



Scallops in Québec Inshore Waters

Background

There are two species of scallop in the Gulf of St Lawrence, the sea scallop and the Iceland scallop. They reach commercial size at age five in the case of the sea scallop and age eight in the case of the Iceland scallop. The sexes are separate and fertilization takes place externally. The spawning season is short and does not occur at the same time throughout the Gulf. Larval development takes nearly five weeks. Scallops are sedentary and live in aggregations known as "beds".

In Québec, commercial harvesting began in the mid 1960s. It is an inshore fishery, taking both species without distinction. Catches are landed mostly as muscle, or meat. The Laurentian Region is divided into 17 areas and has 82 fishing licences. All areas are managed by controlling fishing effort, but the Middle North Shore and Anticosti Island are also governed by quotas. Since 1980, the North Shore has been the most productive region in Québec.

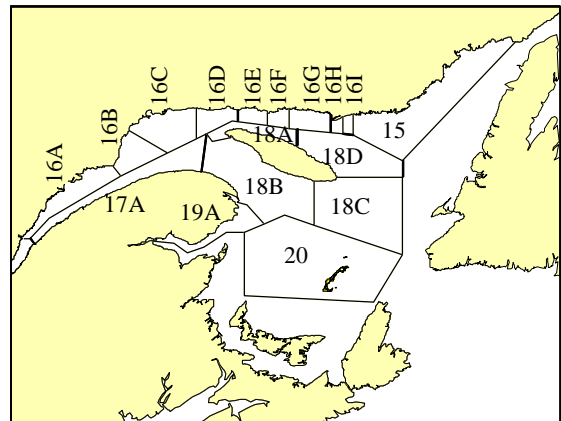


Figure 1. Québec scallop management areas.

Summary

All areas

- Scallops spawn in late summer, and the juveniles settle on the seabed in the fall. During the settling period, the young are very sensitive to any disturbance of the sediment by fishing gear. Scallop fishing during the breeding season and while the young are settling (August through November) is therefore not recommended. Closing the fishery at this time is a conservation measure that will maximize breeding potential and promote survival of the young.

Îles-de-la-Madeleine

- In 1998, fishing effort rose by 30 %, even though the exploitable biomass was very limited.
- Intensive fishing of large spawners on the Banc de l'Est is probably the cause of the sharp drop in catch rates for spats in 1998.
- Recruitment has been low for several years on all beds.
- There is only one cohort of prerecruits in the population (that of 1995), but it is not abundant, and it will not be recruited to the fishery until 2000 or 2001.

- There are serious fears for the conservation of the Îles-de-la-Madeleine sea scallop stock.

Gaspé

- Falling catches per unit effort and the smaller average size of the scallops taken on the north shore of the Gaspé Peninsula may reflect a degree of resource depletion. In the short term, it would be wise to reduce fishing effort in the eastern part of Area 17A.
- Landings and catches per unit effort in Area 18B (and 18C) have been rising for several years. The state of the resource in this areas is not of concern given the low local fishing effort.
- Since 1994, with the exception of 1997, catches per unit effort in Area 19A have remained stable but low. Fishing effort shrank significantly in 1998, and current levels are probably more consistent with the population's capacity for renewal.

North Shore

- The situation in areas 16A and 16B is hard to interpret because of the lack of information available. Tighter management in these areas may forestall excessive pressure on the resource.
- Imposition of quotas since 1997 has helped stabilized catch rates in Area 16C, but the decline in the average size of the scallops taken in 1998 should be monitored closely, for it may indicate local overfishing.
- The stability of the size structure of the Iceland scallop population in Area 16E in 1998 reflects the stock's ability to withstand the exploitation rates of recent years. However, uncertainty surrounding abundance indicators makes it impossible to estimate the state of the resource accurately.
- The main commercial indicators in Area 16F were positive in 1998, but because of the limited number of beds available

in this area, it would be wise to stabilize harvesting levels in the short term.

- The average size of Iceland scallops in Area 16G is small, which accounts for the lack of interest shown and the resulting drop in fishing effort seen in the last few years, even though the beds are densely settled.
- The main commercial indicators in Area 18A were stable relative to 1997. Current harvesting levels do not seem to have any adverse impact on the resource.
- Landings and fishing effort in areas 16H and 16I have been negligible since 1995. For now, there is no concern over the resource.
- In 1998, higher landings in Area 15 were attributable to the eastern sector, around Blanc Sablon, where the fishery seems to have some potential. Fishing potential in the western sector of Area 15, however, is limited.

