



C S A S

Canadian Science Advisory Secretariat

S C C S

Secrétariat Canadien de Consultation Scientifique

Proceedings Series 2001/29

Série des compte rendus 2001/29

Newfoundland 2001 Shellfish RAP Proceedings

March 6 – 9, 2001

Airport Plaza Hotel, St. John's, Newfoundland

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May 2001

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ABSTRACT

Newfoundland Region conducted assessments of northern shrimp, snow crab and Iceland scallops in March 2001. Summaries of the working papers presented along with ensuing discussion are provided here. Also included as appendices are lists of papers and other documents available to the meeting, participants, and briefing notes prepared following the meeting. Additional information on the resources assessed is available in CSAS research documents and stock status reports.

RÉSUMÉ

La Région de Terre-Neuve a procédé à des évaluations des stocks de crevette nordique, de crabe des neiges et de pétoncle d'Islande en mars 2001. On trouvera dans les présentes des sommaires des documents de travail présentés, ainsi que des discussions subséquentes. On trouvera aussi en annexe une liste des participants, des communications et autres documents disponibles à la rencontre et des notes de synthèse préparées subséquemment. Des renseignements additionnels sur les ressources évaluées sont aussi disponibles dans les documents de recherche et les évaluations des stocks du SCES.

INTRODUCTION/SUMMARY

Regional assessments of northern shrimp (*Pandalus borealis*), snow crab (*Chionoecetes opilio*), and Iceland scallops (*Chlamys islandica*) were conducted March 6 – 9, 2001. 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 2000 in comparison to long term norms was also presented. A list of working papers and other documents available to the meeting is included in Appendix I and a list of meeting participants is included in Appendix II.

For the northern shrimp fishery, 2000 was the first of a 3-year management plan. A review was conducted and an update SSR produced. The briefing note prepared is included in Appendix III. Use of a “traffic light” evaluation of the resource, was continued and included in the SSR. Shrimp continue to be distributed widely throughout Div. 0B to 3K at a high level of abundance.

For the snow crab fishery, 2000 was the second of a 3-year management plan. Survey results indicating a decline in abundance in 1999 triggered a full review and a new SSR. The briefing note prepared is included in Appendix III. Last year use of a “traffic light” evaluation of the resource was continued and included in the SSR. In the 2001 RAP, a review was conducted and a SSR update produced.

For the Iceland scallop fishery, 2000 was the third of a 3-year management plan. A full review was conducted and a new SSR produced. The briefing note prepared is included in Appendix III. There has been very substantial decline in landings associated with resource depletion and diversion of effort onto shrimp and crab.

For additional information on these resources, see references provided in the SSRs, check the CSAS research document series, or consult with authors listed in Appendix I regarding status of documentation.

DOCUMENT SUMMARIES AND RELATED DISCUSSIONS

CRAB

Reference:

WP SF 2001/01 - Assessment of the 2000 Newfoundland and Labrador snow crab fishery by D.M. Taylor, P.G. O'Keefe and P.J. Veitch.

Summary:

Newfoundland and Labrador snow crab landings fell to 56,000t in 1999, a decrease of 19% from the previous year. This decline in landings reflected a perceived decline in available commercial biomass based on the 1999 post-season multi-species trawl survey and TAC reductions imposed by Resource Management Branch in response to them.

The fishery is concentrated along the Northeast and Southeast coasts of the province with a small, inshore fishery, inaugurated in 1995 operating within 25 nautical miles of land. It 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 2000 approximately 3400 licences were issued to Newfoundland and Labrador fishers. Vessels are licensed by NAFO division boundaries and are restricted to fishing snow specific crab management areas within their division and each fishing enterprise is allocated an individual quota for each management area they are entitled to fish. The fishery is on the basis of a 3-year comprehensive management plan.

Assessment of fishery performance for fleet sectors fishing each management area previously relied on analyses of fishers' logbook entries (mandatory for all fleet sectors) as the principal means of comparing a given year's fishery performance to that of the previous fishing season or a time-series of fishery performance data. Analysis of catch/effort data for the 2000 fishery was based solely on data for NAFO Divisions. Information for individual management areas was tabled as an information item at the 2001 RAP session.

Changes in CPUE from one year to the next may not accurately reflect commercial abundance due to influences of such things as environmental effects (water temperature), changes in fishing patterns (soak times and gear configuration) and changes in fishing patterns etc. Comparison of CPUE of recent years and those calculated pre-1996 are 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 101 mm carapace width. This industry policy led to high-grading at sea which presumably artificially reduced CPUE's. Additionally, in recent years fishers, particularly those in NAFO Division 3LNO, increased the mesh size of their traps and have begun to deliberately soak their traps for longer time periods in an

effort to reduce the catch of sub-legal and legal-sized crabs that are less than 102 mm carapace width. These fishing practices may also have reduced commercial CPUE. In previous years onboard handling practices and their probable contribution to discarded crab mortality have been a major concern. While concerns continue as to the survival of discarded crabs SEAWATCH at-sea observers participating in the 2001 RAP reported a great improvement in handling practices during the 2000 fishing season.

Logbooks have been utilized to determine fishing positions of crab fishers with the aim of summarizing fleet fishing patterns. They have also been used to identify portions of the fishing grounds that are most heavily fished, to delineate the boundaries of new fishing grounds and to illustrate 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 is used to create a computer-generated map (ACON) of Newfoundland and Labrador delineating the commercial fishing grounds. To date, figures illustrating fishing positions for the 1994-2000 seasons have been produced.

