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Science Advisory Report 2005/031

STOCK ASSESSMENT REPORT ON SCALLOPS OF THE INSHORE WATERS OF QUEBEC IN 2004

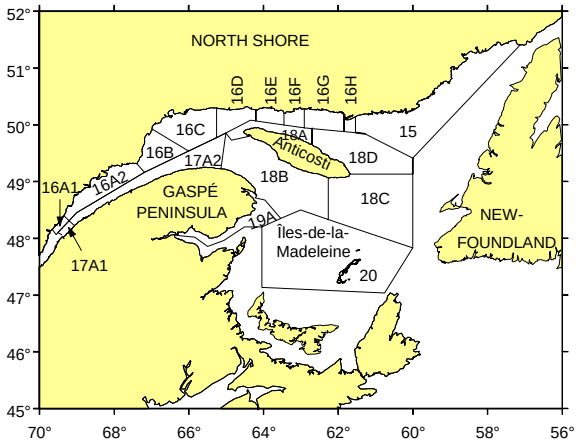

Figure 1: Scallop management areas in Quebec.

Context

Commercial scallop fishery in Quebec began in the late 1960s. It is an inshore fishery that targets two species indiscriminately, namely sea scallop (Placopecten magellanicus) and Iceland scallop (Chlamys islandica). Catches are landed mostly as meat (muscle), but the proportion landed in the shell has been growing since the late 1990s. The region is divided into 18 management units with 79 permanent fishing licences and 10 exploratory licences. Fishing effort is controlled in all units, and most units on the North Shore and around Anticosti Island are governed by quotas, as well. The North Shore region has posted the largest scallop landings in Quebec since 1985.

SUMMARY

- In 2004, Quebec scallop landings totalled 127.4 t of meat, down 21% from 2003. Fishing effort also decreased by 34%. The North Shore sector accounted for 82% of the landings, the Magdalen Islands for 14% and the Gaspé for 4%.

Magdalen Islands

- Data obtained from aquaculture sites have for the first time been included in the assessment of Magdalen Islands scallop stock.

- Although commercial scallop landings had been declining since 1995, the scallops harvested from seeding sites began to reverse this trend in 2000. The fishing effort outside aquaculture sites has been declining since 1998.

- Owing to the higher scallop densities of seeding sites, egg production in 2004 is estimated to be higher there than outside aquaculture sites. Total egg production in 2004 was higher than before aquacultural activities began. In addition, the density of scallops smaller than 70 mm and the spat collection rate show that recruitment has been average, but steady in the last five years.

- The density of naturally occurring prerecruits is significantly higher in aquaculture sites than outside the sites. Rotational fishing appears to reduce the mortality rate of prerecruits. Consequently, the rotational fishing strategy is recommended for all fishing grounds.

- The status of the resource could be improved through a strategy of maintaining fishing effort at a similar level to that of 2004 in traditional fishing areas.

Gaspé

- In 2004, Gaspé landings and fishing effort plummeted to an all-time low of 5.5 t of meat. The decline in fishing effort characterized all of the harvested areas.

- For a number of years now, low commercial sea scallop catches in Chaleur Bay (Area 19A) have been cause for concern. The current fishing effort should not be increased until the status of the resource has improved.

- On Anticosti Island (Area 18B), the 2003 exploratory fishery revealed that the resource is today much weaker than when this area was first harvested.

- As for the other areas in the Gaspé, the few data available do not provide any indication of changes from previous years.

Île Rouge (Areas 16A1 and 17A1)

- For the second year in a row, the quota for Area 16A1 was not met. Furthermore, no fishing activity has been conducted in Area 17A1 since 2001. Although fishing effort was greater in 2004 than in 2003, it remained below average. Iceland scallop is abundant in this small scallop bed. It is recommended that the total allowable catch (TAC) be maintained for now.

North Shore

- Area 16E: Harvesting yields and landings have been stable since 1998, indicating that the stock can sustain the present harvesting level. In 2004, the research survey index showed that the abundance of commercial-size scallop is similar to the average estimated for 1998–2003. The abundance of scallop smaller than 70 mm was also above average in 2003 and 2004. It is therefore recommended that the TAC be maintained at the 2004 level.

- Area 16F: In 2004, landings increased by 23% following the addition of quotas for two previously unexploited subareas (16F-1 and 16F-2), for a total of 32.4 t of meat. Since 2000, the fishing yields observed for the main scallop bed were higher than those recorded in the late 1990s and indicate that the stock can sustain the current harvesting level. Fishing yields in Subarea 16F-1 are higher than those recorded for the main bed. In addition, scallop size structures in 16F-1 are similar to those found in the main bed. Although yields are high in

Subarea 16F-2, the average size of the scallops is smaller than in the two above-mentioned beds. In 2005, it is recommended that Subarea 16F-1 and Area 16F and their respective TACs be consolidated. It is also recommended that Subarea 16F-2 be maintained and that its TAC remain unchanged from the 2004 level.

- Area 18A: Since 2001, landings have dropped substantially as a result of the decrease in fishing effort. It is recommended that the TAC be maintained at the 2004 level for the time being.

- Areas 15, 16A2, 16B, 16C, 16D, 16G, 16H, 18D: Few fishers are active in areas 15, 16A2, 16B, 16C, 16D, 16G, 16H and 18D, where recent fishing effort has not been very high. Based on the commercial indices for these areas, there are no major changes to report for these areas from previous years. The data available are incomplete, thus precluding an assessment of the state of the resource.

DESCRIPTION OF THE ISSUE

Species Biology

There are two indigenous species of scallops in Quebec: the sea scallop (*Placopecten magellanicus*) and the Iceland scallop (*Chlamys islandica*). These two species are found mainly on gravel, shell or rocky bottoms, generally at depths of 20 to 60 metres. Iceland scallops occur along the North Shore, around Anticosti Island and off the north coast of the Gaspé Peninsula, but are virtually absent from the southern Gulf. In contrast, sea scallops are found primarily in the southern Gulf, including the Magdalen Islands and Chaleur Bay, and occasionally along the Lower North Shore. Scallops are sedentary and live in aggregations known as “beds.” This aspect of their biology needs to be taken into account when developing conservation strategies and management plans.

Sea scallops grow in length more rapidly than Iceland scallops. Their growth rate varies from one area to another and is affected by habitat quality and environmental conditions. In the Gulf of St. Lawrence, Iceland scallops reach commercial size at about age 8 (70 mm) and sea scallops at about age 6 (95 mm).

Scallops have separate sexes and are broadcast spawners. The spawning period is short and does not occur at the same time throughout the Gulf. The number of eggs that a female scallop produces is roughly proportional to its size cubed, with successful fertilization depending on the proximity of other scallops. Along the North Shore and around Anticosti Island, spawning occurs between mid-July and late August, depending on the sector. Sea scallops spawn in August in Chaleur Bay and in late August around the Magdalen Islands.

