

## Lobster of the Inshore Waters of Quebec in 1999

### Background

Since the early 1990s, lobster landings have been declining almost everywhere in Canada. In 1999, Quebec landings were 24% below the peak level of 1992. Throughout Quebec, the minimum legal size was higher in 1999 than in 1996: carapace length was 78 mm in lobster fishing areas (LFAs) 15 to 18 and 79 mm in LFAs 19 to 22, compared with 76 mm between 1957 and 1996. These increases are part of the measures set out in conservation plans, the objective of which is to double egg production per recruit (E/R) from 1995 levels. So far, this measure has increased E/R by 26% to 40%, depending on the region. This measure affects only small females, however. Measures to increase the contribution of larger females are worth considering because of the potential benefits associated with the quality of their eggs and larvae. The lobster exploitation rate is still very high and has been increasing over the last 15 years. Computer modelling of E/R has shown that the anticipated benefits of raising the minimum legal size are reduced if the exploitation rate increases. To protect the resource better, a major reduction in fishing effort or some type of control on catches should be envisaged.

### Summary

- Quebec lobster landings reached 2921 t in 1999, compared with 3049 t in 1998 and 2825 t in 1997. They have been declining since the early 1990s. For the last three years, landings in the Magdalen Islands have remained stable at about 1900 t, but are 34% below their 1992 peak. Gaspé landings were about 950 t, roughly the same as in 1998, and above the mean of the last 14 years (695 t). Landings on the North Shore dropped to 32 t and those of Anticosti Island to 89 t.
- In 1999, for the Magdalen Islands as a whole, catch rates held steady at 1998 levels, although on the north side they have been dropping constantly since 1992. In 1999, in the Gaspé, in LFAs 20A and 20B, catch rates were equivalent to those of 1998 and above the mean for the last 15 years. Catch rates in LFA 21 and on the North Shore (LFAs 15 and 16) remained stable in 1999, but were only half to a third of those in LFAs 20A and 20B. We have no figures on catch rates for LFAs 17 (Anticosti), 18 (North Shore) and 19 (Northern Gaspé).
- In 1999, as a result of the increase in the minimum legal size, the mean size of

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lobster caught was about 3 mm longer than in 1996 in the Magdalen Islands and the Gaspé and about 2 mm longer on the North Shore.

- Exploitation rates remained high in the Magdalen Islands (about 70%), the Gaspé (about 75%) and probably on the North Shore, as well. They have been increasing since 1985, highlighting the fishery's dependency on annual recruitment. The exploitation rate was lower on Anticosti Island (about 20%).
- Since the legal size limit was raised 3 mm, computer modelling suggests that E/R has increased 26% in the Magdalen Islands and 40% in the Gaspé over 1996 levels. The goal is a 100% increase.
- In the Magdalen Islands, fishery recruitment indices are up, which suggests that landings in 2000 could be comparable to those of 1999. The same is true of the Gaspé, but the indices for that region are less reliable.

### **Biological**

The American lobster, *Homarus americanus*, ranges along the west coast of the Atlantic from Labrador to Cape Hatteras. Adults prefer rocky substrates where they can find shelter, but also live on sandy or even muddy bottoms. While commercial-size lobster are generally found at depths of less than 35 m, they are also fished by an offshore fleet along the outer Scotian Shelf at depths to 450 m.

Females reach sexual maturity at a carapace length (CL) of about 79 mm in the southern part of the Magdalen Islands, about 84 mm in the northern part of the Islands and in the Gaspé, and about 90 mm on the North Shore and on Anticosti Island. In general, they have a two-year reproductive cycle, spawning one year and moulting the next. A female spawning for the first time can produce nearly 8,000 eggs, while a large female with a CL of 127 mm (5 inches;

jumbo) can lay up to 35,000 eggs. Once released, the eggs remain attached to the female's 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 water temperature. Following metamorphosis, the postlarval lobster (Stage IV), which now resemble adults, drift down from the surface layer to settle on the bottom. During the first few years of their benthic life, or until they reach a CL of about 40 mm, lobsters lead a cryptic existence, living in structurally varied habitats that offer many hiding places. Lobsters reach minimum legal size between 6 and 8 years of age, after moulting 15 to 20 times.