Discussion:

Other than some general remarks regarding the difficulty in interpreting commercial catch rates due to effort changes (e.g. mesh size, soak times, bait bags and highgrading), discussion focused on the spatial scale chosen for data summarization. Industry representatives requested that fishery catch and effort data be presented by management area. It was explained that, for assessment purposes, RAP requires the data be aggregated over larger areas and this has been the practice for several years. Nevertheless, RAP recognizes the need to provide data on an area-by-area basis for management purposes and these were tabled as an appendix.

Reference:

WP 2001/02 An Assessment of Newfoundland and Labrador Snow Crab in 2000 by E. G. Dawe, H. J. Drew, P. C. Beck, P. J. Veitch, R. T. Warren and R. L. Costigan

Summary:

Data on catch rate, size (carapace width, CW), sex, maturity, egg development and molt status (shell condition and chela allometry) from the 1995-2000 fall multispecies bottom trawl surveys were used to infer resource status of Newfoundland and Labrador snow crab (*Chionecetes opilio*) in NAFO Div. 2J3KLNO. These surveys are conducted near the end of the fishing season and so are considered to provide an index of residual biomass. Legal-sized and pre-recruit males were broadly distributed throughout much of the survey area but were absent from Div. 2GH and 3M, some inshore areas, and across much of the shallow southern Grand Bank. The fall survey residual biomass index for 2000 was 19% lower than that of the previous year and the 95% confidence intervals ranged within 22% and 20% of the mean estimates in

1999 and 2000 respectively. The exploitable biomass available to the Div. 2J3KLNO fishery in 2001 was projected to be 22% lower than the biomass that had been projected for 2000. The portion of the exploitable biomass comprised of new-shelled (recently-molted) crabs was projected to increase from 33% for 2000 to 40% for 2001. Annual changes in projected exploitable biomass were not consistent among divisions or size groups, reflecting annual and spatial variability in trawl catchability. The exploitation rate has increased regularly since 1997 but this has apparently had minimal impact on reproductive potential. Biomass of mature females has declined since 1995 throughout Div. 2J3KLNO but sex ratios of adults continue to favour males and there is no evidence of any decrease in mating success of females.

Discussion:

Questions were raised on the efficacy of the Campelen trawl survey in estimating biomass of commercial sized crabs and pre-recruits of intermediate sizes. Regarding the latter it was noted that, although intermediate sizes typically appear to be poorly represented in trawl survey catches, small-meshed traps would not provide much useful information either given reduced catchability of small crabs and the limited spatial coverage using traps. The lack of agreement between commercial CPUE (remained high in 1999 and 2000) and trawl biomass estimates (decrease between 1999 and 2000) in Div. 3L raised the issue of which data set was representative of the commercial stock. It was pointed out that both series have uncertainties; the unknown catchability of the research trawl is a major concern for interpretation of survey results while highly variable fishing practices (as noted in WP 01) limit the usefulness of CPUE data as an indicator of stock size. It was noted that the decrease in the projected exploitable biomass for 2001 was slight relative to that projected for 2000 and approximated the deviation of the 95% confidence intervals from the annual mean estimates. When this was considered together with the evidence for variation in catchability by the survey trawl and the continued strong performance by the fishery in 2000, it was felt that there was not sufficient basis to conclude that the exploitable biomass for 2001 would be appreciably different from that of 2000.

Reference:

WP 2001/03 - Trends in prevalence of Bitter Crab Disease (*Hematodinium spp.*) in snow crab (*Chionecetes opilio*) at Newfoundland and Labrador by E. G. Dawe, H. J. Drew, and R. T. Warren

Summary:

This working paper described the spatial distribution and prevalence of Bitter Crab Disease (BCD) in snow crab throughout the Newfoundland and southern Labrador Continental Shelf (NAFO Divisions 2J3KLNO) during 1996-2000. The disease, caused by hemo-parasitic infection by a dinoflagellate of the genus *Hematodinium*, occurs predominately in recently-molted (new-shelled) crabs of both sexes and is fatal to the snow crab host. Estimation of prevalence of this parasitism was based on

macroscopic identification of chronic cases during annual fall bottom trawl surveys. BCD was overall most prevalent within the center of the broad snow crab distribution (Div. 3K) and was rare in southern-most areas of the Grand Bank (Div. 3NO). Spatial and annual changes in both distribution and prevalence of BCD were considerable. Prevalence was highest in mature females and in intermediate-sized males, but there was annual and spatial variation in size ranges most affected. Inverse relationships were apparent in some cases between catch rates and prevalence of BCD, suggesting that this parasitism may represent a substantial source of natural mortality. There is considerable uncertainty regarding the extent to which observations from the trawl-caught samples represent true prevalence in the wild.

Discussion:

This working paper led to brief discussion of possible dispersal mechanisms for the parasite and infections reported in other host species, neither of which was well known. Incidence of BCD might be higher than estimated macroscopically and early detection methods (e.g. a study of seasonal prevalence and microscopic examination) could improve estimates of infection rates. BCD is not accounted for in biomass projections. It was unclear whether relationships between BCD prevalence and survey catch rate, by male size group and NAFO Division, were more commonly negative (implying a significant mortality) or positive (implying density dependent infection). A longer time series would probably have to accumulate to determine such relationships.

Reference:

WP SF 2001/04 - Results of the Div. 3L inshore/nearshore snow crab time-series research cruises by D.M. Taylor, P.G. O'Keefe, P.W. Collins and R. Warren.