Larval development takes about five weeks, from fertilization to settlement on the seabed. During this time, the larvae are dispersed throughout the water column. Juvenile scallops generally attach themselves to the seabed in proximity to the adults. Scallop beds are generally found in areas where currents cause the larvae to be retained, but a good substrate is needed to ensure the successful attachment of juveniles. During the settlement period, juveniles are very sensitive to disturbance of the sediment by fishing gear. To ensure more successful settlement of juvenile scallops, it is recommended that scallop beds not be dragged from August to November.

The weight of meat yielded by a scallop of a given size varies over the reproductive cycle. Meat weight peaks in spring just before gonad development, drops to its lowest point during the summer spawning period, and starts rising again in the fall.

The fishery

In the Gulf of St. Lawrence, the scallop fishery is an inshore fishery. The Digby drag is widely used. Over the years, there has been a substantial increase in fishing effort, primarily as a result of the fleet's increased capacity and efficiency.

The commercial fishery harvests both Iceland scallops and sea scallops without distinction. Catches are generally landed as meat (muscle). The difficulty in visually distinguishing between the meat of the two species complicates the analysis of fishing statistics. However, the two species are not distributed uniformly in the Gulf of St. Lawrence, and catches in any one area usually consist of just one species.

Since the late 1990s, landings of scallops in the shell have been on the rise. Because of the mixed nature of the landings (as meat or in the shell), a conversion factor (8.3) has to be applied to quantify the catch.

Quebec waters are divided into 18 management areas, which are grouped into three sectors, namely the Magdalen Islands (Area 20), the Gaspé (Areas 17A1, 17A2, 18B, 18C, 19A) and the North Shore (Areas 15, 16A1, 16A2, 16B, 16C, 16D, 16E, 16F, 16G, 16H, 18A, 18D) (Figure 1). Few fishers are active in Areas 15, 16A2, 16B, 16C, 16D, 16G, 16H and 18D, and there has been little fishing effort there, if any, of late. In 2004, 79 regular licences and 10 exploratory licences were issued. Separate management plans were developed for each area, based on the following factors: vessel length, drag size (< 7.31 m), fishing season and hours, and individual and overall quotas (Table 1).

In 2004, landings totalled more than 127 t of meat, down by 21% from 2003 (Figure 2). The North Shore accounted for 82% of the landings, followed by the Magdalen Islands with 14%, and the Gaspé with 4%. Fishing effort also decreased by 34% in 2004.

Table 1. Management measures for scallop in 2004.

Area	Number of licences	Quota (t meat)	Season (day/month)	Daily schedule	Coverage for dockside weighing	Hail in	At-sea observers (% of trip)	Type of quota	Limit size; Meat count
15	33 + 10[1]		01/04 - 31/12		100 %				
16A1	1	13.6	01/04 - 30/11		100 %		5 %	competitive	
16A2	1	9.1	01/04 - 30/11			100 %		competitive	
16B	2		01/04 - 15/11					competitive	
16C	2	17.2	12/05 - 28/10		100 %		10 %	competitive	
16D[2]		22.2	19/04 - 15/11	Hour	100 %			competitive	
16E	7	57.2	27/06 - 04/09	Hour	100 %		10 %	QIT[3]	
16F	9	27.6 + 10.2	10/05 - 26/06	Hour	100 %		10 %	QI	
16G	5	35.8	30/04 - 30/11		100 %			competitive	
16H	8	30.8	18/04 - 30/10		100 %			QI	
17A1	1	13.6	01/04 - 30/11		100 %		5 %	competitive	
17A2	1	9.1	01/04 - 30/11			100 %		competitive	
18A	9	50.8	10/05 - 30/10		100 %		10 %	QIT	
18B	3	49.9	01/04 - 30/11		100 %	100 %		competitive	
18C	3		01/04 - 30/11		100 %	100 %			
18D			02/05 - 30/10		100 %				
19A	3		01/05 - 15/08 16/08 - 30/09	Day and hour					95 mm; 38 sca./500 g
20	23		29/03 - 17/07 01/04 - 31/10	Day and hour					85 mm; 35 sca./500 g

[1] = Exploratory licence for Iceland scallops.
[2] = Open to fishers residing between Sept-Îles and Pointe Parent, on an experimental basis.
[3] = Individual quota.

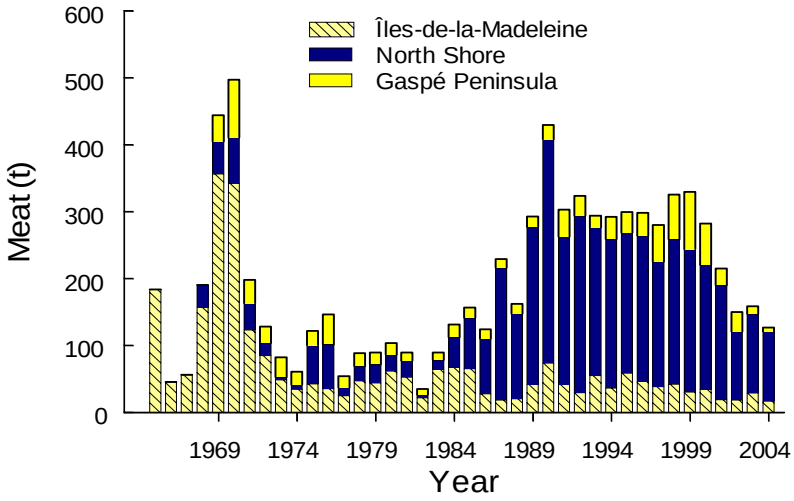

Figure 2. Scallop landings in Quebec.

RESOURCE ASSESSMENT

The assessment of the status of scallop populations is based mainly on an analysis of commercial indices. For scallop beds in the Mingan sector (Areas 16E and 16F) and the Magdalen Islands, it also incorporates indices derived from the research surveys that are carried out periodically. In addition, exploratory surveys were conducted in Areas 15, 16F, 16H and 18B in 2003.

Magdalen Islands (Area 20)

The Magdalen Islands comprise a number of concentrations of scallop, namely the fishing grounds of Étang du Nord (Pointe du Ouest), Dix Milles, Chaîne de la Passe, Sud Ouest, Île Brion and Banc de l'Est (Figure 3). Subarea 20E is closed to fishing year-round, as it is a refuge area for sea scallop. Chaîne de la Passe and part of the Étang du Nord bed are aquacultural sites reserved for scallop seeding.

Landings in Area 20 consist primarily of sea scallop, totalling 17 t in 2004, down 42% from 2003 (Figure 4). The downward trend that began in 1995 was reversed in 2000 by the addition of scallops harvested from seeding sites. In 2004, the total landings made in fishing grounds and seeding sites combined was 25% higher than the average for the 10 previous years.

