

Figure 1. Scallop management units in Quebec.

Scallops in Quebec inshore waters in 2002

Background

There are two species of scallops in the Gulf of St. Lawrence: the sea scallop and the Iceland scallop. Sea scallops reach commercial size at about age 6, while Iceland scallops reach commercial size at around age 8. Both species have separate sexes and are broadcast spawners. The spawning season is short and varies from one location to another. Larval development takes nearly five weeks. Scallops are sedentary and live in aggregations called "beds."

Commercial harvesting in Quebec began in the mid-1960s. This inshore fishery harvests both species without distinction. 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 82 regular fishing licences and 10 exploratory fishing licences. All of these units are managed by controls over fishing effort, but most of the North Shore and Anticosti Island units are also governed by quotas. The North Shore has been the most productive scallop region in Quebec since 1980.

Summary

All areas

Scallops generally spawn in late summer, and the juveniles settle on the seabed in the fall. Meat weight yield varies over the reproductive cycle and is lowest during the spawning season. Subsequently, during the settling period, the juveniles are very sensitive to any disturbance of the sediment by fishing gear. For these reasons, it is recommended that scallop beds not be dragged from August to November.

In 2002, Quebec scallop landings totalled 143.3 t of meat, down 33 % from 2001; 69 % of the landings came from the North Shore, 20 % from the Gaspé and 11 % from the Magdalen Islands.

Magdalen Islands

- Landings from the traditional fishing grounds totalled 15.1 t in 2002, down 22 % from 2001.
- Restrictive measures enforced in recent years, including the creation of a spawning refuge, the gradual

implementation of a minimum legal size limit of 100 mm and the reduction of fishing effort, are intended to help the declining wild stock to recover. But despite all these measures, the wild stock is not recovering. Consequently, we recommend that the refuge area (20E) be kept closed, and that Area 20A also be closed to commercial fishing for three to four years to allow the wild stock of the Magdalen Islands to recover.

Gaspé

- Landings in the Gaspé rose 15 % from 2001, to 28.7 t. This increase is attributed to the resumption of fishing south of Anticosti Island (Areas 18B and 18C). Landings from Chaleur Bay (Area 19A) totalled 13.8 t, down 20 % from 2001.
- For several years now, the smallness of the commercial catch of sea scallops in Chaleur Bay (Area 19A) has raised concerns about the state of this resource. Measures such as reducing the number of fishers in the area and gradually increasing the minimum legal size, with a target of 100 mm in 2003, have been taken in order to reduce fishing effort and preserve reproductive potential. These measures must be maintained, because they help to improve the state of the resource.
- It is also recommended that refuge areas be created for a period of four years in order to protect the concentrations of young scallops that were found in a research survey conducted in Chaleur Bay in 2002.
- Lastly, to continue reducing fishing effort, it is recommended that the use of offshore drags be prohibited in

Area 19A. This gear is so efficient that its use would offset some of the progress already being achieved in this regard.

Île Rouge (Areas 16A1 and 17A1)

- The Île Rouge Iceland scallop bed straddles two fishing areas (16A1 and 17A1). In 2002, only the quota for Area 16A1 was fished. To promote a better distribution of fishing effort, it is recommended that these two areas be merged, so that both fishers can have access to the entire bed. For the moment, it would be desirable to maintain the current quota for this bed.

North Shore

- In 2002, landings from the North Shore totalled 99.5 t, which was 44 % less than in 2001. This decrease seems largely attributable to the low price that scallop were fetching on the market.
- In the Mingan area (16E), for the first time since the quota of 57.2 t was instituted in 1998, it was not reached. The low market price for scallop would appear to explain the decline in landings. The fishing yields in this area have generally been stable since 1998, and it is recommended that the *status quo* be maintained as regards management measures.
- Unlike in most of the North Shore fishing areas, landings in the Île à la Chasse area (16F) increased slightly, partly because of the temporary supplementary allocations granted to fishers in 2002. To promote the stability of the stock and conserve the resource, it is recommended that in 2003,

harvesting be brought back down to a level similar to that in 2001 (27.5 t).

- The largest decline in landings along the North Shore was observed north of Anticosti Island (Area 18A), where the 2002 figure was down 64 % from 2001. But the decline in landings and the limited fishing effort in 2002 still did not reverse the downward trend in yields in this area. For this reason, the quotas should be reduced to their 1999 level (50.4 t), so that the biomass on the sea bottom can increase and the trend toward declining yields can be reversed.

Biology

There are two indigenous species of scallops in Quebec: the sea scallop (*Placopecten magellanicus*) and the Iceland scallop (*Chlamys islandica*). In the Gulf of St. Lawrence, these two species are found mainly on gravel, shell or rocky bottoms, generally at depths of 20 to 60 metres. The Iceland scallop occurs along the North Shore, around Anticosti Island and off the north coast of the Gaspé Peninsula, but is virtually absent from the Southern Gulf. In contrast, the sea scallop is 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 must be taken into account when scallop conservation strategies and fishing plans are being developed.

Sea scallops grow in length more rapidly than Iceland scallops, at a rate that varies from one area to another and is influenced by habitat quality and environmental conditions. In the Gulf of

St. Lawrence, sea scallops reach their commercial size (95 mm) at about age 6, while Iceland scallops reach theirs (70 mm) at about age 8.

