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**Regional Stock Assessment Process  
(RSAP) of the Quebec Region for the  
2002 fishing season.**

**Processus Régional d'évaluations  
des stocks (P.R.E.S.) de la région du  
Québec suivant la saison de pêche  
2002.**

**January 21 to April 25, 2003  
Maurice Lamontagne Institute**

**Jean Landry, Serge Gosselin and Dominique Gascon  
Editors**

**Maurice Lamontagne Institute  
850, Route de la Mer,  
Mont-Joli, Quebec, G5H 3Z4**

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# TABLE OF CONTENTS

<b>TABLE OF CONTENTS</b> .....	<b>III</b>
<b>ABSTRACT</b> .....	<b>IV</b>
<b>RÉSUMÉ</b> .....	<b>IV</b>
<b>INTRODUCTION</b> .....	<b>1</b>
<b>PART ONE: MEETINGS HELD FROM JANUARY 21 TO 31, 2003</b> .....	<b>2</b>
STATUS OF THE SHRIMP STOCK IN THE ESTUARY AND THE GULF OF ST. LAWRENCE IN 2002 .....	2
STATUS OF THE SNOW CRAB STOCKS IN THE ESTUARY AND THE NORTHERN GULF OF ST. LAWRENCE (AREAS 13 TO 17) IN 2002 .....	5
STATUS OF THE LOBSTER STOCKS IN 2002 .....	14
STATUS OF THE STOCK OF CAPELIN IN THE ESTUARY AND THE GULF OF ST. LAWRENCE (4RST) IN 2002 .....	24
<b>PART TWO: MEETINGS HELD FROM FEBRUARY 11 TO 14, 2003</b> .....	<b>26</b>
STATUS OF THE SCALLOP STOCKS IN QUEBEC NEARSHORE WATER IN 2002 .....	26
STATUS OF THE ROCK CRAB STOCKS IN 2002 .....	35
STATUS OF THE GREENLAND HALIBUT STOCK IN THE GULF OF ST. LAWRENCE (4RST) IN 2002 .....	39
STATUS OF THE ATLANTIC HALIBUT STOCK IN THE GULF OF ST. LAWRENCE (4RST) IN 2002 .....	42
STATUS OF THE HERRING STOCKS IN AREA 4R IN 2002 .....	44
STATUS OF THE MACKEREL STOCK OF THE NORTH-WEST OF THE ATLANTIC .....	48
<b>APPENDIX 1</b> .....	<b>51</b>
SCHEDULE OF THE REGIONAL STOCK ASSESSMENT PROCESS OF THE REGION OF QUEBEC HELD BETWEEN JANUARY 21 AND APRIL 25, 2003. ....	51
<b>APPENDIX 2</b> .....	<b>52</b>
INVITATION LETTER FOR STAKEHOLDERS FROM THE OUTSIDE OF THE DFO TO PARTICIPATE IN THE REGIONAL REVIEW PROCESS .....	52
<b>APPENDIX 3</b> .....	<b>56</b>
LIST OF THE PARTICIPANTS TO THE REGIONAL REVIEW PROCESS .....	56
<b>APPENDIX 4</b> .....	<b>62</b>
RECOMMENDATIONS ARISING OUT OF THE PRESENTATIONS .....	62
<b>APPENDIX 5</b> .....	<b>66</b>
LIST OF THE STOCK STATUS REPORTS PRODUCED FOLLOWING THE REGIONAL REVIEW PROCESS OF THIS YEAR. ....	66

## **ABSTRACT**

This document contains the proceedings of the meetings made within the framework of the Regional Advisory Process (R.A.P.) of the Quebec region following the 2002 fishing season. This advisory process was carried out between January 21<sup>st</sup> and April 24<sup>th</sup>, 2003 at the Maurice Lamontagne Institute in Mont-Joli. During these meetings, the status of several marine species stocks commercially exploited in the Estuary and the Gulf of St. Lawrence, and some of the environmental parameters prevailing at the time of the 2002 fishing season were reviewed. These proceedings document the major points presented and discussed during the meetings and also present the main recommendations and conclusions that were developed at the time of the review.

## **RÉSUMÉ**

Le présent document renferme les comptes rendus des différentes réunions tenues dans le cadre du processus régional d'évaluation des stocks (P.R.E.S.) de la région du Québec suite à la saison de pêche 2002. Ce processus de revue s'est déroulé en plusieurs étapes, échelonnées du 21 janvier au 24 avril 2003, à l'Institut Maurice-Lamontagne, à Mont-Joli. Lors de ces rencontres, l'assemblée a revu l'état de plusieurs stocks d'espèces marines exploitées commercialement dans l'estuaire et le golfe du Saint-Laurent ainsi que certains paramètres environnementaux qui prévalaient lors de la saison de pêche 2002. Ces comptes rendus contiennent donc l'essentiel des présentations et des discussions tenues et font état des principales recommandations et conclusions émises au moment de la revue.

## INTRODUCTION

The Quebec Region of the Department of Fisheries and Oceans (DFO) is responsible for the evaluation of several stocks of fish and invertebrate species exploited in the Estuary and the Gulf of St. Lawrence. Most of these stocks are reviewed annually through a regional advisory process carried out at the Maurice Lamontagne Institute in Mont-Joli. The current review was performed in several stages phased from January 21 to April 24, 2003. The various pelagic, groundfish, crustacean and shellfish species that were evaluated are described in Appendix 1.

The proceedings contained in this series present the highlights of presentations and discussions that occurred during the activities of the Stock Assessment Regional Committee. The regional review is an open process of consultation bringing a critical perspective on the status of the resources evaluated. People from the outside of the DFO were invited to participate in the Committee activities (Appendices 2 and 3). Recommendations put forth by the assembly are also presented in these proceedings (Appendix 4).

The stock status reports that were produced following the regional advisory process contain the results of the evaluations made on the fish, shellfish and crustacean populations exploited in the Estuary and the Gulf. They also describe the state of the resource and the perspectives for recruitment and abundance of populations, and address the issue of the impact of fishing practices. These reports, as well as the series of proceedings presented here, make scientific information meaningful to fishing industry stakeholders, resource administrators, Fisheries Resource Conservation Council (FRCC) members as well as the public in general. These documents are public and available from the Canadian Science Advisory Secretariat (CSAS) in Ottawa. The list of the stock status reports that will be produced this year following the review process of the Quebec Region is available in Appendix 5.

Lastly, more technical and more detailed descriptions of the evaluations are available in the series of research documents published by the DFO. These documents are also available from the Canadian Science Advisory Secretariat (CSAS) in Ottawa.

## **PART ONE: MEETINGS HELD FROM JANUARY 21 TO 31, 2003**

### **STATUS OF THE SHRIMP STOCK IN THE ESTUARY AND THE GULF OF ST. LAWRENCE IN 2002**

**Dates:** January 21 and February 10, 2003

**Responsible biologist:** Louise Savard

**Chairperson:** Martin Castonguay

**Rapporteur :** Bernard Morin

#### **Introduction**

This review covered the 4 shrimp stocks of the Gulf: Estuary, Sept-Îles, Anticosti, and Esquiman.

To begin the presentation, a comparison is made between the highlights of 2002 and of 2003. This comparison emphasized the main conclusions of the evaluation and the changes that have occurred since last year. This methodology was well appreciated by the participants.

#### **Summary on fishing activities for the 4 stocks**

In 2002, shrimp landings increased compared to 2000 and 2001, and added up to more than 28,000 tons. Fishing statistics for 2002 are preliminary and incomplete for Esquiman (data of the Newfoundland fleet were not available before January 17). A new update of the Esquiman area data will be made in the following days.

#### **Presentation of indices for the stocks**

The base lines were discussed. Currently, these base lines correspond to confidence intervals of 95% for the 1990-1999 averages. The two following options were suggested: 1) to use a 10-years window moved every year; or 2) to add one year to every new annual evaluation in order to keep an historical perspective. No conclusion on the preferred method was formulated.

Explored and exploited areas in commercial fishing: the distribution area did not increase since 1993 in the Sept-Îles sector, but main shrimp concentrations made a shift towards the South.

Standardization of CPUEs: Current trawls are more effective than in the 1980s, and this was not taken into account in the standardization. For Esquiman, the difference between the 2001 and the 2002 fishing periods could have had an effect on CPUEs.

Information was requested concerning the effect of the hatching period on reproductive females NPUEs in the spring (April and May), as a great variability was observed.

An increase in the primiparous females and a reduction in the multiparous females were observed. This change could be due to the loss of the older year-classes or to different selectivities.

The results of the 2002 Needler survey in Esquiman were discussed. According to these results, there was a reduction in the abundance of the stock during the last years, whereas catch rates of commercial fishermen remained high. Compared to the previous years, a fewer number of stations was used during 2002 in the significant layers for shrimp, making the low abundance estimate uncertain. However, a downward trend has been observed during the last few years.



Moreover, in Esquiman, fishing activities occur mainly during the spring, while the Needler survey takes place in August. In 2002, some fishermen observed a significant drop in their catch rates after mid-August in Esquiman. Fishermen also observed, since 1998-99, the mixing of small and large shrimps at great depths, which never happened before.

It is possible that, in spite of the reduction in abundance, CPUEs of the annual commercial fishery remained high because fishermen concentrated their activities in locations where the highest densities were measured by the survey. The inconsistencies between the catch rates of fishery and the Needler survey must be examined.

It was asked why little differences were recorded between day and night in recent CPUEs. No specific explanation was advanced, but there could be a link with reduced vertical migrations, behaviour changes or abundance.

A suggestion was made concerning the identification of station positions on kriging charts.

The distribution area estimates for 90% of the biomass did not seem to correlate with the abundance of the stock. However, an increase of the density per kriging block was observed. Therefore, when the biomass increases, it is possible to observe a greater proportion of higher concentrations but few changes in the area of distribution.

**Recommendation (1):** To calculate sex ratios in the following way: males / males + females.  
A balanced ratio would be 0.5.

Exploitation rate index: this is a relative index because the biomass of the survey is not absolute and depends on catchability. Moreover, increases in TAC had little effect on these indices as biomasses of the Needler survey increased during the same period. In addition, exploitation rates are not comparable between the areas as catchability differences could exist between areas and because the depths of the layers are different.

It was mentioned that the first years are determining for the growth rate of a cohort.

Since large females are becoming increasingly scanty in Esquiman, it was suggested to examine the relation between the rate of exploitation of males and the size of females.

### **Conclusion of the first meeting**

The situation in Esquiman was considered to be alarming, particularly in relation to size reductions. While it was considered important not to wait until the next year to correct the situation, no specific reduction goals were recommended. The proposal made by the biologist responsible for the stock to the effect that additional analyses should be carried out was accepted, including the new data made available recently and not comprised in the current presentation. According to the results of these analyses, a specific proposal would be made for the stock of Esquiman. Peers should discuss this proposal at the beginning of February.

### **Second presentation on February 10, 2003**

New figures and information were presented in order to compare the trends in management units and gain a better understanding of what occurs in Esquiman. Therefore, the issue was to finalize the evaluation and provide opinions on the fisheries of 2003.

The reproductive female sizes have dropped in the four stocks since 1998 and in Esquiman, they are very low.

The addition of the new catch and effort data in Esquiman had little impact on the standardized CPUEs. They have remained high since 1996.

Whereas the exploited area index (CPUE by statistical square) was similar for the last three years in Sept-Îles and Anticosti, Esquiman index changed: a lower number of fishing squares with higher concentrations was observed in 2002, but the number of squares needed to reach 6,000 tons increased. This could indicate that shrimps were dispersed in 2002 compared to 2000 and 2001.

**Suggestion:** To analyse fishing effort data collected by observers; to compare voyages made with or without an observer.

**Suggestion:** To bring back CPUEs and abundance indices to a scale of 1 by dividing them by the average (standardization).

**Suggestion:** To examine the abundance indices of the Needler for the North and the South of the Anticosti Island.

The highlights were reviewed and distributed to the follow-up team after the meeting.

# STATUS OF THE SNOW CRAB STOCKS IN THE ESTUARY AND THE NORTHERN GULF OF ST. LAWRENCE (AREAS 13 TO 17) IN 2002

**Dates:** January 22-24 and 31, 2003

**Responsible biologist:** Réjean Dufour

**Chairperson:** Serge Gosselin

**Rapporteurs:** January 22 – Denis Chabot  
January 23 – Sylvain Hurtubise  
January 24 – Jean Lambert  
January 31 – Denis Bernier

## Introduction

The review of the snow crab stock status in the Estuary and northern Gulf of St. Lawrence (Areas 12A, B, C, and 13, 14, 15, 16 and 17) took place on January 22, 23, 24 and 31, 2003. An additional meeting was also held on January 31 in order to complete the examination of some analyses and to draft the advice for stocks.

## Biology of snow crab (Presenter: Bernard Sainte-Marie)

### Growth:

A west-to-east gradient exists for several biological variables (from the Estuary towards the lower North Shore). For example, data of research missions (13 years of data, crabs harvested with trawls, except in the Saguenay, where the fishery is made with traps) showed that the median width of the carapace of adult males is larger in the west than in the east, even when interannual variations are taken into account. The situation is similar for females. Juveniles (stage VI and larger), for a same life stage, are on the other hand increasingly larger as we move to the east.

Temperature is probably a key factor for the establishment of these gradients. The temperature of the cold intermediate layer (CIL) decreases slightly from west to east, but these weak differences in temperatures can have a significant impact on stenothermal animals like snow crab, i.e. tolerating a very narrow range of temperatures.

Two possible explanations exist for the final size gradient (size of adults). First, the terminal moult could be earlier at temperatures relatively colder. Second, fishery could have an impact on final size. Data for Newfoundland and Bering Sea support the assumption of an impact of temperature. For juveniles, data are consistent with literature on shellfish: in cold water, the interval between moults tends to be longer, and the growth at moult tends to be more significant. But in general, this increase in size at each moult does not compensate for the drastic increase in interval between moults.

Since males can reach their final size following a variable number of moults, they can reach the legal size while still at the adolescence stage. In a lightly exploited population, the average size of legal males continues to increase a few years after a wave of recruitment occurred, as these legal size adolescent crabs will still have one or two moults before becoming adults. In a population exploited to a greater extent, where legal size adolescents are not rejected at sea, crabs have a shorter life expectancy after having reached the legal size, and the average size after a wave of recruitment does not continue to increase.

### Reproduction:

Adult females are of course smaller than males. As they can reach their final size over 2 years (starting from adolescents), rather than over 6 years for males, their recruitment is much more condensed in time.

Field and laboratory data indicate that sperm limitation is a real problem, because natural recruitment cycles and rates of maturation are different for males and females, a situation that can be worsen by fishery. In times of abundance of females, males invest less sperm per female, to such an extent that the fecundity of females decreases. Thus, the oscillations of sex ratios are really occurring in the field, and they have an impact on the reproductive success of females.

This work suggests points of reference for the management of snow crab. For example, the quantity of sperm in female seminal receptacle is an easy-to-measure variable that is strongly correlated with spermatozoid count. The threshold at which sperm becomes a limiting factor for the first brood could be used as a point of reference. Another threshold could be the quantity of sperm necessary for a whole life fecundation. In fact, this last threshold can consist of two values: the quantity of sperm necessary for whole life fecundity in a context of bi-annual egg-laying, and in a context of annual egg-laying.

### **Introduction to the stock assessment** (Presenter: Réjean Dufour)

For the eastern areas of Canada as a whole, an increase in landings of 11% was noted in 2002, especially in the southern part of the Gulf (57%). Elsewhere, the increases are weak, and for the west of Cape Breton area, landings decreased by 19%. In the northern Gulf of St. Lawrence, landings reached a record level in 2002. But as it will be shown later on, these good news are accompanied by several concerns. To minimize the impact of the 30% decrease of the TAC in area 13, fishermen were allowed, during the 2002 season, to access to a sector of area 16 ("A") which had been specifically created to give assistance to fleets having problems. In 2002, a special allowance was also granted to turbot fishermen of Gaspé, allowing them to harvest approximately 500 tons in area 17.

### **Area 17**

In this area, the TAC increased by 7% and attained in 2002. CPUEs also increased compared to the year before for Japanese traps, but those for conical traps dropped by 17% (north) and 20% (south). The index of carapace condition slightly dropped in 2002, which could indicate the arrival of soft crabs or the loss of old crabs. Following a discussion on the ambiguity associated with the interpretation of this index, the consensus was that this index should be re-examined and possibly modified or associated with another index (for example, % of recently moulted crabs). The examination of carapace width frequencies for adolescents-1 (78-95 mm CW) shows that the end of a wave of recruitment is currently being harvested, and that recruitment should slightly decrease during the next year. But the next low point in recruitment would be at least one year longer than predicted. In 2001 and 2002, male crabs were abundant compared to females, and female fecundity should remain good.

Carapace widths (commercial male adults), which were low from 1998 to 2001, increased in 2002, but remained lower than the long-term average. This increase is probably due to the presence of adolescent crabs having reached the legal size one to three years ago, and which moult until becoming adults. Temperature and intensity of the fishery can also affect the size of

harvested crabs, and this might explain why carapace average widths observed during the current wave of recruitment are lower than those observed during the preceding wave.

It was initially suggested that the harvest rate be decreased by about 10 to 15% as of now to reduce yield drops during the next low point in recruitment and to leave more reproductive males on the bottom. The recommendation to reduce catch rates in 2003 by 15% is mainly based on the decrease of CPUEs for commercial crabs observed during the post-season trap survey, which indicates the level of abundance for these crabs over the next year. However, it is not necessary to adjust the level of captures for the size effect. It is important to harvest old crabs (dirty carapaces) first and to reject adolescents, even though they have reached the legal size. These measures are particularly significant as the current wave of recruitment was much more exploited than the last one, and than legal size crabs encountered on the end of this wave are smaller than at the end of the preceding wave.

### **Area 16**

The indicators used to monitor the status of the resource in this area differed from what was observed in area 17. Indeed, all available sources of information showed a decline of CPUEs and a reduction in the average size of legal size crabs, in spite of the arrival of a new wave of recruitment at the end of the 1990s. Recruitment to the exploitable population was less abundant than predicted, and the available biomass on the bottom is relatively low. We realize that biomass is low at a time where it should be high to support the imminent approach of a recruitment low point, which could place us, in the short term, in a context of recruitment fishery.

