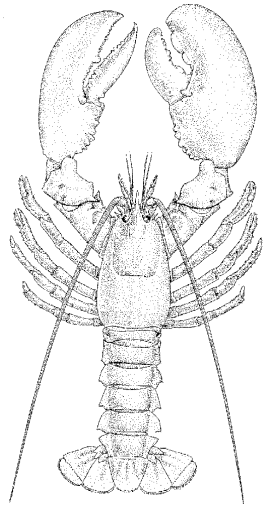

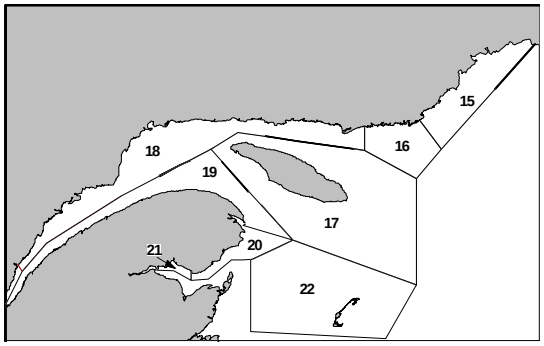

Figure 1. Lobster fishing areas in Québec.

Lobster of the Inshore Waters of Québec

Abstract

Over the past 20 years, lobster landings have reached very high levels in Québec and Atlantic Canada as a whole, in some areas approaching the levels seen at the end of the last century, when lobster harvesting began. In parallel with this increase in landings, catch rates have risen as well.

Catches per unit of effort (CPUEs) are markedly higher than in the mid-1960s and the late 1970s. The increase in CPUEs has always been attributed largely to expansion of the lobster biomass on fishing grounds. However, information from fishermen indicates that harvesting capacity has increased considerably since the early 1990s and has definitely contributed greatly to the rise in CPUEs and landings observed during this period.

Biology

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 lobsters are generally found in commercial numbers at depths 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 cephalothorax length (CTL) of about 79 mm in the southern part of the Magdalen Islands and about 84 mm in the northern part and in the Gaspé. In general, females 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 one with a CTL of 125 mm (jumbo) can lay up to 35 000 eggs. After the eggs are released, they remain attached to the female's swimmerets for 9 to 12 months, until they hatch the following summer. The newly released pelagic larvae go through a plank-

tonic phase which lasts from 3 to 10 weeks, depending on the water temperature. Once they reach Stage 4 of their development, following metamorphosis, the postlarvae drift down from the surface layer and settle on the bottom. During the first few years of their benthic life, or until they reach a CTL of about 40 mm, lobsters lead a cryptic existence, living in structurally varied habitats that offer numerous hiding places. They reach minimum legal size (76 mm CTL) between 6 and 8 years of age, after 15 to 20 moults.

Fishery management

The lobster fishery is managed by controlling fishing effort through a limit on the number of licences operated and the number of traps allowed per licence. In 1996, there were 658 active fishing licences, distributed within 8 fishing areas (Figure 1). The number of standard traps authorized per licence was 250 or 300 depending on the area. The use of larger traps was controlled in 1995 and 1996 by limiting their number in proportion to their greater fishing efficiency. For example, the number of traps larger than the standard size, which varies with the fishing area, was restricted to 175 or 210 in areas where a maximum of 250 or 300 standard traps was authorized. Fishing effort is also controlled by the length of the fishing season. The fishery begins in spring after ice breakup and lasts 9 to 12 weeks depending on the area concerned.

In addition, fishing effort is controlled by regulations on minimum legal size and returning berried females to the water, which are aimed at conserving the resource by maintaining a certain level of egg production. At present, the minimum legal size in all Québec fishing areas is 76 mm (3") CTL. To reduce catches of noncommercial-sized lobsters, the use of traps with escape vents was made compulsory in 1994. All traps must now have a 43 mm × 127 mm rectangular opening or two 56 mm-diameter circular openings in each parlour. Fishermen in southern Gaspé [areas 20A (in part), 20B and 21] have been marking berried females for several years. They mark a notch on the telson (V-notch) of a certain number of egg-bearing individuals and throw them back into the water. The mark is still visible the following year, making it possible to recognize females that are potential spawners even when they are not bearing eggs. Protecting these females enables them to produce eggs a second and perhaps even a third time. Since 1994, fishermen have been required to return V-notched females to the sea.

