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Proceedings of the Newfoundland and Labrador Regional Advisory Process (RAP) for Capelin (Subarea 2 + Div. 3KL)

October 26-28, 2010
Battery Hotel and Conference Centre
100 Signal Hill Rd.
St. John's, NL

Meeting Chairperson
E. Dawe

Rapporteur
C. Bourne

Compte rendu du processus de consultation scientifique régional (PCSR) de Terre-Neuve et du Labrador sur le capelan (sous-zone 2 + div. 3KL)

Du 26 au 28 octobre 2010
Hôtel Battery et Centre des congrès
100, chemin Signal Hill
St. John's, T.-N.-L.

Président de réunion
E. Dawe

Rapporteur
C. Bourne

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October 2011 | **Octobre 2011**

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings 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.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenus dans le présent rapport puissent être inexacts ou propres à induire en erreur, ils sont quand même reproduits aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considéré en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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SUMMARY

A meeting of the Newfoundland and Labrador Regional Advisory Process (RAP) on capelin (*Mallotus villosus*) was held October 26-28, 2010, in St. John's, Newfoundland. Its purpose was to assess capelin stocks in NAFO Subarea 2 + Div. 3KL. The previous assessment was in 2008. Summaries of the omnibus working papers and presentations, as well as the ensuing discussions are provided, along with research recommendations intended to reduce current uncertainties and to increase the analytical power of the next capelin assessment. The following components were examined during the RAP: stock structure, distribution, ecosystem and biological information, spawning times, aging, catch information, spawning habitat, recruitment and abundance indices. Also included are the terms of reference, a list of attendees and a list of working papers. Additional information on the resources assessed is available in the Science Advisory Report (SAR) and the CSAS Research Document Series.

SOMMAIRE

Une réunion du Processus de consultation scientifique régional (PCSR) de Terre-Neuve et du Labrador sur le capelan (*Mallotus villosus*) a eu lieu du 26 au 28 octobre 2010, à St. John's, Terre-Neuve. Le but de l'exercice est d'évaluer les stocks de capelan dans la sous-zone 2 + div. 3KL de l'OPANO. La dernière évaluation remonte à 2008. Le présent document expose des résumés des documents de travail et des présentations d'ordre général ainsi que les discussions connexes et les recommandations en matière de recherche qui visent à atténuer les incertitudes actuelles et à améliorer la qualité de l'analyse de la prochaine évaluation du capelan. Dans le cadre du PCSR, on a examiné les points suivants : structure du stock, répartition, information sur l'écosystème et la biologie, moment du frai, détermination de l'âge, renseignements sur les prises, habitat de frai, recrutement et indices de l'abondance. Il inclut également le cadre de référence, une liste des participants et une liste des documents de travail. On peut obtenir de l'information supplémentaire sur les ressources évaluées dans l'avis scientifique (AS) et dans la série des documents de recherche du SCCS.

INTRODUCTION

A Regional Advisory Process meeting for Capelin (subarea 2 + divisions 3KL) was held from October 26-28, 2010 at the Battery Hotel and Conference Centre, 100 Signal Hill Rd., St. John's, NL. The Chairperson, E. Dawe, opened the meeting and welcomed all attendees, which included fisheries scientists, managers and technicians from DFO, as well as representatives from Memorial University, provincial Department of Fisheries and Aquaculture and the FFAW. The Chairperson described the plan for the meeting after which attendees introduced themselves; this was followed by the adoption of the agenda.

Newfoundland capelin stocks are assessed bi-annually, with the last assessment having been done in 2008. Summaries of the working papers and presentations, along with subsequent discussions are provided, along with research recommendations made during the meeting. Also included are the meeting agenda (Appendix I), terms of reference (Appendix II), a list of attendees (Appendix III) and a list of working papers presented (Appendix IV). Additional information on the resources assessed is available in the Science Advisory Report (SAR).