An "erosion" of recruitment at the commercial size for the year classes comprising the last wave of recruitment was noted. An unusual proportion of males made their terminal moult under the minimum commercial size (95 mm), making them unavailable for fishery. Various assumptions were presented to try to explain this early terminal moult. Data on blue crab of the Chesapeake Bay, a species having no dimorphism, show that a greater fishery pressure caused an increase in the number of under-legal crabs and a reduction in the number of classes of legal size. However, theoretical expectations are that the species with sexual dimorphism, like snow crab, react even more quickly to an increase in fishery pressure. In area 16, quota was increased by 10% in 2002. Moreover, a harvest protocol for old crabs was set up in 2000, but was only partially applied, and fishermen rather took advantage of the opportunity to increase their good quality crab catches. The increase in fishery pressure could have caused the early maturation (terminal moult under legal size) of the individuals of this area. The impact of water temperature in crab habitat of this area was briefly addressed, but remains hypothetical since there is no drastic variation between the values observed during the last three years and what was noted from 1989 to 1996.

The use of a model, currently developed by Bernard Sainte-Marie and a colleague from Alaska, to provide recommendations of quantified levels of catch was mentioned. However, it is still too early to use this method as much uncertainty remains with respect to the results of the model, the best available estimates having to be used for some important parameters. It was recognized that it would be important to use true data with the model. In the same way, it was agreed that it would be interesting to be able to correlate the data of the survey carried out in Baie Sainte-Marguerite with the data of the commercial fishery for this area, and that the results could be presented the following day.

Although there was no consensus on the extent of the TAC decrease required and on the formulation of the recommendation for this area, the participants agreed on the need for adopting drastic measures to bring the exploitation back to a level allowing a stabilization of the decline in biomass.

Two approaches were examined:

1. To use a standardized reference period and to adjust catch rates according to the position of the stock in its cycle of abundance.
2. To use a relative model of production describing the orientation of the stock in time.

Both approaches are similar in that they use previous trends to estimate the catches corresponding to the average trends of the stock, but differ in some basic premises. After long, and sometimes tumultuous discussions, it was decided to retain the first approach. The use of the model, which was developed during the meeting, was considered to be premature since it had not been completely evaluated. The discussion on the model is summarized at the end of this document.

Based on the years 1997 to 1999 as a reference period, corresponding to the period where the stock had a low level of recruitment, catches should be reduced by 47%. Moreover, as the average size in 2003 is lower than that observed during the reference period, an additional reduction of 19% should be implemented so that catches in number of individuals are at the same level as those of the reference period. Consequently, it is recommended that the TAC for 2003 be reduced by 57% compared to that of 2002. This reduction should bring back the CPUEs to the level of 1997-1999. It is the area where the lowest recruitment is observed. This method was applied for the majority of areas.

The objectives of these measures are to increase the average size of legal crabs, as well as to stabilize their number and CPUEs. Thus, by examining these indicators, we will be able to monitor the status of the resource and to evaluate the success of implemented measures.

### **Area 15**

The landings in area 15, which have been high and stable for a few years, slightly decreased in 2002. Raw and standardized CPUEs have been falling since 1996-1997, which indicates a decline in the legal size crab biomass on the bottom. The condition of carapace in commercial catches and the research survey with traps showed a little drop, suggesting the arrival of recruits or the mortality of old crabs. Average sizes in commercial catches and the research survey have been falling since 1998-1999. Indications are thus mixed: the increase in recruitment observed in 2002 is a positive indication for the next year, but the yields are generally low in this area. Moreover, the decrease in sizes and the rapid harvesting of crabs as they reach the legal size give rise to concern, especially as the data suggest that the present wave of recruitment will be of short duration. The 15% decrease in TAC implemented for the 2002 season was not sufficient to limit the drop of CPUEs. It is thus recommended to decrease the TAC by 20%, a level corresponding to the catch levels prevailing at the time of the last low point of recruitment (1991-1993) in this area. However, the adjustment of the catch level for the size effect proved to be positive, the current size average being slightly higher than that of the reference period, which brought back the initial reduction to 18% of the TAC of 2002 for this area. This catch reduction is necessary to increase the biomass of snow crab on the bottom, and to increase the abundance of reproductive males during the recruitment low point to come if the current wave of recruitment is as short as it was predicted.

## **Area 14**

The situation in area 14 is not very good and seems to worsen slowly. CPUEs and average sizes of legal crabs keep on decreasing, regardless of the source of information analyzed.

The protocol for the deployment of traps for the post-season survey was changed in 2002.

**Recommendation (1):** To carry out, if the necessary resources are available, a comparative study between the behavior of a four-trap longline and of a ten-trap longline

It was also noted that the indication given by the analysis of raw CPUEs of commercial fishery were considerably different from the indication given by standardized CPUEs. After discussion, it was concluded that raw CPUEs did not reflect the status of the stock. The increase in soaking time of traps since 1996 and an earlier season tend to introduce an upward bias in the abundance index. CPUEs resulting from standardization – which consists of an adjustment of the soaking time of traps to an uniform 24-hour duration by means of a model which uses an exponential curve, followed up by the application of a multiplicative model for other factors – were considered to be much more representative of the abundance of the stock. The trends indicated by standardized CPUEs are also consistent with other indicators. The participants thus recommended that the catch level for 2003 in area 14 be brought back to that of the last recruitment low point in this area (reference period: 1991-1893), which would thereafter be adjusted to take account of the average size of legal crabs in 2002 compared to that of the reference period. On the whole, the catch level (TAC) for 2003 would be 42% lower than that of 2002 (TAC of 603 T), and would thus be of 351 T.

Just like in area 16, the objectives of these measures are to increase the average size of legal crabs, as well as to stabilize their number and CPUEs. Thus, by examining these indicators, we will be able to monitor the status of the resource and to evaluate the success of implemented measures.

## **Area 13**

The situation is even more alarming in area 13 than in the other studied areas because several indicators reached their "floor" values in 2002. It was noted that the capacity of fishery is too high compared to the capacity of the stock to support this exploitation. The participants unanimously recommended the closing of the snow crab fishery in area 13 in 2003.

It is clear that a follow-up of the status of this stock will be needed. However, it will be necessary to have a more in depth discussion on the way to proceed since it could be difficult to obtain the support of fishermen towards a "sentinel" type survey, as fishermen are already collaborating with reluctance in the realization of the post-season trap survey.

Bernard Sainte-Marie presented a draft evaluation model based on the relationship existing between cumulated commercial catches and standardized CPUEs. This tool, which aims at determining the trends in the evolution of commercial fishery compared to a desirable balance in the biomass, was well accepted, and it was recommended to continue its development.

## **Areas 12A, 12B (Presenter: Luc Bourassa) and 12C (Presenter: Réjean Dufour)**

Areas 12A, 12B and 12C were created in 1994 and 1995 in order to allow fishermen having problems to have access to the resource. A "permanent" status was given to these areas in 2001.

## **Area 12A**

In 2002, catches in area 12A totalled 259 T. Yields of commercial fishery have been falling since 2001, but remain over the average of the years 1994 to 2001. The average commercial size was 108 mm, which is higher than the average size of the years 1994 to 2001.

Fishing effort distribution in this area tends to follow the sites where the strongest densities of crab are found. The size structure (and thus the estimate of recruitment), for a year given, can be very different between the east and the west parts of the area.

**Recommendation (2):** To proceed every year with a uniform commercial sampling in the area, and weighting is recommended for size estimate (at sea and at dockside).

The examination of the carapace condition shows a light drop for new crabs and crabs of condition 3 as well as a rise for old crabs. However, expressing the conditions of carapace as a percentage can hide some trends. For example, the frequency of a stage that is slightly increasing can be hidden by a stage whose frequency increase is significant. It is suggested to present these results in a more conventional way.

The use of a near-average confidence interval to localize the trends of the various indicators and to establish their significance was discussed. The method was not rejected, but the way of using it did not make consensus (choice of the average interval, basic postulates).

In 2002, the post-season survey made in area 12 A revealed an average yield of legal crabs similar to that of 2001 as well as a weak reduction in recruitment. The average size of harvested individuals was also higher than that of 2000 and 2001.

Some statistical analyses were presented to compare the results between the years. It was suggested to reconsider the choice of the statistical methods used for the comparisons (e.g. kW for CPUEs by trap).

It was indicated that the depth of the experimental traps might induce a bias in the estimate of pre-recruits since these could concentrate at different depths from a year to another. Since short-term recruitment seems to be absent, we recommend a decrease of 15% of the TAC in order to allow the conservation of biomass. See what was mentioned later in this document in connection with the scientific advice for areas 12A, B and C.

## **Area 12B**

The quota of 404 T was reached in 2002. The average yield of commercial fishery decreased in 2002, but remains in the average established for the years 1994 to 2001. In 2002, the average size of landed crabs slightly declined compared to 2001.

Snow crab biologists indicate that many mutilated crabs are found in this area. This could be explained by the presence of trawlers.

The results of the 2002 post-season survey suggest a significant drop in recruitment, residual biomass and exploitable biomass. The average size of crabs of legal size was higher in 2002 compared to 2001.

A colleague mentioned that there were too many indices in the analytical record, and that they were sometimes difficult to interpret. For example, indices on recruitment can be contradictory. It is suggested to purge indicators (to reorganize them). It is also suggested to standardize the



criteria leading to the selection of the colour codes, and to involve the follow-up team in the development of this method.

It was asked to further specify (from the analytical records) the source of the suggestion to reduce the TAC between 20% and 36%. Since areas 12A, 12B and 12C are transitory and non-independent, the colleagues decided that the scientific advice for these areas be formulated in the same manner and in taking into account the stock status of adjacent areas. For area B, a decrease of 36% was recommended.

### **Area 12C**

Réjean Dufour presented the stock status for area 12C. The document was prepared by Frank Collier of the LNSFA (RAPBCN in French).

In 2002, the 308 T TAC was reached, including temporary allowances of 89 T. Commercial yields decreased compared to 2001. In 2002, the average size of 106 mm for landed crabs was close to the level of the years 2000 and 2001.

Fishing effort distribution is very unequal in the area as a whole. In 2002, 73% of catches came from the most south-western part of the area. It was stressed that the northern and southern parts of the area have few relationships.

The results of the post-season survey indicate a decline in the exploitable and residual biomasses. These results also indicate a rise or, at the very least, a stability in recruitment. Moreover, the results of this survey showed that the average size of harvested crabs is at the same level as in 2001. It was suggested to verify the method used to measure the width of the carapace of the crabs for this area. It seems that unexpected modes to the 5 mm are present in size structures. The scientific advice should be extended to adjacent areas, or at the very least, should take into account areas 15, 16A, 16 and 12, where a general decrease in CPUEs was noted. The advice should follow this trend. No specific advice was thus formulated during this presentation for area 12C.

### **DAY 4 - JANUARY 31, 2003, 1 H P.M. TO 5 H P.M.**

#### **Method used to establish a diagnostic on the status of an exploited stock and to recommend a TAC** (Presenter: Bernard Sainte-Marie)

For given species and year, the formulation of the advice on the TAC level is often based on the examination of historical trends of the stock status indicators. Consequently, the recommendations put forth with regard to the nature of the changes in TAC level to be implemented are of a qualitative nature. To be able to formulate a TAC level in an objective and quantitative manner, it was suggested to use a simple model that put in relationship the catch levels and an index of stock biomass.

#### **Model description:**

Simple model for which catches are presented on the x-axis and the abundance index are presented on the y-axis. The 2 parameters are expressed in a logarithm form.

A slope of 1 means that the stock is in balance, i.e. the "inputs" (recruitment and growth) are equal to the "outputs" (natural mortality and fishery).

A slope higher than 1 means that the "inputs" are higher than the "outputs".

A slope lower than 1 means that the "outputs" are higher than the "inputs".

Expressed in a logarithmic form, the model allows comparisons between variables that are initially evaluated with different units.

The model allows the simultaneous consideration of several indices of biomass, abundance or condition.

A cumulative analysis makes it possible to trace the history of the stock.

The model is valid if the following basic premises are met: fishery managed by a TAC; F value sufficiently high to have a perceptible impact on the stock; and finally, index used not biased and catches reported with accuracy.

To avoid working with data transformed into a logarithmic form, and for a better visual appreciation of the changes required, a "reduced" graphic representation of the model was proposed:

The model considers variations at the average of the catches and variations at the average of the abundance index. The variations are expressed as a percentage.

The variations at the average of the catches are presented on the x-axis, and the variations at the average of the abundance index are presented on the y-axis.

With this model, confidence intervals can be calculated.

The discussions surrounding the presentation of the two versions of the model resulted in the clarification of the following points:

For snow crab, could we consider commercial standardized CPUE as a good biomass index?

- i. Currently, it is the only valuable index available we can use to obtain an historical basis to perform cumulative analysis.
- ii. It is also the only index that can be used for each stock. The other indices available (beam trawl and post-season) do not offer the same spatial coverage.

If stocks are not managed by a TAC, couldn't we use this model?

- iii. In a situation where CPUE is in balance with the abundance, convincing results are obtained with the model. It is the case with the lobster stock as we are in a context of recruitment fishery.

With regard to the basic postulates, it was noted that the model did not consider the stock resilience, the buffer effects, the residual biomass on fishery bottoms, the size and the recruitment.

The model was applied to each fishery area where snow crab is harvested. As a whole, the model is consistent with the trends revealed by stock assessment, i.e. that the levels of exploitation are too high and that they must be decreased for the return to a balanced situation. Let us recall that for a given year, the "reduced" model uses the percentage of variation at the average. To determine the level to which the TAC should be modified, the discussions clearly emphasize the need for determining in an appropriate manner the reference period that will be used to establish an average value.

Area 17: No modification compared to the last meeting. The TAC should be reduced by 15%.

Area 16: Considering the 1997-1999 reference period, the TAC should be decreased by 57%. This reduction should bring back CPUEs to the level of 1997-1999. It is the area where the weakest recruitment is observed.

Area 15: Considering the 1991-1993 reference period, the TAC should be lowered by 18%. The reduction in TAC is less important than in area 16 because recruitment is observed.

Area 14: Considering the 1991-1993 reference period, the TAC should be decreased by 42%. The reduction in TAC should bring back the catch level to that of the reference period.

Area 13: Moratorium on fishery closing maintained.

Finally, it should be noted that there are significant divergences on the use of the results of the model in its current form. In spite of the identification of certain refinements to be brought to the model, which will obviously have to be re-examined and evaluated later on before using it for the evaluation of stocks, some members of the committee wished ardently that the advices formulated by the Sciences with regard to the TAC levels recommended for these stocks next year be in conformity with the predictions achieved using the model. By adopting levels of TAC as calculated by the more traditional methods used during the assessment, the model predicts that the equilibrium context between the production of the stock and the harvest for all stocks will not be reached during the next year, and subsequent declines in harvest are to be predicted over the next years.

## STATUS OF THE LOBSTER STOCKS IN 2002

**Dates:** January 28 and 29, 2003

**Responsible biologist:** Louise Gendron

**Chairperson:** Jacques A. Gagné

**Rapporteur:** Diane Archambault

### Introduction

The presentation began with a short description of the geographical distribution of the various management areas (8) and sub-areas, which totalled 36 small sectors in 2002. The number of sectors was multiplied in order to distribute the fishing effort over the territory. An assessment of the status of stocks was made for the majority of the large areas. Information for some sectors was also presented in order to give a better view of the various lobster populations and prevailing environmental conditions.

Then, the main elements of the lobster conservation framework established by the FRCC in 1995 were presented. The main three objectives of this framework are the following: 1) to increase egg production per recruit (E/R) in order to double the production compared to the level of 1996; 2) to improve the structure of the stocks; 3) to reduce the fishing effort. The tools considered effective in achieving these goals were the application of minimum and maximum catch sizes and of fishing effort limits, as well as the creation of temporal and spatial "refuge" areas in relation to fishing practices, based on a precautionary approach. It was decided to double E/R production rather than to increase it compared to a certain level of virgin stock (e.g. 10% as in the U.S.) as the biological characteristics of virgin stocks are unknown in the coastal waters of Quebec. The quality of eggs is also compared with production of two female groups, the primiparous and the multiparous.

The presentation continued with a summary description of the various management measures and types of data collected in every fishing area, which was followed by a description of landing patterns over the last years. In 2002, landings in Quebec accounted for 8% of Canadian landings. Landings in Magdalen Islands totalled more than 68% of Quebec lobster landings. It was emphasized that the problems in obtaining a representative estimate of landings for the last year were due to the difficulty in making a correct estimate of undeclared landings (estimate carried out by fisheries agents), which, in the case of the Gaspesia sector, could represent up to 10% of landings.

Canadian landings were also compared to U.S. landings. The generalized rises in landings over the last years could be attributed to favourable climatic and oceanographical conditions reducing the negative effects of resource overexploitation.

**Comments:** *fishermen formulated two specific requests. They want to know the results of the impact study of scallop drags made on lobster bottoms in the St-Godefroi sector; and the potential effect of mussel farming on natural mortality (predation by filtration) in lobster larvae. These two items will be discussed during the presentation.*

### Status of the stock of the Magdalen Islands (Area 22)

#### Highlights

Initially, it was shown that lobster commercial fishing in this area was mainly concentrated on the rock outcrops bordering the Islands. Some specific details were brought as to the annual scientific trawling survey made on the southern side of the Islands during the fall. At this time of the year, the lobster, which is in postmoult stage, is very mobile and moves in the search of

food. Because of this mobility, the lobster is found on loose bottoms that could be trawled. The survey did not provide an absolute abundance index since rocky bottoms were not sampled during this activity. The sampling plan used for this survey was systematic, with more narrow sampling intervals at low depths.

Due to a silting problem in certain quays of the North of the Islands, the fishing season began on May 13, 2002, whereas requests had been made for opening on May 6. The water temperatures were rather cold all over fishing season, compared to previous seasons. After three weeks of fishing, 50% of landings had been made. The fishing effort deployed for the whole season totalled between 85 and 97% of the possible maximum effort.

### Abundance indices

Two fishing strategies are employed in the Islands: 1) a pursuit strategy, consisting in going offshore to meet lobster at the beginning of the season; 2) an interception strategy at the coast, consisting in awaiting arrival of lobster there. Fishermen mainly use the first strategy in the South of the Islands, while a mixing of both strategies is used in the North. Landings for 2002 in the Islands were 7% lower than those of 2001; 70% came from the southern part of the Islands.

As in former years, CPUEs (catches per unit of effort) of the 2002 commercial fishing were at their maximum level at the beginning of the season, at intermediate levels in the middle of the season, and at their lowest level at the end of the season, reflecting the depletion of exploitable biomass. On the northern side as well as on the southern side of the Islands, only CPUEs recorded at the end of the 2002 season were comparable with those of the former years, CPUEs at the beginning and middle of the season being all lower. CPUEs calculated for index fishermen were comparable with the average of the 1990s for the South of the Islands, while they are lower for the North. The colder water temperatures recorded in 2002 could have decreased the catchability of lobster and thus influenced CPUEs.

