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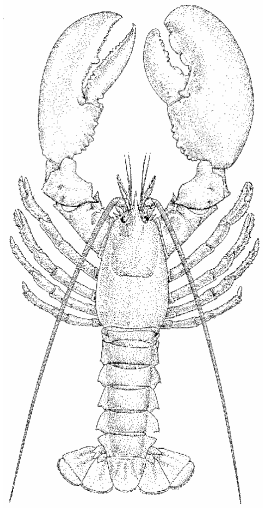
ASSESSMENT OF THE LOBSTER STOCKS OF THE GASPÉ PENINSULA (LFAs 19, 20, and 21) IN 2005



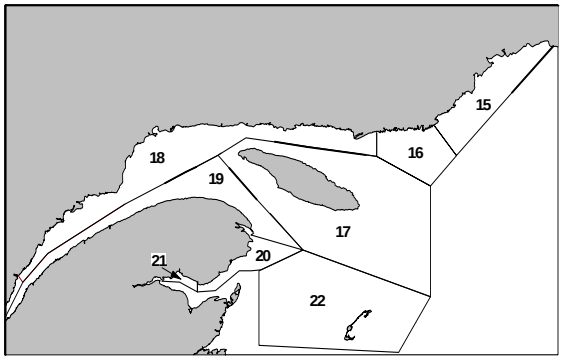


Figure 1: Map showing the lobster fishing areas (LFAs) in Quebec (LFAs 15 to 18, North Shore and Anticosti, LFAs 19 to 21, Gaspé Peninsula, and LFA 22, Magdalen Islands).

Context

Lobster fishing is practiced along the Gaspé Peninsula by 203 fishing enterprises distributed among 3 lobster fishing areas (LFAs 19, 20, and 21) (Figure 1). These LFAs are subdivided in 27 sub-areas to distribute the fishing effort across the whole of the Gaspé Peninsula territory (Figure 2). The lobster fishery is managed by controlling the fishing effort and is also subjected to a regulation prescribing a minimum legal size and the protection of berried females in order to maintain the reproductive potential. The minimum legal size has been increased since 1997 at a rate of 1-2 mm every 1 or 2 years. The minimum legal size, which was established to 76 mm between 1957 and 1996, reached 82 mm (carapace length) in 2004. This increase made it possible to achieve the goal of doubling the egg production per recruit compared to the levels of 1996. The resource status assessment is done on an annual basis in order to closely monitor the impacts of the changes made to the management measures of the lobster population and to focus on the elements for which additional conservation efforts would be desirable.

SUMMARY

- In 2005, landings and CPUEs in the Gaspé Peninsula dropped in most of the sampled sub-areas. Weather factors can partially explain these drops, but in some areas, they can also be the result of a decrease in recruitment.

- The average sizes and weights have stabilized since the end of the increase in minimum legal size, up to 82 mm in 2004. The size is now 7% larger and the weight 25% higher than before 1997, when the minimum legal size was 76 mm.

- Marked differences were observed between the size structures of males and females due, among other things, to a decrease in female growth when they reach their sexual maturity and to the fact that females that spawn enter the fishery a year later than males.

- The 2004 exploitation rates calculated for males in the commercial portion were above 80% in the Gaspé Peninsula. A lower fishing mortality level is desirable.

- The abundance of berried females is significantly higher than it was before the increase of the minimum legal size; during the same period, the egg production index doubled. The number of multiparous females also increased, but their proportion compared to primiparous females did not change significantly between 1996 and 2005.

- In order to decrease exploitation rates, measures to reduce fishing effort by 15% have been proposed to the industry for most of the fishing sub-areas of the Gaspé Peninsula. This would therefore make it possible to reduce the fishery's dependence on annual recruitment, to increase the levels of egg production per recruit, to increase the proportion of multiparous females in the population, and to ensure their reproductive success by keeping balanced sex ratios.

- In the specific case of LFA 21B, it is recommended to limit the annual fishing effort so that it does not exceed the historical levels for this area, by taking into account the greater effectiveness of the traps used during the fall fishery when calculating the total effort.