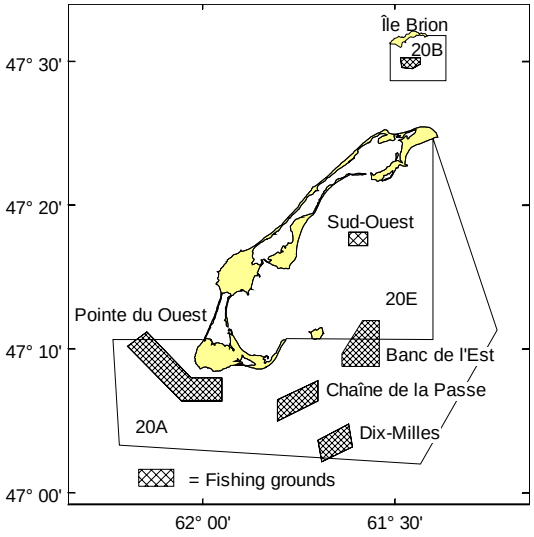

Figure 3. Sub-areas and main scallop fishing grounds in the Magdalen Islands.

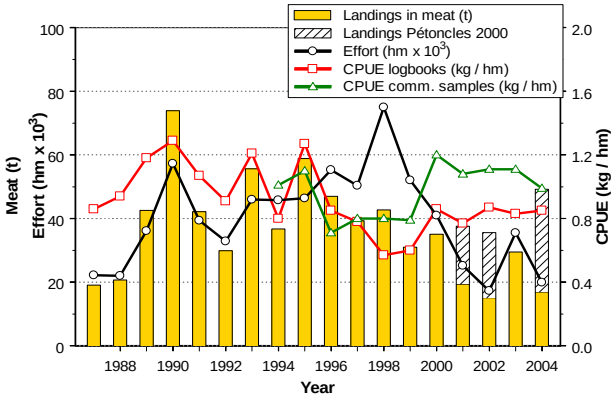

Figure 4. Scallop landings from fishing and seeding (Pétoncles 2000), fishing effort (by standardized fishing hour per metre of drag width) and catch per unit effort, estimated from logbooks and commercial samples in Area 20.

Fishing effort decreased by 44% from 2003 and was mostly concentrated around Pointe du Ouest, followed by Dix Milles and Banc de l'Est. According to data obtained from logbooks and commercial catch sampling, the estimated commercial catch per unit effort in 2004 is similar to the average for the 10 previous years.

The abundance of prerecruits, as measured in research surveys, was low in the mid-1990s, but has been equal to or greater than the average since 1999 (Figure 5). However, the abundance of commercial-size scallop remains relatively low. In 2004, the density of commercial-size scallops and prerecruits was four times greater in seeded zones than in fishing grounds (Figure 6).

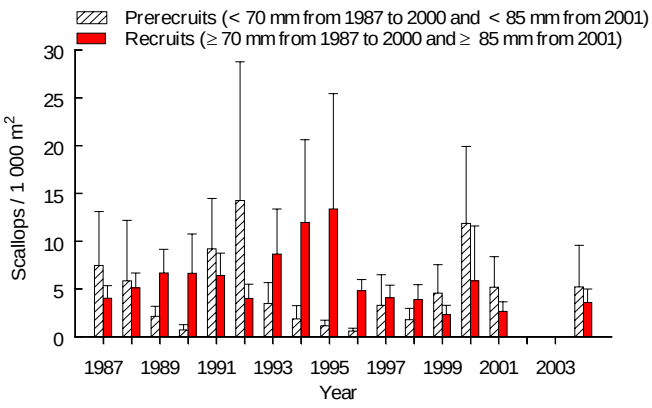

Figure 5. Density (± 2 standard errors) of sea scallops sampled in research surveys in the Magdalen Islands.

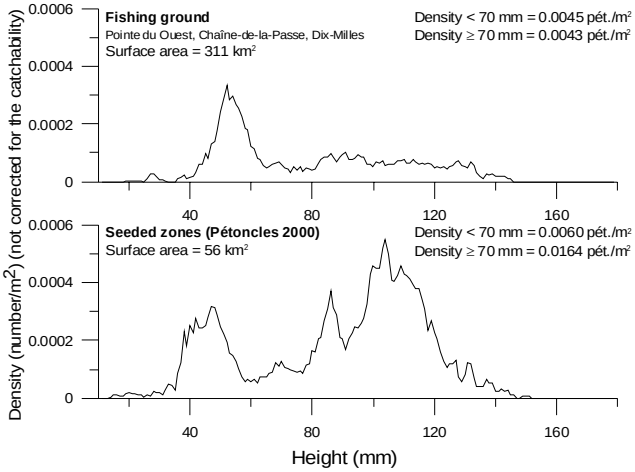

Figure 6. Size structure for sea scallops sampled in research surveys in the Magdalen Islands in 2004 in fishing ground and seeded zones.

Egg production was estimated based on the population structure derived from the research survey, taking into account fertilization success, which depends on the relative proximity of scallops on the seabed. Based on these estimates, in 2004, 71% of eggs originated in seeding sites and 29% in traditional beds (Figure 7). This is attributable to the greater chance of fertilization in seeding sites, as fertilization is proportional to the density of scallops on the seabed.

Spat collection monitoring in 2004 indicated that the amount of scallop spat collected in the Sud Ouest bed was greater than the average of previous years. Since 1999, collection has been equal to or greater than the 1990–2004 series average (Figure 8).

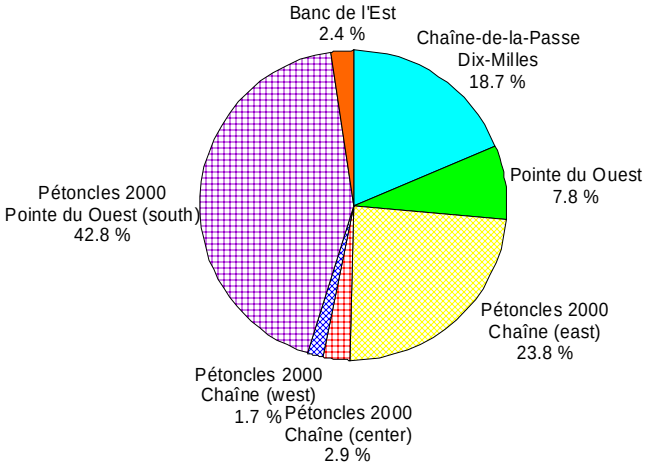

Figure 7. Egg production estimated in different sectors of fishing and aquacultural sampled in research surveys in the Magdalen Islands in 2004.

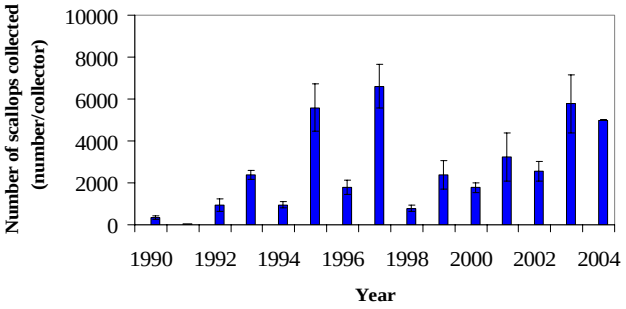

Figure 8. Mean number of scallops spat collected in fond du Sud-Ouest.