Compared with 2001, CPUE seasonal averages for 2002 indicated a reduction in number of 13% and a weight decrease of 2%. The gradual annual increase in the minimum catch size, that came into force in 1997, would have supported an additional moult, thus allowing an increase in the weight of landed lobsters over last years, which compensated partially for the reduction of the number of captured lobsters.

It was shown that the various abundance indices for the Islands were strongly correlated with landings. However, the survey-based lobster abundance indices were not as well correlated with the other abundance indices. The data series is shorter (8 years) and is characterized by some stability. Moreover, since the minimum catch size has been increased over the last years, perhaps the trawl catches larger lobster more efficiently, which would bias the rise of the commercial lobster index calculated from the survey data.

### Composition of catches and characteristics of populations

Since 1997, average sizes measured for the commercial fraction of the Island lobster stock did not stop growing, whatever the time of sampling (beginning, middle, or end of the fishing season), the place (northern and southern parts of the Islands), or the source of data (commercial sampling, trawling surveys). This upward trend for average sizes, which followed the increase in the minimum legal catch size, was consistent with the recruitment fishing practiced on this stock. The fraction of "market" category lobsters (total carapace length (TCL) > 83 mm) exceeds 90% in the two sectors of the Islands. However, the fraction of "jumbo" category lobsters (TCL > 127 mm) remains lower than 1%. The average weight of lobsters has also increased since 1997 (higher average weight in the northern part of the Islands than in the southern part).

Since 1985, the exploitation rates have been in constant progression both in the northern and southern side of the Islands. The exploitation rate indicated for several years only represents the exploitation rate of commercial size males. In 2001, exploitation rates exceeded 70%. In a context of constant effort, the exploitation rate depends on the catchability rate. With lobster, this parameter also depends on temperature. A significant and positive correlation has thus been established between the evaluated annual exploitation rates for the south of the Islands and the annual degree-days abnormalities.

Following last year discussions, a new method for the calculation of the exploitation rate was introduced this year. This method (changes in the proportions) allows calculation of the changes in the exploitation rate for the lobster fraction  $\geq 76$  mm that occurred since the increase in the minimum catch size. Increasing the minimum catch size from 76 to 82 mm generated a reduction in the exploitation rates of approximately a third on the population fraction > 76 mm. Calculations are however preliminary, and the method will be explored in greater detail over the next year. Postulates to be examined relate to changes in parameter  $q$  (catchability) according to the size, which will make it possible to better choose the size classes to be compared in the method.

**Recommendation (1):** To explore in greater detail the new method of changes in the proportions.

In 2002, the CPUEs of egg-bearing females continued to increase in the Islands commercial lobster catches. The densities of egg-bearing females observed since 2000 in the scientific survey are 2 to 3 times higher than those recorded during the 1990s. However, it appears that egg production is mainly by primiparous females. Concerning this, the relevance to have a greater number of multiparous females taking part in egg production was noted. Indeed, according to works in progress, it would seem that primiparous females release larvae of smaller sizes, and that the period of time needed to reach the benthic deposition stage is longer.

According to the theoretical model of E/R (eggs/recruit) production, E/R production in the South of the Islands was 80% higher in 2002 than that calculated for the reference year (1996), with a minimum catch size of 82 mm. It was estimated that the goal to double E/R production would be reached with a size of 83 mm for the South and of 84 mm for the North of the Islands. However, if the uncertainties of the model parameters are taken into account, possibilities to reach this goal with a minimum catch size of 83 mm are of 50% for the South of the Islands and of 30% for the North. The effects of the variation of  $F$  (mortality due to fishing) on E/R production were discussed. By increasing  $F$ , the benefits gained with the increase in the minimum catch size are reduced.

### Perspectives for 2003

In the scientific trawl survey, the abundance indices calculated for commercial size lobsters were high and did not show reductions in landings for 2003. On the other hand, the indices calculated for juveniles and pre-recruits indicated a reduction in 2002, which would predict a reduction in mid-term landings. This situation could be due to the low benthic establishment observed during 1995 and 1996 and to the bad climatic conditions that prevailed during the fall of 2000, which would have compromised the strong benthic recruitment of 1999.

In conclusion, conservation measures had a measurable positive effect on lobster populations. The objective of doubling E/R production is almost reached. However, populations continue to undergo a strong exploitation of their exploitable fraction. Without a significant reduction of the fishing effort, it was recommended to apply other measures to support egg production by multiparous females.

**Recommendation (2):** To reduce the exploitation rate once the objective to double egg production per recruit is reached.

### Other objectives to be considered:

- 1) Improve the stock structure. Must targets be established?
- 2) Reduce F either by limiting the number of daily raisings or the number of authorized fishing days.

It was mentioned that before considering other objectives, the habitat capacity to support the resource must be evaluated. The biologist stressed that for now lobster condition was being evaluated, which makes it possible to detect changes in the environment support capacity.

### **Status of the stock of Gaspesia – Areas 20A and 20B (Pointe-Gaspé to Bonaventure)**

Before beginning the presentation on this stock, a short summary was presented on the experiment conducted in order to study the effect of mussel filtration on lobster larvae in the context of the mussel farming projects carried out in Gaspesia in environments known to shelter lobster larvae. The mussels used in the study ranged from 50 to 70 mm in size. The results of the experiment showed that mussel farming activities did not represent a threat for lobster larvae.

### Highlights

The evaluation of the lobster stock of areas 20A and 20B began with a brief presentation on the management measures in force in each sector in 2002, as well as on the legal minimum catch size (81 mm in 2002) per sector and year of implementation since 1996.

As for the Magdalen Islands, the 2002 season was colder than former years, the number of degree-days being lower than the last 5 years average.

From a fishing effort perspective, the 2002 fishing season spread over ten weeks and was better than the 2001 season. About half of the catches were made after the first three weeks of fishing.

### Abundance indices

The landings for areas 20A and 20B in 2002 accounted for 25% of Quebec landings and 95% of the total landings in Gaspesia. Compared to 2001, the landings (declared catches) of area 20 decreased by 17%. Area 20A provided the greatest part of landings (60%) and was the main place where fishing effort (53%) occurred. There was a great variability in catches and number of fishermen among the various localities. The yields by fisherman presented a negative gradient from Grande-Rivière to the head of the Chaleur Bay; this was due either to a too great number of fishermen, or a decline in the resource.

In 2002, the highest CPUEs were recorded in the middle of the season. However, the seasonal pattern of CPUEs observed with index fishermen was very variable, the drops in CPUEs being often associated with cold water intrusions which could affect the catchability of lobster. The examination of the seasonal average yields of 2002, in number and weight, showed a reduction compared to 2001 in the various areas of study.

The correlations between abundance indices and landings were not as positive as the one established for the Magdalen Islands.

### Composition of catches and characteristics of populations

Since 1996, the average size of captured lobsters has continuously increased, as for the average weight and the fraction of "market" size lobsters (> 83 mm). This upward trend followed the increase in the minimum catch size and was foreseeable in the recruitment lobster fishing made in Gaspesia. However, the size structures observed in 2002 presented a reduced number of large size lobsters, which goes against the objectives awaited with the increase in the minimum catch size. Such a situation could be explained by high exploitation rates, or by slower growth, which would put lobsters under an increased fishing pressure while remaining in the same size group. If the catchability of lobster differs and increases according to size, individuals of larger size would undergo a larger mortality.

**Comments:** *fishermen raised another item: an exceptional fall in 2001 would have increased the quantity of food available. Lobsters would then have taken advantage of this food supply "to fill their carapace with muscles"; already filled at the beginning of the 2002 season, and would have been less likely to seek food and thus to penetrate in traps.*

Despite a decrease in 2001, the exploitation rate of males of commercial size remained high (about 80%). This reduction would be the reflection of a catchability reduction due to colder water temperatures in 2002. In addition, the mortality rate calculated for the fraction of the population made up of males  $\geq 76$  mm also decreased with the increase in the minimum catch size.

Although the abundance indices (number, CPUEs) for egg-bearing females were high in 2002 compared to the values obtained from 1986 to 1990, they were lower than in 2001. However, due to the increase in the minimum catch size, the proportion of egg-bearing females whose size varied from 76 to 80 mm increased over the whole territory occupied by this stock. The primiparous females continue however to be the main contributing group for egg production.

**Observation formulated by fishermen:** *as with the increase in the minimum catch size, the "V-notching" practice would support an additional moult in the primiparous females. This technique would also allow the calculation of a catch rate for this group of females.*

According to the model, the 5 mm increase in the minimum catch size produced a 90% increase in egg production per recruit. By taking the model uncertainties into account, the probability of doubling E/R production at 82 mm is of 80%. Compared with the Magdalen Islands stock, E/R production for this stock at a given size will remain lower.



### Perspectives for 2003

By virtue of the pre-recruit abundance observed at the end of the 2002 season, which was weaker than in 2001, the landings should decrease in 2003. However, the relation between the abundance of pre-recruits of the year and predicted landings for the following year is not always positive. Was this connected with a catchability effect? For these reasons, the forecasts for 2003 were associated with a high error margin.

**Comments:** *Following the presentation on the stock, several issues generated additional discussions:*

- 1) *"V-notching" practice. How to quantify the benefits? Usefulness of a follow-up program?*
- 2) *Female protection. Is a perverse effect created? Don't we move fishing pressure on males? It is necessary to preserve large males to breed with large females.*
- 3) *Creation of refuge areas. According to fishermen, there are unexploited areas offshore already. The exploitation of lobster could be limited to shallower water.*

*The ultimate goal is to protect the reproductive potential.*

### **Status of the stock of Gaspesia – 21A and 21B (Bonaventure to Miguasha)**

#### Highlights

In 2002, the minimum catch size was 81 mm, that is to say an increase of 5 mm since 1996. As in the other areas, unusually cold water temperatures characterized the environmental conditions of 2002. It should be noted that in 2000 and 2001, the Native people in area 21B made a fall subsistence fishery.

#### Abundance indices

According to the fishing sectors or season, the landings of 2002 were comparable or lower than those of 2001. They follow the downward trend that has been observed since 1990. In sector 21B, fall fishing concentrated on new recruits of the year — those that should have been captured the next spring. This fishing intercepted recruitment, which raised some concerns concerning the availability of the resource for the next spring fishing. In the spring of 2002, there were some changes in fishing patterns because fishermen found very few lobsters on the bottoms that were usually visited.

CPUEs observed for this stock were lower than those recorded for sectors more downstream the Chaleur Bay. The actual values at the beginning of the 2002 season appeared lower compared to 2001. This could also be explained by the exploitation of the stock by new insufficiently trained fishermen.

#### Composition of catches and characteristics of populations

Average sizes of commercial lobsters have increased since 1997, the year where the minimum catch size was increased. The catch composition review revealed that the abundance pattern of egg-bearing females during fishing season is variable over the years. Large individuals were

observed at any given time during the fishing season. This situation could be due to lobsters coming from sectors upstream of the Bay.

**Recommendation (3):** To weigh frequencies by the CPUEs in the size frequency distribution graphs in order to eliminate percentages and make it possible to work on figures. It was stressed that in the case of commercial data, size structures are already weighted by landings.

***Comments:*** Several issues were raised, in particular egg-bearing females and their abundance.

- 1) *Could the source of large lobsters be related to exchanges between the New Brunswick and Quebec sides of the Chaleur Bay? The biologist answered that a tagging program was on-going to clarify this question.*
- 2) *If an increase in egg-bearing females was observed in catches but CPUEs did not increase, is this to say that the non-egg-bearing females did not increase?*
- 3) *Did the increase in the minimum catch size influences the number of egg-bearing females?*
- 4) *Did the percentages of abundance observed for a group reflect the real abundance of this group in the stock, or a relative abundance due to variations in the abundance of the other groups?*

Contrary to the areas downstream of the Chaleur Bay, 2002 egg production in areas 21A and 21B was attributed to large females, which, in the case of area 21A, were undoubtedly mainly multiparous.

Future landings cannot be predicted from 2002 data on pre-recruitment. However, one element can be exactly predicted: in sectors where fall fishing occurs, awaited landings for next spring will be strongly dependent on the intensity of fishing during the preceding fall.

Since 2000, a fall subsistence fishing has been practiced by Native people in area 21B. In 2002, fall fishing lasted only half of usual time (3 weeks) compared to that of 2001. Catch rates during the fall were on average 7 times higher than those of the spring. These high yields would be caused by the arrival in the fishery of pre-commercial lobsters having moulted during the summer. In addition, at this time, lobsters are concentrated near the coast, are in post-moult and looking for food, which would support catchability. Catch rates presented a reduction over time.

The size of lobsters captured during the fall was slightly lower than that observed in the spring. The egg-bearing females were also abundant during the fall, and their size remained comparable with that measured for the egg-bearing females captured in the spring. Pre-recruits were present in significant quantities at the time of fall fishery.

A lobster tagging program began in the fall of 2000. Until now, recapture levels were very low. No information on recaptures did come from New Brunswick.

**Recommendation (4):** To keep the fishing effort from increasing for this stock (limited number of traps and daily raisings, quotas, license buy-back?), particularly as the yields of some sectors seem precarious and unforeseeable. Some concerns were raised about the successes of fall fishery and on the possible effects on the success of the following season fishery.

- Recommendation (5):** To determine if large individuals migrate towards the head of the Bay in sub-area 21B. This sector is known to have favourable bottoms for common crab and warmer water temperatures. From the pre-recruitment point of view, CPUEs was always weak, indicating that this sector was not conducive to lobster production. However, multibeam surveys showed potential sites that could be used as refuges.
- Recommendation (6):** To verify the assumption raised to the effect that downstream exploitation could have had impacts on upstream sectors as these would be dependent on migration from downstream sectors.
- Recommendation (7):** To verify if the carapaces of large lobsters in the upstream part of the Bay are cleaner, since it would indicate that lobsters in this sector are younger.
- Recommendation (8):** To verify if the input of cold and fresh water from rivers could influence the concentration of egg-bearing females. At present, there are no data available to answer to this question.

### **Status of the stock of Gaspesia – Area 19 (North Gaspé)**

#### Highlights

In 2002, only eight fishermen exploited lobster in area 19. The minimum catch size (81 mm) was that established in 2001.

#### Abundance indices

In 2002, lobster landings from area 19 (around 30 tons) accounted for 3.5% of total landings in Gaspesia. CPUEs are lower than 1 lobster/trap, the highest yields being observed at the beginning of the season.

#### Composition of catches and characteristics of population

Average size (100 mm) of lobsters captured in area 19 remained high during the whole 2002 fishing season. Distributions of size frequencies comprised several categories of large individuals, which could suggest a much lower exploitation rate than for the others areas of Gaspesia. The proportion of "jumbo" lobsters (TCL of 127 mm) reached 3.5%.

In 2002, the exploitation rate ranged between 15% and 22%. Egg-bearing females were abundant and of large size. Egg production was attributed to females of several size classes. It should be noted that the size at sexual maturity in this sector would approach 100 mm, undoubtedly because of the colder water temperatures in this area.

#### Perspectives for 2003

Very few small lobsters were captured at the end of the 2001 and 2002 seasons. Recruitment could be low, or large lobsters prevent the catch of small individuals.

## **Status of the stock of the North Shore – Areas 15, 16, 18**

### Highlights

In 2002, the minimum catch size was 80 mm for lower and middle North Shore (respectively, areas 15 and 16) and 82 mm for upper North Shore (area 18). Within the limits of lobster distribution, water is cold in these areas of the Magdalen Islands, and this was particularly true in 2002.

### Abundance indices

Landings decreased in the 3 areas in 2002, and more significantly (50%) in areas 15 and 16. As for previous years, the exploitation of lobster in area 18 was low, the number of licenses being limited to about 10. CPUEs recorded in 2002 (about 0,20 lobster/trap) were among the lowest of the last 10 years.

### Composition of catches and characteristics of populations

Size structures vary over years. The median size of 2002 was comparable with that of 2001 and was among the highest (86-87 mm) recorded over the last 10 years. However, no trend has been detected in relation with the increase in the minimum catch size, and these high values would rather reflect changes in fishing or sampling sites. The presence of jumbos (> 127 mm TCL) in the catches remained sporadic over the years, and no such catch was observed in 2002. The exploitation rate would be high if evaluated from modal classes.

E/R production was not calculated for the North Shore. Egg-bearing females were very few and CPUEs remained low. The average size of egg-bearing females was approximately 90 mm and decreased at the end of the season. The size at sexual maturity was approximately 92 mm.

Following observations collected for the North Shore lobster (high sizes at sexual maturity and high exploitation rates), this situation would resemble to that observed for the Gaspesia lobster, which warrants the implementation of additional measures to increase egg production per recruit considered to be low compared to virgin stock egg production.

***Comments:*** *In some sectors of the North Shore, small-scale fishing is practiced. Yields are relatively low and fishermen leave traps in water for several days. Fishing can be done in specific locations where water temperature is warmer.*

## **Status of the stock of the Anticosti Island – Area 17**

### Highlights

The commercial exploitation of this stock was mainly concentrated in area 17B, and particularly in the eastern part of the Island. The minimum catch size was 82 mm in 2002. As for North Shore, the lobster was in its northern limits of distribution, and the temperatures of water are rather cold compared to that observed in the Magdalen Islands.

### Abundance indices

Since 2000, landings have exceeded 130 tons and were approximately 3 times higher than at the beginning of the 1990s. According to available data, the yields observed since the middle of the 1990s were stable.

**Recommendation (9):** To increase the sampling effort in the Anticosti area. Landing volumes are rather significant compared to others areas that are sampled. It was stressed that the Anticosti area is an interesting area to investigate as the exploitation rate is low and the population shows characteristics comparable to those of a population in a virgin state.

#### Composition of catches and characteristics of populations

The size structures of the lobster stock of the Anticosti Island present many categories (evaluated to 5 classes of moult) extending on a wide range of sizes, which suggests an exploitation rate lower than for other stocks in Quebec. During the last five years, average sizes have ranged between 92 and 102 mm. In 2002, the proportion of jumbo lobsters (> 127 mm TCL) reached 7,5%.

The proportion of females in commercial catches remained rather high, and females of very large sizes were observed. According to the samples collected, the sex ratio would be 1:1, but the way sampling was carried out must be checked before making any conclusion. The size at sexual maturity of females was around 92 mm.

***Comments:*** *Would the actual values for the sex ratio be the result of laminated sampling in which as many females as males were measured?*

Although not evaluated, E/R production did not seem as low as for other lobster stocks.

