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Proceedings of the Newfoundland and Labrador Regional Peer Review of the Sea Scallop Assessment on St. Pierre Bank, and the Newfoundland and Labrador Snow Crab Assessment

February 22-24, 2016
St. John's, NL.

Chairperson: Mark Simpson
Rapporteur: Jane Tucker

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Canada

Foreword

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

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SUMMARY

A meeting of the Newfoundland and Labrador Regional Peer Review Process was held February 22-24, 2016, in St. John's, Newfoundland and Labrador (NL), to assess the stock status of Sea Scallop (*Placopecten magellanicus*) in Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps, and Snow Crab (*Chionoecetes opilio*) in NAFO Divisions 2HJ3KLNOP4. 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.

Participants at the meeting included representatives from Fisheries and Oceans Canada (DFO) Science and Fisheries Management Branches (NL Region), the NL Department of Fisheries and Aquaculture, Aboriginal groups, and the fishing industry.

In addition to these proceedings, publications to be produced from the meeting include a Science Advisory Report and a comprehensive Research Document for each species, all to be available online on the Canadian Science Advisory Secretariat website.

Compte rendu du processus régional d'examen par les pairs de Terre-Neuve-et-Labrador sur l'évaluation du pétoncle géant sur le banc de Saint-Pierre et sur l'évaluation du crabe des neiges de Terre-Neuve-et-Labrador

SOMMAIRE

Une réunion du processus régional d'examen par les pairs de Terre-Neuve-et-Labrador a eu lieu du 22 au 24 février 2016, à St. John's (Terre-Neuve-et-Labrador) afin d'évaluer l'état du stock de pétoncles géants (*Placopecten magellanicus*) dans la sous-division 3Ps de l'Organisation des pêches de l'Atlantique Nord-Ouest (OPANO) et du stock de crabes des neiges (*Chionoecetes opilio*) dans les divisions 2HJ3KLNOP4 de l'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.

Parmi les participants à la réunion, on retrouve des représentants des secteurs des Sciences et de la Gestion des pêches de la région de Terre-Neuve-et-Labrador de Pêches et Océans Canada (MPO), du ministère des Pêches et de l'Aquaculture de Terre-Neuve-et-Labrador, des groupes autochtones et de l'industrie des pêches.

En plus du présent compte rendu, les publications à produire émanant de la réunion incluent un avis scientifique et un document de recherche exhaustif pour chaque espèce, qui seront tous disponibles en ligne sur le site Web du Secrétariat canadien de consultation scientifique de Pêches et Océans Canada.

INTRODUCTION

The status of Northwest Atlantic Fisheries Organization (NAFO) Subdivision (Subdiv.) 3Ps Sea Scallop was last assessed in 2011. The status of Snow Crab in NAFO Divisions (Divs.) 2HJ3KLNOP4R was last assessed February 24-26, 2015. The main objectives of these assessments were to evaluate the status of the stocks and to provide scientific advice concerning conservation outcomes related to various fishery management options.

The current assessments were used to reach consensus on main points (summary bullets) to inform management options for the upcoming 2016 fishing season. The summary bullets are included in the Science Advisory Report (SAR) for each of Sea Scallop and Snow Crab, which were written and reviewed on March 1-2, 2016.

The proceedings include an abstract and summary of discussion for each presentation. Additional information can be found in the SAR and research documents or from references cited therein.

PRESENTATIONS

PHYSICAL OCEANOGRAPHIC CONDITIONS ON THE NL SHELF, UPDATE FOR 2015

E. Colbourne, J. Holden, D. Senciall, W. Bailey, S. Snook

Presenter: E. Colbourne

Abstract

The North Atlantic Oscillation (NAO) Index, an indicator of the direction and intensity of the winter wind field patterns over the Northwest Atlantic, remained in a positive phase in 2015, reaching a record high and resulting in a strong arctic air outflow in the northwest Atlantic during the winter months and consequently lower than normal winter air temperatures. Sea ice extent increased substantially during winter 2014 with the first positive anomaly (higher-than-normal extent) observed in 16 years and in 2015 the total extent was about normal. Annual sea-surface temperatures (SST) based on infrared satellite imagery across the Newfoundland and Labrador Shelves were below normal in 2015, the coldest since 1993. The annual bottom (176 m) water temperature at the inshore monitoring station (Station 27) was below normal in 2015 by - 0.7 standard deviations (SD), a significant decrease from the record high in 2011. The cold-intermediate layer (CIL; volume of water < 0°C) in both 2014 and 2015 was at its highest level since 1985 on the Grand Bank during the spring. Spring bottom temperatures in Subdiv. 3Ps remained above normal by about 0.5°C (0.8 SD) and about normal on the Grand Banks. Fall bottom temperatures in Divs. 2J, 3K and 3LNO decreased from 2, 2.7, and 1.8 SD above normal in 2011 to 0.2 and 0.8 SD above normal in Divs. 2J and 3K and to -0.4 SD below normal in 3LNO in 2015, a significant decrease in the past 4 years. A standardized climate index derived from 28 meteorological, ice and ocean temperature and salinity time series declined for the 4th consecutive year, reaching the 7th lowest in 66 years and the lowest value since 1993. As a result, the area of bottom habitat covered by water < 2°C increased to near-normal values in recent years compared to the record low observed in 2011.

Discussion

No discussion took place regarding this presentation.

BIOLOGICAL OCEANOGRAPHIC CONDITIONS ON THE NEWFOUNDLAND AND LABRADOR SHELVES

G. Maillet, P. Pepin, E. Colbourne, D. Mullowney

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 extent and delay in the onset of the spring bloom in 2015. In general, trends in the timing indices indicate a potential link to ice dynamics for certain regions but the overall intensity of blooms is likely regulated by local physical processes.

Zooplankton biomass trends based on seasonal oceanographic monitoring along standard sections indicate lower standing stocks of both small and large size classes in 2015 compared to the long-term average. Long-term changes in plankton taxa based on the Continuous Plankton Recorder (CPR) indicate increased standing stocks of phytoplankton and dominant zooplankton taxa in recent years (2010-14) but lower levels of cold-water adapted calanoids on the Newfoundland Shelf. Exploratory relationships between various plankton stocks based on the CPR Survey and ocean climate conditions have not detected any significant relationships. Changes in standing stocks of plankton do not appear to be a simple response to thermal conditions but one that reflects the combined effects of transport, trophic interactions and physiological response to a changing environment.