Summary:

Research vessel surveys are conducted annually in 3 inshore snow crab management areas in NAFO Div. 3L; Northeast Avalon (6C), Bonavista Bay (5A) and Conception Bay (6A). The surveys are carried out using commercial crab traps (in order to emulate those used in the fishery), small-meshed traps and a modified shrimp trawl. Traps are set at randomly selected stations stratified by depth. Weather permitting, traps were hauled after a 24 hr. soak and sampled in order to determine legal-sized catch per trap, size frequency, shell condition and proportion of small-clawed males (potential recruits). In 1996 bottom trawling was initiated in all areas. An attempt is made to occupy all stations with both types of traps and to tow for 10 minutes at each selected location. Tows of 10 minutes duration were made at a speed of 2.5 knots and were monitored by SCANMAR> Trawl sets are sampled in the same manner as are trap catches. In Bonavista and Conception Bays there has been an increase in the proportion of small-clawed pre-recruit sized males in both small-meshed traps and the modified shrimp trawl. Bitter Crab Disease (BCD) remains a concern in both these bays, having increased in prevalence over 1998

levels. The prevalence of the disease in Conception Bay in 2000 was particularly high. Details on the distribution and prevalence of the disease in this snow crab management area was presented. Although the impact of this disease on the snow crab fishery is unknown the fact that it is 100% fatal to infected animals is cause for concern.

Tow results were utilized to generate population size STRAP-based estimates for both sexes in all areas for the first time.

Detailed information on skip-molting and commercial vs. research CPUE data were also presented.

Discussion:

Inshore surveys off the northeast Avalon, in Conception Bay and Bonavista Bay produced mixed results when compared to commercial CPUE trends within the same areas. Comments from primarily industry representatives stressed the need to revisit the Div. 3L survey results along with the commercial catch rates. There was also a suggestion to integrate both research and commercial data from inshore and offshore areas.

SCALLOP

Reference:

WP SF 2001/05 - The Scallop Fishery in Newfoundland and Labrador becomes beleaguered by K. S. Naidu, F. M. Cahill and E. M. Seward.

Summary:

Two species of scallop are found in commercial densities in Newfoundland and Labrador; the sea scallop, (*Placopecten magellanicus*) and the Iceland scallop, (*Chlamys islandica*).

In 2000, the scallop fishery was in the final year of a three-year (1998-2000) Management Plan. Nominal landings, estimated at 2,647 t, were down 12% from the previous year making it the fourth consecutive year-to-year of decline. The number of active vessels prosecuting scallops was down slightly (72 vs. 79 in 1999). As in 1999, effort diversion primarily into crab and shrimp, together with declining availability of scallop, had resulted in catches typically short of pre-emptive catch limits. The nominal catch was only about one-quarter of the 11,266 t peak in 1996. Overall, excluding Labrador, only 23% of the available TAC (11,430 t) was taken.

The Iceland scallop resource in 4R was updated from a research survey in 2000. For other aggregations, only fishery performance was summarized.

Iceland Scallop

Fishery

In 2000, a total of 2,647 t of Iceland scallop was taken. The bulk (43%) of the removals was drawn from St. Pierre Bank, followed by the Strait of Belle Isle (41%). The remainder came from the Grand Bank (12%) and Labrador (4%).

The trans-boundary aggregations of Iceland scallop within St. Pierre Bank remain unfished. When last this area was surveyed it was estimated that approximately 55% of scallops had been consumed by predatory starfish.

Research

Composite acoustical data from *RoxAnn* sweeps over the Strait of Belle Isle going back to 1995 were used to better infer scallop distribution over the area and to optimize survey design. Configuration of scallop beds in the area was modified in 2000 and the number of beds reduced from six (1997) to three.

Overall, it was estimated that only 50% of the area (300 n.mi² out of 612.2 n.mi²) surveyed was considered suitable for the presence of scallop. Based on an efficiency-corrected (20% swept area methodology, it was estimated that the biomass in 2000 was between 7000 t – 10,600 t, round with a mean of 8,800 t, down from the mean estimated in 1997 (9,300 t). The recommended catch based on 10% of the mean was 880 t. The TAC for area remained 1,100 t.

Sea Scallop

Fishery

After a two-year hiatus, the Maritimes' based offshore sea scallop fleet returned to St. Pierre Bank. Approximately 34 t were taken. In the absence of new biological information, a pre-emptive TAC of 415 t has been in place for the sea scallop since 1996. Newfoundland-based vessels fishing for the Iceland scallop sometimes catch and retain sea scallop. Regulations currently permit a 10% tolerance. As scallops are shucked at sea and only "meats" landed, species discrimination for monitoring purposes is fraught with difficulty.

Discussion:

Debate on the assessment of Icelandic scallop revisited the philosophies of sustainability versus pulse fishing and the establishment of refuge areas. With episodic recruitment, which is likely environmentally driven, either strategy is defensible. In Div. 4R, it was noted that there is no incoming recruitment and somatic growth is minimal, yet the fishery is being maintained. This was attributed to catch controls that have resulted in a slow rate of removal.

SHRIMP

Reference:

WP SF 2001/06 Assessment of northern shrimp off Baffin Island, Labrador and northeastern Newfoundland in 2000 by D. Orr, D. G. Parsons, P. J. Veitch and D. J. Sullivan.