Scallops have separate sexes and are broadcast spawners. The spawning period is short and does not occur at the same time throughout the Gulf. Along the North Shore and around Anticosti Island, spawning occurs between mid-July and late August, depending on the area. 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 period, the larvae are dispersed throughout the water column. Juvenile scallops generally attach themselves to the seabed in proximity to adults. Scallop beds are usually found in areas where currents cause the larvae to be retained, but a good substrate is needed to ensure that the juveniles attach successfully. During the settlement period, juveniles are very sensitive to disturbance of the sediment by fishing gear. To ensure more successful spawning and settlement, it is recommended that scallop beds not be dragged from August through November.

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

The fishery

Quebec’s commercial fishery harvests both Iceland scallops and sea scallops

without distinction. The difficulty of visually distinguishing 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.

Catches are generally landed as meat (muscle), but occasionally as meat and gonads. Since the late 1990's, however, landings in the shell have been on the rise. Because of the mixed nature of the landings, conversion factors have to be applied to quantify the catch and to monitor quotas. The result can be a bias in these measurements, as well as in the calculated exploitation rate.

In 2002, Quebec waters were divided into three sectors comprising 18 fishing areas: the Magdalen Islands (Area 20), the Gaspé (Areas 17A1, 17A2, 18B, 18C, 19A) and the North Shore (Areas 16A1, 16A2, 16B, 16C, 16D, 16E, 16F, 16G, 16H, 15, 18A, 18D) (Figure 1). Areas 16D and 18D have seen little if any fishing to date. In 2002, 82 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, fishing season and hours, and individual and overall quotas.

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.

Landings in the Magdalen Islands have fluctuated a great deal since the commercial fishery began (Figure 2). Sea scallop stocks in the Magdalen Islands collapsed in 1971. Landings on

the North Shore rose rapidly from 1984 to 1990. Catches have levelled off since 1991, owing to the introduction of individual quotas on the Middle North Shore.

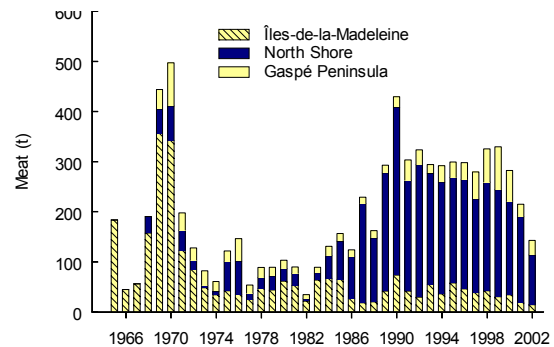


Figure 2. Scallop landings in Quebec.

In 2002, landings totalled over 143 t of meat and came from (in descending order) the North Shore (69 %), the Gaspé (20 %) and the Magdalen Islands (11 %). The assessment of the status of the scallop populations is based essentially on an analysis of commercial indices. For the Île Rouge bed of Iceland scallops (areas 16A1 and 17A1) and for Chaleur Bay (Area 19A), it is also based on indices measured in research surveys in 2002.

The following sections present more detailed information on the scallops taken in the Magdalen Islands, in the Gaspé, around Île Rouge in the St Lawrence Estuary, and on the North Shore.

Magdalen Islands (Area 20)

The Magdalen Islands contain several concentrations of scallops, at 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). In 2002, 23 scallop licences were issued. The fishery was open from

April 8 to July 27 in sub-areas 20A and 20B; Sub-area 20E was closed to fishing for the entire year. The fishing ground at Chaîne de la Passe and part of the fishing ground at Étang du Nord are now also closed to fishing and dedicated to scallop aquaculture. The rest of the Magdalen Islands sector was open to fishing from December 12, 2001 to January 12, 2002 and from April 1 to October 31, 2002.

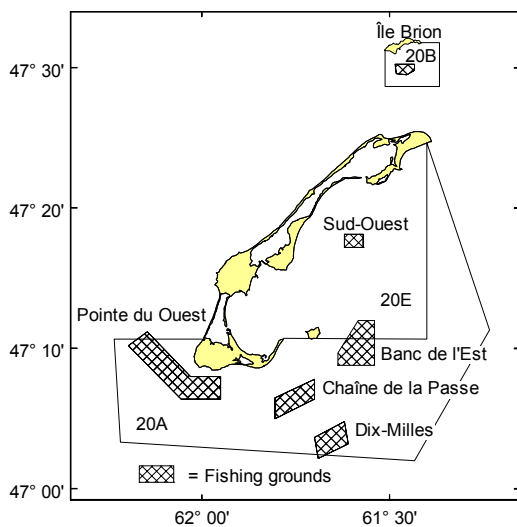


Figure 3. Sub-areas and main scallop fishing grounds in the Magdalen Islands.

The scallop catch in the Magdalen Islands consists mainly of sea scallops. In 2002, Iceland scallops made up around 5% of the landings, and landings for both scallop species combined totalled 15 t, down 22 % from 2001 (Figure 4).

Overall, the fishing effort in the Magdalen Islands fell by 30 % from 2001 to 2002. The fishing effort in the Chaîne de la Passe and Dix-Milles area showed a sharper decline (down 50 %), but the figures for catch per unit effort also remained low. The fishing effort in the Pointe du Ouest (Étang du Nord) scallop bed fell slightly, but was

concentrated in a smaller area, around the new area that was closed in 2002 to create an aquaculture site. The commercial catch per unit effort, based on the fisher's logbooks and expressed in kilograms of meat per hour of fishing and metre of drag width, was estimated at 0.86 kg/h m in 2002. In general, the commercial yields have been low (≤ 1 kg/h m) since 1996, and far lower than the yield of 2.8 kg/h m that was achieved in 1968.