Discussion

During the discussion it was noted that there is a discrepancy between the CPR and ST trends, and it was asked which of the two data sources to believe. The response was that the discrepancy could be because CPR data are not available yet. It was noted that CPR has better spatial coverage, while ST data provide snapshots in time and depend upon what the stage of the production is at the time of sampling. CPR and satellite ocean colour provide a temporal and spatial context. Survey data reflect timing in the production cycle. It was noted that the CPR may collect the largest animals present. Regarding the figure presenting a time series of anomalies for age two to three years Snow Crab and lagged Decapoda (CPR), it was noted that although not significant, the slopes decrease for both. It was then asked if the two decreasing lines were tested against one another to infer whether or not the two metrics are measuring the same animals. The response was that the time lag has not been fine-tuned yet to test this, but it could be done in the future. It was asked: what is the data source for cold water copepods? The response was that both CPR and ST data are used, the more recent data being from ST. It was noted that both data sources are generally consistent in terms of arctic copepods. In regard to ocean colour and peak timing, the overall message showed delayed and less intense blooms. It was then asked if it could be inferred that this means there was lower primary production in 2015. The response was that in general, that statement was correct. It was stated that the Bedford Institute of Oceanography (BIO) is developing primary production curves based on these data. It was then noted that a lot of information is not currently up to date and in the next year or so the data to address that question should be available.

NEWFOUNDLAND AND LABRADOR BIOREGION: ECOSYSTEM SUMMARY

Mariano Koen-Alonso, Nadine Wells, Denise Holloway, and Jennifer Mercer

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 (2GH), the Newfoundland Shelf (2J3K), the Grand Bank (3LNO), and southern Newfoundland (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 the 2010s the overall biomass has remained relatively stable, but the dominance of groundfishes has increased, and shellfish decreased.

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 in the northern area. This EPU shows a higher dominance of benthivores, and it was never dominated by shellfish. The groundfish community shows 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 a upward trend in fish size in the late 1990s and early 2000s, fish sized has declined since, and has oscillated around the post-collapse average since the late 2000s. In recent years, an increase in silver hake (warm water species) has been observed among piscivores (western portion of the bank, 3O). In the 2010s the overall biomass has remained relatively stable, but shellfish biomass has shown important declines.

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. Overall fish size did not improve after the decline, but has shown a clear decline in the mid-2000s, and still remains at that lower level. 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. In the 2010s the overall biomass has remained relatively stable, but shellfish biomass has shown important declines.

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 are signals of rebuilding in the groundfish community, but current levels are still well below pre-collapse levels. Shellfish became a dominant functional group in Divs. 2J3K after the collapse, but although it increased its dominance in other ecosystems, it never reached the overwhelming dominance observed in the northern region. The functional

groups leading the groundfish rebuilding are not the same across ecosystems; piscivores are important drivers in the northern area, but they have a lesser role in southern ecosystems. Silver hake, a warm water species, is increasing its dominance among piscivores. They have become a major component of this functional group in Subdiv. 3Ps, and are increasing in the Grand Bank. This may hint of the changes to be expected under warming conditions; the full extent of these kinds of impacts on these ecosystems remains largely unknown.

Estimations of food consumption by the fish community were produced on the basis of 8 models, which taken together, aim at producing a reasonable envelope for the total food consumption. These models are generally based on bioenergetics-allometric relationships or daily rations, and assume that all food requirements are satisfied. Diet composition of key predators (cod, turbot, American plaice, redfish, and Yellowtail flounder) was estimated from stomach content analyses, and used to fraction the total consumption among prey classes.

In Divs. 2J3K the order of magnitude of the annual food consumption by the fish community has been estimated in the range of 5-12 million tonnes. Snow Crab is a small part of the diet of core predatory fishes. There are records of Snow Crab in the diet in the pre-collapse period. Predation on Snow Crab is associated with larger predator sizes. A first approximation to the annual consumption of Snow Crab by the large benthivores and piscivores has been estimated in the range of 50-250 thousand tonnes. Consumption of Snow Crab is more important in Div. 3K than in 2J.

In Divs. 3LNO the order of magnitude of the annual food consumption by the fish community has been estimated in the range of 6-15 million tonnes. Snow Crab is still a small part of the diet of core predatory fishes, but is more important than in the northern area. There are records of Snow Crab in the diet in the pre-collapse period. Predation on Snow Crab is observed over a larger range of predator sizes. Predation on Snow Crab appears more important in the spring than in the fall diets. A first approximation to the annual consumption of Snow Crab (based on fall diets) by the large benthivores and piscivores has been estimated in the range of 50-200 thousand tonnes, but the range for key predators is 50-100 thousand tonnes.

In Subdiv. 3Ps the order of magnitude of the annual food consumption by the fish community has been estimated in the range of 1-2.5 million tonnes. Snow Crab is an important component of the diet of cod, but American plaice also consumes Snow Crab. There are records of Snow Crab in the diet of cod in the mid-1990s. Predation on Snow Crab is observed over a broad range of predator sizes, but is more important in larger predators. A first approximation to the annual consumption of Snow Crab (based on spring diets) by the large benthivores and piscivores has been estimated in the range of 100-350 thousand tonnes, but the range for key predators is around 40-130 thousand tonnes. If predation on Snow Crab follows a similar pattern as Divs. 3LNO, these figures derived from spring diet compositions would likely be on the high end of the spectrum. Still, predation may be an important factor for Snow Crab in this region.

