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**Meeting of the Newfoundland and
Labrador/Central and Arctic Zonal
Advisory Process (ZAP) on Northern
Shrimp**

March 6 - 8, 2008

**Meeting Chairperson
Dr. Noel Cadigan**

**Réunion du Processus de
consultation scientifique zonal (PCSZ)
de Terre et du Labrador/Centre et de
l'Arctique sur la crevette nordique**

Du 6 au 8 mars 2008

**Président de réunion
Dr. Noel Cadigan**

Fisheries and Oceans Canada / Pêches et Océans Canada
Science Branch / Direction des science
80 East White Hills Road
St. John's NL / St. John's, T.N.L.
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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/Central and Arctic Zonal Advisory Process (ZAP) on Northern Shrimp was held March 6 - 8, 2008 in St. John's, Newfoundland. Its purpose was to assess northern shrimp stocks in Shrimp Fishing Areas (SFAs) 4, 5 and 6 (Div. 2G to 3K) and northern and striped shrimp stocks in SFAs 0, 2 and 3.

A Science Advisory Report (SAR 2008/008) for SFAs 4 to 6 was written and reviewed in meetings from March 12 – 13, 2008. A SAR (SAR 2008/018) for SFAs 0 to 3 was written by Central and Arctic staff during the week of March 17, 2008 and circulated for review by ZAP participants. Both include overall and SFA-by-SFA summary bullets reviewed at the ZAP meeting. Detailed rapporteur's notes of discussion on each working paper presented at the ZAP, in question-and-answer/comment-and-response form, were produced. This Proceedings Report includes an abstract and summary of discussion for each working paper presented, as well as progress on research recommendations from the 2006 NL Northern Shrimp RAP and 2007 Framework Meeting and a list of research recommendations from this ZAP, including those from the 2006 and 2007 meetings that are being carried forward for further work.

SOMMAIRE

Une réunion du Processus de consultation scientifique zonal (PCSZ) de Terre et du Labrador/Centre et de l'Arctique sur la crevette nordique a eu lieu du 6 au 8 mars 2008, à St. John's, Terre-Neuve. Le but de la réunion était d'évaluer les stocks de crevette nordique des zones de pêche à la crevette (ZPC) 4, 5 et 6 (divisions 2G à 3K) et les stocks de crevette nordique et ésope des ZPC 0, 2 et 3.

Les participants des réunions des 12 et 13 mars 2008 ont formulé et passé en revue un avis scientifique (AS 2008/008) pour les ZPC 4 à 6. Le personnel de la Région du Centre et de l'Arctique a formulé un AS (AS 2008/018) pour les ZPC 0 à 3 pendant la semaine du 17 mars 2008, lequel a été passé en revue par les participants du PCSZ. Les deux documents comprennent des points de sommaire généraux et propres à chacune des ZPC qui ont été passés en revue pendant la réunion du PCSZ. Les notes détaillées prises par le rapporteur pendant les discussions concernant chaque document de travail présenté pendant le PCSZ ont été rédigées sous la forme de questions/réponses ou de commentaires/réponses. Le présent compte rendu comprend un résumé ainsi qu'un sommaire des discussions sur chaque document de travail présenté, fait état des progrès accomplis dans la recherche en regard des recommandations formulées pendant le PCSR de T.-N.-L. sur la crevette nordique de 2006 et la réunion cadre de 2007. Il inclut également une liste des recommandations en matière de recherche formulées pendant le PCSZ, y compris des recommandations de 2006 et de 2007 qui feront l'objet d'autres travaux.

INTRODUCTION

A meeting of the Newfoundland and Labrador/Central and Arctic Zonal Advisory Process (ZAP) on Northern Shrimp was held from March 6 - 8, 2008 in St. John's to assess northern shrimp stocks in SFAs 4, 5 and 6 (Div. 2G to 3K) and northern and striped shrimp in SFAs 0, 2 and 3. The Terms of reference, agenda, and lists of participants and working papers presented at the meeting are provided in Appendices I through IV, respectively.

Participation included personnel of DFO Science (Newfoundland and Labrador, Central and Arctic and NCR Regions), Fisheries and Aquaculture Management (NL Region), and representatives from the fishing industry, Fish, Food and Allied Workers (FFAW/CAW), the Provincial Department of Fisheries and Aquaculture (NL), the Nunavut Territorial Government and Memorial University.

Open discussion and debate proceeded during and after each presentation. At the meeting, consensus was reached on overall and SFA-by-SFA summary bullets of results of the assessment. These are included in Science Advisory Reports (SARs) 2008/008, (SFAs 4, 5 and 6) and SAR: 2008/018 (SFAs 0, 2 and 3).

These proceedings contain abstracts for working papers presented and summaries of the discussion on each. Additional information can be found in the SARs and in research documents cited or from contacts provided therein.

MEETING PROCEEDINGS

Presentation 1: Physical oceanographic conditions on the Newfoundland and Labrador Shelf during 2007 by E. Colbourne, J. Craig, C. Fitzpatrick, D. Senciall, P. Stead, and W. Bailey

PRESENTER: J. Craig

ABSTRACT:

Oceanographic observations on the Newfoundland and Labrador Shelf during 2007 are presented in relation to their long-term (1971-2000) means. At Station 27 off St. John's, the depth-averaged annual water temperature decreased from the record high observed in 2006 to about normal. Annual surface temperatures at Station 27 also decreased from the 61-year record of 1.7°C above normal in 2006 to 0.2°C above normal in 2007. Bottom temperatures decreased from 0.8°C above normal in 2006 to 0.4°C above normal in 2007. Annual surface temperatures on Hamilton Bank and the Flemish Cap were 0.5°C above normal and on St. Pierre Bank they were about normal. Upper-layer salinities at Station 27 were above normal for the 6th consecutive year. The area of the Cold-Intermediate-Layer (CIL) water mass on the eastern Newfoundland Shelf during 2007 was below normal for the 13th consecutive year and the 14th lowest since 1948. Bottom temperatures during the spring of 2007 remained above normal on the Grand Banks but were below normal on St. Pierre Bank. During the fall they were significantly above normal in NAFO Div. 2J and 3K and most of 3L, but were below normal in the shallow areas of 3NO. The area of bottom habitat on the Grand Banks covered by sub-zero water decreased from >50% during the first half of the 1990s to near 15% during 2004-06 but increased to near-normal at about 30% in 2007. In general, water temperatures on the Newfoundland and Labrador Shelf decreased from 2006 values but remained above normal in most areas. Notable exceptions were on St. Pierre Bank during spring where temperatures were below normal and in northern areas of NAFO Div. 2J and 3K where bottom temperatures were significantly above normal during the fall of 2007.

DISCUSSION:

Ocean climate was generally cooler throughout the Newfoundland-Labrador region during 2007. The unusual spatial flip-flop with warmer water in the north and cooler in the south could have been an artifact or carry over of the warmer than usual conditions in 2006. Trends in the North Atlantic Oscillation (NAO) and sea ice extent tracked each other in the past but this seems to have broken down in recent years. The lagged relationships between temperature and recruitment in shrimp and crab seem to have been affected as well. There seems to have been a shift in basic relationships in the whole system. These large-scale environmental changes are variously ascribed to shifting of upper atmospheric systems, i.e., the large-scale atmospheric forcing associated with changes in the NAO, which result in changes in wind direction over the Labrador Sea.

Presentation 2: The effect of gear modifications on the performance of the Campelen 1800 trawl–flume tank results by T. Siferd

PRESENTER: T. Siferd

ABSTRACT:

The damage rate of the Campelen 1800 trawl observed in the Resolution Island study area is higher than other areas surveyed in Atlantic Canada. This is costly both financially and to the integrity of the survey results. To reduce the occurrence of tear-ups, modifications to the standard trawl were suggested which included increasing foot gear diameter, lessening the weight of the footgear by adding floatation to the fishing line, increasing the length of toggle chains, adding floatation to the side of the mesh and the use of a restrictor strap to limit the door spread. How these modifications, except the strap, affected the geometry of the trawl were investigated using an exact model of the trawl in the flume tank at the Marine Institute, Memorial University. Results showed that overall the geometry of the trawl changed little with any of the modifications tested. The main effect was to increase the distance the trawl is off bottom which should reduce the possibility of tear-ups. The addition of floatation along the side of the trawl showed little benefit while the trawl was being towed. However, when the trawl stopped it did help to keep the bellies clear of the bottom. Floatation to the fishing line was optimised over all flow speeds encountered so that the trawl maintained good bottom contact over towing speed observed on previous surveys.

DISCUSSION:

Gear tear ups occurred for the most part on muddy bottom apparently due to the doors and foot gear sinking into the mud. However, it appeared from Scanmar that some of the tears occurred before the doors actually hooked. The modifications tested in the flume tank should reduce the problem. Use of shoes on the doors has been found to reduce hooking without affecting trawl geometry and this will be tried at sea.

Modified gear will be tried in the Resolution Island area this year, and if it works out well, it may be used throughout the area covered by the Northern Shrimp Research Foundation (NSRF) survey in the future.

There was concern with introducing gear modifications after three years into the survey and essentially starting a new time series, especially for 2G where the survey had gone well. It was explained that in this kind of survey anything that can be controlled, such as the gear, is standardized. If the gear is modified in any way, the results are not directly comparable and the validity of the time series will be challenged in peer review. However, others felt that the modifications were really just tweaking and unlikely to affect trawl performance or catchability. In trawl surveys there are many other factors that contribute to variability and affect trawl performance to a greater extent than these modifications to the gear. There would be great advantages in terms of survey efficiency and the number of sets that could be made each year and this should reduce some of the other variability.

With the kind of variability in trawl catchability that occurs in the Resolution Island area, the proposed gear modifications are not likely to contribute to it, but should at least allow

for completion of the survey there. Nevertheless, it would be better to keep the same gear for the 2G part of the survey.

Presentation 3: An experiment to determine the appropriateness of reducing the Nordmore Grate spacing from 28 mm to 22 mm by D. Orr and N. Cadigan

PRESENTER: D. Orr

ABSTRACT:

During a December 2006 meeting of the Northern Shrimp Compliance Working Group, Resource Managers within DFO (NL Region) proposed that the Nordmore Grate bar spacing be reduced from 28 mm to 22 mm and that the 22 mm bar spacing be used as a standard throughout all fleets fishing shrimp off the eastern coast of Labrador and northeastern Newfoundland. The objective of this exercise was to reduce the impact that shrimp fishing has upon groundfish. The proposal was based upon the results of an experiment conducted during 1993 on the M.V. Newfoundland Otter (Hickey *et al*, 1993) and a follow up experiment conducted during 1997 on the M. V. Cape Mariner (CAFID, 1997). Both experiments were conducted in Shrimp Fishing Area 6 (SFA 6) where shrimp were small relative to more northern areas. Results from these experiments indicated that reducing the Nordmore Grate bar spacing from 28 mm to 22 mm would significantly reduce groundfish bycatch without affecting the mean carapace length of shrimp caught.