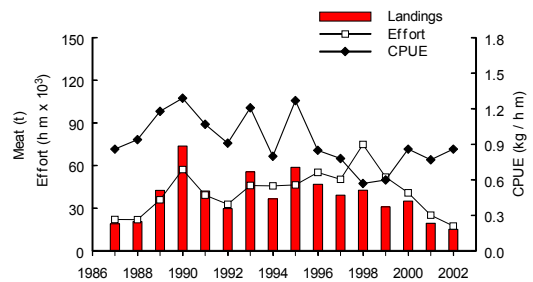


Figure 4. Scallop landings, fishing effort (by standardized fishing hour per metre of drag width) and catch per unit effort based on logbooks in the Magdalen Islands.

One of the major concerns in recent years has been this stock's ability to replenish itself. If the abundance of spawners continues its gradual decline, the stock's reproductive success will likely be affected. Over the years, large scallops have practically disappeared from the commercial catch taken in the traditional fishing grounds of Chaîne de la Passe, Dix-Milles and Étang du Nord (Figure 5). In 2002, few large spawners were present in these fishing grounds, and fishing was directed chiefly at scallops that had only recently reached minimum legal size.

The commercial catch in 2002 included high proportions of sea scallops that had not reached the minimum size limit of

95 mm. Dockside sampling of the commercial catch indicated that the weight of the meat landed ranged from 5 g to 49 g per scallop. In the western fishing bed (Étang du Nord), where the landings consist almost exclusively of sea scallops, the proportion of muscles landed that weighed less than 14.0 g (representing scallops less than 95 mm in size) was estimated at nearly 39 %. The use of an average count of 35 muscles per 500 g of meat thus did not prove an effective means of protecting scallops measuring less than 95 mm.

Outlook

From 1990 to 2002, the levels of exploitation have caused the stock to decline continuously. The current biomass is so low that the conservation of the stock is threatened. Since 1998, a series of measures designed to reverse the downtrend have been introduced: the creation of a refuge for spawners, a reduction in fishing effort, and a gradual increase in the minimum size limit, which will rise to 100 mm in 2003. Despite all these efforts, the wild stock is not recovering. For these reasons, it is recommended that the refuge area (20E) remain closed to fishing and that

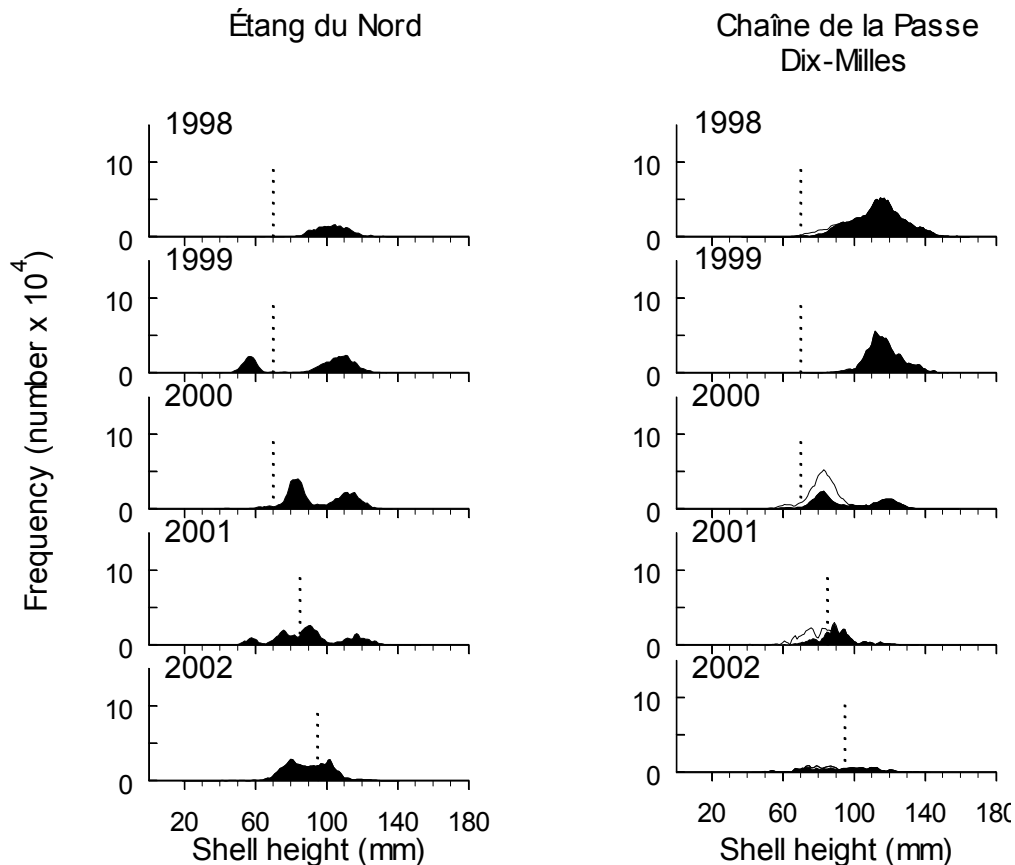


Figure 5. Size structures of sea scallops (black) and Iceland scallops (white) based on samples from commercial catches. The minimum legal size was increased gradually from 2000 through 2002 and is indicated by the dotted line at 70 mm for years prior to 2001, 85 mm for 2001, and 95 mm for 2002. This line thus separates the pre-recruits from the recruits for each of these years.

all commercial fishing be halted in Area 20A for at least three or four years to let the wild stock in the Magdalen Islands recover.