Gaspé (Areas 17A1, 17A2, 18B, 18C and 19A)

The Gaspé is composed of three fishing sectors: the St. Lawrence Estuary (17A1, 17A2), Anticosti Island (18B and 18C) and Chaleur Bay (19A). In 2003, in order to reduce fishing effort in Chaleur Bay, two fewer licences were issued. Therefore, in 2004, only one licence was issued in Areas 17A1 and 17A2, three in Areas 18B and 18C and another three in Area 19A. Each area had its own fishing season, and quotas were set in Areas 17A1, 17A2 and 18B.

Gaspé landings increased steadily between 1993 and 1999, when they reached an all-time high of about 80 t of meat. Since then, Gaspé landings have been on the decline, hitting a record low of 5.5 t in 2004 (Figure 9). Gaspé landings were down 48% from 2003, with fishing effort decreasing by 47%.

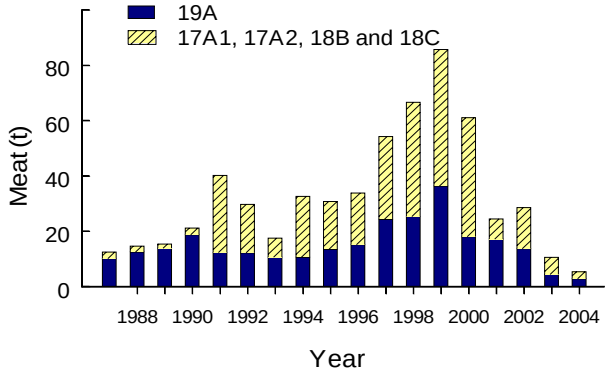

Figure 9. Scallops landing in Gaspé Peninsula.

The situation in Area 17A1 is discussed below in the Île Rouge (Areas 16A1 and 17A1) section.

No landings were made north of the Gaspé Peninsula (Area 17A2) in 2004, with only one fishing trip being recorded. As a result, catch per unit effort was not estimated.

Landings in Areas 18B and 18C remain lower than those made in the late 1990s. In 2004, landings and fishing effort were down 87% compared with the average for the 10 previous years. For both areas combined, catches per unit effort (logbooks) were estimated at 2.4 kg/hm, a decrease of 37% compared with the average for the 10 previous years. The modal size of Iceland scallop and the average weight of meat were estimated at 78 mm and 12.2 g in Area 18C. In Area 18B, fishing effort was concentrated off the northern shore of the Gaspé Peninsula instead of around Anticosti Island, where large sea scallops, whose modal size is 118 mm, are harvested.

In June 2003, a fisher conducted an exploratory survey in Area 18B under the supervision of the Department. Systematic sampling was done south of Anticosti Island. Lower densities were recorded than in the previous exploratory survey conducted in 1994; however, the distribution of scallops along the coast was comparable.

Between 1994 and 1999, landings in Chaleur Bay (Area 19A) rose steadily, peaking at about 37 t in 1999 (Figure 9). In 1998 and 1999, the increase in landings was attributable to the shift in fishing effort toward Iceland scallop. Since 2000, the fishery has once again been concentrating on sea scallop and landings have been decreasing. In 2004, catches made in Area 19A totalled

2.9 t, down 35% from 2003. Fishing effort in the area also fell by 37%. The fishery was directed mainly at sea scallop.

In 2004, the catch per unit effort index estimated during at-sea sampling increased for both scallop species combined in Area 19A (Table 2). The size of sea scallops was smaller in commercial catches made in 2004 (Figure 10), while the average weight of meat landed remained around the average for the 10 previous years.

Table 2. Catch per unit effort (kg of meat per hour of fishing and meter of drag width) estimated from commercial samples.

Année	17A1	17A2	18B	18C	19A
1994			4.83		1.29
1995					
1996		3.76	0.63		1.22
1997		2.64	5.04		1.66
1998		3.48	6.70	4.90	0.73
1999	24.58	3.29		19.54	0.99
2000	28.48	4.61		42.33	1.17
2001		4.99			0.97
2002		2.60		13.65	0.70
2003		3.12	1.37	5.76	0.76
2004			4.87	5.57	1.08

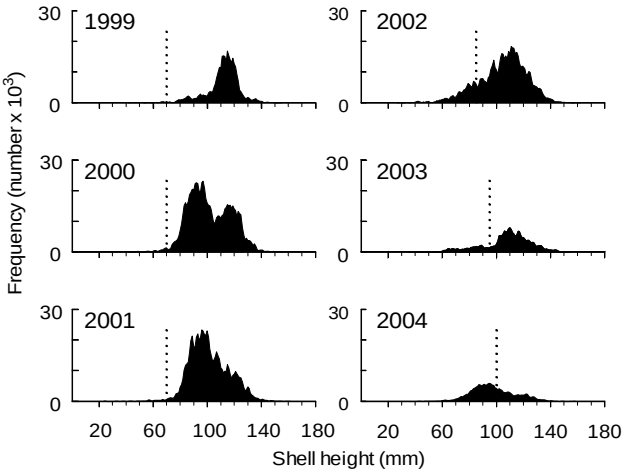

Figure 10. Size structures of sea scallops in Area 19A based on commercial samples. The dotted line separates the pre-recruits from the recruits.

Île Rouge (Areas 16A1 and 17A1)

In the St. Lawrence Estuary, the Île Rouge Iceland scallop bed straddles two fishing areas (Areas 16A1 and 17A1) managed by two separate administrative sectors (North Shore and Gaspé). As the bed likely constitutes a single biological entity, these areas are considered to be one and the same stock.

The Iceland scallop bed was first harvested in 1998. In 2000, quotas were set at 13.6 t of meat. Since 2001, no fishing has taken place in the southern part of the bed (17A1); the quota set for the northern part of the bed (16A1) was not reached in 2003 or 2004.

In 2003 and 2004, landings consisted of meat as opposed to scallops in the shell. The fishing strategy was modified, by harvesting fishing grounds with more promising meat yields and abandoning sites with high scallop densities but low meat yields. The decrease in CPUEs observed based on commercial catch sampling and logbook data in 2003 and 2004 appears to be attributable to the fishing strategy rather than a decrease in the resource (Table 3). This finding is confirmed by the weight of dockside landings of meat and the modal size of harvested scallop, which has increased significantly since 2003.

The results of the research survey conducted throughout the bed in June 2003 are comparable to those observed in previous years. Commercial-size scallop (≥ 70 mm) are concentrated in a very small area of about 22 km^2 at the boundary between Areas 16A1 and 17A1. Their

estimated density is slightly higher than that observed in 2002. Scallops of all sizes have been harvested at this site, suggesting regular recruitment (Figure 11). It is nevertheless difficult to distinguish between cohorts on the basis of size structure. Small individuals (≤ 10 mm) have been found around the periphery of the bed, all attached to the inside of empty bivalve shells.

