree with one another. It was noted that it may be better to simply state a stock is positive, negative or stable.

The RGN program results show that the Fortune Bay (FB) stock status has been negative for the last several assessments.

There is no RGN program in WBNDB and the BBTB RGN program results were used to infer relationships about this stock during the last assessment. However, it is uncertain how comparable the two stock areas are to allow assessment of one area based on results from another area.

Harvesters commented that the WBNDB area has shown positive signs of a healthy stock but they are frustrated that there is no index to confirm their observations. There was some discussion regarding an increase in TAC based on harvesters' observations as there is no data but this is an issue for fisheries managers.

When asked why the phone and logbook surveys are not being used in the assessment it was explained that there was little to no returns of logbooks and therefore not much information to use. The logbooks and the RGN program also did not track well together and it was decided not to use a qualitative index. The logbooks are not a stable index as they do not provide reliable CPUE data due to widely varying effort (a bait fishery), but they do provide a good indication of harvesters' perceptions of what is in their area and indications of when spawning of herring is taking place. Harvesters asked that the logbooks be considered for incorporation into the assessment again, as they were in the past, if returns increase when logbooks are made mandatory.

The status of the CBSS stock is uncertain. It was commented that catches went up only because tuck seine quota was increased and that the tuck seiners are fishing for bait.

It was noted that an experimental acoustic survey was conducted in SMBPB this year; this is only one data point. It was asked if the acoustic survey has a potential of continuing in SMPB. There is a potential for it to happen in 2018 but likely not in the same area, after that it is unknown when future surveys will take place.

It was suggested to provide status updates for only those stock areas with the RGN program and to provide a biological update for the remaining three areas.

ACOUSTIC UPDATE

Presenter: F. Mowbray

ABSTRACT

An opportunistic acoustic herring survey was conducted in Placentia Bay in February 2016, using a chartered purse seine vessel. The survey did not cover all historical strata or St. Mary's Bay, but it did cover core strata. As with previous surveys in the 1980s and 1990s, the highest concentrations of herring were detected in a few strata in Placentia Bay. It is therefore considered likely that the survey did encounter the densest herring aggregations in the area and can provide a reasonable estimate of relative abundance.

DISCUSSION

It was noted that the Placentia Bay experimental acoustic survey biomass estimate tracked well with past abundance estimates. If fish were caught, a sample of 200 was retained. Herring were found in two locations with one location having a larger abundance of small fish than the other. Purse seine harvesters also mentioned the presence of many small fish, suggesting there may be good recruitment in the area.

When comparing the recent experimental acoustic survey to the 1990s, fish abundance has increased in SMPB. All indicators suggest the abundance is stable and age distribution is broad. It was recommended that the status be reported as positive for this assessment, however if an acoustic survey is not completed for this area for future assessments, a more cautious approach should be taken.

There was discussion that during the acoustic survey herring were found in only a few stratum. If the acoustic survey continues, the stratum where fish are found should be noted to determine if it is consistent over time and to explore if fewer strata could be sampled in PB to get an accurate estimate. If this is the case, it may be possible to increase sampling effort in SMB in any future surveys.

It was discussed that in the future if the actual abundance number is used the target strength needs to be reassessed. If the acoustic survey is only used for trends in abundance the target strength is irrelevant as long as it is kept consistent.

HERRING FINAL DISCUSSION

Overall the science is lacking due to reductions in the acoustic survey in the past, and recent reductions to the gillnet survey in bays that are still being harvested. These survey changes lead to an inability to assess some stocks/ bays. More knowledge, in particular in abundance estimates and migration patterns, would allow more informed decision-making in the future.

HERRING RECOMMENDATIONS

- Reinstate regular acoustic surveys in all stock areas to get an estimation of biomass and reinstate the research gillnet program in WBNDB, CBSS, and SMBPB.
- Reassess the target strength used to estimate biomass from acoustic survey data.
- Continue to investigate stock complex migration; investigate most appropriate method to obtain information on migration patterns, including the use of telemetry.
- Develop a GSI to identify spring and autumn stock spawning components.
- Investigate the potential impact of the licence condition requiring bait nets to be set parallel to shore on the bait survey.
- Use a fixed reference period when calculating average catch rate numbers for each stock area.
- Investigate from the commercial logbooks, the percentage of undersized fish released/ discarded from sets.
- Continue to investigate relationships between recruitment and environmental drivers.
- Investigate changes in the timing of spring spawning/availability to the spring research gillnet program.