WORKING PAPER AND PRESENTATION SUMMARIES, RELATED DISCUSSIONS AND RESEARCH RECOMMENDATIONS

DEFINING CAPELIN STOCKS

Working Paper: Defining population structure of capelin (Mallotus villosus) in the Northwest Atlantic inferred from microsatellite loci. B. Nakashima, E. Kenchington, C. Taggart, L. Hamilton (Draft paper)

Based on preliminary results of genetic analysis, 8 capelin populations have been identified in the northwest Atlantic. Four out of 5 demersal spawning sites support potential genetic populations; these include the offshore sites on the Southeast Shoal of the Grand Bank and Scotian Shelf, as well as nearshore sites. If the nearshore sites do support distinct populations, management measures may need to be taken to support genetic richness as nearshore fishing effort using mobile gear may have an impact on these spawning beds. In addition to information on demersal sites, the genetic analysis results have also suggested that the Div. 2J3KL stock may be redefined to include Placentia Bay, and that some capelin populations in northern 3K and southern 2J are mixing with capelin from the northern Gulf of St. Lawrence. Future work is going to be conducted using samples collected in the Gulf to better define that stock complex and to look at spawning site selection.

Discussion

There was a discussion about how reliable these results are in determining that nearshore demersal sites have distinct genetic populations in Trinity Bay. A question was asked regarding the impacts of rare alleles on the outcome of analysis because sites so close together with genetic separation seemed suspect. The response was that some testing was done to ensure that genetic populations would separate if samples were mixed, but some sites could not be sampled more than once – however in the winter of 2011, additional fish from these sites will be sampled for their DNA to increase the sample size. There was also some discussion about what constituted a barrier to gene flow and whether Fst values (a measure of genetic distance) were considered in analysis of populations. It was asked whether capelin in Placentia and Trinity Bays are a part of the same stock. They are in this analysis. In 1992-1993 Div. 3L was

combined with 2J3K and considered one stock and 3Ps was separate. There could be a further division in stocks in the White Bay/Green Bay areas, but these bays were not sampled in this study.

DISTRIBUTION INFORMATION

Presentation: Distribution: Spring acoustics and fall bottom trawl surveys. F. Mowbray.

Horizontal Distribution

Distribution of capelin in the fall based on catch per tow in the Div. 2J3KLNO multispecies survey indicates some presence in 2J in 2007-2009, but most in 3K; this was similar to the past 2 decades. There were very few capelin detected in the area off Trinity/Bonavista which in the past has had the highest densities, based on acoustic surveys, but there were still large amounts in Trinity Bay. Capelin along the shelf break were observed in deeper water during the spring 3L acoustic surveys in 2009 and 2010. During those surveys, acoustic densities of capelin throughout the entire survey area declined.

Vertical Distribution

Vertical distribution and diurnal movement patterns have changed significantly since the late 1980's, with fish now spending more time near the bottom and showing less predicable daily vertical movement. It may be that capelin are spending more time at the bottom in the acoustic 'dead zone,' where they cannot be resolved and accounted for during the offshore spring acoustic survey. This is a potential issue which needs to be investigated further. In 2008 capelin appeared to be higher off the bottom but by 2010 they had returned to being close to the bottom and in deeper water.

Discussion

There was a query as to what had changed in 2009/2010 in comparison to previous years. The response was that in 2009 fish were distributed in as large an area as previous years, but within that area there were large gaps with no fish. In regards to the potential underestimation using an echosounder due to fish being in the bottom dead zone, it was noted that that zone is only ¾ of a meter so it is rare that losses occur in estimates. However, it was acknowledged that sometimes bottom trawls do pick up capelin when they have not been detected by the echosounder. The observed changes in distribution do not seem to be related to changes in survey timing. Dietary changes are possible, but stomach analysis does not necessarily support this – but it does not discount it either. It is difficult to consider predators as their populations have declined as well.

BIOLOGICAL INFORMATION

Presentation: Catches and biology. B. Nakashima, F. Mowbray.