Tableau 3. Catch per unit effort (kg of meat per hour of fishing and meter of drag width) estimated from commercial samples or logbooks.

Année	16A1	16A2	16B*	16C*
1994			2.80	1.89
1995			1.38	7.60
1996			1.00	7.86
1997		4.57		5.28
1998			1.84	8.99
1999	18.99		1.32	4.48
2000	28.69	4.89	3.06	6.37
2001	14.14	7.08	2.32	3.02
2002	62.65			8.00
2003	6.59		1.16	
2004	8.80		0.74	

* Logbooks

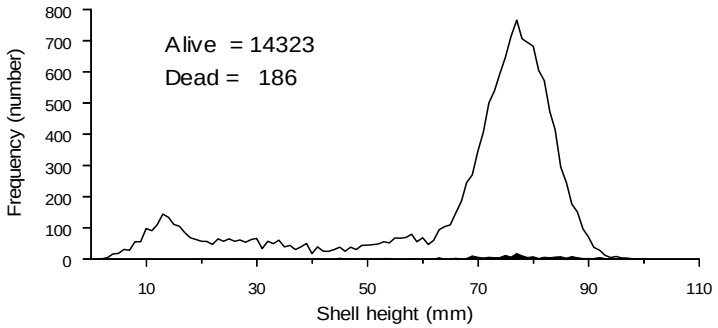

Figure 11. Size structures of living (white) and dead (black) Iceland scallops sampled from the Île Rouge bed in the 2003 research survey.

North Shore

Iceland scallops are harvested along the entire north shore of the Gulf of St. Lawrence, while sea scallops are taken only along the Lower North Shore. The North Shore is subdivided into 12 fishing areas located between the mouth of the Saguenay River and Blanc Sablon. Landings on the North Shore totalled around 104 t of meat in 2004, down 12% from 2003. Since the late 1980s, scallop landings on the North Shore have always accounted for more than 65% of the Quebec catch, with most of the landings coming from the waters around the Mingan Archipelago and Anticosti Island (Areas 16E, 16F and 18A).

Upper North Shore (Areas 16A1, 16A2, 16B and 16C)

Landings in these areas, which roughly constitute the Upper North Shore, totalled about 4.6 t in 2004 and consisted entirely of Iceland scallop (Figure 12). These areas are harvested by five fishers. Fishing effort is low and controlled by the number of licences issued and quotas set in Areas 16A1, 16A2 and 16C.

The situation in Area 16A1 is discussed above in the Île Rouge (Areas 16A1 and 17A1) section.

In 2004, there was no fishing in Areas 16A2 and 16C and limited fishing effort in Area 16B. Landings in these areas vary widely and depend on the intensity of fishing effort. Landings in Area 16B amounted to 140 kg in 2004. Fishing yields (based on logbooks) were estimated at 0.74 kg/hm, a decrease of 60% compared with the average for the previous 10 years (Table 3). Only one vessel fished this area commercially in 2004, and no samples of its catch were taken.

Middle North Shore (Areas 16D, 16E, 16F, 16G and 18A)

Seven fishing licences were issued for Area 16E, nine for Areas 16F and 18A, four for Area 16G, and all Middle North Shore scallop fishers have access to Area 16D. Each of these areas is governed by a quota, and there are daily and seasonal restrictions on fishing effort. Iceland scallop landings from these fishing areas along the Middle North Shore have risen sharply since the early 1980s. This is the most productive scallop region in Quebec; it is also the one with the strictest management measures.

Fishing effort decreased substantially in these areas in the 1990s as a result of the imposition of individual quotas in 1991, the shortening of the fishing seasons in all areas, and the subdivision of the areas. Although the adjustment of quotas (upward or downward depending on the area) has also affected fishing effort, the downturn in recent years is attributable to the drop in the market price for scallop.

The landed volume (meat) reached an all-time high of nearly 300 t in 1990 (Figure 13). In 1991, landings fell off sharply, especially in Areas 16E and 16F. Since then, landings have fluctuated according to the same pattern as the quotas, by and large. In 2004, the quotas were met in Areas 16E and 16F, but not in Area 18A. Landings on the Middle North Shore totalled 95 t in 2004, down 16% from 2003.

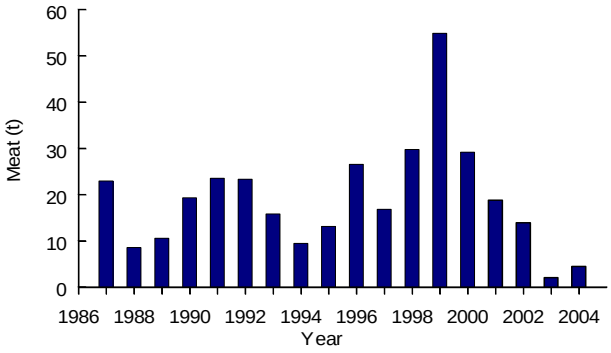

Figure 12. Landings of scallops from areas 16A1, 16A2, 16B and 16C.

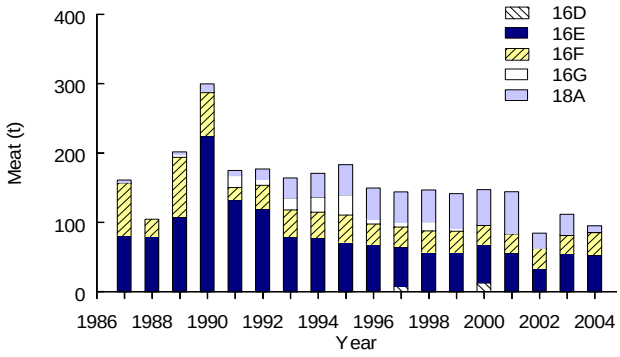

Figure 13. Landings of scallops from areas 16D, 16E, 16F, 16G and 18A.

Along the shoreline from the Manitou River to the Île aux Perroquets (Area 16D), landings totalled 46 kg in 2004, compared with 112 kg in 2003. Since 1996, landings and yields have been low because of the sporadic nature of the fishing effort in this area. No commercial catch samples were taken.

In Area 16E, landings totalled 53.2 t in 2004 (Figure 14). Excluding 2002, which was characterized by reduced fishing effort, fishing effort and the exploitation index have held steady since 1993. Catch per unit effort values have been fairly stable since 1998. The modal size of scallops (Figure 15) and the average weight of dockside landings of meat are close to the average for the past 10 years. In 2001, the indices derived from the research survey appeared to show a decline in the number of scallops potentially recruiting to the

fishery in the short term; however, in 2003 and 2004, a large number of prerecruits measuring between 40 mm and 60 mm were observed (Figure 16). The 2004 research survey showed slightly smaller densities of commercial-size scallops than the average for 1990–2003 (Figure 17).

