Lobster of the Inshore Waters of Quebec in 2002

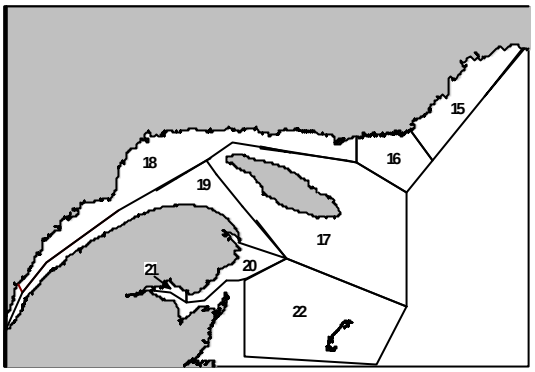

Figure 1. Quebec lobster fishing areas.

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 the egg production per recruit levels recorded in 1996. In 2002, the minimum legal size was 82 mm (carapace length) in LFAs 17 (Anticosti Island), 18 (North Shore) and 22 (Magdalen Islands), 81 mm in LFAs 19, 20 and 21 (Gaspé Peninsula) and 80 mm in LFAs 15 and 16 (Lower North Shore); the minimum legal size was 76 mm between 1957 and 1996. To date, these size increases appear to have led to a 75 % to 90 % rise in egg production per recruit, 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 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 improve 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 2,969 t in 2002, a decrease of 11 % from 2001 levels (3,321 t). Landings in 2002 were 10% below the average for the 1990s and 10 % higher than the 25-year average. In 2002, 68 % of landings came from the Magdalen Islands, 27 % from the Gaspé Peninsula, 4 % from Anticosti Island and 1 % from the North Shore. Compared with 2001, landings decreased in all fishing areas in Quebec. In 2002, landings totalled 2,024 t in the Magdalen Islands (LFA 22), compared with 2,177 t in 2001. Landings in the Gaspé Peninsula (LFAs 19, 20 and 21) totalled 789 t, down 17 % from 2001. Landings on the North Shore (LFAs 15, 16 and 18) were very low in 2002, totalling 21 t, compared with 46 t in 2001, a decrease of more than 50 %. Anticosti Island landings (LFA 17) remained relatively unchanged from 2001 levels at 135 t.
- In 2002, catch rates were down in the Magdalen Islands and the Gaspé, compared with recent years. The decrease in yields (in weight)

was not as significant, as larger lobsters offset the smaller number of lobsters caught.

- Since 1996, the year before the minimum catch size was increased, the mean size of lobsters landed in the Gaspé and the Magdalen Islands has increased by 4 mm to 5 mm, while their mean weight has increased by 15 % to 22 %.
- 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. Anticosti Island posted the lowest exploitation rate (approximately 20 %).
- To date, egg production per recruit has increased by approximately 75 % in the Magdalen Islands and by 90 % in the Gaspé from 1996 levels. The goal is to increase egg production per recruit by 100 %. 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 2003 could be comparable to those in 2002.

Biology

Lobster (*Homarus americanus*) occur along the west coast of the Atlantic Ocean, from Labrador to Cape Hatteras. Adult lobster prefer rocky substrates where they can take shelter, but also live on sandy and even muddy bottoms. While commercial-size lobsters are generally found at depths of less than 35 m, they are also harvested by an offshore fleet along the outer Scotian Shelf at depths to 450 m.

Females reach sexual maturity at approximately 79 mm (carapace length) in the southern Magdalen Islands, at 82 mm to 84 mm in the northern Magdalen Islands and around the Gaspé Peninsula, and at over 90 mm on the North Shore and around Anticosti Island. 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, living in structurally varied habitat providing many hiding places. In the Magdalen Islands and the Gaspé, lobsters are estimated to reach minimum catch size between 6 and 8 years of age, after having moulted 15 to 20 times.

Lobster reproduction research conducted recently indicates that the size of larvae at release is bigger among females that have already spawned before (multiparous). A larger emergence size could also be related to more rapid larval growth. In addition, observations made with regard to lobsters' mating system show that smaller males can mate with larger females. However, the amount of sperm released during mating depends on the size of the male. Additional research will

need to be conducted to determine whether the amount of sperm released by small males is enough to fertilize all of the eggs of large females.

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 2002, there were 644 active licences in Quebec's three maritime sectors: the Magdalen Islands (325), the Gaspé Peninsula (216) and the North Shore and Anticosti Island (103). 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 traps larger than the standard size is limited by a policy of equivalence that has been 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. The use of large traps has been prohibited in the Magdalen Islands since 1997. In order to reduce landings of undersized lobster, escape vents on traps have been mandatory since 1994. In 2002, the size of vertical escape vents was increased from 43 mm to 46 mm in the Gaspé.

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 requirement to release berried females, with the objective of conserving reproductive potential. Between 1957 and 1996, the minimum catch size for Quebec was 76 mm. Since 1997, the minimum catch size has been increased by 1 mm to 2 mm (carapace length) every year or every two years, depending on the region. In 2002, the minimum catch size was 82 mm in the Magdalen Islands (LFA 22), around Anticosti Island (LFA 17) and on the Upper and Middle North Shore (LFA 18). It was 81 mm in the Gaspé (LFAs 19, 20 and 21) and 80 mm on the Lower North Shore (LFAs 15 and 16). The increase in minimum catch size is intended to double 1996 levels of egg production per recruit. V-notching of berried females is done on a voluntary basis in some sectors in the southern Gaspé. Since 1994, V-notched females must be thrown back.