Stock status in 1996

In 1996, lobster landings in Québec stood at 3267 t, down 4% from 3391 t in 1995 (Figure 2, Table 1). The breakdown of the total 1996 Québec catch is as follows: 64% from the Magdalen Islands (Area 22), 31% from the Gaspé (areas 19, 20 and 21) and 5% from the North Shore (areas 15, 16 and 18) and Anticosti Island (Area 17). In general, landings throughout Québec were very high compared with the past 25 years, when they averaged 2285 t. Landings rose steadily from the mid-1970s to the early 1990s along most of Canada's Atlantic coast. In Québec, this uptrend has been especially noticeable in the Magdalen Islands, where landings almost tripled between 1976 and 1992. This far-ranging pattern suggests that common variables may have favoured large-scale lobster recruitment. For the moment, however, the factors behind this phenomenon are still being studied (climate, hydrodynamics, predation, etc.). The increase is also believed to be partly attributable to an expansion in certain components of fishing effort.

Table 1. Lobster landings (t) in Québec by fishing area.

	1991	1992	1993	1994	1995	1996[1]
Area 15	32	37	26	8	12	12
Area 16	12	16	14	10	12	16
Area 17	76	98	108	143	137	134
Area 18	12	5	12	8	17	2
Area 19	17	18	25	25	40	32
Area 20	621	797	751	730	985	947
Area 21	64	58	59	51	46	35
Area 22	2642	2806	2593	2007	2142	2089
TOTAL	**3476**	**3835**	**3588**	**2982**	**3391**	**3267**

1 preliminary data

Magdalen Islands (Area 22)

Landings

In 1996, the lobster landings in the Magdalen Islands totalled 2089 t, down 2.5% from 1995. The catch for the southern sector (between Old Harry and Havre Aubert) stood at 1393 t compared with 696 t in the north (between Bassin and Grosse Île), making up respectively 67% and 33% of total landings which corresponds to the normal historical pattern. The 1996 landings represent a decline of 5% in the north and 1.5% in the south compared with the 1995 catch of 730 t in the north 1413 t in the south.

Meteorological and climatic conditions during the 1996 lobster fishing were similar to those in 1995. When the fishery opened on May 13, the water temperature on the fishing grounds in the southern sector (10 m deep) was about 3° C, which is relatively warm. No major meteorological perturbations occurred during the season. According to observations gathered from Index Fishermen, fishing effort was at a near-maximum level during the first three weeks of the season. In 1996, 56% of landings were made after the third week of fishing, which is slightly above the 1995 figure of 53%.

Abundance indices

Abundance indices for commercial-sized lobster (CTL ≥ 76 mm) are derived from catch per unit of effort (CPUE) data obtained by sampling commercial catches at sea. CPUE values, generally expressed as a number of lobster per trap, were converted into weight (kg) per trap to be able to compare them with the data collected in the mid-1960s and the late 1970s (Figure 3).

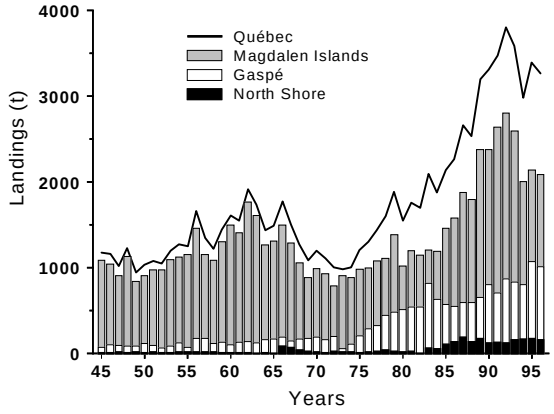

Figure 2. Lobster landings (t) in Québec from 1945 to 1996.

