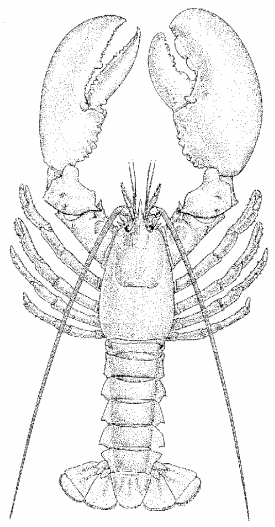
ASSESSMENT OF LOBSTER STOCKS OF THE GASPÉ (LFAs 19, 20 and 21) IN 2008



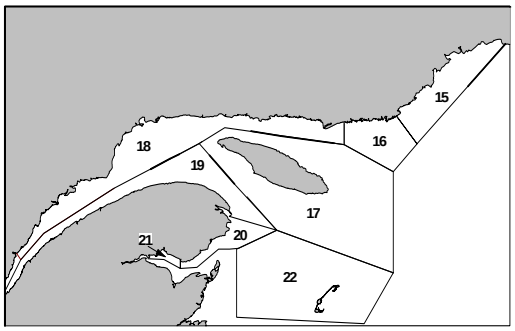


Figure 1. Map showing the lobster fishing areas (LFAs) in Quebec (LFAs 15 to 18: North Shore and Anticosti; LFAs 19 to 21: Gaspé Peninsula; and LFA 22: Magdalen Islands).

Context

Lobster fishing in the Gaspé is practiced by 204 enterprises distributed among 3 lobster fishing areas (LFAs 19, 20 and 21)(Figure 1). These LFAs are subdivided into 27 sub-areas (Figure 2). The lobster fishery is managed by controlling the fishing effort (number of permits, number and size of traps, season duration) and by escapement measures: release of berried females and minimum legal size. V-notching of berried females is practiced on a voluntary basis but their release is mandatory. A maximum size was recently implemented in LFA 20. The management strategies introduced over the last decade were developed based on the recommendations from the Fisheries Resource Conservation Council (FRCC).

The resource status assessment was done on an annual basis until 2005, which helped to closely monitor the impacts of the increase in minimum legal size on the lobster populations. Assessments are now conducted every three years. The present advice describes the situation in 2008 and the changes observed over the 2006-2008 period.

SUMMARY

- In the Gaspé, between 2006 and 2008, the **abundance indicators** were on the whole similar to those observed in 2005. The 2008 landings were however 11.5 % higher compared to 2005, reaching 785 tons. They were slightly (2.6 %) below the 1984-2007 average. The majority of the 2008 landings came from LFA 20 (94 %), while LFAs 19 and 21 comprised 3.6 % and 2.4 % of the landings respectively. The mean catch per unit effort (CPUE) in LFA 20 remained somewhat stable between 2006 and 2008 at 0.4 lobster/trap

and 0,25 kg/trap, and comparable to 2005. CPUE was 26% (in number) and 9% (in weight) below the 1986-2007 average. A reduction in fishing effort, unfavourable climatic factors and a reduced catchability could partly explain the decrease. In LFA 19, from 2006 to 2008, the abundance indicators were comparable to the previous years. CPUEs in this LFA (0.5 kg/trap in 2008) are among the highest in the Gaspé, although very variable from year to year.

- In LFA 20, the **demographic indicators** showed that the average size of lobster caught has been stable since 2004 at a level about 6-7 mm larger (carapace length, CL) than the mean size recorded prior to the increase of the minimum legal size. The mean weight is of about 25% higher. Mean sizes observed from 2006 to 2008 were comparable to 2005. During the last three years, the sex-ratio remained in favour of males overall and seems appropriate for reproduction. The proportion of jumbo size lobster (≥ 127 mm CL) remained low (< 1%) in LFA 20. LFA 19 is different and the size structure is more spread out. The porportion of jumbos reached 6.5% in 2008.

- The **fishing pressure indicators** estimated for 2005 to 2007 in LFA 20 varied from 77 to 84%, which is slightly lower compared to 2004. However, fishing mortality for the portion of the population ≥ 76 mm CL dropped as a result of the increase in the minimum legal size. Exploitation rate is much lower in LFA 19 than elsewhere in the Gaspé.