INTRODUCTION

Biology

American lobster (*Homarus americanus*) occurs along the west coast of the Atlantic Ocean, from Labrador to Cape Hatteras. Adult lobsters prefer rocky substrates where they can find shelter, but can also live on sandy and even muddy bottoms. Commercial concentrations are generally found at depths of less than 35 m. In the Gaspé Peninsula, females reach sexual maturity at around 82 mm of carapace length. Males reach sexual maturity at a smaller size. Females generally have a two-year reproductive cycle, spawning one year and moulting the next. Females spawning for the first time can produce nearly 8,000 eggs, while large females measuring 127 mm (jumbo size) can lay up to 35,000 eggs. Once released, the eggs remain attached to the females' swimmerets for 9 to 12 months, until the planktonic larvae emerge the following summer. The larvae's planktonic phase lasts from 3 to 10 weeks, depending on the temperature of the water. Following metamorphosis, postlarval lobsters (stage IV), which now resemble adult lobsters, drift down from the surface layer to settle on the sea floor. During the first few years of benthic life or until they reach approximately 40 mm, lobsters lead a cryptic existence, i.e. they live hidden in habitat providing many shelters. Lobsters are estimated to reach the minimum legal size (82 mm) around 8 years of age, after having moulted approximately 16 times since their benthic settlement.

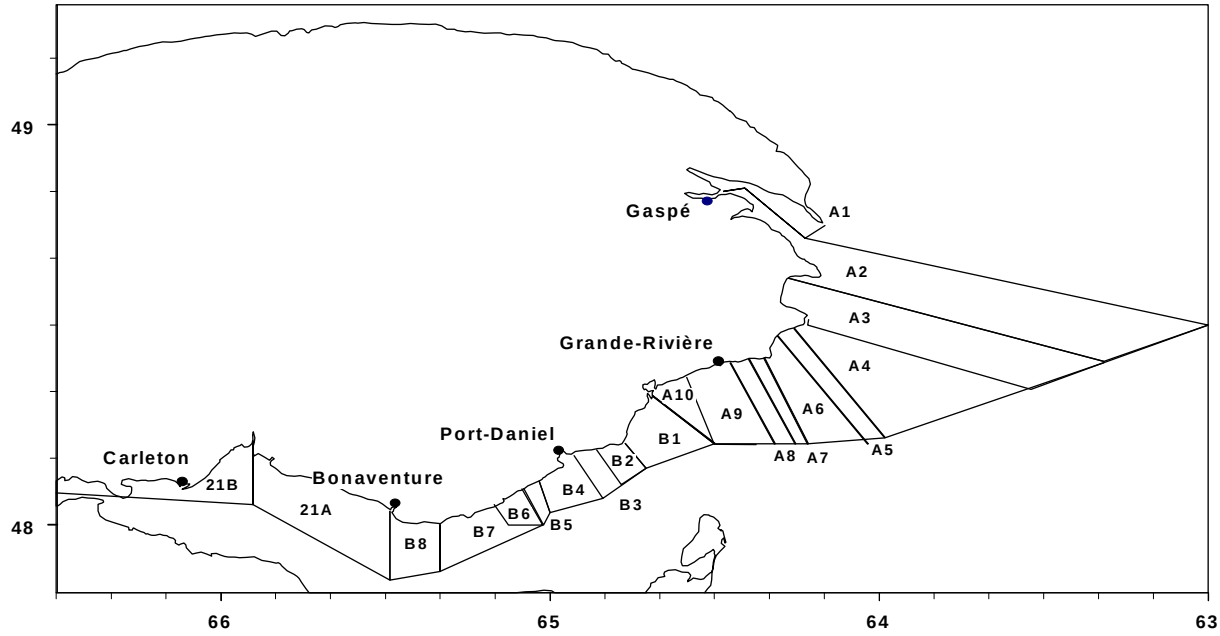


Figure 2. Lobster fishing sub-areas on the southern side of the Gaspé Peninsula, LFA 20A (A1 to A10), LFA 20B (B1 to B8), and LFA 21 (A and B).

Fishery management

The lobster fishery is managed by controlling fishing effort by restricting the number of licences, the number and size of traps, and the duration of the fishing season. The lobster fishery is a spring activity that lasts 10 weeks in the Gaspé Peninsula. However, the Listuguj First Nation has been practicing a fall subsistence fishery since 2002 in LFA 21B, which lasts 3 weeks. In 2005, 203 commercial licences were issued with a limitation of 250 traps each. In 2005, an allowance of 500 traps was granted to the Listuguj First Nation for their fall subsistence fishery. From 2002 to 2004, they had been limited to 400 traps. In addition to the size of the traps, which is currently limited to 92 cm in length, 61 cm in width and 50 cm in height, the presence of escape vents on traps has been mandatory since 1994, and the size of their vertical opening went from 43 mm to 46 mm in 2002. In 2005, the minimum legal size was 82 mm, and the release of berried females was mandatory. V-notching (making a V-notch on telson) of berried females is made on a voluntary basis in some sectors of the Gaspé Peninsula.