Biological context

There are two indigenous species of scallop in Eastern Canada, 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, at depths of 20 to 60 metres. Geographic distribution is different for the two species. In the Gulf of St. Lawrence, the Iceland scallop occurs on the North Shore, around Anticosti Island and on the north shore of the Gaspé, but is virtually absent in the southern Gulf. By contrast, the sea scallop is found primarily in the southern Gulf, including the Îles-de-la-Madeleine and Chaleur Bay, and occasionally appears on the Lower North Shore.

The sea scallop grows at a faster rate than the Iceland scallop. Growth varies from one region to another, and is chiefly influenced by habitat quality and environmental conditions. In the Gulf of St. Lawrence, commer-

cial size is reached at about age 5 for the sea scallop and age 8 for the Iceland scallop.

In scallops, the sexes are separate and eggs are fertilized externally in the water. The spawning period is short and does not occur at the same time Gulf-wide. In the sector extending from Havre St. Pierre to Johan-Beetz Bay, Iceland scallop spawn in July, whereas in the rest of the Middle and Lower North Shore and off 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 in the Îles-de-la-Madeleine region.

Larval development takes about 5 weeks, from fertilization until settlement on the bottom. The larvae seek to attach themselves to the seabed, in fairly close proximity to adult scallops, but a good substrate is needed to ensure successful settlement.

Scallops are sedentary and live in aggregations called "beds". This fact is important to consider when developing conservation strategies and harvesting approaches.

The fishery

Commercial harvesting in Québec targets Iceland scallops and sea scallops indiscriminately. Catches are generally landed as muscle (meat) and occasionally as meat and roe (muscle and gonad) or in the shell (whole). The difficulty of distinguishing the muscle of the two species visually complicates analysis of fishing statistics. However, the two species are not uniformly distributed in the Gulf of St. Lawrence, and catches in any one sector usually consist of just one species.

In 1998, the Québec Region comprised 17 fishing areas divided among three sectors, namely the Îles-de-la-Madeleine (Area 20), the Gaspé (Areas 17A, 18B, 18C, 19A) and the North Shore (Areas 16A, 16B, 16C,

16D, 16E, 16F, 16G, 16H, 16I, 15, 18A, 18D) (Figure 1). Areas 18C and 18D, however, have hardly been fished, if at all. In 1998 a total of 82 regular licences were issued. Management plans varied depending on the 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 essentially an inshore fishery. The Digby-type drag has been used since harvesting began in Québec. Over the years, there has been a significant increase in fishing effort, primarily as a result of the fleet's increased fishing capacity and effectiveness.

Landings in the Îles-de-la-Madeleine have fluctuated widely since the beginning of the commercial fishery (Figure 2). The sea scallop stocks in this region collapsed in 1971. Landings on the North Shore rose rapidly from 1984 to 1990. There has been a levelling off of catches since 1991 owing to the introduction of individual quotas on the Middle North Shore.

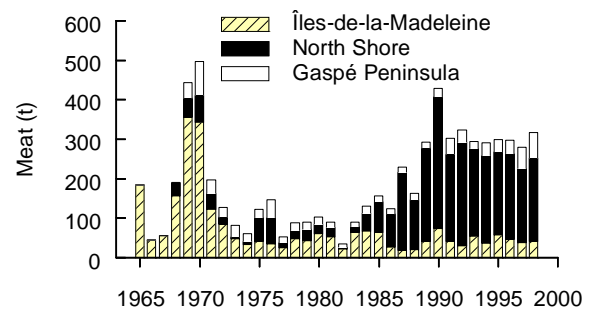


Figure 2. Scallop landings in Québec.

1998 landings totalled 317 t of meat, coming, in descending order, from the North Shore (66 %), the Gaspé (21 %) and the Îles-de-la-Madeleine (13 %).

Assessment of the status of scallop populations is based essentially on analysis of commercial indices. In areas 20 and 16E it is also based on indices measured during research surveys.

Where there are no research surveys, assessment of the status of populations is thus entirely dependent on the quality of the data supplied by the fishing industry. According to well informed sources, unreported catches are so large in some areas in some years that they jeopardize the reliability of analyses based on fishing statistics.

