

Newfoundland 1999 Shellfish RAP Proceedings

D. B. Atkinson

Northwest Atlantic Fisheries Center

August 1999

Abstract

Regional assessments of three invertebrate species (northern shrimp (*Pandalus borealis*), snow crab (*Chionoecetes opilio*) and Iceland scallops (*Chlamys islandica*)) were conducted in February and March 1999. These proceedings contain summaries of the working papers presented at the meeting, as well as summaries of the discussions of these papers. Information on oceanic conditions during 1998 in comparison to long term norms was also presented. A list of working papers available to the meeting and a list of meeting participants are given.

For northern shrimp the fishery is in the last year of a 3-year management plan so recent data were reviewed but no updated SSR was produced. Results of the review were incorporated into a Briefing Note that is attached. There will be a full review in 2000. The committee reiterated that for the area as a whole (Div. 0B to 3K) the current high level of abundance is unprecedented. In addition, a 'traffic light' evaluation of the resource was developed in recognition of the Precautionary Approach.

The Iceland scallop fishery is in the second year of a 3-year management plan, so only an interim review was carried out of the 1998 fishery, and no SSR was produced. Data from Div. 4R were examined in more detail in response to perspectives raised by industry during 1998. Results of the review were incorporated into a Briefing Note that is attached. Overall, it is believed that the Iceland scallop resources in the Newfoundland area are over-exploited.

For snow crab, a full review was carried out and updated Stock Status Report prepared. Based on fall bottom trawl survey information, the exploitable biomass has not changed significantly over the past 3 years in Divisions 3K3LNO. In Div. 2J the biomass increased significantly during the same period. Based on commercial CPUE, the fishery is expected to perform well again in 1999.

Résumé

Les évaluations régionales des trois espèces d'invertébrés: la crevette du nord (*Pendalus borealis*), le crabe des neiges (*Chionoecetes opilio*) et la pétoncle d'islande (*Chlanys islandical*) ont été effectuées durant les mois de Février et Mars 1999. Les comptes-rendus contiennent les résumés des communications des travaux présentés à cette reunion ainsi que les discussions associées à ces travaux. L'information sur les conditions océaniques durant l'année 1998, en comparaison avec les normes à long terme, est présenté. Une liste des travaux décrits dans les communications et la liste des participants à cette reunion sont aussi présentées.

La pêche de la crevette du nord est dans la dernière phase d'un plan de gestion de trois ans, c'est pour cette raison que seulement des données récentes ont été examinées et aucune mise à point finale du rapport sur le statut des stocks a été faite. Les résultats de ces comptes-rendus sont incorporés dans la note de service ci-inclus. Il y aura une revue totale des résultats en l'an 2000. Le comité a reiteré que pour la zone entière (Div. 0B à 3K) le niveau courant des très grande abondance est sans précédent. De plus une évaluation qualitative légère type Alumiére de signalisateur de traffic@ a été developpé en reconnaissance de l'approche precautionaire.

La pêche de la pétoncle d'islande est dans la deuxième année d'un plan de gestion de trois ans. C'est pour cette raison que seulement une revue interimat a été faite pour l'année 1998 et aucun rapport final sur le statut des stocks est présenté. Les données obtenues à partir de la Div. 4R ont été examinées avec plus de details en reponse aux perspectives présentés par l'industrie en 1998. Les résultats de cette revue sont incorporés dans la note de service ci-inclus. En general, on croit que les ressources de la pétoncle d'islande ont été sur-exploitées dans la région de Terre-Neuve.

Pour la crabe des neiges, une revue complete a été accomplie et un rapport final sur le statut des stocks a été préparé. Une examen attentif sur l'information obtenu a partir de la pêche de fond au chalut en automne a indiqué que la biomasse exploitable n'a pas vraiment changé au cours de ces trois dernières années dans les Divisions 3K3LNO. Dans la Div. 2J, la biomasse a augmenté significativement pendant la même periode. Basée sur les previsions PUE commerciales il est prévu que le niveau de pêche sera bon en 1999.

Introduction

Regional assessments and interim reviews of three invertebrate species (northern shrimp (*Pandalus borealis*), snow crab (*Chionoecetes opilio*) and Iceland scallops (*Chlamys islandica*)) were conducted in February and March 1999. Northern shrimp are assessed as four management areas, NAFO Div. 0B, NAFO Div. 2G, Hopedale and Cartwright Channels, and Hawke Channel + NAFO Div. 3K. There is thought to be one stock of snow crab throughout the Newfoundland - Labrador area, although there are numerous management areas. The 1998 fisheries for Iceland scallop on the Grand Banks (3LN), 3Ps and 4R were also reviewed. Additional information for 4R was reviewed in response to issues raised by industry in 1998.

Data from the fall bottom trawl surveys again proved to be a valuable part of the assessments of crab and shrimp. This information will become more and more valuable as a time series is developed. The survey design and coverage may not be optimal for these species, however.

These proceedings contain summaries of the working papers presented at the meeting, as well as summaries of the discussions of these papers. The summaries of the working papers and discussions are grouped by species. The appendices list participants at the various sessions (Appendix I). As Stock Status Reports were not updated for shrimp (in final year of 3 year management plan) or scallops (in second year of 3 year management plan), the final reports and briefing notes are also included (Appendix II and Appendix III respectively).

Readers are also directed to the CSAS research document series for additional information on these resources.

Oceanography:

Reference

- Oceanographic conditions in NAFO Div. 2J3KLMNO during 1998 with comparisons to the long term (1961 - 1990) average. WP 99/19 by E. Colbourne.
- Oceanographic conditions in NAFO Subdivisions 3Pn and 3Ps during 1997 and 1998 with comparisons to the long term (1961 - 1990) average. WP 99/20 by E. Colbourne.

Summary

E. Colbourne tabled these environmental overviews as an introduction to the shellfish assessments. Detailed summaries can be found in proceedings of groundfish assessments.

Discussion

Discussions tended to be general, with inference to the possible relationships between changes in the environment and trends in shellfish abundance and distribution.

Crab:

Reference

- Assessment of the 1998 Newfoundland and Labrador snow crab fishery. WP SF 98/1 by D.M. Taylor and P.G. O'Keefe

Summary

Newfoundland snow crab landings reached 52,600t in 1998, an increase of 14.6% over the previous year. The fishery is concentrated along the northeast and southeast coasts of Newfoundland and Labrador with a small, inshore fishery, inaugurated in 1995 operating in nearshore areas of the island. The fishery is prosecuted by several fleet sectors; these include full-time, large supplementary (>40 gross tons), small supplementary vessels (<40 gross tons) and vessels under 35 ft. In 1998 approximately 3300 licenses were issued to Newfoundland and Labrador fishers. Vessels are licensed by NAFO division boundaries and are restricted to fishing snow crab management areas within their division. Each year, before fishing activity commences, Resource Management Branch issues a Snow Crab Management Plan which outlines quotas per fleet sector by management area, trap limits, seasons etc and describes intra-area boundaries which serve to segregate fleet sectors.

Assessment of fishery performance for each of the various management areas relies on analyses of fishers logbook entries (mandatory for all fleet sectors) as the principle means of comparing a given years fishery performance to that of the previous fishing season. The standard used in this comparison is catch per unit of effort (CPUE) calculated by dividing the landings for a trip by the number of traps hauled as reported in the log books. While it is felt that information obtained from most logbooks during the course of a fishery is reasonably accurate, providing reliable data on catch and effort, some management areas are problematical in terms of interpreting the information provided.