In 1996, the CPUEs were comparable to those observed in 1995. At the start of the season, they were slightly higher (15%) than the previous year, namely 0.81 kg/trap versus 0.70 kg/trap in 1995, which is equivalent to 1.65 and 1.44 lobsters per trap respectively. At the time the fishery began, the ice cover had been gone from the southern part of the Islands for over a week, allowing the water temperature to rise somewhat. The water temperature on the fishing grounds was moderately higher (1° to 2° C) than in 1995. A slight warming trend like this can enhance the catchability of lobster, and may partly explain the interannual differences observed in early-season catch rates.

The mid-season CPUEs were 0.31 kg/trap (Figure 3). CPUE values have been falling since 1994, a trend attributed to the fact that the lobster biomass is no longer large enough to support high yields right through mid-season. During 1990, 1991 and 1992, the abundance of lobster was likely at a peak level, enabling fishermen to maintain high catch rates for a longer time period. The abundance level is believed to have declined since then, although it has been fairly stable over the past three years. The season-end CPUEs were moderately lower than in 1995, 0.18 kg/trap compared to 0.20.

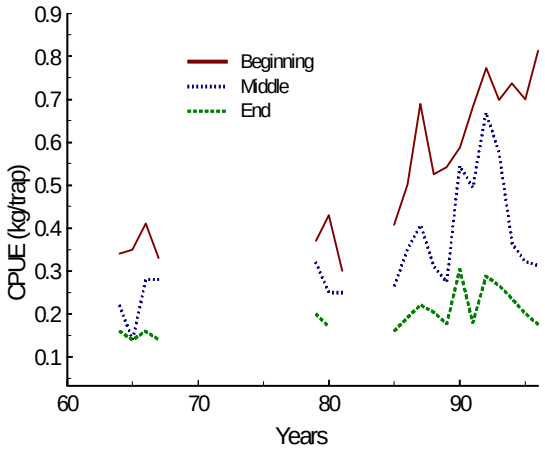

Figure 3. Catches per unit of effort (CPUE in kg per trap) in the Magdalen Islands.

The CPUEs recorded at the beginning and middle of the fishing season have been substantially higher since the late 1980s than in the mid-1960s and late 1970s. Uptrends in CPUEs have always been attributed to expansion of the lobster biomass on fishing grounds. However, this interpretation is based on the assumption that the unit of effort, that is, the trap, has not changed over the years, which is obviously not the case. Information gathered from interviews with fishermen in winter 1996 in a study undertaken to harness their traditional knowledge has helped shed light on the adjustments made to the unit of effort since the early 1980s.

These changes have affected not only the trap configuration itself (size, weight, entrance ring, proportions, bait type), but also the fishing strategy associated with the newer, more efficient trap designs. The sophisticated electronic equipment (navigation system and colour sounder) introduced recently has made it possible to identify new fishing grounds. According to fishermen, all of the lobster grounds around the Magdalen Islands are now exploited, compared with only 50 or 60% of them in the early 1980s. The new equipment has also permitted the determination of bottom type and fine-scale topography applications. The enhanced knowledge of seabed configuration has given fishermen more effective control, as they can now strategically position their traps in locations ensuring better catches. Traps are no longer deployed randomly on fishing grounds, a situation which is also due to the fact that the number of traps per line has been reduced to 6-7, compared with 10-12 before. Changes in the size and motor power of vessels, coupled with the use of electronic navigation systems, have made fishermen much more mobile than ever before. As a result of this increased mobility, fishing strategy has shifted from mere interception to active pursuit of lobster. All these technological and strategic changes have led to more efficient fishing operations and definitely contributed greatly to the upward trend in CPUEs and landings observed since the mid-1980s, when the changes were occurring. However, an increase in harvesting capacity of this magnitude might mask a decline in stock abundance.