Information specific to scallops in the Îles-de-la-Madeleine, Gaspé and North Shore regions is presented in the following sections. Since it is not yet possible to provide advice for each of the small beds scattered along the Québec coast, this review is organized according to management areas. A group of scientists examined the data during the regional review of invertebrate stock status in the Laurentian Region.

Îles-de-la-Madeleine (Area 20)

The Îles-de-la-Madeleine sector comprises several scallop concentrations, namely the fishing grounds of Étang-du-Nord, Dix-Milles, Chaîne-de-la-Passe, Sud-Ouest, Île Brion and Banc de l'Est (Figure 3). In 1998, 23 licences were active. The fishery was open from April 15 to August 25 on the Étang-du-Nord (except for a small protected area), Dix-Milles and Banc de l'Est beds.

Magdalen Island catches consist of over 95 % sea scallops, with the balance being Iceland scallops. Since 1990, landings have fluctuated between 29.9 and 73.9 t. In 1997 and 1998, landings stabilized at around 40 t of meat (Figure 4).

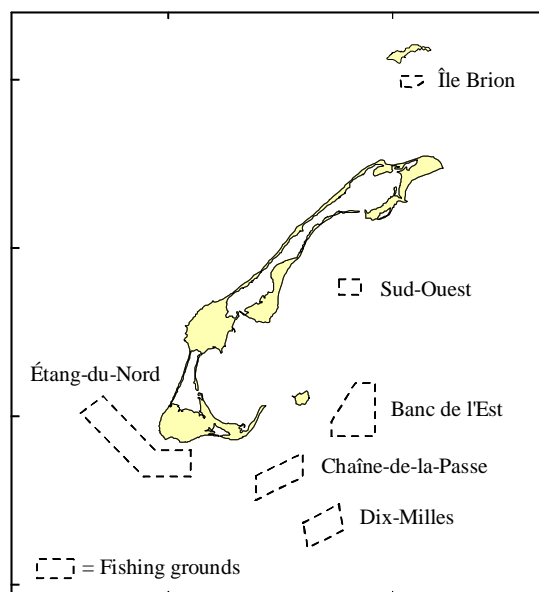


Figure 3. Principal scallop fishing grounds of the Îles-de-la-Madeleine.

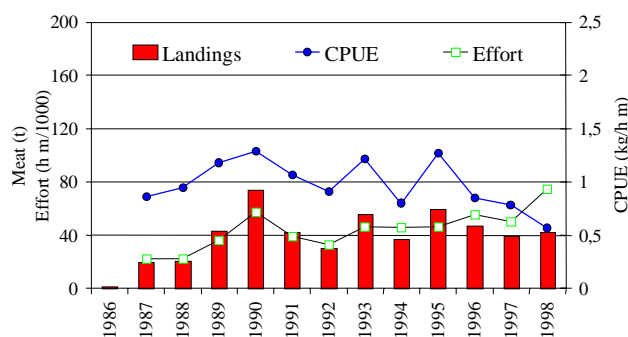


Figure 4. Scallop landings (t of meat), fishing effort (by fishing hour and metres of drag width) and catches per unit effort (kg of meat per effort unit).

The increase in catches per unit effort (CPUE) in 1993 was due to recruitment of the 1988 cohort, which was relatively abundant. This cohort was harvested intensively and exhausted within a few weeks. In 1994, catches per unit effort fell to an all-time low for the past ten years. However, the Chaîne-de-la-Passe bed, which contained the highest scallop densities, was closed to the fishery. Higher catches per unit effort and landings in 1995 were attributable to harvesting of the 1989 cohort in the western part of the

