



## Lobster of the Inshore Waters of Quebec in 2003

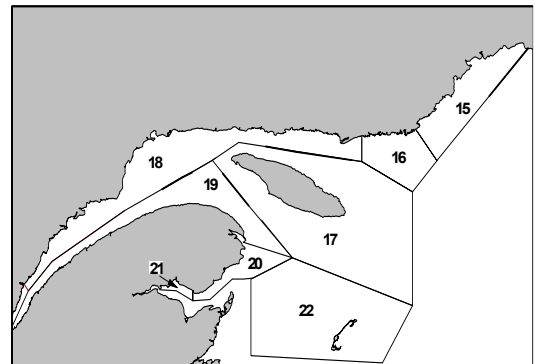


Figure 1. Quebec lobster fishing areas (LFAs).

### Background

A program to increase minimum catch size by 1 mm to 2 mm per year was introduced in 1997 in all lobster fishing areas (LFAs) in Quebec. The purpose of the program is to double (100% increase) the egg-per-recruit production relative to the 1996 levels. In 2003, the minimum legal size was 83 mm (carapace length) in LFAs 17 (Anticosti Island), 18 (North Shore) and 22 (Magdalen Islands), and 81 mm in LFAs 15 and 16 (Lower North Shore) and LFAs 19, 20 and 21 (Gaspé Peninsula); the minimum legal size was 76 mm between 1957 and 1996. To date, these size increases appear to have led to a 90% to 100% rise in egg-per-recruit production, depending on the region. The expected benefits of increasing the legal size have been increasingly evident in recent years. Marked changes in the size composition of stocks and the number of berried females have occurred in a number of fishing areas. Although the overall exploitation rate for the stock has dropped with the increase in minimum catch size, the exploitation rate for commercial-size lobster continues to be very high, causing the fishery to be highly dependent on annual recruitment. A substantial reduction in fishing effort should be considered to widen the size structure of stocks and increase larger females' contribution to egg production, which would be desirable given the potential benefits related to the quality of their eggs and larvae.

### Summary

- Quebec lobster landings totalled 3,135 t in 2003, an increase of 5% from 2002 levels. Landings in 2003 were 5% below the average for the 1990s but 14% higher than the average of the last 25 years. In 2003, 66.6% of landings came from the Magdalen Islands, 28.5% from the Gaspé Peninsula, 3.6% from Anticosti Island and 1.3% from the North Shore.
- In 2003, landings totalled 2,087 t in the Magdalen Islands (LFA 22), compared with 2,024 t in 2002. Landings in the Gaspé Peninsula (LFAs 19, 20 and 21) totalled 894 t, up by 14% from 2002. Landings on the North Shore (LFAs 15, 16 and 18) were 40 t in 2003, compared to 30 t in 2002. Anticosti Island landings (LFA 17) were down in 2003 (114 t) compared to 2002 (135 t).
- In 2003, catch rates in numbers were similar to those of 2002 in the Magdalen Islands and the Gaspé. They were however higher in weight, because of the larger size of lobsters in the catch. Since 1996, the year before the minimum catch size was increased, the mean size of lobsters landed has increased by 5-6 mm, while their mean weight has increased by 20% to 25%.

- Exploitation rates (measured on the fraction of the stock that is harvestable) remain high in the Magdalen Islands (approximately 75%), the Gaspé (approximately 85%) and possibly the North Shore. Exploitation rate in Anticosti Island is lower (approximately 20%).
- To date, egg production per recruit has increased by 100% in the Magdalen Islands (goal reached) and by 90% in the Gaspé from 1996 levels. Since the increase in minimum catch size, the abundance of berried females has visibly increased in many LFAs.
- Recruitment indices in the Magdalen Islands suggest that landings in 2004 could be comparable to those in 2003.

### **Biology**

American Lobster (*Homarus americanus*) occurs along the west coast of the Atlantic Ocean, from Labrador to Cape Hatteras. Adult lobster prefers rocky substrates where they can take shelter, but can also live on sandy and even muddy bottoms. Commercial-size lobsters are generally found at depths of less than 35 m.

Females reach sexual maturity at approximately 79 mm (carapace length) in the southern Magdalen Islands, at 82-84 mm in the northern Magdalen Islands and around the Gaspé Peninsula, and over 90 mm on the North Shore and around Anticosti Island. Males reach maturity at a smaller size. Females generally have a two-year reproductive cycle, spawning one year and moulting the next. Females spawning for the first time can produce nearly 8,000 eggs, while large females measuring 127 mm (jumbo size) can lay up to 35,000 eggs. Once released, the eggs remain attached to the females' swimmerets for 9 to 12 months, until the planktonic larvae emerge the following summer. The larvae's planktonic phase lasts from 3 to 10 weeks, depending on the temperature of the water. Following metamorphosis, postlarval

lobsters (stage IV), which now resemble adult lobsters, drift down from the surface layer to settle on the sea floor. During the first few years of benthic life or until they reach approximately 40 mm, lobsters lead a cryptic existence, which means that they live hidden in structurally varied habitat providing many shelters. Lobsters are estimated to reach minimum catch size around 8 years of age, after having moulted approximately 15 times since their benthic settlement.