Gaspé (Areas 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). Since 1998, scallop fishers from Area 18B have had access to Area 18C. In 2002, in order to reduce the fishing effort in Chaleur Bay, a licence that previously provided access to Area 19A was redirected to areas 18B and 18C. Thus, in 2002, there was only one scallop licence in areas 17A1 and 17A2, while there were three in areas 18B and 18C and five in Area 19A. There was a fishing season in each of these areas, and quotas were set for areas 17A1, 17A2 and 18B.

In 2002, landings in the Gaspé increased by 14 % compared with 2001 (Figure 6). These landings came from Chaleur Bay (Area 19A), Anticosti Island (areas 18B and 18C) and the St. Lawrence Estuary on the north shore of the Gaspé Peninsula (Area 17A2). In Chaleur Bay, the fishery targeted mainly

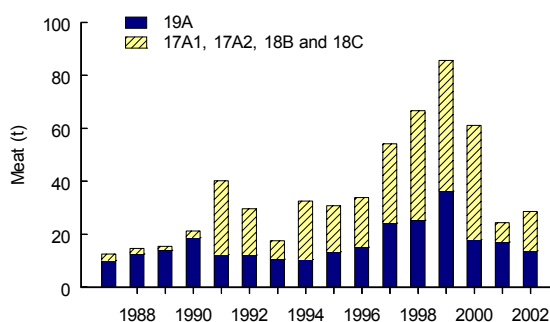


Figure 6. Scallop landings for Areas 17A1, 17A2, 18B, 18C and 19A in the Gaspé.

sea scallops and occasionally Iceland scallops, as it did in 1998 and 1999. Iceland scallops are harvested around Anticosti Island and in the St. Lawrence Estuary. Landings in the Gaspé increased gradually from 1993 to 1999, when they peaked at about 80 t of meat. Since 1999, landings in the Gaspé sector had been on the decline, but they rose slightly in 2002, when they totalled 28.7 t.

The situation in Area 17A1 is discussed later in this report, under the heading “*Île Rouge (Areas 16A1 and 17A1)*”.

North of the Gaspé Peninsula (Area 17A2), landings and fishing effort rose from 1999 to 2001. But in 2002, landings fell by 63 % compared with 2001, and fishing effort fell by 53 %. The catch per unit effort was estimated at 2.6 kg/h m, down 48 % from 2001 and down 32 % compared with the past six years of samples of the commercial catch (Table 1). The catch per unit effort estimated from logbooks also shows a downward trend. However, the size of the scallops and the muscle weights have remained relatively high and stable

Table 1. Catch per unit effort (kg of meat per hour of fishing and metre of drag width) estimated from commercial samples.

Year	17A1	17A2	18B	18C	19A
1992					
1993				1.25	
1994			4.83		1.29
1995					
1996		3.79	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

since 1994.

In 2001, there was no scallop fishing in areas 18B and 18C. In 2002, fishing operations resumed in both of these areas, with a greater effort in Area 18C. Landings and fishing effort decreased by 44 % and 86 %, respectively, compared with the average for the past ten years. For the two areas combined, the catch per unit effort (based on logbooks) was estimated at 6.8 kg/h m, which is 138 % higher than the average for the past ten years. It was in Area 18C, however, that the catch per unit effort was highest: 7.0 kg/h m, based on logbooks, and 13.6 kg/h m, based on sampling at sea. The modal size of the Iceland scallops (77 mm) and the average muscle weight (7.7 g) measured in Area 18C have been stable indices since 1999.

From 1994 to 1999, landings from Chaleur Bay (Area 19A) increased steadily, peaking at close to 37 t in 1999. In 1998 and 1999, the growth in landings was due to the redirection of fishing effort toward Iceland scallops. Since 2000, the fishery has again targeted sea scallops, and landings have declined. In 2002, the catch in Area 19A totalled 13.8 t, down 20 % from 2001. The fishing effort in this area also fell, by 24 %. The fishery focused mainly on sea scallops, which accounted for about 81 % of the catch.

In 2002, the index of catch per unit effort for both species of scallops combined, as estimated from sampling at sea, fell in area 19A (Table 1). For sea scallops, the indices of catch per unit effort estimated from sampling at sea and from logbooks fell by 14 % and 33 %, respectively, compared with 2001, while the indices for Iceland scallops rose. The size of the sea scallops in the commercial catch increased in 2002 (Figure 7). The average meat weight

landed also rose slightly, but remained close to the average for the past ten years.

A research survey conducted in Chaleur Bay in Fall 2002 showed that commercial-size scallops of both species were present at very low densities in the fishing grounds sampled, in beds covering modest surface areas. Some concentrations of sea scallop pre-recruits were discovered near Chandler and Paspébiac.

Outlook

The steady increase in the Gaspé scallop catch from 1993 to 1999 was attributable to the development of the Iceland scallop fishery in Chaleur Bay and around Île Rouge. The subsequent decline in landings was due to a smaller catch in Chaleur Bay and, in 2001, to the total absence of any fishing activity off the southern shore of Anticosti Island (Areas 18B and 18C) and around Île Rouge in the St. Lawrence Estuary (Area 17A1). The increase in landings in 2002 is attributable mainly to the resumption of fishing operations south of Anticosti Island.