Biological data

Since 1985, the average size of harvested lobsters (≥ 76 mm) has declined, both in the northern and the southern sectors (Figure 4).

Whereas in the south, the decrease is noted early in the season, in the north it spans the

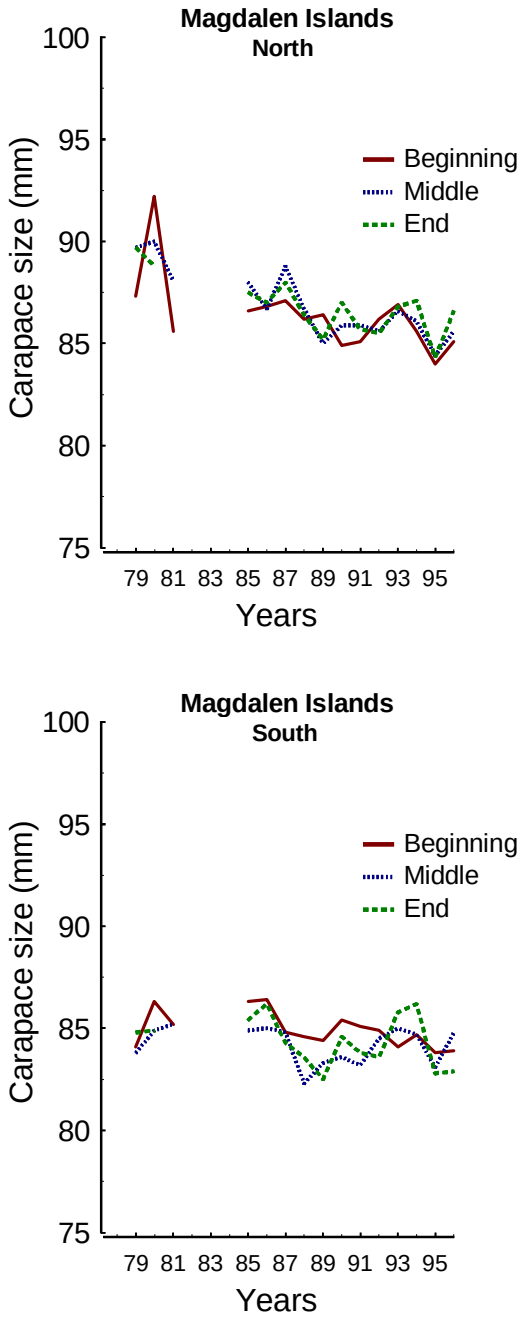

Figure 4. Average size of lobster (≥ 76 mm CTL) in the Magdalen Islands.

three fishing periods. The situation in the northern part of the Magdalen Islands is becoming more and more like that in the south.

The difference in lobster size between the north, once reputed to have larger lobsters, and the south is declining. There is a very low abundance of large lobsters in the Magdalen Islands; an estimate of the abundance of "jumbo" lobsters (127 mm and over) has been derived from commercial sampling data. Large individuals make up less than 1% of landings. Comprehensive catch sampling carried out in 1996 by the APPIM (Magdalen Islands Professional Fishermen's Association) confirmed the results of commercial sampling. The decline in average size and the small number of large individuals are both indicators of high exploitation rates.

Analysis of the size composition of catches provides a means of quantifying harvesting intensity. The average observed over the past 11 years was 64.5%. In the southern part of the Islands, the exploitation rate has been moving up gradually since 1988. In the north, the exploitation rate was 59% in 1995, compared with an average level of 53% for the past 11 years.

Egg production per recruit for lobster in the Magdalen Islands remains below the target level recommended by the FRCC (Fisheries Resource Conservation Council), namely 5% of what it would be if there were no fishery. At a level below this, a stock is considered overfished.