Capelin Fishery

The mean length, weight and age of capelin are consistently decreasing; in 2009 these metrics were the lowest in their respective series. The percent of age 2 capelin maturing in the spring has been increasing since 2007, with their mean length from 1999-2010 being higher in the spring than in 1985-1992.

Spring 3L Acoustic Survey

Lower roe content and the poor somatic condition of fish observed on the acoustic survey in 2009 corresponded with late beach spawning times. There has been a decline in the condition of spawners for most lengths and both sexes since the early 1990's, with the conditions in 2009 being the poorest in the series.

Discussion

Most of the discussion focused on how the temporal changes in mean lengths in offshore surveys and the fishery differ. The dominant age of fish caught in the most recent fishery is different than in the past, but it was noted that it was interesting not to see a change in length of age 3 fish from the survey when compared to commercial data. Offshore survey data show a mix of mature and immature fish, unlike fishery data; if these fish were separated by maturity, different trends may be seen. Because the fish are spawning at a younger age than in the past, the mean lengths are decreasing. Also, commercial data showed all ages combined for mature fish. It was commented that during the 2009 fishery some harvesters observed that capelin with shorter body lengths had more roe than longer fish. A discussion ensued as to possible explanations for this observation and it was suggested that the earlier age or size at maturity could result in increased total egg production.

SPAWNING TIMES

Presentation: Capelin spawning times. B. Nakashima

Spawning diaries are collected from about 20 different sites, with the focus being on 6 that have the most extensive data sets. In 2009 spawning was late along the entire east coast, with one of the shortest and latest beach spawning times in the series being recorded at Bellevue Beach – larval survival is poor when spawning is late. In 2010 spawning times were earlier than in 2009 and more within the range seen during the past 2 decades.

Discussion

It was mentioned that 5 years worth of capelin data has been collected for International Polar Year (IPY) research and that this could possibly be integrated with DFO's data set. It was questioned whether the shift in spawning times observed in the early 1990's was due to the cold period during that time. While this was suspected, there was no shift back to historical spawning times when water temperatures returned to normal levels.

Research recommendation

1. Examine the historical data on the duration of capelin spawning at Bryants Cove to compare with the Bellevue series.

ECOSYSTEM INFORMATION

Presentation: Overview of environmental trends on the Newfoundland-Labrador Shelf and Grand Banks. G. Maillet, P. Pepin, E. Colbourne.

Physical Oceanographic Environment

Atmospheric anomalies were close to normal levels in 2008-2009. In 2009 the cross sectional area of <0°C water mass (CIL) was slightly below normal on the Newfoundland Shelf and slightly above normal on the Labrador Shelf. Coastal temperatures and salinities on the Newfoundland Shelf appear to be decreasing to long-term average levels based on information collected at Station 27.

Biological Oceanographic Environment

The duration and extent of the spring and autumn phytoplankton blooms in 2009 were reduced. An early bloom was observed in the spring of 2009 on the southeast shoal. During the past decade the patterns in blooms on the Newfoundland Shelf and Grand Banks have been fairly coherent, but there were notable changes in timing and duration of production in recent years, with productivity increasing. Generally, smaller copepods are found on the shelf, whereas larger copepods are off the shelf. The calanoid copepods which make up a large portion of the copepod biomass show divergent patterns, but *C. finmarchicus*, a major capelin prey species, is declining. A correlation has been found in the decline of the abundance of this species and increases in transport of the Labrador Current. Since the inception of zonal monitoring, euphausiids have tended to increase in abundance, while the hyperiid taxa have been in constant decline since the mid-2000s.

Discussion

Much of the discussion centered on what is driving the observed volume transport. Presumably the recent warming and melting are contributing, but this trend has possibly been going on since the early 1980's. It may be assumed that this trend seen in the offshore branch of the Labrador Current reflects the trend in volume transport by the inshore branch. The changes observed seem to be largely related to changes in stratification on the shelf in the fall, and this may be dictating the amount of phytoplankton observed there. When questioned as to whether satellite data could be collected from some inshore sites, it was noted that this may be possible, but factors such as cloud cover and suspended sediment can result in potential bias in satellite imagery. It was noted that when comparing physical and biological oceanographic processes, the abiotic conditions of the inshore fixed sampling station (Station 27) is representative of a much larger area, whereas biological trends tend to be much more localized.