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 production per recruit (EPR), which is a relative measure of a stock's reproductive potential. Following reports of overfishing, it was recommended that egg production per recruit be increased. Since 1997, measures have been taken to double 1996 EPR levels. However, doubling EPR is but a first step in meeting the conservation objectives also intended to distribute egg production between primiparous females (females spawning for the first time) and multiparous

females (females that have already spawned) and to improve the size structure of stocks.

Stock status in 2002

Stock status reports are based primarily on analyses of data from three sources: landings, 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 2,969 t in 2002 (Table 1; Figure 2), which is down 11 % from 2001 levels (3,321 t). They were below the 10-year average, but 10 % higher than the 25-year average. The distribution of landings in 2002 was as follows: 68 % from the Magdalen Islands (LFA 22), 27 % from the Gaspé Peninsula (LFAs 19, 20 and 21), 4 % from Anticosti Island (LFA 17) and 1 % from the North Shore (LFAs 15, 16 and 18).

Magdalen Islands – LFA 22

Minimum catch size

For the sixth year in a row, the minimum catch size for lobster taken in LFA 22 was increased by 1 mm, reaching 82 mm in 2002.

Landings

Lobster landings in the Magdalen Islands totalled 2,024 t in 2002, compared with 2,177 t in 2001, representing a 7 % decrease. They were 12 % higher than the 25-year average, but 10 % below the average for the 1990s. In 2002, 70 % of lobster landings came from the southern Magdalen Islands (Old Harry to Havre Aubert), while 30 % came from the northern

Table 1. Quebec lobster landings (t) by fishing area, 1984–2002.

	North Shore - Anticosti				Gaspé Peninsula			Magdalen Island	Total
	15	**16**	**17**	**18**	**19**	**20**	**21**	**22**	
1984	41	10	10	-	8	573	40	1193	1875
1985	30	14	38	-	26	510	33	1458	2109
1986	51	5	51	-	9	513	28	1581	2238
1987	34	5	117	-	9	553	27	1878	2623
1988	42	6	68	-	21	530	44	1798	2509
1989	32	19	91	-	21	592	38	2375	3168
1990	31	20	51	-	26	709	70	2380	3287
1991	29	11	75	-	22	626	64	2646	3473
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	2142	3393
1996	14	18	155	6	36	1016	39	2219	3503
1997	19	12	184	19	23	648	37	1883	2825
1998	18	15	130	7	32	889	42	1915	3049
1999	18	22	178	8	40	981	30	1936	3214
2000	38	11	148	21	36	1053	26	2080	3413
2001[1]	26	17	139	3	30	911	18	2177	3321
2002[1]*****	11	8	135	2	28	743	18	2024	2969

[1]: declared landings only

* preliminary data

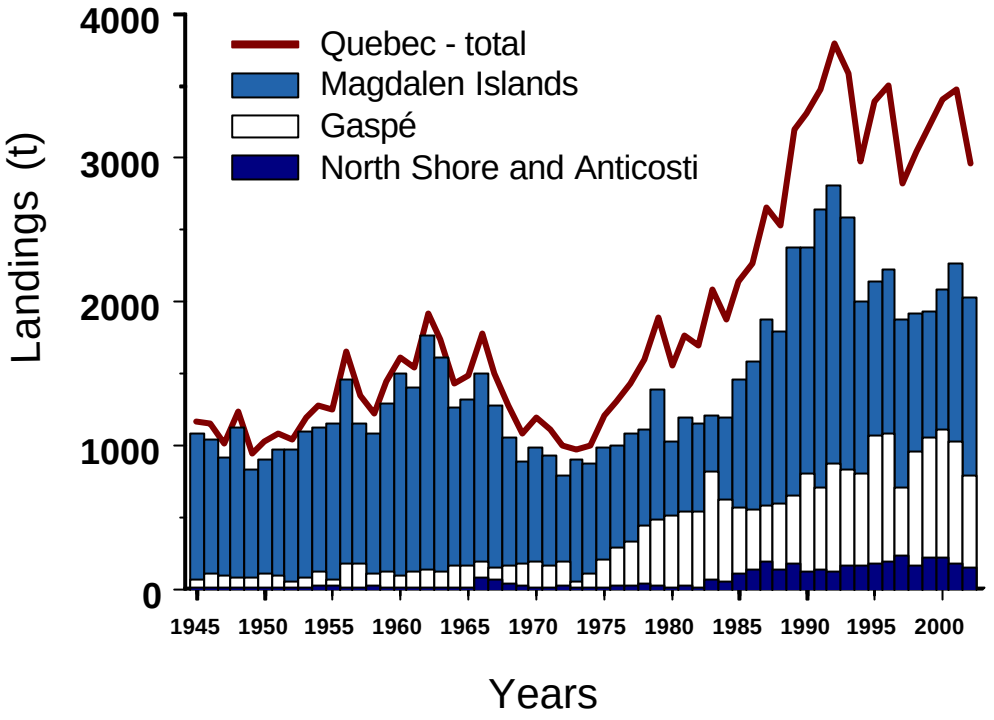

Figure 2. Quebec lobster landings (t), 1945–2002.

Magdalen Islands (Grosse Île to Millerand). Southern and northern landing levels were down by 6 % and 9 %, respectively, from 2001. For the area as a whole, the 2002 fishing season was colder than in the four previous years (1998–2001), but faced similar conditions to those in 1997.