ASSESSMENT

Source of data

The stock status assessment is based on abundance indicators derived from landings recorded on processing plant purchase slips, catch rates of commercial-size lobsters obtained from commercial capture at-sea samplings, and logbooks kept on a voluntary basis since 1992 by a variable number of index fishermen (from 4 to 12). In 2005, a logbook implementation pilot-project was launched in the Gaspé Peninsula. Eight fishermen agreed to complete the logbook, but only three of them made it throughout the season. The assessment is also based on the analysis of the size structures of lobsters captured at sea, which are used to follow the evolution

of the average and maximum sizes, to estimate the exploitation rates, to assess the abundance of berried females, and to calculate a relative index of egg production. At-sea sampling has been conducted annually since 1986 at La Malbaie (20A2), Ste-Thérèse/Grande-Rivière (20A8-A9) and Shigawake/St-Godefroi (20B5-B6). It was also carried out from 1997 to 2004 in 21B during the spring fishery, from 2002 to 2004 during the fall fishery, and from 2000 to 2004 in 19C. Dockside sampling replaced at-sea sampling in the LFAs 21B (spring and fall) and 19C in 2005.

Landings

Landings for the whole of the Gaspé Peninsula reached 698 tons in 2005 (preliminary data), which represents a reduction of 16.6% compared to 2004 (837 tons). These are 10.9% lower than the average of the last 25 years (783 tons) (Figure 3A). Reductions were observed in most of the 27 sub-areas. In LFA 20, landings reached 647 tons in 2005, an 18% reduction compared to 2004 (Figure 3B). In 2005, 93% of the Gaspé landings were from LFA 20, 4% from LFA 19, and 3% from LFA 21.

In 2005, landings from LFA 19 reached 28 tons (Figure 3C). Their levels have remained relatively stable since 2001 and slightly above the average of 26 tons landed for the 1984-2004 period.

Landings from LFA 21A totalled 14 tons in 2005, as in 2004 (Figure 3D). These were below the average of 21 tons recorded from 1984 to 2004. Fishing effort has slightly decreased in LFA 21A since 2001 due to the buyback of five of the eight commercial licences, which were transferred thereafter to the Gesgapegiag First Nation in Maria. For the moment, only four of the five First Nation's licences are active.

Since 1999, landings made in LFA 21B during the spring have remained below 10 tons (Figure 3E). They totalled around 20 tons at the beginning of the 1990s. In the spring of 2005, captures of 5.2 tons were reported compared to 4.2 tons in 2004. Fishing effort has decreased in LFA 21B since 1997. Between 1997 and 2001, five commercial licences out of six were bought back and transferred to the Listuguj First Nation. The First Nation exploits 4 commercial fishing licences in the spring, but only two were really active in 2005. In the fall of 2005, captures of 4.2 tons were landed, compared to 5.0 tons during the fall of 2004. Landings had totalled 8.2 tons during the 2003 fall fishery. It should be noted that spring landing levels of a given year in LFA 21B can be affected by the fishery of the preceding fall could. The annual recruitment of lobsters of legal size occurs during the summer, after the moult season. The fall fishery intercepts the annual recruitment, which makes the spring fishery dependent on the intensity of the preceding fall fishery.

The 2005 fishing season was very windy according to fishermen, who also noted that currents were strong. The fishing season was cold, and the temperature recorders installed on fishermen traps revealed that there had been several periods of water cooling consecutive to upwelling events generated by the winds. Data from index fishermen indicated that the effort made in 2005 represented approximately 80% of the maximum effort authorized, which corresponds to the average observed from 1992 to 2004. However, the level of effort was lower than that observed for the 1999-2003 period, when it averaged 90% of the maximum effort. As a whole, the weather conditions of 2005 would not have been favourable to lobster capture, and this could partly explain the reduction in landings. However, the 2005 unfished biomass should be for the most part present on the fishing grounds next year.