### **Fishery Management**

The lobster fishery is managed by controlling fishing effort. The number of licences and the number of traps per licence are limited. In 1999, there were 656 active licences in Quebec's three maritime sectors: the Magdalen Islands (329), the Gaspé (226) and the North Shore (101). There are eight main lobster fishing areas (LFAs 15 to 22) (Figure 1) and 38 subareas. The trap limit is 250 in most LFAs, except for the Magdalen Islands and Anticosti Island, where the limit is 300. The use of traps larger than the standard size is limited by a policy of equivalence, in force since 1995. In LFAs where 250 standard traps are authorized, a total of 175 large traps are permitted, and in LFAs where 300 standard traps are authorized, 210 large traps are permitted. In the Magdalen Islands, however, large traps were completely banned in 1997. To reduce the catch of undersized lobster, escape vents on traps have been mandatory since 1994.

The lobster fishery takes place in spring and lasts 9 to 12 weeks, depending on the LFA. The season starts around the time of ice

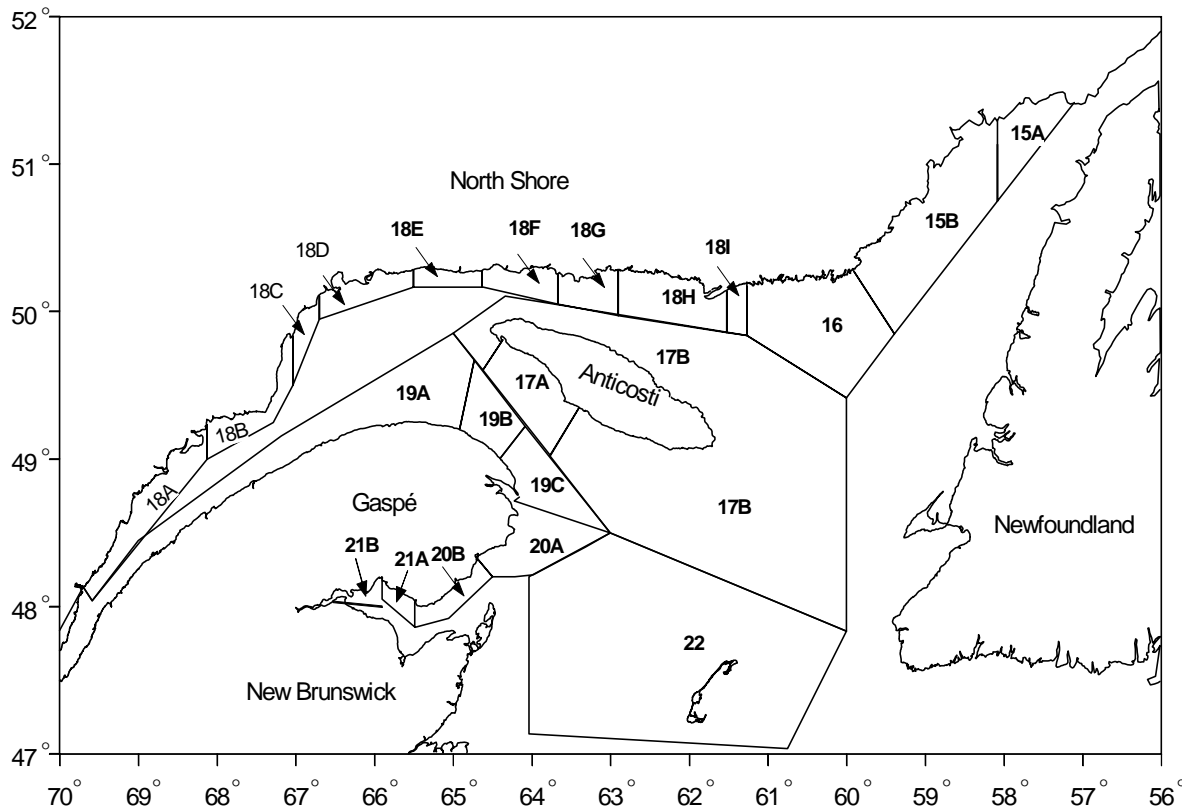


Figure 1. Quebec lobster fishing areas.

break-up and generally ends before the lobsters moult. The fishery is regulated by a minimum size limit and a requirement to return berried females to the sea, with the intention of conserving reproductive potential. A minimum size limit of 76 mm was established in Quebec in 1957, after being raised gradually from 64 mm to 76 mm between 1953 and 1957. In 1999, the size limit was 78 mm in LFAs 15 to 18 and 79 mm in LFAs 19 to 22. These increases are part of conservation plans aiming to double E/R from the 1995 level. V-notching of berried females is done on a voluntary basis in some sectors of the southern Gaspé and offers additional protection to spawning females. Since 1994, V-notched females must be thrown back.