It should be noted that changes in CPUE from one year to the next may not accurately reflect abundance due to the influences of such things as environmental effects (water temperature), changing fishing patterns, changes in fishing season etc. Comparison of 1995 and 1996 CPUE data is particularly problematical for several reasons. In 1996 a two-tiered pricing system was introduced whereby fishers were paid a higher price for crabs greater than 102mm carapace width. Also in 1996, a harvesting strategy that assigned individual quotas to fishers was applied to all fleet sectors. These factors led to an extensive high-grading in all areas except Labrador. In NAFO Div. 3LNO fishers in offshore areas increased the mesh size of a large proportion of their traps. These three factors could have artificially reduced CPUEs in comparison with 1995 catch rates. In 1997 the fishery was again delayed in opening due to a price dispute. This meant that much fishing activity was carried out during the hottest time of the year. The additional culling necessitated by the two-tiered price system carried out during the hot summer months rather than the cooler spring may have contributed to higher- than-average discard mortality for a second year in a row. In 1998, despite an agreement between the harvesting and processing sectors of the industry to eliminate high-grading there is evidence from at-sea observers and dock-side monitors that high-grading continued in NAFO Div. 3LNO and 3Ps.

In all NAFO Divisions landings and catch rates increased over 1997 levels.

Logbooks have also been utilized to determine fishing positions of crab fishers with the aim of summarizing fleet fishing patterns, identifying portions of the fishing grounds that are the most heavily fished, delineating the boundaries of new fishing grounds and illustrating the expansion of the fishery in recent years both in terms of effort and area. A large sub-sample of the log book entries of full-time and supplementary fishers are entered into a computer data bank and a computer-generated map of Newfoundland and Labrador indicating these fishing positions is produced. To date, figures illustrating fishing positions for the 1994-98 seasons inclusive have been produced.

Discussion

The problem of falsification of logbook information was discussed in relation to interpretation of annual change in commercial catch rates. It was felt that as indicators of broad-scale changes or trends logbooks may be useful but reported changes in individual management areas should be viewed with caution. It was apparent that, with very few exceptions (e.g. St. Mary's Bay), catch rates either increased or remained stable in 1998, reflecting a continued high level of fishery performance. It was noted that spatial effects have not been accounted for and suggestions were offered to address this problem including a multiplicative approach, summarising trends by fleet sector, and establishment of an index fisher program. The concept of an index fisher program was attractive in that it could largely be run by industry.

Sampling conducted by at-sea observers appears to provide a promising independent source of information on commercial catch rates, highgrading and Bitter Crab Disease.

Reference

- Results of the 1998 inshore/nearshore 3L snow crab time-series research cruises. WP SF 98/2 by D.M. Taylor and P.G. O'Keefe

Summary

Research vessel surveys are conducted annually in 3 snow crab management areas in NAFO Div. 3L; Northeast Avalon (6C), Bonavista Bay (5A) and Conception Bay (6B) and since 1994 in White Bay (3B) in Div. 3K. The surveys are carried out using both commercial crab traps (in order to emulate those used in the commercial fishery), and small-meshed traps. Traps were set at randomly selected stations stratified by depth. Weather permitting, traps were hauled after a 24h soak and sampled in order to determine catch per trap, size frequency, shell condition, and proportion small-clawed males (potential recruits). In 1996 bottom trawling with a modified shrimp trawl was initiated in all 4 survey areas. Tows of 10 minutes duration were made at a speed of 2.5 knots and monitored by SCANMAR. Catches were sorted according to sex and sampled in the same manner as were trap-caught crabs.

In recent years, it has been observed that there had been a steady decline in the proportion of small-clawed crabs in all areas that may indicate a downward trend in future

recruitment to the fishery. This phenomenon was monitored closely during 1998 research surveys by means of both small-meshed traps and the modified shrimp trawl. It appears that the decline in the proportion of small-clawed catches may have "bottomed out" as their abundance in all 3L survey areas was slightly increased in 1997 and remained at comparable levels in 1998. Bitter Crab Disease (BCD) remains a concern, particularly in 3K. Although the impact of this disease on the snow crabs fishery is unknown the fact that is 100% fatal to infected animals is cause for concern.

Discussion

Although catch rates from large-meshed traps varied considerably among the 3 areas, they generally remained high, consistent with trends in commercial catch rates. Trends in time series of size frequencies from small-meshed traps were generally unclear in terms of interpreting them as a predictor of future resource availability. It was noted that traps are very selective and catchability, of small crabs in particular, may be greatly affected by changes in size structure of the population. These trap surveys are intended to focus on the deepest inshore strata (commercial ground) and therefore do not account for spatial effects. The small shrimp trawl catches very small crabs and so has potential for providing an early indication of year-class strength. Size frequencies for 1998 differed among the 3 areas.

Reference

- A study of the efficiency of the Campelen trawl for sampling snow crab in White Bay and Notre Dame Bay, September, 1998. WP SF 98/3 by E.G. Dawe, P.C. Beck, and H.J. Drew

Summary

Comparative sampling, using two research vessels concurrently, showed that, relative to traps, the Campelen trawl performed much more poorly in catching snow crabs in shallow inshore strata (<300m) than in deeper strata (300-500m). Application of estimates of area fished by both those gear types suggested that catchability was less than 1, highly variable, and declined with stratum depth and crab size. Another comparison, based on common stations, indicated that crab catches were consistently higher when the trawl was equipped with a tickler chain, than when it was not modified. This represented direct evidence that trawl catchability for snow crab is less than 1. Data from the ROXANNE seabed classification system indicated a higher prevalence of rocky bottom in the shallower strata than in the deeper strata.

A September Div. 3K inshore trapping survey showed that small-meshed trap catch rates of sublegal-sized crabs (about 40-75 mm CW) have increased continuously since 1994, especially in shallow strata. This supports the suggestion that crabs of this approximate size are distributed predominately in shallow-water strata, with rough substrates, where the Campelen trawl does not efficiently sample them

Discussion

Results of the study were considered preliminary, especially in relation to the estimates of catchability (q). The regular increase in intermediate-sized crabs in shallow White Bay strata during the past 5 years may reflect competitive exclusion of these crabs from preferred deeper strata by larger crabs.

Reference

- An update on the incidence of Bitter Crab Disease in Newfoundland and Labrador snow crab. WP SF 98/4 by E.G. Dawe, P.C. Beck, and H.J. Drew

Summary

Bitter Crab Disease (BCD) is most evident to macroscopic examination in the fall. It is found only in new-shelled crabs of both sexes indicating that it is fatal within a year of infecting its host. Data from fall 1996-98 multispecies surveys indicate that the disease is most prevalent in Div. 3K and is virtually absent in Div. 3NO. Throughout Div. 2J3KL it has remained most prevalent in small crabs of 40-60 mm CW. Inshore Div. 3K trap surveys during September indicate that in White Bay its incidence has increased overall since 1995, and it appears to have progressed to deeper strata and larger crabs.

Discussion

It was questioned whether the apparent increase in this disease in recent years may be largely an artefact related to a recent increase in awareness and experience in recognizing diseased crabs. This is unlikely since the disease was recognized in the late-1980's when it was rarely encountered and the trends described in White Bay suggest proliferation. The possible merit of increasing exploitation in the short term to reduce loss of yield was considered. However it was noted that BCD is primarily found in sublegal-sized crabs, so increased exploitation would not address this problem.

Reference

- An assessment of Newfoundland and Labrador snow crab in 1998. WP SF 99/5 by E.G. Dawe, D.W. Kulka, H.J. Drew, P.C. Beck, and P.J. Veitch.

Data on catch rate, size (carapace width, CW) and moult status (chela allometry and carapace hardness) from various sources, but especially fall multispecies bottom trawl surveys, were used to interpret resource status. The 1998 Div. 2GHJ3KLNO fall survey showed that males were broadly distributed throughout the survey area. They were virtually absent north of 2J, on the slope of the continental shelf deeper than about 800 m, and across most of the shallow southern Grand Bank. Legal-sized crabs predominated in catches at greatest depths near the shelf edge, smaller crabs predominated in shallower water, especially near the coast, and a mixture of sizes occurred at intermediate depths over most of the shelf. Spatial analysis suggested a northward shift of highest densities, for both sexes and all male sizes, since 1995.