Research recommendations

1. Develop collaboration with the AZMP group to explore more fully the linkages between capelin early life history processes and regional physical and primary and secondary biological events.

Capelin food and feeding

Working Paper: Comparative analysis of feeding ecology of capelin from two shelf ecosystems, off Newfoundland and the Barents Sea. P. Dalpadado, F. Mowbray. (In Press: 2010 Progress in Oceanography)

Stomachs have been collected since 1999 in the spring acoustic survey, with total fullness and prey composition being recorded. The primary prey species is *C. finmarchicus* for all sizes of capelin. The time of day and sampling effects may be masking results regarding the total fullness of collected stomachs. Of the 7 areas sampled, Trinity Bay was the only one where euphausiids and pteropods were in the diet – this was a very different prey spectrum compared to what is seen in offshore samples. In 2009, feeding success was low in Trinity Bay and the area north of Bonavista.

Based on the comparative study between Newfoundland capelin and those found in the Barents Sea, the fullness index was consistently higher for all length classes in the Barents Sea compared to fish sampled from 3KL. Fish in the Barents Sea were primarily feeding on larger euphausiids and very few copepods, in contrast to Newfoundland where copepods are the main prey type. One possible issue with the study was the timing of sampling, with Newfoundland fish being collected in May and those in the Barents Sea in September. Based on the vertical distribution of copepods, the species found in Newfoundland capelin stomachs suggest that the fish may be migrating up in the water column without being detected by acoustics.

Discussion

It was asked how the body condition of capelin in Newfoundland compares to those in the Barents Sea. Preliminary results suggest that Newfoundland capelin are in worse condition, but samples were taken at different points in the life cycle so it is difficult to make those comparisons. There was also discussion about why capelin are largely being detected near the bottom during the acoustic survey, yet are consuming prey species which are found near the surface. It was suggested that they may be moving vertically individually (not at the school level) and going undetected by the acoustic equipment.

Research recommendations

1. Resolve the discontinuity between the observation that capelin feeding on copepods are observed acoustically near the bottom well below *C. finmarchicus'* maximum vertical distribution depth of 100m.

Seabird-Capelin Interactions

Presentation: Seabirds – Puffins at Witless Bay. M. Rector.

In 2009 there was a decrease in the amount of capelin found in Puffin diets in Witless Bay compared to the previous 5 years, with sandlance being the predominant prey species in late summer. Kleptoparasitism and chick mortality were higher in 2009 than previous years and provisioning rates were low. There was no recorded capelin spawning in nearby Ferryland in 2009 and growth rates of chicks were lower than usual.

Presentation: Seabird and capelin interactions. W. Montevecchi, C. Burke, A. Buren, P. Regular, A. Hedd, G. Davoren.

Below average ocean temperatures during capelin gonad development have coincided with later spawning. The percentage of capelin in gannet diets and gravid capelin in murre diets increases with later spawning, as does murre chick condition. When spawning was early on demersal sites, which served as feeding 'hotspots,' the sites were not active during the period of murre chick-rearing, meaning less capelin in the diet. When water temperatures were warmer, movement patterns of gannets changed in an apparent attempt to seek out preferred prey of large pelagics (mackerel, saury). When capelin availability is low, murres forage further from colonies and select higher proportions of large capelin; mean lengths of capelin in murre diets in 2009-2010 were the highest in the 20 year series.

Discussion

It was questioned whether gannets were foraging further from the colony to get prey because it was scarce or that they were seeking out more abundant, large pelagics. The latter theory seems to be most likely as the tracks of tagged birds mirror mackerel distribution. There was some discussion about why/how murres select larger capelin and that it may have less to do with intentional selection, as suggested, and more because when capelin are less abundant they are not as densely schooled, making it easier for birds to pick out larger fish.