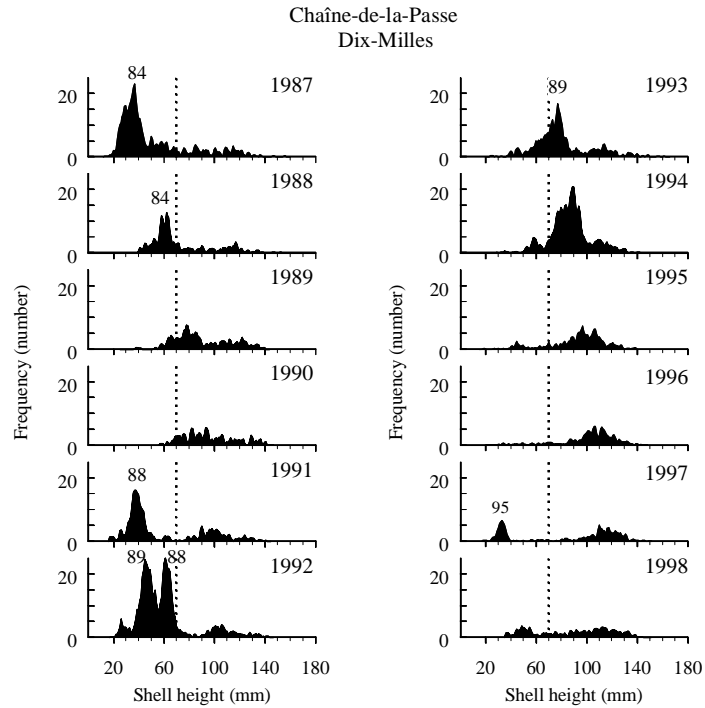


Figure 5. Size structure of *Îles-de-la-Madeleine* sea scallops sampled in research surveys. The numbers written over certain modes refer to the birth years of dominant cohorts. The dotted line divides prerecruits (<70 mm) from recruits (≥70 mm).

Chaîne-de-la-Passe ground. In 1996, Chaîne-de-la-Passe was closed, and catches per unit effort slumped. In 1997, even though the eastern part of Chaîne-de-la-Passe was fished, taking the rest of the 1989 cohort, and an old fishing ground (Banc de l'Est) was harvested for the first time in many years, catches per unit effort remained unchanged from 1996, ie 0.87 kg per hour/metres of drag (hm). In 1998, fishing was concentrated on Banc de l'Est, notwithstanding catches per unit effort on the order of 0.56 kg per hm.

The research survey provide a clear picture of the fluctuations of prerecruits, that is, scallops smaller than 70 mm, and of recruits (scallops ≥70 mm) (Figures 5 and 6). Prerecruits peaked in 1992, then gradually declined until 1996. In 1997, the prerecruitment index grew thanks to the 1995 cohort. However, this cohort is much smaller than those of 1984, 1988 and 1989. The abun-

dance index remained stable in 1998 because these beds were not fished. Recruit abundance indices follow a similar trend, but with a two-year lag, corresponding to the time needed for prerecruits to reach recruitment size.

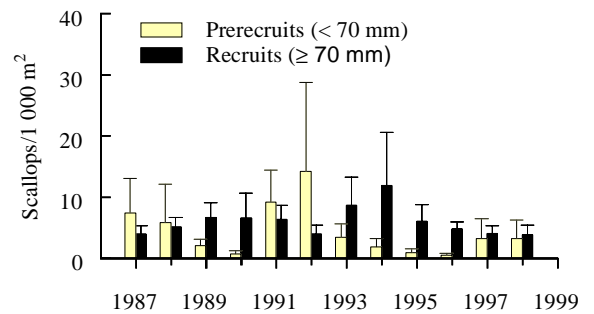


Figure 6. Density (± 2 standard errors) of sea scallops sampled in the *Îles-de-la-Madeleine* during research surveys.

An abundance index for two-year-old prerecruits can be calculated from research surveys. This index can be used to project

abundance of recruits to the fishery three years hence, ie at age five. This index has proved reliable so far and forecasts weak recruitment for 1999, but slightly better figures for 2000 (Figure 7).

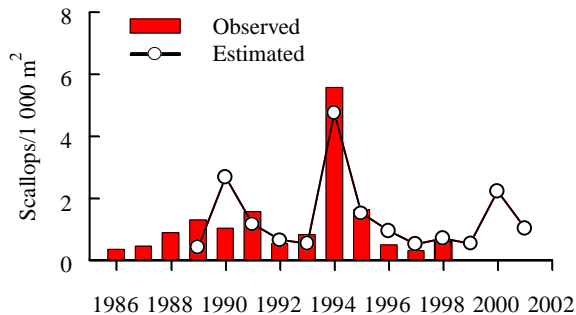


Figure 7. Density of 5-year-old recruits, values from current research surveys and values projected from numbers of 2-year-old prerecruits observed in research surveys 3 years earlier.