### **Fishery management**

The lobster fishery is managed by controlling fishing effort. The number of licences issued and the number of traps authorized per licence are limited. In 2003, there were 607 active licences in Quebec's three maritime sectors: the Magdalen Islands (325), the Gaspé Peninsula (219) and the North Shore and Anticosti Island (63). There are 8 main lobster fishing areas (LFAs 15 to 22) (Figure 1) and 41 subareas. The trap limit per licence is 250 in most LFAs, except for the Magdalen Islands and Anticosti Island, where it is 300. The use of large-size traps is limited to 175 and 210 traps, in areas where the number of standard traps authorized is 250 and 300, respectively. The use of large traps has been prohibited in the Magdalen Islands since 1997. Escape vents on traps have been mandatory since 1994. In 2002, the size of the vertical opening of the escape vents was increased from 43 mm to 46 mm in the Gaspé and from 43 mm to 47 mm in the Magdalen Islands in 2003.

The lobster fishery takes place in spring and lasts 9 to 12 weeks, depending on the LFA. The fishery is regulated by a minimum catch size and the release of berried females. Between 1957 and 1996, the minimum catch size for Quebec was 76 mm. Since 1997, the minimum catch size has been increased. In 2003, the minimum catch size was 83 mm around Anticosti Island (LFA 17), on the Upper and Middle North

Shore (LFA 18) and in the Magdalen Islands (LFA 22). It was 81 mm on the Lower North Shore (LFAs 15 and 16) and in the Gaspé (LFAs 19, 20 and 21). V-notching of berried females is done on a voluntary basis in some sectors of the Gaspé Peninsula.

### ***Conservation approach***

The conservation approach for all lobster stocks in Atlantic Canada is based on recommendations made by the Fisheries Resource Conservation Council (FRCC) (1995) and a national working group assigned to examine the issue of lobster conservation, which produced a report in 2001. The overall conservation objective is to keep stocks at an optimum level for a whole range of possible environmental conditions by maintaining a sufficient spawning biomass that is conducive to a strong, steady production of juveniles. Current conservation discussions centre on the concept of egg-per-recruit production, which is a measure of a stock's reproductive potential. The conservation goal established in 1997 is to double the egg-per-recruit production relative to 1996 levels. Since 1997, minimum catch size has been increased in all Quebec LFAs to reach this goal. Doubling egg-per-recruit production is however only a first step to improve lobster stock conservation. The reduction of fishing pressure, the improvement of the size structure of stocks and the increase of the contribution of multiparous females (females that have already spawned) to egg production are other conservation objectives to be taken into consideration in the coming years.

### ***Stock status in 2003***

Stock status assessment is based primarily on analyses of data from three sources: landings (reported catches plus an estimation of unreported catches), sampling done on board fishing vessels at sea, and catch and fishing effort data from index

fishers' logbooks. A trawl survey conducted off the Magdalen Islands provides additional information on this stock.

Quebec lobster landings totalled 3,135 t in 2002, an increase of 5% from 2002 levels (2,976 t) (reported catches only). Landings in 2003 were 5% below the average for the 1990s but 14% higher than the average of the last 25 years. In 2003, 66.6% of landings came from the Magdalen Islands (LFA 22), 28.5% from the Gaspé Peninsula (LFAs 19, 20 and 21), 3.6% from Anticosti Island (LFA 17) and 1.3% from the North Shore (LFAs 15, 16 and 18).

### ***Magdalen Islands – LFA 22***

#### ***Minimum catch size***

For the seventh year in a row, the minimum catch size for lobster taken in LFA 22 was increased by 1 mm, reaching 83 mm in 2003.

#### ***Landings***

Lobster landings in the Magdalen Islands totalled 2,087 t in 2003, compared with 2,024 t in 2002 (reported landings only). They were 12.5% higher than the average of the last 25 years, but 7.3% below the average for the 1990s. In 2003, 70% of lobster landings came from the southern Magdalen Islands (Old Harry to Havre Aubert), while 30% came from the northern Magdalen Islands (Grosse Île to Millerand). Compared to 2002, landings have increased by 1% and 8% in the southern and northern parts of the Magdalen Islands, respectively. The beginning of the 2003 fishing season was colder than usual in the southern part and caused a delay in the capture. In 2003, only 40% of total annual landings were recorded after the first three weeks of the season, compared to 50% normally, or 60% when spring is warmer than usual, as in 1998.