The overall Div. 2J3KLNO biomass index was relatively precise ($\pm 14\%$), whereas divisional indices were variable and less precise. The 95% confidence intervals were widest for Div. 3N and 3O, probably due to an aggregated distribution of the resource near its southern limit. Estimates indicate a stable biomass of legal-sized crabs in 3KLNO and an increase in 2J. The ratio of commercial catch to the biomass index for the survey area was 0.40 and 0.39 in 1997 and 1998 respectively. Because the catchability of the Campelen survey trawl is believed to be less than 1, the overall exploitation rate has not exceeded 40% in the past two years.

Size distributions reflect the stable commercial biomass over the past 3 years and indicate that continued strong recruitment, by 76-94 mm CW crabs, to legal size is expected for 1999. Uncertainties exist regarding the efficiency of the Campelen trawl in sampling sublegal-sized crabs (40-75 mm) which would begin to recruit to commercial size two years after the survey year. Therefore, it is not possible to predict recruitment to the exploitable biomass in the intermediate term. Abundance estimates of small crab (carapace width less than 40 mm) have declined in fall survey catches from 1995-1998. Crabs of this size would begin to recruit to legal size about 4 years after the survey year.

Data were also available from spring multispecies bottom trawl surveys conducted in Div. 3P during 1996-1998. Generally, catches of legal-sized crabs were localized in the eastern portion of 3Ps. Biomass estimates were unreliable, highly variable, and trends could not be interpreted.

Comparison of crab size structure from at-sea sampling with that from dockside grading provided evidence of 'high-grading'. It had been supposed that this practise, of discarding small legal-sized crab of lower commercial value, would be eliminated in 1998 by the abolition of a two-tiered pricing system.

Discussion

The basis of the apparent progressive shift of biomass to the north over the past 2-3 years was discussed. This phenomenon could not be attributed to the fishery alone since it was observed for both sexes and all sizes. Environmental change, annual change in catchability, migration across divisional boundaries, and bitter crab disease (BCD) were considered as possible contributing factors.

The relative merits of two approaches to estimating maximum exploitation rate were discussed. One approach was retrospective whereby the annual catch was compared with an initial biomass that was estimated by adding the catch to the fall survey 'residual' biomass estimate of the same year. Another approach was prospective; whereby the catch was compared with an initial biomass which was projected from the previous fall survey results. The latter approach, which included estimation of growth and recruitment, was favoured as producing initial biomass estimates that are less sensitive to effects of annual variation in catch.

The basis for the apparent continuation of high grading in 1998, despite abolition of a two-tiered pricing system was also discussed. Apparently high-grading was practised to maintain the percentage of smaller legal-sized crabs below an established 'tolerance limit'. The implications of high discard mortality associated with intense fishing during

the soft-shell season were also discussed. It was noted that soft-shelled crab is prevalent throughout much of the fishing season and it varies considerably among areas.

Shrimp:

Reference

- Local estimation of probability distribution and how it changes. WP SF 98/7 by G. Evans

Summary

This paper was tabled for information only. There was no presentation and no discussion.

Reference

- A Monte Carlo approach to possible levels of shrimp abundance. WP SF 98/8 by G. Evans

Summary

This paper discussed the fact that catches vary over time due to shrimp movements, therefore, one should not think in terms of shrimp concentrations at a point rather one should think in terms of probability distributions at each point. Thus the proposed method derives the whole probability distribution for shrimp abundance/ biomass at any point for which bottom depth is known. The initial step is to set up a network of triangles. The vertices of each triangle are latitudes and longitudes of known depth. These locations are accumulated from several years of catch/ set records. The expected abundance/ biomass for the distribution at every vertex is computed from trawl survey data and bilinear interpolation is used to estimate a density within each triangle. The sum of these values is an estimate of the expected abundance/ biomass of shrimp within the study area. Monte Carlo simulations are then obtained through resampling the probability distribution estimated for each point. An ensemble of 100 such estimates provides a probability distribution for the abundance/ biomass. The results from this method are similar to those provided by STRAP, with the exception that Monte Carlo simulations ensure that negative estimates, due to anomalous catches, are avoided.

Discussion

It was noted that the 'spatial averaging' utilized in this approach resulted in narrower confidence intervals than did STRAP, but the sampling resolution remains a concern with respect to defining areas of high (and low) density. It was suggested that one approach to improving such delineation might be to define 'nearby' points for triangulation by depth rather than spatial co-ordinates. Possibly the median would be a better biomass index than the point estimate. Additionally, comparisons should be made with Steve Smith's bootstrap adaptation to the strap programs.

Reference

- Trends in spring and winter research CPUE of shrimp in Hawke Channel, 1994-1999. WP SF 98/9 by G.A. Rose and W. Hiscock

Summary

This paper discussed the results of seven hydroacoustic research surveys in Hawke Channel, with emphasis on analyses of data on shrimp. Shrimp were detected using a calibrated 38 kHz echosounder. The CPUE data indicated that biomass was greatest in the 250 – 450 m depth zone and that shrimp in Hawke Channel achieved maximum densities in 1996 and have since declined.

Discussion

The fishing sets were made upon 5 different classes of fish with no attempt at random sampling. When one looks at the so-called "Hot Zone" of 250 – 450 m the general trend is that of increasing shrimp CPUE for the years 1994 – 1996 then a decrease until 1998. It was noted that, within the areas sampled, other abundance/ biomass indices did follow the trend suggested here, however, the 1996 – 1998 declines were not due to fewer shrimp but were the result of changes in geographic distribution of shrimp. It was concluded that this study should be used as an indication of possible trends rather than as an index.

Reference

- Assessments of northern shrimp (*Pandalus borealis*) resources off eastern Newfoundland and Labrador. Hawke + Division 3K SFA 6. WP SF 98/10 by D.G. Parsons and P.J. Veitch

Summary

Catches in SFA 6 increased from about 11,000 tons during 1994 - 1996 to 21,000 in 1997 and 46,000 in 1998 due to TAC increases. TAC's have been reached each year since 1988. Effort increased from 1996 to 1998 with the large increase in TAC. New effort was primarily due to vessels < 65 feet. Some double trawling has been reported from the area (about 5% of offshore effort in 1997). CPUE increased for the offshore fleet up to 1996 and has remained at a high level (> 2000 kg/hr) since then. The inshore sector, including inexperienced fishers, had high catch rates when the fishery by vessels <65' began in 1997.

Biomass/abundance indices from research trawl surveys averaged about 400,000 tons/90 billion animals (lower 95% confidence intervals) during the 1996 - 1998 period. Results suggest that female abundance should be maintained in the short term (1999 and 2000) by the continued recruitment of the 1993 and 1994 year classes but recruitment of males will likely decline, beginning in 1999 and continuing into the next millennium. The ratio of nominal catch to survey biomass index (lower confidence intervals) has been less than 12% for the past 3 years. Catchability of the survey gear is believed to be <1 and, therefore, the exploitation rate likely has been <12%.

Current resource status is favourable with high biomass/abundance of male and female components but the available information suggests a decline in future recruitment is likely.

Discussion

There was an indication that windows were used for certain sets to ensure that catches were not greater than the capability of the factory deck. This was not noted in the vessel logs and therefore not taken into account when calculating CPUEs. This means that the current CPUEs may be underestimated.