In summary, the regime shift in the 1990s triggered a cascade of changes in the NL marine ecosystems, which were already under stress due to overfishing. These changes are still working themselves out. The increase and decline of shellfish resources, as well as the current build-up of groundfishes can be interpreted as part of this process. Current rebuilding of groundfishes is not homogenous across all ecosystem production units, but in general terms, it implies reductions of shellfish and small benthivores functional groups. Despite the observed increases in groundfishes, overall biomass is still well below pre-collapse levels. Although the overall perspective appears positive for groundfishes, some signals in the southern areas suggest caution. Warm water species, like silver hake, are increasing in the Subdiv. 3Ps and Div. 3O. This may be a hint of changes to come, potentially linked to climate change, or at least

a warm phase in climate variability. In relation to Snow Crab, predation by groundfishes may become an important regulatory factor as groundfishes recover, and may already be at play in southern Newfoundland (Subdiv. 3Ps).

Discussion

It was noted that over the last “number of years” the size of shrimp and other shellfish in Subdiv. 3Ps became smaller. It was noted that an overall size decrease does not mean that, for example, a six year old fish is smaller now than a six year old fish was several years ago. Regarding seasonal differences in diet composition of some piscivores, it was asked if there is species overlap between the two surveyed seasons. The answer was no, but it was noted that this is a good idea for future study.

ASSESSMENT OF SUBDIVISION 3PS SEA SCALLOP

Presenter: E. Coughlan

Abstract

The directed fishery for Sea Scallops (P*lacopecten magellanicus*) started on St. Pierre Bank (NAFO Subdiv. 3Ps in the late 1970s. This is a pulse fishery largely dependent on sporadic recruitment. Populations on St. Pierre Bank are mainly found in three beds (North, Middle and South beds) at depths from 40-100 m. They are usually found on hard bottom, with variable substrate composition, consisting largely of sand, gravel, shell fragments, and stones.

Prior to 2006 the fishery was managed by Total Allowable Catch (TAC) and meat count regulations applied to the offshore fleet, but not to the inshore fleet. In 2006, following the recommendations of the “Hooley Report”, specific fishing areas and TACs were applied to each fleet. Since then fishing has only been prosecuted on the North bed by the NL inshore fleet. Between 2005 and 2010 landings ranged from 300 t to 770 t then increased to 1,190 t in 2012, and since then has averaged 1,125 t shell stock (136 t meat weight).

A DFO research vessel survey in September 2015 resulted in a minimum dredgeable biomass (MDB) estimate of 5,912 t, the lowest since 2005. In addition, it was determined the abundance is currently dominated by a modal group of scallops (110 mm) in the South bed and North bed, and the natural mortality index for Sea Scallop has increased from 0.09 in 2010 to 0.13 in 2015. Recruitment prospects are unknown.

Discussion

During the presentation there were some questions of clarification regarding the use of symbols in figures, the presence of apparent zeros in figures, and the calculation used to develop the mortality estimates. It was noted that there was a significant mortality increase in the south bed, compared to the north, especially in 2003-06. It was noted this was due to the presence of relatively younger scallops that had died.

There were Fisheries Management questions regarding the division of the fishing fleet between north and middle beds (inshore), and south beds (offshore). It was noted that in 2014, 275 t of scallops were caught on the boundary of the southern bed, and it was asked if those catches were really inside, outside or a combination of in and outside the southern bed. The reply was that they were outside the southern bed. It was also asked why fishing is only taking place in the northern bed, to which the response was that the three beds were separated by fleet in 2006 by the recommendation of the Hooley Report and that the offshore fleet has opted to have a 0 TAC in the middle and southern beds. It was noted that a graph presented showed a greater than

65 ft Newfoundland fleet, but this does not exist as there are no licenses in NL for offshore scallops. The response from Fisheries Management was that there are offshore licenses for Subdiv. 3Ps. It was noted that Nova Scotia did not take part in the fishery until 1978. It was then asked if it is fair to conclude that all of Newfoundland and Labrador's effort has taken place in the northern bed. The reply was that fleet separation took place in 2006, so prior to that harvesting occurred throughout Subdiv. 3Ps and the proportion of effort that took place in each of the three current management beds up to 2006 was not documented. It was noted that fishers did, in fact, fish in all three beds prior to 2006.

Regarding the DFO survey, there was a comment that the timing of the survey is always the same (post-fishery). It was then noted that in 2015 there were more scallops taken in the fishery in the north bed, which would explain a lower biomass from the post-fishery fall survey. It was further stated that the timing of the survey means the survey biomass estimates do not reflect what fishers see during the commercial fishery. It was noted that in some strata, the 2015 survey resulted in a zero biomass estimate, while looking at the previous 12 years for the same strata, there is a mean of about 500 kg biomass. It was asked if zeros were applied when calculating biomass or if in fact some scallops are present. The reply was that the stratified random design used in the survey does not take previous years' data into account and that zero catches in some sets does not mean there are no scallops in the area, it only means there were zero catches in those particular sets. Lastly, there was concern over variation from protocol warp length (wire length) to depth ratio of 3:1 in the 2015 survey affecting the pitch angle and therefore catchability of the dredge.

NAFO DIVISIONS 2HJ3KLNOP4R SNOW CRAB

Presenter: D. Mullowney

Abstract

Resource status was evaluated throughout NAFO Divs. 2HJ3KLNOP4R based on trends in biomass, recruitment, production, and mortality. Multiple indices of these metrics were derived from a suite of data sources that include dockside-monitored landings, harvester logbooks, at-sea observer monitoring, pre- and post-season trawl surveys, broad-scale post-season trap surveys, localized inshore trap surveys, a vessel monitoring system (VMS), and biological and oceanographic sampling data from multiple sources.

Data availability varied among divisions and between inshore and offshore areas within divisions. Trap and trawl surveys indicate that overall the exploitable biomass has recently declined to its lowest observed level, and Division 3L now accounts for most of the biomass. Overall, recruitment has declined in recent years and is expected to decline further in the short term (two to three years). The emergence of a pulse of small crabs, associated with cooling oceanographic conditions in the past three years, suggest a modest increase in recruitment within some NAFO Divisions in about five to seven years. However, a warm oceanographic regime coupled with relatively low abundance of young crabs for the past decade suggests overall weak recruitment in the long term. Trends in indices are described in detail for each division and conclusions are presented with respect to the anticipated effects of short-term changes in removal levels on fishery-induced mortality.