The probability that the stock of the Anticosti Island would be able to support high exploitation rates in a recurring way is very low due to low rearing rates and because sexual maturity is reached at large sizes. It is thus important to maintain the current low exploitation rates and to continue increasing the minimum catch size to decrease fishing pressure on immature lobsters.

The presentation concerning this stock ended by the description of a Montagnais group Mamit Innuat project proposal to experiment fall fishing, after spring fishing, in two sectors of the western part of the Island not exploited by traditional fishermen. This fall fishing would be carried out only from October and at greater depths than normally, which would make it possible to avoid the strong exploitation rates observed at the time of fall fisheries practiced on the other lobster stocks of the Gulf. Based on the presentation and the examination of the proposal, and according to current knowledge on the Anticosti Island stock, recommendations (e.g.: duration of the fishing season, captured sizes, follow-up protocols, presence of observers, conditions for longer-term fishing) were proposed for this project.

The last subject concerning the evaluation of the lobster stocks in Quebec was an investigation project on the impacts (interferences) of scallop drag on lobsters, which was carried out in the sector of Saint-Godefroi. According to the course of the experiment and to the results obtained, it was not possible to detect disturbances on dragged sites because of the too great variability in the control sites compared to the sites where the experiments with scallops were made. In addition, the type of sampling (simulating scallop fishing) was not representative of traditional activities of scallop vessels.

# **STATUS OF THE STOCK OF CAPELIN IN THE ESTUARY AND THE GULF OF ST. LAWRENCE (4RST) IN 2002**

**Dates:** January 29, 2003

**Responsible biologist:** François Grégoire

**Chairperson:** Alain Fréchet

**Rapporteur:** Jean-Louis Beaulieu

## **Introduction**

The main objective of the presentation was to describe the most recent data concerning the biology, fishing and distribution of capelin in NAFO divisions 4RST.

## **Commercial fishing**

Preliminary landings of capelin reached 3,302 T in 2002, which represented an increase of about 2,500 tons compared to 2001. The majority of catches were made in division 4R, mainly in 4Rc. The main fishing gear used in this division was the seine purse. In division 4T, no landings have been recorded since 2000.

## **Biological data**

Later fishing seasons were observed at the end of the 1980s and at the beginning of the 1990s. Between 1996 and 1998, fishing started earlier, but began later between 1999 and 2002. A reduction in the average size of capelin was noted the end of 1980 until 1994 and was at the origin of fishing closure in 1994 and 1995. Sizes stabilized between 1996 and 1998 and have increased slightly since 1999.

## **By-catch of shrimpers**

The catches of capelin of shrimpers occurred especially around the Anticosti Island and in the area of Sept-Îles as well as in the Esquiman Channel. Other information, such as depth of catch, could be obtained from a more detailed examination of the observer database. According to the industry, the capelin would be increasingly captured by the shrimpers in the beginning of the spring in the area of the Esquiman Channel. Catches were so significant that shrimpers even mentioned that they would delay their fishing by a few weeks to avoid this problem.

## **Bottom trawl surveys**

The examination of capelin catches made during the bottom trawl surveys of the Alfred Needler in the North and the South of the Gulf of St. Lawrence indicated that the distribution of this species has expanded in the Gulf since 1990. Even if the fishing gear used is considered to be less efficient for pelagic species, capelin by-catches made during these surveys could be used to evaluate the distribution and to measure the dispersion of this species.

The indices of dispersion are calculated by kriging based on the data on the presence and the absence of capelin per net tow in the case of bottom trawl surveys. Calculations are made from the data of the two statements. Initially, they are calculated for the Estuary and North of the Gulf, then for the Estuary and the whole of the Gulf (North + South). The second index consists of the average probability to find capelin per unit of area (25 km<sup>2</sup>).

Surfaces of minimum probabilities showed an upward trend between 1990 and 2002. The average probabilities to find capelin per unit of area also presented an upward trend for the

same period of time. All these indices, except for the average probabilities for the Estuary and the whole of the Gulf of St. Lawrence (North + South), have shown a downward variation since 2000.

**Recommendation (1):** To carry out kriging for surfaces that are more representative of the layers visited by the Needler; to use a weight of catch of 1 kg as a basis for the presence or the absence of capelin.

### **Oceanographical data, foraging and predation**

Works were undertaken on the links that could exist between various oceanographical parameters and the biology of the stock of capelin as well as on the predatory-prey relationships.

### **Industry comments**

The presence of capelin seemed more perceptible in the Chaleur Bay, and the egg-laying seemed to be observed more frequently offshore than on the beach. The presence of the capelin offshore was also mentioned by the fishermen of the Estuary and the Newfoundland West coast.

### **Highlights**

Capelin is undoubtedly one of the most significant foraging species in the Estuary and the Gulf of St. Lawrence. The yearly consumption of capelin by its main predatory is estimated at several hundreds of thousands of tons.

Preliminary landings of capelin made in 2002 in the NAFO divisions 4RST totalled 3,302 tons, which represented an increase of about 2,500 tons compared to 2001. However, these catches represented only 58 % of the average annual landings of the 1990-2001 period, and they were significantly lower than TAC.

Since the end of the 1980s, capelin fishing occurs more and more later. To this regard, the industry mentioned that it was not possible any more to predict the moment egg-laying occurs and that egg-laying occurs earlier on the beach.

The size of capelin has been rising since 1999. It was a gradual reduction of the size of this species that was at the origin of the premature cessation of fishing in 1994 and of its nearly complete closure in 1995. However, it was the loss of traditional markets and not the size of the capelin, which was responsible for the low level of landings recorded since 1999.

The geographical area of distribution of the species is now measured with two indices of dispersion. These indices have shown an upward trend since 1990. The capelin is also increasingly present in the South of the Gulf of St. Lawrence.

Post-spawning mortality and mortality by predation are naturally very high in the capelin. The current level of landings has little influence on the variations in the abundance of the species. However, effects of the recent changes in the distribution, migration and egg-laying on the production and the abundance of the species are unknown.

Even if commercial fishing takes only a low percentage of the total biomass, we recommend the maintenance of current levels of TAC due to a lack of knowledge on the biology of this species, the absence of an abundance survey directed on capelin and the significant role capelin plays in the marine ecosystem.

## PART TWO: MEETINGS HELD FROM FEBRUARY 11 TO 14, 2003

### STATUS OF THE SCALLOP STOCKS IN QUEBEC NEARSHORE WATER IN 2002

**Dates:** February 11, 2003

**Responsible biologist:** Line Pelletier

**Chairperson:** Louise Gendron

**Rapporteur:** Sylvie Brulotte

#### General

##### Definitions

- **Landings:** Expressed in kg or tons of muscle weight.
- **Effort:** Fishing effort expressed in standardized hours of dredging for a drag of 1 meter of width (h.m.). For the logbooks, fishing time includes sometimes travel time.
- **CPUE:** Catch per unit of effort expressed in kg of muscle weight per hour of dredging and standardized for a drag of 1 meter of width (kg/h.m.).
- **CPUE<sub>f</sub>:** Catch per unit of effort calculated from the logbooks.
- **CPUE<sub>s</sub>:** Catch per unit of effort calculated from commercial samplings at sea.

##### Innovations

- Confidence intervals of 95 % were calculated on CPUEs from commercial samplings.
- The responsible biologist and her team will circulate a survey, when sending the next stock status report, in order to obtain details on how each fisherman fills out his logbooks. They will also try to standardize information about fishing time recorded by fishermen so that it corresponds to the real time of dredging, as this standardization would facilitate CPUE calculations. Currently, uncertainties remain in the values recorded in the logbooks because travel time is included sometimes.

##### Suggestions for the next review of the stock of scallops following the 2003 fishing season

- Process separately CPUEs coming from real vessel trips and those coming from samplings made by fishermen themselves when there are no samplers on board (simulated commercial sampling at sea).
- Calculate the exploitation indices based on the number of scallops, not on the weight of muscles.
- Add TAC on the landing figures.
- Change the scale of CPUEs on figures based on "Landings, effort and CPUE by area" variables so that it is more visible (decrease the maximum).
- Standardize the symbols and the colors for the figures of the same type.

##### Description of the fishing areas covered by this review

- North Shore: areas 16A1, 16A2, 16B, 16C, 16E, 16F, 16G, 16H, 15, 18A et 18D.
- Gaspesia: areas 17A1, 17A2, 18B, 18C et 19A.
- Magdalen Islands: areas 20A, 20B, 20E (refuge area).



## Distribution

Giant scallop is abundant in the South of the Gulf of St. Lawrence, mainly in the Chaleur Bay and in the Magdalen Islands, while Iceland scallop is present everywhere in the Estuary and the North of the Gulf, between 20 and 60 m of depth.

## Biology

These are sedentary species found in aggregations. The sexes are separated, fecundation occurs in the column of water, and fertilized egg gives a pelagic larva that derives during approximately 5 weeks. The rearing varies according to the species, the place and the depth of the deposit. Giant scallop reach the size of 85 mm after 6 years approximately, and Iceland scallop needs from 8 to 10 years to reach this size. Recruitment is generally sporadic.

## Management measures

In Quebec, 82 licences were emitted for 18 management areas in 2002. Management measures were as follows:

- The length of the boats was limited to 15.24 m, except for the Anticosti Island and the Île Rouge where boats could reach 19.8 meters in length.
- The maximum width of drags was 7,3 m.
- The fishing seasons differed from one area to another.
- Depending on the area, there were TPA, individual quotas or global quotas.
- The minimum catch size was 95 mm for giant scallop in the Magdalen Islands (area 20) and in the South of Gaspesia (area 19A).

## Fishing in Quebec

Generally, fishermen use the *Digby*-type drag, but there are some exceptions, particularly in the Anticosti Island and the Île Rouge sectors, where fishermen use the *Offshore*-type drag. Preliminary landings totaled 143.3 tons in 2002, that is to say a drop of 33 % compared to those of 2001. Landings for the North Shore totalized 99.5 tons, those of the Magdalen Islands 15.1 tons and those of Gaspesia 28.7 tons of muscle weight. The largest drop was observed on the North Shore, where landings decreased by 42% compared to those of 2001. This diminution in landings is mainly due to the low prices of muscle.

## Area 19A - Gaspesia

### Fishing

There were 5 active fishermen in this area at the beginning of the fishing season (2 licences were bought at the end of the season: one by the lobster fishermen and the other by the DFO). Fishing was aimed at the two species of scallops found in this area. Interesting fact, one of the fishermen used an *Offshore*-type drag. This type of drag is of a more robust construction than the *Digby*-type drag, allowing fishermen equipped with such a gear to harvest sites that normally would not be visited. Moreover, this drag is more effective than the *Digby*-type drag, so fishermen using the *Offshore*-type drag can decrease the number of tows on a same site. However, given its robustness, the *Offshore*-type drag causes more damages to bottoms.

**Recommendation (1):** To limit and even prohibit, as a measure of conservation, the *Offshore*-type drag in Gaspesia.

In 2002, fishermen were equipped with a "black box" used to track their comings and goings during their fishing activities. Even if this system is not fine tuned yet, it can provide some useful information (especially fishing positions) to the DFO scientific personnel.

Landings added up to 13.8 tons in 2002, a decrease of 20% compared to 2001. There also was a drop in the fishing effort. CPUEI and CPUEs were low at 1.0 kg/h.m. and 0.7 kg/h.m. respectively.

The modal size of giant scallop increased to 114 mm in 2002. The average weight of muscle was 19.3 g for the giant scallop, that is to say an increase of 10% compared to 2001. However, it should be mentioned that the implementation of the increase in the minimum catch size is done by the calculation of muscle weights in kg. Thus, this does not allow an accurate regulation based on size since fishermen can mix large and small muscles (of large and small scallops) to obtain the desired result.

### Research index

A research survey was made in 2002 covering 4 deposits: Bonaventure, Paspébiac, Pointe-à-Maquereau and Chandler. The areas of these deposits ranged from 4.1 (Pointe-à-Maquereau) to 32.2 km<sup>2</sup> (Bonaventure) for the giant scallop and from 9.2 (Pointe-à-Maquereau) to 23.7 km<sup>2</sup> (Paspébiac) for the Iceland scallop. Average densities were low on these 4 deposits. They were, for giant scallops of all sizes, of 0.022 scallop/m<sup>2</sup> in Bonaventure, of 0.047 scallop/m<sup>2</sup> in Paspébiac and of 0.015 scallop/m<sup>2</sup> in Pointe-à-Maquereau. Densities for giant scallops are the highest in Chandler, with 0.130 scallop/m<sup>2</sup>.

For the Iceland scallop, densities ranged between 0.010 and 0.027 scallop/m<sup>2</sup>. The size structures showed the presence of recruitment in Paspébiac and Chandler for the giant scallop. On these two deposits, small scallops were found on a substrate made of small gravel. This type of substrate tends to clog the drags, what could explain the high quantity of small scallops in the drags. But it also would be possible that small scallops were more abundant on this type of substrate.

In a general way, giant scallops seemed present at depths of about 10 fathoms, while Iceland scallop were found at greater depths, between 15 and 20 fathoms.

### Conclusions and recommendations

Measures were already implemented to decrease fishing effort and to preserve the reproductive potential. It is necessary to continue in this way, and it is only during the next years that we will be able to see the effect produced on the state of this resource.

The research survey carried out in 2002 allowed to collect new information on recruitment. Strong concentrations of giant scallops of small size were present at depths of approximately 10 fathoms on the deposits of Chandler and Paspébiac.

**Recommendation (2):** To limit the fishing effort in these sectors by establishing refuge areas for a period of four years.

**Recommendation (3):** To restrict and even prohibit the use of the *Offshore* –type drag in area 19A, in order to maintain the reduction of the fishing effort.

## **Areas 18B et 18C – Gaspesia**

### **Fishing**

Only one active licence was in force for area 18B and two for area 18C in 2002; no fishing occurred in these areas in 2001. Iceland scallops were primarily aimed by fishing.

Landings varied from one year to another but decreased by 44% compared to those of the last ten years. CPUE<sub>I</sub> were of 6.8 kg/h.m. and CPUE<sub>S</sub> of 13.6 kg/h.m. Modal sizes were rather stable in area 18C.

### **Conclusions**

To the south of the Anticosti Island (areas 18B and 18C), landings and yields have been variable since 1991 and were mainly connected to fishing effort. In these areas, fishing is still under development. The yields of the 2002 fishing were significant, but the remoteness of deposits and the size of scallops make these deposits less interesting for vessel operators. The status of the resource in these areas appears not very alarming for the moment given the low fishing effort exerted there.

## **Area 17A2 – Gaspesia**

### **Fishing**

Only one fisherman was active in this area in 2002. Iceland scallops were primarily aimed by fishing. Landings decreased by 63% compared to those of 2001. The fishing effort was variable from one year to another. In 2002, CPUE<sub>I</sub> were of 1.3 kg/h.m. (a drop of 22% compared to 2001) and CPUE<sub>S</sub> of 2.6 kg/h.m. The modal size of scallops was 92 mm and the average weight of muscle of 16.1 g, these the last two indices being stable compared to 2001.

### **Conclusions**

To the North of the Gaspesian Peninsula (area 17A2), commercial indices for 2002 indicated a drop in fishing yields to levels equivalent to those of 1996 and 1997. Only one fisherman is exploiting the various deposits of this area, and this fisherman is varying his fishing effort within this area from one year to another. For the moment, it is not possible to evaluate the status of the resource for area 17A2 as a whole. If the downward trend of the indices continues during the next fishing season, the status of the resource could become a concern.

## **Areas 16A1 and 17A1 – Gaspesia and North Shore**

### **Fishing**

The deposit of the Île Rouge is a small deposit overlapping areas 16A1 and 17A1. One fisherman exploits each area. In 2002, the fisherman of area 16A1 used a new drag that he considered to be more efficient than his old drag.

Iceland scallops were primarily aimed by fishing. Landings reached 13.0 tons of muscles for these two areas in 2002. The fishing effort decreased by 62 % compared to 2001. CPUEs were very high: CPUE<sub>I</sub> were of 17.4 kg/h.m. (a significant rise of 183% compared to 2001, possibly related to the change of drag) and CPUE<sub>S</sub> were of 62,6 kg/h.m.

The modal size of Iceland scallops was 74 mm in 2002, remaining stable compared to that of 2001. The exploitation index was of 2.5% in 2002, the lowest since 1999. However, the use of a new drag in 2002 could bring changes to the index calculation related to the modification of the percentage of effectiveness of the gear.

### Research index

This small deposit covers an area of approximately 22 km<sup>2</sup>. The average density of Iceland scallops of all sizes on the deposit was high (0,99 scallop/m<sup>2</sup>). The dominating size structure was of 79 mm, with constant recruitment. A number of very small scallops (from 1 to 2 mm) were found attached to empty shells of scallop. The exploitation index was estimated at 4.5% in 2002, even when assuming an identical effectiveness (33%) for the new drag.

### Conclusions and recommendations

**Recommendation (4):** To combine the two fishing areas and to allow access to the whole deposit by two fishermen. This will ensure the good management of this deposit. Since 2001, only the quota for the northern portion (16A1) of the deposit of the Île Rouge was used.

**Recommendation (5):** To maintain the quota at the current level for the moment. Currently, the fishing effort distribution is not proportional to the biomass and could result in an overexploitation of the deposit.

**Recommendation (6):** To discard the empty shells of died scallops directly on the deposit since small scallops can attach themselves to the inside of these empty shells. This will support the survival of pre-recruits and preserve an environment favorable to their establishment on bottoms.

### **Area 16C – North Shore**

#### Fishing

There are two fishermen in this area with a TAC of 17.25 tons of muscles. Iceland scallops were primarily aimed by fishing. Landings were of 1.0 tons of muscle in 2002, a decrease of 63% compared to 2001. Landings comprised both muscles and shells, which complicates the calculation of CPUES. CPUE<sub>i</sub> were of 8.8 kg/h.m. (a significant rise of 192% compared to 2001). No sampling at sea was carried out in this area in 2002, indicating that no information on size structure is available.

#### Conclusions

Available information is partial and difficult to interpret. However, available commercial indices are positive. Thus, it seems that the status of the resource is not a concern given the current low level of exploitation.

### **Area 16D – North Shore**

#### Fishing

The area is opened to every licence holder residing between Sept-Îles and Pointe Parent. TAC was of 22.25 tons of muscle. Iceland scallops were primarily aimed by fishing. Landings added up to 104 kg in 2002 and CPUE<sub>i</sub> were of 3.4 kg/h.m. However, there are uncertainties on the way fishing times are compiled.

## Conclusions

In area 16D, fishing effort is relatively low and very irregular. Information is partial and insufficient, and it is not possible to make a conclusion about the status of the resource.