North of the Gaspé Peninsula (Area 17A2), fishing yields in 2002 fell to levels equivalent to those in 1996 and 1997. Only one fisher is harvesting the various beds, moving around within the area and exerting a level of effort that varies from year to year. For now, it is not possible to assess the state of the stock for Area 17A2 as a whole. If the current downward trend in the indices continues over the next fishing season, it might mean that the fishing effort is too high for this area's production capacity.

South of Anticosti Island (Areas 18B and 18C), landings and yields have varied

since 1991, mainly in relation to fishing effort. In these areas, the fishery is still in the development phase. The fishing yields in 2002 were high, but the remoteness of these beds and the size

of the scallops they contain make them less attractive to fishers. The state of the resource in these areas is not a great concern for the moment, given the limited fishing effort.

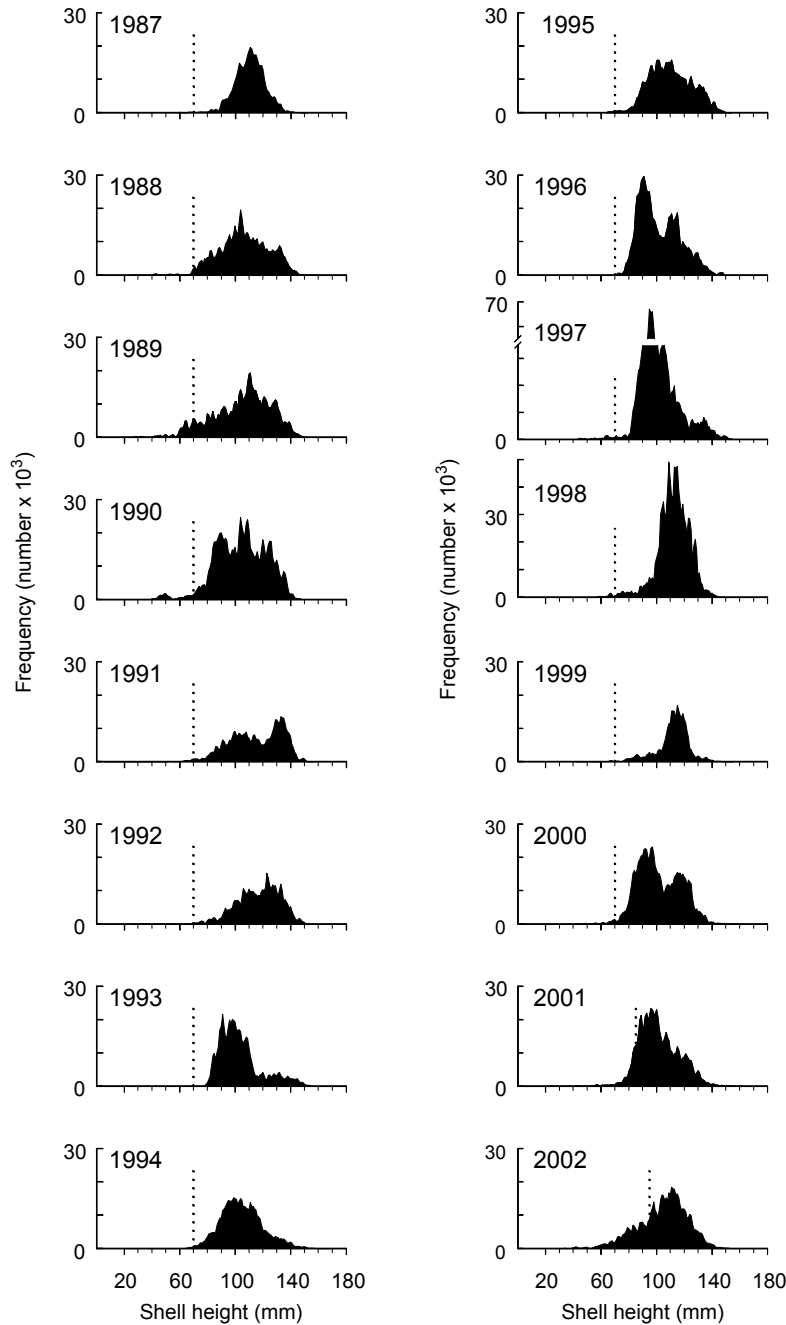


Figure 7. Size structures of sea scallops in Area 19A, based on commercial samples. Through the year 2000, the dotted line at 70 mm separates the pre-recruits (< 70 mm) from the recruits (\geq 70 mm). For 2001 and 2002, the dotted line is located at 85 mm and 95 mm, respectively, reflecting the gradual increase in the minimum legal size.

For the past several years, the poor commercial catch of sea scallops in Chaleur Bay has been a concern, however. Steps such as reducing the number of fishers in the area and gradually increasing the minimum legal size, with a target of 100 mm in 2003, have already been taken with the goals of reducing fishing effort and protecting the stock's reproductive potential. These measures must be continued, because they help to improve the state of the resource. Their effects may not become visible until a few more years have passed.

In the past, the offshore drag has been used in this area. Because it is so much more efficient than the Digby drag, its use would reduce the benefits of the current measures to reduce fishing effort. It is therefore recommended that the use of the offshore drag be prohibited in Area 19A.

The research survey performed in Chaleur Bay in 2002 provided some information about recruitment. Aggregations of small sea scallops were present near the 10-fathom (20-metre) line in the Chandler and Paspébiac beds. It is recommended that refuge areas be established for a period of four years in order to protect these juvenile scallops.