The apparent southward shift in distribution, out of Hawke Channel, was discussed. It was suggested that there appears to have been an expansion, followed by contraction during 1995-1998. It was also noted that an apparent recent shift of distribution toward the warmer slope area in recent warm years does not seem to be consistent with shrimp preference for low temperatures. Possible causes for the apparent production of weaker year classes since 1993 were also discussed. Environmental variation was considered as a causal factor given that predation and spawning biomass could not be implicated. Industry perceptions of early spawning and prevalence of small shrimp in 1998 could not be corroborated. There was much discussion of the incidence of dumping and high grading. This practise is believed to occur in both the inshore and offshore fishery, but to be more common inshore due to the limited observer coverage.

It was noted that the length frequency plots were derived using STRAP estimates and wondered if Evans' Monte Carlo method would produce similar results. Thus, Evan's method should be expanded to include analyses by length class.

It was concluded that further increases in TAC were probably not sustainable.

The 'traffic light' spreadsheet should be changed by moving CPUE (kg/hr), effort and by-catch to a new category referred to as fishery. The interpretations and evaluations would be removed from these rows.

Reference

- Assessments of northern shrimp (*Pandalus borealis*) resources off eastern Newfoundland and Labrador. Hopedale + Cartwright SFA 5. WP SF 98/11 by D.G. Parsons and P.J. Veitch

Summary

Catches in SFA 5 increased from about 7500 tons during 1994-96 to 15,000 in 1997 and 14,000 in 1998 due to TAC increases within the 1997-1999 management plan. TAC's have been reached each year since 1986. Effort increased in 1997/98 with the large increase in TAC. New effort was primarily due to offshore vessels. There was some indication of double trawling, especially in 1997 (about 10% of total effort). CPUE increased for offshore fleet during the 1990's. There was no significant difference between 1997 and 1998 estimates (about 1400 kg/hr).

Mean biomass/abundance indices from 1996 - 98 estimated from research trawl surveys showed a decline but the variance was high (confidence limits up to $\pm 100\%$). The high estimates in 1996 were "driven" by two only observations. Therefore, trend in biomass/abundance is unknown. The ratio of nominal catch to survey biomass index (lower confidence interval) has been less than 40% for the past three years. The high ratio is more a reflection of the uncertainty in the survey estimates than a reliable estimation of exploitation. The exploitation rate is unknown.

Current resource status appears favourable from fishery data but is uncertain from survey data. Available information suggests that, similar to SFA 6, a decline in future recruitment is possible.

Discussion

The negative relationship between temperature and age 0-2 shrimp was discussed. It was suggested that lagged relationships be explored with temperature averaged over 3-year periods, and that relationships be presented to depict temporal trends. It was noted that relationships are also apparent when the data are broken out by age class but the current growth model can no longer be applied to this area because of recent changes in growth, maturation and apparent immigration of shrimp from Hawke Channel + Div. 3K.

There was also discussion of the survey limitations in this area, particularly in the northern portion. It was noted that the problem is reflected by the occurrence of occasional very large catches (most evident in 1996). Although survey coverage was revised for 1997 to focus more on deeper strata, it was noted that strata would have to be redefined with narrower depth ranges to further improve coverage. It was noted that very large sets do not usually affect size compositions but that future efforts should examine spatial distribution by size. It was suggested that the effects of very large catches on size composition be compared using STRAP and Monte Carlo methods, as part of evaluation of the relative suitability of those methods.

Reference

- Assessments of northern shrimp (*Pandalus borealis*) resources off eastern Newfoundland and Labrador. Division 2G SFA 4. WP SF 98/12 by D.G. Parsons and P.J. Veitch

Summary

Catches in SFA 4 increased from about 5200 tons during 1995-97 to 8100 in 1998 due to TAC increase. TAC's have been reached each year since 1988. Some *P. montagui* occur in catches taken in the northwest. Effort increased from 1994 to 1996 and has fluctuated since. There was some indication of double trawling in 1997 and 1998 but the extent has not been quantified. CPUE has fluctuated about a mean level of 2300 kg/hr since 1991.

Mean biomass indices in 1996 and 1997 were about 70,000 and 80,000 tons but confidence intervals were wide ($\pm 85\%$). Abundance estimates also were imprecise. No survey was completed in 1998. The ratio of nominal catch to survey biomass indices

(lower confidence interval) was less than 45% in 1996 and 1997. Similar to the situation in SFA 5, the high ratio is a reflection of the uncertainty in the survey estimates. Exploitation rate is unknown.

Although fishery data indicate continued high catch rates of female shrimp in 1998, current status is uncertain in the absence of a trawl survey. Future prospects also are uncertain.

Discussion

There was considerable debate regarding the relative value of fishery data, as a basis for providing advice, when no research data are available. One argument was that fishery data should be more heavily relied upon for areas where no survey data are available than for areas for which there are survey data. The more widely supported argument was that absence of fishery-independent data represents no basis for increased confidence in fishery data.

Reference

- Assessments of northern shrimp (*Pandalus borealis*) resources off eastern Newfoundland and Labrador. Division OB SFA 2. WP SF 98/13 by D.G. Parsons and P.J. Veitch

Summary

Catches in SFA 2 increased from about 3200 tons in 1996 to 5200 in 1997 and 1998 due to TAC increase. TAC's have been reached only since 1985. Catches are mixed extensively with *P. montagui* in the southwest. Effort increased since 1993 but the "target species" is, at times, uncertain. There was some indication of double trawling in 1997 and 1998 but the extent has not been quantified. CPUE increased since 1994 to about 1700 kg/hr with concentration of activity in the southwest. The mixed fishery introduces uncertainty in the CPUE index as an indicator of trend in stock size for either species.

No biomass indices are available for this area. The exploitation rate is unknown. Current status is uncertain in the absence of trawl surveys. Future prospects also are unknown.

Discussion

Much of the discussion centred on industry's perspective that CPUE has increased in the past 2 years, that the TAC should be increased. It was recommended that additional catch be taken in an area north of 63 N.

A problem of accuracy of reporting by species was discussed. It was suggested that it is not clear whether this actually represents a reporting problem, or error in keypunching.

It was noted that there will be a Greenland - Nunavut groundfish survey in Davis Strait during the summer of 1999. We will have to determine if the survey will provide shrimp abundance/ biomass indices.

Reference

- Assessments of northern shrimp off Baffin Island, Labrador and northeastern Newfoundland (SFA's 2, 4, 5, and 6) summary. WP SF 98/14 by D.G. Parsons and P.J. Veitch

Summary

This working paper provided 'traffic-light' spreadsheets, summarizing the details provided in the documents described above. A single spreadsheet comparing all four areas in 1998 was included, illustrating the increasing uncertainty in resource indicators from south to north.

Discussion

Considerable discussion revolved around the most appropriate way to present the information following this approach, as well as what information to actually include. It was agreed that the use of the 'traffic light' approach is valuable.

Icelandic Scallops:

Reference

- Strait of Belle Isle (4R) Scallop Fishery, 1998. WP SF 99/15 by K.S. Naidu.
- Where in 4R is the alleged recruitment to Scallop aggregations? WP SF 99/16 by K.S. Naidu, F.M. Cahill and E.M. Seward.

Summary

Based on two research vessel surveys, one each in 1995 and 1997, Science has expressed concerns regarding the absence of significant recruitment events in the Strait of Belle Isle. This has been corroborated by limited onboard observations in 1998 on two commercial vessels. Science participated in two commercial excursions to sample the catch. Only 1.2% of scallops sampled produced scallops measuring less than 60 mm and contributed to less than 0.5% of the total round weight taken. Whereas these observations were from an aggregation to the south and somewhat limited in scope, the research vessel data had been assembled from a much larger area covering some 611 sq. mi.