- The stock **productivity indicators** remained positive from 2006 to 2008. The abundance of berried females in LFA 20 has remained higher than prior to the increase of the minimum legal size. As in 2005, egg production estimates for 2006-2008 were higher by a factor of around two compared to those prior to the increase of the minimum legal size. In 2008, the number of multiparous females was slightly higher than in 2005 but their relative contribution to the total egg production was similar to 1996. Recruitment indices in LFA 20 were positive in 2008. Prerecruits appeared more abundant than in 2007 in many sub-areas. However, because the data series is short it is ot possible to forecast the recruitment to the fishery for 2009 or 2010.

- Despite the efforts and some positive signs, improvements to the size structure of the stocks appear necessary in LFA 20. This will help reduce the dependence of the fishery on the annual recruitment and will also help increase the proportion of multiparous females in the population and ensure their reproductive success by maintaining suitable sex-ratios, according to the recommendations by the FRCC (2007). Thus, it is important to continue the program for reducing the fishing effort introduced in 2006. In a long term outlook, it is important to identify some biological reference points in developing a formal precautionary approach for this fishery.

- In LFA 21B, fishing effort remained under historic levels, as recommended. Catch rates (CPUE) during the fall fishery remained stable since 2004. It is recommended to maintain the minimum legal size at 82 mm CL and to continue the limitation of the annual fishing effort so that it does not exceed the historical levels for this area.

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.

Females reach sexual maturity at around 82 mm (carapace length) in the southern part of the Gaspé Peninsula, but at a larger size along the north shore of the Peninsula. 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. In addition to being more fertile, certain large females could spawn two consecutive years before moulting. Once released, the eggs remain attached to the females' swimmerets for 9 to 12 months, until the planktonic larvae hatch the following summer. Spawning and hatching can occur earlier in the season for multiparous females (females spawning for the second time at least) than for primiparous females. It was also noticed that larvae at the time of release could be larger for multiparous females than primiparous females. 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. The survival of lobster from their larval stage to their benthic cryptic stages is impacted by predation as well as by hydrodynamic factors that cause advection or retain the larvae near the areas that are favourable for benthic settlement. 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.

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. In the Gaspé, the lobster fishery is a spring activity that lasts 68 days (LFAs 20 and 21) and 70 days (LFA 19). In 2008, 204 commercial licences were issued with a limitation of 235 (LFAs 20 and 21) and 250 traps each (LFA 19). Effort reductions (2 days of fishing and 15 traps) were implemented in LFAs 20 and 21 in 2006. 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 2004, to comply with the introduction of the new minimum legal size of 82 mm. Moreover, a number of initiatives to buy back licenses have been put forward and since 2003, 16 lobster fishing licences were removed. Fishery management also includes escapement measures. Along with a minimum legal size (carapace length), berried females must be released. The minimum legal size of 76 mm CL (implemented in 1957) was increased starting in 1997 by 1-2 mm every 1-2 years, over eight years. It reached 82 mm in 2004. The minimum size was raised to 83 mm CL in LFA 19 in 2006. The objective of increasing the minimum legal size was to double the 1996 level of egg production per recruit. V-notching of berried females is practiced on a voluntary basis but their release is mandatory. However the number of V-notched lobsters is not monitored. In 2008, a maximum catch size of 155 mm CL has been implemented in LFA 20.