The Canadian Association of Prawn Producers (CAPP) requested that a protocol be developed to determine whether such a reduction in bar spacing would be appropriate for more northern areas, SFA's 4 and 5. Anecdotal evidence suggested that such a reduction would result in a loss of at least 20% of the shrimp catch. Therefore the goal of the present study was to find a bar spacing that reduced the impacts on finfish while allowing industry to maximize shrimp retention in terms of total catch and individual shrimp size. The study's objective was to test whether reducing the Nordmore Grate bar spacing from 28 mm to 22 mm would result in a reduction in:

- 1) total weight of shrimp catch and shrimp size selectivity;
and
- 2) total weight of Atlantic cod (*Gadus morhua*), Greenland halibut (*Reinhardtius hippoglossoides*), redfish (*Sebastes* spp.), spotted wolffish (*Anarhichas minor*), striped wolffish (*Anarhichas lupus*), northern wolffish (*Anarhichas denticulatus*) and American Plaice (*Hippoglossoides platessoides*) bycatch and size selectivity of these species.

DISCUSSION:

Twin trawls were used in this experiment to eliminate bias associated with covered codends and to mimic real fishing conditions. Each trawl was fitted with either the standard 28 mm or the experimental 22 mm grate spacing and these were switched between port and starboard trawls. Only what passes through the grate and gets caught in the codend is sampled, so relative and not absolute selectivities are derived.

There were only 5 sets in a southern area of SFA 4 compared to 23 in a northern area. Results for the northern area did not support reducing the grate spacing from 28 to 22 mm and it was concluded that a switch to a 22 mm grate in the northern area would not result in a reduction in groundfish by-catch but it would reduce the catch of shrimp. The amount of groundfish by-catch in the shrimp fishery using 28 mm grates is very small and there would be a significant cost to switching over to use of 22 mm grates if there is no benefit in terms of reducing by-catch. There were too few sets in the southern area to reach a conclusion, but there seemed to be some differences between the two areas that will require further work in the south to resolve. It was considered that results for one area are not portable to others.

Presentation 4: Assessment of the northern shrimp (*Pandalus borealis*) resource off the eastern coast of Labrador and northeast Newfoundland by D. Orr, P. Veitch, D. Sullivan, K. Skanes, and E. Hynick

PRESENTER: D. Orr

ABSTRACT:

Updates of northern shrimp (*Pandalus borealis*) assessments were performed for NAFO Div. 2G, Hopedale + Cartwright Channels as well as Hawke Channel + Div. 3K, which correspond to shrimp fishing areas (SFA) 4, 5 and 6, respectively. Status of the resource in each area was inferred, in part, by examining trends in commercial catch, effort, catch-per-unit effort, fishing pattern and size/sex/age composition of the catches. Fisheries independent data include an autumn multispecies research bottom trawl survey into SFA's 5 and 6 (1996 – 2007). The Northern Shrimp Research Foundation, in partnership with Fisheries and Oceans Canada, conducted a shrimp based research survey into Div. 2G (SFA 4) during each of the past three summers (2005–07). Surveys in SFA's 4-6 provide information on distribution, abundance, biomass, size/ sex composition and age structure of shrimp.

Catches increased from 22,000 t in 1994 to over 110,000 t by 2004-05 due mainly to increases in Total Allowable Catch (TAC). The TAC for the 2007-08 management year was set at 114,426 t and catches for that year equaled 114,000 t. Please note that due to a pilot bridging program that began in 2007, offshore licence holders may elect to fish up to 250 t of their total combined 2008-09 EAs in the period March 1-30 of 2008, or elect to fish up to 250 t of their 2007-08 EAs in the period April 1-30, 2009. Therefore it is possible for the total catch to exceed the TAC for any one year.

Annual catches within SFA 6 increased from 11,000 t during 1994-96 to 78,000 t by 2004-05. The TAC for the 2007-08 management year was set at 80,305 t (this TAC includes quota transfers and bridging). Catches for the 2007-08 management year equaled 80,733 t.

Spatial distribution of the SFA 6 fishery expanded between the mid 90's and 2000 increasing slightly thereafter. The 2007 large (>500 t) vessel Catch Per Unit Effort (CPUE) remained at a high level, while the small vessel (<=500 t; LOA<=100') CPUE increased significantly since 2003. Biomass and abundance indices from autumn multi-species surveys have generally increased since 1997. Recruitment indices in 2006 and 2007 (04 and 05 year-classes) were the highest in the time series. Female spawning

stock indices increased from 181,700 t in 1997 to 462,500 t in 2006, remaining at a high level in 2007. The resource continues to be distributed over a broad area and exploitation rates have remained low with recent catches having no observable impact upon shrimp abundance and biomass.

Catches within SFA 5 (Hopedale + Cartwright Channels) increased from 7500 t in 1994-96 to 23,000 t in 2004-05 and 2006-07. In 2007-08 catches were 23,768 t against a TAC of 23,805 t. Since 1996, CPUE has fluctuated above the long-term average. Biomass and abundance indices after 2000 have been somewhat higher than before 2000. Recruitment in the short-term, while uncertain, appears average. Longer term prospects are unknown. The resource continues to be distributed over a broad area and the exploitation rate index remains low. Recent catches have had no observable impact on shrimp abundance and biomass.

Catches within SFA 4 increased from 4000 t in 1994 to 9,600 t by 2004-05. Approximately 10,200 t of shrimp were caught against a 10,348 t TAC during 2007-08. Since 2002, fishery catch rates have varied about the long-term average. The fishable biomass index ranged between 66,000 t and 111,000 t since 2005.

SFA 6

DISCUSSION:

It was noted that landings were being reported for calendar year but the TAC management plan is for an April 1 to March 31 fiscal year, and it was agreed to change the landings data to the TAC year.