Discussion

During the presentation a brief explanation of OGive MAPping (OGMAP) was provided. OGMAP is a new statistical method used to estimate probability distributions of catches (i.e. abundances, biomasses) at any surveyed point. The analysis gives a confidence bound around a mean value

for every point, using bootstrapping methods. The previously used STRAP (Stratified Random Assessment Process) method allowed negative numbers in the confidence bounds, while OGMAP does not, which is considered an advantage.

During the discussion period, it was asked how much confidence DFO has in the information presented, given that it is known that the Campelen trawl used in the surveys is not very effective at catching crab. The response was that it is assumed that it performs consistently every year and thus can still provide an accurate time series of information. It was also noted that indices rather than absolute values are presented, for that very reason. It was stated that management is confident in the science and typically what is assessed each year comes to fruition in the following year. It was asked if the DFO trap survey takes place at the same time each year. A response was given that precise times will differ, but each bay is sampled in the same month each year and they are all sampled post-fishery (except Fortune Bay, which is sampled during the fishery). It was then asked if the results of the DFO trap survey are similar to the catch rates seen in the fishery. The reply was that all the pre-recruit indices are showing the same story. It was asked what are the implications of a low sign of recruitment in Div. 2J and it was noted that the fishery in that area performed well last year. It was asked: “what are the implications of maintaining such exploitation levels with no incoming recruitment?” The answer was that a positive signal implied by recent cooling temperatures presented in the Environmental/ Oceanographic Update presentation will occur in about six or seven years.

A new model was developed this year to attempt to more accurately represent catch per unit effort (CPUE). When reviewing the bullets, it was noted that the new model was not fully trusted by several participants. After review of the model during a break in the meeting, it was decided to use raw CPUE values, as in previous years, and to work on the model CPUE again for next year.

NAFO DIVISIONS 2HJ SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings have remained relatively low at less than 2,000 t since 2011. Meanwhile, effort has been substantially reduced and has been at its lowest level during the past three years and CPUE has increased throughout the division since 2012. The trawl and CPS trap survey-based exploitable biomass indices both increased sharply in 2014. The trawl index returned to a relatively low level in 2015 but the CPS trap survey index suggests the biomass remains unchanged on primary fishing grounds. Recruitment increased sharply to a recent high in 2014 but subsequently decreased to a relatively low level in both the trap and trawl surveys in 2015 and short-term recruitment prospects appear poor. The pre-recruit fishing mortality index was very low in 2015, and while the exploitation rate index peaked in 2012, it has since decreased to about its lowest level in 2015. Status quo removals in 2016 would once again increase the index to a level similar to recent norms.

Discussion

It was noted that in 2011 fishers were more spread out than in 2015, where fishing took place mostly in the Cartwright and Hawke Channels. When asked if there is an explanation for this, the reply was that it is not known why this was the case. Divs. 2HJ is an area of concern in general, but perhaps specific regions where fishing activity takes place (such as the Cartwright Channel) are of less concern.

During review of the summary bullets, concern was expressed regarding differences among crab management areas (CMAs) within Divisions (e.g. 2JN and 2JS). It was asked if maintaining status quo in the fishery would be acceptable, and the response provided was that the relatively high ratio of exploitable biomass to pre-recruit biomass suggests a safe zone for fishing.

NAFO DIVISION 3K SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings declined by 52% since 2008 to 7,200 t in 2015, their lowest level in two decades. Meanwhile effort has declined by 35% and has been near its lowest level for the past three years. CPUE declined by 55% from 2008 to 2011 and has since changed little, remaining near a historic low and reflecting trends throughout most of the division. The trawl and CPS trap survey exploitable biomass indices both declined since 2008 to their lowest observed levels. Both indices decreased by a third from 2014 to 2015, reflecting decreases throughout the division. Recruitment is at or near time series' lows throughout the division and is expected to decline further in the short term with all trawl and trap pre-recruit indices near historical lows during the past three years. The pre-recruit fishing mortality index was relatively low from 2005-13 but has since increased to a recent high, while the exploitation rate index was about average during 2014 and 2015. Maintaining the current level of removals would increase the exploitation rate in all management areas in 2016 with the overall trawl survey exploitation rate index increasing to its highest level in a decade and second highest level in the time series.

Discussion

A participant asked what age are 30-50 mm carapace width (CW) crabs. The response was that the ability to age crabs is lacking. Up to about 25 mm CW is considered three years of age, and 30-50 mm CW could be four or five years old. One reason for imprecision in crab-ageing is that skip-molting takes place, especially in colder areas. It was noted that in 2013-14 there was a presence of small crabs, but they disappeared in 2015. It was also noted that 2013-14 saw a build-up of small crabs Atlantic Canada-wide. It is believed the trawl does not pick up these intermediate-sized crabs and it is hoped to catch them when they grow. It was stated that commercial shrimp trawls catch very small, thumbnail - sized crabs, the size observed and discussed in the aforementioned 2013-14 build-up of small crabs. It was noted that shrimp trawlers are catching lots of thumbnail – sized crabs in the Funk Island Deep.

During review of the summary bullets, there was discussion over what a "decline in effort" really means. It was argued that if the number of pots in the water remains the same while the TAC is lowered, effort has relatively increased. It was countered that, regardless, fewer crabs are coming out of the water and that the number of pots in the water for the past three years has been low compared with previous years. It was also noted that only half of the logbooks for the 2015 season have been returned or entered into the data system, so the number for effort could change.

A participant asked how much emphasis is placed on the Collaborative Post-Season (CPS) survey. It was noted that some pots soak for 12 hours, after which it is believed groundfish have eaten all the bait, thus no crabs are being caught. An anecdote was shared whereby a harvester caught 11 cod and about 30 turbot in 200 pots during the CPS in the Funk Island Deep. The response was that the trawl survey and the logbooks are the main source of data and that the trawl survey and CPS data are "in line." It was noted that discard numbers scaled to landings cause a high pre-recruit fishing mortality index (PFMI), even though pre-recruit abundance

indices (denominator in index) are low. It was asked if this is alarming, and the reply was that it could be with so few pre-recruits. There was a request to clarify whether the PFMI is all due to fishing mortality, with the response being that it is a fishing mortality index. It was then asked how the PFMI is related to a peak in 2004. The reply was that in 2004 the fishery was much more wasteful and fishing did not cease as soon as it encountered soft shell crabs. It was also noted that since the environment is resulting in so few pre-recruits, the fishery must take care to be as efficient as possible.