Discussion

Much discussion centred on industry's argument that there has been recent recruitment. It was noted that a small peak in the size frequency at about 65 mm might represent recruitment. However, fishers picked small scallops (<60 mm) from multiple commercial sets in an attempt to demonstrate recruitment. There was debate regarding where the burden of proof for this issue should reside. The conclusions were unclear but it was noted that there is a great deal of mutual distrust between DFO scientists and fishermen. The Area Manager (W. Bruce) acknowledged that there is no evidence of substantial recruitment but that commercial sampling was limited. Increased observer coverage with

extensive sampling of the unsorted catch was recommended to investigate the alleged good recruitment. It was indicated that the RDG made a commitment to conduct a research survey into 4R during 1999. The main thrust of the survey is to reconcile the difference in opinion between fishers and scientists as to whether there is substantial recruitment.

It was noted that, since the 1980's, fishers have been removing scallops and then dumping the shells on land or, more recently, a few miles from shore. Since scallop larvae prefer to settle on scallop shells, this removal of shell stock must have a deleterious effect upon scallop recruitment. Therefore, shells should be returned to the fishing beds.

It was noted that 1998 CPUE was similar to that of 1994. This was attributed to the high mobility of the fleet hence CPUE does not reflect resource status. The fact that the exploitation area has decreased, such that only an area in the south can support viable catch rates, indicates that the resource is being depleted. The number of vessels not utilizing scallop licenses, and targeting other fisheries, have increased, also reflecting resource decline. The apparent trend of increasing CPUE with decreasing vessel size could not be explained but it implies that changes in fleet composition introduce bias into annual CPUE indices. It was noted that it is very difficult to standardize CPUE for such effects and so CPUE is summarized by fleet sector. Monitoring CPUE on a 'days per trip' basis was noted to be inappropriate because it does not account for variability among trips in number of days actually fished.

The basis for the management target of 10% exploitation of the mean survey biomass estimate was discussed. This target level was derived from Iceland and accounts for indirect fishing mortality. However the 4R fishery is prosecuted on harder substrate than in Iceland, implying that total loss due to the fishery in 4R may exceed 10% by an unknown quantity. The concept of establishing refugia was felt to be a viable concept from a science perspective, especially in an area such as 4R, where multiple relatively distinct aggregations exist.

Reference

- Conversion factors: a can of worms. WP SF 99/17 by K.S. Naidu, F.M. Cahill, and E.M. Seward

Summary

Factors affecting meat yield in Iceland scallop were discussed in detail. The accumulated information on yields and corresponding conversion factors to estimate round weights from meat weights for the various aggregations from Newfoundland were reviewed. It is evident that yields and resultant conversion factors vary from one area to another. In addition to this spatial variation, there are seasonal changes and sometimes temporal changes reflecting changes in productivity. Epibiont load and losses in yield through rapid manual shucking also affect yields realized.

Using such data as were then available (1990's), mostly from St. Pierre Bank and to a lesser extent from 4R, Science had recommended a conversion factor of 9.2 to convert

meat weights (landed product) to weights round. In Newfoundland, TAC's for Iceland scallop are provided in round weights. The need to revisit the conversion factor became necessary in order to address claims that higher yields are being realized by the small proportion of fishers in 4R who choose to land whole scallops for land-based shucking. To address this seeming disparity, fishery officers on the west coast had conducted a study. The independent study had concluded that based on an average yield of 13.1% the conversion factor to estimate round weight from meat weight to be 7.6%. In fact, this lower conversion factor allowed additional volumes to be taken, in part accounting for the overrun on the TAC. On closer inspection of the sampling protocols it was determined that scallop yields had been computed from scallops long held out of water (drained scallops). Typically, scallops lose approximately 20% of their weight within 12 hrs of capture when held out of water. It was determined that round weights computed from yields based on freshly caught scallops better reflected removals in weights round.

Discussion

The difference between the existing conversion factor (9.2) and one recently derived by fishery officers (7.6) was attributed to draining of fluids in deriving the smaller estimate. It was noted that the established estimate of 9.2, from undrained scallops was more appropriate for applying to fresh-caught scallops. It was also noted that weight loss is known to be about 20% when scallops are left to drain for a day, and this represents the difference between the two estimates. It was also noted that the 9.2 estimate favours industry in that it is based on 100% meat recovery and it is lower than area-specific estimates.

Reference

- Icelandic Scallop Fishery, 1998. NAFO div. 3LNOPs. WP SF 99/18?? By K.S. Naidu

Summary

The Newfoundland fishery (1998) for Iceland scallop in three management areas was summarized. These include the Strait of Belle Isle (NAFO Div. 4R), Grand Bank (NAFO Div. 3LNO), and St. Pierre Bank (NAFO Subdiv. 3Ps).

Overall landings in 1998 have declined by some 45% (6,162 t versus 11,210 t round). By area, the declines were: -60% (3LNO); -50% (3Ps). In the Strait of Belle Isle a 16% overrun on the TAC was recorded. Nominal catch from the Labrador in 1998 increased to 1,190 t from 653 t in 1997.

Effort diversion into other species (especially shrimp and crab) notwithstanding, there appears to be a pattern of sequential depletion of scallop beds throughout. Pre-emptive catch limits for areas for which there is no scientific information are generally high.

The trans-boundary stock of Iceland scallops continues to be plagued by starfish. Estimated biomass here has plummeted to about 10% of the levels recorded in 1992. There was no directed fishery in these aggregations.

Discussion

There is no new scientific information except in 3Ps. The scallop surveys completed off Labrador by the province were of poor quality. The trends in 3LNO and 3NF (off the edge of the Grand Banks) are toward smaller scallops. This trend results from too much effort being applied in eastern Newfoundland scallop fishery.

It was noted that consideration should be given to bringing TAC's in line with recent catches because otherwise the incentive exists to strive to maximize catches so as to rationalize high TAC's.

APPENDIX I

List of Attendees

CRAB RAP - 1999

NAME	AFFILIATION	PHONE #	FAX #	E-MAIL
Campbell, Scott	DFO-Science	(709) 772-2000	(709) 772-4105	campbell@athena.nwafc.nf.ca
Dooley, Tom	DFA	(709) 729-0335	(709) 729-0335	tdooley@mail.gov.nf.ca
Morgan, Joanne	DFO-Science	(709) 772-2261	(709) 772-4188	morgan@athena.nwafc.nf.ca
Baird, James A.	DFO-Fish. Mgmt.	(709) 772-4497	(709) 772-3628	bairdj@dfo-mpo.gc.a
Dawe, Earl	DFO-Science	(709) 772-2076	(709) 772-4105	Dawe@athena.nwafc.nf.ca
Ennis, Jerry	DFO-Science	(709) 772-2094	(709) 772-4105	ennisg@athena.nwafc.nf.ca
Parsons, Don	DFO-Science	(709) 772-2093	(709) 772-4105	parsons@athena.nwafc.nf.ca
Drew, Joseph	DFO-Science	(709) 772-6014	(709) 772-4105	drew@athena.nwafc.nf.ca
Beck, Paul	DFO-Science	(709) 772-4652	(709) 772-4105	beck@athena.nwafc.nf.ca
Naidu, Sam	DFO-Science	(709) 772-2091	(709) 772-4105	naidu@athena.nwafc.nf.ca
Taylor, Dave	DFO-Science	(709) 772-2077	(709) 772-4105	taylor@athena.nwafc.nf.ca
Colbourne, Eugene	DFO-Science	(709) 772-6106	(709) 772-5315	eugene@sunny.nwafc.nf.ca
O'Reilly, Allister	FANL	(709) 726-7223	(709) 754-3339	aoreilly@nfld.com
Butler, Ross	FPIL	(709) 570-0431	(709) 570-0436	rbutler@nfld.com