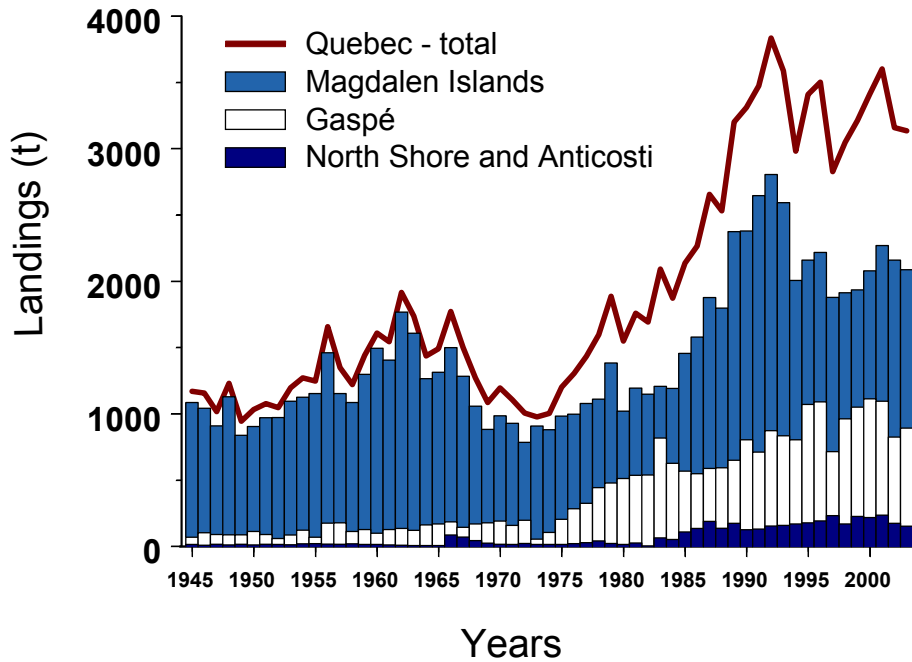


Figure 2. Quebec lobster landings (t), 1945–2003.

Table 1. Quebec lobster landings (t) by fishing area, 1984–2003.

	North Shore - Anticosti				Gaspé Peninsula		Magdalen Island		Total
	15	16	17	18	19	20	21	22	
1984	29	8	10	-	15	573	40	1193	1873
1985	30	14	38	-	26	510	33	1458	2137
1986	51	5	51	-	9	513	28	1581	2268
1987	34	5	117	-	9	553	27	1878	2657
1988	42	6	68	-	21	530	44	1798	2531
1989	32	19	91	-	21	592	38	2375	3201
1990	31	20	51	-	26	709	70	2380	3312
1991	29	11	75	-	22	626	64	2646	3474
1992	37	16	98	5	18	797	58	2806	3835
1993	26	14	108	12	25	751	59	2593	3588
1994	8	10	143	8	25	730	51	2007	2982
1995	12	12	137	17	40	985	46	2160	3410
1996	14	18	155	6	36	1016	39	2219	3503
1997	19	12	184	19	23	648	37	1879	2827
1998	18	15	130	7	32	889	42	1914	3049
1999	19	22	178	8	40	981	30	1936	3214
2000	38	11	148	21	36	1053	26	2080	3413
2001	26	17	139	3	30	911	18	2270	3603
2002 <sup>1</sup>	19	9	135	2	28	741	18	2024	2976
2003 <sup>1*</sup>	30	8	114	2	29	844	21	2087	3135

<sup>1</sup>: reported landings only    \*: preliminary data

**Catch rates**

Catch rates represent the catch per unit effort (CPUE) for commercial-size lobster, expressed as the number of lobsters per trap or the weight (kg) per trap (Figure 3). Between 1985 and 2002, the average annual CPUE for commercial-size lobster for the Magdalen Islands as a whole has ranged from 0.5 lobsters to 1.1 lobsters per trap, for an average of 0.77 lobsters per trap. In 2003, the average CPUE was 0.68 lobsters per trap, which is similar to that of 2002. The 2003 CPUE is 12% below the series average. However, when expressed as a weight, the average CPUE for 2003 (0.42 kg/trap) is 7% above the series average (0.39 kg/trap). Since 1997, despite the decrease in the number of lobsters caught, yields in weight can be maintained because the lobsters taken are now bigger. The trend described for the Magdalen Islands as a whole reflects the

situation in the southern archipelago. In the northern Magdalen Islands the increase in yields in 2003 was more important. Because of unusual cold water in the southern part, catch rates at the beginning of the fishing season were much lower (1.1 lobsters/trap) compared to the recent years (average of 1.55 lobsters/trap for 1997-2002). The CPUEs obtained from index fishers' data generally show the same trends.

**Catch composition and exploitation rates**

Following the increase in minimum legal size, changes in size structure have been noted (Figure 4). The mean size of lobsters caught increased by approximately 6 mm from 1996 to 2003, and mean weight was up by about 25%. Landings in 2003 consisted exclusively of "market" lobsters ( $\geq 83$  mm), compared with 54% and 65% in 1996 in the southern and northern