It was noted that the Funk Island Closed Area is mandatory for small vessels but voluntary for large vessels.

A CPUE series based on a new standardization model was presented along with the old standardized and unstandardized series. The new model was developed because the old standardized and unstandardized series have been diverging, apparently due to a shift in fishing season from primarily winter/spring to largely year-round in recent years. There has also been increasing use of twin trawls which the new model includes. While the new model explains more of the variability, there was no understanding why it eliminates the season effect. A better understanding of why the new model works better is required before it can be considered further. It was decided to carry forward the research recommendation that initiated this work and further recommended that the new model be fully evaluated.

There was concern, from an environmental impact perspective, that the indication the fishery had expanded spatially and was therefore impacting more habitat could be misleading. The increased area fished reflects good catches over a wide area rather than an expansion in area fished in order to catch the quota. It also reflects searching for large shrimp by a component of the small vessel fleet. As far as the fleet is concerned, the area fished has not changed much at all.

Attention was drawn to a shift in depth distribution in SFA 6 resulting in much more of the biomass concentrated in the 200-300 m range in 2007 compared to previously when it was more broadly distributed over the 200-400 m depth range, although total biomass

had not changed very much. It was suggested this could be related to inversions in bottom temperature at these depths as had been described for the area. It was recommended that this shift in distribution be investigated.

A 15% exploitation rate is broadly considered to be a reference point for management of shrimp fisheries. The origin of this rate is a 1999 NAFO meeting in which an exploitation rate of about 15% was estimated using the lower Confidence Interval (C.I.) for a biomass estimate of shrimp in 3LNO – its use as a reference point has been arbitrary.

Industry is involved in a Marine Stewardship Council (MSC) compliance process and they are concerned that estimated exploitation rates in northern shrimp fisheries remain below 15%. In the past the exploitation rate index was estimated by dividing the catch in a given year by the lower C.I. of the fishable biomass estimate from the previous fall survey. However, it has been decided to use the point estimate rather than the lower C.I. and that will lower the estimated exploitation rate.

The decision to change landings to fiscal year to match the TAC year necessitated looking at exactly how exploitation rates will be calculated. The catch in a given fiscal year will be applied to the fall survey fishable biomass estimate from the previous year. The expected range in the exploitation rate index for SFA 6 in 2008/09 provided in the SAR is based on an assumed roll-over of the 2007/08 TAC divided by the upper and lower C.I.s of the fishable biomass index from the 2007 fall survey.

SFA 5

DISCUSSION:

It was noted that the standardized CPUE series for this area was from the old model and for large vessels only because small vessels are a small component of the fishery there. It also did not include use of data from twin trawls which will have to be considered in future. It was also pointed out that reference to a long-term mean when the time series includes anomalously high values is questionable.

Attention was drawn to the fact that the 2J (Cartwright Channel) part of SFA 5 is surveyed annually but the 2H (Hopedale Channel) part is surveyed in alternate years. Although data for the two areas track each other very well, it was considered that using the relationship between them to fill in the gap for SFA 5 as a whole in years that 2H is not surveyed is unacceptable for assessment purposes given the magnitude of the bumping up involved. It was noted that all of SFA 5 had not been surveyed in 2007 and had been surveyed in only 3 of the last 8 years. Nevertheless, it was agreed that for the assessment, survey indices for all of SFA 5 would be used when available.

SFA 4

DISCUSSION:

As for SFA 5, the standardized CPUE series for this area is from the old model and for large vessels only. It also did not include use of data from twin trawls which will have to be considered in future.

It was noted that the survey in this area is conducted in July, more or less in the middle of a fishing season, and not in the fall as in SFAs 5 and 6. It was suggested that it is more appropriate to estimate the exploitation rate index using the survey fishable biomass in the same year as the catch rather than the survey fishable biomass in the previous year. This approach was accepted and allowed an estimate for each of the three survey years rather than only two. The 3-year series was considered too short to infer trends in any of the survey indices.

Proportional changes in exploitation rate indices expected to result from changes in TAC were estimated using fishable biomass indices for 2007.

Although not directly related to the assessment, attention was drawn to the fact that the fleet was required to take part of the TAC north and south of a dividing line through the area. This restriction is considered to have a significant financial bearing on fishing operations in the area and the need for it was questioned. It was explained that this had originated with concerns in the early years of the fishery that the full TAC would be taken in an area in the northern part where shrimp were larger and the fishing grounds better. The dividing line was put in place to ensure some of the TAC was taken in the southern part of the area. Although industry is hoping for Science input on this issue prior to an upcoming NSAC meeting, it was not possible to consider it further at this meeting.

SFAs 4-6

Information on groundfish by-catch in the shrimp fishery was presented; however, the method of estimation was not reviewed. Since by-catch had not been included in the terms of reference for the meeting, it was decided not to report it in the SAR. Nevertheless, the information could be included in the research document that covers the remainder of the shrimp assessment material. A research recommendation to evaluate the by-catch estimation methodology was made so the information could be considered further in future assessments.

In discussion it was requested that estimates be provided for SFAs 4-6 of exploitation rates that would result from possible TAC increases next year. It was explained there was no basis for the projections of fishable biomass for the following year necessary to generate such estimates. At this time, exploitation rates for next year could only be based on the assumption that fishable biomass in 2008 will be the same as estimated from the 2007 fall survey. The request was not included in the terms of reference for this meeting and it was decided that estimates of exploitation rate at various TAC options for the following year would not be attempted unless specifically requested for future assessments.

While reviewing the draft SAR, the absence of a Species Biology section, as required by the Canadian Science Advisory Secretariat (CSAS), was noted. This section will be included in future shrimp SARs.