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. Over the past 18 years, 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 (Figure 3). In 2002, the average CPUE was 0.67 lobsters per trap, representing a decrease of 15 % from 2001. The 2002 CPUE is 13 % below the series average. However, when expressed as a weight, the average CPUE for 2002 corresponded to the series average (0.4 kg/trap). 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. Yields in number in the northern Magdalen Islands dropped considerably in 1997 and have remained low ever since. However, with the exception of 2002, yields in weight have been rising since 1997. In 2002, they were down 19 % in number and 7 % in weight from the series average. 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

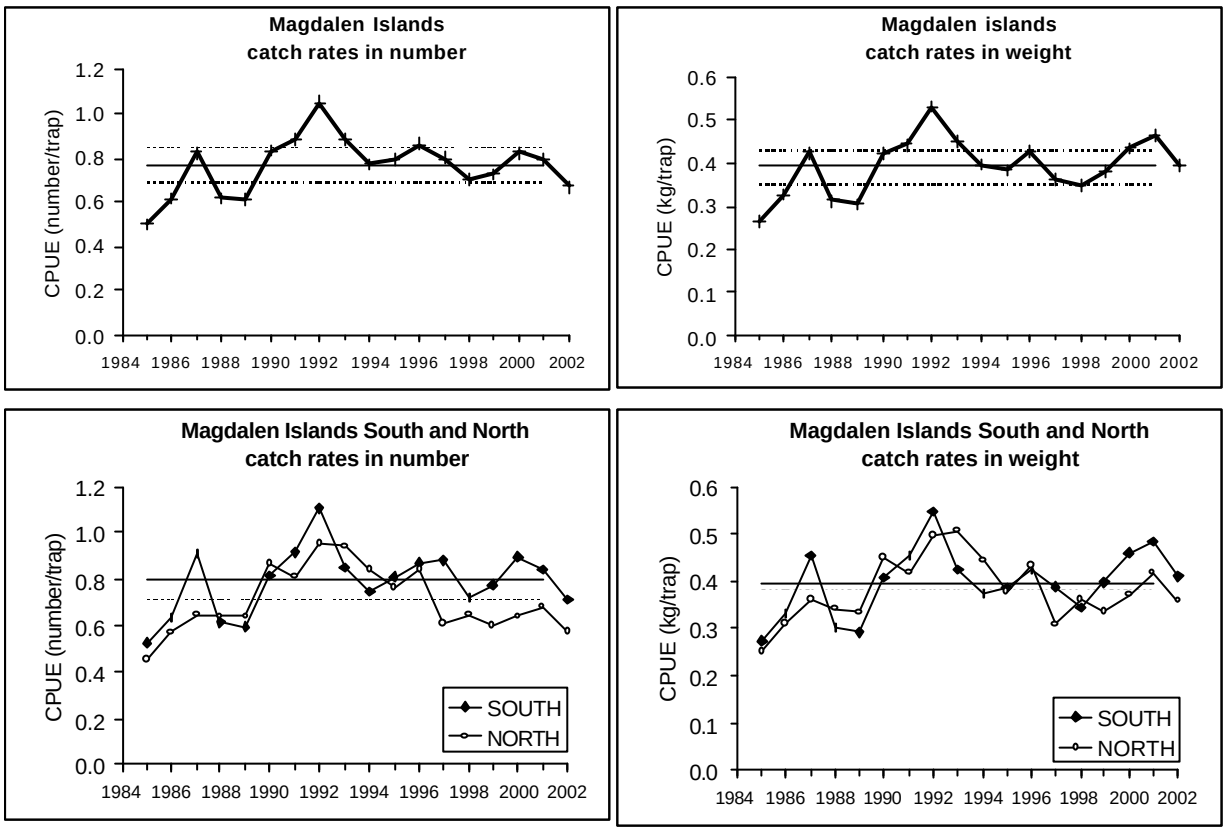

Figure 3. Catch rates (CPUE) in number and weight of commercial-sized lobsters per trap. Top: Annual averages, 1985–2002, for the Magdalen Islands as a whole. The solid line represents the average for 1985–2001 and the dotted lines represent the 10% interval around the average. Bottom: Annual averages for the southern and northern Magdalen Islands. The solid line represents the series averages (1985–2001) for the southern Magdalen Islands and the dotted line represents the series average for the northern Magdalen Islands.

been noted (Figure 4). The mean size of lobsters caught increased by approximately 5 mm in 2002, compared with 1996, and mean weight was up by about 22 %. Landings in 2002 consisted of larger lobsters, and the proportion of "market" lobsters (≥ 83 mm) was 91 % and 93 % in the southern and northern Magdalen Islands, respectively, compared with averages of 54 % and 65 % from 1993 to 1996. These changes are significant and represent the kind of results expected in a recruitment fishery when the minimum catch size is increased.