## **Area 16E – North Shore**

### Fishing

In 2002, seven active licences were in force for this area, and TAC was of 57.2 tons of muscle. Iceland scallops were primarily aimed by fishing. Landings reached 33.6 tons, a reduction of 40% compared to 2001. This reduction can be due to the bad weather and to the low scallop prices this year. CPUE<sub>i</sub> were of 4.5 kg/h.m. The gradual decrease observed since 1994 was maintained, although CPUE<sub>i</sub> were stable between 2001 and 2002. CPUE<sub>s</sub> were of 8.9 kg/h.m. in 2002. The modal size was of 87 mm. Modal sizes varied between 90 and 85 mm since the exploitation began. The weight of muscle was of 13.8 grams, a decrease of 12% compared to 2001.

### Research index

No research survey was made in this area in 2002 due to conflicts with fishermen during the planned survey period. It is thus impossible to confirm a decrease in recruitment (low number of individuals between 40 and 60 mm) that could affect landings during the next years.

### Recommendations

The fishing activities in Minganie would have been affected by the low market prices of scallop. The quota for this area was not reached for the first time since 1998. The abundance of small scallops in the research surveys of 2000 and 2001 makes it possible to believe that the biomass could increase in a few years. However, there could be no recruitment for the moment. While waiting for a possible recovery, it is recommended to maintain the *status quo*.

## **Area 16F – North Shore**

### Fishing

In 2002, there were nine active licences for this area. Iceland scallops were primarily aimed by fishing. TAC was of 32.7 tons of muscle, with an additional quota of 5 tons (0.555 ton per fisherman) for fishermen who agreed to take part in the exploratory survey. Unfortunately, the survey did not occur, but fishermen took advantage of the additional quota. The survey will have to be made at the beginning of the 2003 fishing season.

Landings reached 28.9 tons of muscle in 2002. CPUE<sub>i</sub> were of 5.7 kg/h.m., a drop of 18% compared to 2001, and CPUE<sub>s</sub> were of 9.8 kg/h.m. The modal size was of 88 mm, the biggest size recorded since 1992. The average weight of muscle was 13.0 g, which is about similar to that of 2001. The exploitation rate index was of 4.7 % in 2002, its lowest value since 2000.

### Conclusions and recommendations

In the area of the Île à la Chasse (area 16F), a gradual drop in yields was observed from 1994 to 2000. A few quota reductions were applied to rectify the downward trend. In 2002, landings slightly increased due to an additional allowance given to fishermen. Except for the catches per unit of effort (logbooks), the commercial indices remained relatively similar to those of 2001, reflecting for the moment some stability in the stock.

**Recommendation (7):** To return to a lower level of exploitation, similar to that of 2000, unless data collected at the time of the exploratory survey planned for 2003 show other possibilities. This will ensure the conservation of the resource.

### **Area 18A – North Shore**

#### **Fishing**

In 2002, there were nine active licences for this area located at the North-West of the Anticosti Island. TAC was of 57.4 tons of muscle. Iceland scallops were primarily aimed by fishing. Landings were of 22.0 tons of muscle, a decrease of 64% compared to 2001. This decrease seems to be mainly related to the low price of muscle, to a late fishing season, to bad weather conditions and to the substantial travel expenses incurred to go to this area. CPUE<sub>i</sub> were of 3.2 kg/h.m., a drop of 16% compared to those of 2001, and CPUE<sub>s</sub> were of 6,3 kg/h.m. The modal size (83 mm) remained stable compared to 2001. The average weight of muscle was 10.0 g. The exploitation index dropped in 2002 to 3.6 %.

#### **Conclusions and recommendations**

Since 1997, quotas for area 18A were increased annually, and sometimes in a substantial way. The fast rise of landings and the growing increase of fishing effort during these years generated concerns as they were accompanied by an increase in the exploitation index and by a decrease of catches per unit of effort. In 2002, the low landings and the low fishing effort did not reverse the downward trend in yields.

**Recommendation (8):** To bring quotas back to the level of 1999 in order to reverse the downward trend in yields and to increase the bottom biomass.

### **Area 15 – North Shore**

#### **Fishing**

There are 33 regular licences and ten exploratory licences for this area. In 2002, only six licences were active. There is no TAC for this area and the two species of scallops are found there. Landings were of 800 kg of muscle in 2002, a drop of 71% compared to 2001. Fishing effort also showed a drop. CPUE<sub>i</sub> were of 1.3 kg/h.m., a decrease of 20% compared to 2001. No commercial sampling at sea was carried out for this area. The average weight of muscle was of 12,6 g.

**Suggestion:** It would be interesting to verify if scallop fishermen of this area have temporary allowances for other species, which could explain their lost of interest for scallop fishing in this area. It would be also interesting to know the perception of fishermen on the scallop resource in their area.

#### **Conclusions and recommendations**

The massive mortalities observed in 2001 in this area were not due to pathogenic agent. It was mentioned that the latent fishing effort is very high and if, for an unspecified reason, all these fishermen (33) became active, it is not certain that the resource would support such an increase of fishing effort, particularly as there is little or no conservation guidelines for this area.

The decrease in landings over the last years for the two scallop species in the lower North Shore (area 15) could reflect a lost of interest of fishermen caused either by the drop in the

price of scallop on the market, or by the temporary deliverance of a fishing licence for other species.

The status of knowledge on the giant scallop of the lower North Shore prevents us from making a progress report on this resource. However, the biological characteristics of giant scallop, its contagious distribution and the massive mortalities observed in the past, and more recently in 2001 on some fishing sites, make this species very sensitive to overexploitation.

**Recommendation (9):** To decrease the potential fishing effort on the lower North Shore (area 15), given the sporadic recruitment of the two scallop species, the recurring massive mortalities, and the potential overcapacity of the fishing effort compared to the stock capacity.

## **Area 20 – Magdalen Islands**

### Fishing

There were 23 fishing licences for area 20 in 2002, and the two species of scallops were fished. A minimum catch size is applied. The goal is to reach 100 mm in 2003. In 2002, the minimal size was supposed to be of 95 mm, but it was finally maintained at 85 mm. A refuge area (20E) has been closed for several years and two aquicultural sites were closed by ordinance (Chaîne-de-la-Passe and Pointe-du-Ouest). Landings resulting from the harvest of stockings totaled 20 tons of muscle in 2002. No harvest of stockings is planned for the 2003 season.

The landings added up to 15.2 tons of muscle in 2002, a drop of 21.8% compared to 2001. CPUEI were of 0.9 kg/h.m. (an increase of 11.7% compared to 2001) and CPUEI were of 1.1 kg/h.m. In 2002, fishing sites were considerably restricted, fishermen concentrating their effort on the Dix-Milles bottom and on the open portion of the Pointe-du-Ouest. Landings came mainly from the western sector (Pointe-du-Ouest) with a total of 10.1 tons. For this sector, a loss of large size individuals in the structures of sizes of 2001 was observed. Scallops of less than 85 mm were present in the commercial samples. For the central sector (Dix-Milles bottom), the same phenomenon was noted.

### Research index

During the summer of 2002, a partial and qualitative photo inventory was carried out by Philippe Archambault and his group (Habitat du poisson). The preliminary results showed a low density on the South-West bottom (area 20E), similar to the other bottoms, but scallops were much larger there.

### Conclusions and recommendations

In spite of the reduction in the effort in Magdalen Islands, the abundance of scallop and yields remained very low. Scallops of large size practically disappeared in commercial samples and the only remaining concentration of wild spawners is located in the western sector. The fishing effort remained high on the Pointe-du-Ouest bottom, in spite of the reduced area of this traditional fishing bottom. It is thus necessary to continue to protect the wild scallops stock. Moreover, it would be imperative to start decreasing the scallop fishing fleet in area 20.

The restrictive measures that have been applied since a few years, such as the creation of refuge areas for spawners, the progressive phasing-in of a minimum catch size of 100 mm for 2003 and the reduction of the fishing effort, were aimed at restoring the wild stock. However, despite all these measures, the wild stock is not restored, and the situation is even worsening.

**Recommendation (10):** To replace dragging by an alternative method, like video, for carrying an eventual inventory in area 20E (refuge area).

**Recommendation (11):** To maintain the closure of the refuge area (20E) and to close commercial fishing in area 20A for a period of 3 or 4 years, in order to allow the wild stock of the Magdalen Islands to be restored.



## **STATUS OF THE ROCK CRAB STOCKS IN 2002**

**Dates:** February 12, 2003

**Responsible biologist:** Jean Lambert

**Chairperson:** Jean Landry

**Rapporteur:** Michel Giguère

Rock crab fishing is directed only on males. The size at sexual maturity is of 60 mm approximately for the females and of 70 mm for the males. The legal catch size (100 mm) for the common crab would be reached towards the age of 6 years. As the size at sexual maturity is much lower than the legal catch size, the reproductive potential of this species is protected by this measure.

In 2002, the fishing is well developed in Gaspesia and in the Magdalen Islands, but not on the North Shore. The increase in Quebec landings was of 15 % compared to 2001. However, the prices at landing showed a drop of 10% approximately during the same period.

### **Magdalen Islands**

There are 14 rock crab fishermen distributed among the different fishing areas of the Magdalen Islands. The total allowable catch is distributed between fishermen in the form of individual quotas. Except for area 12C1, located in the North-East of the archipelago, rock crab is fished everywhere around the Magdalen Islands. Fishermen who fish in the North of the archipelago are entitled to 150 traps, while those of the south can use 100 traps.

Rock crab landings have been relatively stable since 2000. They however peaked at 716 tons in 2002 (total quota exceeded). Over the years, an increase was noted in lobster fishermen's by-catches. In 2002, the by-catch was of 95 tons, an increase of approximately 200% compared to 2001.

In 2002, catches per unit of effort increased in general compared to 2001 in almost all areas. The best yields were recorded especially in the South of the archipelago (areas 12A and 12B).

In 2002, some fishermen of the North of the archipelago tested 4-foot-long traps. The comparison of the fishing effectiveness of these traps versus the 3-foot-long traps tends to show a greater effectiveness for the 4-foot-long traps. The yield variation between the two types of traps seems to be particularly important at the beginning of the fishing season, but the difference decreased by the end of the season. This situation could be explained by the saturation of the 3-foot-long traps. The assembly stressed that this saturation is a positive point as such, indicating that fishing would have for the moment a little effect on the stock. The remark was also made that the 4-foot-long traps would be a better indicator than the 3-foot-long traps for fishing follow-up purposes.

The average size of landed crabs has been high and stable in the different areas since the beginning of the fishing season. There has been however an unexplainable collapse in the size structure since 2000 in the South of the archipelago (area 12B). Some members of the assembly also questioned the apparent reduction in the number of crabs of very large size and the collapse of the right end of the size structure. It seems that fishing exploited only the last two year-classes of the population. The assembly believed that this situation was the reflection of a sound and balanced exploitation.

Data of the lobster trawl survey carried out in the South-East of the archipelago showed a certain stability in the size structure of the population sampled over the last years. The small

number of rock crabs of an approximate size of 120 mm was questioned, but no conclusion was reached. It was also mentioned that the trawl was not very selective for small crabs and that the survey focused on lobster was not necessarily a valuable picture of the rock crab population because the sampling plan did not take the spatial distribution of crab (often contagious) into account.

**Recommendation (1):** To keep the total allowable catch (TAC) for rock crab from increasing over the next three years, in order to observe the reaction of the stock compared to the current level of exploitation. Until now, the rock crab stocks of the Magdalen Islands seem to react well to the pressure of fishing. However, rock crab fishing is relatively recent, and its effects on the productivity of the populations remain unknown. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.

The members of the assembly also suggested to remove the limits of areas 12B1 and 12B2, and to give area 12C1 the statute of refuge area (inserted in the section of the special requests of management).

### **Special requests of resource managers**

#### **4-foot traps**

A request for opinion was formulated by the managers of the Magdalen Islands to evaluate the potential use of 4-foot-long traps in area 12C.

**Recommendation (2):** To allow the use of large traps as the assembly does not think that they will have a negative impact on the rock crab population as long as this fishing is managed by individual quotas and that the total allowable catch does not exceed the output of the stock.

The apparent saturation of the 3-foot-long traps is an indication of the capacity of the stock to support the level of exploitation at the beginning of the years 2000s. For Sciences, the use of more than one type of fishing gear complicates the interpretation of results. It was considered important not to multiply ad infinitum the types of fishing gear used in a same fishing area.

The need for asking equivalences for large traps raised interrogations. Opinions were shared. Some members argued that in a context of quota-based management, the impact of large traps on the population would not be measurable on the short term. Others were less affirmative and stressed that there were information gaps on the impact of large traps on the exploitation, and that there was a risk of production overcapacity by the fleet.

**Recommendation (3):** To allow the use of large traps (4 feet) in area 12C. Unanimously, the members of the assembly believe that the use of larger traps is acceptable because of the high currents, provided that a strict follow-up be applied over a 3-years period in order to see how the stock responds to this change.

## Permanent licences

A request for opinion was formulated by the resource managers for the purpose of making permanent the rock crab exploratory licences. The assembly considered that crab fishing was a fishing of its own rights and did not oppose to making rock crab licences permanent.

## North Gaspesia

Landings have increased regularly since the beginning of the fishing. In 2002, landings peaked at 365 tons, which was an increase of 50% compared to 2001. No increase in the by-catches was reported for this sector. Areas 12D5 and 12D6 showed the highest landing levels by fisherman in Quebec.

In 2002, a few logbooks came from this sector; it will thus be necessary to make a conservative interpretation of the results. For the moment, fishing does not seem to be slowing down. Yields increased in the West as well as in the East. From 2001 to 2002, the average yield of areas 12D increased from 6 to 9 kg/trap. Catches per unit of effort in these areas were stable during all the fishing season. On the other hand, in 17B, a decrease in the catches per unit of effort was observed for the first time during the 2002 season.

The average size of crabs landed in areas 17B and 12D has been relatively high and constant since the beginning of the fishing. The impact of rock crab fishing on lobster was questioned. To answer this question, it was mentioned that the predation was primarily targeted on small individuals and that there was no predation on large individuals (110 mm and more).

It was also mentioned that fishermen should be made aware of the fact that their area needs to be exploited in a better way. As they are not in a situation of competitive fishing, this could only have positive impacts on their businesses. As an example, it is strongly suggested to maintain buffer areas between (or in) fishing areas. These buffer areas would be used as a refuge by the species and would act as a safety valve for the conservation of the resource. The best resource conservation strategies remain to be defined. We are however conscious of the fact that it will be necessary to quickly establish the limits of these areas before fishing become too intensive and before such limits are perceived as a constraint by fishermen. Criteria for the selection of these buffer areas, e.g. their dimensions and localization, will have to be proposed quickly in order to direct the selection of the sites to be retained as well as their respective limits. It was thus strongly suggested to undertake, as soon as possible, a pilot project aimed at the establishment of refuge areas for rock crab in the northern sector of Gaspesia.

**Recommendation (4):** To keep the rock crab fishing effort from increasing over the next three years, in order to observe the response of the stock compared to the current level of exploitation. This is necessary as our knowledge is insufficient to determine if the stocks can support the same fishing intensity in the short or medium term, in particular where landings are highest. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.

Finally, in a context of resource conservation and sustainable development, it was also strongly suggested to set up buffer areas where fishing would be prohibited.

## South Gaspesia

Landings for the whole of the rock crab fishing areas of the South of the Gaspesia have been relatively stable since the beginning of the fishing. In 2002, landings of areas 12EP and 12QX

were similar to those of 2001. For the same period, however, they increased in areas 12Y and 12Z.

The yields of area 12QX have shown a light reduction for some years. They have remained stable however in the others areas of the South of Gaspesia. Yields were weaker in the western sector and increased gradually as one moves towards the East.

The average size of landed crabs was lower than in the Magdalen Islands and than in the North of Gaspesia. Large individuals were fewer, and the size structure was narrower there. Catches per unit of effort and average size of landed crabs in area 12QX seem to have decreased slightly.

A trap survey (standard type, but without escape vent) was made in the South of Gaspesia. As there is no research history for this sector, results are not readily interpretable for the moment.

**Recommendation (5):** To keep the fishing effort from increasing over the next three years, in order to observe the reaction of the stock compared to the current level of exploitation. The various indicators of the status of the stocks of the southern part of Gaspesia suggest some stability in the exploitation. However, this information is not sufficient to make a conclusion about the capacity of these populations to support a long-term exploitation. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.

Finally, in a context of resource conservation and sustainable development, it was also strongly suggested to set up buffer areas where fishing would be prohibited. These areas could correspond to areas where no exploitation occurs currently.

### **Special requests of the resource managers**

#### **Access to the resource**

Resource managers questioned the relevance of delivering licences in some areas of the Chaleur Bay, at locations where the licences have not been exploited yet and where there is no moratorium on the development of rock crab fishing. The assembly was not necessary against this option, however it was mentioned that it would be convenient to use some of these areas as refuge areas.

#### **Permanent licences**

A request for opinion was formulated by the resource managers for the purpose of making permanent the rock crab exploratory licences. The assembly considered that crab fishing was a fishing of its own rights and did not oppose to making rock crab licences permanent.

## **STATUS OF THE GREENLAND HALIBUT STOCK IN THE GULF OF ST. LAWRENCE (4RST) IN 2002**

**Dates:** February 13, 2003

**Responsible biologist:** Bernard Morin

**Chairperson:** Dominique Gascon

**Rapporteur:** Louise Savard

### **General**

Four documents were distributed: figures, tables, survey stratification chart, summary (highlights).

The plan of the presentation was as follows:

- Summary of the status of the stock: indicators
- Fishing
- Scientific fishing project
- Surveys
- Feeding
- Other indicators
- Highlights

### **Status of the stock: indicators**

Two series: a) from 1990 to 2002 (reference period: 1990-2000);  
b) from 1995 to 2002 (reference period: 1996-2000).

### **Fishing**

#### **Landings and TAC**

The difference between the catches and the TAC has increased over last years. The TAC decreased in 2002, and a light increase of landings occurred in 2002 compared to 2001 (thus the difference decreased) due to experimental fishing with 5.5-inches nets in Quebec and to the great success of fishing in Newfoundland (allowance exceeded). A discussion followed on the significance of this indicator for the status of the stock and, therefore, on the relevance of its use in the summary.

#### **Catch rates**

For traditional fishermen using 6 inches nets (a total of about twenty fishermen filled out their logbooks), CPUEs slightly increased in 2002 in the East (on Newfoundland West coast), and not in the West (Estuary). Standardized CPUEs (month, subdivision, immersion time, year) indicated a drop in 2000 and 2001, then an increase in 2002.