### **Conservation Approach**

The conservation approach for all lobster stocks in Atlantic Canada is founded on the 1995 Fisheries Resource Conservation Council (FRCC) report, which said that stocks were being overfished. The FRCC's general conservation objective is to maintain stocks at an optimum level for the whole range of possible environmental conditions, by conserving a sufficient spawning biomass to allow a continuing strong production of juveniles. The aims of the conservation measures proposed by the FRCC are to increase egg production, reduce the exploitation rate and effective fishing effort, and improve stock structure by increasing the number of moult-groups. The FRCC's

arguments were based on the concept of egg production per recruit, which is a relative measure of a population's reproductive potential. The FRCC considered that E/R was too low and recommended that it be increased to 5% of that of an unfished stock, not just in Quebec but throughout Atlantic Canada. The conservation objective is now to double the E/R from the 1995 level.

### Stock Status in 1999

Lobster landings in Quebec were 2921 t in 1999, compared with 3049 t in 1998 and 2825 t in 1997 (Table 1; Figure 2). They have been dropping since the early 1990s. Landings are 16.6% lower than 1996 levels and 24% lower than the 1992 high of 3835 t. Landings are below the mean of the last 10 years and equivalent to the mean of the last 25 years. In 1999, 64% of Quebec landings were made in the Magdalen Islands (LFA 22), 31% in the Gaspé (LFAs 19, 20 and 21) and 5% along the North Shore (LFAs 15, 16 and 18) and on Anticosti Island (LFA 17).

### Magdalen Islands (LFA 22)

For the third year running, the minimum legal size was increased by 1 mm. In 1999, the legal minimum carapace size was 79 mm compared with 76 mm between 1957 and 1996.

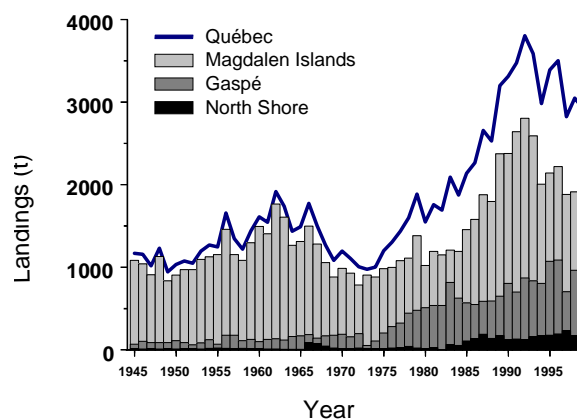


Figure 2. Quebec landings (t), 1945–99.

### Landings

Lobster landings in the Magdalen Islands have been stable for the last three years. They were 1854 t in 1999, compared with 1915 t in 1998 and 1883 t in 1997. However, they are 16.5% below the 1996 level and 34% below the 1992 peak of 2806 t. The drop from 1996 levels was steeper (29%) on the north side of the islands (Grosse Île to Millerand) than on the south side (10%). For several years now, the proportion of landings from the north side has been declining. In 1999, they accounted for less than 30%, while traditionally they have represented about 35%. Landings are below the 10-year mean, and equivalent to the mean of the last 25 years.

Table 1. Quebec lobster landings (t), by LFA, 1990–99.