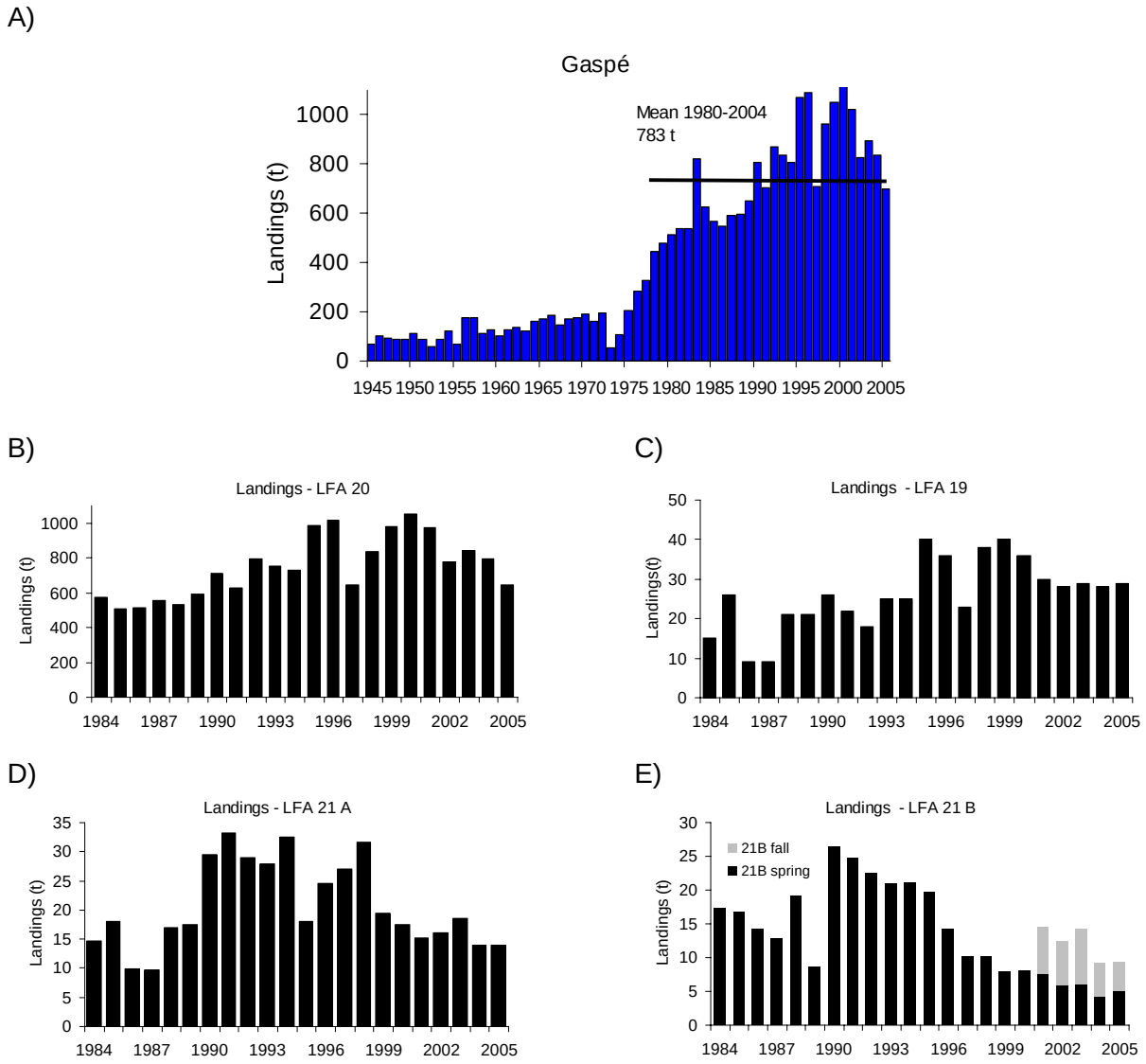


Figure 3. Lobster landings A) in the Gaspé Peninsula from 1945 to 2005, B) in LFA 20, C) in LFA 19, D) in LFA 21A, and E) in LFA 21B.

Catch rates for commercial lobsters

Catch rates correspond to the catches per unit of effort (CPUEs) expressed in number or weight of lobster per trap (Figure 4). Since 1986, in LFA 20, average annual CPUEs of commercial size lobsters derived from at-sea sampling of commercial captures ranged from 0.41 to 0.85 lobsters per trap (l/t). In 2005, CPUEs were 0.38 l/t, which corresponds to a 17.4 % reduction compared to 2004 and to a 30.9% decrease compared to the average of 0.55 l/t for the 1986-2004 time series. It is the lowest value of this series. Average CPUE weight value was 0.24 kg/trap in 2005, which is 8 % lower than the value of 2004 and 10.8 % lower than the average for the series. Logbook data indicate approximately the same trends.