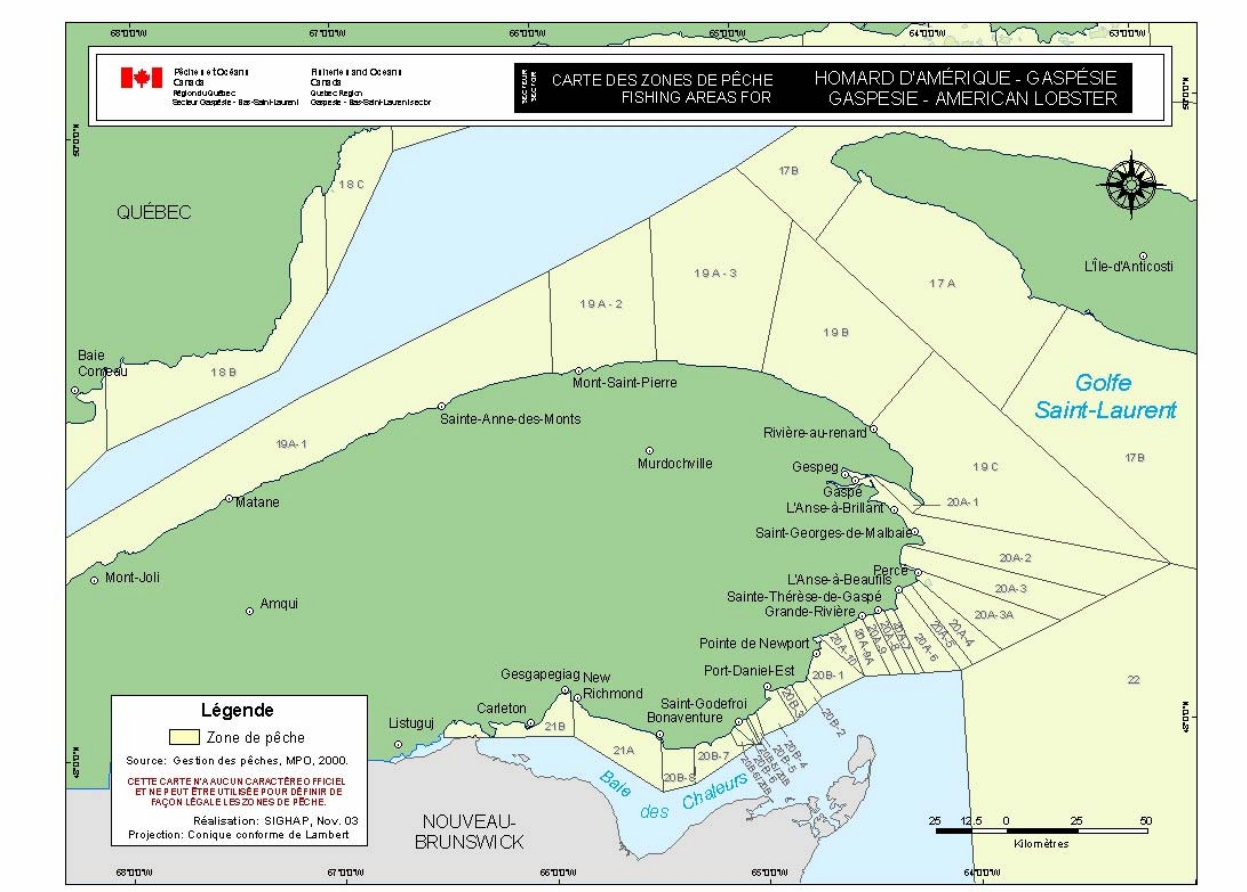


Figure 2. Map of the Gaspé Peninsula showing the different sub-zones of LFA 19 (19A1 to 19C), LFA 20 (20 A1 to 20A10 and 20B1 to 20B8) and LFA 21 (21 A and 21B).

ASSESSMENT

Source of data

The stock status assessment is based on indicators of abundance, demographics, fishing pressure and stock productivity. For each indicator, data from the three previous years are examined and the 2008 data are compared to the averages from the existing data series Abundance indicators include landings recorded on processing plant purchase slips, catch rates of commercial-size lobsters obtained from at-sea samplings and from logbooks kept on a voluntary basis since 1992 by a variable number of index fishermen. 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. Since 2005, dockside sampling replaced at-sea sampling in the LFAs 21B (spring and fall) and 19C in 2005. In 2008, an additional sampling at-sea was done in the Forillon National Park (19C and 20A1).

The demographic indicators are taken from the lobster size structures and include mean size and weight, jumbo (≥ 127 mm CL) abundance and sex-ratios. The fishing pressure index (exploitation rate) is derived from a measurement of the ratio between the number of individuals (males) from the first moult class recruited to the fishery in a given year and that of the second moult class recruited to the fishery one year later (modal analysis). A fishing mortality index for

the portion of the population ≥ 76 mm CL is also calculated and is based on the change-in-ratio method (CIR). Productivity indicators (reproduction) are based on abundance of berried females and on egg production. Since 2006, 25-35 fishermen have participated to a project to develop a recruitment index. Participants are allowed to use two traps modified by closing the escapement vents to retain lobster under the commercial size. They collect data on the number and size (with a special gage) of lobster caught in these two traps. The abundance of pre-recruits is to be used as an index of recruitment to the fishery one and two years in advance.