Research recommendations

1. Data on capelin spawning from the Straight Shore should be examined and considered before the next capelin RAP

Predator Field

Presentation: Capelin as prey: A summary exploration of its predator field and ecological role as prey from a mosaic of studies. M. Koen-Alonso

There were overall declines in biomass based on fall multispecies surveys in the early 1990's; during this time there was a dramatic decline in capelin and changes in the species' biology. The biomass of piscivores has increased over the past decade, with a slight decrease in fall 2009 in 2J3KL. The harp seal population has steadily increased over the past two decades. Based on limited offshore data, capelin make up a large proportion of the seals' diet, whereas more reliable inshore data shows less capelin consumption inshore. There has been less predation on capelin by cod and turbot since the 1990's, although predation by turbot has increased slightly. A model projecting cod biomass was sensitive to changes in capelin biomass and in cod fishery removals, but harp seal numbers did not have a significant effect. Recent declines in shrimp biomass may signal an increase in predation pressure on capelin by cod and turbot.

Discussion

The cod population model is influenced by changes in the cod fishery but it does not account for changes in the capelin fishery; it instead assumes a constant biomass of capelin. There was some discussion about the shift in cod diet from capelin to shrimp. This observation was based on a low sample size which could make the sudden shift look more dramatic than it actually was. The shift did not occur at the same time across all areas: it was more gradual than the presentation suggested. Sample sizes of turbot were larger and more consistent, so the species

may provide a good indication of prey availability. There was also a brief discussion about whether the capelin stock collapsed or just became redistributed.

Research recommendations

1. Harp seals are a dominant predator on capelin and their dietary requirement should be considered at the next RAP.

CAPELIN AGING WORKSHOP

Presentation: Capelin aging workshop. B. Nakashima.

A workshop was held in Bergen in May 2009 to review capelin aging protocols. A reference collection of 89 otoliths from the 3 capelin stock areas was reviewed by 8 readers from 4 different labs (Norway, Russia, Iceland, Newfoundland). There was 89-95% agreement among readings and it was agreed that in the future, the labs would exchange otoliths regularly to compare readings.

Discussion

It was asked what the discrepancies that did occur between readers were. It was likely that there was some over-estimation of fish age. However it was noted that the 11% discrepancy only translated to about 4 or 5 otoliths from the whole collection.

Research recommendations

1. The pelagic section should develop more expertise in reading capelin otoliths instead of relying on a single age reader.

CATCH INFORMATION

Presentation: Capelin landings. B. Nakashima.

In Div. 3KL, the TACs in 2009 and 2010 were not taken. Preliminary landings for 2010 were 1549 t, approximately 55% of the TAC. There are various possible reasons for this, such as poor market conditions, capelin availability or a mismatch between the season opening dates and capelin occurrence. There are no estimates for discards, which creates uncertainty in catch statistics; high unreported discards could mean that the TAC's have actually been attained in recent years. There has been a potential contraction of inshore distribution since the early 1990's, with fewer capelin in southern areas. In some bays, the proportion of TAC taken has declined in recent years and there is a concern that this may represent a contraction of distribution. There is some capelin bycatch in the shrimp fishery – about 150 t in Div. 2J3K and 200 t in Div. 3L. We may be seeing more bycatch in recent years because capelin have moved to deeper water where shrimp are fished.

Discussion

Much of the discussion focused on the potential issue of discarding. It is thought that there has been less dumping in recent years due to the market for males, dockside monitoring and the observer program. However the point was raised that if the fishery is opened too early while fish quality is poor, there will likely be more dumping. It was questioned why the TAC is sometimes exceeded. Concerns were raised that discarding is more likely in the mobile gear fleet, and that this behaviour may impact availability to fixed gear fishers. It is difficult to interpret trends using landings as many other factors are involved in the fishery. There is currently no way to determine catch rates. Logbooks and phone surveys were used in the past to try to estimate catch rates, but were cut out due to lack of returns, funding issues, and changes in the fishery. Trying to reinstate these programs would be a major effort at this point.