Prospects

Scallop abundance on the traditional Îles-de-la-Madeleine fishing grounds was very low in 1998. Our research surveys showed that the harvestable biomass was at its lowest since 1984, and it is estimated to be only one-tenth of what it was in the late 1960s. Recruitment was very low. The last large year classes to be recruited were those of 1988 and 1989. Since then, there has been no significant recruitment. Only one prerecruit cohort (that of 1995) is present in the population, but it is much less abundant than those of 1988 and 1989. This cohort will be recruited for fishing in the year 2000 or in 2001.

In 1998, fishing effort increased by over 30 %, even though almost all beds were closed to the fishery. Commercial catch rates have been falling since 1990. Intensive fishing of large breeders on Banc de l'Est probably accounts for the sharp drop in catch rates for spats seen in 1998, though scattering of larvae by unfavourable winds may also have been a factor. The fleet's

fishing effort is much too great for the productivity of the Îles-de-la-Madeleine scallop beds. In line with the management philosophy adopted on the Middle North Shore, fishing effort needs to be reduced to about one-fifth of what it is. Regardless of the many recommendations made to this effect, fishing effort has never been cut back.

There is serious concern for the conservation of the stock. The biomass is at record low levels, and without recruitment, breeding stocks will not rebuild any time soon. Any commercial fishing will entail further declines in the breeding biomass to levels never yet seen. **We therefore strongly recommend ceasing all scallop fishing in Area 20.**

Gaspé (Areas 17A, 18B and 19A)

The Gaspé comprises three management units: areas 17A, 18B (18C) and 19A. In 1998, there was only one licence in Area 17A, two in Area 18B and six in Area 19A. Area 18C was accessible for exploratory fishing. There was a fishing season in each of these areas, and in 18B an overall quota was imposed.

Gaspé landings come chiefly from Anticosti Island (Area 18B) and Chaleur Bay (19A) (Figure 8). The Chaleur Bay fishery targets mainly sea scallops, but around Anticosti Island and along the north shore of the Gaspé, the Iceland scallop is harvested.

On the north side of the Gaspé Peninsula (Area 17A), exploitation has been steady, but landings are low. For several years, the share of south-west Anticosti (Area 18B) has been rising. The area has only recently been exploited, and the fishery is still developing there. In 1998, landings in Area 17A fell by around 300 %. This drop is explained by the cumulative effects of declining effort, lower catches per unit effort (Ta-

ble 1) and the smaller average size of the scallops taken.

In Area 18B, landings and catches per unit effort have been rising since 1995 (Table 1). Size structure, prerecruitment index and mortality index (% of empty shells) have been stable since 1996.

Since 1994, with the exception of 1997, catches per unit effort in Area 19A have been stable, though low (Table 1). In 1998, fishing effort fell off significantly, which accounts for the lower landings (Figure 8).

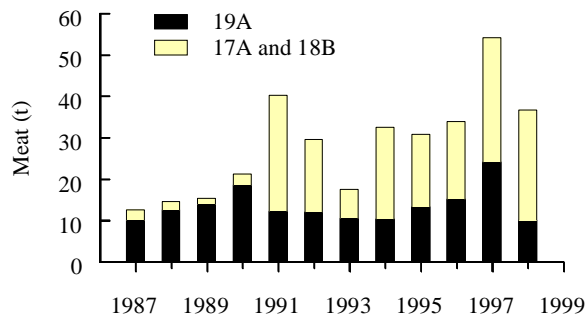


Figure 8. Gaspé scallop landings.

Table 1. Catches per unit effort (kg of meat per fishing hour and metre of drag width).

	17A	18B	19A
1991	1.07		0.88
1992	1.67	0.92	0.93
1993	1.51		0.96
1994	2.06	2.71	0.74
1995	1.57	0.98	0.73
1996	1.27	1.19	0.71
1997	1.03	1.32	1.00
1998	1.02	3.70	0.71

The occasional entry of new fishermen (licence transfers) accounts for the fluctuations in effort. The average size of sea scallops taken has been increasing since 1996, and prerecruitment seems to have been low for the past ten years (Figure 9).