NAFO DIVISIONS 3LNO OFFSHORE SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings increased gradually since 2009 to a historical high of 28,750 t in 2015. Effort declined considerably from 2011-12 but increased slightly in the past two years. Overall CPUE most recently peaked in 2013 and while it declined slightly in the past two years it remains high. The trawl survey of exploitable biomass shows the resource has become increasingly localized into portions of Division 3L, with the biomass index at its lowest observed level in 2015. The CPS trap survey index suggests the density of exploitable crabs remains unchanged on the primary fishing grounds. Overall recruitment has declined since 2012 to be near its lowest level reflecting trends throughout most of the division, and is expected to decline further in the short term (two to three years). The trawl survey pre-recruit biomass index has steadily declined since 2009 to a historic low and the CPS trap survey index is at or near its lowest observed level in most surveyed areas. The pre-recruit fishing mortality index has remained relatively low since 2008 while the exploitation rate index changed little from 2010-14. Maintaining the current level of fishery removals would substantially increase the trawl survey exploitation rate index to a new high in 2016.

Discussion

During the presentation it was noted that some fishers have seen no increase in landings recently, despite an increase in total landings. The response was that not all CMAs are trending the same and that increases are largely in CMAs 3NS, 3MSex, and 3N200. For example, landings in 3NS increased by 11% in 2015. The overall increase in landings is driven by increases in CMAs 3NS and 3N200. It was also asked if there is evidence for strong biomass of older crab. The response was that there is, in the northern and central management areas. It was then asked what is the life expectancy of a crab, and the reply was that it is believed to be about seven years but is more likely about five years. It was noted that this would be encouraging to know for the next few years as older healthy crab could be fished. It was agreed that this is the stronghold for the fishery in these management areas and there is a need to work to prevent taking all of the remaining crabs. It was also noted that a decline in availability of crabs is not evident during fishing from the first of April to the end of July. Concern was expressed that there is no post-season trap survey in Div. 3N and there is no faith in trawl survey data. It was noted that a flaw in the trap survey is that it only takes place in areas of successful fishing. The response was reiteration that, from a science perspective, there is good faith in the trawl survey and that there is a clear sign of decline in pre-recruit biomass. There was a question on how deep in the water column the trawl survey extends, and the response was that it extends down to 750 m depth and is a depth-stratified sampling design in order to capture all depths. It was pointed out that by exploring into depths of 300 fathoms, a fisher caught his quota very quickly. He had moved his pots out to the area due to ice in his normal fishing area. It was agreed there is a thin band of crabs in the slope edge.

It was stated that pre-recruits are not seen in crab pots because they wash out of the pots as they are hauled to the surface. However, a small claw is a sign of a pre-recruit, so some larger pre-recruits could be coming up in pots and identified by this feature. There was more concern regarding the CPS survey, as every survey does not have small mesh pots. The response was that this is due to limited capacity in the Science Branch as all of the crabs captured in small mesh pots in the CPS survey are returned to DFO for analysis. Ideally they would be measured on the water, but this is not the case. It was stated that it is not known how the stations that include small mesh pots were selected. It was further noted that despite the small sample size, there is good consistency in the data from small mesh pots.

It was asked if presence of ice was considered when calculating effort as ice caused many pots to tip over in Div. 3N and in CMA 3L200 in 2015. The response was that ice was not considered but nevertheless, the trends are trustworthy and reflect what is seen in the biomass. It was noted that some fishers are not seeing any evidence of a decline in biomass. They noted that every year is different and a lot depends on ice and tides. It was further noted that many fishers were in one small, shallow area, not catching much crab. They noted there could many areas in Div. 3N that never see a pot and they would like an exploratory fishery to look in the deep areas of Div. 3N. The response was that the whole range of Div. 3N slope is experiencing a decline based on logbook data. It was noted that the data presented show a gap in fishing in 3O200. A participant pointed out that many boats moved from Div. 3O to Div. 3N in 2006, due to poor crab condition (high incidence of barnacles) in Div. 3O.

Concern was raised that small mesh pots are not used anywhere offshore for CPS surveys. The response was that small-mesh pots are used, just in limited numbers, and this is on the science managers' radar. There was concern expressed about using data from small mesh pots to show zero pre-recruits, when it was admitted that there is little capacity at DFO to do the science on more small mesh pots. It was noted that fishers have been finding small crabs for years in their 5.5 inch (large) mesh pots. It was suggested that this could be included in the Research Recommendations section. It was stated that the same process has been used every year previous and generates good science. It was further noted that the take home message is to think about the data and remember that in 2004 harvesters said the fishery in Div. 3K was doing well.

It was noted that for the last three or four years, Div. 3L has been surviving on one pulse of recruitment. The fishers present were asked if that was being seen in the fishery. The response was that no, fishers are seeing clean (i.e. young) crab. It was noted that the pulse in Div. 3L is a prolonged pulse and that recruits have been entering the fishery there over a number of years. A participant noted that the aforementioned situation in Div. 3K included a high incidence of soft shell, which is not being seen in this situation. The participant also noted he saw a presentation 15 years ago suggesting poor recruitment that never manifested in the fishery. It was asked if the residual (old, sub-legal sized) crab present represent crab that could come into the fishery at all. The response was that below legal size, both adults and adolescents will reproduce and that, in fact, in Alaska it has been shown that the biggest males may move away from mature females. Thus, under-size crabs of both maturities do reproduce and could contribute to future recruitment.

During review of the summary bullets, there was concern again about making blanket statements for the whole division when some CMAs do not follow the overall pattern. Concern was reiterated regarding using the scant data for small mesh surveys. It was asked what variable other than current landings are used to calculate the projected exploitation rate index and the reply was that the exploitable biomass index from the trawl survey is used. The high exploitation rate index was questioned to which it was responded that it is due to the low exploitable biomass, which is predominately reflecting declining biomass in areas outside

200 nM and in Divs. 3NO. It was noted that this must be mentioned in the SAR. It was asked if a bullet specifically about the retraction of the resource should be added. It was noted that this would bring up more problems regarding making blanket statements for whole divisions and that NHQ managers may not understand discrepancies among CMAs. It was decided to work a statement into the bullets regarding retraction of the resource into Div. 3L. A statement was made regarding how the trawl survey does not sample in identical positions each year, and that this could result in inconsistent results.