Outlook for 1997

The abundance of prerecruits, or individuals under the prescribed commercial size, can provide an indication of the number of lobsters that will enter the fishery in the coming years. Generally, prerecruits between 67 and 76 mm in the Magdalen Islands moult during the summer or fall after the fishing season, and thus make up the following year's catch. An abundance index for prerecruits is derived from catch rates recorded during at-sea sampling of commercial catches. In the past,

analysis of the relationship between prerecruit abundance indices for a given year and the landings for the following year used to provide a fairly accurate forecast of landing trends for the next year. However, since the regulation on escape vents came into effect in 1994, there has been a substantial reduction in the number of prerecruits found in traps, and consequently recent data have no predictive value. Moreover, the practice of blocking escape vents has precluded the calculation of a reliable index; hence predictions cannot be made for 1997 on the basis of these data.

Nonetheless, a fishery-independent tool for predicting landings is being developed in the Magdalen Islands. Sampling conducted with a Nephrops bottom trawl provides a picture of the population segment comprising the smallest individuals, namely the moult classes that will enter the fishery in one to three years. An abundance survey of lobster was conducted off Grande Entrée in 1995 and again in 1996 after the fishing season. The spatial distribution of the lobster abundance observed during the two years is shown in Figure 5. Total abundance across the study area was 24% lower in 1996 than in 1995. Commercial-sized lobsters (≥76 mm), namely those that will be available to the fishery in 1997, were 30% less abundant. At the end of the 1997 fishing season, we will know whether results of this type can serve as a good predictor of landings in the coming years.

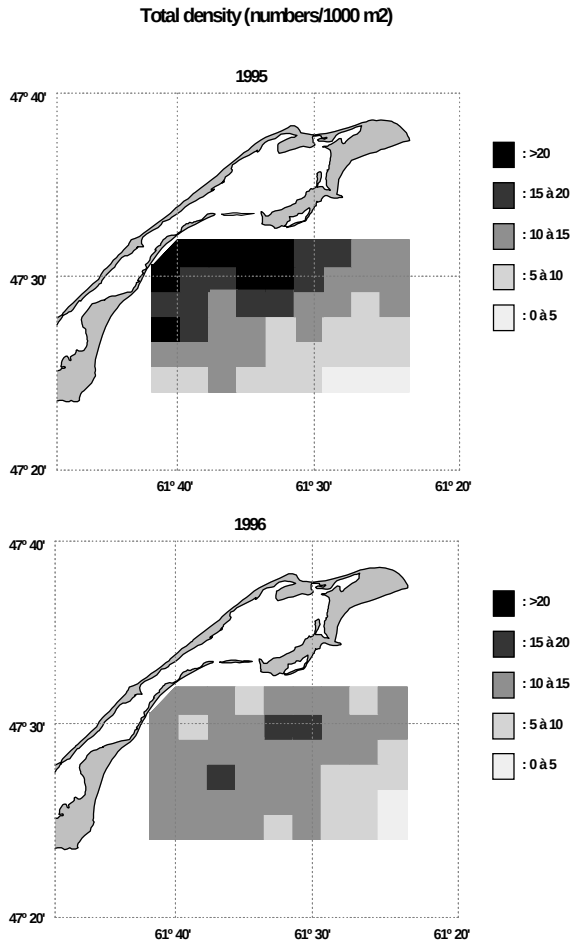

Figure 5. Abundance (number /1000 m^2) of lobster in 1995 and 1996, according to a

Conclusion

The Magdalen Islands lobster population is heavily exploited, and the harvest rate appears to have risen in recent years, partly as a consequence of increased fishing efficiency. All of the biological indictors confirm this trend: the average size of lobsters caught has declined over time or remained minimal, egg production per recruit is very low, and catches contain almost no large individuals. Furthermore, according to fishermen, all the lobster grounds around the Islands are now exploited, compared with 50 or 60% of them in the early 1980s, reducing the area of unexploited grounds that may previously have provided a refuge for lobsters.

A high exploitation rate of this type is very risky and could easily lead to recruitment overfishing, threatening the stock's survival. We recommend that conservation measures, such as those proposed by the FRCC, be implemented immediately. However, the only approach that could have a signficant effect on egg production per recruit is a major adjustment in minimum legal size or in fishing effort.