APPENDIX I

Terms of Reference: Status of Divisions 3KL and Subdivision 3Ps Herring

Regional Peer Review, Newfoundland and Labrador Region

January 31-February 1, 2017
St. John's NL

Chairperson: Rick Rideout, Science Branch, DFO, Newfoundland and Labrador Region

Context

The status of herring in Divs. 3KL and Subdivision 3Ps was last assessed in 2015. The current assessment was requested by Fisheries Management to provide the Minister with detailed advice on the status of these stocks.

Objectives

A review of any new information concerning the status of East and South Newfoundland Herring in the following stock areas:

- White Bay – Notre Dame Bay
- Bonavista Bay – Trinity Bay
- Conception Bay-Southern Shore
- St. Mary's Bay – Placentia Bay
- Fortune Bay

The meeting will focus on the general state of herring stocks in Newfoundland and Labrador and identify any conservation issues requiring adjustments to the management plan. The following topics will be discussed:

- Description of the 2015 and 2016 Commercial Fisheries
- Results of the Herring Research Gill Net Program for 2015-2016 in Bonavista Bay-Trinity Bay and Fortune Bay
- Results from Herring Bait Logbooks for 2014-2016
- Results of the Herring Purse Seine Questionnaires for 2015-2016
- Results of the Herring Telephone Questionnaire 2015-2016
- Results of the Cumulative Change in Abundance Index 2015-2016
- Examination of Biological and Ecological Data for 2015
- Examination of the Biology and Distribution of Herring caught in spring offshore surveys from 2015-2016
- Results of sampling and an acoustic survey conducted in Placentia Bay in winter 2016

Expected Publications

- Science Advisory Report
- Proceedings
- Research Document

Participation

- DFO Science, Newfoundland and Labrador, Maritimes, Gulf and Quebec Regions
- DFO Fisheries Management, Newfoundland and Labrador Region
- Fish, Food and Allied Workers Representatives
- Industry Representatives
- Aboriginal Groups
- Provincial Department of Fisheries and Aquaculture
- Academia
- Non-Governmental Organizations

APPENDIX II

Agenda: Status of Divisions 3KL and Subdivision 3Ps Herring

Memorial Room-NAFC, St. John's, NL
January 31-February 1, 2017
Chairperson: Rick Rideout

Tuesday, January 31

Activity	Presenter
Introduction	R. Rideout (Chair)
Physical Oceanography	E. Colbourne
Biological Oceanography	G. Maillet
Ecosystem Overview	M. Koen-Alonso
Refreshment Break	N/A
Introduction • Stock structure/distribution	C. Bourne
Commercial Fishery • Landings, catch at age, industry input	C. Bourne
Research Gillnet Program • Recruitment, catch at age, catch rates	C. Bourne
Biological and Ecological Data • Length/weight at age, L50, environmental drivers, spawning times • Placentia Bay 2016 Acoustic Survey results	C. Bourne/F. Mowbray
Lunch (Not Provided)	N.A
Summary and Stock Status Update	C. Bourne
Research Recommendations, Conclusions and Advice	C. Bourne
Drafting of SAR/ Summary Bullets	C. Bourne

Wednesday, February 1

Activity	Presenter
Drafting of SAR/ Summary Bullets (continued)	C. Bourne
Additional Items/ Time (*as necessary)*	ALL
Adjourn	R. Rideout (Chair)

APPENDIX III

List of Attendees: 2017 Herring Peer Review Meeting

January 31-February 1, 2017
Memorial Room-NAFC, St. John's, NL

Name	Affiliation
Rick Rideout	DFO Science, NL Region
Jim Meade	DFO Science, NL Region CSA Office
Brad Squires	DFO Science, NL Region
Hannah Murphy	DFO Science, NL Region
Ellen Careen	DFO Resource Management, NL Region
Patricia Williams	DFO Resource Management, NL Region
Carissa Wilson	DFO Science, NL Region
Kim Émond	DFO Science, Québec Region
Jenni McDermid	DFO Science, Gulf Region
Gary Melvin	DFO Science, Maritimes Region
Steven Miller	Fish Harvester-3L
Gilbert Penney	Fish Harvester-3L
Roland Hedderson	Fish, Food and Allied Workers Union (FFAW)
John Boland	FFAW
Erin Carruthers	FFAW
Christina Bourne	DFO Science, NL Region
Richard Gillett	Fish Harvester
Nancy Pond	Department of Fisheries, Forestry and Agrifoods, NL Government
Fran Mowbray	DFO Science, NL Region
Eugene Colbourne	DFO Science, NL Region
Paul Regular	DFO Science, NL Region
Mariano Koen-Alonso	DFO Science, NL Region
Gary Maillet	DFO Science, NL Region
Brandi O'Keefe	DFO Science, NL Region
Randy Randall	Fish Harvester
Everett Roberts	Fish Harvester