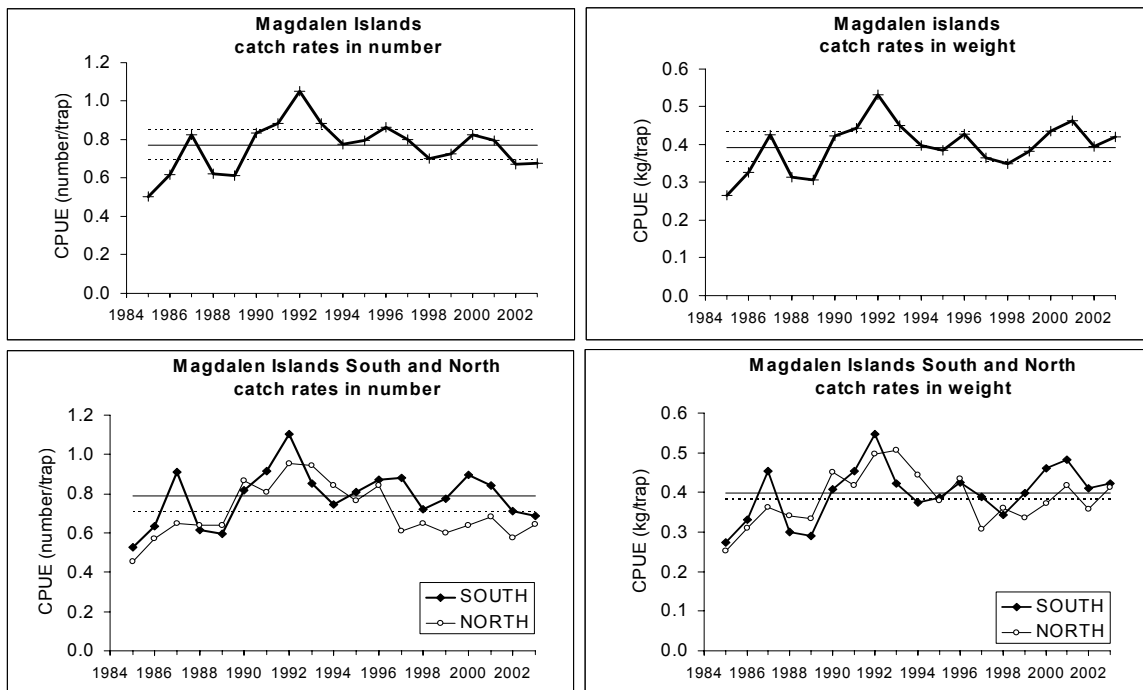


Figure 3. Catch rates (CPUE) in number and weight of commercial-sized lobsters per trap. Top: Annual averages, 1985–2003, for the Magdalen Islands as a whole. The solid line represents the average for 1985–2002 and the dotted lines represent the 10% interval around the average. Bottom: Annual averages for the southern and northern Magdalen Islands. The solid line represents the average for 1985–2002 for the southern Magdalen Islands and the dotted line represents the series average for the northern Magdalen Islands.

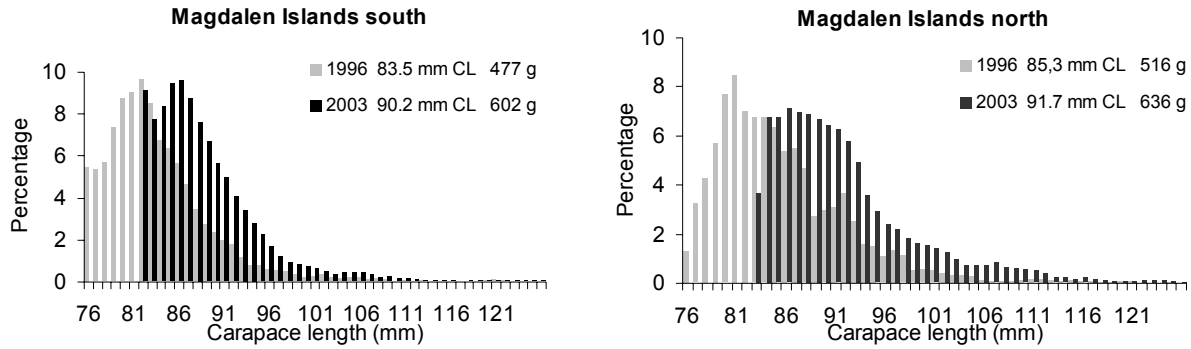


Figure 4. Size frequency distribution for lobster (commercial fraction) caught in the southern and northern Magdalen Islands in 2003 and 1996. Mean carapace length (CL) and mean weight of lobster caught are indicated.

Magdalen Islands, respectively. These changes are significant and represent the kind of results expected in a recruitment fishery when the minimum catch size is increased.

Size structures remain however as highly truncated, which is an indication of high exploitation rates. Exploitation rates calculated for male lobsters of commercial size remain high in the southern and northern Magdalen Islands and have increased since 1985 (Figure 5). They reached 76% and 73%, respectively, in 2002, compared with the 1985–2001 averages of 66% and 56%. These exploitation rates are obtained by measuring the change in abundance between the first moult-group recruited to the fishery and the second moult-group one year later. The exploitation rate of males  $\geq 76$  mm has however decreased since the increase in minimum legal size. It now reaches approximately 45% compared to 75% for the harvestable fraction of the population. In this case, calculation of the exploitation rate is done using a method based on changes in the proportions of recruit and prerecruit lobsters over the fishing season. The mortality of females is however lower because of their protection when berried.

The proportion of jumbo lobster ( $\geq 127$  mm CL) remains very low ( $< 2\%$ ), due to the high exploitation rate that prevents lobsters from reaching large sizes.

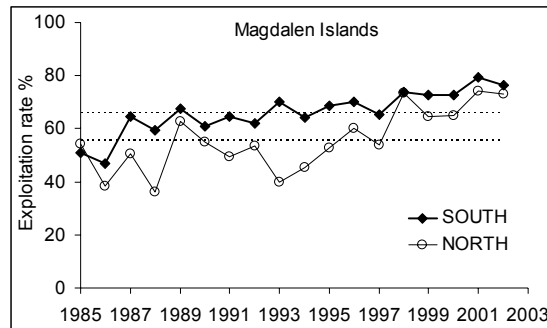


Figure 5. Exploitation rate indices for commercial-size males in the southern and northern Magdalen Islands, 1985–2002. The dotted lines indicate the mean data for 1985–2001 for the south (upper line) and north (lower line).