Gaspé (Areas 19,20,21)

Landings

In 1996, lobster landings in the Gaspé (1014 t) were down 5% from 1995, although they remained very high compared to the last 10 years. In contrast, the total catch rose 33% between 1994 and 1995. A total of 93% of Gaspé landings come from Area 20. In 1996, the catch in this area was 947 t compared with 985 t in 1995. Fishing areas 19 and 21 are marginal zones characterized by small landings. In 1996, the landings there stood at 32 t and 35 t respectively, down 20% and 24% from 1995.

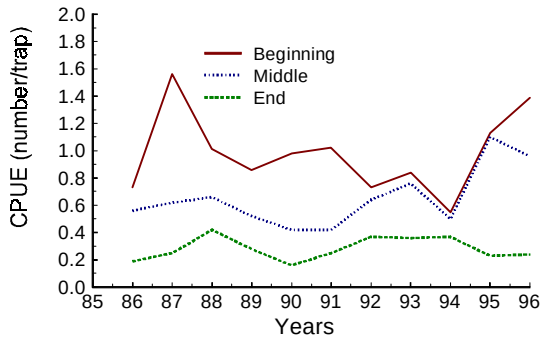

Figure 6. Catches per unit of effort (CPUE in number of lobster per trap) in the Gaspé.

In most of the subareas of Area 20 (there are 18), fishing began on April 27, about ten days earlier than in 1995. When the fishery opened, the water temperature was about 1°C, but it warmed up quickly, reaching 3°C the following week. According to observations gathered from Index Fishermen, fishing effort during the first three weeks of the season was slightly lower (10%) than in 1995; however, for the season as a whole it was only 4% lower. In 1996, some 40% of landings were made after the third week of fishing, compared with about 50% in 1995.

Abundance indices

In the Gaspé, the CPUE values recorded at the start of the season in 1996 were higher than in 1995, or 1.39 compared with 1.13 lobsters/trap/day (Figure 6).

Despite a slight decrease from 1995, the catch level remained quite high in mid-season (0.96 lobster/trap in 1996 versus 1.10 in 1995). The high catch rates may to a certain extent reflect a high level of resource abundance. However, they may also point to increased fishing efficiency, as is the case in the Magdalen Islands. At season-end, the CPUEs were substantially lower, just as in 1995, at 0.24 lobster/trap. The high yields described above characterize Area 20A (Cap Gaspé to Chandler) above all. The farther one moves into Chaleur Bay, the lower the yields are. Data from the Index Fishermen Program indicate that during the 1996 fishing season the average CPUEs for areas 20B and 21 represented about 80% and 40% respectively of the yields in Area 20A.

Biological data

The average size of lobster caught in the Gaspé is very small, showing that the fishery is dominated by recruits-of-the-year. Furthermore, since 1993 the average size of lobsters caught (≥ 76 mm CTL) at the beginning and middle of the fishing season (Figure 7) has declined, as has the average size of berried females. In the Gaspé, exploitation rates are very high, averaging 73% over the past 10 years. This situation has made fishing success dependent on the abundance of lobster that reach commercial size in a given year. Harvesting affects only one moult class essentially. At high exploitation rates of this sort, good recruitment years cannot sustain the fishery for very long.

Egg production per recruit for lobster in the Gaspé is still lower than the target level recommended by the FRCC (Fisheries Resource

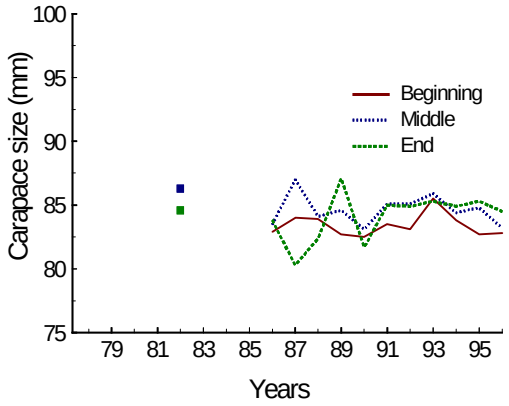

Figure 7. Average size of lobsters (≥ 76 mm CTL) in the Gaspé.