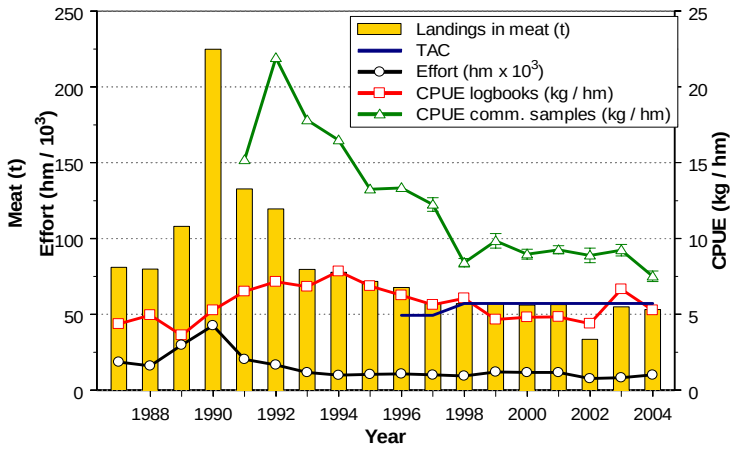

Figure 14. Scallop landings, fishing effort (by standardized fishing hour per meter of drag width) and catch per unit effort estimated from logbooks and commercial samples in area 16E.

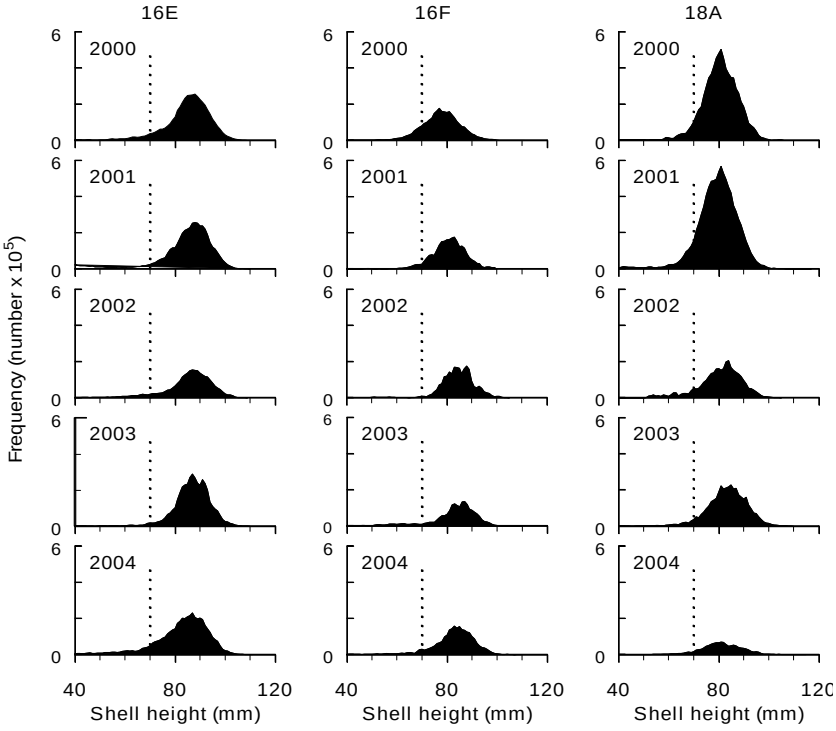

Figure 15. Size structures of Iceland scallops in area 16E, 16F and 18A, based on commercial samples. The dotted line at 70 mm separates the pre-recruits (< 70 mm) from the recruits (≥ 70 mm).

Landings in Area 16F were up by 23% in 2004, totalling 32.4 t (Figure 18). The increase is attributable to the addition of two quotas for beds that had never been harvested before (16F-1 and 16F-2). In the past year, fishing effort decreased by 9%, while catch per unit

effort for the main scallop bed increased by about 35%. The size of landed scallops is comparable to the average for the last 10 years, while landed meat weight is above the average. The research survey conducted in May 2004 revealed that the highest scallop densities were measured in beds that had not been harvested before 2004 (16F-1 and 16F-2). Over the past year, a link has been noted between the daily positions of fishers and sites with high scallop densities.

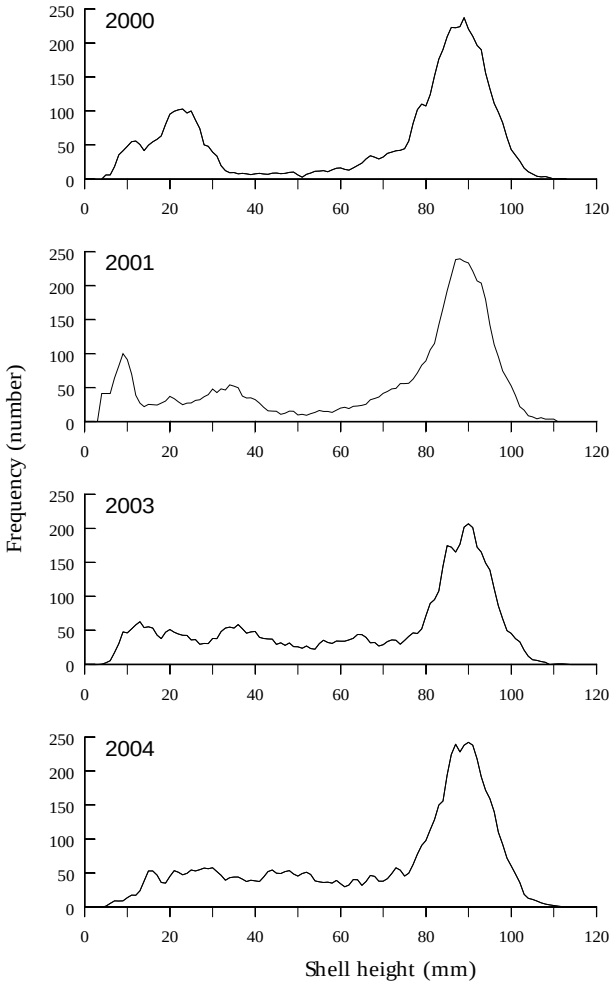

Figure 16. Size structure values for Iceland scallop sampled outside the Mingan Archipelago (Area 16E) during the research surveys from 2000.