Abundance indicators

Landings

Landings for the whole of the Gaspé Peninsula reached 785 tons in 2008 (preliminary data), which is slightly (2.6%) under the average for the 1984-2007 period (Figure 3). Landings were relatively low in 2005 and 2007, around 700 t, compared to those recorded from 1995 to 2001 (except 1997), that oscillated between 900 and 1,000 t. In 2008, 94% of the Gaspé landings were from LFA 20, 3.6% from LFA 19, and 2.4% from LFA 21. Landings from the Gaspé accounted for 23% of total Québec landings (3,443 t).

In 2008, landings in LFA 19 reached 28 t. This is comparable to the average of the last 25 years (26 t), and higher than what was recorded the two previous years (24 and 20 t) (Figure 3). In LFA 21-A, landings reached 16 t in 2008. They are lower since the beginning of the 2000s (around 15 t), compared to the 1990s (27 t), mainly because of a reduction of fishing effort. In LFA 21-B, since 2003, landings have been more important during the fall fishery (4-8 t) than during the spring fishery (1-6 t) (Figure 3). An important reduction of fishing effort can explain the decrease in landings from the spring fishery. During most of the 1990s, landings from the spring fishery were around 20-25 t. The fall fishery intercepts recruitment since it operates just after the molting season.

There has been a reduction of fishing effort in the Gaspé during the last years. In 2008, fishing effort, in terms of number of traps hauled (number of fishing trips x number of traps) was estimated at 2.36 millions for the Gaspé. This is 22 % lower than the average for the 1994-2005 period (3 millions traps hauled).

The 2008 fishing season was slightly colder than the 1996-2007 average, although warmer than the 2005 and 2007 fishing seasons. On the whole, temperature conditions seem colder since 2002, compared to the 1996-2001 period. This could have a negative impact on lobster catchability, explaining to a certain extent the decrease in the landings observed in recent years.