Exploitation rates are calculated for male lobsters and 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. Exploitation rates for commercial-size male lobsters remain high in the southern and northern Magdalen Islands and are increasing steadily (Figure 5). They reached 82 % and 72 %, respectively, in 2001, compared with the 1985–2000 averages of 65 % and 53 %. The mortality of females is presumably lower because of their protection when berried. A new way of calculating the exploitation rate (change-in-ratio)

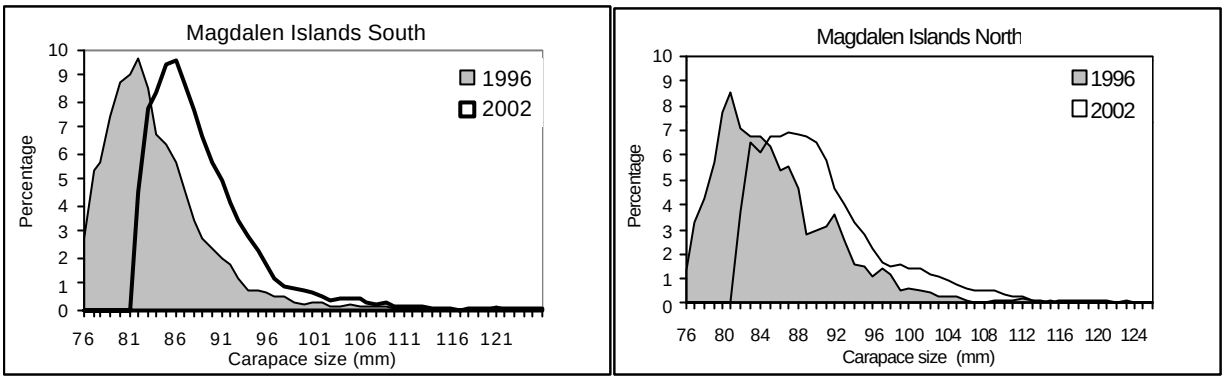

Figure 4. Size frequency distribution for lobster caught in the southern and northern Magdalen Islands in 2002 and 1996.

applied to the proportion of males ≥76 mm in the stock indicates that the exploitation rate has decreased since the minimum catch size was increased. Preliminary data suggest that in 2002 the exploitation rate for this proportion of the stock was about 45 %, compared with 75 % for the harvestable portion (≥ 82 mm). The proportion of jumbo lobster (≥ 127 mm CL) remains very low (< 1 %), due to the high exploitation rate that prevents lobsters from reaching large sizes.

Egg production

The results of a simulation model show that with the 6-mm increase in minimum catch size, egg production per recruit appears to have increased by approximately 75 % from 1996 levels. The objective of the conservation plan is to double 1996 EPR levels (i.e. increase them by 100 %). 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 indicate that the abundance of berried females has increased in recent years, which has no doubt helped boost egg production in stocks. In the last two years in the southern Magdalen Islands, the CPUE of berried females at the end of the season was approximately 0.35 lobsters per trap versus 0.28 lobsters per trap in 2000 and 0.19 lobsters per trap in 1999. In the northern Magdalen Islands, the CPUE was approximately 0.2 lobsters per trap in 2001 and 2002, compared with 0.12 and 0.11 lobsters per trap in 2000 and 1999, respectively. Observations made during the trawl survey indicate a marked increase in the abundance of berried females. With the increase in minimum catch size, more berried females will have the chance to spawn before being harvested. The increases observed are in line with expectations.

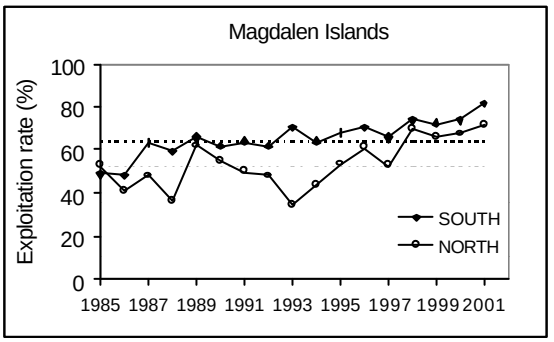

Figure 5. Exploitation rate indices for commercial-size males in the southern and northern Magdalen Islands, 1985–2001. The dotted lines indicate the mean data for 1985–2000.

Recruitment

The abundance of commercial-size lobster (≥ 83 mm in 2003) determined from trawl survey data is high and suggests that current landing levels could be maintained in 2003. However, prerecruit and juvenile abundance indices were down in 2002, suggesting a possible drop in fishing recruitment in the coming years. Annual monitoring of postlarval lobsters (5–10 mm) that settle on the sea floor was cut short in 2002, but data gathered until 2001 show that the abundance of cohorts varies from year to year. For now, however, it is difficult to predict what effect these fluctuations will have on recruitment to the fishery.

Summary

The conservation measures taken since 1997 have had a tangible, positive impact on lobster stocks. Egg production has increased and the growth potential