The drop in the CPUE number value observed since 2000 could be associated to the increase in the minimum catch size as lobsters remain on the bottom an extra year before being fished and as they are subjected to an estimated natural mortality of approximately 10-15%. Until very recently, the larger size of lobsters landed compensated for the reduction in numbers. Contrary to what was observed in sector 20A8-A9 where, aside from 2005, the situation was rather stable, the drop in the CPUE number and weight values in the sectors of La Malbaie (20A2) and of St-Godefroi/Shigawake (20B5-B6) seems to be more severe, suggesting a reduction in recruitment.

CPUEs of LFA 19 are among the highest for the Gaspé Peninsula. They represented 0.59 l/t in 2005, which corresponds to a weight of 0.49 kg/t. Since 2001, they have fluctuated between 0.42 and 0.62 l/t, and 0.35 and 0.51 kg/t (Figure 4).

A) B)

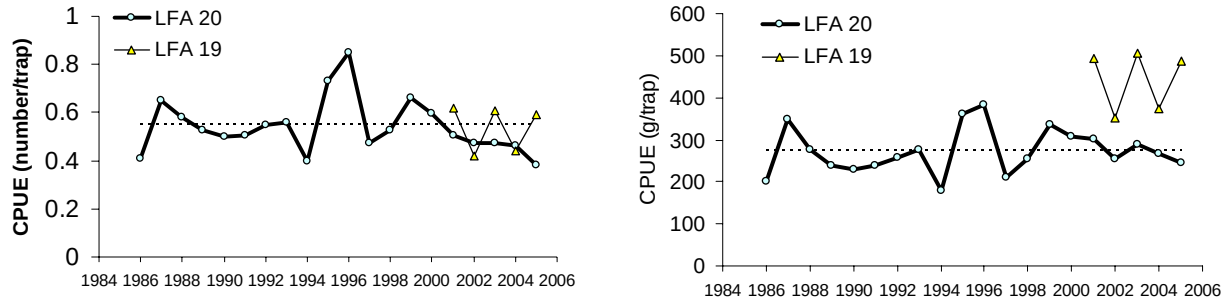


Figure 4. Catch rates (CPUEs) A) in number and B) in weight per trap of commercial-size lobsters from 1986 to 2005 in LFA 20 and from 2001 to 2005 in LFA 19. The dotted line represents the average for 1986-2004 in LFA 20.

In 2005, CPUEs for LFA 21B (spring fishery) were a little higher than in 2004. However, they remain the lowest of the Gaspé Peninsula area. CPUEs measured at the time of the 2005 fall fishery totalled 1.93 l/t on average, which corresponds to 1.1 kg/t. In 2001, fall CPUEs were on average seven times higher than those measured during the spring. The catchability of lobster is higher in the fall than in the spring because lobsters are in their postmoult phase. After moulting, lobsters are looking for food and are more easily attracted by bait in traps.

Catch composition

Size structures, average sizes and weights

In LFA 20, the size composition of landed lobsters stabilized since the end of the increase in the minimum catch size in 2004. The 2004 and 2005 size structures are similar and different from what they were in 1996, before the increase of the minimum catch size (Figure 5). In 2005, the average size of captured lobsters was 88.5 mm for an average weight of 582 g, compared to 88.7 mm and 576 g in 2004. This represents a size increase of 7.5% and a weight increase of 22% compared to 1996. However, in 20A2, the average size was lower in 2005 than in 2004 (Figure 6).

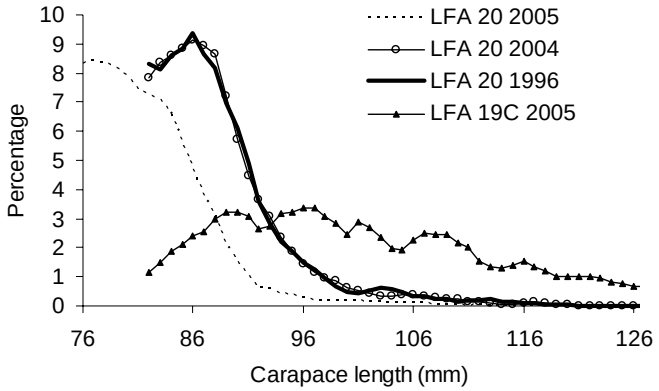


Figure 5. Size frequency distributions of commercial-size lobster in LFA 20 in 1996, 2004 and 2005 and in LFA 19 in 2005.