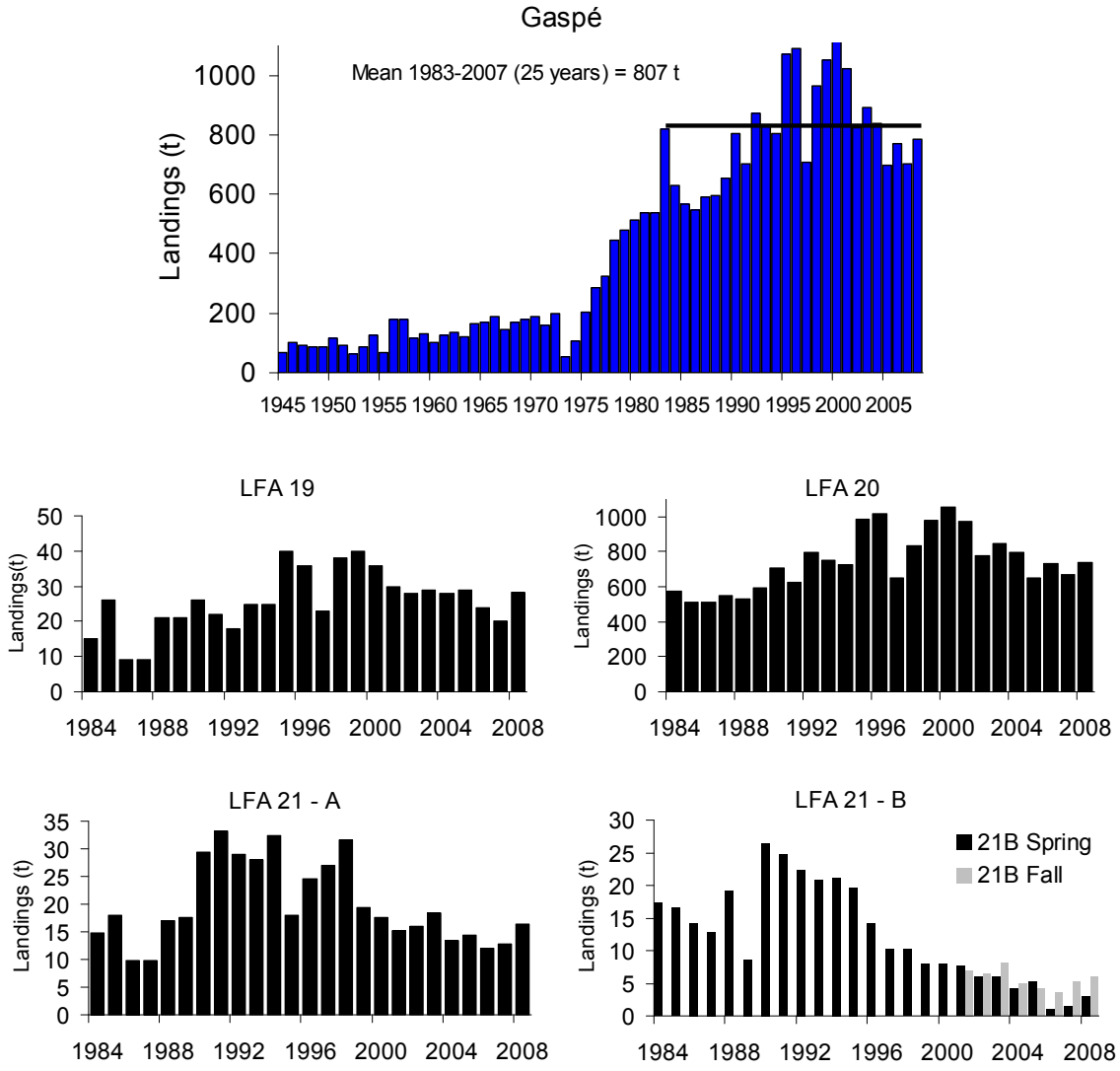


Figure 3. Lobster landings in the Gaspé from 1945 to 2008 and from 1984 to 2008 for LFAs 19, 20, 21-A and 21-B.

Catch rates for commercial-size lobsters

Catch rates correspond to the catches per unit of effort (CPUEs) expressed in number or weight of lobster per trap. Since 1986, in LFA 20, average annual CPUEs of commercial-size lobsters derived from at-sea sampling of commercial captures ranged from 0.4 to 0.8 lobster per trap (l/t) (Figure 4A). For the same period, the CPUE in weight ranged between 0.18 and 0.38 kg/trap (kg/t) (Figure 4B). The average CPUE was relatively stable from 2006 to 2008, estimated at 0.4 l/t and 0.25 kg/t, which is comparable to what was observed in 2005. In 2008, the CPUE was 26% lower than the 1986-2007 series average at 0.53 l/t. Part of the decrease can be accounted for by the increase in the minimum legal size. Since 2005 however, the low CPUEs can reflect a reduction of recruitment or a lower catchability. CPUEs in weight were however lower only by 9% from the series average (0.27 kg/t), because lobster caught are of a larger size.

Catch rates are higher in LFA 19 than in LFA 20, but more variable and influenced by the meteorological conditions. In 2008, CPUE reached 0.64 l/t and a weight of 0,5 kg/t (Figure 4AB).

These values are among the highest recorded since 2001. In the Forillon National Park area, the catch rates are approximately three times lower in the Gaspé Bay (20A1) than on the north side of the Peninsula (19C). CPUEs in sub-areas 20A8-A9 (Ste-Thérèse/Grande-Rivière) and 20B5-B6 (Shigawake/St-Godefroi) follow the general trend described for LFA 20. However, in 2008, in sub-area 20A2 (La Malbaie), there was a strong increase in CPUEs in number and weight, (0.53 l/t et 0,36 kg/t), reversing the downward trend observed since 2005.