Conservation Council), namely 5% of what it would be if there were no fishery. At a level below this, a stock is considered overfished.

Outlook for 1997

The abundance of undersized lobster (prerecruits) may provide an indication of the number of individuals that will enter the fishery in the coming years. As a rule, prerecruits between 64 and 76 mm CTL moult during the summer or fall after the fishing season, and thus contribute to the following year's catch. As in the Magdalen Islands, an analysis of the relationship between prerecruit abundance indices for a given year and landings for the following year used to permit a fairly accurate forecast of landing trends for the following year. However, since the regulation on escape vents came into effect in 1994, the number of prerecruits found in traps has dropped significantly, and hence recent data have no predictive value. Furthermore, blocking of the escape vents has precluded the calculation of a reliable index; therefore, projections cannot be made for 1997 on the basis of the available data.

Conclusion

Gaspé lobster is heavily exploited, a situation which is borne out by all the biological indicators: the average size of lobster caught has declined over time or remained minimal, the average size of berried females is decreasing, and egg production per recruit is very low. The exploitation rate is very risky and could easily lead to recruitment overfishing, endangering the stock's survival. We recommend that conservation measures, such as those recommended by the FRCC, be implemented as soon as possible. However, the only approach that could have a signficant effect on egg production per recruit is a major adjustment in minimum legal size or in fishing effort.

Anticosti (Area 17)
North Shore (areas 15, 16, 18)

The lobster population around Anticosti Island (Area 17) was sampled once in 1996 (dockside sampling). The sample showed a population structure composed of several moult classes, indicating that the exploitation rate is probably much lower than that observed in the Gaspé and the Magdalen Islands. The average size of commercial-sized lobster was 93 mm CTL, in comparison with a CTL of about 85 mm in the Magdalen Islands and the Gaspé.

The landings posted in Area 15 in 1996 were on a par with those of 1995, or 12 t. In Area 16, the catch was 16 t compared with 12 t in 1995, whereas in Area 18, landings of only 2 t were recorded. Sampling at sea has been done in areas 15 and 16 since 1993. As a rule, catch rates decline moving toward the northern edge of the species' distribution. The catch rates on the North Shore are markedly lower than in the other regions, but comparable to those seen at season-end in the Gaspé and the Magdalen Islands. The CPUEs for commercial-sized lobster at the beginning, middle and end of the 1996 season were 0.51, 0.28 and 0.19 lobster/trap respectively, which is on a par with last year. The 1995 and 1996 results differ from those of 1993 and 1994 in that the

catch rates dropped more rapidly during the fishing season. In 1993 and 1994, the CPUEs for the beginning and middle of the season were equivalent. During the four years of sampling, another trend noted was a decline in the average size of individuals caught. Between 1993 and 1996, the average size fell from 86.9 to 83.2 mm at the start of the season. Similar decreases were observed at mid-season and at season-end as well, reflecting an increase in the exploitation rate. We do not have any data on the size at sexual maturity of lobster in this sector; however, since the waters there are relatively colder than in the Gaspé and the Magdalen Islands, sexual maturity likely occurs at a larger body size. If so, the minimum legal size of 76 mm CTL might not be large enough to ensure an adequate level of egg production per recruit.

On the North Shore, the same conservation problems are likely to exist as in the Gaspé and the Magdalen Islands, which have been studied to a greater extent.

For more information:

FRCC, 1995. A Conservation Framework for Atlantic Lobster. 49 p. + Appendices.

Gendron, L. 1996. État des stocks de homard des côtes du Québec en 1995 et analyse des mesures de conservation. DFO Atlantic Fisheries. Research document 96/123. 55 p.

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