Presentation 5: Northern shrimp (*Pandalus borealis*) mortality and survival in Hawke Channel + 3K by K. Skanes and D. Orr

PRESENTER: K. Skanes

ABSTRACT:

The traditional methods of Ricker were used to evaluate mortality of Northern Shrimp stocks. Male mortality was estimated under the assumption that shrimp can be aged by modal analysis. This is not a total mortality estimate since shrimp transition to females starting at age 3. Female mortality was estimated by comparing multiparous shrimp on one year to the number of primiparous and multiparous shrimp from the previous year. This method is not perfect in shrimp where a female shrimp can remain multiparous for several years.

DISCUSSION:

The estimation of Z based on females in two consecutive years is compromised by the fact that males are becoming females between years and the assumption that a whole year class of males change sex in the same year is questionable. Interpretation of ages based on length is complicated by overlapping size groups especially among older females which tend to accumulate in a narrow size range making age separation impossible – the estimate is probably not a true mortality rate.

Nevertheless, this represents a first attempt to provide estimates of Z and they are in agreement with those in the literature, as tenuous as the assumptions may be.

A reliable estimate of Z would be useful as a precautionary approach reference point. Z is the total mortality rate and, if F (fishing mortality) can be estimated by other means, M (natural mortality) can also be estimated.

This is considered to be work in progress and will not be reported in the SAR.

Presentation 6: A way forward on the implementation of the precautionary approach (PA) in the management of Canadian fisheries–use of proxies for identification of limit reference points by J. Landry

PRESENTER: J. Landry

ABSTRACT:

This presentation provided a brief overview of the work completed until now regarding the development and implementation of the precautionary approach (PA) in Canadian marine fisheries. The intent was to stimulate discussions among participants about what could be done by DFO Science as the next step to ensure further progress in implementation of PA with particular emphasis on shrimp and other shellfish stocks. The presentation highlighted the most important steps since the entry into force of the 1995 United Nations *Agreement on Straddling and Highly Migratory Fish Stocks* (UNFA) that committed Canada to use the PA in managing straddling stocks as well as domestic stocks. Among these steps, two major products were identified as the principal guidance available for the next steps: 1) a DFO Science framework released in 2006

(http://www.dfo-mpo.gc.ca/csas/Csas/status/2006/SAR-AS2006_023_E.pdf) and 2) a draft decision-making framework developed by Fisheries and Aquaculture Management (FAM) that will be finalized soon and for which the implementation is expected to begin in 2008.

The framework identifies three stock status zones (critical, cautious and healthy) with a limit reference point and an upper stock reference. It identifies maximum removal rates for each zone and defines serious harm as impaired productivity of a stock. It also recognizes the need to use other metrics when quantitatively derived biomass metrics are not available to define reference points.

As the use of other metrics than biomass for the identification of reference points is relatively new in Canada, a workshop has been proposed to allow scientific experts to develop a common understanding on this matter. The results of this potential workshop could guide further work needed to complete the development and implementation of reference points for various fisheries across Canada. Some urgency was noted for the fisheries undertaking eco-labelling certification assessments (e.g., shrimp fisheries) and for which no reference points are available because they are a requirement of certification. Participants were invited to discuss this specific workshop proposal and the potential way forward regarding the implementation of PA.

DISCUSSION:

The proposed workshop will be a starting point in terms of the development of proxies for reference points in order to move forward with implementation of the precautionary approach (PA). The expectation is that participants will come to the workshop with case studies that develop approaches to identifying proxies and hopefully go away with a clear idea of the next step forward in the process.

It was noted that SFAs 4, 5 and 6 are presently in the MSC process and that work on shrimp is required very soon if deadlines are to be met. Although MSC is creating a stimulus to get on with implementation of the PA, unfortunately the initial candidates for certification are shellfish species for which relatively little work has been done in terms of defining reference points, and the development of proxies is essential. Most of the PA work has been done on groundfish species for which stock-recruitment relationships are easier to develop and reference points based on stock and recruitment considerations easier to define.

The PA is meant to ensure harvesting with a low risk of doing serious harm; however, the emphasis has shifted from estimating risk to developing harvesting strategies that are robust to uncertainty which can be tested by way of simulation. Quantitatively, this can be very challenging. It is not just a matter of developing proxies. MSC requires that harvest control rules be scientifically evaluated through some sort of simulation. This is not a short-term process and not easy to do in terms of peer review standards.

The process of defining reference points requires fitting some kind of model to the available data. A major problem with trying to develop reference points for these northern shrimp stocks is the lack of dynamic range in the data because they come mainly from a period of high abundance. Also, the fishery is not a big factor in shrimp population dynamics, and the development of reference points or proxies would have to include a consideration of the ecosystem, both physical and biological components, as

the major factor in processes affecting shrimp dynamics. There are broader ecosystem considerations involved because shrimp is an important forage species, which is something that MSC emphasizes as well. So, any PA applied to shrimp would have to consider its role as prey and address ecosystem objectives as well.

The present notion of PA implementation is that it will be evolutionary. Progress on the development of proxy reference points must be made soon even if it is imperfect. The intent is to make best use of available data and proceed with something that can be improved upon over time – the workshop will be a step forward but it is not expected to answer all the questions or solve all the problems.

DFO managers are aware that MSC is an industry issue that requires attention. Any concern over the pace of progress with the work required to achieve MSC compliance can go forward in the Industry Perspectives section of the SAR, but this meeting will not be making specific recommendations on the matter.