NAFO DIVISION 3L INSHORE SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings increased gradually since 2012 to a historical high of 8,400 t in 2015 while effort changed little. Overall CPUE has been near its highest level for the past four years, reflecting trends in CMAs 6A, 6B, and 6C while other CMAs have been declining during the past two years. The post-season trap survey exploitable biomass index increased steadily from 2011-2014 to its highest levels in the time series. However, it decreased in all areas in 2015 and returned to the 2011 level. Overall recruitment has declined gradually since 2010 to its lowest observed level and is expected to decline further in the short-term (two to three years) as pre-recruit biomass surveys from CPS and DFO trap surveys throughout the division have been at or near their lowest levels in a decade during the past two years. The overall post-season trap survey-based exploitation rate index changed little from 2005-15. Maintaining the current level of fishery removals would increase the exploitation rate index in all areas in 2016.

Discussion

During the presentation it was asked if there are data for pre-recruit fishing mortality in this division. The response was that there are not as the PFMI is based on at-sea observer data, and the division has poor observer coverage. It was noted that St. Mary's Bay fishers have been reporting exclusively large crab, which matches the data presented. It was asked if the DFO surveys measure the claw, and the answer was yes. It was noted that fishers had to fish later in the season in Bonavista Bay and that some small pockets appeared to be fished clear. It was asked if there has been any signal of pre-recruits in DFO surveys in Conception Bay, and the reply was that there is some there. It was asked if it could be that a small amount of pre-recruits are present in Conception Bay and that they skip-molt and are entering the fishery at a slower rate. The response was that this concept applies to Div. 3L in general, so that could be the case.

More concern regarding the validity of the data from the CPS survey was raised. It was described that for the CPS survey, fishers set some pots in 2014 in the same areas fished successfully earlier in the season, only to find the bait gone and groundfish (such as wolffish) in the pots. They then returned to fish there again in 2015 and had good catches during the fishery. It was noted again that CPS survey should extend into the offshore region.

During the review of the summary bullets, there was again concern about mentioning particular CMAs in the bullets and excluding others and this was adjusted in the bullets. It was asked if a decrease in the number of pots used in the CPS survey affects the data on recruitment and recruitment prospects. The answer was that it does not, as the data were mostly showing under-sized adults anyway for the past number of years. It was asked if the statement that "maintaining current levels of fishery removals would increase the exploitation rate index in

2016…" (last bullet) could be trusted. The response was that the index will increase but we do not know exact values for exploitation rate.

NAFO SUBDIVISION 3PS SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings declined from a recent peak of 6,700 t in 2011 to 2,500 t in 2015. Effort reached a historic high in 2014 and decreased slightly in 2015, when only 60% of the TAC was taken. CPUE has steadily declined since 2009 to a record low in 2015 reflecting declines throughout the division in recent years. The trawl survey exploitable biomass index declined by 78% since 2009 to a time series low in 2015. The CPS trap survey was not conducted in most areas in 2015 due to poor resource status, thus no biomass index is available from that survey. Overall recruitment has declined since 2009 to its lowest observed level and is expected to remain low in the short term (two to three years) as the trawl survey pre-recruit biomass index has been at its lowest levels for three consecutive years. The pre-recruit fishing mortality index and the exploitation rate index have both been at or near their highest observed levels during the past three years. Maintaining the current level of fishery removals would result in a continued high exploitation rate in 2016.

Discussion

During the presentation the fishers confirmed that the reason the CPS survey in Subdiv. 3Ps was not carried out in 2015 was due to the payment structure for the survey. Currently, fishers are paid in extra quota the following year. Since fishing has been poor in this area, fishers did not participate in the CPS survey as they would not be able to catch the extra payment quota in the following year. The point was raised that there should be a different payment scheme in this situation and it was stated that this is on the radar from a management perspective. It was asked how many times the fishing season in Subdiv. 3Ps was extended in 2015 and the response was that it was extended three times, equaling three weeks total extension. It was then noted that in the past it has been said not to extend the fishery in an area where the resource is in trouble. The response was that the previous push was to avoid encountering soft-shell crab, which has not been much of an issue in Subdiv. 3Ps (except maybe in 2005). It was pointed out that in 2015, there were two weeks (weeks 12 and 14) where incidence of soft-shell was relatively high. The response was that the catch was so low that there was not enough soft-shell encountered to close the soft-shell management grids. It was further asked why extend the season at all if the fishers cannot catch it. The response was that this is a management issue and not a science issue. It was then asked if science over-rules management when the resource shows signs of a collapse, to which it was replied that no, management still regulates the fishery in that situation.

A participant asked why do Div. 3L and Subdiv. 3Ps use a different temperature marker (< 1°C) than other areas (< 2°C) to determine the habitat index (HI). It was explained that Div. 3L and Subdiv. 3Ps are colder than the other areas and thus have more area representing "prime" (< 1°C) temperature conditions. A question was asked regarding the apparent disappearance of crab in the past eight or ten years, inside 12 nM, near St. Bride's. The response was that the resource is contracting and is subject to what is known as a "basin effect" where crabs become distributed around the edge instead of the core. A participant stated he had fished a large area in 2015 and on multiple occasions, hauled pots with numerous (up to 22) dead crabs, which appeared to have been healthy prior to getting in the pot. He also stated there have been a lot of worms in the pots and suggested something happened in a short period to diminish crab

abundances, particularly between 2012 and 2015. The response was that there is no solid explanation for this and there is some work being done that suggests natural mortality could be high in old crabs. The participant reiterated that the dead crab were not old and had to be healthy to get into the pot.

Post-presentation, it was clarified that water temperature data are collected during the trawl surveys. It was asked if there has been a difference in water temperature over the past five or six years. The response was that there has generally been warming with some variability and that a talk on the physical parameters took place on the first day of the meeting.