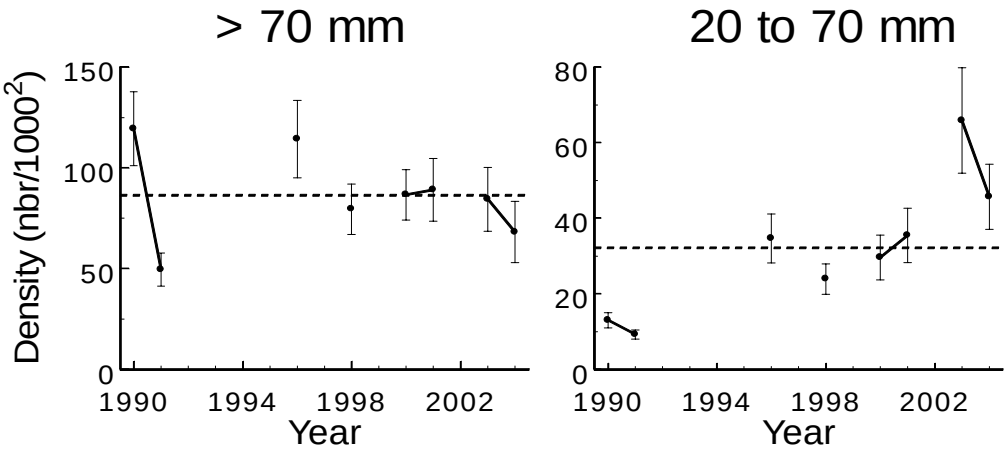

Figure 17. Catch per unit effort index of pre-recruits and recruits scallops based on research surveys in the Mingan sector, Area 16E (± standard error). The dotted line represents the average for the 1990-2004 series.

Landings, fishing effort and yields tend to vary between Johan Beetz Bay and Natashquan in Area 16G (Table 4). Landings totalled 1 t of meat in 2004 and catches per unit effort were above the average for the 10 previous years.

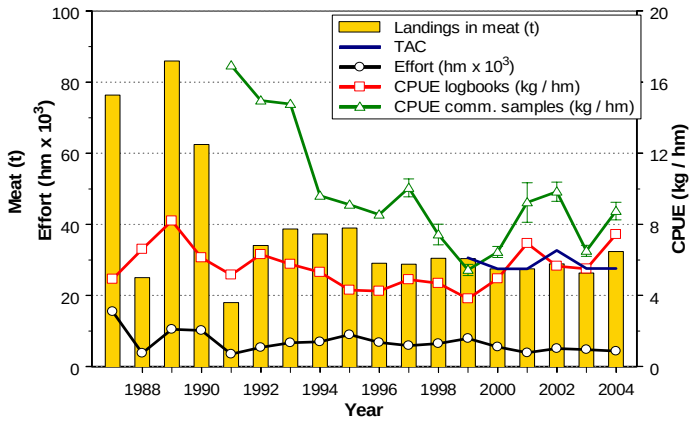

Figure 18. Scallop landings, fishing effort (by standardized fishing hour per meter of drag width) and catch per unit effort estimated from logbooks and commercial samples in area 16F.

Tableau 4. Catch per unit effort (kg of meat per hour of fishing and meter of drag width) estimated from logbooks.

Year	16G	16H	15	
			west	east
1994	3.01	3.27	2.20	1.49
1995	2.63	2.15	1.40	1.12
1996	1.92	2.27		1.09
1997	1.58	2.64		1.42
1998	2.64	2.66	1.86	2.10
1999	3.76		3.63	2.16
2000	2.40		3.24	3.80
2001	1.45			1.64
2002				1.31
2003	3.63			1.64
2004	4.29	2.79		1.91

In Area 18A, the quota of 51 t has not been attained since 2002, and landings amounted to only 8.7 t (Figure 19). Fishing effort decreased in 2004 and was 75% below the average for the 10 previous years. The remoteness of the beds from Anticosti Island and the low market price for scallops may explain fishers' lack of interest in harvesting this area over the past two years. Catch per unit effort estimated from logbooks has been stable since 1999, whereas the corresponding estimates obtained by at-sea samplers, which had shown a

downward trend since 1999, were up in 2004. The size structure values for landed scallops are roughly average, and the mean meat weight is below the average.

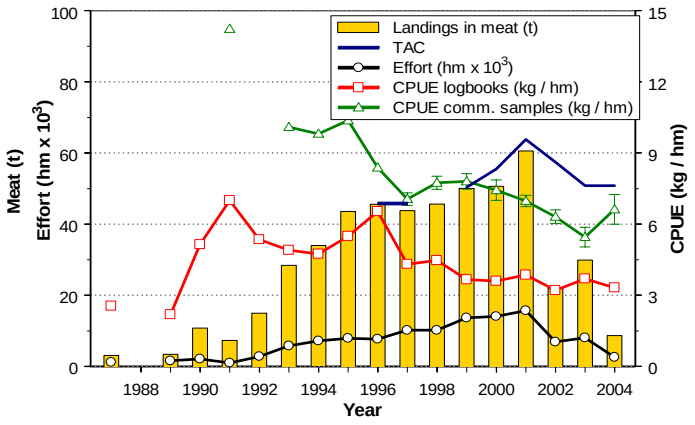

Figure 19. Scallop landings, fishing effort (by standardized fishing hour per meter of drag width) and catch per unit effort estimated from logbooks and commercial samples in area 18A.

Lower North Shore (Areas 16H and 15)

In 2004, 8 scallop fishing licences were issued for Area 16H, and 33 regular and 10 exploratory licences were issued for Iceland scallop fishing in Area 15. Prior to 1992, most of the scallops landed on the Lower North Shore were sea scallops, but from 1992 to 1998, Iceland scallop landings from Areas 16H and 15 increased. Since 1998, landings of the two scallop species have fallen on the Lower North Shore, totalling only 1.5 t of meat in 2004 (Figure 20).

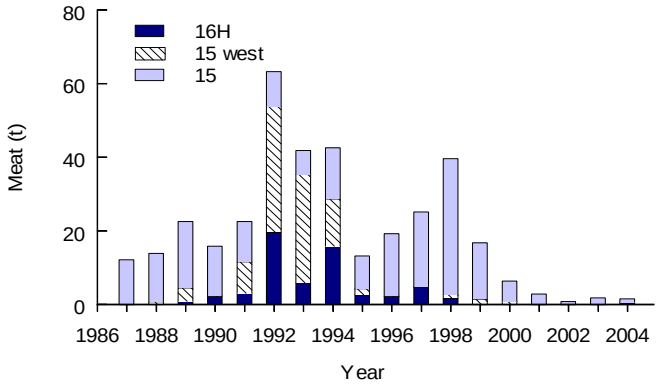

Figure 20. Scallop landings in areas 16H and 15 of the Lower North Shore.

Landings were made in Area 16H for the first time since 1998, amounting to 0.6 t in 2004, compared with 19.6 t in 1992. The steady yields (estimated from logbooks) recorded in Area 16H since 1994 are inconsistent with the drop in landings since 1995 (Table 4).

In Area 15, landings and fishing effort have dropped off sharply since 1998. From 1995 to 1998, landings in this area increased from 8.7 t to 36.9 t, but they have been declining since 1999. Area 16I was included in Area 15 (west of the current Area 15) in 1999. In 2004,

landings totalled 0.9 t of meat, 92% below the average for the 10 previous years (Figure 20). Yields rose by 16% compared with 2003 levels (Table 4).