Presentation 7: Assessment of northern shrimp (*Pandalus borealis*) and striped shrimp (*Pandalus montagui*) in shrimp fishing areas 0, 2 and 3 by T. Siferd

PRESENTER: T. Siferd

ABSTRACT:

An assessment of Shrimp Fishing Areas (SFA) 0, 2 and 3 was presented. The survey areas included in the assessment were SFA 0, the Resolution Island Study Area (RISA), which includes SFA 2 west of 63°W and SFA 3 east of 66°W, SFA 2 Exploratory (SFA 2EX), which is SFA 2 east of 63°W, and SFA 3 west of 66°W for both commercial species of shrimp *Pandalus borealis* and *P. montagui*. Three research surveys: 2006 DFO survey of SFA 0, 2007 DFO survey of SFA 3 and the 2005-07 Northern Shrimp Research Foundation/DFO surveys of SFA 2EX and RISA provide the fishery independent data for this assessment. SFA 0 and SFA 3 were surveyed with the Greenland Institute of Natural Resource's research vessel Paamiut using the Cosmos 2600 trawl. SFA 2EX and RISA were sampled with the Fishery Products International's fishing vessel Cape Ballard using the Campelen 1800 trawl. Production (survey biomass and fishery data) and recruitment indices were used to assess the stocks of both species when present in an area. Commercial data from the observer program was used to determine exploitation rates and trends in catch-per-unit effort of the fishery.

SFA 0

DISCUSSION:

Information on shrimp in this area comes from a broader OA survey on the Paamiut using the Cosmos trawl in shallower strata. Survey results indicate a very low biomass of mainly large shrimp and a general absence of small animals, apparently due to spotty recruitment in the area.

General warming and reduction of ice throughout the north has resulted in the area being ice free and accessible for much longer in recent years. However, cold water flows southward through the area keeping bottom temperatures (down to around 300 m) below the range preferred by shrimp. There has been no active fishery and the 500 t

TAC for the area is exploratory in nature. Given just one survey at a particular time of year, stock status is uncertain. However, there is no reason to reduce the TAC and eliminate the opportunity for exploratory fishing.

SFA 2

DISCUSSION:

There is a lack of confidence in the interpretation of the unstandardized CPUE series for this area and it is uncertain what it means in terms of the fishery and stock biomass. The fishery is highly concentrated in a small area east of Resolution Island near the territorial boundary lines. Vessels usually go into the area at different times during the year and sometimes do very well in a short time, however, catch rates tend to be low.

The survey in SFA 2 was done using the fishing vessel Cape Ballard and the Campelen trawl. There is greater uncertainty in survey indices for SFA 2 than for other areas. Therefore, the high exploitation rate indices in this area compared to other areas are suspect.

There is much confusion regarding boundaries, quotas and allocations in this area related to 3 different land-claim areas, commercial and exploratory areas, etc. This results in a mish-mash of regulations and different management jurisdictions. It is not possible to provide scientific advice at the spatial level that the area is managed by, but advice will be provided on the spatial scale justified by the information available for the purpose.

A request to examine the possibility of redefining management area boundaries in the Resolution Island area had been included in the terms of reference; however, this meeting was unable to deal with the issue. There is a working group dealing with the matter and it was considered appropriated that this be taken up at NSAC. It was explained that the issue had been brought forward at this meeting as an information item rather than for resolution. The group was also unable to conclude there would be an improvement in future scientific advice by changing the management areas in question.

SFA 3

DISCUSSION

There is no active fishery in SFA 3. The survey in the area was done on the Paamiut using the Cosmos trawl. There is extreme variability in catchability of shrimp associated with very strong tidal currents in this area along with diurnal effects. Trawl catch rates seem to track the tidal cycle, but much work is required before the effect is predictable. Tow direction in relation to currents as well as time of towing in relation to the tidal cycle appear to affect catches and this contributes greater uncertainty to biomass estimation, despite the randomized survey design.

**PROGRESS ON RESEARCH RECOMMENDATIONS FROM THE 2007 ASSESSMENT
FRAMEWORK FOR NORTHERN SHRIMP OFF LABRADOR AND THE
NORTHEASTERN COAST OF NEWFOUNDLAND**

1. Evaluate the time series of standardized and unstandardized CPUEs for SFA 5 to explain the inconsistencies in differences between the two over the period and determine whether it may be possible to model the data without leaving gaps in the time series.

The unstandardized and standardized CPUE's were compared, and their differences were considered to be not too large. Gaps in time series could not be filled in because there was too much missing data.

2. Undertake to improve upon the use of modal analysis to separate age groups for tracking cohorts and estimating mortality. This should include simulation testing.

No new information was presented at the meeting.

3. Explore a better method of aging and validate reliability of age 2 as an early indicator of year-class strength.

No new information was presented at the meeting regarding a better method of aging or to validate the reliability of age 2 as an early indicator of year-class strength.

4. Validate a recruitment index based on the 11.5 to 16.0 mm size group for the next assessment.

A recruitment index based on the 11.5 to 16.0 mm size group was included in the 2007 assessment presented at the 2008 ZAP. This index was not validated, and it was not clear how the index could be validated.

5. Undertake an evaluation of the standardization process to ensure the CPUE series reflect stock size.

A new standardization model was applied to SFA 6 CPUE data in the 2007 assessment and presented at the 2008 ZAP. A presentation with more details about the old and new formulations is required before the new model can be properly evaluated. This presentation should include evidence of why the new model performs better than the old model for predicting total fishery CPUE.

6. Investigate the estimation of Z using length-based methodologies and other approaches.

A length-based method of estimating Z was presented and reviewed at the 2008 ZAP. The work is ongoing and utility of the estimates will be evaluated at the next assessment.