LFA	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999*
15	31	32	37	26	8	12	14	19	18	14
16	20	12	16	14	10	12	18	12	15	14
17	51	76	98	108	143	137	155	184	130	83
18		12	5	12	8	17	6	19	7	4
19	26	17	18	25	25	40	36	23	32	36
20	709	621	797	751	730	985	1016	648	889	889
21	70	64	58	59	51	46	39	37	42	27
22	2380	2642	2806	2593	2007	2142	2219	1883	1915	1854
<b>TOTAL</b>	<b>3287</b>	<b>3476</b>	<b>3835</b>	<b>3588</b>	<b>2982</b>	<b>3391</b>	<b>3503</b>	<b>2825</b>	<b>3049</b>	<b>2921</b>

\* preliminary data

**Abundance Indices**

An abundance index of commercial-size lobster ( $\geq 76$  mm before 1997,  $\geq 77$  mm in 1997,  $\geq 78$  mm in 1998 and  $\geq 79$  mm in 1999) is computed using catch per unit of effort (CPUE) data obtained from at-sea sampling operations, conducted since 1985. In 1999, the abundance indices were equivalent to those of 1998 for the Magdalen Islands as a whole. Mean CPUE was about 0.75 lobster per trap haul. CPUEs have been fairly stable on the south side of the islands since 1994, but have been declining steadily since 1992 on the north side (Figure 3). The decrease may be due to lower resource abundance, especially since the environmental conditions of the last two years have not been unfavourable to lobstering. CPUEs are generally higher at the beginning of the season, partly because of greater catchability and the strategy of pursuit employed.

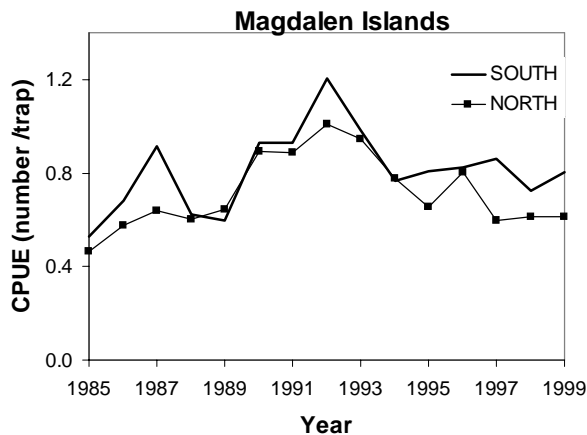


Figure 3. Catch per unit of effort (CPUE), as number of commercial-size lobster per trap haul. Seasonal means for the southern and northern Magdalen Islands, 1985–99.

**Catch Composition**

The mean size of lobster caught was about 3 mm greater in 1999 than in 1996. Lobster landed in 1999 were bigger, and 84.7% were market-size specimens ( $\geq 81$  mm), as

opposed to the mean of 71.4% for the years 1993–96.

Exploitation rates remained high in both parts 72% in the south and 67% in the north in 1998 (Figure 4) and have been rising since 1985. The proportion of large lobster is still low, and no jumbos (CL  $\geq 127$  mm) were found on the south side in 1997 or 1998. In 1999, they accounted for a mere 0.5% of landings by weight in the south and 0.8% in the north.

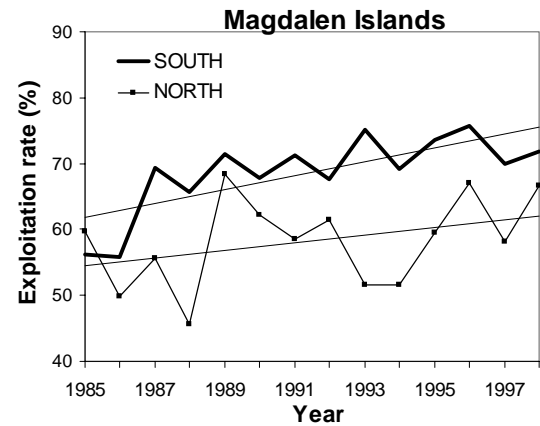


Figure 4. Exploitation rate indices for lobster in the southern and northern Magdalen Islands. The straight lines indicate data trends.

The percentage of berried females observed in the southern area at the end of the season has been higher in the last two years (55% in 1998 and 30% in 1999). With the increase in the minimum legal size, more females have a chance to spawn before being caught. At present, the effect is more noticeable on the south side of the islands, where sexual maturity is reached at a lower size (79 mm) than on the north side (84 mm).

**Outlook**

Computer modelling shows that egg production per recruit has increased an average of 26% over 1996 levels with the 3 mm increase in the minimum legal size. The objective of the conservation plan is to

double (increase by 100%) E/R from 1996 levels.