#### **Composition of commercial catches**

Much more females (86%) than males were captured; larger halibuts captured in 4S than in 4R and 4T. The average size has decreased since 1996. The size of 44 cm is a target size and not a legal minimum size as it is for lobster; the size decreased to 40 cm with the use of 5.5-inches nets in Quebec. A discussion followed on the fact that the minimum size was not applied (not enforced), and it was noted that the protocol for small fish and the minimum size should be more closely controlled.

### **Scientific fishing project**

During the summer: CPUEs were higher and fish were smaller with the 5.5 inches nets. The catches were mostly females (80% and more) with the two types of nets. The proportion of females did not significantly decrease with the reduction in the mesh size, as opposed to what was expected. A discussion followed on the mesh size to know if 5.5 inches nets were effectively 5.5 inches, because of the high proportion of females that were caught (measurement of the mesh size of the nets: before 1997, from center to center; after 1997, inside the nodes). During the fall, additional information on maturity was available: as expected, the number of immature females caught increased with smaller mesh size. However, the percentage of mature males was slightly higher with the 5.5 inches nets, compared to the 6 inches, compared to what was expected. A discussion followed on the significance of this result and it was suggested that two different year-classes were aimed by the two mesh sizes.

### **Surveys**

Three series: Hammond-Needler, sentinel fisheries during the summer, sentinel fisheries during the fall.

Distribution of the catches of the Needler: the extent of the stock increased from 1990 to 2001 (from the West towards the East). In 2002, the number of stations visited in Esquiman was rather limited. A discussion followed on the coverage by the Needler of layers 801 and 813 in 2002; could the limited coverage had an effect on the estimate of the biomass, because the stations would have been outside the concentration areas.

Distribution and concentration indices: the extent of the stock increased from 1990 to 1995, and then remained stable until 2002.

Fusion of the series of the Hammond with that of the Needler and of the sentinel fisheries: the fall survey was more similar to that of the Needler (reduction in 2001 and in 2002) than the summer survey. Here are a few comments on the inconsistency of the three indices. As different parameters were measured (with or without the Estuaire, length of fish), questions were raised. In Esquiman, the three surveys did not give the same results in 2002. The discussion then addressed the effectiveness of the trawl survey (Needler) of 2002. Some details need to be reviewed, such as the frequencies of size. The differences could be normal if fish were larger. The sentinel fisheries of summer were never consistent with the Needler.

Length frequencies for the Needler and the sentinel fisheries: abundant year-classes in alternation (1995, 1997, 1999, and 2001 in the three surveys). One underlined the inconsistency between, on the one hand, the estimated abundance of large fish in 1987 and the success of the fishing of 1987 and, on the other hand, current estimations compared to the success of the fishing now. The fact was underlined that the fish of one year grew only of 1 or 2 cm between July and October, whereas the growth for the year was approximately 10 cm. It was indicated that the gut fullness level in August was low and that consequently the growth could occur during the winter.

**Recommendation (1):** To make deeper analyses on the fusion of the two series (Lady Hammond – Needler) before using it in the evaluation.

Length frequencies per sector or area: the modal length was larger in Esquiman than in the West; this difference was especially associated the year-class of 1997 which would have had a weaker growth in the West. There could be an effect of the density on the growth.

## **Feeding**

The halibut tended to feed more in 2002 (especially shrimps). In the West, halibut ate more in 2002 (especially shrimps and *Themisto*); in the North of Anticosti, the gut fullness index was higher than in the west; in Esquiman, the index was even higher than in the North of Anticosti and in the West of the Gulf. In these three areas, the index was higher in 2002 than in 2001. For fish <40 cm, the fullness level was higher in 2002; by area, the index was higher in Esquiman for the two sizes. Many invertebrates were observed for <40 cm individuals; for >40 cm individuals, it was less evident that the fullness level was higher in 2002, but it showed the same West-East progression.

## **Other indicators**

Indices by classes of size: Based on the spawner-recruit (stock-recruitment) relation, the year-class 2001 was also very abundant (3rd place after 1997 and 1999). The abundance of individuals larger than 44 cm decreased in 2001 and 2002. Indices by classes of size and sex: males have decreased since 1998.

***Comment:*** the 2002 fishing in Esquiman was intensive and took place in the layer sector where good yields were expected for the Needler. The following assumption was mentioned: there was a local depletion resulting in a decrease in the density measured by the survey.

The percentage of females for the sizes selected in fishing followed the same trend for the Needler and the commercial fishing. This point was discussed in details, but a consensus was not reached on the significance to give to this result.

The average length at 3-year-old decreased in 2002 and 2001, but increased in 2002.

***Comment:*** one must pay attention to these average lengths as they come from modal analyses or average lengths which could be imprecise for the not very abundant year-classes.

Index of condition: the index increased in 2001 and 2002 for fish <40 cm, which is consistent with the increase in stomach fullness.

**Recommendation (2):** To use the most suitable exponent for the species. This recommendation follows a discussion on the difference between the index of condition of < and of >40 cm fish (higher index for largest).

Size at maturity: the causes of sexual maturity at smaller sizes were discussed without reaching a consensus.

**Recommendation (3):** To check the sizes at sexual maturity for the 1980s (if this information is available), in order to determine the variation amplitude of the size at maturity.

Temperature: the effect of the temperature and oxygen dissolved on the metabolism was discussed. It was very interesting and we will continue to work on this matter.

## **Highlights**

Harvest strategies (e.g., to decrease the catch size, but also to decrease the exploitation rate, etc.) were discussed.

The highlights were reviewed and modifications made progressively.

## STATUS OF THE ATLANTIC HALIBUT STOCK IN THE GULF OF ST. LAWRENCE (4RST) IN 2002

**Dates:** February 14, 2003

**Responsible biologist:** Diane Archambault

**Chairperson:** Dominique Gascon

**Rapporteur:** Jean-Paul Dallaire

Although Atlantic halibut landings have remained at nearly 300 tons for the last 6 years, it was noted that they remained at a low level compared to the 1000 tons and more landed during the first half of the last century. These landings were lower than the 350 tons TAC since the allowance attributed to mobile gears could not be fished. On the other hand, fixed-gear fleets of less than 45 feet exceeded their quota. However, fishermen must sometimes stop their fishing when their cod by-catches exceed a given percentage of their total halibut catches. In this fishery, the longliners collected approximately 95% of the allocated quota.

**Suggestion:** To include the landing history values of the beginning of 20<sup>th</sup> century, not only the values starting in 1953, in order to enable us to take the large previous landings into account.

It was noted that the landings of 3Pn have been in constant increase since 1995.

**Recommendation (1):** To suggest the exercise of a better control of area 3Pn by Management, as should be done for any groundfish. Currently, no management measures are implemented, including the establishment of quotas. Landings could increase substantially if adequate measures are not taken.

If the sexual maturation of the Gulf halibut stock were identical to that of the Atlantic coast stock, males would reach sexual maturity (M50) at a size of 75 cm, whereas female size would rather range from 110 to 115 cm. The minimum catch size is 81 cm. With a growth rate of 7 to 8 cm a year, the captured fish would thus be at least 10 years old.

In the North of the Gulf, almost all catches are done along the 200 m isobath or in channel bottoms.

A reduction in the average size of the individuals in the commercial catches was observed whereas the range of sizes did not change. In 2002 however, a lower proportion of individuals greater than 100 cm was recorded. Could the catches by mobile gears (with doubled trawls) have contributed to this situation.

**Suggestion:** It would be interesting to see the landings coming exclusively from the sentinel fisheries. It would also be interesting to see whether the size structures include data from the mobile gear sentinel fisheries (where the cod-end of the trawl was doubled). This variation could also be due to the fact that a very low number of individuals were measured.

**Suggestion:** In order to facilitate the interpretation of figure 12, it was suggested to incorporate the figure of the length frequencies (by number and by percentage) already presented in the research document 2002/090.



**Suggestion:** It would be necessary to pay a greater attention to the recruitment in order to determine whether a real depletion of the sizes higher than 100 cm is occurring or if we rather face an increase in the recruitment (sizes between 80 and 100 cm).

The survey of the South-West of the Gulf could be used to this end. A chart of the number of halibuts captured in surveys in the Gulf (CGS Alfred Needler for the areas of Quebec and of the Gulf) by year would enable us to better understand the size structure of figure 11 as well as that of the average sizes of figure 12. It was pointed out that the increase in abundance of individuals ranging from 80 to 100 cm could result from the use of the Nordmore grid since the last 10 years and from the cessation of trawling following the implementation of moratoriums on cod and redfish (since 10 years approximately). With an annual rate of growth ranging from 7 to 8 cm, uncaught individuals should have reached this size.

Although most of the recaptures made under the tagging program undertaken 5 years ago occurred in the same sector fish were tagged, some fish tagged in the South-West of the Gulf underwent greater displacements (Magdalen Islands towards 3Pn, Banc Miscou towards Banc Beaugé). There could be seasonal displacements linked to foraging. Thus, fishermen of Rivière-du-Loup and of Trois-Pistoles affirm to be able to fish only during a very precise period. It was noted that a displacement of halibuts also occurred between the *Gadus Atlantica* winter survey and the CGS Alfred Needler summer survey. During winter, much of the catches were done in channels, whereas catches of summer were less deep and took place along the 200 m isobath.

**Recommendation (2):** To ensure the visualization of the temporal evolution of CPUEs, in order to determine if the increase in abundance perceived in the surveys is also perceptible in the commercial fishing. This would increase significantly the confidence level of this trend.

## **Conclusions**

In the "Summary of the status of the resource", it would be necessary to eliminate the 3rd paragraph on gonads, as it does not add information on the status of the resource. It would also be necessary to delete the portion on tagging in the highlight section, and rather discuss this issue in the body of the text. Finally, it would be important to add to this paragraph: "although they are mainly captured at the same place".

To conclude, some participants pointed out that the Atlantic halibut is one of the rare groundfish species showing apparently certain positive evidences of status improvement.

## **STATUS OF THE HERRING STOCKS IN AREA 4R IN 2002**

**Dates:** March 25, 2003

**Responsible biologist:** François Grégoire

**Chairperson:** Bernard Sainte-Marie

**Rapporteur:** Hugues Bouchard

### **Definitions**

- TAC: Total allowable catch.
- ASP: Sequential populations analysis.
- CV: Coefficient of variation.

### **Summary for 2000 and 2001**

A short retrospective on the status of the herring stocks was presented for 2000 and 2001. Highlights (landings, mean age, spawner condition, SPA, etc.) as well as the prospects concerning spring and fall spawners were also addressed.

### **Review of the fishing of 2002**

In 2002, total landings for division 4R added up to 12,258 tons (preliminary data) for a total allowable catch (TAC) of 15,000 tons. The lower level of catches [+capture] compared to the TAC would be connected to factors other than fishing capacity. It was mentioned, among other things, that there were market problems for the gillnet catches from the unit area 4Ra and that the difference between the landings and the TAC in 2002 was mainly due to a reduction of fishing activities with this type of gear (the seiners reached their quota limit). It should be noted that there was a preventive cessation of fishing for seiners in 2001 and that their 2002 season ended up very early because of the abundance of herring and due to the fact their quota limits were rapidly reached.

The fishery was mainly carried out by seiners in the center and southern parts of division 4R (unit areas 4Rb, 4Rc and 4Rd) and was distributed quite evenly between seiners and gillnets in the northern part (unit area 4Ra). Nearly 60% of landings came from unit area 4Rc. The fishing in unit area 4Rc was stronger in July, June and October compared with the average for these months observed during the 1993-2001 period. The analysis of landings per month for the gillnets indicated that landings were less important than usually for each month of the season, except for July, while for the large seiners (more than 65 feet), landings were more significant in June, July and October.

### **Description of landings**

Spring spawners were largely dominant in commercial catches, and their proportion has increased since 1999 while the proportion of fall spawners has decreased since 1998.

### **Biological parameters**

The analysis of commercial samples revealed an improvement of the condition of spawners in 2002 for the two stocks of spawners. The values recorded for 2002 were the highest since 1970. The weight-at-age curves for the 2 stocks in 2002 were within the historical averages of

the 1970-1979 and 1990-1999 decades, but remained lower than the average of the 1980-1989 decade, which exceeded all of the analyzed periods.

The analysis of the average weight at 4 and 6 years showed an increase for the 2 stocks of spawners since 1998. The particularly high average weight of the 4-years spring spawners, a weight similar to that of age 6, could be due to the low representativeness of these fish in the samples and to the insufficient number of commercial samples collected.

**Recommendation (1):** To increase the frequency and the spatio-temporal coverage of the commercial sampling made with small seiners (less than 65 feet), among other things.

The review of the commercial samples catch-at-ages showed that the year-classes of 1996 and 1998 dominated the herring catches of the spring and of the fall respectively. It should be noted that since the middle of the 1990s, the 8-year-old herrings and over are practically missing in the catches. In the case of the seiners, this scarcity could be due to an effort concentration towards the strong year-classes found on fishing sites. It may be also possible that the oldest individuals were missing because of the strong fishing pressures.

The examination of modes of length frequencies for spring spawners captured with gillnets in unit areas 4Ra and 4Rd would indicate a difference in the rates of growth between these two areas since 1998. Growth would be faster in the southernmost unit area 4Rd. It was suggested that the growth variations could determine the type of spawner and consequently spring spawners observed in the North (4Ra) could be the offspring of fall spawners. This assumption would also explain the strong proportions of spring spawners that has been observed in gillnet commercial samples from unit area 4Ra since 1998, compared to the small proportions observed in the 1970s.

### **Surveys, indices and analytical assessment of the biomass**

The spatial distribution charts of herring catches for August coming from the Alfred Needler surveys as well as the abundance index were examined for guidance only. The distribution charts showed a very variable presence of herring in the Gulf of the St. Lawrence and yields generally lower than 30 kg per 24-minute tow. For the next reviews, it was suggested to only present the pattern of spatial distribution of herring catches obtained from this survey. The age structure of herring catches coming from this survey was not examined during the last 2 years. However, in the previous years, herring catches were mainly made up of young fish.

An acoustic survey was carried out in September 2002 after a suspension of 2 years. According to this survey, the abundance of the spring stock decreased from 1991 to 1995, and remained relatively stable since this time. The abundance of the fall stock increased from 1997 to 1999 and remained stable in 2002. A concern was raised concerning the duration of this survey, the period (September) it was carried out as well as the covered surface.

A sequential analysis of population (SPA) was carried out on the fall spawners using the data of the acoustic survey only. The diagnostics resulting from this analysis indicated major problems of model adjustment for the fall spawners. It was noted that the coefficients of variation (CV) of parameters estimated with the SPA were too high, and that for the majority of these parameters, the coefficients of correlation were also very high, which reveals an absence of independence between these parameters. Moreover, as the correlations were negative, the adjustment of the model could have been made using various combinations of the parameter values to be measured (without however determining the true combination). The diagnostics also indicated the presence of a retrospective pattern showing a trend to underestimate the abundance of this

reproductive stock. Given the very high uncertainties, the results of the SPA for the fall spawners must be used with care. The reproductive biomass of the stock of fall herrings, according to the SPA, would have shifted from 71,412 tons in 1994, i.e. the maximum value for the 1990s, to 48,481 tons in 2003. A number of problems were raised over and over again: the low frequency of the acoustic survey (every two or three years), the quality of its space coverage and the period during which it was carried out, the absence of gillnet fishing logbooks for fall herrings and, finally, the gaps in commercial sampling.

The abundance index of the spring spawners established with index fishermen data and with industry logbooks (only ten or so) for gillnet fishing in the St-George Bay (4Rd) has been increasing since 1998. In 2002, this index reached a level similar to that observed at the end of the 1980s. This rise is due in particular to the year-classes of 1994, 1995 and 1996, whose abundance was higher than the average.

A spring spawner SPA was also carried out using the data of the abundance index of gillnet fishing and acoustic surveys. The entry parameters used were the catches and the weight-at-ages (from 1965 to 2002), the standardized catch rates at the age of gillnet fishing (from 1985 to 2002) as well as the numbers at the age estimated derived from acoustic surveys made every two or three years during the 1991-2002 period. A major divergence was observed between the indices derived from gillnet fishing and from acoustic surveys for the spring stock. As in the case of the fall spawners, this divergence as well as the analysis diagnostics (high coefficients of variation and coefficients of correlation) showed major problems of model adjustment and the presence of a retrospective pattern indicating a trend to underestimate the abundance of the stock and to over-estimate fishing effort. Moreover, the residues associated with the acoustic survey presented a year effect for the spring spawners. Given these uncertainties, the results of the SPA for the spring spawners must be used with care. The reproductive biomass of the spring herring stock, according to the SPA, would have shifted from a historical minimum of 35,011 tons in 1997 to 58,921 tons in 2003.

A consensus was reached to the effect that signals coming from the 2 herring stocks were gradually disappearing and that the low frequency of the surveys and the time they were carried out have largely contributed to the wrong SPA diagnostics. Moreover, the lack of information on the gillnet fall fishing (no logbook) and the sometimes insufficient spatio-temporal coverage of commercial fishing sampling reduced our capacity to accurately evaluate the abundance of the two reproductive stocks.

**Recommendation (2):** To increase the frequency of the acoustic survey, its duration and the surface covered; to obtain information on the gillnet fall fishing; to globally improve the spatio-temporal commercial fishing coverage.

### **Risk analysis**

An exam of risk analysis was followed by a discussion on the probable effect that the various fishing quotas applied on the 2 stocks in 2003 could have on different management objectives. Given the very high uncertainties of results of the SPA carried out for the 2 reproductive stocks, a higher level of uncertainty would also be associated to the risk analysis projections. The risk analysis carried out on spring spawners indicated that the probability of exceeding  $F_{0,1}$  would be lower than 50% with catches of less than 11,000 tons in 2003. The risk analysis made for fall spawners indicated that the probability of exceeding  $F_{0,1}$  would be lower than 50% with catches of less than 11,600 tons in 2003.

### **Industry comments**

Some comments were formulated by the industry. In particular, some remarks concerning the spring fishing carried out in the St-George Bay (4Rd), which is used as a basis to calculate the gillnet index, indicated an opposite trend to that observed in the acoustic survey, whose results did not correspond to industry observations.