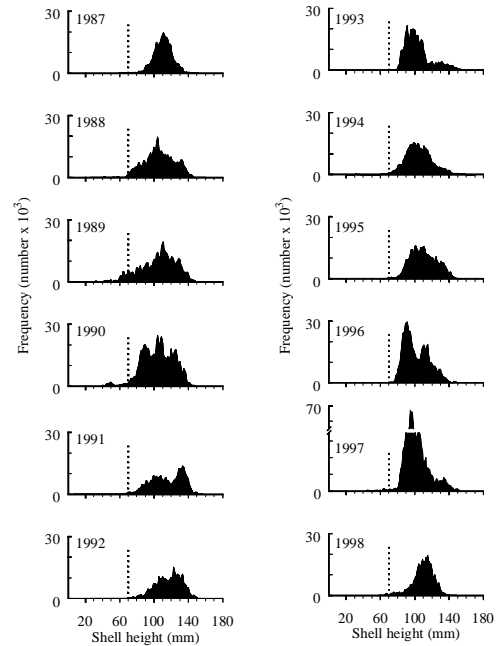


Figure 9. Size structure of sea scallops in Area 19A according to commercial sampling. The dotted line divides prerecruits (<70 mm) from recruits (≥70 mm).

Prospects

Recent fluctuations in Gaspé scallop landings are due to irregular harvesting of Iceland scallops south-west of Anticosti Island. Chaleur Bay landings are relatively constant, though low, such variation as there is being attributable to changes in fishing patterns.

The downward trend of abundance indices in Area 17A may reflect a degree of depletion of the resource. In the short term, it would be prudent to reduce fishing effort in the eastern part of 17A. In Area 18B (and 18C), landings and catches per unit effort have been growing for several years. In the short term, this gives no grounds for concern, as the fishing effort in this sector is low.

The lack of strong recruitment over the last ten years in Area 19A means that little improvement can be expected in the status of Chaleur Bay scallop stocks over the next few years. Fishing effort fell significantly in

1998, and this level is probably more consistent with the population's capacity for recovery.

North Shore

The North Shore is divided into 11 separate fishing areas between the mouth of the Saguenay and Blanc Sablon. North Shore landings in 1998 amounted to some 210 t of meat, of which nearly 80 % came from the Middle North Shore.

Areas 16A, 16B and 16C

Landings in these areas, which are broadly coterminous with the Upper North Shore, totalled some 20 t in 1998 and consisted solely of Iceland scallops (Figure 10). These areas are exploited by five fishermen, and fishing effort is low. Effort is controlled by the number of licences issued by the Department, and since 1997 there has been a competitive quota for Area 16C.

Landings and catches per unit effort have been on the increase in Area 16A since 1997 (Table 2) because of the discovery of a new bed and the opening of a market for scallop on the shell. There have been few, if any official landings in 16B since 1995.

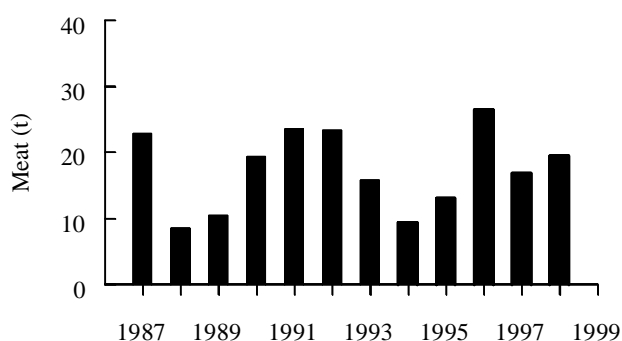


Figure 10. Scallop landings in areas 16A, 16B and 16C.

Table 2. Catches per unit effort (kg of meat per fishing hour and metre of drag width).

	16A	16B	16C
1991		4.16	2.78
1992	0.80	2.25	4.34
1993	0.76	1.82	2.94
1994	1.23	2.80	1.89
1995		1.38	7.60
1996		0.97	7.92
1997	3.11		5.28
1998	5.92	1.84	8.89

The rise in landings between 1995 and 1997 is due to the exploitation of new beds. Landings have stabilized since 1997 because an overall quota was imposed. The increase in yields relative to 1994 is partly explained by the emergence of a market for scallop on the shell. This speeds up fishing operations because the scallops no longer need to be shucked on board. Catches per unit effort have been relatively stable since 1995, and may even have risen in 1998. The size structure of commercial samples is characterized by scallops of a shell width of about 80 mm.

Prospects

The situation in areas 16A and 16B is hard to interpret because of the lack of available information. Tighter management of these areas may forestall excessive exploitation of the resource. Imposition of an overall quota in Area 16C since 1997 has helped stabilize catch rates and reduce the risk of overfishing. The decline in average size seen in 1998 catches is a call to vigilance. If this trend persists, it may signal local overfishing.