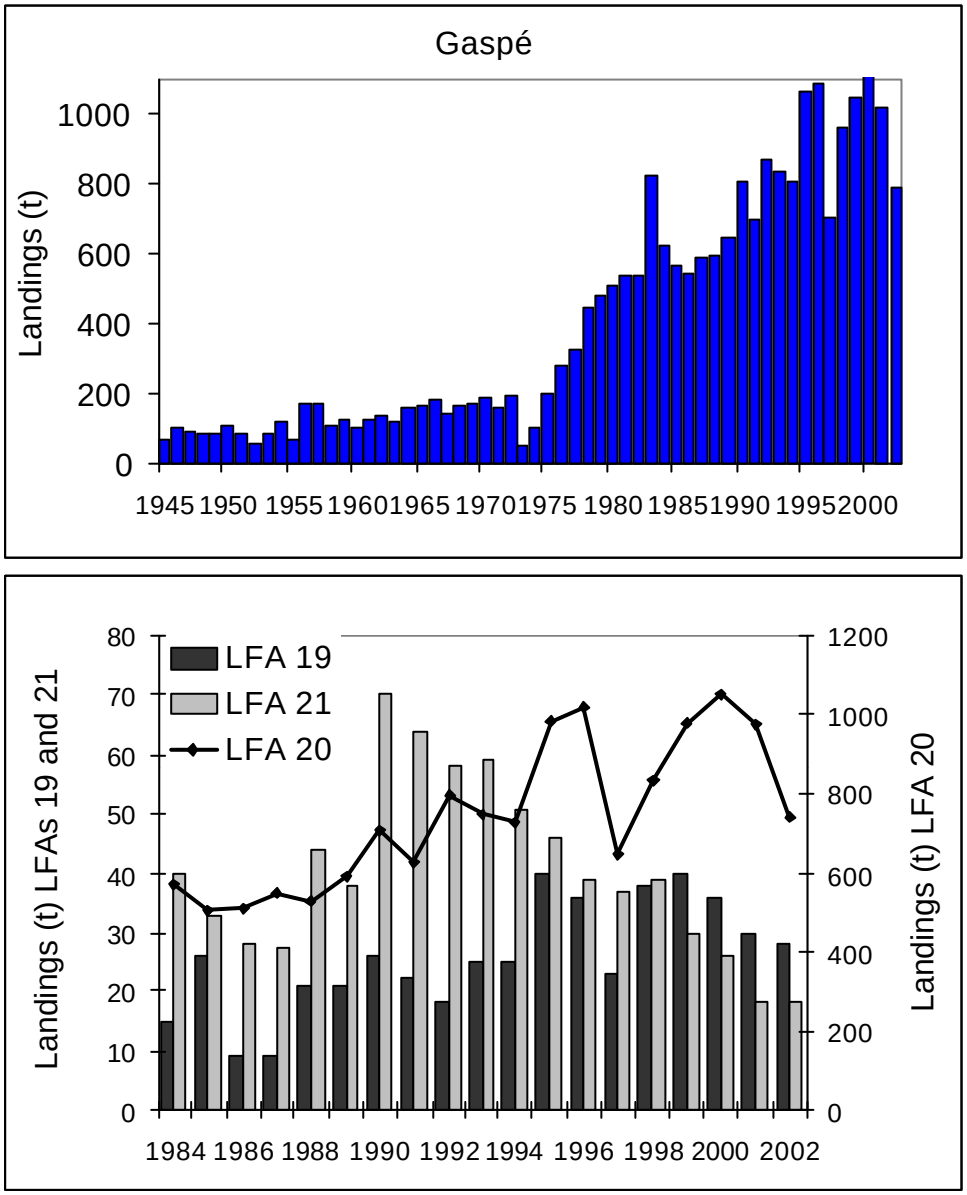

Figure 6. Gaspé lobsters landings (t) since 1945 and in LFAs 19, 20 and 21 (1984–2002).

of lobster is better expressed. The objective of doubling egg production per recruit should be reached by increasing minimum catch size to 83 mm. Doubling egg production per recruit is the first step in meeting the conservation objectives that are also intended to ensure the distribution of egg production between primiparous and multiparous females and to improve the size structure of stocks. Exploitation rates remain high and need to be reduced. Such high exploitation rates make the fishery heavily dependent on annual recruitment, offset the expected benefits of increasing the minimum catch size, and slow down the increase in the proportion of multiparous females in stocks. Measures to reduce fishing effort (e.g. reducing the number of licences and closing areas) and increase the number of multiparous females in stocks (size windows, maximum size or the resumption of V-notching berried females) will eventually need to be implemented to meet conservation objectives other than that of doubling egg production per recruit.

Gaspé Peninsula – LFAs 19, 20 and 21

Minimum catch size

In 2002, the minimum catch size for taking lobster around the Gaspé Peninsula was increased to 81 mm in LFAs 20A3, 20B8 and 21. It was already 81 mm in LFAs 19, 20A1 and 20A2 in 2001 and remained unchanged in 2002.

Landings

In 2002, lobster landings in LFA 20 totalled 789 t, a decrease of 17 % from 2001 (959 t) (Table 1, Figure 6). Landings in 2002 were 11 % below the average for the 1990s (890 t), but 8% above the 18-year average (731 t). In the Gaspé in 2002, 93 % of landings were from LFA 20, 3.5 % were from LFA 19 and 3.5 % were from LFA 21. Landings in LFA 19 totalled 28 t in 2002, which was slightly below levels that have been observed since 1995 (30–40 t), with the exception of 1997, which was disastrous due to poor weather conditions. Landings in LFA 21A totalled 16 t in 2002, compared with 14 t in 2001, but have been dropping since 1990. Landings recorded in LFA 21B in the spring totalled 6 t, a decrease of 22 % from landings made in the spring of 2001. The decrease in spring landings can be attributed to a cold fishing season, which can reduce lobster catchability. However, the spring fishery may also have been affected by the preceding fall fishery that landed 7 t. Legal-size lobster are 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 affected by fishing intensity during the previous fall. The spring fishery could even be seriously compromised if fishing is too intense in the fall.