In LFA 19C, the size frequency distributions are more spread out (Figure 5), and the average lobster size is definitely higher (Figure 6). In 2005, the average size was 102.8 mm, for an average weight of 1.01 kg. Historically, lobsters of LFA 21B (spring fishery) were larger than those of LFA 20. Since 2002, the average size has been declining (Figure 7). This could be the result of an increase in exploitation rates.

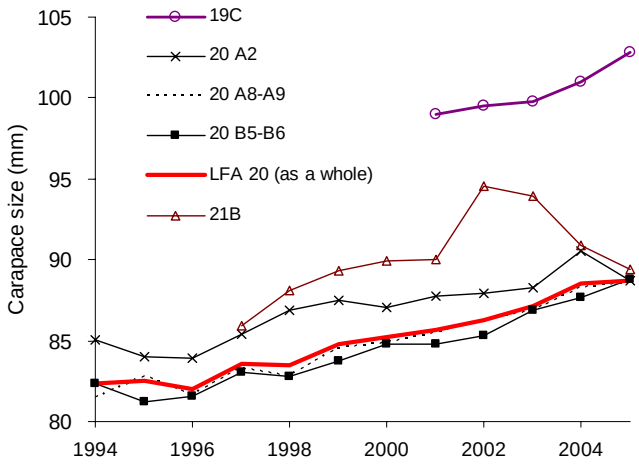


Figure 6. Evolution of commercial-size lobster mean size between 1994 and 2005 in different fishing sub-areas of the Gaspé Peninsula

Marked differences can also be observed between male and female size structures. Female size distributions are more truncated toward smaller sizes than those of males, which reflect a decrease in female growth as they reach sexual maturity. Differences are also observed in the numbers. The number of females in the catches exceeds the number of males, and more particularly in area 20A8-A9, the sex ratio is 0.5 (one male for two females). These differences could be partly explained by the fact that females that spawn a given year will enter the fishery one year later than males. If a reduction in recruitment occurs, it will be visible on the male population first. Changes in sex ratios could also be related to variations in male and female catchability, an issue that needs to be investigated somewhat further.

Jumbo lobsters (CL ≥ 127 mm)

The proportion of large size lobsters observed during at-sea samplings remains low and, in 2005, for the whole of LFA 20, jumbo lobsters (CL ≥127 mm) represented only 0.46% of the catches. They were somewhat not as rare in area 20A2 (1%). They totalled 6.5% of the catches in area 19C, whereas in LFA 21B, no "jumbo" was identified in the samples.

Exploitation Rates

Truncated size structures are indicative of high exploitation rates. Exploitation rates calculated for the commercial-size males in LFA 20 remained high, reaching 86.5% in 2004 compared to 80.1% in 2003 (Figure 7A). It is above the series average (74.5%). The values have been higher since 1997. On the other hand, the 2004 values could have been over-estimated if there was a catchability problem in 2005. This exploitation rate is derived from a measurement of the change in abundance between the first moult class recruited to the fishery and that of the second moult class one year later. The exploitation rate for males ≥76 mm has decreased since the minimal size was increased and is around 50% (Figure 7B). In this case, the exploitation rate is calculated using a method based on changes in the proportions of recruits and pre-recruits over the fishing season. Size structures for LFA 19 show several modes, which reflect a low level of exploitation, perhaps around 20%.

Generally, the fishing mortality is lower for females because they are protected when bearing eggs. Consequently, the sex ratio for lobsters remaining on the bottom tends to favour females, and this trend is further visible at higher exploitation rates.