Île Rouge (Areas 16A1 and 17A1)

The Île Rouge Iceland scallop bed is located in the St. Lawrence Estuary and straddles two fishing areas (16A1 and 17A1) that belong to two different administrative regions of Quebec (Gaspé and Côte-Nord). Since this scallop bed is a single biological entity,

scallops in these two fishing areas are treated as a single stock.

Harvesting of this bed began in 1998. In 2000, quotas of 13.6 t of meat were set and met both in the northern part of the bed (area 16A1) and in the southern part (area 17A1). Since 2001, only the quota for the northern part (area 16A1) has been fished.

In 2002, the biomass abundance index, based on samples taken at sea, increased compared with 2001. Catch per unit effort was also up sharply, while fishing effort fell 62 % compared with 2001 (Table 2). It should be noted, however, that in 2002, the fisher used a new, more efficient type of scallop drag. The scallops in the commercial samples remain small compared with those harvested during the first few years that this bed was fished.

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

Year	16A1	16A2	16B*	16C*
1992			2.25	4.34
1993			1.82	2.94
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			8.82

* Logbooks

A scientific survey of this entire scallop bed, conducted in June 2002, confirmed the observations of an earlier survey: the commercial-sized scallops (≥ 70 mm) are concentrated in a very small zone (about 22 km²) at the border

between areas 17A1 and 16A1. Scallops of all sizes have been harvested in this zone, which suggests regular recruitment (Figure 8). It is hard to distinguish cohorts on the basis of the size structure, however. Small individuals (≤ 10 mm) have been found around the periphery of the bed, all attached to the inside of empty bivalve shells.

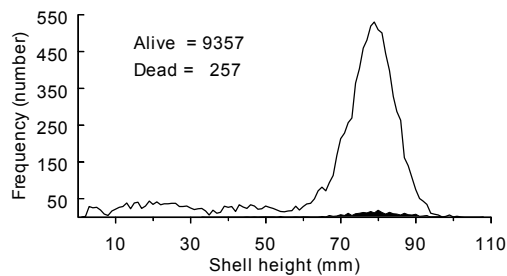


Figure 8. Size structure of living (white) and dead (black) Iceland scallops sampled from the Île Rouge bed in the 2002 research survey.

Outlook

The scallop fishery on the Île Rouge bed in the St Lawrence Estuary is quite recent, having begun in 1998. Because the time series of the available commercial indices therefore cover only a short period, and because the area fished is so small, caution must be exercised in the harvesting of this bed. For the moment, it is desirable to keep the overall quota at its current level.

Currently, the distribution of the fishing effort is not proportional to the biomass, which could result in local overfishing of the bed. To ensure a proportional distribution of fishing effort, it is recommended that the two fishing areas (16A1 and 17A1) be combined, so that both fishers will have access to the entire bed.

In addition, since small scallops attach themselves to the insides of the shells of dead scallops, it is recommended that when the catch is sorted at sea, any empty shells be returned directly to the Île Rouge bed, to enable more pre-recruits to survive and to maintain a bottom environment where they can become established more easily.

North Shore

Iceland scallops are fished 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 99.5 t of meat in 2002, down 42 % from 2001. Since the late 1980s, scallop landings on the North Shore have accounted for more than 65 % of the total Quebec catch and have come mostly from the waters around the Mingan Archipelago and Anticosti Island (Areas 16E, 16F and 18A).

Areas 16A2, 16B and 16C

Landings from these areas, which roughly constitute the Upper North Shore, totalled 14 t in 2002 and consisted entirely of Iceland scallops (Figure 9). These areas are harvested by five fishers. Fishing effort is low and is controlled by the number of licences issued and by quotas in areas 16A1, 16A2 and 16C.

The situation in area 16A1 is described earlier in this report, under the heading “Île Rouge (Areas 16A1 and 17A1)”.

In areas 16A2 and 16B, there was no scallop fishing in 2002. Landings from

these two areas have varied widely, according to the intensity of the fishing effort. In area 16C, landings also vary from year to year, and fishing effort is low. In 2002, landings from area 16C fell by 63 % compared with 2001. The fishing yields (based on logbooks) were estimated at 8.82 kg/h m, an increase of 192 % compared with 2001. Only one vessel fished this area commercially in 2002, and no samples of its catch were taken.

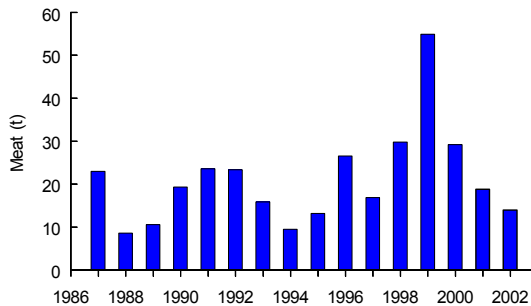


Figure 9. Landings of scallops from areas 16A1, 16A2, 16B and 16C.

Outlook

There are few fishers in areas 16A2, 16B and 16C. Fishing effort in these areas is low and varies widely from year to year. For area 16C, only partial information was available for 2002. However, the available index for catch per unit effort was positive. The state of the resource does not seem to be a concern, given the current low level of exploitation.

Areas 16D, 16E, 16F, 16G and 18A

Seven licences have been issued that allow scallop fishing in Area 16E, nine in areas 16F and 18A and four in Area 16G, while all of the Middle North

Shore’s scallop fishers are allowed access to 16D. Each of these areas is subject to a quota, and fishing effort in them is governed on both a daily and a seasonal basis. Iceland scallop landings from the fishing areas along the Middle North Shore have risen substantially since the early 1980s. This is the most productive scallop region in Quebec; it is also the one where the management measures are the strictest.