Many factors can explain the decrease in landings in 2002. The fishing season was very cold, which could have impacted catchability. In addition, the 1-mm increase in minimum catch size can account for up to 10 % of the drop in landings and yields in certain sectors. Fishers report that bigger escape vents, whose size was increased from 43 mm to 46 mm, also caused commercial-size lobster landings to decrease. However, data gathered using traps with blocked escape vents do not show changes in the selectivity of commercial sizes. Decreases that have been noted in

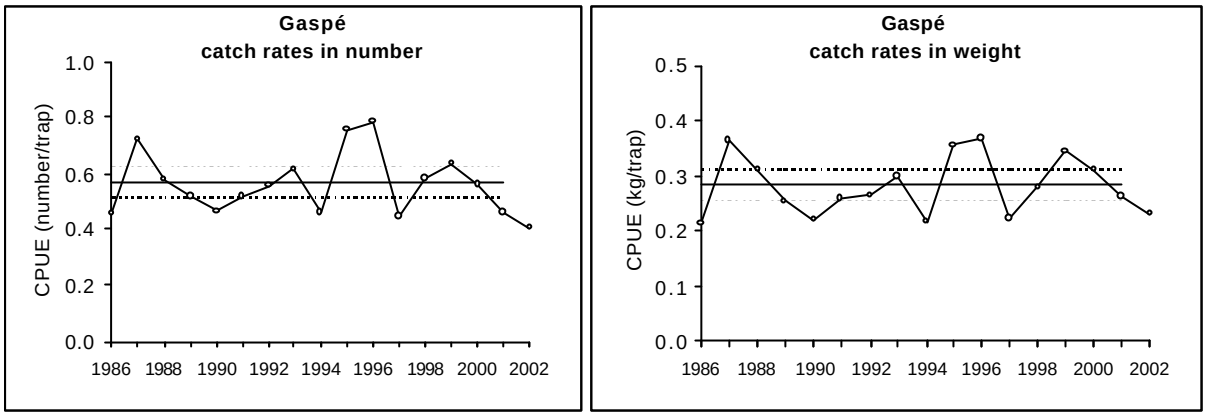

Figure 7. Catch rates (CPUEs) in number and weight of commercial-size lobsters per trap. Annual averages, 1986–2002 for the Gaspé (LFA 20). The solid line represents the average for 1986–2001, while the dotted lines represent the 10% interval around the average.

certain sectors since 1999 and 2000 may reflect a drop in lobster abundance.

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 (kg) per trap. Since 1986, the average annual CPUE of commercial-size lobster in LFA 20 has ranged from 0.4 to 0.8 lobsters per trap (Figure 7). In 2002, the CPUE was 0.41 lobster/trap, its lowest level in the series. It was 28 % below the average (in number) for 1986–2001 (0.57 lobsters per trap) and 18 % below 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. In addition to the overall drop in catch rates in most LFAs in 2002 for the above-mentioned reasons, significant drops in yields have been noted in the sector of St Godefroi/Shigawake (20B6) since 1999 and in La Malbaie Bay/Pointe St Pierre (20A2) since 2000. These decreases could indicate weaker lobster abundance in these sectors. Unlike those in other areas, catch rates in LFA 19 remained unchanged in 2002 from 2001. It is important to keep in mind that minimum catch size in this area was increased to 81 mm in 2001 and that it remained unchanged in 2002. The fishing season also started late and weather conditions were favourable to lobster harvesting. The CPUEs in LFA 21B were very low in the spring of 2002, compared with those that have been recorded since 1997. However, 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 from 4mm to 5 mm in 2002 compared with 1996, while mean weight rose by about 15 %. Landings in 2002 consisted of larger lobsters and the

proportion of "market" lobsters (≥ 83 mm) was 82 % in 2002, 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. However, size structures observed in 2002 indicate a shift toward smaller sizes compared with trends observed in 2001, whereas the opposite was expected to happen following the increase in minimum catch size. This could be attributable to high exploitation rates or weaker growth. Fishers report that larger lobsters occurred in fishing grounds only after the end of the fishing season (observations made by divers).

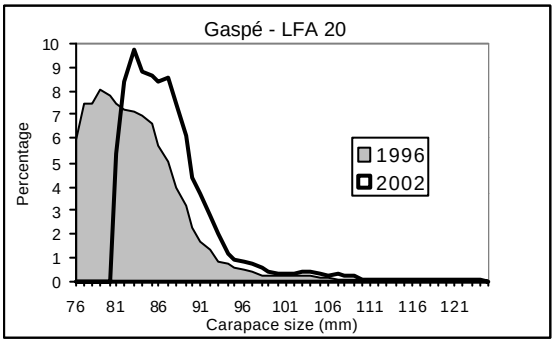

Figure 8. Size frequency distribution for lobster caught in the Gaspé in 2002 and 1996 (LFA 20).

Exploitation rates are calculated for males and 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 for commercial-size males has increased in LFA 20 in recent years, peaking at 88 % in 2001 (Figure 9). Female mortality is presumably lower because of their protection when berried. A new way of calculating the exploitation rate (change-in-ratio) applied to the proportion of males ≥76 mm in the stock indicates that the exploitation rate has decreased since the minimum catch size was increased. Preliminary data suggest that in 2001 the exploitation rate for this portion of the stock was about 60 %, compared with 80 % for the harvestable portion (≥ 80 mm, for 2001).