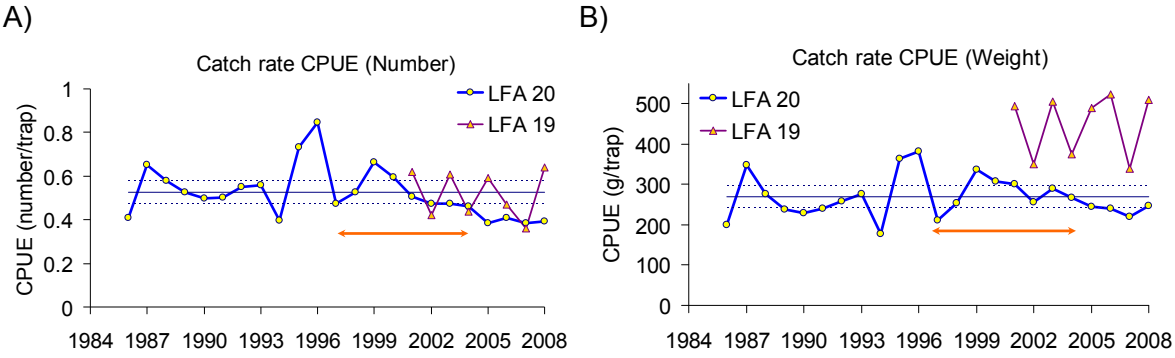


Figure 4. Catch rates (CPUEs) of commercial-size lobsters for LFAs 19 and 20 in the Gaspé from 1986 to 2008 in A) number and B) in weight per trap; 1986-2007 mean for LFA 20 (solid line) ± 10 % (dotted line). The horizontal arrow indicates the period (1997-2004) when the minimum legal size was increased by 1-2 mm every 1-2 years, from 76 to 82 mm CL.

CPUEs recorded during the fall fishery in LFA 21-B remained stable since 2004, around 1.0 kg/t. Since 2005, between 4,000 and 5,000 traps have been hauled during the fall fishery, compared to a total of 10,000 traps allowed. On the whole, fishing effort (nominal and effective) presently deployed in this area is lower than during the 1990s. The yields from the fal fishery are much higher than what can be seen during the spring fishery in the same area (historically around 0.15 kg/t), because catchability of lobster is much higher (by a factor of seven) in fall because lobsters are in postmoult. After moulting, lobsters are looking for food and are more easily attracted by bait in traps.

Demographic indicators

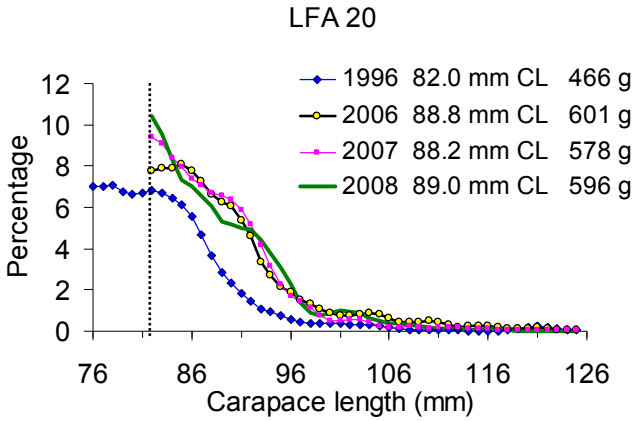
Over the last three years, in LFA 20, the size structures of lobster from the commercial portion have remained similar and characterized by a truncated appearance. They show a strong mode corresponding to the recruits of the year. They are shifted to the right in comparison to what was observed in 1996, before the increase of the minimum catch size (Figure 5A). Over the last three years, and more generally since the end of the minimum size increase in 2004, the average size of harvested lobsters remains around 88-89 mm CL, 6-7 mm above the average size observed in 1996. The mean weight of landed lobsters increased from 466 g in 1996 to around 600 g since 2004, a 25% increase. The proportion of jumbo lobsters (≥ 127 mm CL) remains low and in 2008, they represented only 0.35 % of the catches. No lobster ≥ 155 mm CL (maximum catch size implemented in 2008) was observed in at-sea samplings in 2008 in LFA 20).

Marked differences were also observed between male and female size structures. Female size distributions were more truncated toward smaller sizes than those of males, which reflect a decrease in female growth as they reach sexual maturity.