### Egg production

The results of a simulation model show that with the 7 mm increase in minimum catch size, egg-per-recruit production appears to have increased by 100% in the southern part of the Magdalen islands and by 92% in the northern part, from 1996 levels. The objective of doubling 1996 EPR levels is considered to have been reached. These theoretical results assume that the other major factors in the dynamics of lobster stocks such as growth, natural and fishing mortality, fecundity and sexual maturation, have remained unchanged since 1996. The at-sea sampling data and trawl data showed a two-fold increase in the abundance of berried females from 1996 to 2002.

However, in 2003, their abundance has decreased in the at-sea samples probably because of the increase in the size of escape vents, and in the trawl survey, possibly because of a problem of catchability. However, examination of the size frequency distributions of berried females and their abundance suggest nevertheless an increase in egg production in line with expectations. The increase in minimum catch size has favoured the increase of primiparous females, and also probably of multiparous females.

### **Recruitment**

The abundance of commercial-size lobster ( $\geq 83$  mm) determined from trawl survey data was slightly lower in 2003 compared to 2002. However, the level of abundance remains high suggesting that current landing levels could be maintained in 2004, assuming good catchability. However, prerecruit and juvenile abundance indices were down in 2003, suggesting a possible drop in fishing recruitment around 2006. Benthic settlement in baie de Plaisance (southern part of the Islands) was however high in 1999, 2002 and 2003. The progression of cohorts from settlement to commercial size is presently under study.

### **Summary**

The increase in the minimum catch size contributed to an increase in egg production and contributed also to correct a problem of growth overfishing. With the increase in minimum catch size, the exploitation rate of the fraction of the population of males  $\geq 76$  mm dropped to approximately 45%. However, exploitation rates of the harvestable portion of the population remains very high and are probably increasing. This makes the fishery heavily dependent on annual recruitment. Measures to reduce fishing effort and prevent its increase should be taken because high exploitation rates will offset the expected benefits of increasing the minimum catch size on egg-per-recruit production.

Moreover, measures to increase the number of multiparous females and to assure their reproductive success by protecting also males of similar sizes should be implemented (size window, maximum size, v-notching of berried females and males).

## **Gaspé Peninsula – LFAs 19, 20 and 21**

### **Minimum catch size**

In 2003, the minimum catch size around the Gaspé Peninsula remained unchanged from 2002 and was set at 81 mm.

### **Landings**

In 2003, lobster landings in the Gaspé reached 894 t, an increase of 14% from 2002 (reported catches only) (Table 1; Figure 6). Landings were similar to the average recorded in the 1990s (890 t) and 19% above the average of the last 25 years. This general pattern reflects the situation LFA 20. In the Gaspé in 2003, 94.4% of total landings were from LFA 20, 3.2% from LFA 19 and 2.4% were from LFA 21. Landings in LFA 19 totalled 29 t in 2003, which is similar to 2002, but slightly below levels that have been observed between 1995 and 2001 (30–40 t), with the exception of 1997, which was disastrous due to poor weather conditions. Landings in LFA 21A (Bonaventure to New Richmond) totalled 19 t in 2003, compared with 16 t in 2001. They have been stable for the past five years, but at levels lower than in the 1990s. Landings recorded in LFA 21B (New Richmond to Miguasha) in the spring of 2003 totalled 6 t. This is similar to 2002 but represents a decrease of 22% from landings reported in the spring of 2001. Fishing effort was lower in 2003, which can explain part of the decrease. However, the spring fishery of the last two years may also have been affected by the preceding fall fisheries (2001-2002), for each of which landings of 7 t were reported. Legal-size lobsters are