SHRIMP RAP - 1999

NAME	AFFILIATION	PHONE #	FAX #	E-MAIL
Campbell, Scott	DFO-Science	(709) 772-2000	(709) 772-4105	campbell@athena.nwafc.nf.ca
Dawe, Earl	DFO-Science	(709) 772-2076	(709) 772-4105	dawe@athena.nwafc.nf.ca
Orr, Dave	DFO-Science	(709) 772-0563	(709) 772-4105	orr@athena.nwafc.nf.ca
Drew, Joseph	DFO-Science	(709) 772-6014	(709) 772-4105	drew@athena.nwafc.nf.ca
Dooley, Tom	DFA	(709) 729-0335	(709) 729-6082	tdooley@mail.gov.nf.ca
Sullivan, Darren	DFO-Science	(709) 772-4622	(709) 772-4105	sullivan@athena.nwafc.nf.ca
Ennis, Jerry	DFO-Science	(709) 772-2094	(709) 772-4105	ennisg@athena.nwafc.nf.ca
Stansbury, Don	DFO-Science	(709) 772-0559	(709) 772-4188	stansbury@athena.nwafc.nf.ca
Veitch, Pat	DFO-Science	(709) 772-4562	(709) 772-4105	veitch@athena.nwafc.nf.ca
Naidu, Sam	DFO-Science	(709) 772-2091	(709) 772-4105	naidu@athena.nwafc.nf.ca
O'Reilly, Allister	FANL	(709) 726-7223	(709) 754-3339	aoreilly@nfld.com
Angel, John	CAPP	(902) 826-7765	(902) 826-7065	jangel@NAVNET.NET
Farrell, Joe	FPI	(709) 745-1936	(709) 745-4283	jarrell@nfld.com
Pezzack, Doug	FRB-Ottawa	(613) 990-0235	(613) 990-0807	pezzackdo@dfo-mpo.gc.ca
Parsons, Don	DFO-Science	(709) 772-2093	(709) 772-4105	parsons@athena.nwafc.nf.ca
Coombs, Rob	DFO-Res. Mgmt.	(709) 772-4653	(709) 772-3628	coombsr@dfo-mpo.gc.ca
Evans, Geoff	DFO-Science	(709) 772-2090	(709) 772-4105	evans@sunny.nwafc.nf.ca

SCALLOP RAP -1999

NAME	AFFILIATION	PHONE #	FAX #	E-MAIL
Dawe, Earl	DFO-Science	(709) 772-2076	(709) 772-4105	dawe@athena.nwafc.nf.ca
Orr, Dave	DFO-Science	(709) 772-0563	(709) 772-4105	orr@athena.nwafc.nf.ca
Pezzack, Doug	DFO-Ottawa	(613) 990-0285	(613) 990-0807	pezzackdo@dfo-mpo.gc.ca
Seward, Elaine	DFO-Science	(709) 772-4562	(709) 772-4105	seward@athena.nwafc.nf.ca
Sullivan, Darren	DFO-Science	(709) 772-6014	(709) 772-4105	sullivanda@athena.nwafc.nf.ca
Emmis, Jerry	DFO-Science	(709) 772-2094	(709) 772-4105	ennisg@athena.nwafc.nf.ca
Morgan, Joanne	DFO-Science	(709) 772-2261	(709) 772-4188	morgan@athena.nwafc.nf.ca
Collins, Patricia	DFO-Stats.	(709) 772-2573	(709) 772-5634	collinsp@dfo-mpo-gc.ca
Kulka, Dave	DFO-Science	(709) 772-2064	(709) 772-4188	kulka@athena.nwafc.nf.ca
Bruce, Willie	DFO-Fish. Mgmt.	(709) 637-4333	(709) 637-4445	brucew@dfo-mpo.gc.ca
Cahill, Frank	DFO-Science	(709) 772-4877	(709) 772-4105	cahill@athena.nwafc.nf.ca
Parsons, Don	DFO-Science	(709) 772-2093	(709) 772-4105	parsons@athena.nwafc.nf.ca
Naidu, Sam	DFO-Science	(709) 772-2091	(709) 772-4105	naidu@athena.nwafc.nf.ca
Campbell, Scott	DFO-Science	(709) 772-2000	(709) 772-4105	campbell@athena.nwafc.nf.ca
Taylor, Dave	DFO-Science	(709) 772-2077	(709) 772-4105	taylor@athena.nwafc.nf.ca

APPENDIX II

Northern shrimp (*Pandalus borealis*) resources from Division 0B to 3K – an interim review

Introduction

TAC's for northern shrimp were increased in 1998 in two of four management areas: Div. 2G (SFA 4) from 5,200 to 8,320 tons; and Hawke + 3K (SFA 6) from 23,100 to 46,200 tons. The current review, within the three-year (1997 - 1999) management plan, examined the most recent commercial fishery and research survey data to update stock status and determine whether changes in TAC's should be considered for 1999, the final year of the multi-year plan.

Background

Assessments are based on comparing catch rates in the commercial fishery, biomass estimates from research surveys and biological sampling data from both sources over many years as indicators of stock conditions and how they are changing. Uncertainty increases from south to north but is hard to quantify. Shrimp distribution is widespread throughout the Hawke Channel + 3K area and both the catch rate and research biomass indices are believed to be reliable indicators of stock status. The distribution becomes more patchy farther north, increasing the variance associated with the indicators. Div. 0B illustrates the extreme situation where commercial CPUE's are not considered representative of changes in the resource and no research survey data exist. TAC's in this area are purely "experimental" with no biological basis.

Results

General

The TAC's were taken in all areas in 1998. Resource abundance remained high throughout the survey area (Divisions 2HJ3K) with healthy spawning (female) and recruitment (male) components. However, stock size indices in the Hopedale + Cartwright area were less precise than those for Hawke + Div. 3K and, therefore, trend in the former area was uncertain. The fishery for "inshore" vessels, initiated in 1997, was expanded in 1998.

Hawke Channel + Division 3K (SFA 6)

Catch rates increased substantially from 1989 to 1996 and remained relatively stable at a high level in 1997 and 1998. Research survey biomass indices were similar in 1996, 1997 and 1998. These observations indicate that abundance is no longer increasing in this area. Research data further suggest that the 1995 and 1996 year classes are weaker than those of 1993 and 1994.

The resource in this area is currently healthy with high abundance of males and females but prospects for future recruitment are uncertain. Considering the latter,

it is uncertain whether the current TAC (46,200 tons) or an increased TAC can be sustained.

Hopedale+Cartwright Channels (SFA 5)

Research surveys from 1996 to 1998 produced indices of biomass/abundance with wide confidence intervals and trend in the stock could not be determined. Research sampling data indicated that the 1995 and 1996 year classes are weaker than those of 1993 and 1994. Catch rates from the fishery increased through the 1990's, stabilizing at a high level in 1997 and 1998.

Current status is uncertain based on the research survey data but appears favourable from the fishery data. A future decline in recruitment is possible. There is no scientific basis for a change in the TAC of 15,300 tons.

Division 2G (SFA 4)

No trawl survey was completed in 1998. Biomass/abundance indices from 1996 and 1997 were imprecise with wide confidence intervals and trend in the stock is uncertain. Commercial catch rates fluctuated at a high level during the 1990's indicating stability in the resource.

Both current status and future prospects are uncertain. There is no scientific basis for a change in the TAC of 8320 tons.

Division 0B (SFA 2)

Knowledge of the biology, distribution and abundance of shrimp off Baffin Island is lacking in the absence of a time series of research trawl surveys. Over the past three years, most of the effort has been directed towards dense concentrations of *P. borealis/montagui* south of 63° N. Fishery data alone cannot be interpreted as an indication of trend in the stock.

The TAC for *P. borealis* should be maintained at 5,250 tons in 1999 and applied to the southern area. An experimental fishery could be considered for the area north of 63° N which has not been fished since 1996.