Summary:

Updates of northern shrimp (*Pandalus borealis*) assessments were performed for Division 0B, Division 2G, Hopedale + Cartwright Channels and Hawke Channel + Division 3K, which correspond to shrimp fishing areas (SFAs) 2, 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 (CPUE), fishing pattern and size/sex/age composition of the catches. A multispecies research trawl survey was conducted in 2000 but reductions in survey coverage only provided information on distribution, abundance, biomass, size/sex composition and age structure of shrimp in Hawke Channel + Div. 3K. These findings were compared with results of previous surveys in this area since 1995.

Hawke + 3K (SFA 6)

The Total Allowable Catch (TAC) increased to 60,980 in 2000 to 61,632 in 2001. Small vessels (<500 ton; <=100 LOA) harvested 43,203 tons of shrimp while the large vessels (=>500 ton) harvested 20,063 tons of shrimp. A CPUE index was determined for each fleet using the General Linear Modeling (GLM) Procedure within SAS. The models were effort weighted and accounted for year, month, vessel and area. The small vessel fishery has been in existence for only 4 years, therefore, this was the initial model for the fleet. The 2000 small vessel CPUE had significantly ($P<0.05$) increased over previous years. Whereas, catch rates by large vessels in Hawke + 3K remained relatively stable at a high level.

The research survey biomass/ abundance estimates showed an increase since 1997 and the lower confidence intervals averaged approximately 446,000 tons/105 billion animals over the 1996 – 2000 period. Research data showed that the 1996 year class was weak compared to others produced during the 1990's. Also, the 1995 year class appeared weaker than most. However, the 1997 and 1998 year classes are strong, the former being the most abundant year class at age 3 within the time series. While it is likely that male abundance and biomass will be maintained in 2001/2002, it is possible that the spawning stock (females) will decrease as the weaker year classes change sex and year classes produced before 1995 are further reduced through both fishing and natural mortality. Positive effects of the stronger 1997 and 1998 year classes on the spawning stock should be evident by 2003. Over the next few years, the residual female stock and the stronger 1997 and 1998 year classes should buffer the negative effects of a weak 1996 year class. However, the impact of

fishing mortality imposed by the inshore fleet upon the 1997 and 1998 year classes is uncertain.

The resource in this area remains healthy with high biomasses/abundances of male and female components. Further, exploitation likely has been less than 12% over the past several years (i.e. the ratio of nominal catch to the lower 95% confidence interval of the research trawl survey biomass index).

Hopedale + Cartwright Channels (SFA 5)

Respectively, the small vessel and large vessel fleets harvested approximately 400 and 14,600 tons of shrimp during 2000. A CPUE model was developed for the large vessel fishery. It indicated that catch rates have increased continually since 1993.

Current status in Hopedale + Cartwright appears favorable from the fishery data but the absence of a complete survey in 2000 and lack of a recruitment index create uncertainty with respect to stock size and level of exploitation.

Long term plans call for the northern portion of SFA 5 to be surveyed every second year. The research data available since 1996 were reanalyzed by area for possible relationships between areas. Abundances and biomasses in Hopedale Channel increased between 1996 and 1997. These indices decreased over the same period in Cartwright Channel. The divergence was probably related to two anomalously high shrimp catches obtained in Hopedale Channel during 1996. The 1998 and 1999 biomass and abundances trends in Hopedale and Cartwright Channels tracked each other. Thus, there may be a relationship between the two areas. If so, it may be possible to create a multiplicative model allowing the estimation of biomass/abundance in the northern parts of SFA 5 during years that are not surveyed.

Division 2G (SFA 4)

The 1999 TAC was maintained at 5,200 tons and the catch was estimated at 5,217 tons.

The SFA 4 large vessel CPUE index has fluctuated since 1991 without a long-term trend.

However, current status and prospects in Div. 2G are unknown because the lack of a research survey in 2000 precluded evaluation of the spawning stock, the level of exploitation and recruitment.

Division 0B (SFA 2)

In 1999, an additional 3500 tons were provided for the area north of 63⁰ N as an incentive for the offshore fleet to return to grounds not fished extensively since 1995. However, just over 100 tons were taken within this area in 1999. In 2000, the additional 3500 tons was not included in the quota report, and accordingly the catch

was not counted against the TAC for the south (5353 tons). Preliminary estimates indicated that 4,236 tons were harvested in SFA 2.

Due to the mixed *P. borealis*/*P. montague* nature of the fishery and the fact that the area being fished has changed since 1995, the CPUE index is not believed to be representative of stock conditions. Similarly, the lack of a research survey into Div. 0B creates uncertainty in understanding the current state of stock distribution, delineation and exploitation level, therefore, prospects in 0B are unknown.

Discussion:

Following the presentation of the northern shrimp assessment, RAP was provided additional information related to the interpretation of results from the commercial fishery in 2000. Indications of smaller shrimp in the catches by inshore vessels in SFA 6 were reflected in average counts per pound which were reported to have increased from 68 in 1998 to 71 and 79 in 1999 and 2000, respectively. In SFA 5, fishermen reportedly observed higher incidence of *P. montagui* but there were no supporting data. In SFA 2, it was noted that the exploratory fishery in the north was not approved until late August and fishery performance might have been better earlier in the year. Also, in recent years, the fishery has been more mixed for *P. borealis*/*P. montagui* due to the implementation of the Nunavut Settlement Area boundary.

The main concern from industry was the lack of research in northern areas and the decreases in trawl survey coverage initiated in 2000. It was argued that, for areas where surveys are lacking or absent, TAC's can be increased experimentally based on commercial fishery data only. This was the practice prior to the implementation of the multispecies trawl surveys in 1995.