Fishing effort in these areas has declined substantially since 1990 as a result of the imposition of individual quotas in 1991, the shortening of the fishing seasons in all areas, and the subdivision of these areas. The adjustment of quotas (upward or downward, depending on the area) has also affected the intensity of the fishing effort.

The meat weight of scallops landed reached an all-time high of nearly 300 t in 1990 (Figure 10). In 1991, landings fell off sharply, especially in areas 16E and 16F. Since then, landings have fluctuated according to substantially the same pattern as the quotas introduced that year. In 2002, however, landings were far below quota in areas 16E and 18A. Landings along the Middle North Shore totalled 85 t of meat in 2002, down 42 % from 2001.

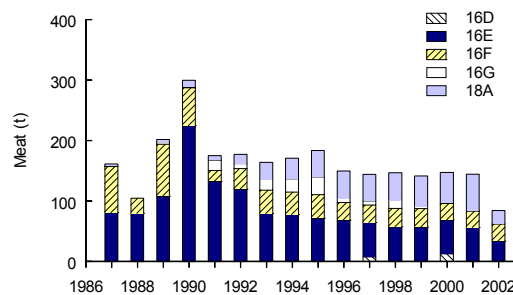


Figure 10. Landings of scallops from areas 16D, 16E, 16F, 16G and 18A on the Middle North Shore.

Along the shoreline from the Manitou River to the Île aux Perroquets lighthouse (Area 16D), landings totalled 104 kg in 2002, compared with 85 kg the preceding year. Since 1996, landings and yields from Area 16D have been low, because of the sporadic nature of the fishing effort in this area (Figure 10). In 2002, the catch per unit effort as estimated from logbooks was 3.4 kg/h m. There was no sampling of the commercial catch.

In Area 16E, landings in 2002 totalled 33.6 t, down 40 % from 2001. Even though the fishing effort was down sharply in 2002 (36 %), the indices for catch per unit effort did not increase (Figure 11 and Table 3). The modal size of the scallops in the commercial catch and the average meat weight landed at dockside in this area have been stable for several years. The abundance index estimated from sampling at sea has also been stable since 1999. In 2001, the indices from the research survey had indicated a possible decrease in the number of scallops that could be expected to be recruited to the fishery in the short term. Since there was no research survey in 2002, however, we cannot confirm the low abundance of scallop pre-recruits measuring 40 to 70 mm.

In Area 16F, landings were up slightly in 2002, because of a supplementary allocation reaching 28.9 t (Figure 10). Fishing effort was up 30 %. The catch per unit effort based on logbooks was 5.7 kg/h m, down 18 % from 2001. On the other hand, the catch per unit effort based on commercial samples was similar to that for the preceding year and stable relative to the average for the past ten years (Table 3). The modal size of the commercial scallops from this

area rose from 83 mm in 2001 to 88 mm in 2002.

Table 3. Catch per unit effort (kg of meat per hour of fishing and metre of drag width) estimated from commercial samples.

Year	16E	16F	16G	18A
1992	21.92	14.97	6.33	
1993	17.81	14.78	8.55	10.09
1994	16.49	9.62	9.48	9.81
1995	13.26	9.11	5.95	10.37
1996	13.34	8.55	4.41	8.39
1997	12.25	10.06	2.52	7.06
1998	8.41	7.43	5.53	7.74
1999	9.85	5.44	1.70	7.80
2000	8.97	6.45		7.43
2001	9.26	9.23		6.98
2002	8.89	9.84		6.31

Landings, fishing effort and fishing yields are fairly variable near Natashquan in Area 16G (Figure 10). In 2002, no fishing activity took place in this area.

In Area 18A, landings rose from 1991 to 2001 (Figure 12), but in 2002, they fell 64 % from the 2001 figure and totalled only 22.0 t. Fishing effort was down by 57 %. The low market price for scallops and the remoteness of the scallop beds along the shores of Anticosti island would explain the fishers' lack of interest in harvesting this area in 2002. The

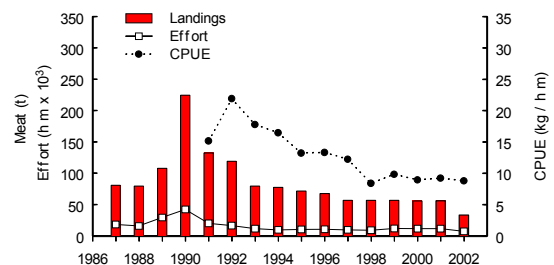


Figure 11. Scallop landings, fishing effort (by standardized fishing hour per metre of drag width) and catch per unit effort, estimated from commercial samples in Area 16E.

figures for catch per unit effort were fairly similar to those in 2001 but were still about 30 % lower than the average for the past ten years. The sizes of the scallops landed in 2002 were fairly similar to those in 2001, with a modal size of 83 mm. In this area, the biomass index estimated from samples taken at sea has declined constantly since 1994.

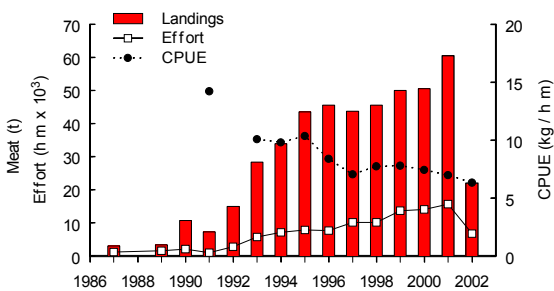


Figure 12. Scallop landings, fishing effort (by standardized fishing hour per metre of drag width) and catch per unit effort, estimated from commercial samples in Area 18A.