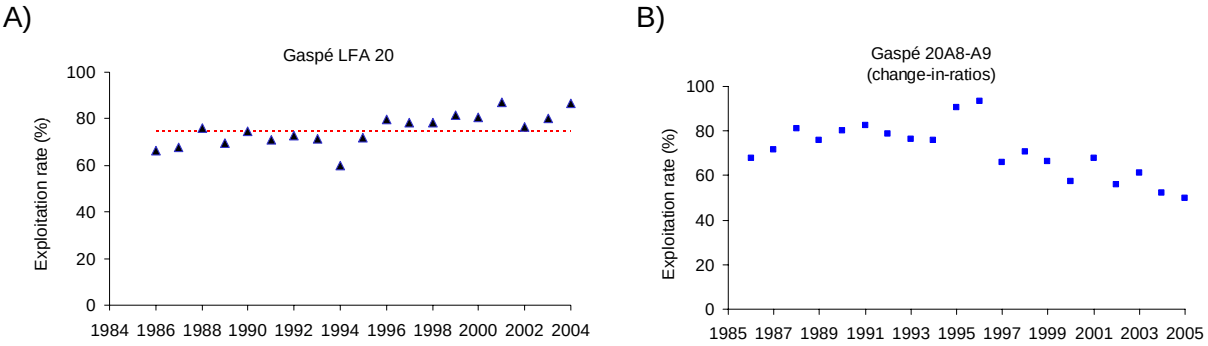


Figure 7. Exploitation rate indices calculated A) for commercial-size male lobsters and B) for males ≥ 76 mm CL between 1986 and 2005. The dotted line represents the average for 1986-2003.

Berried females and egg production index

Data from at-sea sampling conducted in LFA 20 indicate that the abundance of berried females increased significantly between 1996 and 2001, despite a slight drop in the abundance of commercial-size lobsters (Figure 8). The reduction in the abundance of berried females observed in 2002 was associated to the increase in the size of escape vents. The abundance continued to increase during recent years and reached 0.18 l/t in 2005. The increase was observed in areas 20A8-A9 and 20B5-B6. No trend was detected in area 20A2, where the level was around 0.08 l/t.

The examination of the size structures and abundance of berried females suggests that egg production doubled between 1996 and 2005 (Figure 9). The egg production index is obtained by multiplying the abundance index of berried females for each 1-mm size class by the size-specific fecundity. The abundance index of berried females is obtained by weighting size frequency distributions by abundance indices (average annual CPUEs). The number of multiparous females would have also increased proportionately since 1996.

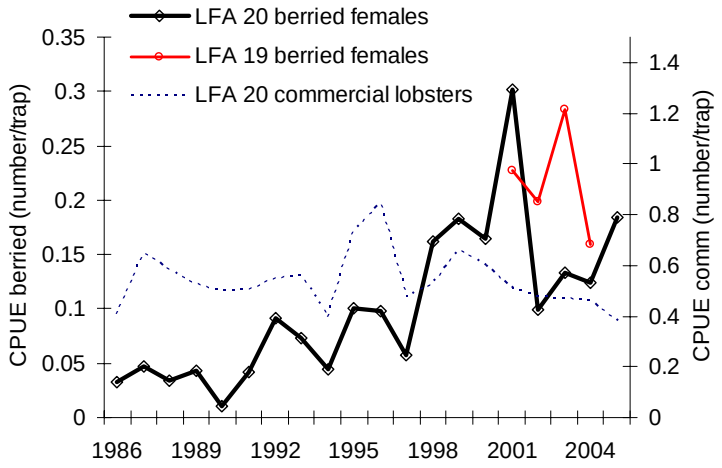


Figure 8. Catch rates (CPUEs) of berried females from 1986 to 2005 in LFA 20 and from 2001 to 2004 in LFA 19.

Data collected on berried females of area 19C during at-sea samplings conducted between 2000 and 2004 show CPUEs that are higher than in LFA 20 (Figure 8). Average size was also higher, reaching 101.1 mm in 2004. There were practically no berried females ≤ 80 mm, as opposed to what was observed in LFA 20, which suggests a higher size at sexual maturity (Figure 9).

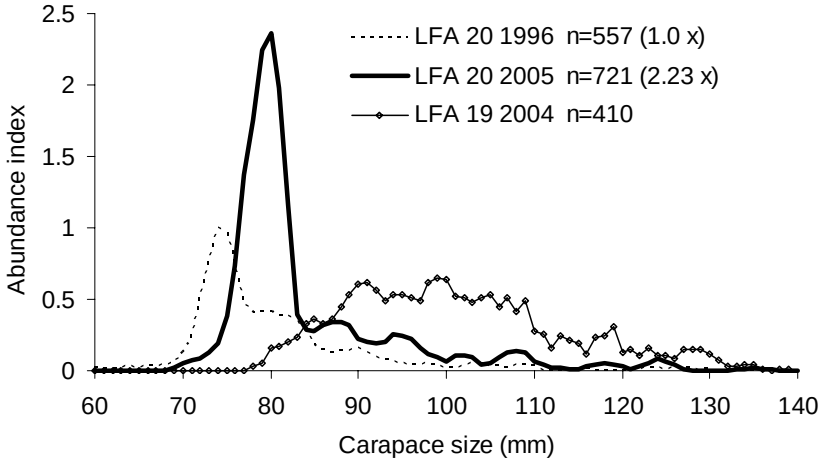


Figure 9. Size frequency distributions of berried female weighted against abundance in 1996 and 2005 in LFA 20 and in 2004 in LFA 19. The egg production in 2005 relative to that of 1996 is indicated in parenthesis.