Some discussion related to the use of the traffic light method in the assessments. It was noted that, in the current context, the yellow condition denotes uncertainty in a stock indicator or attribute rather than describing a condition of the stock. Future formulations of the method will attempt to represent uncertainty in a different way (possibly through weighting) and use the yellow to represent some "average" or "neutral" stock condition. RAP was informed the traffic light method is now receiving much attention through a Fisheries Management Studies Working Group which was formed in the Maritimes Region but includes zonal participation. Developments are expected in time for the 2002 shellfish assessments.

Reference:

WP SF 2001/07 - A pilot project to study fishing practices by the inshore shrimp fishing fleet – shrimp discarding by D. Orr, D. Decker, D. Kulka, P. Veitch and J. Firth.

Summary:

This study made use of small vessel shrimp grading data that had been received from the FFAW. The size frequencies from unobserved vessels were compared with those from observed vessels. Differences in size distribution could not be detected, therefore it was concluded that there was no evidence of discarding by the small vessel fleet. However, it was noted that the sample sizes were small and that fish plants bought shrimp regardless of size, therefore, there was no incentive to discard small shrimp. Thus it was concluded that the study should extend over a number of years and should include the larger Dockside Monitoring dataset.

Reference:

WP SF 2001/08 - Bycatch of snow crab, Atlantic cod, Greenland halibut and redfish in the inshore shrimp fishery during 2000 by D. Orr, D. Kulka and J. Firth.

Summary:

Both logbook and observer datasets were analysed in order to determine whether bycatch levels were a problem. The logbook datasets rarely included bycatch records therefore, analyses concentrated upon Observer records. Observers were posted on all of the large vessels approximately 9% of the small vessel fleet. Estimates of bycatch were determined accordingly.

Snow crab and Atlantic cod were not frequently found within the shrimp nets. On the other hand, redfish and Greenland halibut were common in Hawke Channel, Funk Island Deep and St. Anthony Basin. Loss of yield estimates indicated that, at current levels of mortality, approximately 134 tons of redfish and 340 tons of Greenland halibut would be removed from the fishery. Thus it was concluded that bycatch was not a concern but that monitoring studies should continue.

Discussion:

Information on minimal bycatch and shrimp discards from the "inshore" shrimp fleet was generally accepted without comment.

Reference:

WP SF 2001/09 - Use of the juvenile shrimp net as a tool in obtaining early instar northern shrimp (*Pandalus borealis*) and snow crab (*Chionocetes opilio*) by D. Orr, E. Dawe, D. Parsons and P. Veitch.

Summary:

A 12.7 mm mesh juvenile shrimp net was attached to the bottom of the Campelen shrimp trawl, 1 m ahead of the codend extension. The net was used in an attempt to

capture a quantitative sample of small fish, snow crab and shrimp that leave the research trawl before they have a chance to enter the codend. Preliminary results indicated that the small mesh net captured smaller snow crab than did the large Campelen shrimp trawl. In southern areas, where shrimp population numbers are high, the small mesh net and the research trawl provided similar shrimp length frequencies. However, in the north, where shrimp densities are lower, the small mesh net provided a stronger recruitment signal than did the Campelen trawl. It was concluded that results from the juvenile shrimp net were encouraging and the juvenile shrimp net may be useful in providing a recruitment index for both shrimp and snow crab.

Discussion:

The presentation on the attachment of a small-meshed bag to the Campelen trawl was well received. This bag, in capturing very small snow crab, provides data that can be useful as a recruitment index and investigated for correlation with environmental indices. Juveniles of other species, including shrimp, also are retained.

PROGRESS ON RESEARCH RECOMMENDATIONS FOR 2000

- 1) Improve estimates of bycatch and discards in shrimp fisheries through improved observer coverage and use of DMP and logbook data.

A small vessel observer allocation plan was developed. The plan makes use of past port performance (number of trips and landings) in assigning the number of observed trips to each port on a monthly basis. The plan was well received by field staff coordinators because it set clear targets and had a well developed time table. Analyses indicated that the plan resulted in improved temporal and spatial observer coverage. Additionally, fishermen now view observers as providing a scientific service rather than as "policemen".

The DMP datasets were not used in bycatch analyses because bycatch is recorded as a total weight for all species. This type of research should be conducted on a species by species basis. Logbook data was not used in the analysis because bycatch is rarely included on the logbook datasheets. Therefore, it was concluded that the observer datasets would be used to provide an indication of bycatch. Levels of Snow crab, Atlantic cod, redfish and Greenland halibut bycatch were estimated.

As indicated by WP 2001/ 07, a pilot joint DFO / FFAW project was initiated to determine the extent of shrimp discarding problem. Grading information was received from the FFAW. Shrimp weight frequencies from unobserved vessels were compared with weight frequencies from observed vessels. No difference could be detected; therefore, it was concluded that discarding was not a concern. However, the sample sizes were small and the results could have been influenced by market conditions, therefore, it was recommended that we include the larger DMP grading dataset and continue the study.

- 2) For biological and industry – related reasons, the SFA boundaries should be modified.

A DFO – Industry working group was established and the SFA 2,3 and 4 boundary was modified. The working group recommended that the future boundary be established along straight lines and that

"*P. borealis* caught in SFA 2 and those portions of SFAs 3 and 4 north of 60°30'N and west of 63°W should be recorded against the SFA 2 commercial shrimp quota of 5,250 tonnes."

- 3) Undertake review of crab fishery databases with a particular focus on the possibility of developing a standardized catch rate series from the logbook database.

Editing of logbook data for recent years was carried out and preliminary investigations of the effect of time on catch rates conducted. This will continue until standardized catch rates for the most recent years of the fishery can be developed.