In fall 2003, an Iceland scallop survey was conducted on the Lower North Shore between Natashquan and Blanc Sablon. It was done under the Fisheries Science Collaborative Program (FSCP) and with the co-operation of the Lower North Shore Fishermen's Association. The findings indicate that Iceland scallop are distributed along the Lower North Shore at depths of 20 to 45 fathoms, but they are present in low densities. The highest densities were observed off Kegaska and Blanc Sablon.

CONCLUSIONS AND ADVICE

Magdalen Islands (Area 20)

When data obtained from aquaculture sites is included in the Magdalen Islands scallop stock assessment, certain trends differ. The overall portrait of the stock's situation is encouraging. Since 2000, commercial and aquaculture landings have increased overall and fishing effort in commercial sites has dropped. Recruitment measures, namely the abundance of prerecruits and spat collection, have at least been steady and have even exceeded the average for the last five years. Egg production figures in 2004 were above those recorded just before the start of seeding activities. Seeded sites accounted for about 70% of the region's egg production.

The survival rate (from juvenile settlement to commercial size) appears to be higher in aquacultural sites harvested once every five years, compared with fishing sites that are harvested annually. Rotational fishing therefore appears to be beneficial to seeded sites. Rotational fishing should be adopted for all scallop stocks in order to increase their productivity.

With continued seeding of aquacultural sites, rotational fishing at these sites, and stabilized fishing effort on traditional fishing grounds, the status of sea scallop stocks could improve.

Gaspé (Zones 17A1, 17A2, 18B, 18C and 19A)

The steady decrease in Gaspé scallop landings since 1999 is attributable to a decline in fishing effort, which can in turn be explained by the smaller number of licences issued for Area 19A, the drop in the market price for scallop, and the granting of temporary allocations for other species.

North of the Gaspé Peninsula (Area 17A2), fishing effort has been decreasing since 2000. There appears to have been no fishing effort in 2004, as no data are available on landings.

Landings made south of Anticosti Island (Areas 18B and 18C) are lower than those made in the late 1990s. The fishery is still in development in these areas. The remoteness and the small size of the scallops make these beds less appealing to fishers. The 2003 exploratory fishery revealed that the resource was less abundant than when Area 18B was first harvested in 1991. The status of the resource in these areas seems worrisome, but given the low fishing effort and the large size of the area, it is recommended that the status quo be maintained for these areas.

For a number of years now, the low commercial sea scallop catches in Chaleur Bay have been troubling. Measures such as the decrease in the number of fishers and the gradual increase in the minimum legal size to 100 mm were implemented with the aim of reducing fishing effort and

preserving the stock's reproductive potential. Although these measures should be maintained because they help improve the status of the resource, they have not yet had the intended effect.

Île Rouge (Areas 16A1 and 17A1)

Exploitation of the Île Rouge bed in the St. Lawrence Estuary began in 1998. Considering that the available series of commercial indices covers only a short period and that the fishing area is limited, a cautious approach is required in relation to the exploitation of this bed. The overall quota should be maintained at the same level for the time being.

In addition, since small scallop attach themselves to the insides of the shells of dead scallops, it is recommended that empty shells be thrown back over the Île Rouge bed during at-sea sorting in order to favour the survival of prerecruits and preserve an environment conducive to their settlement on the seabed.

North Shore

Upper North Shore (Areas 16A1, 16A2, 16B and 16C)

Few fishers are active in Areas 16A2, 16B and 16C and fishing effort has been limited, varying year to year. Information on these areas is incomplete, precluding an assessment of resource status.

Middle North Shore (Areas 16D, 16E, 16F, 16G and 18A)

At present, it is impossible to accurately determine the status of the fishery in each of the management units on the Middle North Shore. The reduction in fishing effort since individual quotas were adopted in 1991 and the creation of many fishing areas have allowed for harvesting to be spread over a larger territory.

In Area 16E, catch per unit effort and fishing effort have stabilized since the 57.2 t quota was introduced in 1998. The abundance of small scallops found in the research surveys of 2000 and 2001 was confirmed in the 2003 and 2004 research surveys by the presence of scallops measuring between 40 mm and 60 mm. These findings suggest that the biomass may increase in a few years. However, until this situation materializes, it is recommended that the status quo be maintained in this area.

Landings in the Île à la Chasse sector (Area 16F) increased in 2004 following the allocation of two additional quotas for Subareas 16F-1 and 16F-2. The high catch per unit effort in Subarea 16F-1 reduced fishing effort in the main scallop bed, thereby achieving the objective set when the subarea was created. Because this new bed was opened up to harvesting, the biomass of scallops accessible to the fishery was higher in 2004. For these reasons, it is recommended that Subarea 16F-1 and Area 16F and their respective quotas be consolidated. Scallops landed in Subarea 16F-2 are smaller than those in Area 16F and Subarea 16F-1, but yields are very high. It is therefore recommended that the status quo be maintained in 16F-2.

Commercial yields, landings and fishing effort vary from year to year between Johan Beetz Bay and Natashquan (Area 16G). Fishing effort was low in 2004. The average size of Iceland scallops in this area is very small, which may explain the fishers' lack of interest in

harvesting this area. Information on this area is incomplete, thus precluding an assessment of resource status.

Anticosti Island quotas have not been met since 2002 (Area 18A). The downward trend in yields has continued owing to the decrease in landings and low fishing effort. The drop in landings can be explained primarily by the lack of interest in fishing this area given the low market price for scallop and high local operating costs. In spite of the foregoing, it is recommended that the quota be maintained.

Lower North Shore (Areas 16H and 15)

Landings on the Lower North Shore (Areas 16H and 15) have been declining steadily for many years. The information on these areas is incomplete and precludes assessment of resource status.

In light of the sporadic recruitment patterns of both scallop species and the recurrent mass mortalities of sea scallops, the number of fishing licences and fishing effort may be too high relative to the productive capacity of the stocks. It is therefore recommended that potential fishing effort on the Lower North Shore be reduced.

OTHER CONSIDERATIONS

Conservation measures

The conservation measures recommended for scallops are intended to allow all the beds to replenish themselves and ensure their sustainability. Any approach designed to boost reproductive potential, whether by leaving more adults on the seabed or by creating refuge areas for spawners, should have a positive effect on conservation of the resource. Moreover, because the number of eggs that a female scallop produces is roughly proportional to its size cubed, allowing the population to age and the scallops to grow more should result in a net gain in productivity, with the concomitant benefit of increasing the yield per recruit, and hence commercial profitability.

Scallops spawn in late summer, and juveniles settle on the seabed in the fall. Dragging the beds with fishing gear at this time of year reduces reproductive potential and stirs up the sediment, which can interfere with successful settlement of juveniles. A halt in fishing during the spawning and settlement periods (August to November) would limit the adverse effects of dragging on the substrate and favour the survival of young scallops. A rotational fishing strategy would also reduce the mortality rate of prerecruits.

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