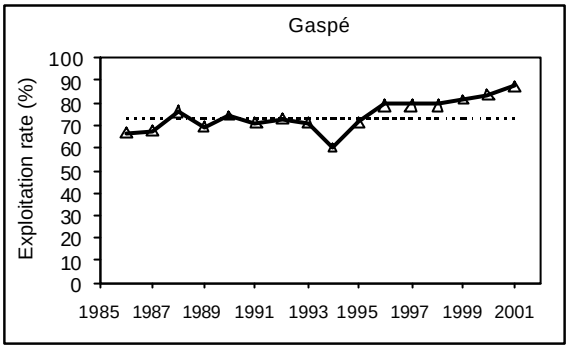

Figure 9. Exploitation rate index for commercial-size male lobsters in the Gaspé, 1985–2000. The dotted line represents the average for 1986–2000.

The proportion of large lobsters remains low and jumbo lobster (≥ 127 mm CTL) accounted for only 0.04 % of the catch (in number) in 2002. The mean size of lobsters in LFAs 19 and 21 is bigger than that of lobsters in LFA 20. More jumbo lobsters were also found there, accounting for 4.5 % and 1.6 % of the catch, respectively.

Egg production

The results of a simulation model show that with the 5-mm increase in minimum catch size, egg production per recruit appears to have increased by approximately 90 % from 1996 levels. The objective of the conservation plan is to double 1996 EPR levels (i.e. increase them by 100 %). 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 indicate that the abundance of berried females has increased in recent years in LFA 20. With the increase in minimum catch size, more berried females will have the chance to spawn before being harvested. Over time, the number of berried females should rise in samples. The increases observed are in line with expectations. However, the increase in the number of berried females could also reflect a rise in the exploitation rate or changes in fishing areas or strategies.

Recruitment

It is difficult to predict 2003 landing levels. The abundance of prerecruits has dropped significantly due to bigger escape vents. However, data derived from traps with blocked escape vents indicate a decrease in the level of prerecruits, which could be attributable to lower catchability. No reliable predictions can be made for 2003 based on 2002 data.

Summary

The conservation measures taken since 1997 have had a tangible, positive impact on lobster stocks. Egg production has risen and the growth potential of lobster is better expressed. The objective of doubling egg production per recruit would be reached by increasing the minimum catch size by another 1 mm. Doubling egg production per recruit is the first step in meeting the conservation objectives that are also intended to ensure the distribution of egg production between primiparous and multiparous females and to improve the size structure of stocks. Exploitations rates are very high and rising steadily and need to be reduced. Such high exploitation rates make the fishery heavily dependent on annual recruitment, offset the expected benefits of increasing minimum catch size, and slow down the increase in the number of multiparous females in stocks. Measures to reduce fishing effort (e.g. reducing the number of licences and closing areas) and increase the proportion of multiparous females in stocks (size windows, maximum size or resumption of V-notching berried females) will eventually need to be implemented to meet conservation objectives other than that of doubling egg production per recruit.

In future, it will be important to closely monitor the development of the fall fishery in LFA 21B. A fall fishery with a nominal effort equal to that in the spring will result in higher mortality because of the higher catchability during that period. 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 record levels in this area. If such a fishery were to become intensive, it could compromise the spring fishery. The fall fishery could also impact other LFAs if lobsters migrate between these areas. This hypothesis is currently being studied.

North Shore – LFAs 15, 16, and 18

Minimum catch size

The minimum catch size for taking lobster on the North Shore was raised from 76 mm to 78 mm in 1998. It remained unchanged in 1999 and was increased to 79 mm in 2000 and to 80 mm in 2001. It remained at 80 mm in 2002.

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 2002 totalled 11 t, a decrease of at least 50 % from 2001 levels. However, landings in 2000 and 2001 were above average, at 38 t and 26 t, respectively. Since 1994, landings have generally remained below 20 t, while they were higher (average of 35 t) between 1984 and 1993. Since 1984, landings in LFA 16 have fluctuated between 10 t and 20 t, without following any particular trend. They totalled 8 t in 2002, down by more than 50 % from 2001 levels. The 2002 fishing season was subject to cold waters, which could have adversely affected lobster catchability.

Landings are very low in LFA 18, and the marked fluctuations are mainly caused by the 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 2001, the average annual CPUE observed during at-sea sampling ranged from 0.3 to 0.4 lobsters per trap. The average annual CPUE recorded in 2002 was 0.19 lobsters per trap, down 45 % from 2001 and 46 % below the average for 1993–2001 (0.35 lobster/trap). From 1996 to 2001, the average CPUE of index fishers fluctuated between 0.1 kg/trap and 0.17 kg/trap. In 2002, this figure was 0.09 kg/trap, a decrease of 45 % from 2001 and 30 % below the average for 1996–2001.

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. In addition, the 2002 fishing season was subject to colder water conditions, which could have adversely affected lobster catchability. This would partially explain lower landings and yields in 2002. Such a situation was also noted in the Gaspé. However, recruitment overfishing has not been ruled out. Immature individuals are taken and, when considering the size structures, the exploitation rate appears quite high. Egg production may be weak and limiting, especially in years when weather conditions are not favourable to larval development and benthic settlement.

Catch composition

In 1998, following the increase in minimum catch size, the mean size of lobsters landed in LFAs 15 and 16 rose slightly, but decreased in 1999 and 2000. The mean size of lobsters landed rose sharply in 2001, but dropped slightly in 2002. Mean size fluctuations are not related to minimum catch size and may reflect changes in fishing or sampling areas. Throughout the 1990s, size frequency distributions occasionally showed a few modes in the larger size groups, but size structures generally seem to indicate relatively high exploitation rates. No jumbo lobsters ($\geq$ 127 mm CL) were ever observed in samples. Over the years, berried females have been observed in catches,

mainly at the end of the fishing season, in proportions that ranged from 5% to 35 % between 1993 and 2002. However, CPUEs indicate that they are not abundant (approximately one berried female per 100 traps). The average size of berried females is about 90 mm. Observations made in 2000 in LFA 15 showed that 50 % of females reach sexual maturity at approximately 92 mm.