RESEARCH RECOMMENDATIONS FOR 2001

- 1) Continue modeling the relationship between biomasses/abundances in Hopedale – Cartwright Channels. The objective of this exercise is to eventually produce a multiplicative model that would allow biomass/ abundance estimation in the northern portion of SFA 5 during alternate years when surveys are not conducted north of 2J.
- 2) Continue using the juvenile shrimp net to capture early instar Snow Crab and shrimp.
- 3) Address the lack of shrimp research north of SFA 5.
- 4) Investigate the effects of annual variation in trawl catchability and/or efficiency on survey-based biomass indices.
- 5) Investigate the effect of annual variation in fishing practices on commercial catch rates.
- 6) Evaluate utility of inshore trap survey catch rates in assessment of resource status.

APPENDIX 1: LIST OF WORKING PAPERS

- WP SF 2001/01 Assessment of the 2000 Newfoundland and Labrador snow crab fishery by D.M. Taylor, P.G. O'Keefe and P.J. Veitch.
- WP SF 2001/02 An assessment of Newfoundland and Labrador snow crab in 2000 by E. G. Dawe, H. J. Drew, R. T. Warren, P. C. Beck, and P. J. Veitch.
- WP SF 2001/03 Trends in prevalence of Bitter Crab Disease (*Hematodinium spp.*) in snow crab (*Chionoecetes opilio*) at Newfoundland and Labrador by E. G. Dawe, H. J. Drew, and R. T. Warren.
- WP SF 2001/04 Results of the Div. 3L inshore/nearshore snow crab time-series research cruises by D.M. Taylor, P.G. O'Keefe, P.W. Collins and R. Warren.
- WP SF 2001/05 The Scallop Fishery in Newfoundland and Labrador becomes beleaguered by K. S. Naidu, F. M. Cahill and E. M. Seward.
- WP SF 2001/06 Assessment of northern shrimp off Baffin Island, Labrador and northeastern Newfoundland in 2000 by D. Orr, D. G. Parsons, P. J. Veitch and D. J. Sullivan.
- WP SF 2001/07 A pilot project to study fishing practices by the inshore shrimp fishing fleet – shrimp discarding by D. Orr, D. Decker, D. Kulka, P. Veitch and J. Firth.
- WP SF 2001/08 Bycatch of snow crab, Atlantic cod, Greenland halibut and redfish in the inshore shrimp fishery during 2000 by D. Orr, D. Kulka and J. Firth.
- WP SF 2001/09 Use of the juvenile shrimp net as a tool in obtaining early instar northern shrimp (*Pandalus borealis*) and snow crab (*Chionoecetes opilio*) by D. Orr, E. Dawe, D. Parsons and P. Veitch.

LIST OF OTHER DOCUMENTS

- Physical oceanographic conditions on the Newfoundland and Labrador Shelves during 2000 by E. Colbourne.
- Distribution and demography of snow crab (*Chionoecetes opilio*) on the Newfoundland and Labrador Shelf by E. G. Dawe and E. B. Colbourne.
- Sensitivity and specificity of macroscopic criteria for diagnosing *Hematodinium sp.* infections in snow crabs by D.M. Taylor, G.P. Pestal, J.M. Hoenig and J.D. Shields.

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APPENDIX III: BRIEFING NOTES

BRIEFING NOTE - CRAB**ISSUE:**

An update of the status of Newfoundland and Labrador Snow Crab (Divisions 2J3KLNO and 4R, and Subdivision 3Ps).

BACKGROUND:

- The regional review of snow crab resources in Divisions 2J3KLNO and 4R and Subdivision 3Ps, was held during March 6 - 9, 2001. The meeting included industry representatives.
- The assessment compared the 2000 fishery and research data with those of previous years to determine whether or not significant changes in stock status have occurred.

CURRENT STATUS:

- Landings from all areas increased steadily from the late 1980's to a record high of 69,200 t in 1999. They decreased by 20% to 55,600 t in 2000.

Division 2J3KLNO

- Landings increased from 6,000 t in 1987 to 59,600 t in 1999. They decreased by 23% to 46,100 t in 2000 while the TAC was reduced by 19%. Inshore landings have accounted for 17% of the total during each of the past three years.
- Commercial catch rates from offshore fleets increased in the late 1980's and early 1990's and have remained high in recent years, reflecting recent high commercial biomass relative to the mid 1980's.
- The ratio of the commercial catch to an exploitable biomass index for offshore areas, which is projected from the fall survey of the previous year, decreased by 26% between 1996-1997 but increased steadily since then, doubling during 1997-2000. While exploitation has been increasing, the actual rate is unknown.
- Overall, the fall survey biomass index of legal-sized crabs in 2000 was lower than that for the 1996-1998 period, and generally similar to that in 1999.
- The fall survey biomass index of 76-94 mm small-clawed males (immediate prerecruits) was similar in 2000 to that in 1999 at about half the 1997-1998 level.

- The exploitable biomass for 2001 is projected to remain similar to that of 2000, at a lower level than during 1997-1999.
- Recruitment prospects in the medium and longer terms are uncertain.
- Factors that affect commercial biomass include recruitment, growth, exploitation, discard mortality, bitter crab disease, environmental variation, predation, and cannibalism.

Subdivision 3Ps

- Landings increased from 600 t when the fishery began in 1987 to 7,900 t in 1999 and remained similar (7,920 t) in 2000.
- The offshore commercial catch rate was relatively stable during 1987-1991, increased steadily through the 1990's, and has remained high since 1996.
- Data from spring bottom trawl surveys in Subdivision 3Ps are unreliable. Resource status and prospects are uncertain because of the lack of fishery independent data.