The Magdalen Islands lobster stock is heavily exploited, which could lead to overfishing of recruits. The increase in the minimum legal size is fully justified, but this conservation measure alone could prove insufficient to achieve certain objectives quickly. Modelling of E/R demonstrates that the anticipated benefits of increasing the minimum legal size are reduced if the exploitation rate increases. To protect the resource better, a major reduction in fishing effort or some type of control on catches should be considered.

Abundance of undersized lobsters (prerecruits) may be an indicator of the numbers that are expected to enter the fishery over the next few years. Prerecruit abundance indices are derived from sampling using traps with blocked escape vents and from a survey conducted off Grande Entrée using a Nephrops bottom trawl. Abundance of prerecruits (72–75 mm), as determined from at-sea sampling, and abundance of commercial lobster ( $\geq 80$  mm), as determined from the trawl survey, is above 1998 levels, which suggests that current landing levels could be maintained in 2000. Abundance indices for prerecruits (55–66 mm and 67–75 mm) that will enter the fishery in 2001 are declining, however.

### ***The Gaspé (LFAs 19, 20AB and 21AB)***

In 1997, the legal size limit was raised to 78 mm, having remained unchanged since it was set at 76 mm in 1957. The limit had been raised to 79 mm in 1998 in LFAs 19 and 20A1-A2, and in 1999 in the other LFAs.

### ***Landings***

In 1999, lobster landings in the Gaspé reached 951 t, which is close to 1998 landings (963 t) (Figure 5). They were above the mean of the last 14 years (695 t), but about 12% below the peak years of 1995 and 1996. In the Gaspé, 93% of landings were made in LFAs 20A and 20B (Cape Gaspé to Bonaventure), where there are 206 licence-holders. They reached 888 t in 1998 and 1999. In LFA 19, there are 7 licences, and landings accounted for approximately 4% of total landings for the Gaspé. The catch was 36 t in 1999 and 32 t in 1998. In LFAs 21A and 21B, landings declined from 32 t and 10 t in 1998 to 20 t and 7 t in 1999. The 12 licence-holders in those two LFAs make 3% of Gaspé landings.

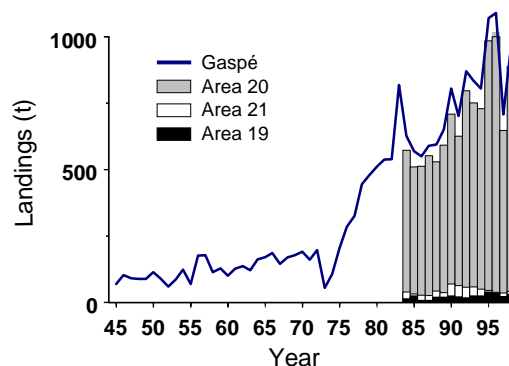


Figure 5. Gaspé lobster landings (t), 1945–99.

### ***Abundance Indices***

For LFAs 20A and 20B together, 1999 CPUEs based on at-sea sampling were equivalent to those of 1998, a mean of 0.65 lobster per trap haul (Figure 6). Although lower than the 1995 and 1996 figures, they were still above the 15-year mean. Yields were high early in the 1999 lobster season (1.3 lobster per trap haul), but declined rapidly over the rest of the season. The 1998 seasonal pattern was lower yields early in the season (0.7 lobster per trap haul) that held steady later. Differences in catchability linked with weather conditions

early in the lobstering season seemed to have a major impact on the seasonal yield pattern.

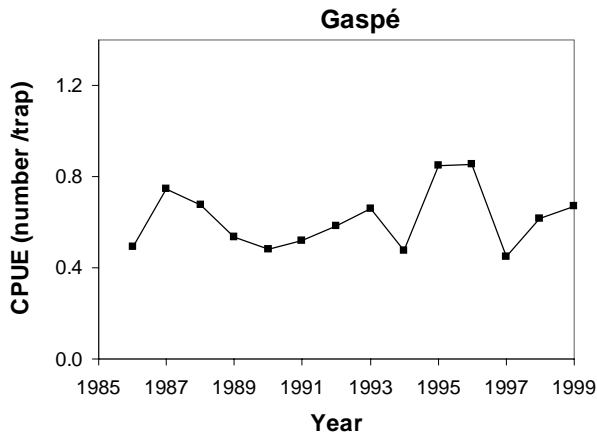


Figure 6. Catch per unit of effort (CPUE), as number of commercial-size lobsters per trap haul. Seasonal means in the Gaspé, 1986–99.