Research recommendations

1. Observer reports from the purse seine fishery should be examined to estimate the level of discarding occurring in the fishery.

BEACH AND DEMERSAL SPAWNING HABITAT

Working Paper: The importance of beach and demersal spawning habitat to larval capelin (Mallotus villosus) production. B. Nakashima, J. Wheeler, B. Slaney, B. Squires.

The majority of the larvae in the Bellevue area originate from beach spawning, typically more than 80%. In 2008 almost 100% of larval production was attributed to beach spawning due to high mortality of eggs on both demersal spawning sites.

Discussion

There was some discussion of the differential survival of larvae from the 2 demersal sites. It was suggested that these sites may have a different genetic populations, but also noted that there are only 2 larval traps placed on each large site. It was questioned whether egg densities in Bellevue were similar to other sites. Right now there are no other sites for comparison, but it is suspected that density in Bellevue is higher.

RECRUITMENT INDICES

Presentation: Capelin early life history. B. Nakashima.

In Bellevue, the pre-emerging larval index is not coherent with the surface larval index, but the emerging larval index is. The emerging larval index indicates that the 2008 and 2009 year classes in Bellevue were average. The surface larval index suggests that the 2008 and 2009 year classes were lower than they were in 2007. The pre-emergent index is the poorest candidate for estimating recruitment and larvae collected for this index are difficult to count.

Discussion

It was suggested that ratios could be calculated of larvae in the three indices within a given year to attempt to quantify survivorship between stages. This would give relative rather than absolute estimates. The pre-emerging larval index would be comparable to spawning stock biomass.

Research Recommendations

1. Survival indices should be developed based on ratios between the various Bellevue recruitment indices.

Presentation: Offshore capelin recruitment indices. F. Mowbray

A comparison of the Trinity Bay age 0 year class (larval density) capelin in September and the age 2 cohort from the spring acoustic survey index was coherent, but this was not the case for the age 0 and age 1 cohort from the acoustic index. From 2003-2010 the emerging larval index and surface tow indices from Bellevue, the Trinity Bay larval index, and the age 2 index from the spring acoustic surveys were coherent. These results indicated that the 3 most recent year classes are weaker than the 2007 year class. The mean lengths of larvae in Trinity Bay in the 2000s are smaller than those in the mid 1980s. Overall, larval densities in the Trinity Bay group are lower than they were in the 1980s. Larval densities ranging from 33 to 74 per square meter in the 1980s correspond with offshore acoustic estimates of age 2 fish of 59000 to 380000 t. Larval densities ranging from 10 to 75 per square meter currently correspond to offshore acoustic estimates of 1000 to 19000 t age 2 capelin.

Discussion

It was agreed that a strong cohort seems to track well using the current indices. The Bellevue Beach indices seem to correlate better with acoustic data than does the September Trinity Bay index, but it is difficult to compare considering differences in the timing of surveys and other factors such as hurricanes. The best index to keep may be Trinity Bay because it represents a time in the capelin life history when recruitment is less variable than other life stages. There was some discussion over whether the August Trinity Bay survey should be continued.

Research recommendations

1. The October Trinity Bay Shamook survey should be reinstated to facilitate the development of the promising Trinity Bay age 0 cohort index and the larval mean length series.

ABUNDANCE INDICES

Presentation: Capelin early life history. B. Nakashima.

Egg deposition on Bellevue Beach in 2008 and 2009 was lower than in 2007, but at approximately the same level as the long term average for the series. This index is not the best candidate for abundance estimation because it assumes Bellevue is representative of all beaches and it may be confounded by varying proportions of off-beach spawning. Right now there are no other beaches being surveyed in the same way so there are no other data sets for comparison.

Discussion

There was some discussion about the applicability of this index to predicting biomass or assessing overall trends in the stock. Using this index for such estimates would not be a reliable method at this time without more data from other beaches, or a longer time series. Right now there is no basis to take trends observed from this index and apply them to the entire stock.