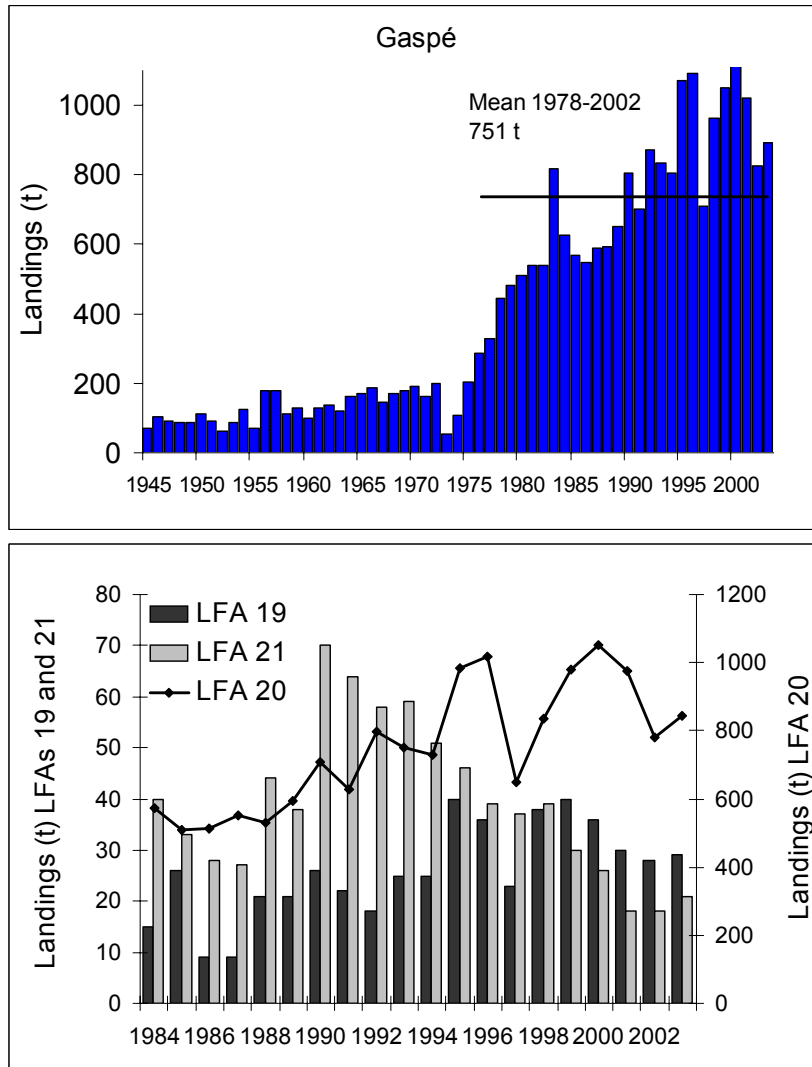


Figure 6. Gaspé lobsters landings (t) since 1945 and in LFAs 19, 20 and 21 from 1984 to 2003.

recruited to the fishery every year in summer, after the moulting period. The fall fishery therefore intercepts annual recruitment, causing the spring fishery to be heavily dependent on fishing intensity during the previous fall. The spring fishery could even be seriously compromised if fishing is too intense in the fall.

**Catch rates**

Catch rates correspond to the catch per unit effort (CPUE) for commercial-size lobster, expressed as the number of lobsters per

trap or the weight (g) per trap. Since 1986, the average annual CPUE of commercial-size lobster in LFA 20 has ranged from 0.41 to 0.85 lobsters per trap (Figure 7). In 2003, the CPUE was 0.47 lobsters/trap, which is equivalent to that of 2002. It was 16% below the average (in number) for 1986–2002 (0.56 lobsters per trap) but 5% above the weight average. Larger lobsters partly offset the decrease in the number of lobsters caught. The CPUEs of index fishers generally indicate the same trends.

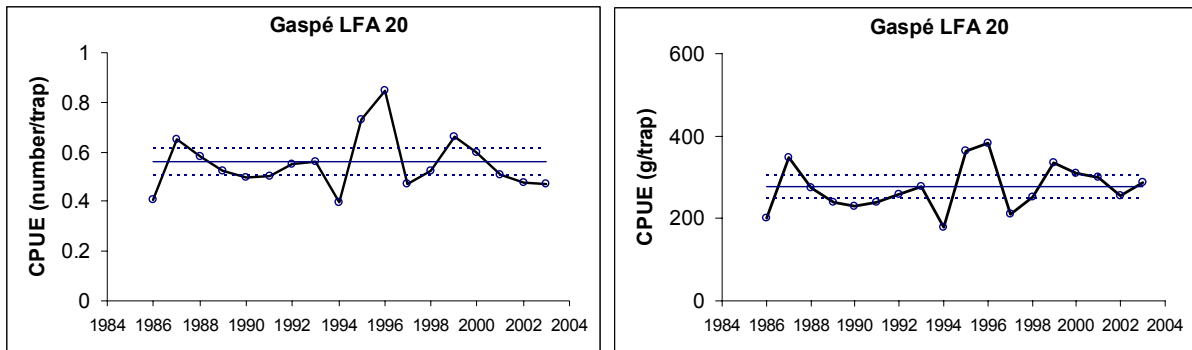


Figure 7. Catch rates (CPUEs) in number and weight of commercial-size lobsters per trap. Annual averages, 1986–2003 for the Gaspé (LFA 20). The solid line represents the average for 1986–2002, while the dotted lines represent the 10% interval around the average.

Between 1999 and 2002, significant drops in yields have been noted in the sector of St Godefroi/Shigawake (20B6) and in La Malbaie (20A2) that could indicate a recent drop in recruitment. A small increase in CPUE has been observed in these sectors in 2003. In the Ste-Thérèse/Grande-Rivière sector, CPUEs have remained relatively high although a slight decrease in CPUE (number) is observed since 1999.

CPUEs in LFA 19 were among the highest in the Gaspé in 2003 (around 0.6 lobsters/trap and 0.5 kg/trap). CPUEs in LFA 21B were higher in 2003 (0.42 lobsters/trap) compared to 2002 (0.36 lobsters/trap) namely because of a lower number of fishers in the area. CPUEs recorded during the fall fishery were on average seven times higher than those in the spring. Lobster catchability is higher in the fall than in the spring because lobsters are in a postmoult phase. After moult, lobsters are looking for food and are more easily attracted to bait in traps.

### Catch composition and exploitation rates

Following the increases in minimum legal size, changes have been noted in size structure (Figure 8). The mean size of lobsters landed in LFA 20 as a whole increased by 5 mm in 2003 compared with 1996, while mean weight rose by about 20%. Landings in 2003 consisted of larger

lobsters and the proportion of “market” lobsters ( $\geq 83$  mm) was 82% in 2003, compared with an average of 49% for 1993–1996. These changes are significant and represent the kind of results expected in a recruitment fishery when minimum catch size is increased.

Size structures remain however as highly truncated which is an indication of high exploitation rates. Exploitation rate calculated for commercial-size males in LFA 20 remains high and is above 75% (Figure 9). This exploitation rate is obtained by measuring the change in abundance between the first moult-group recruited to the fishery and the second-moult group one year later.