CPUEs for LFA 21 are generally half to a third those of LFAs 20A and 20B, and in 1999, they were at the same level as in 1997 and 1998 (mean of 0.3–0.4 lobster per trap haul). Yields were low at the start of the season (0.5 lobster per trap haul), but held steady after that, unlike 1998, when yields dropped from 0.7 lobster per trap haul early in the season to 0.3 midseason.

### Catch Composition

For LFAs 20A and 20B taken together, the mean size of lobster caught in 1999 was about 3 mm greater than in 1996. Landings in 1999 were made up of bigger lobster and 84.2% were market size, that is  $\geq 81$  mm, as opposed to a mean of 67.4% from 1993 to 1996. These changes are significant, and are to be expected with the increase in the legal size limit. The Gaspé fishery is a recruitment fishery, so it is not surprising that the changes would be noticeable so soon.

The exploitation rate is very high in LFAs 20A and 20B and reached 78% in 1998, having gone up over the last few years (Figure 7). The percentage of large lobster is

still low, with jumbos ( $CL \geq 127$  mm) constituting only 0.07% of the 1999 catch by weight.

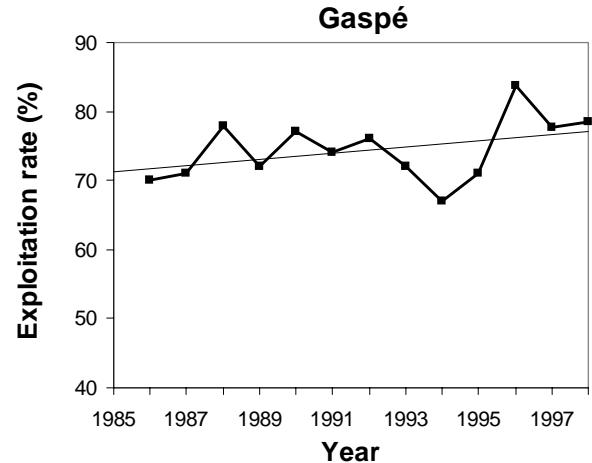


Figure 7. Exploitation rate indices for Gaspé lobster populations (LFAs 20A and 20B). The straight line indicates the data trend.

The percentage of berried females at season's end increased throughout the 1990s. This increase may rather reflect the exploitation rate than the true abundance of berried females.

Catch composition in LFA 21, sampled for the first time in 1997, revealed differences from the rest of the Gaspé. The percentage of berried females and the mean size of lobster taken were greater overall. In 1999, mean size was 88.1 mm at the start of the season and 92.4 mm at the end, with 89% of the catch made up of market-size specimens. More large lobster are found in LFA 21, and in 1999, jumbos made up 12% of the catch by weight. There are also fewer undersized lobster in the area. The area may be dependent on more productive areas situated farther downstream.

### Outlook

Computer modelling shows that egg production per recruit jumped 40% from the 1996 level as the legal size increased 3 mm.

The Gaspé lobster stock is heavily exploited, a situation which could lead to recruitment overfishing. The increase in the legal size is fully justified, but this conservation measure alone could prove insufficient to achieve certain objectives quickly. Modelling of E/R demonstrates that the anticipated benefits of increasing the minimum legal size are reduced if the exploitation rate increases. To protect the resource better, a major reduction in fishing effort or some type of control on catches should be considered.

Abundance of slightly undersized lobsters (prerecruits) may be an indicator of the numbers that are expected to enter the fishery over the next few years. But in the last few years, it has been difficult to determine the relationship between abundance of prerecruits one year and landings the next. That said, prerecruit abundance (72–75 mm), as determined in 1999 from sampling using traps with blocked escape vents, was up. This observation suggests that, subject to certain reservations, 2000 landings could be comparable to those of 1999.

### ***North Shore (LFAs 15, 16, 18) and Anticosti (LFA 17)***

The minimum legal size for the North Shore and Anticosti Island was raised to 78 mm in 1998 and remained the same in 1999.