Research Recommendations

1. The Bellevue acoustic dataset should be examined to see if it tracks the egg deposition index and the emerging larvae index.

Presentation: Offshore capelin acoustic surveys. F. Mowbray.

Abundance estimates have continued to decline despite advances in technology since this spring survey began in the early 1980s, indicating that observed declines are not due to a lack of detection. The abundance estimate based on the 2010 offshore acoustic survey was only about 10% of that estimated for recent years, and 1% of historic levels. This was the lowest estimate in the series. The relatively strong 2007 year class seemed to disappear in 2010 in offshore areas, but not in Trinity Bay – there was no correlation in data collected between these 2 areas. The overall age composition was dominated by the age 2 year class, similar to the 1990s, with very few age 3 fish. The surveyed population now contains a significant amount of maturing fish, whereas in the past it was largely immature.

Discussion

There was some discussion of possible issues with fish detectability. This has not been quantitatively investigated but based on observation. Generally abundance of fish estimated from trawl catches were not significantly larger than those from acoustic estimates of the same ground. If fish are being missed by acoustic equipment, it would not be enough to account for the large interdecadal differences observed. The change in capelin vertical distribution in the 1990s did not closely correspond to biomass declines. It was questioned whether fish were moving out of the survey area. Fish have never been detected to the northern extent of the survey area; also, the survey area has been enlarged to ensure it always contains the stock's distribution.

Presentation: Using acoustic data to investigate capelin availability to the fall bottom trawl survey in NAFO divisions 2J3KLNO. L. Mello, F. Mowbray, G. Rose, M. Alonso-Koen.

The acoustic data collected during these surveys is potentially useful because it covers a large part of the known distribution of capelin in the fall, including maturing fish which may not be available to the spring acoustic survey. There were some issues with data collection, such as missing data, and poor signals from interference and bad weather: however, a large amount of usable data was collected which is valuable because it samples more of the survey area than does the survey trawl and, unlike trawl data, it accounts for diel movements of fish.

Discussion

It was questioned whether distinguishing between fish species in acoustic data was reliable. Using shape, target strength, distribution information and the experience of the person interpreting the data, it is believed that reliable identification of capelin was occurring. In areas

where more than one species occurred together, other techniques could be used to help differentiate (e.g. using the ratio among different species present in catch to partition the acoustic backscatter). There was also some discussion about the possibility that fish could migrate during the 10 to 11 week survey period and be detected more than once. This is a valid concern since capelin migration patterns are not known. It is possible that, in time, data collected between vessels can be examined to uncouple potential double sampling.

Research Recommendations

1. The 2008 fall acoustic data from the bottom trawl survey shows promise in establishing a more comprehensive fall capelin distribution map and in providing a synoptic index of capelin abundance. The analysis of data collected in 2009 needs to be expedited.
2. Every effort should be made to present the potential value of the above information being collected, in particular for capelin and in general for forage species, in a timely manner.

FUTURE CAPELIN RESEARCH

A model should be developed to correct trawl catches for fish availability using acoustic information acquired during fishing sets. The feasibility of geostatistically deriving abundance estimates from the acoustically surveyed stratum and then exptrapolating them to the larger survey area should be examined.

Discussion

A model could be created which combines catch and acoustic data to provide absolute abundance and biomass estimates. A possible issue is that bottom trawls only catch fish on the bottom 5 m, but small fish can move up further than this meaning that the population would not be consistently sampled; this could be accounted for in a model.

Research Recommendations

1. Investigate conventional and non-conventional methods to help in the development of reference points that could apply to the 2J3KL capelin stock.