# STATUS OF THE MACKEREL STOCK OF THE NORTH-WEST OF THE ATLANTIC

**Dates:** April 25, 2003

**Responsible biologist:** François Grégoire

**Chairperson:** Bernard Sainte-Marie

**Rapporteur:** Denis Bernier

## **Background**

This review on the status of the mackerel stock consisted of an update on the commercial fishing for the 2002 season and on the biological parameters obtained via commercial catch sampling activities. The formulation of the scientific opinion was based on a review of the egg abundance index derived from the 2002 survey as well as the plankton abundance index for the South of the Gulf of St. Lawrence between 1983 and 2002. The distribution of mackerel eggs on the Scotian Shelf as observed during 1960s, 1970s and 1980s was also presented.

## **Commercial fishing**

The landings were presented in a general way as well as in a breakdown by country, province, NAFO division and by fishing gear. The 2002 fishing season was marked by significant catches by the Newfoundland fishermen who used the seine purse. On the 23,433 tons landed in the Atlantic Provinces (Quebec included), nearly 16,500 tons came from this province. Of these landings, nearly 12,000 tons were harvested on the West coast, in unit areas 4Rc and 4Rd mainly. These catches were carried out over a few weeks.

The discussions mainly addressed the fact that the data presented were minimum values since the activities of sport fishing and those linked to lure acquisition were not accounted for. The obligation to record these catches in a logbook was one of the components of the fishing plan, which will start its third year of application in 2003. However, due to a lack of budget, this obligation was still not applied. Moreover, the data on catches came from ZIFF files and did not contain those of the Canadian and foreign ships sampled by the Nova-Scotian observer program. Thus, for 2002, it was necessary to add nearly 20 tons of mackerel to the ZIFF statistics.

## **Biological parameters**

The results of analysis of the length-at-age emphasized a reduction of the length and weight, for a given age, for individuals from dominant year-classes. Like it was already suggested, we would probably be face with a density-dependent relation.

**Suggestion:** To calculate a rate of growth based on the graphic illustrating the length slopes according to the year for the various year-classes.

The follow-up of the dominant year-classes evolution by examining the annual length frequencies for the 2002 fishing season was characterized by the presence of fish mainly from the 1999 year-class. The length frequencies for catches from seine purse and line fishery clearly showed this predominance. As gillnets are more selective fishing gears, it was observed, in the length frequencies, that the catches are mainly from the 1996 year-class. The importance of the 1999 year-class was also evident in the examination of the catch-at-age established for commercial sampling. Indeed, the 1999 year-class composed 76.6% of the 2002 catches. This percentage was the highest of the series. This could reflect the real importance of the 1999

year-class. However, this strong percentage could also be the reflection of the preponderance of this year-class in the whole stock.

The condition of mackerel deteriorated during the first half of the 1990s, but return, in 2002, close to the 1973-2001 average. Much similarity was noted between the evolution of the mackerel condition (measured in June) and the temperature of the higher portion of the cold intermediate layer (CIL). This similarity was also observed for various age groups and with fish of the year-classes that dominated the mackerel fishing during several years.

**Suggestion:** To verify if a relation exists between the length and the factor of condition. According to the results obtained, it would be interesting to present the evolution of the factor of condition for a target group of the same length. The similarity between the evolution of the factor of condition and the CIL could appear in a more precise way.

The evolution of the gonadosomatic index (GSC) according to the day of the year indicated that the egg-laying of 1999 preceded the mean value for the 1973-2002 period (1999 excluded) by at least 3 weeks. Data used for the calculation of the GSC came from sampling carried out mainly in the Gulf since the middle of the 1980s. The discussions on this observation related to 2 points in particular:

- Was it an early egg-laying which had already begun on the Scotian Shelf before the arrival of mackerel in the Gulf?
- Was it a migration combined to an earlier egg-laying in the Gulf (in 1999, the early presence of mackerel in the Gulf had been mentioned by the industry)?

To answer these questions, data were presented to illustrate the possibility of finding mature size mackerel in the Scotian Shelf as well as survey data indicating where mackerel eggs were observed, in particular in division 4X.

Currently, data are too fragmentary to answer the question raised concerning the scope of egg-laying in the Scotian Shelf. The assembly agreed that sampling problems limit our ability to explain early egg-laying in the Gulf.

### **Egg survey**

The results of the survey carried out in June 2002 were presented. A plankton abundance index was defined as the relationship between the deposited volume of plankton in samples and the filtered volume of water. This index would be in relation with CIL temperature. As well, it was possible to observe that this index was higher for the years that produced strong year-classes.

The calculation of the mackerel reproductive biomass was based on 2 methods. The reproductive biomass was thus evaluated based on a modified total eggs production method (TEPM) and on the daily fecundity reduction method (DFRM). For 2002, the reproductive biomass was evaluated at 379,069 tons and at 359,330 tons when considering the TEPM and the DFRM respectively.

## **Discussion**

### **TEPM**

Since the catches are mainly made up (in number and in percentage) of fish of the 1999 year-class, the assembly advanced the assumption that the index could have been higher for 2002. However, the value of the index was absolutely logical if we consider the fact that the fish were 20% smaller in weight.

### **DFRM**

It is possible that no linear relation exists between the reduction in the reproductive potential and the proportion of females in an egg-laying condition. A gain in precision could be obtained by using another type of relation. However, the DFRM which was also used for other fish stocks had until now never been applied with nonlinear models because of an increased complexity in calculations. A nonlinear model could probably offer a better coefficient of correlation, but it could not give biological explanation to the changes observed in the decline of the fecundity.

The standard deviations could be lower if the daily egg production parameter per unit of area (P0) was evaluated by kriging.

No consensus was reached concerning the continuation of the reproductive biomass assessment with the 2 methods for of the next survey. A suggestion was made to keep the 2 methods and considering the use of the DFRM one year every 3 to 4 years.

A highlights review concluded the meeting. The modifications suggested by the assembly will be considered during the final drafting of the report on the evaluation of the mackerel stock.



## APPENDIX 1

### Schedule of the Regional Stock Assessment Process of the Region of Quebec held between January 21 and April 25, 2003.

STOCK	DATE(S)	DURATION (DAYS)	ASSEMBLY CHAIRPERSON	RESPONSIBLE BIOLOGIST	RAPPORTEUR(S)
<b>PART 1 – SHELLFISH AND CAPELIN</b>					
Shrimp	January 21 and February 10 (am)	1.5	Martin Castonguay	Louise Savard	Bernard Morin
Snow crab	January 22-24	3.5	Serge Gosselin	Réjean Dufour	Denis Chabot Sylvain Hurtubise Jean Lambert Denis Bernier
Lobster	January 28-29	1.5	Jacques A. Gagné	Louise Gendron	Diane Archambault
Capelin	January 29 (pm)	0.5	Alain Fréchet	François Grégoire	Jean-Louis Beaulieu
<b>PART 2 – SHELLFISH, MOLLUSCS AND GROUND FISH</b>					
Scallop	February 11	1	Louise Gendron	Line Pelletier	Sylvie Brulotte
Rock crab	February 12	1	Jean Landry	Jean Lambert	Michel Giguère
Greenland halibut	February 13	1	Dominique Gascon	Bernard Morin	Louise Savard
Atlantic halibut	February 14 (am)	0.5	Dominique Gascon	Diane Archambault	Jean-Paul Dallaire
<b>PART 3 – HERRING</b>					
Herring	March 25	1	Bernard Sainte-Marie	François Grégoire	Hugues Bouchard
<b>PART 4 – MACKEREL</b>					
Mackerel	April 25	1	Bernard Sainte-Marie	François Grégoire	Denis Bernier

## APPENDIX 2

### Invitation letter for stakeholders from the outside of the DFO to participate in the regional review process

Date

Date

Nom

Titre

Association / Regroupement

Adresse

**Objet: Invitation à participer au prochain processus régional de revue de l'état des stocks à l'Institut Maurice-Lamontagne.**

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**Subject: Invitation to participate in the next stock assessment review at the Maurice Lamontagne Institute**

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Monsieur,

Dear Sir:

Pêches et Océans Canada, région du Québec, effectue annuellement un examen scientifique des évaluations de stocks et produit des avis sur l'état des ressources marines sous sa juridiction. Le produit de ces rencontres prend la forme de *Rapports sur l'état des stocks* pour l'année courante. Des travaux scientifiques additionnels sur des enjeux d'importance affectant la gestion des pêches et de leur habitat ainsi que la dynamique des écosystèmes peuvent, par la même occasion, être examinés et évalués. Ces évaluations sont réalisées par des experts responsables des différents stocks de la Région du Québec.

Each year, Fisheries and Oceans Canada, Quebec Region conducts a scientific review of stock assessments and issues advisory notices on the status of the marine resources under its jurisdiction. The product of these deliberations constitutes the *Stock Status Reports* for the current year. This is also the occasion for review and appraisal of additional scientific work on significant issues with a bearing on fisheries and habitat management and on ecosystem dynamics. This task falls to the Quebec Region specialists assigned to the various stocks.

Les présentations pour évaluer le statut des différents stocks de crustacés, de poissons de fond, de mollusques et de poissons pélagiques, suite à la saison de

Presentations on stock assessments for crustacean, groundfish, shellfish and pelagic species following the 2002 fishing season will be given from

pêche 2002, se dérouleront au cours des périodes du 21 au 29 janvier 2003, du 11 au 14 février 2003 et le 25 mars 2003. Ces présentations auront lieu à l'Institut Maurice-Lamontagne, à Mont-Joli. Une copie de l'horaire de la prochaine revue est jointe. Cependant, si cela s'avérait nécessaire, le temps alloué pour évaluer chacun des stocks pourrait être allongé et nécessiter d'autres périodes de discussion non prévues à l'horaire.

L'examen des évaluations se fait par un comité technique composé de scientifiques du MPO, de scientifiques externes, et d'intervenants dans le domaine des pêches ayant une connaissance approfondie de la pêche et qui peuvent contribuer de façon significative aux discussions scientifiques sur ces stocks. Le rôle du comité est d'identifier des questions et/ou des enjeux qui n'ont pas été traités dans les analyses présentées, incluant le déroulement de la pêche et les aspects mathématiques et statistiques, et d'identifier des faiblesses potentielles dans les données et/ou les méthodes utilisées pour les analyses et de contribuer à trouver des solutions à ces problèmes.

Je désire donc vous inviter à participer aux différentes rencontres en tant que participant externe au comité de revue scientifique. Vous n'êtes pas invité à titre de représentant de votre secteur d'activité ou de votre organisation, mais bien en tant que personne qui peut contribuer significativement, par vos connaissances et votre expérience, aux évaluations scientifiques des stocks. Votre participation fournira une valeur ajoutée et une perspective externe sur les analyses présentées.

Les discussions qui se dérouleront lors de ces rencontres seront centrées uniquement sur les aspects et enjeux scientifiques des évaluations de stocks et ne sont pas le lieu pour débattre de problèmes de gestion et/ou d'allocation de la ressource. De plus, compte tenu des discussions qui prévalent à ces

January 21 to 29, from February 11 to 14 and on March 25, 2003 at the Maurice Lamontagne Institute in Mont Joli. A copy of the schedule for the next review is attached. However, should it prove necessary, the time allocated for discussion of each stock may be extended beyond the times shown in the schedule.

The review is conducted by a technical committee consisting of DFO and outside scientists and representatives of the fishing industry with in-depth knowledge of the fisheries, thus being a source of meaningful input into scientific discussion of the stocks. The committee's role is to identify questions and/or issues not addressed in the analyses presented, such as the *modus operandi* of the fishery, mathematical and statistical factors, and potential flaws in the data and/or analytical methods applied, and to help find solutions to these problems.

I therefore invite you to take part in the review as an outside member of the technical committee. You are being invited not as a representative of your industry or association, but rather as an individual with a significant contribution to make, through your knowledge and experience, to the scientific evaluation of stocks. Your participation will lend both added value and an outside perspective on the analyses presented.

The discussions held in the course of this review will focus solely on scientific aspects and issues relating to stock assessment; it is not the right forum for debating management problems and/or resource allocation. Moreover, given the nature and content of the discussions, they must remain

rencontres, la nature et le contenu de celles-ci doivent demeurer confidentiels jusqu'à ce qu'un avis officiel ait été publié, habituellement quelques semaines après la fin des rencontres sur l'évaluation de l'état des stocks. Cela est particulièrement important dans le cas de pêches gérées par quotas individuels en raison des dangers de transfert de ces quotas basé sur de l'information privilégiée. Pour éviter ce genre de situation, les participants externes acceptent de ne pas acheter, vendre ou échanger des quotas ou des parts de quotas pour la période comprise entre le début des rencontres d'évaluation et la publication des avis scientifiques.

Si vous avez de l'information inédite à présenter, nous vous encourageons à soumettre des contributions écrites parce qu'il s'agit de la façon la plus efficace de contribuer aux évaluations. Celles-ci devront nous être acheminées avant le 11 janvier, pour les stocks dont la revue aura lieu dans la période du 21 au 29 janvier 2003, avant le 1<sup>er</sup> février, pour les stocks évalués du 11 au 14 février 2003, et avant le 15 mars, pour les stocks dont la revue aura lieu le 25 mars 2003. Les contributions orales seront aussi les bienvenues. Les participants externes sont priés de se présenter avec un sommaire de leur perspective pour la dernière année et, si possible, avec toute information pertinente en relation avec les années précédentes. Ces sommaires constitueront une bonne base pour la section *Perspectives des Rapports sur l'état des stocks*. Les documents seront acceptés dans les deux langues officielles mais ne seront pas traduits.

Ces réunions se déroulent habituellement en français. Cependant, il est prévu de recourir à un service d'interprétation simultanée aux fins de discussion lors des réunions, dans l'éventualité où un tel service serait requis. Nous vous prions donc de confirmer votre présence à ces réunions au moins deux semaines avant qu'elles ne débutent et de nous indiquer si vous désirez vous prévaloir d'un service

confidentiel until publication of the official notices, which usually takes place several weeks after conclusion of the review. This is particularly important in the case of those fisheries managed by individual quotas because of the risk of quota transfers on the basis of privileged information. To preclude such situations, outside participants agree not to buy, sell or exchange quotas or shares in quotas during the period extending from the beginning of the review until publication of the scientific conclusions.

If you have unpublished information to present, we urge you to submit it in writing, this being the most effective way to contribute to the review. Send in your submissions by January 11 for stocks to be reviewed January 21 to 29, by February 1 for stocks to be reviewed February 11 to 14, and by March 15 for those to be reviewed on March 25, 2003. Verbal contributions are also welcome. Outside participants are asked to arrive with a brief statement of how they see the past year, adding, if possible, any useful information about previous years. These statements will make an excellent basis for the *Resource Status and Outlook* section. Submissions will be accepted in either official language, but will not be translated.

Discussions customarily take place in French. However, allowance has been made for provision of simultaneous interpretation, should the need arise. We would like you to confirm your attendance at least two weeks ahead of the scheduled starting date, indicating whether you want simultaneous interpretation. We undertake to provide this service if

d'interprétation simultanée. Le cas échéant, nous nous assurerons que le service sera disponible afin que vous puissiez contribuer activement à ce processus dans la langue de votre choix.

Les participants ont la responsabilité de prendre les arrangements nécessaires en ce qui a trait aux réservations d'hôtel et de transport ainsi que d'en assumer les coûts.

Veuillez contacter M. Jean Landry par téléphone au (418) 775-0766, par télécopieur au (418) 775-0740 ou par courriel à [landryj@dfo-mpo.gc.ca](mailto:landryj@dfo-mpo.gc.ca) pour nous aviser si vous comptez être des nôtres et pour nous informer si vous prévoyez faire une présentation écrite ou orale et si vous désirez que l'on prévoit des services d'interprétation simultanée.

Sincèrement,

needed so that you can make an active contribution in the language of your choice.

Participants are responsible for making the necessary travel arrangements and hotel reservations and for paying the attendant costs.

Please contact Jean Landry by telephone at (418) 775-0766, by fax at (418) 775-0740, or by e-mail at [landryj@dfo-mpo.gc.ca](mailto:landryj@dfo-mpo.gc.ca) to tell us if you will be there, if you intend to deliver a written or verbal presentation and if you want simultaneous interpretation.

Sincerely,

Jean Boulva  
Directeur régional des Sciences / Regional Director, Sciences

p. j./ Encl. (1)

c.c.