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

Seven fishermen have access to areas 16D and 16E, nine to areas 16F and 18A, and four to Area 16G. Quotas are set for each area, and fishing effort is subject to daily

and seasonal controls. Iceland scallop landings in the areas along the Middle North Shore have risen steeply since the early 1980s. This region is the most productive in Québec, but also the one with the strictest management measures.

Fishing effort has dropped considerably since 1990. This is due to the imposition of individual quotas in 1991, curtailed fishing seasons in all areas and subdivision of the fishing areas. Quota adjustment, either upward or downward, depending on the area, has also had an impact on effort.

Landings hit a historic peak of nearly 300 t of meat in 1990 (Figure 11). In 1991, landings dropped sharply, especially in Area 16E. From 1993 to 1995, landings in 16E, 16F and 16G were relatively stable. In 1998, landings in this sector reached nearly 150 t of meat, the largest contributions coming from areas 16E and 18A.

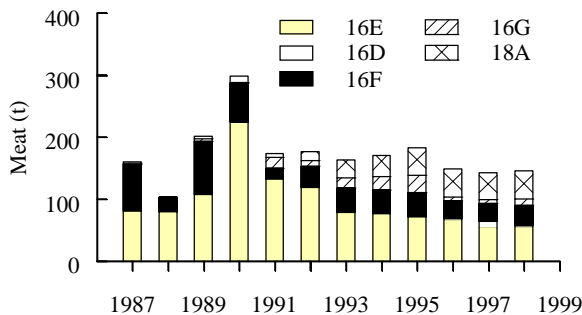


Figure 11. Scallop landings in areas 16D, 16E, 16F, 16G and 18A.

Since 1996, catches per unit effort in Area 16D have varied because of the limited effort applied there (Table 3). In Area 16E, catches per unit effort steadily fell from 1994 to 1997, then rose in 1998, though this upturn is questionable, since abundance indices from sampling at sea (Figure 12) and the 1998 research survey show different trends. Catches per unit effort in 16F are up slightly from 1997 because a new bed was

being exploited (Table 3). Higher catches per unit effort in 1998 in areas 16G and 18A are likewise due to exploitation of new beds. Except for Area 16D, where exploration has only just begun, catches per unit effort tail off from west to east because of local growth variations.

The mortality index (% of empty shells) measured in commercial samples reached high levels in 1995 and 1996 in several fishing areas along the Middle North Shore, but in 1997 and 1998 mortality rates dropped in most areas. The results of research into natural mortality in the Iceland scallop in Area 16E show that empty shells may remain on the seabed for more than one year, so that this index is not reliable for gauging the annual natural mortality rate in Iceland scallops.

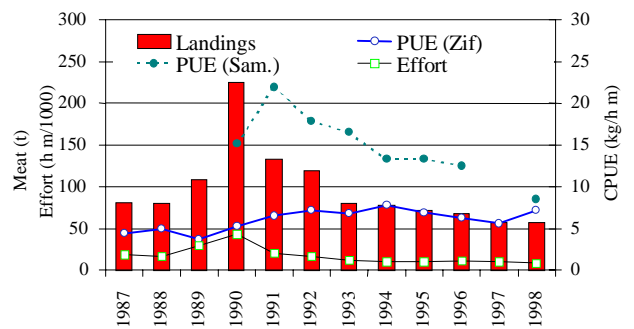


Figure 12. Scallop landings (t of meat), effort (fishing hour per metre of drag width) and catches per unit effort (kg of meat per effort) calculated from logs (Zif) and from commercial sampling (Ech).

Table 3. Catches per unit effort (kg of meat per fishing hour and metre of drag width) estimated from log entries.

	16D	16E	16F	16G	18A
1991		6.51	5.16	3.45	7.00
1992		7.15	6.31	4.16	5.35
1993		6.83	5.76	3.16	4.90
1994		7.84	5.31	3.01	4.74
1995		6.87	4.31	2.63	5.49
1996	1.46	6.26	4.25	1.92	6.54
1997	2.66	5.63	4.90	1.58	4.31
1998	0.87	7.12	5.23	2.63	4.73

In 1998, the size of scallops in commercial samples in Area 16E was relatively stable. The small size variations in the scallops taken in areas 16F, 16G and 18A since 1997 is due to the movement of the fleet to other beds. This variation in growth and size structure is greater from one area to another and shows up as a decline in average size from west (16D) to east (16G) and from north (16D) to south (18).