BRIEFING NOTE

ISSUE:

Status of northern shrimp (*Pandalus borealis*) off Newfoundland and Labrador

BACKGROUND:

- The interim, regional review of northern shrimp resources in four management areas was held during February 23 - 26, 1999. The meeting included industry representatives.
- The assessment included data from the commercial fishery in 1998 and previous years and research trawl survey data from 1995 to 1998.

CURRENT STATUS:

- Hawke Channel + Division 3K (SFA 6)

Catch rates increased substantially from 1989 to 1996 and remained relatively stable at a high level in 1997 and 1998. Research survey biomass indices were similar in 1996, 1997 and 1998. These observations indicate that abundance is no longer increasing in this area. Research data further suggest that the 1995 and 1996 year classes are weaker than those of 1993 and 1994.

The resource in this area is currently healthy with high abundance of males and females but prospects for future recruitment are uncertain. Considering the latter, it is uncertain whether the current or an increased TAC can be sustained.

- Hopedale+Cartwright Channels (SFA 5)

Research surveys from 1996 to 1998 produced indices of biomass/abundance with wide confidence intervals and trends in the stock could not be determined. Research sampling data indicated that the 1995 and 1996 year classes are weaker than those of 1993 and 1994. Catch rates from the fishery increased through the 1990's, stabilizing at a high level in 1997 and 1998.

Current status is uncertain based on the research survey data but appears favourable from the fishery data. A future decline in recruitment is possible. There is no scientific basis for a change in the TAC of 15,300 tons.

- Division 2G (SFA 4)

No trawl survey was completed in 1998. Biomass/abundance indices from 1996 and 1997 were imprecise with wide confidence intervals and stock size is uncertain. Commercial catch rates fluctuated at a high level during the 1990's indicating stability in the resource.

Both current status and future prospects are uncertain. There is no scientific basis for a change in the TAC of 8320 tons.

Division 0B (SFA 2)

Knowledge of the biology, distribution and abundance of shrimp off Baffin Island is lacking in the absence of a time series of research trawl surveys. Over the past three years, most of the effort has been directed towards dense concentrations of *P. borealis/montagui* south of 63° N. Fishery data alone cannot be interpreted as an indication of trend in the stock.

The TAC for *P. borealis* in the southern area should be maintained at 5,250 tons in 1999 while the experimental fishery could be applied to the area north of 63° N which has not been fished since 1996.

APPENDIX III

THE 1998 SCALLOP FISHERY - AN INTERIM REPORT

The Newfoundland regional review of Iceland scallop resources was held February 23, 1999. Reviews of the resource were completed for three management areas (Strait of Belle Isle [NAFO Div. 4R], Grand Bank [Div. 3LNO] and St. Pierre Bank [Subdiv. 3Ps]). Formal assessments were not undertaken because the fishery is in the second of a 3-year management plan. Instead, summaries of updated information were examined. In addition, information concerning issues raised by 4R stakeholders in 1998 pertaining to (a) recruitment, (b) effort distribution, (c) catch rates and (d) conversion factors to estimate whole round weights from meats were reviewed.

Overall landings from Newfoundland in 1998 have declined 45% from the previous year(6,162 vs. 11,210 t, round).

NAFO Div. 3LNO (Grand Bank)*The 1998 Fishery*

Removals in 1998 dropped by 67% (3,986 to 1310 t). The number of vessels prosecuting the fishery declined by 60%(52 to 21) due to diversion of effort towards shrimp. Most (86%) of the catch came from Div. 3N where 83% of the total effort had been directed.

The nominal catch (777 t) from the aggregations around the Lilly Canyon and Carson Canyon fell short of the TAC by 14%. Also, catch rates have declined by approximately 10% in each of the last three years. The trend towards smaller meats (i.e. high meat counts) continued into 1998.

Catches from 3Nf continued declining from the record set in its first year (1996). Again, the nominal catch fell short of the catch limit for the area (164t out of 400 t). Here, too, there is a dominance of small meats.

NAFO Subdiv.3Ps (St. Pierre Bank)*The 1998 Fishery*

Catches dropped by nearly 50% from 1997 (2,763 t vs. 5,245 t). Record declines (1,321 to 13 t or -99%) were evident in the eastern aggregation first fished in 1997. Declines were not as severe (1,497 to 508 t or -66%) to the west but catch rates were halved. Near-shore aggregations off Perch Rocks/Cape St. Mary's also recorded a decline (1,197 to 842 t or -30%), but catch rates have remained the same (~52 kg/tow) , suggesting that vessels had moved around to fish newly-discovered aggregations.

Canada/France Transboundary Area

Scallop aggregations within the transboundary area continue to be plagued by starfish. The most recent (1998) survey points to a biomass that is only 10% of

that estimated in 1992. There was no directed fishing effort in this area. The prognosis continues to be poor.

NAFO Div. 4R (Strait of Belle Isle)

The need to revisit the science within the plan became necessary because of the divergent views between stakeholders and Science. Among the issues raised by fishers, two required immediate attention: (a) recruitment and (b) the conversion factor used to estimate round (whole) weights from meat weights. Other concerns included reports of record catch rates in 1998 and perceptions that the fishing effort was widely distributed and indicative of resource availability.

The 1998 Fishery

Although a 1998 catch limit of 930 t round had been adopted for this fishery, a mid-season adjustment permitted additional removals estimated at 380 t bringing the total to 1310 t. Catch rates remained unchanged from 1997. However, the majority of the catch (94%) came from a limited southern portion of the fishing area.

Recruitment

Scallops here consist primarily of old animals with a modal size of 90 mm. As elsewhere, a few, sometimes well-separated, age cohorts drive this fishery. In 1998, based on results from two research vessel surveys, one each in 1995 and 1997. Science raised concerns about the recent lack of significant recruitment in this area.

In 1998, fishers indicated that small scallops were in fact abundant and that poor prices discouraged their harvesting and landing. In order to support their perspective, representatives invited Science to participate in fishing missions onboard two commercial vessels. Detailed sampling of the catches at sea did not indicate the presence of small scallops. Only eight scallops (out of 855) measuring less than 60 mm were caught and contributed less than 0.5% of the total round weight taken. Whereas these observations were spatially restricted and limited in scope, the research vessel data in 1995 and 1997 had been assembled from a much larger area (~611 sq. mi.). At present there is no evidence in support of good recruitment in 4R.

While shucking of scallops at sea is now the norm in this fishery, shellstocking (landing round scallops in the shell) was the common practice in earlier years. The removal of large quantities of shells, which constitute a preferred settlement substrate for scallop larvae, may have played a role in poor settlement over a number of years. This in turn may have contributed to several consecutive years of poor recruitment. Also, it has been hypothesized that fishing activity itself may inflict collateral damage to young, recently settled scallops.

Shucking scallops at sea and redistributing shells over scallop beds is widely thought to confer ecological benefits to the resource. Consequently, it is **recommended** that shellstocking be prohibited in this fishery in order to assist in resource rehabilitation.

Conversion Factors

The conversion factor of 9.2 currently used throughout the Newfoundland Region was derived in the early 1990's using data from fresh-caught scallops, mostly from St. Pierre Bank and to a lesser extent from the Strait of Belle Isle.

A number of items must be considered when estimating round weight from meat weight. A myriad of factors, including reproductive state, handling methods (including the duration scallops are held out of water) and shucking efficiency affect overall yield. On average, approximately 20% of the "meat" from Iceland scallop is lost during rapid manual shucking at sea. Since TAC's are based on biological yield (what is available) rather than commercial yield (what is recovered), Science had factored these considerations in deriving conversion factors.

Commercial yield from scallops long held out of water is approximately 20% higher than that estimated using fresh scallops.