### ***Landings***

Lobster landings in the North Shore region make up between 1% and 2% of Quebec's total catch, depending on the year, while Anticosti Island landings account for about 3% or 4%. For the North Shore as a whole, 1999 landings were 32 t, down from 40 t in 1998. The 10-year mean is 39 t. Landings around Anticosti Island (mainly the east side) in 1999 were only 83 t, as opposed to 130 t in 1998 and 184 t in 1997. Landings have been dropping since 1994. Catch data

for this LFA are rather unreliable and no firm conclusions on trends can be drawn.

### ***Abundance Indices***

Abundance indices calculated for the North Shore since 1993 indicate that the region is less productive than LFAs 20A and 20B in the Gaspé or the Magdalen Islands. It is more like LFA 21, in upper Chaleur Bay. Between 1993 and 1999, mean CPUEs varied between 0.3 and 0.4 lobster per trap haul. In 1999, CPUEs were 0.3 lobster per trap haul, about the same as in the three preceding years. Lobster abundance indices for Anticosti Island were obtained from at-sea sampling done in 1997. CPUEs were much higher than anywhere else (1.9 lobster per trap haul in midseason) and the lobster caught were much bigger.

### ***Catch Composition***

The mean size of lobster caught in LFAs 15 and 16 was greater in 1998 and 1999 than in 1997, reflecting the increase in the minimum legal size. A high exploitation level is assumed, although perhaps slightly lower than in the Gaspé, as size frequency distributions show a few modes for large lobster. Nonetheless, the 1999 samples contained no specimens of 127 mm or larger.

The size structure on Anticosti is different from those of the other regions. This suggests that the exploitation rate, estimated at 20%, is much lower there than elsewhere. An exploitation rate like this would help maintain a population structure characterized by several moult-groups and make the fishery much less dependent on annual recruitment. The FRCC considers this to be an ideal situation, and one that is quite different from other areas, where additional conservation measures are necessary. On Anticosti there are also large numbers of big lobster, with a good



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percentage of jumbos ( $\geq 127$  mm): 8.7% (by weight) in 1997.

### ***Outlook***

Egg production per recruit was not computed for the North Shore and Anticosti Island. We feel that the situation on the North Shore is similar to that in the Gaspé with regard to size at sexual maturity and the high exploitation rate. We are assuming that E/R is not as low around Anticosti Island as it is elsewhere and that it is above the level that would indicate overfishing (5–10% of an unfished stock).

We believe that the North Shore lobster stock would benefit from stricter conservation measures, especially an increase in the legal size limit. In the current situation, it is possible that recruits are being overfished. Although E/R is considered to be satisfactory at Anticosti, the data for the area suggest that the stock could be less able to recover from high exploitation rates because of slow growth and the fact that sexual maturity is achieved at a bigger size (around 90 mm). It is therefore important to keep the exploitation rate low. At the moment, the fishery targets a high proportion of immature lobster. Too much fishing pressure on immature lobster could have a negative impact on the population dynamics by reducing E/R.

### ***General Outlook***

The increase in the minimum legal size should make it possible to achieve the objective of doubling the E/R from the 1995 level within a few years. This measure will only increase egg production by small females, however. Measures to increase the contribution of larger females are worth considering because of the potential benefits associated with the quality of their eggs and larvae.

Raising the legal size will lead to changes in catch size and composition. With constant recruitment, the number of lobster caught can be expected to decrease. Some lobster will not be caught until a year later, and their number will be reduced through natural mortality, which is estimated to be 10–15% per year. On the other hand, they will be bigger, as another moult will enable them to gain about 45% in weight. The greater weight should more than compensate for the lower numbers, as far as males and immature females are concerned.

With regard to mature females, increasing the legal size will allow a larger proportion to spawn before being caught. The number of berried females in the population should rise and by the same token, the number of unberried females caught should decline.

So far, nothing has been done to reduce fishing effort and exploitation rates, so the fishery will remain just as dependent as before on annual recruitment. Modelling of egg production per recruit demonstrates that the anticipated benefits of increasing the minimum legal size are reduced if the exploitation rate increases. To protect the resource better, a major reduction in fishing effort or some type of control on catches should be considered.

Although it is difficult 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 should translate into improved recruitment. Under unfavourable environmental conditions, higher egg production could reduce the risk of stock collapse.

Our ability to predict landings is still poor for most lobster stocks of the inshore waters of Quebec. However, in both the Magdalen Islands and the Gaspé, prerecruit indices

were up, suggesting that 2000 landings may be comparable to those of 1999.

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