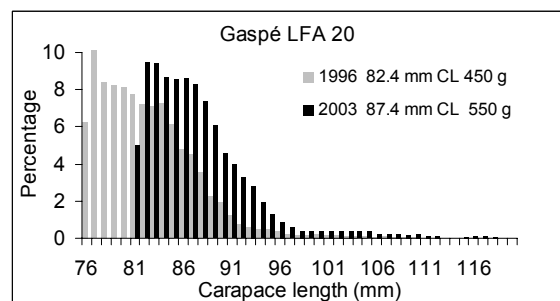


Figure 8. Size frequency distribution for lobster caught in the Gaspé in 2003 and 1996 (LFA 20). Mean carapace length (CL) and mean weight are indicated.

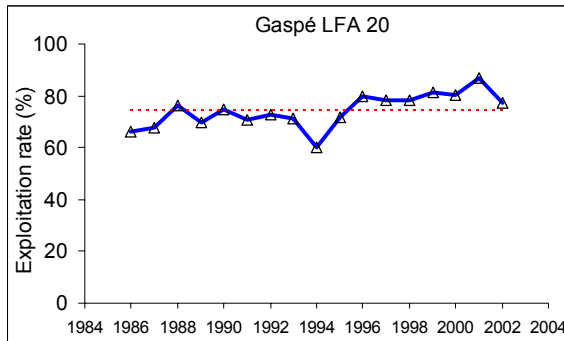


Figure 9. Exploitation rate index for commercial-size male lobsters in the Gaspé, 1985–2002. The dotted line represents the average for 1986–2001.

The exploitation rate of males  $\geq 76$  mm has however decreased since the increase in minimum legal size. It now reaches approximately 45% compared to 75% for the harvestable fraction of the population. In this case, calculation of the exploitation rate is done using a method based on changes in the proportions of recruit and prerecruit lobsters over the fishing season. The mortality of females is however lower because of their protection when berried.

The proportion of large lobsters remains low and jumbo lobster ( $\geq 127$  mm CL) were found only in La Malbaie (20A2), and accounted for only 0.3% of the catch. Jumbo lobsters are found more frequently in LFAs 19 and 21A.

### Egg production

The results of a simulation model show that with the 5 mm increase in minimum catch size, egg-per-recruit production appears to have increased by approximately 90% from 1996 levels. According to the model, the objective of doubling will be reached with a minimum legal size of 82 mm. These theoretical results assume that the other major factors in the dynamics of lobster stocks such as growth, natural and fishing mortality, fecundity and sexual maturation, have remained unchanged since 1996. The at-sea sampling data shows that the

abundance of berried females has increased between 1997 and 2001. The abundance in traps however declined in 2002 and 2003, possibly because of the increase in the size of the escape vents. Examination of the size frequency distributions of berried females and their abundance suggest nevertheless an increase in egg production in line with expectations.

### Recruitment

It is difficult to predict landing levels for the coming year in the Gaspé. The abundance of prerecruits in traps with closed escape vents can also reflect changes in catchability. Nevertheless, the level of prerecruits observed in 2003 was high, suggesting a good potential for the fishery in 2004.

### Lobster movements

The results of a tagging program held in the areas of Miguasha, Carleton, Rivière-Caplan, Bonaventure, Ste-Thérèse and Malbaie showed that from summer to the next spring, lobster movements are generally limited and occur inside a distance of about 10 km. A greater dispersion (20 km) was however seen in the sector of St-Godefroi, towards the east. The short delay between tagging and recapture does not allow the determination of dispersion patterns over a larger scale, which could have helped understand the origin of the large lobsters found in the upper Baie-des-Chaleurs area (LFAs 21A, 21B).

### Summary

The increase in the minimum catch size contributed to an increase in egg production and contributed also to correct a problem of growth overfishing. With the increase in minimum catch size, the exploitation rate of the fraction of the population of males  $\geq 76$  mm dropped to approximately 45%. However, exploitation rates of the harvestable portion of the population

remains very high and are probably increasing. This makes the fishery heavily dependent on annual recruitment. Measures to reduce fishing effort and prevent its increase should be taken because high exploitation rates will offset the expected benefits of increasing the minimum catch size on egg-per-recruit production. Moreover, measures to increase the number of multiparous females and to assure their reproductive success by protecting also males of similar sizes should be implemented (size window, maximum size, v-notching of berried females and males).

A fall fishery, such as the one in LFA 21B, operating with a nominal effort equal to that in the spring, could result in higher mortality because the fall catchability is about 7 times higher than the spring catchability. The total annual fishing effort that could be authorized in LFA 21B should be based on a calibrating factor for traps used in the fall that would take catchability into account. Fishing effort should be limited so that it does not exceed historic levels in this area. The landings in the spring season could be negatively impacted by the preceding fall fishery which intercepts the annual recruitment.

### **North Shore – LFAs 15, 16, and 18**

#### **Minimum catch size**

On the North Shore, in LFAs 15 and 16, the minimum catch size was raised from 76 mm to 78 mm in 1998. It was then increased to 79 mm in 2000, to 80 mm in 2001 and to 81 mm in 2003. In LFA 18, in 2003, the minimum catch size was 83 mm.

#### **Landings**

Depending on the year, lobster landings from the North Shore account for 1% to 2% of total lobster landings in Quebec. Landings recorded in LFA 15 in 2003

totalled 30 t, which is higher than in 2002 (19 t). It is equivalent to the 1984-1993 average (35 t). Landings in 2003 were higher than those observed between 1994 and 1998 (14 t).