RESEARCH RECOMMENDATIONS FROM 2008 RAP

1. Shrimp fisheries are managed on a fiscal year basis. For future assessments, landings should be presented on a fiscal, rather than calendar, year basis to be consistent with annual TACs.
2. An evaluation of the proposed new CPUE standardization model is required before using it to replace the old model. A presentation with more details about the old and new formulations is required so that the new model can be properly evaluated. This presentation should include evidence of why the new model performs better than the old model for predicting total fishery CPUE.
3. The shift in depth distribution in SFA 6 resulted in more biomass concentrated in the 200-300 m range in 2007 compared to previously when it was more broadly distributed over the 200-400 m depth range, although total biomass had not changed very much. It was suggested this could be related to inversions in bottom temperature at these depths as had been described for the area. It was recommended that this shift in distribution be investigated.
4. For SFA's 4-6, evaluate the by-catch estimation methodology so this information could be considered further in future assessments.

APPENDIX I: TERMS OF REFERENCE

**Meeting of the Newfoundland and Labrador/Central and Arctic
Zonal Advisory Process (ZAP) on Northern Shrimp
T Gazebo, Clovelly Golf Course
Stavanger Drive
St. John's NL
March 6-8, 2008
Northwest Atlantic Fisheries Centre
80 East White Hills Road
St. John's NL
March 10-14, 2007**

Meeting Chairperson: Dr. Noel Cadigan, Research Scientist, Groundfish Section, Aquatic Resources Division, DFO, Newfoundland and Labrador Region.

TERMS OF REFERENCE:

Context

The status of Northern Shrimp in Divisions 0B to 3K was last assessed in March 2006. The 2008 assessment will also include Shrimp Fishing Areas (SFAs) 0, 2, and 3 for both Northern and Striped Shrimp. An assessment framework for Northern Shrimp (*Pandalus borealis*) in SFAs 4, 5, and 6 was reviewed in May 2007.²

The current assessment is requested by Fisheries and Aquaculture Management to provide harvest advice for 2008.

These stocks will be assessed in a zonal advisory meeting (ZAP) every two years.

Objectives

- Applicability of framework extension to cover all SFAs.
 - Assessment of Northern Shrimp in Divisions 2G to 3K (SFAs 4 to 6).
 - Assessment of Northern and Striped Shrimp in SFAs 0, 2, and 3.
 - Examination of harvest advice in relation to survey biomass for SFAs 0, 2, 3, and 4.

¹ A second week has been planned to word craft the complete text of the NL SAR. Summary bullets for each stock will be agreed upon in plenary during the March 6-8, 2008 meeting. RAP participants are encouraged to attend the second week of discussions and assist in the drafting of the SAR.

² DFO, 2007. Assessment Framework for Northern Shrimp (*Pandalus borealis*) off Labrador and the northeastern coast of Newfoundland; 28-30 May 2007. DFO Can. Sci. Advis. Sec. Proceed. Ser. 2007/034.

- A review of an experiment to determine the appropriate Nordmore
- grate space size in SFA 4.
- Examine the possibility of redefining shrimp fishing area boundaries in the Resolution Island area.

Products

Two Science Advisory Reports (SARs) will be produced during the zonal Northern Shrimp assessment: Newfoundland and Labrador Region will produce a SAR for Shrimp Fishing Area (SFA) 4 - Division 2G, SFA 5 - Hopedale and Cartwright Channels and SFA 6 - Hawke Channel + Division 3K. Central and Arctic Region will produce a SAR for SFAs 0, 2 and 3.

Associated research documents will also be produced to support these SARs. A Proceedings document will record the meeting discussions.

Participation

- DFO Science, Newfoundland and Labrador, Central and Arctic and NCR
- DFO Fisheries and Aquaculture Management, Newfoundland and Labrador and Central and Arctic
- Industry Representatives
- Fish, Food and Allied Workers Representatives
- Newfoundland and Labrador Provincial Department of Fisheries and Aquaculture
- Nunavut Territorial Government representation
- Memorial University
- Members of the public with knowledge of the fishery and/or shrimp biology.

**Réunion du Processus consultatif régional (PCR)
de Terre-Neuve et du Labrador/du Centre et de l'Arctique
sur la crevette nordique
The Gazebo, Club de golf Clovelly
Promenade Stavanger
St. John's T.-N.-L.
Du 6 au 8 mars 2008
Centre des pêches de l'Atlantique nord-ouest
80, chemin East White Hills
St. John's, T.-N.-L.
Du 10 au 14 mars 2007**

Président de la réunion : M. Noel Cadigan, Ph. D., Chercheur scientifique, Section des poissons de fond, Division des ressources aquatiques, MPO, Région de Terre-Neuve et du Labrador

CADRE DE RÉFÉRENCE

Contexte

L'état du stock de la crevette nordique dans les divisions 0B à 3K a été évalué pour la dernière fois en mars 2006. L'évaluation de 2008 inclura également les zones de pêche à la crevette (ZPC) 0, 2 et 3 pour la crevette nordique et la crevette ésope. Un cadre d'évaluation pour la crevette nordique (*Pandalus borealis*) dans les ZPC 4, 5 et 6 a été passé en revue en mai 2007⁴.

Gestion des pêches et de l'aquaculture a demandé la présente évaluation afin d'être en mesure de produire un avis sur l'exploitation de la ressource pour 2008.

Ces stocks seront évalués dans le cadre d'une réunion du Processus consultatif régional (PCR) tous les deux ans.

Objectifs

- Applicabilité de l'expansion du cadre pour couvrir toutes les ZPC.
 - Évaluation de l'état du stock de la crevette nordique dans les divisions 2G à 3K (ZPC 4 à 6).
 - Évaluation de l'état du stock de la crevette nordique et de la crevette ésope dans les ZPC 0, 2 et 3.