Prospects

At present, it is impossible to specify the status of the fishery in each management area with any precision, especially as areas 16D and 16G have as yet hardly been explored. The reduction in fishing effort since individual quotas were imposed in 1991 and the creation of a larger number of fishing areas have helped spread exploitation over a larger territory.

The stable size structure of Iceland scallop in Area 16E in 1998 reflects this population's ability to withstand the exploitation rates of recent years. However, uncertainty surrounding abundance indices precludes accurate assessments of the status of the resource. The main indicators in Area 16F were positive in 1998, but given the small number of beds available in this area, it would be wise to stabilize harvesting levels in the short term. The average size of Iceland scallop in Area 16G is small, which accounts for the lack of interest and consequent decline in fishing effort seen in recent years, even though scallop densities are very high on these beds. The main scallop indices in Area 18A showed little change in 1998 from 1997. Current harvesting levels do not appear to be adversely affecting the resource.

Areas 16H, 16I and 15

In 1998, there were 3 licences in Area 16H and 34 granting access to areas 16I and 15. Prior to 1992, landings on the Lower North

Shore consisted mainly of sea scallops (Figure 13), but since then landings of Iceland scallop from areas 16H, 16I and the western and eastern ends of 15 have assumed a larger share.

Fluctuating catch rates in areas 16H and 16I do not account for the steep drop in landings since 1993 (Table 4). Smaller landings in these areas owe more to fading interest in the scallop fishery among some fishermen because of the small size of the scallops. Landings in Area 15 have almost tripled since 1995, reaching some 34 t in 1998. This boost in landings, about 70 %, is because the Iceland scallop fishery in the eastern part of Area 15 is just developing.

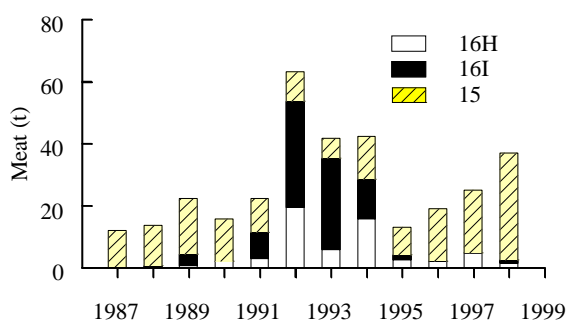


Figure 13. Scallop landings in areas 16H, 16I and 15.

Table 4. Catches per unit effort (kg of meat per fishing hour and metre of drag width).

	16H	16I	15
1991	5.64	4.51	0.67
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	2.05

Prospects

Iceland scallop landings and fishing effort in areas 16H and 16I have been negligible

since 1995. For the time being, conservation of this resource is not an issue. In 1998, higher landings in Area 15 came from the eastern sector, around Blanc Sablon, where the fishery seems to have some potential. The fishing potential of the western part of the area, however, is limited.

The state of our knowledge of the sea scallop of the Lower North Shore precludes any assessment of the status of this resource. The biological characteristics of the species, its contagious distribution and the massive die-offs seen at some fishing locations in the past make it highly vulnerable to overfishing. For the time being, it would be inappropriate to step up the fishing effort directed at sea scallops in Area 15 in view of the mortality problems encountered on the Lower North Shore.

Conservation measures

The scallop conservation measures recommended are intended to preserve the capacity of each bed to renew itself so that it will survive. Any approach geared to boosting breeding potential, whether by leaving more adult specimens on the bottom or by creating closed areas, will have a positive impact on conservation of the resource. Moreover, because scallop egg production is proportionate to the size of the specimen, allowing the population to age would result in a distinct gain in productivity, and this tactic would have the secondary effect of increasing the yield per recruit, and hence improving commercial viability.

Scallops spawn in late summer, and the juveniles settle to the bottom in the fall. Dragging the beds with fishing gear at this time reduces breeding potential and stirs up sediments, which disrupts the settlement of the juveniles. A halt in fishing during the breeding and settling seasons (August through November) would limit damage to

the substrate caused by dragging and would favour survival of young scallops.

For more information:

Giguère, M., S. Brulotte and P. Goudreau. 1998. *État des stocks de pétoncle des eaux côtières du Québec* (Status of scallop stocks in Québec inshore waters). Canadian Stock Assessment Secretariat, Research Paper 98/73.

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