There was much discussion over concern that the CPS survey did not take place in Subdiv. 3Ps in 2015. Some participants believed there should be an emergency fund available to cover the survey during times when the resource is extremely poor. The conversation shifted from a science discussion to detailed changes that have been made to the payment structure over the past several years.

During review of the summary bullets, it was asked why suggestions for TACs are not given; since the bullets are statements of the status of the resource in the past, present, and future. The response was that this cannot be done as science works with indices and not exact numbers and the assessment and resultant bullets are meant only to give direction to management.

NAFO DIVISIONS 4R3PN SNOW CRAB

Presenter: D. Mullowney

Abstract

Landings increased from a historical low of 190 t in 2010 to between 750-900 t since 2012. Effort has been relatively unchanged since 2012. Overall CPUE has remained near its highest observed level in the past four years but there is considerable variability among management areas. The exploitable biomass index has been unchanged for the past three years. Overall recruitment has been low for the past two years and prospects appear relatively weak for the next two to three years as the CPS trap survey pre-recruit index has been relatively low since 2012. The post-season trap survey-based exploitation rate index has varied since 2005 and was about average in 2015. Maintaining the current level of fishery removals would result in little change to the exploitation rate index in 2016.

Discussion

There was discussion regarding a difference in patterns of recruitment in Divs. 4R and 3L, despite having similar signs of a recruitment pulse a few years ago. It was argued that the lag in Div. 3L should not be any more than about half a year, as skip-molting in two successive years is unheard of and between 2010-14, the crabs should have molted at least twice, resulting in a 30 mm change. The response was that crab in Div. 3L grow more slowly than in Div. 4R, that the colder conditions in Div. 3L results in a broader cohort before it reaches pre-recruit size, and that some of the recruits presented are not actually adults and there is more opportunity for molts occurring slowly over time.

During review of the summary bullets, it was suggested that numbers, rather than biomass should be used for recruitment prospects for next year.

PROGRESS ON PRECAUTIONARY APPROACH REFERENCE POINTS AND HARVEST CONTROL RULES

Presenter: G. Evans

Abstract

Management of NL Snow Crab is intrinsically cautious. Females are totally protected; undersized mature males are largely protected. Although stock size has changed, there is no evidence suggesting that fishing had anything to do with it. There is no reason to think that biomass-based "precautionary reference points" would contribute anything to the cautious management of the stock.

One point that has not been generally recognized is that even when soft-shelled crabs make up 20% of the catch, this should not be interpreted as anything near 20% of the population of soft-shell in the water. Therefore it is very unreliable as a measure of damage to the potential resource.

Discussion

Discussion was generated as the presenter asked participants if the typical size at terminal molt for Snow Crabs has decreased over time, due to fishery pressures. A response was given that in the fish species where there has been evidence for such a situation, the smaller males in the population are not reproducing. In Snow Crabs, however, individuals reproduce at all sizes. Moreover, there was evidence presented during the meeting to suggest smaller males may mate more frequently than large males. It was also noted that size differences in Snow Crab are known to be phenotypic (i.e. environmentally driven) rather than genotypic, and this has been studied in the Gulf of St. Lawrence and as far as the Bering Sea.

It was stated that the Marine Stewardship Council's (MSC) condition for reference points is problematic and that discussions on removing the condition will take place between the MSC and the Association of Seafood Producers (ASP). Additionally, in other areas, the reference points are based on protecting large males, which do not need to be protected – they represent a very small fraction of the population. It was noted that for the purposes of this meeting, a reference point needs to have been established and tested. A reference point based on egg clutches has been proposed, but no simulation testing on it has been done. It was also noted that there is a second version of the MSC conditions, where reference points are not necessary, but this fishery is bound by the first version of the conditions. In order to switch to the second version, an audit would be required, which would be expensive. Regarding harvest control rules (HCR), it was noted that in year three (of "sustainable fishery" delegation) an HCR needs to have been considered and selected. It was stated that the purpose of an HCR is to protect reproduction and the question was asked, "if there is a pulse how long do we fish it?" The response was that there may be an incoming pulse that has only been seen in the CPS survey and implications have not yet been considered. It was noted that the Precautionary Approach in relation to the Integrated Fisheries Management Plan (IFMP) binds DFO to the use of reference points.

2016 RESEARCH RECOMMENDATIONS

- An analysis of shell-age composition that is focused specifically on survey data from highly fished areas to look for evidence of fishery-induced effect.
- Investigate new ageing methodology (gastric mill).
- Investigate development of total mortality estimates based on survey shell condition data.
- Examine Campelen survey behaviour on different substrates. This may occur by testing whether Snow Crabs in trap surveys have a catchability independent of bottom type. Follow this with nearest neighbor analysis of trap versus Campelen trawl and how it is affected by bottom type. (Compare NL Campelen and Gulf Nephrops trawls).
- Investigate a comparison of existing CPS survey gear with weighted pots equipped with bait protectors in areas of strong currents.
- Consider changes to the existing CPS survey to better understand trends in adolescents vs. adults (e.g. measuring claws, reviewing small mesh trap deployment, increase sample size particularly in 3N).
- To fulfil MSC certification requirements, continue to explore MMB (Mature Male Biomass) as an indicator of mating success and larval production. Also, investigate the relationship of percent full clutches and co-occurrence of mature males.

APPENDIX I: TERMS OF REFERENCE – SEA SCALLOP

SEA SCALLOP ASSESSMENT ON ST. PIERRE BANK

Regional Peer Review Process - Newfoundland and Labrador Region

February 22, 2016
St. John's, NL

Chairperson: Mark Simpson

Context

The status of Sea Scallop on the St. Pierre Bank, in NAFO Subdivision 3Ps, was assessed in 2011. The current assessment of the stock components was requested by Fisheries Management to provide current information on the status of the resource and to provide the data that will be used in the 2016 Scallop Management Plan.

Objectives

- To assess the status of Sea Scallop resource on St. Pierre Bank.
- To determine the impact of maintaining the current harvest level.