The 2003 fishing season took place in warmer water conditions than in 2002, which can explain the higher yields recorded in 2003. Cold water has a negative effect on catchability.

In LFA 16, landings totalled 8 t which is lower than the 1984-2002 average (13 t). From 1989 to 2001, landings in LFA 16 have fluctuated between 10 t and 20 t, without following any particular trend. In 2002 and 2003, landings were below 10 t, and down by more than 50% from 2001 levels.

Landings are very low in LFA 18, and the marked fluctuations are mainly caused by changes in the number of active fishers from year to year, and estimated unreported catches landed in this area. These estimates probably include quantities fished elsewhere than in LFA 18.

#### **Catch rates**

Catch rates represent the catch per unit effort (CPUE) for commercial-size lobster, expressed as the number of lobsters per trap or the weight (kg) per trap. Between 1993 and 2003, the average annual CPUE observed during at-sea sampling ranged from 0.2 to 0.4 lobsters per trap. The lowest value was recorded in 2002. Mean CPUE recorded in 2003 (0.3 lobsters/trap) was higher than in 2002 but slightly below the series average. The average CPUE of index fishers show the same trends.

#### **Catch composition**

Mean size of commercial-size lobsters increased slowly from 1995 (82.4 mm) to 2000 (85.4 mm). During this period, minimum catch size was increased by 4 mm. In 2001, mean size was high and reached 89.3 mm. Mean size remained high

in 2002 and 2003 (87.5 mm). Mean size of commercial lobsters is higher since the minimum catch size has been increased.

Although size frequency distributions occasionally show a few modes in the larger size groups, they nevertheless seem to indicate relatively high exploitation rates. No jumbo lobsters ( $\geq 127$  mm CL) were found in samples in 2003.

Over the years, berried females have been seen in catches, mainly at the end of the fishing season, in proportions that ranged from 5% to 35%. However, the abundance is generally low and between 1993 and 2003, an average of only 24 berried females was sampled each year. The average size of berried females is about 90 mm. Observations made in 2003 in LFA 15 showed that females reach sexual maturity at approximately 93 mm.

### ***Egg production***

Egg-per-recruit production was not calculated specifically for North Shore sectors. Nevertheless, because of the large size at sexual maturity and high exploitation rates, the situation could resemble the situation in the Gaspé. Therefore, the egg production level is thought to be low compared with a non-harvested lobster stock. Consequently, it is recommended that minimum catch size continue to be increased up to 82 mm, in order to double egg-per-recruit levels recorded when the minimum catch size was 76 mm.

### ***Summary***

LFAs 15 and 16 are close to the northern limit of the lobster's range. These areas are characterized by much colder waters than around the Gaspé Peninsula and in the Magdalen Islands, which very likely slows growth, reproduction and recruitment processes, thereby decreasing stock productivity.

Doubling egg-per-recruit production is but a first step in meeting conservation objectives.

Although increasing minimum catch size to 82 mm would very likely double egg-per-recruit production, because of the large size at sexual maturity and relatively high exploitation rates conservation benefits brought by this measure may be low. There is always the risk of recruitment overfishing, because the fishery targets immature lobsters despite the minimum catch size of 82 mm. In addition, it is generally considered that the exploitation level of lobster stocks is too high and that fishing effort needs to be reduced. The North Shore is not exempt from this rule. Exploitation rates that are too high cause the fishery to be heavily dependent on annual recruitment, offset the expected benefits of increasing minimum catch size, and slow down the increase in the proportion of multiparous females in the stock.

### ***Anticosti Island – LFA 17***

In 1998, the minimum catch size for Anticosti Island was increased from 76 mm to 78 mm. It was subsequently increased by 1-2 mm each year. It was 83 mm in 2003. There has been no new stock assessment for Anticosti Island for 2003 and the recommendations formulated in 2002 were maintained.

Egg-per-recruit production has not been calculated for Anticosti Island. Nevertheless, because of the lower exploitation rates, egg production per recruit is assumed to be higher than elsewhere. However, this fishery might not be able to withstand high exploitation rates, because of the lobsters' slow growth and late sexual maturation. It is therefore important to keep the exploitation rate low in this area and to increase the minimum catch size to reduce the harvesting of immature lobsters.

### ***General outlook***

The increase in the minimum catch size contributed to an increase in egg production and contributed also to correct a problem of

growth overfishing. The increase in the minimum catch size has helped to reduce fishing pressure on immature lobster, promoting the production of eggs by primiparous females (i.e. females that are spawning for the first time). Studies in progress show that it would also be advantageous to increase the contribution of multiparous females (i.e. females that have already spawned once). The larvae from larger females are themselves larger and heavier at emergence, which may indicate better survival potential of larvae produced by multiparous females.

To date, nothing has been done to reduce fishing effort and exploitation rates, so the fishery remains just as dependent as before on annual recruitment. Modelling of egg-per-recruit production shows that the anticipated benefits of increasing the minimum legal size are reduced if the exploitation rate increases. In order to better protect the resource, a major reduction in fishing effort is needed.

Although it is hard to establish a direct link between the quantity of eggs produced and recruitment to the fishery, higher egg production should at least ensure that this factor does not become limiting. When environmental conditions are favourable, increased egg production could translate into improved recruitment. Under unfavourable environmental conditions, higher egg production could reduce the risk of the stock collapsing.

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