Division 4R

- Landings increased from 650 t when the fishery began in 1994 to 1,610 t in 1999 and remained virtually unchanged (1,640 t) in 2000.
- The commercial catch rate in Division 4R has remained stable over the past 3 years at a lower level than in other divisions.
- Resource status and prospects are uncertain because of the lack of fishery independent data.

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BRIEFING NOTE - SCALLOP

ISSUE:

Status of Iceland scallop in Newfoundland and Labrador

BACKGROUND:

- The Newfoundland and Labrador regional review of Iceland scallop in three management areas [Strait of Belle Isle (NAFO Div.4R), Grand Banks (NAFO Div.3LNO) and St. Pierre Bank (NAFO Subdiv.3Ps)] was held March 07, 2001. A brief update for the sea scallop fishery on St. Pierre Bank was included.
- The assessment included fisheries data from each of the above areas as well as data from a research survey in 4R in 2000.

CURRENT STATUS:

During 2000 the Iceland scallop fishery was in the final year of a three-year Management Plan. Effort directed into the species expanded rapidly beginning in the early 1990's but has since declined. The reduction in effort is related to the greater (relative) availability of other species, notably crab and shrimp, but in part also due to declines in scallop abundance throughout the areas once supporting lucrative fisheries. Total catch for the Region peaked at 11,266 t in 1996. Combined nominal catch in 2000, estimated at 2,647 t round, was down 12% from 1999 (2,647 vs. 3016 t, round), making it the fourth consecutive yearly decline. With the exception of the 4R fishery, TACs were not taken. Overall catches represented only 22% of the total TAC.

Divisions 3LNO

- Eight vessels participated in the scallop fishery in 2000, up from six in 1999 but still well below the 21 recorded in 1998.
- Overall, only 5% (335 t out of 6,800 t) of the available TAC for Divisions 3LNO was taken.
- Total catch doubled that in 1999 (335 t vs. 138 t). As in previous years, the majority (295 t out of 335 t, or 88%) came from aggregations around the Lilly Canyon and Carson Canyon (NAFO Div. 3N). Catch rate dropped 8% from 1999 (68 kg/tow vs. 74 kg/tow), down 31% from 98 kg/tow when deposits were first discovered.
- Catch from Cape Ballard Bank increased to 35 t in 2000 from 4 t in 1999.

- None of the aggregations in 3Nf, 3LN and Eastern 3L was fished in 2000. Only 5 t of the 2,500 t catch limit available for the remainder of 3LNO (i.e. areas outside of the discrete TAC zones) was taken.

Subdivision 3Ps (Canadian Zone)

Iceland Scallop

- Total catch in 2000 was similar to that estimated for the area in 1999 (1,134 t vs. 1,188 t), and represents only 32% of the 3,500 t TAC available for the entire area.
- In 2000, the number of vessels participating remained unchanged (35 vs. 34).
- Most (676 t or 60%) of the catch was drawn from offshore aggregations.
- As in 1999, near-shore aggregations in the Perch Rocks area accounted for the remaining 40% (458 t) of overall removals. Catch rates remained unchanged from the previous year (34 kg/tow vs. 35 kg/tow), but are well below those estimated (50 kg/tow) when aggregations here were first exploited.

Sea Scallop

- Sea scallop on St. Pierre Bank was last assessed in 1990. A pre-emptive TAC of 415 t round has been in place since 1996.
- In 2000, after a two-year hiatus, the Maritimes-based offshore fleet returned to St. Pierre Bank. Approximately 34 t was taken.

Canada-France Trans-boundary scallops

- Neither Canada nor France has fished these aggregations for Iceland scallop since 1998.

NAFO Division 4R (Strait of Belle Isle)

- The catch limit for 2000 had been set at 1,100 t, split 40:60 with the lesser amount to be taken south of 51° 25'N where fishing effort and removals are believed to have been generally higher than north of it.
- Only 32 vessels participated, down from 42 the previous year. This is the smallest number of vessels prosecuting the fishery in nearly a decade.
- The nominal catch in 2000 is estimated at 1,073 t with 663 t (or 62%) coming from the northern area.

- Catch rate for the entire area in 2000 dropped 11% from the 1999 estimate (26.6 kg/tow vs. 29.9 kg/tow), the second consecutive year of decline.
- Number of days-at-sea in 2000 increased by 24% from the previous year (1458 vs. 1177 days) while the catch per day decreased by 17% to 736 kg/day from 889 kg/day.
- Recruitment indices in 4R are down. Two sources of information (research survey and observer) again indicated little incoming recruitment. Aggregations consist almost entirely of large (old) scallop with little potential for further growth.
- Averaged over two years, it is estimated that one in three scallops has had one or more past sub-lethal encounters with fishing gear suggesting high fishing intensity.
- In the absence of significant recruitment, sustainability at current catch levels is unlikely.
- In consultation with stakeholders, a corridor 5 mi. wide across the Strait, encompassing 6.5% of Fishing Area 14, has been closed to the fishery. The indeterminate area closure is intended to determine if the absence of fishing activity will assist in resource rehabilitation.
- An update of the resource in 2000, using improved estimates of area of bottom types suitable for scallop and an efficiency-corrected (20%) swept area methodology, indicates that fishable biomass is now in the range of 7,000 -10,600 t round with a mean of 8,800 t . The catch, based as in the past, on 10% of the biomass would be 700 t – 1,060 t with the mean at 880 t .