APPENDIX 1: MEETING AGENDA

Agenda – Newfoundland and Labrador Regional Advisory Process for Capelin

Tuesday, October 26 (am)

Introduction	E Dawe (Chair)
Defining Capelin Stocks (B. Nakashima,E. Kenchington, C. Taggart, and L. Hamilton)	B. Nakashima
Distribution Information	F. Mowbray
• Vertical distribution	
• Horizontal distribution	
Biological Information	
• Fishery	B. Nakashima
• Spring acoustic survey	F. Mowbray
Spawning Times	B. Nakashima

Tuesday, October 26 (pm)

Ecosystem Information	
• Physical Oceanographic environment	G. Maillet
• Biological Oceanographic environment	G. Maillet
• Capelin food and feeding (F. Mowbray, Salpadado and P. Lundrigan)	F. Mowbray
• Seabirds-puffins at Witless Bay (M. Rector and Storey)	M. Rector
• Seabirds-indications and consequences of change (B. Montevecchi, C. Burke, G. Davoren, and P. Regular)	B. Montevecchi
• Predator field	M. Koen-Alonso

Wednesday, October 27 (am)

Capelin Aging Workshop (Nakashima and Dawson)	B. Nakashima
Catch Information	B. Nakashima
Beach and Demersal Spawning Habitat (B. Nakashima, J. Wheeler, B. Slaney, and B. Squires)	B. Nakashima

Recruitment Indices

- Bellevue larvae — B. Nakashima
- Trinity Bay larvae — F. Mowbray

Wednesday, October 27 (pm)

Abundance Indices

- Bellevue eggs — B. Nakashima
- Spring acoustic survey — F. Mowbray
- Fall trawl-acoustic survey
  (L. Mello, F. Mowbray and G. Rose) — L. Mello

Additional Agenda Items

Thursday, October 28 (am)

Drafting of the SAR	ALL

APPENDIX 2: TERMS OF REFERENCE

Context

The status of capelin in Subarea 2 + Div. 3KL was last assessed in 2008 refer to Science Advisory Repo 2008/054; and Proceedings 2009/025. The current assessment is requested by Fisheries and Aquaculture Management to provide the Minister with detailed advice on the status of these stocks.

Objectives

A review of any new information available concerning the status of Subarea 2 + Div. 3KL capelin as follows:

- Observations from the 2008-2009 Fishery and Research data.
- Information on historical catches including the 2010 fishery. Information on the length/weight/age of capelin from these fisheries will be available from 1980-2009.
- Trends in abundance from spring acoustic survey, egg and larval studies, and the fall multi-species survey including Ecosystem Research (ERI) results.
- Behavioural information on occurrence, distribution, and spawning times.
- Biological information on sizes, ages and maturities.
- 2008-2009 Bellevue Capelin Spawning Project.
- Information will be presented on capelin stock structure based on genetic data for all capelin stocks in the northwest Atlantic.
- To the extent possible comment on the: 1) impact on growth of the stock by maintaining current TAC level of 30,496 t, and 2) impact on stock of setting a TAC in 2011 at the same level (30,496 t) it was in 2010.

Products

A science advisory report (SAR) will be produced from this meeting for Subarea 2 + Div. 3KL capelin. A proceedings report will detail the meeting discussions, and at least one associated research document will be produced as a result of this meeting.

Participation

- DFO Science, Newfoundland and Labrador and Maritimes Regions
- DFO Fisheries and Aquaculture Management, Newfoundland and Labrador Region
- Industry Representatives
- Non-Governmental Organizations
- Fish, Food and Allied Workers Representatives

- Provincial Department of Fisheries and Aquaculture
- Memorial University
- Fisheries Resource Conservation Council (FRCC)

APPENDIX 3: LIST OF ATTENDEES

Name	Affiliation	Email	Phone/Fax
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Kevin Hurley	DFO Area II	hurleyk@dfo-mpo.gc.ca	(709) 292-5167

APPENDIX 4: LIST OF WORKING PAPERS

Nakashima, B. Information presented at the 2J3KL capelin RAP, October 26-28, 2010.

Nakashima, B., Kenchington, E.L., Taggart, C.T., Hamilton, L. Defining Population Structure of Capelin (Mallotus villosus) in the Northwest Atlantic Inferred from Microsatellite Loci.

Nakashima, B., Wheeler, J.P., Slaney, B.W., Squires, B. The importance of beach and demersal spawning habitat to larval capelin (Mallotus villosus) production.