Expected Publications

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

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Province of Newfoundland and Labrador Department of Fisheries and Aquaculture
- Academia
- Aboriginal Groups
- Fishing Industry
- Other invited experts

[1] Joint Proceedings with the February 22-26, 2016 Newfoundland and Labrador Snow Crab Assessment

APPENDIX II: TERMS OF REFERENCE – SNOW CRAB

NEWFOUNDLAND AND LABRADOR SNOW CRAB ASSESSMENT

Regional Peer Review Process - Newfoundland and Labrador Region

February 22–24, 2016
St. John's, NL

Chairperson: Mark Simpson

Context

The status of Div. 2HJ3KLNO, Subdiv. 3Ps and Div. 4R Snow Crab was assessed in 2015. The current assessment of the stock components was requested by Fisheries Management to provide current information on the status of the resource and to provide the data that will be used in the 2016 Snow Crab Management Plan.

Objectives

- To assess the status of Snow Crab resource: Divisions 2HJ3KLNOP4R;
- To determine the impact of maintaining the current harvest levels; and
- To provide status updates on the Precautionary Approach (PA) framework reference points and harvest control rules.

Expected Publications

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

Participation

- Fisheries and Oceans Canada (DFO) Science and Fisheries Management
- Province of Newfoundland and Labrador Department of Fisheries and Aquaculture
- Academia
- Aboriginal Groups
- Fishing Industry
- Other invited experts

[2] Joint Proceedings with the February 22, 2016 Sea Scallop Assessment on St. Pierre Bank

APPENDIX III: AGENDA[3]

Regional Peer Review Process: Stock Assessments of Sea Scallop on St. Pierre Bank (Subdiv. 3Ps) and Snow Crab in Divs. 2HJ, 3KLNO, 3Ps & 4R

Memorial Meeting Room - NAFC, St. John's

February 22-26, 2016

Chairperson: Mark Simpson

Monday, February 22 (0900-1700)

Activity	Presenter
Opening/Chair remarks (0900)	M. Simpson
Introductions/ ToR	M. Simpson
Environmental /Oceanographic Update	E. Colbourne
Biological Oceanographic Update	G. Maillet
Ecosystem Overview	M. Koen-Alonso
Subdivision 3Ps Sea Scallop	E. Coughlan

2016 Snow Crab Assessment

Activity	Presenter
Divisions 2HJ3KLNOP4R Overview and Science Advisory Report Bullets	D. Mullowney
Divisions 2HJ and Science Advisory Report Bullets	D. Mullowney

Tuesday, February 23 (0900-1700)

Activity	Presenter
Division 3K Inshore & Offshore and Science Advisory Report Bullets	D. Mullowney
Divisions 3LNO Offshore and Science Advisory Report Bullets	D. Mullowney
Division 3L Inshore and Science Advisory Report Bullets	D. Mullowney

[3] Please note that this agenda is fluid and changes may be made during the meeting to the timing of specific items on the agenda to allow for necessary discussion of each topic.

Wednesday, February 24 (0900-1700)

Activity	Presenter
Subdivision 3Ps Inshore & Offshore and Science Advisory Report Bullets	D. Mullowney
Division 4R Inshore & Offshore and Science Advisory Report Bullets	D. Mullowney

Thursday, February 25 (0900-1700)

Activity	Presenter
Progress on Precautionary Approach reference points and harvest control rules	G. Evans
Research Recommendations	ALL
ADJOURN	M. Simpson

APPENDIX IV: LIST OF PARTICIPANTS

LAST	FIRST	AFFILIATION
Beauchamp	Brittany	DFO-NHQ
Boland	John	FFAW
Broomfield	Todd	NG
Brown	Kirby	Harvester
Budden	Ken	Fogo Island CO-OP
Bussey	Nelson	Harvester
Butler	Chris	Quinsea Fisheries
Butler	Derek	ASP
Cadigan	Neil	CFER/ MI
Careen	Andy	Harvester
Careen	Brian	Harvester
Carruthers	Erin	FFAW
Coffey	Edgar	Quinsea Fisheries
Coffey	William	DFO Science-NL
Colbourne	Eugene	DFO Science-NL
Coughlan	Elizabeth	DFO Science-NL
Crocker	Peter	Torngat CO-OP
Dalley	Ray	Quinsea Fisheries
Dooley	Tom	DFA-NL
Doyle	Tony	Harvester
Dumaresque	Danny	Processor
Dunne	Erin	DFO FM-NL
Evans	Geoff	DFO Science-NL
Fiander	Darlene	DFO Science-NL
Furlong	John	Seawatch
Green	Robbie	Harvester
Hawkins	Laurie	DFO FM-NL
Hedderson	Roland	FFAW
Hurley	Kevin	DFO FM-NL
Hynick	Elaine	DFO Science-NL
Johnson	Ron	Torngat CO-OP
Jones	Trevor	Harvester
Kean	Rick	Harvester
Kerrivan	Calvin	Harvester

LAST	FIRST	AFFILIATION
King	Leon	DFO FM-NL
King	Wayne	DFO FM-NL
Koen-Alonso	Mariano	DFO Science-NL
Lacosta	Roger	Harvester
Lewis	Sara	DFO Science-NL
Lubar	John	DFO FM-NL
Maillet	Gary	DFO Science-NL
Meade	James	CSAS - DFO Science-NL
Mullowney	Darrell	DFO Science-NL
Newbury	Glen	Harvester
Pantin	Julia	DFO Science-NL
Payne	Aubrey	Harvester
Penney	Gilbert	Harvester
Petten	Dwight	Harvester
Petten	Glen	Harvester
Rumbolt	Annette	DFO FM-NL
Rumbolt	Claude	Consultant
Russell	Dwight	Harvester
Simpson	Mark	DFO Science-NL
Skanes	Katherine	DFO Science-NL
Small	Lyndon	Harvester
Stansbury	Don	DFO Science-NL
Stirling	Roger	SPANS
Strowbridge	Chris	Harvester
Sullivan	Darren	DFO Science-NL
Sullivan	Karl	Barry Group
Tucker	Jane	Contractor/ Rapporteur
Way	Monty	FFAW
Whalen	Julie	Torngat Secretariat