Labrador

- There is no scientific information for this fishery.
- Total landings from aggregations off Labrador were down sharply from 1999 (105 t vs. 644 t or 84%), the second consecutive year of decline.
- The catch in 2000 came exclusively from the Nain area.

Outlook and Overall Management Perspectives for Iceland Scallop

As pointed out in the previous stock status report, pre-emptive catch limits and exploitation rates for the Iceland scallop in Newfoundland and Labrador have generally been high. This precludes a sustained fishery which is achievable on this species only with low annual yields. There currently is sufficient latent effort to further deplete the residual resource base and to quickly deplete any new aggregations that

may be discovered. However, after years of expansion on the Grand Bank and St. Pierre Bank, prospects for locating new aggregations are diminished. The kind of short-term, high-yield “pulse” fishing which has been the normal pattern of exploitation is not likely to be possible for any of the known aggregations throughout these areas over the near term. Short-term economic considerations will likely continue to provide the basis for harvesting the resource.

Although the fishery in 4R appears to have been relatively stable in recent years, it continues to slowly deplete a standing stock. In the prolonged absence of significant recruitment, it is unlikely that strong year-classes will become available to the fishery during the next several years.

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BRIEFING NOTE - SHRIMP

ISSUE:

An update of the status of northern shrimp (*Pandalus borealis*) off Newfoundland, Labrador and Nunavut.

BACKGROUND:

- The regional review of northern shrimp resources in four shrimp fishing areas (SFA) was held during March 6 - 9, 2001. The meeting included industry representatives.
- The assessment included data from the commercial fishery for shrimp in 2000 and previous years and research trawl survey data from 1995 to 2000.

CURRENT STATUS:

Hawke Channel + Division 3K (SFA 6)

- Preliminary estimate of catch for 2000 is 63,000 t – about 43,000 t or 2/3 taken by the inshore fleet. The quota was 60,908 t.
- Catch rates have remained high since 1995, with both offshore and inshore sectors showing an increase in 2000 compared to 1998 and 1999.
- Research survey biomass and abundance estimates increased since 1997 and the lower confidence intervals averaged 446,000 tons (105 billion animals) over the 1996 – 2000 period.
- Research survey data suggest that the 1996 year class is relatively weak and the 1995 year class appears weaker than most.
- The 1997 and 1998 year classes appear to be strong.
- Overall the resource remains healthy with high biomass of both males and females.
- But, it is anticipated that in the short term there will be a decrease in the spawning component due to the relatively weak 1995 and 1996 year classes coupled with the impacts of the fishery on year classes born before 1995.
- There are also some concerns related to the narrow size range of females in the catch in 2000 compared to earlier years – this may suggest that in 2000 the female (spawning) component was comprised of relatively few age groups.
- It is anticipated that the spawning component will increase again beginning around 2003 as the 1997 and 1998 year classes begin to contribute.

- But, there is concern related to the fact that in 2000, the inshore fleet, which took 2/3 of the total catch, took a high proportion of smaller male shrimp (offshore took larger males and females).
- There is the possibility, if this harvest pattern continues, the 1997 and 1998 year classes may be reduced before contributing to the spawning component.
- There is also uncertainty with regards to the possible impacts of the general warming trend in the waters of the area on growth, survival and sex change.
- Recent catches have had no observable impact on the stock and removals at the current level will not likely increase the exploitation rate.

Hopedale + Cartwright Channels (SFA 5)

- Quota was 15,300 t for 2000.
- Preliminary estimate of catch in 2000 is 15,000 t.
- The research survey in 2000 only covered a portion of the area.
- Strong recruitment occurred through the 1990's resulting in continuing high catch rates of males.
- Spawning component appears healthy.
- There is some concern regarding the narrow size range of females in the catch in 2000 suggesting this component was made up of only a few age classes relative to earlier years.
- Future prospects are uncertain due to the lack of a recruitment index.
- Current status appears favourable but the lack of survey information raises uncertainties regarding the possible impacts of exploitation in 2000.
- There is also uncertainty with regards to the possible impacts of the general warming trend in the waters of the area on growth, survival and sex change.

Division 2G (SFA 4)

- Quota was 8320 t for 2000.
- Preliminary estimate of catch in 2000 is approximately 8000 t.
- There was no survey to the area in 2000 so there is no current fishery independent data.
- There are no estimates of strengths of recruiting year classes.
- Oceanographic data is limited.
- Commercial fishery data from the offshore shows continued high catch rates in both the northern and southern portions of the SFA. There are uncertainties concerning the resource related to changes in areas fished between years.

- Given the recent high and stable catch rates of primarily female shrimp in this area, it appears that a healthy spawning biomass is being maintained.
- There is some concern regarding the narrow size range of females in the catch in 2000, suggesting this component was made up of only a few age classes relative to earlier years
- The level of exploitation is uncertain but catches prior to 2000 had no observable impact on the resource.
- It was not possible to evaluate the potential impact of the 2000 catch on the resource.

Division 0B (SFA 2)

- Preliminary catch data indicates that the quota of 5353 t for 2000 was taken.
- Catch rates of both males and females have been maintained at a high level since 1997.
- There are no fishery independent data available from this area.
- There are no estimates of strengths of recruiting year classes.
- Oceanographic data is limited.
- There are uncertainties concerning the resource related to changes in areas fished between years, as well as the fact that there is a mixed catch consisting of 2 different species.
- It is not possible to evaluate the impact of recent catches on the resource in this area.

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