³ Une deuxième semaine a été prévue pour la rédaction de l'avis scientifique en entier pour la Région de T.-N.-L. On s'entendra sur les points énumérés dans le sommaire pour chaque stock dans le cadre d'une séance plénière qui aura lieu durant les réunions du 6 au 8 mars 2008. Nous incitons les participants au PCR à assister à la deuxième semaine de discussions ainsi qu'à participer à la rédaction de l'avis scientifique.

⁴ MPO, 2007. Compte rendu sur le cadre d'évaluation de la crevette nordique (*Pandalus borealis*) au large du Labrador et sur la côte nord-est de Terre-Neuve, du 28 au 30 mai 2007. Secr. can. de consult. sci. du MPO, Compte rendu 2007/034.

- Examen de l'avis sur l'exploitation de la ressource en lien avec la biomasse relevée dans les ZPC 0, 2, 3 et 4.
- Revue d'une expérience visant à déterminer la taille appropriée des mailles de la grille Nordmore dans la ZPC 4.
- Examen de la redéfinition possible des limites des zones de pêche à la crevette dans la région de l'île Resolution.

Résultats

Deux avis scientifiques seront rédigés durant l'évaluation zonale de la crevette nordique : la Région de Terre-Neuve et du Labrador produira un avis scientifique pour la ZPC 4 (division 2G), la ZPC 5 (chenaux Hopedale et Cartwright) et la ZPC 6 (chenal Hawke et division 3K). La Région du Centre et de l'Arctique produira un avis scientifique pour les ZPC 0, 2 et 3.

Des documents de recherche connexes seront rédigés à l'appui de ces avis scientifiques. Les discussions tenues à la réunion seront consignées dans un compte rendu.

Participation

- Secteur des Sciences du MPO, Terre-Neuve et Labrador, Centre et Arctique et RCN
- Gestion des pêches et de l'aquaculture du MPO, Terre-Neuve et du Labrador et Centre et Arctique
- Représentants de l'industrie
- Représentants de la Fishermen, Food and Allied Workers Union
- Ministère provincial des Pêches et de l'Aquaculture
- Représentants du gouvernement du territoire du Nunavut
- Université Memorial
- Membres du public possédant des connaissances des pêches ou de la biologie de la crevette

APPENDIX II: AGENDA

Zonal Advisory Process (ZAP) Meeting on Northern Shrimp
The Gazebo, Clovelly Golf Course
Stavanger Drive
St. John's NL
March 6–8, 2008

Thursday March 6 2008

0900-0930 Preliminaries *N Cadigan (Chair)*

- Introduction of participants
- Terms of Reference
- Work Plan
- Reporting
- Comments on Agenda

0930-0955 Oceanography *J. Craig*
0955-1015 Working paper *Tim Siferd*

The effect of gear modifications on the performance of the Campelen 1800 Trawl – flume tank results

1015-1030 **BREAK**
1030-1140 Working paper *D. Orr*

An experiment to determine the appropriateness of reducing the Nordmore Grate spacing from 28 mm to 22 mm

1140-1200 SFA 6 *D. Orr*
1200-1300 **LUNCH BREAK**
1300-1500 SFA 6 (cont'd) *D. Orr*
Presentation *K. Skanes*

Northern Shrimp (Pandalus borealis) Mortality and Survival in Hawke Channel + 3K Mortality and Survival

1500-1515 **BREAK**
1515-1600 SFA 6 (cont'd) *D. Orr*
1600-1640 SFA 5 *D. Orr*
1640-1730 SFA 4 *D. Orr*

Friday March 7 2008

0900-1015 *Review of Provisional Summary Bullets for SFA 6-* *D. Orr*

1015-1030 **BREAK**

1030-1200	<i>Review of Provisional Summary Bullets for SFA 5 -</i>	D. Orr
1200-1300	LUNCH BREAK	
1300-1400	<i>Review of Provisional Summary Bullets for SFA 4</i>	D. Orr
1400-1500	<i>Strategy to develop reference points for next year</i>	J. Landry
1500-1515	BREAK	
1515-1700	<i>Summary Bullets and Research Recommendations</i>	D. Orr

APPENDIX III: List of Participants

Northern Shrimp Zonal Advisory Process Meeting

March 6-8, 2008

Clovelly Golf Club, St. John's NL

Name	Affiliation	Mailing Address	E-mail	Phone/Fax
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APPENDIX IV: LIST OF WORKING PAPERS PRESENTED

- Colbourne, E., Craig, J., Fitzpatrick, C., Senciall, D., Stead, P., and Bailey, W. Physical oceanographic conditions on the Newfoundland and Labrador Shelf during 2007. WP2008/01.
- Siferd, T. The effect of gear modifications on the performance of the Campelen 1800 trawl-flume tank results. WP2008/02.
- Orr, D., and Cadigan, N. An experiment to determine the appropriateness of reducing the Nordmore Grate spacing from 28 mm to 22 mm. WP2008/03.
- Orr, D., Veitch, P., Sullivan, D., Skanes, K., and Hynick, E. Assessment of the northern shrimp (*Pandalus borealis*) resource off the eastern coast of Labrador and northeast Newfoundland. WP2008/04.
- Skanes, K., and Orr, D. Northern Shrimp (*Pandalus borealis*) mortality and survival in Hawke Channel + 3K. WP2008/05.
- Landry, J. A way forward on the implementation of the precautionary approach (PA) in the management of Canadian fisheries—use of proxies for identification of limit reference points. WP2008/06.
- Siferd, T. Assessment of Northern Shrimp (*Pandalus borealis*) and striped shrimp (*Pandalus montagui*) in shrimp fishing areas 0, 2 and 3. WP2008/07.