Egg production

Egg production per recruit was not calculated specifically for North Shore sectors. Nevertheless, because of the large size at sexual maturity and high exploitation rates, the situation could, at best, 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 E/R levels recorded when the minimum catch size was 76 mm.

Summary

Doubling egg production per recruit is but a first step in meeting conservation objectives. Although increasing minimum catch size to 82 mm would very likely double egg production per recruit, 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 taking lobster around Anticosti Island was increased from 76 mm to 78 mm. It was subsequently increased to 80 mm in 2000, 81 mm in 2001 and 82 mm in 2002.

Landings

Lobster landings from Anticosti Island generally account for 3 % or 4 % of total landings in Quebec. They rose steadily from 76 t to 184 t between 1991 and 1997. In 2002, Anticosti Island landings totalled 136 t, which is above the 10-year average (128 t). A dockside monitoring program (involving the counting of crates) was instituted in 2000 to obtain more reliable landing data.

Catch rates

Since there is no regular at-sea sampling for Anticosti Island, no catch rate data could be tabulated for 2002. However, high catch rates (1.6 lobsters per trap and 0.8 lobsters per trap in the middle and at the end of the fishing season) were observed in at-sea sampling conducted in 1997.

Catch composition

The demographic profile of the Anticosti Island lobster population is characterized by several modes. The exploitation rate in this fishing area is far lower than elsewhere (about 20 %), and so a demographic structure

characterized by several moult-groups has been maintained. This situation, which the FRCC considers ideal, is very different from that observed in other LFAs, where additional conservation measures are needed. The mean size of commercial-size lobster measured at dockside between 1998 and 2002 ranged from 92 mm to 102 mm. In addition, the proportion of jumbo lobsters (≥ 127 mm) is higher than in other lobster stocks in Quebec; it was 7.5 % (in number) in 2002. The berried females that were observed during sampling at sea in 1997 were large, because their sexual maturation is delayed. According to cement gland observations made in 2000, females reach sexual maturity at ≈92 mm.

Egg production and summary

Egg production per recruit has not been calculated for Anticosti Island. Nevertheless, because of the lower exploitations 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 reduces fishing pressure on immature lobster and thus promotes 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). The larvae from larger females are themselves larger and heavier at emergence. It has also been observed that larger, heavier larvae have a faster growth rate and are larger at the time they settle on the sea floor. All of these characteristics may indicate better survival potential of larvae produced by multiparous females.

The increase in the minimum catch size will continue to cause changes in both catch rates and size structures. If recruitment remains constant, the number of lobster caught can be expected to decrease. Some lobster will not be taken until a year or two later, when their numbers will have been reduced by natural mortality, which is estimated at about 10 % to 15 % per year. However, they will be bigger, because the additional moult will have enabled them to increase their weight by about 45 %. The greater weight gains should more than offset the lower numbers, as far as males and immature females are concerned.

As for mature females, increasing the minimum catch 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 will decline. Marked changes in this direction have recently been observed in the Magdalen Islands and the Gaspé.

To date, 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. 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 never becomes 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.

Our ability to predict landings is still poor for most lobster stocks of the inshore waters of Quebec. However, the trawl survey that has been conducted since 1995 in the southeastern Magdalen Islands seems to offer some potential in this regard. In 2002, the abundance of the lobster that will be available to the fishery in 2003 was high, suggesting that 2003 landings could be similar to those in 2002. In the Gaspé, an index of recruitment to the fishery is derived from samples taken using traps with blocked escape vents. This index is less reliable because it reflects not only lobster abundance, but also lobster catchability. No reliable forecast can be made for 2003.

References

FRCC, 1995. A Conservation Framework for Atlantic Lobster. 53 pp. + appendices.

Gendron, L. and G. Savard. 2000. État des stocks de homard des eaux côtières du Québec en 2000 et suivi des impacts de l'augmentation de la taille minimale de capture. CSAS Research Document 2000/15. 73 pp.

Gendron, L. and P. Gagnon. 2001. Impact of various fishery management measures on egg production per recruit in American lobster (*Homarus americanus*). Can. Tech. Rep. Fish. Aquat. Sci. 2369: vi + 31 p.

Correct citation for this publication:

DFO, 2003. Lobster of the Inshore Waters of Quebec in 2002. DFO – Science, Stock Status Report 2003/013.

For more information:

Louise Gendron
Maurice-Lamontagne Institute
850 route de la Mer
P.O. Box 1000
Mont-Joli (Québec)
G5H 3Z4
Tél. (418)775-0618
Fax. (418)775-0740
Email: gendronl@dfo-mpo.gc.ca

This report is available from the:

Regional Science Advisory Bureau,
Department of Fisheries and Oceans,
Maurice Lamontagne Institute,
P.O. Box. 1000, Mont-Joli,
Quebec, Canada
G5H 3Z4

Email: Bras@dfo-mpo.gc.ca

ISSN 1480-4913

La version française est disponible à l'adresse ci-dessus.