### APPENDIX 3

#### List of the participants to the regional review process

<b>Name</b>	<b>Affiliation</b>
<b>Shrimp</b>	
Archambault, Diane	DRS / DPMM
Basque, Johanne	GESPEG
Bernier, Denis	DRS / DIBE
Boisvert, Daniel	Gestion des pêches / Québec
Bouchard, Hugues	DRS / DIBE
Bourassa, Luc	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Brillon, Sophie	DRS / DIBE
Castonguay, Martin	DRS / DPMM
Chabot, Denis	DRS / DIBE
Chiasson, Hector	ACAG
Condo, Lina	Conseil de bande de Gesgapegiag
Couillard, Pierre	Gestion des pêches / Québec
Dallaire, Jean-Paul	DRS / DIBE
Deslauriers, Marcelle	Gestion des pêches / Québec
Dionne, Hélène	DRS / DIBE
Dufresne, Yvon	DRS / DIBE
Fréchette, Marcel	DRS / DIBE
Gascon, Dominique	DRS / DIBE
Gaudet, Mario	MAPAQ
Gauthier, Johanne	DRS / DPMM
Gendron, Louise	DRS / DIBE
Giguère, Michel	DRS / DIBE
Gionet, Daniel	ACAG
Gosselin, Serge	DRS / DPMM
Hurtubise, Sylvain	DRS / DIBE
Harvey, Michel	DRS / DSO
Joncas, Jeannot	ACPY
Lambert, Jean	DRS / DIBE
Lambert, Yvan	DRS / DIBE
Landry, Jean	DRS / DPMM
Leblanc, David	DRS / DIBE
Legere, Michel	ACAG
McQuinn, Ian	DRS / DPMM
Morin, Bernard	DRS / DPMM
Morneau, Renée	DRS / DIBE
Nozères, Claude	DRS / DPMM
O'Conner, Bertrand	ACPG
Ouellet, Patrick	DRS / DSO
Pelletier, Line	DRS / DIBE
Roussel, Eda	ACAG
Saint-Cyr, Jean	FRAPP
Sainte-Marie, Bernard	DRS / DIBE
Samuel, Sylvain	ACPG
Savage, Yvon	ACPG

Savenkoff, Claude	DRS / DPMM
Simard, Yvan	DRS / DPMM
Sylvestre, Pierre	Mamit Innuat

### **Snow crab**

Ancil, Robin	Pêcheur
Bernier, Denis	DRS / DIBE
Bérubé, Isabelle	DRS / DIBE
Bourassa, Luc	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Chabot, Denis	DRS / DIBE
Couillard, Pierre	Gestion des pêches / Québec
Coulombe, Francis	MAPAQ
Dallaire, Jean-Paul	DRS / DIBE
Dufour, Réjean	DRS / DIBE
Duluc, Céline	DRS / DIBE
Duplisea, Daniel	DRS / DPMM
Dutil, Jean-Denis	DRS / DIBE
Fréchette, Marcel	DRS / DIBE
Gascon, Dominique	DRS / DIBE
Gaudet, Mario	MAPAQ
Gendron, Louise	DRS / DIBE
Giguère, Michel	DRS / DIBE
Gosselin, Serge	DRS / DPMM
Gosselin, Thierry	DRS / DIBE
Girard, Jacques	AC zone 17
Hurtubise, Sylvain	DRS / DIBE
Lambert, Jean	DRS / DIBE
Landry, Jean	DRS / DPMM
Langelier, Serge	RPPHMCN
McQuinn, Ian	DRS / DPMM
Morency, Isabelle	MPO / Sept-Iles
Morneau, Renée	DRS / DIBE
Nozères, Claude	DRS / DPMM
Ouellet, Camille	APR
Pelletier, Line	DRS / DIBE
Raymond, Magella	AC zone 17
Sainte-Marie, Bernard	DRS / DIBE
Sylvestre, Pierre	Mamit Innuat
Wright, Tony	Conseil Montagnais de Natasquan

### **Lobster**

Archambault, Diane	DRS / DPMM
Beaulieu, Jean-Louis	DRS / DPMM
Bernier, Denis	DRS / DIBE
Bouchard, Hugues	DRS / DIBE
Bourassa, Luc	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Cameron, W.	Mamit Innuat
Castonguay, Martin	DRS / DPMM
Chabot, Denis	DRS / DIBE

Condo, Lina	GESGAPEGIAG
Dallaire, Jean-Paul	DRS / DIBE
Dauteuil, Isabelle	DRS / DIBE
Dufour, Réjean	DRS / DIBE
Fournier, Marie-Paule	Gestion de la ressource / Québec
Fréchette, Marcel	DRS / DIBE
Gagné, Jacques. A.	DRS / DPMM
Gascon, Dominique	DRS / DIBE
Gauthier, Johanne	DRS / DPMM
Giguère, Michel	DRS / DIBE
Goudreau, Patrice	DRS / DIBE
Gosselin, Jean-François	DRS / DPMM
Gosselin, Serge	DRS / DPMM
Grégoire, François	DRS / DPMM
Hurtubise, Sylvain	DRS / DIBE
Lambert, Jean	DRS / DIBE
Landry, Jean	DRS / DPMM
Lefebvre, Louise	DRS / DPMM
Lemieux, Jean-François	Gestion de la ressource / Québec
Martel, Jean-François	RPPSG
McQuinn, Ian	DRS / DPMM
Mercier, Daniel	RPPSG
Morin, Bernard	DRS / DPMM
Morneau, Renée	DRS / DIBE
Ouellet, Patrick	DRS / DSO
Roy, Nathalie	DRS / DPMM
Sainte-Marie, Bernard	DRS / DIBE
Savard, Gilles	DRS / DIBE
Savard, Louise	DRS / DIBE
Savenkoff, Claude	DRS / DPMM
Sylvestre, Pierre	Mamit Innuat

**Capelin (Incomplete list)**

Archambault, Diane	DRS / DPMM
Beaulieu, Jean-Louis	DRS / DPMM
Bourdages, Hugo	DRS / DPMM
Castonguay, Martin	DRS / DPMM
Dauteuil, Isabelle	DRS / DIBE
Fréchet, Alain	DRS / DPMM
Gagné, Jacques-A.	DRS / DPMM
Gendron, Louise	DRS / DIBE
Gosselin, Serge	DRS / DPMM
Grégoire, François	DRS / DPMM
Landry, Jean	DRS / DPMM
McQuinn, Ian	DRS / DPMM
Morneau, Renée	DRS / DIBE
Roy, Nathalie	DRS / DPMM

**Scallop**

Archambault, Philippe	DRS / DSE
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Arseneau, Marie-Josée	DRS / DIBE
Beaudoin, Madeleine	DRS / DIBE
Brulotte, Sylvie	DRS / DIBE
Dufresne, Yvon	DRS / DIBE
Fréchet, Alain	DRS / DPMM
Fréchette, Marcel	DRS / DIBE
Gendron, Louise	DRS / DIBE
Giguère, Michel	DRS / DIBE
Goudreau, Patrice	DRS / DIBE
Hartog, Frédéric	DRS / DSE
Landry, Jean	DRS / DPMM
Morneau, Renée	DRS / DIBE
Patterson, Richard	MPO / Gaspé
Savenkoff, Claude	DRS / DPMM
Sylvestre, Pierre	Mamit Innuat
Turbide, Carole	DRS / DIBE

### Rock crab

Beaudoin, Madeleine	DRS / DIBE
Bouchard, Hugues	DRS / DIBE
Bourassa, Luc	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Dufresne, Yvon	DRS / DIBE
Fréchette, Marcel	DRS / DIBE
Gascon, Dominique	DRS / DIBE
Gauthier, Pierre	DRS / DIBE
Gendron, Louise	DRS / DIBE
Giguère, Michel	DRS / DIBE
Hurtubise, Sylvain	DRS / DIBE
Landry, Jean	DRS / DPMM
Morneau, Renée	DRS / DIBE
Patterson, Richard	MPO / Gaspé
Savard, Louise	DRS / DIBE
Turbide, Carole	DRS / DIBE

### Greenland halibut

Ancil, Robin	Pêcheur
Beaudoin, Madeleine	DRS / DIBE
Bernier, Brigitte	DRS / DPMM
Bernier, Denis	DRS / DIBE
Bourassa, Luc	DRS / DIBE
Bourdage, Hugo	DRS / DPMM
Castonguay, Martin	DRS / DPMM
Chouinard, Réal	Pêcheur
Ouellet, Camille	APR
Dufour, Réjean	DRS / DIBE
Dufresne, Yvon	DRS / DIBE
Fréchet, Alain	DRS / DPMM
Gascon, Dominique	DRS / DIBE
Gauthier, Johanne	DRS / DPMM
Gilbert, Denis	DRS / DSO

Gosselin, Raynald	MPO / Québec
Gosselin, Serge	DRS / DPMM
Lambert, Yvan	DRS / DIBE
Landry, Jean	DRS / DPMM
Landry, René	AC zone 17
Leblanc, David	DRS / DIBE
Lemelin, Dario	MAPAQ
McQuinn, Ian	DRS / DPMM
Méthot, Red	DRS / DPMM
Morneau, Renée	DRS / DIBE
Patterson, Richard	MPO / Gaspé
Savard, Louise	DRS / DIBE
Turbide, Carole	DRS / DIBE

### Atlantic halibut

Beaulieu, Jean-Louis	DRS / DPMM
Beaudoin, Madeleine	DRS / DIBE
Bernier, Denis	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Castonguay, Martin	DRS / DPMM
Dallaire, Jean-Paul	DRS / DIBE
Dufresne, Yvon	DRS / DIBE
Fréchet, Alain	DRS / DPMM
Gascon, Dominique	DRS / DIBE
Gauthier, Johanne	DRS / DPMM
Gosselin, Raynald	MPO / Québec
Gosselin, Serge	DRS / DPMM
Hurtubise, Sylvain	DRS / DIBE
Landry, Jean	DRS / DPMM
Lemelin, Dario	MAPAQ
Morin, Bernard	DRS / DPMM
Patterson, Richard	MPO / Gaspé
Turbide, Carole	DRS / DIBE

### Herring

Archambault, Diane	DRS / DPMM
Ball, Donald	MPO / Terre-Neuve
Bernier, Denis	DRS / DIBE
Bouchard, Hugues	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Castonguay, Martin	DRS / DPMM
Cormier, Roméo	Canadiens Ltée
Fréchet, Alain	DRS / DPMM
Gagné, Jacques-A.	DRS / DPMM
Gauthier, Johanne	DRS / DPMM
Godin, Sylvie	Produits océaniques
Hurtubise, Sylvain	DRS / DIBE
McQuinn, Ian	DRS / DPMM
Morin, Bernard	DRS / DPMM
Sainte-Marie, Bernard	DRS / DIBE

## Mackerel

Bernier, Denis	DRS / DPMM
Bouchard, Hugues	DRS / DIBE
Bourdages, Hugo	DRS / DPMM
Castonguay, Martin	DRS / DPMM
Coutu, Jean-Maurice	MPO / Ottawa
Dallaire, Jean-Paul	DRS / DIBE
Fréchet, Alain	DRS / DPMM
Gagné, Jacques-A.	DRS / DPMM
Gauthier, Johanne	DRS / DPMM
Gendron, Louise	DRS / DIBE
Gosselin, Serge	DRS / DPMM
Hurtubise, Sylvain	DRS / DIBE
Lefebvre, Louise	DRS / DPMM
Lévesque, Charlyne	DRS / DPMM
Morin, Bernard	DRS / DPMM
Morneau, Renée	DRS / DIBE
Sainte-Marie, Bernard	DRS / DIBE
Savenkoff, Claude	DRS / DPMM

AC : Association des Crabiers

ACAG : Association des Crevettiers Acadiens du Golfe

ACPG : Association des Capitaines Propriétaires de la Gaspésie

APR : Association des Pêcheurs de Rimouski

DIBE : Direction des Invertébrés et Biologie Expérimentale

DPMM : Direction des Poissons et Mammifères Marins

DRS : Direction Régionale des Sciences

DSE : Direction des Sciences de l'Environnement

DSO : Direction des Sciences Océaniques

FRAPP : Fédération Régionale Acadienne des Pêcheurs Professionnels

GP : Gestion des Pêches

MAPAQ : Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec

MPO : Ministère des Pêches et des Océans

RPPHMCN : Regroupement des Pêcheurs Professionnels de la Haute et Moyenne Côte-Nord

RPPSG : Regroupement des Pêcheurs Professionnels du Sud de la Gaspésie

## APPENDIX 4

### Recommendations arising out of the presentations

#### Shrimp

Recommendation (1): To calculate sex ratios in the following way: males / males + females. A balanced ratio would be 0.5 .....**3**

#### Snow crab

Recommendation (1): To carry out, if the necessary resources are available, a comparative study between the behavior of a four-trap longline and of a ten-trap longline.....**9**

Recommendation (2): To proceed every year with a uniform commercial sampling in the area, and weighting is recommended for size estimate (at sea and at dockside).....**10**

#### Lobster

Recommendation (1): To explore in greater detail the new method of changes in the proportions.....**16**

Recommendation (2): To reduce the exploitation rate once the objective to double egg production per recruit is reached.....**17**

Recommendation (3): To weigh frequencies by the CPUEs in the size frequency distribution graphs in order to eliminate percentages and make it possible to work on figures. It was stressed that in the case of commercial data, size structures are already weighted by landings.....**20**

Recommendation (4): To keep the fishing effort from increasing for this stock (limited number of traps and daily raisings, quotas, license buy-back?), particularly as the yields of some sectors seem precarious and unforeseeable. Some concerns were raised about the successes of fall fishery and on the possible effects on the success of the following season fishery.....**20**

Recommendation (5): To determine if large individuals migrate towards the head of the Bay in sub-area 21B. This sector is known to have favourable bottoms for common crab and warmer water temperatures. From the pre-recruitment point of view, CPUEs was always weak, indicating that this sector was not conducive to lobster production. However, multibeam surveys showed potential sites that could be used as refuges.....**21**

- Recommendation (6): To verify the assumption raised to the effect that downstream exploitation could have had impacts on upstream sectors as these would be dependent on migration from downstream sectors.....**21**
- Recommendation (7): To verify if the carapaces of large lobsters in the upstream part of the Bay are cleaner, since it would indicate that lobsters in this sector are younger.....**21**
- Recommendation (8): To verify if the input of cold and fresh water from rivers could influence the concentration of egg-bearing females. At present, there are no data available to answer to this question.....**21**
- Recommendation (9): To increase the sampling effort in the Anticosti area. Landing volumes are rather significant compared to others areas that are sampled. It was stressed that the Anticosti area is an interesting area to investigate as the exploitation rate is low and the population shows characteristics comparable to those of a population in a virgin state.....**23**

### **Capelin**

- Recommendation (1): To carry out kriging for surfaces that are more representative of the layers visited by the Needler; to use a weight of catch of 1 kg as a basis for the presence or the absence of capelin.....**25**

### **Scallop**

- Recommendation (1): To limit and even prohibit, as a measure of conservation, the Offshore-type drag in Gaspesia.....**29**
- Recommendation (2): To limit the fishing effort in these sectors by establishing refuge areas for a period of four years.....**29**
- Recommendation (3): To restrict and even prohibit the use of the Offshore –type drag in area 19A, in order to maintain the reduction of the fishing effort...**30**
- Recommendation (4): To combine the two fishing areas and to allow access to the whole deposit by two fishermen. This will ensure the good management of this deposit. Since 2001, only the quota for the northern portion (16A1) of the deposit of the Île Rouge was used.....**31**
- Recommendation (5): To maintain the quota at the current level for the moment. Currently, the fishing effort distribution is not proportional to the biomass and could result in an overexploitation of the deposit.....**31**
- Recommendation (6): To discard the empty shells of died scallops directly on the deposit since small scallops can attach themselves to the inside of these empty shells. This will support the survival of pre-recruits and preserve an environment favorable to their establishment on bottoms.....**31**

- Recommendation (7): To return to a lower level of exploitation, similar to that of 2000, unless data collected at the time of the exploratory survey planned for 2003 show other possibilities. This will ensure the conservation of the resource.....**33**
- Recommendation (8): To bring quotas back to the level of 1999 in order to reverse the downward trend in yields and to increase the bottom biomass.....**33**
- Recommendation (9): To decrease the potential fishing effort on the lower North Shore (area 15), given the sporadic recruitment of the two scallop species, the recurring massive mortalities, and the potential overcapacity of the fishing effort compared to the stock capacity.....**34**
- Recommendation (10): To replace dragging by an alternative method, like video, for carrying an eventual inventory in area 20E (refuge area).....**35**
- Recommendation (11): To maintain the closure of the refuge area (20E) and to close commercial fishing in area 20A for a period of 3 or 4 years, in order to allow the wild stock of the Magdalen Islands to be restored.....**35**

**Rock crab**

- Recommendation (1): To keep the total allowable catch (TAC) for rock crab from increasing over the next three years, in order to observe the reaction of the stock compared to the current level of exploitation. Until now, the rock crab stocks of the Magdalen Islands seem to react well to the pressure of fishing. However, rock crab fishing is relatively recent, and its effects on the productivity of the populations remain unknown. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.....**37**
- Recommendation (2): To allow the use of large traps as the assembly does not think that they will have a negative impact on the rock crab population as long as this fishing is managed by individual quotas and that the total allowable catch does not exceed the output of the stock.....**37**
- Recommendation (3): To allow the use of large traps (4 feet) in area 12C. Unanimously, the members of the assembly believe that the use of larger traps is acceptable because of the high currents, provided that a strict follow-up be applied over a 3-years period in order to see how the stock responds to this change.....**37**
- Recommendation (4): To keep the rock crab fishing effort from increasing over the next three years, in order to observe the response of the stock compared to the current level of exploitation. This is necessary as our knowledge is insufficient to determine if the stocks can support the same fishing intensity in the short or medium term, in particular where landings are highest. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.....**38**

Recommendation (5): To keep the fishing effort from increasing over the next three years, in order to observe the reaction of the stock compared to the current level of exploitation. The various indicators of the status of the stocks of the southern part of Gaspesia suggest some stability in the exploitation. However, this information is not sufficient to make a conclusion about the capacity of these populations to support a long-term exploitation. There will also be a need to ensure that rock crab by-catches unloaded by lobster fishermen are well controlled.....**39**

### **Greenland halibut**

Recommendation (1): To make deeper analyses on the fusion of the two series (Lady Hammond – Needler) before using it in the evaluation.....**41**

Recommendation (2): To use the most suitable exponent for the species. This recommendation follows a discussion on the difference between the index of condition of < and of >40 cm fish (higher index for largest).....**42**

Recommendation (3): To check the sizes at sexual maturity for the 1980s (if this information is available), in order to determine the variation amplitude of the size at maturity.....**42**

### **Atlantic halibut**

Recommendation (1): To suggest the exercise of a better control of area 3Pn by Management, as should be done for any groundfish. Currently, no management measures are implemented, including the establishment of quotas. Landings could increase substantially if adequate measures are not taken.....**44**

Recommendation (2): To ensure the visualization of the temporal evolution of CPUEs, in order to determine if the increase in abundance perceived in the surveys is also perceptible in the commercial fishing. This would increase significantly the confidence level of this trend.....**45**

### **Herring**

Recommendation (1): To increase the frequency and the spatio-temporal coverage of the commercial sampling made with small seiners (less than 65 feet), among other things.....**47**

Recommendation (2): To increase the frequency of the acoustic survey, its duration and the surface covered; to obtain information on the gillnet fall fishing; to globally improve the spatio-temporal commercial fishing coverage.....**48**

## APPENDIX 5

### List of the stock status reports produced following the regional review process of this year.

DFO, 2003. Atlantic Halibut of the Gulf of St. Lawrence (4RST) – 2002 update. DFO – Sciences, Stock Status Report 2003/006 (2003)

DFO, 2003. Gulf of St. Lawrence Greenland Halibut. DFO – Sciences, Stock Status Report 2003/007 (2003)

DFO, 2003. West Coast of Newfoundland Atlantic Herring (Division 4R) in 2002. DFO – Sciences, Stock Status Report 2003/008 (2003)

DFO, 2003. Capelin in the Estuary and the Gulf of St. Lawrence (4RST) in 2002. DFO – Sciences, 2003/009 (2003)

DFO, 2003. Mackerel in the northwest Atlantic in 2002. DFO – Sciences, Stock Status Report 2003/010 (2003)

DFO, 2003. Snow crab of the Estuary and Northern Gulf of St. Lawrence (areas 13 to 17 and 12A, 12B and 12C) in 2002. DFO – Sciences, Stock Status Report 2003/011 (2003)

DFO, 2003. Rock crab of the inshore waters of Quebec. DFO – Sciences, Stock Status Report 2003/012 (2003)

DFO, 2003. Lobster of the inshore waters of Quebec in 2002. DFO – Sciences, Stock Status Report 2003/013 (2003)

DFO, 2003. Shrimp in the Estuary and the Gulf of St. Lawrence in 2002. DFO – Sciences, Stock Status Report 2003/014 (2003)

DFO, 2003. Scallops of the inshore waters of Quebec. DFO – Sciences, Stock Status Report 2003/015 (2003)