Outlook

At present, it is impossible to determine the status of the fishery in each of the management units of the Middle North Shore very precisely, especially since there is often little fishing activity in areas 16D and 16G.

In Area 16D, there are few fishers; fishing effort is low and varies from year to year. The information available about this area is only partial and not sufficient for an assessment of the state of the resource.

In Area 16E (the Mingan Archipelago), the catch per unit effort has stabilized since the 57.2 t quota was introduced in 1998. In 2002, for the first time, this quota was not reached. The decline in

landings is likely attributable to the low market price for scallops. The abundance of small scallops in the 2000 and 2001 research surveys suggests that the biomass could increase in a few years. Meanwhile, however, recruitment to the fishery might be low, so it is recommended that the *status quo* be maintained.

In the waters around Île à la Chasse (Area 16F), yields declined gradually from 1994 to 1999. To reverse this downtrend, the quotas have been reduced a number of times. In 2002, landings increased slightly when the fishers were granted a supplementary allocation. Except for the index of catch per unit effort (based on logbooks), the commercial indices in 2002 remained fairly similar to those in 2001, suggesting that the stock has stabilized for the moment. A return to a lower level of exploitation, similar to that for 2001, would be recommended to ensure the conservation of the resource, unless the data gathered in the exploratory survey scheduled for the start of the 2003 season indicate other possibilities.

Near Natashquan (Area 16G), landings, fishing effort and commercial yields are variable. In 2002, there was no fishery. The average size of the Iceland scallops in this area is very small (75 mm), which would explain the fishers' lack of interest in it. The information available about this area is only partial and not sufficient to make any judgments about the state of the resource.

From 1999 to 2001, the quotas for Area 18A were increased substantially every year. Over this period, the rapid rise in landings and the steady growth in fishing effort gave cause for concern, because they were accompanied by a decline in the catch per unit effort. It was

uncertain whether the stock would be able to sustain these harvesting levels without any negative impact on the resource. The small landings and low fishing effort recorded in 2002 did not reverse this decline in yields, however. For this reason, the quotas should be reduced to their 1999 level (50.4 t), so as to reverse the downward trend in yields and increase the biomass in the scallop beds.

Areas 16H and 15

In 2002, there were eight scallop fishing licences for Area 16H, and 33 permanent licences and 10 exploratory licences that allowed access to Area 15. Before 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 830 kg of meat in 2002 (Figure 13).

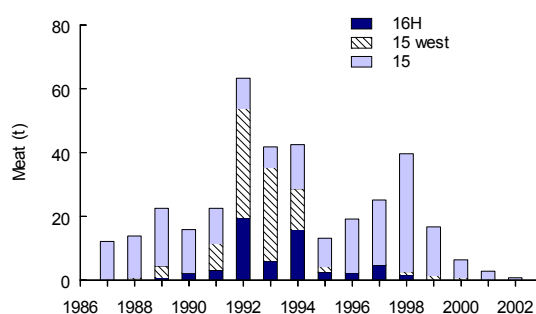


Figure 13. Scallop landings in areas 16H and 15 on the Lower North Shore.

In Area 16H, no scallops have been landed since 1998. From 1994 to 1998, landings for this area fell from 15.9 t to 1.7 t. The stability of the logbook yields for Area 16H since 1993 does not explain the decline in landings since that year (Table 4).

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

Year	16H	15	
		ouest	est
1992	4.15	2.91	1.00
1993	2.58	2.75	1.14
1994	3.27	2.20	1.49
1995	2.15	1.40	1.12
1996	2.27		1.09
1997	2.64		1.42
1998	2.66	1.86	2.10
1999		3.63	2.16
2000		3.24	3.80
2001			1.64
2002			1.31

In Area 15, landings and fishing effort have fallen substantially since 1998. From 1995 to 1998, landings in this area increased to 36.9 t from 8.7 t, but since 1999, they have declined. In 1999, Area 16I was included in Area 15 (west of the current Area 15). In 2002, the landings totalled 830 kg of meat, which was 71 % lower than in 2001 and 94 % lower than the average landings for the past ten years. Yields in 2002 were 20 % lower than in 2001 (Table 4).

Outlook

Landings on the Lower North Shore (Areas 16H and 15) have been declining steadily for several years. The information about these areas is partial and insufficient to assess the state of the resource.

The decrease in landings of both scallop species on the Lower North Shore in recent years could reflect fishers' lack of interest owing either to the drop in market price for scallops or to the fishers' having obtained temporary licences to fish for other species.

The sporadic recruitment patterns of both species of scallops and the

recurrent massive mortality observed in sea scallops on the Lower North Shore suggest that the number of fishing licences may be too high relative to the productive capacity of the stocks. It is therefore recommended that this excess of potential fishing effort on the Lower North Shore be reduced.

Conservation measures

The conservation measures recommended for scallops are intended to protect each bed's ability to replenish itself, and thus ensure its sustainability. Any approach designed to boost reproductive potential, whether by leaving more adults on the seabed or by creating refuge areas for spawners, would have a positive impact on conservation of the resource. Moreover, because the number of eggs that a female scallop produces is proportional to its size, allowing the population to age would result in a net gain in productivity, with the side 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 disrupts settlement of the juveniles. A halt in fishing during the spawning and settlement seasons (August through November) would limit dragging damage to the substrate and favour the survival of young scallops.

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