Using the conversion factor of 9.2, it was determined that the 1998 catch limit of 930 t had been reached at the end of August 1998. It was at this point that fishers argued that the conversion factor employed to convert meat weights to round was flawed and requested that it be revisited. In response, Fishery Officers conducted a study that resulted in an estimated factor of 7.6. Application of this revised estimate allowed fishers to harvest an additional 380 t.

Further examination of the protocols applied in the 1998 study by the Fishery Officers indicated that the scallops had been held out of water for approximately 12 hours prior to shucking and weight determination. Application of the 20% weight loss due to fluid drainage in order to adjust for the lag in analysis time resulted in a revised conversion factor not significantly different from the original 9.2 value based on fresh round weights.

Since biomass estimates and TAC's are based on fresh round weights, it is **recommended** that the original conversion factor of 9.2 be re-instated in 4R to convert meat weight to round weight.

Catch Rates and Distribution of Fishing Effort in 1998

Fishers argued that catch rates in 1998 were among the highest in some twenty years and that fishing was distributed over a much larger area than previous years. Information extracted from the 1998 logbooks, however, does not support these claims. In fact, estimated mean catch rate in 1998 remained unchanged from 1997 (74 vs. 75 lb/tow) and the 1998 fishery took place in a relatively small area compared to previous years.

Management Considerations

Because of the existence of numerous well separated aggregations the Strait of Belle Isle is particularly amenable to an experimental strategy to investigate scallop recruitment dynamics. Establishing refugia here may assist in the rebuilding of the stock. While fishers supported this idea in 1998, they failed to

carry out agreed-to initiatives in setting out spat collectors (to estimate reproductive success).

Labrador

The 1998 Fishery

Inshore aggregations along the Labrador coast attracted increased attention over the last couple of years. The nominal catch has increased from 653 t to 782 t round.

Assessment

There is no scientific information on the scallop resources in the inshore Labrador area.

Shucking of scallops takes place on shore and may have a detrimental effect on recruitment success in the area.

Overall Management Perspectives

Fishing effort has been disproportionately high relative to the known resource base.

Strong recruitment in Iceland scallop populations tends to occur sporadically between which it is generally low or negligible. Combined with very slow growth, this means that annual exploitation rate within an aggregation has to be low to be sustainable over the long term.

The general management objective has been to achieve sustainability through a strategy of 10% exploitation of the mean research vessel biomass estimates. However, because of the interaction of the fishing gear used with the hard bottom found in Newfoundland waters, it is believed that there is considerable additional and unaccounted mortality which occurs as a result of fishing itself. Exploitation has been substantially higher than the target and has resulted in significant depletion of localized aggregations over very short time periods. When faced with depletion in one area, the fleet normally moves on to other aggregations, often newly discovered. This pattern of sequential depletion results in a form of 'pulse' fishing.

It is anticipated that newly-discovered aggregations will decline as most of the suitable habitat has now been explored.

From a biological perspective, there is probably no reason why a 'pulse' fishery could not be an alternative management strategy. The key would be to maintain a balance between the number/size of commercially attractive aggregations along with a pattern of exploitation that would allow individual aggregations to be left unfished long enough to fully recover.

The alternative would be periodic long-term fishery closures.

The long-term management strategy for this resource should be re-evaluated through dialogue among Science, Management and stakeholders. Stakeholders

should be fully apprised of the consequences of the current management strategy for the resource.

BRIEFING NOTE

ISSUE: Status of Newfoundland and Labrador Iceland scallop (*Chlamys islandica*)

BACKGROUND

- The Newfoundland regional review of Iceland scallop resources was held February 23, 1999.
- The 1998 fishery in three management areas (Strait of Belle Isle [NAFO Div. 4R], Grand Bank [Div. 3LNO] and St. Pierre Bank [Subdiv. 3Ps]) was reviewed.
- Formal assessments were not undertaken because the fishery is in the second of a 3-year management plan.
- In particular, information provided in 1998 by 4R stakeholders pertaining to (a) recruitment, (b) effort distribution, (c) catch rates and (d) conversion factors to estimate whole round weights from meat weights were reviewed separately.

CURRENT STATUS

- Combined nominal catch from Newfoundland in 1998 declined 45% from the previous year (6,162 t vs. 11,210 t, round).

Divisions 3LNO

- In 1998, the catch of 1310 t represents a decline of 67% from 1997.
- Number of vessels prosecuting the fishery in 1998 declined by 60%.
- Most of the catch (86%) came from Division 3N.
- Areas adjacent the Lilly Canyon and Carson Canyon offshore in Division 3N continue to attract a significant amount of the 3N fishing effort (50% in 1998).
- Catch rates in the Lilly Canyon and Carson Canyon area have declined by 10% in each of the last three years.
- The trend towards higher meat counts (smaller meats) continued into 1998.

Subdivision 3Ps (Canadian Zone)

- The overall 1998 catch dropped by almost 50% compared to the previous year (2763 t vs. 5245 t).
- The greatest decline was from the eastern aggregation first fished in 1997 (-99%).
- Declines were not as severe on the western aggregations (-66%).
- Declines also occurred in the near-shore aggregations off Cape St. Mary's/Perch Rocks (-30%) but catch rates remained unchanged suggesting newly discovered aggregations were fished.

Canada/France Transboundary Area of Subdivision 3Ps

- The scallop beds here continue to be plagued by starfish. The biomass is estimated to be only 10% of what it was in 1992. There continues to be no directed fishery in this area and the prognosis remains poor.

NAFO Div. 4R (Strait of Belle Isle)

- Although a 1998 catch limit of 930 t had been adopted for this fishery, a mid-season review permitted additional removals estimated at 380 t bringing the total harvest to 1310 t. Catch rates remained unchanged from 1997. However, the majority of the catch (94%) came from a limited southern portion of the fishing area.
- Based on research surveys in 1995 and 1997 and 2 trips by Science Branch staff onboard commercial vessels in 1998, there is continued concern about the absence of incoming recruitment into scallop aggregations.
- Claims by fishers that their 1998 catch rates were the highest on record were not supported by the corresponding logbook information.
- Assertions by fishers that the distribution of fishing effort was more widespread in 1998 than in earlier years were not corroborated by logbook information.
- A revised conversion factor developed mid-season (1998) (7.6 versus the prescribed value of 9.2) was based on examination of scallops left out of the water for approximately 12 hours during which time scallops lose about 20% of their original weight due to fluid drainage. This would have the effect of increasing yield and lowering the conversion factor. Thus the factor of 9.2 is more appropriate for conversion to round weight.

Labrador

- Commercial interest in this resource has increased in recent years.
- The catch from inshore aggregations in 1998 increased (+20%) over that of 1997 (782t vs 653 t).
- There is no scientific information available for the resource in the inshore Labrador area.
- Shucking of scallops takes place on shore and shells discarded on land. This may have a detrimental effect on larval settlement and subsequent recruitment.

OVERALL MANAGEMENT PERSPECTIVES

- Fishing effort has been disproportionately high relative to the known resource base.
- Strong recruitment in Iceland scallop populations tends to occur sporadically between which it is generally low or negligible.

- Management target has traditionally been exploitation of the average biomass estimate from research surveys at about 10%.
- Effective exploitation has been higher than 10% since there is unaccounted for incidental mortality caused by the fishing gear on hard bottom. Together with catch mortality, this results in rapid depletion of localized aggregations over short periods and the fleet then moves on to sequentially deplete other aggregations (pulse fishing).
- A 'pulse' type of fishery is not necessarily inappropriate as long as it is carefully managed to allow for appropriate rotation of effort.
- The long-term management strategy for scallops should be re-evaluated through dialogue among Science, Management and stakeholders. Stakeholders should be fully apprised of the consequences of the current management strategy for the resource.