The berried females observed in LFA 21B until 2004 were generally of a size slightly higher than those observed in LFA 20, but their number was generally lower.

Sources of Uncertainty

The data on landings presented correspond to the landings recorded on processing plant purchase slips. There are uncertainties as for the non-recorded lobster captures, which correspond among other things to the quantities set aside for personal consumption and to the quantities poached. A bipartite group composed of industry and DFO representatives is currently working on developing and validating a model to assess non-recorded lobster landings. Moreover, there are no exact data available on the level and location of fishing effort. These gaps do not allow the calculation of abundance indices for the various sub-areas of the Gaspé Peninsula.

There is much spatial heterogeneity in the lobster populations of the Gaspé Peninsula, and the level of sampling is not sufficient to account for the whole of the geographical variations. Some sectors are characterized by an abundance of large individuals (21A and 21B), whereas others show a relatively high abundance of small individuals (20A8-A9). Sectors where small lobsters are highly abundant could correspond to recruitment areas that could act as source populations. Conversely, sectors characterized by a strong abundance of large individuals could represent sink-populations, which would be dependent on the migration of the source-populations. The various sectors are very likely interconnected by larval exchanges and by adult migration, which for the moment remain poorly known.

Although it is considered that catch rates reflect the abundance of lobster on the seafloor, they can also be affected by both intra and inter-annual variations in lobster catchability. Cold temperatures, winds and currents are factors that have a negative impact on catchability. Fishermen also reported that the presence of capelin on the seafloor impairs lobster catchability. These effects are difficult to quantify and introduce uncertainty into the interpretation of catch rates. Changes in catchability can also create uncertainty in the calculation of exploitation rate indices.

CONCLUSIONS AND ADVICE

Globally, the 2005 abundance indices were lower than those of 2004, which were lower than those of 2003. Over the longer term, they were below the average of the series of observations made over the last 20 (at-sea sampling) or 25 (landings) years. Climatic and weather factors could partly explain this drop: cold temperatures, mixing of water, and speed and direction of currents. The presence of food on the seafloor (e.g. capelin) has also negative impacts on lobster catchability. The strong wind conditions have also affected the deployment of fishing effort. Ultimately, this year's unharvested biomass should be for the most part present on the seafloor next year.

It is not excluded however that poor results from 2005 are due to a reduction in lobster recruitment in the Gaspé. If 2005 reflects a decrease in recruitment, the increase in size has certainly help attenuate the drop in landings because the weight of 82 mm lobsters is approximately 25% higher than that of 76 mm lobsters. This measure will also have made it possible to leave a larger spawning biomass on the seafloor. The drop in landings does not call into question the conservation measures that have been implemented since 1997. The 2005 fishing season targeted lobsters from an egg-laying that occurred there around ten years ago (in 1995). The expected benefits of the increase in egg production in terms of recruitment, if the case arises, could be perceptible only as of 2010-2011.

Until now, very few measures have been implemented to decrease fishing effort and exploitation rates. Although fishing mortality for the whole of the population decreased with the increase in the minimum legal size, it also true that the exploitation rates measured on the commercial portion are constantly increasing. Moreover, the greatest protection granted to females compared to males tends to create an asymmetry in exploitation rates between both sexes. With high exploitation rates, the sex ratio tends to advantage females. If the exploitation rates are too high, the number of large male lobsters could be reduced to a point where it could have an impact on the capacity of females to reproduce normally. An unbalanced sex ratio could affect the mating ratio and the success of female insemination. And this could ultimately affect the quantity of eggs produced.

In order to reduce exploitation rates, measures to decrease fishing effort by 15% were proposed to the industry for most of the fishing sub-areas of the Gaspé Peninsula. If the effort reduction is not counterbalanced by changes in gear (size of traps) and in fishing practices (increase in the number of liftings per day), this reduction could help reduce fishery dependence on annual recruitment, increase the level of egg production per recruit, increase the proportion of multiparous females in the population, and ensure spawning success by keeping sex ratios balanced.

In the specific case of LFA 21B, it is recommended to limit the annual fishing effort so that it does not exceed the historical levels for this area, by taking into account the greatest effectiveness of the traps used during the fall fishery in the calculation of total effort.

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