Over the last three years, the sex-ratio (number of males/number of non berried females) remained, in general, near or above the value of one, for commercial-size lobsters. The added

protection given to females as a consequence of the increase in the minimum catch size could eventually cause asymmetry in exploitation rates between males and females and cause unbalanced sex-ratios. For the moment, the sex-ratios appear suitable for mating.

A)



B)

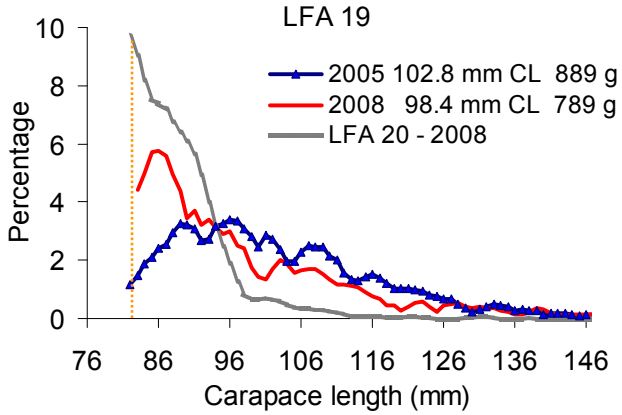


Figure 5. Size frequency distributions of harvested lobsters (commercial portion) A) 1n 1996 and from 2006 to 2008 in LFA 20 and B) in 2005 and 2008 in LFA 19, with the 2008 LFA 20 curve in the background.

In LFA 19, the size frequency distributions of commercial-size lobsters are more spread out, and up to five modes can be detected (Figure 5B). In 2008, an important mode was observed around 86 mm CL, which could reflect the arrival of new recruits. The average size of lobster was thus smaller in 2008 than in 2005, with 98.4 and 102.4 mm CL respectively. The proportion of jumbo lobsters (≥ 127 mm CL) was 6.5 % in LFA 19, but no lobster ≥ 155 mm CL was observed in the samples. A good proportion of jumbo lobsters was observed in the Forillon Park area (average of 3.6 %). Lobsters ≥ 155 mm CL were also seen in the sub-areas 19C (0.1%) and 20A1 (0.4%). In LFA 19, except in 2004 and 2005, the sex-ratios have always been over to one and seem suitable for mating. The additional sampling that was done in 2008 in the Forillon Park area showed that in sub-area 20A1, for jumbo lobsters, the females outnumbered males. The sex-ratio was 0.67.

Fishing pressure

Truncated size structures are indicative of high exploitation rates. Exploitation rates calculated for the commercial-size males in LFA 20 (modal analysis) remained high from 2005 to 2007. It ranged between 76 and 84%, compared to an average of 76 % for the 1985-2006 period (Figure 6). Overall, female mortality is not as high because they are protected when they are berried. In LFA 20, the male ≥ 76 mm CL mortality rate index (CIR) has decreased since the minimum legal size of 82 mm was reached in 2004 to values varying between 50 and 60 %. The presence of several modes in the size frequency distributions of lobster in LFA 19 reflects lower exploitation rates than in LFA 20, probably around 20-30 %.

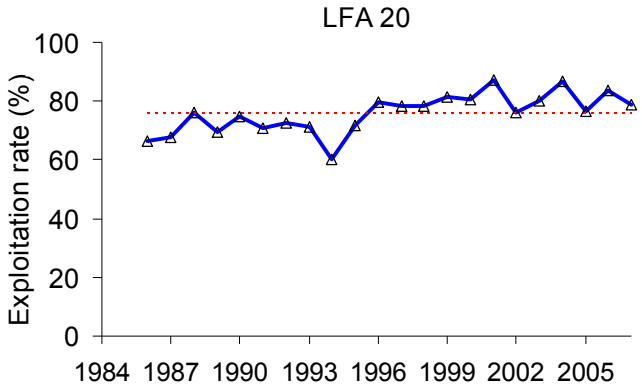


Figure 6. Exploitation rate indices for commercial-size males estimated by modal analysis based on data from commercial sampling for LFA 20 from 1986 to 2007. Dotted lines represent the mean for the 1986-2006 period.

Productivity indicators

Berried females and egg production

Over the last three years, from 2006 to 2008, the abundance of berried females remained high compared to what was observed before the increase in the minimum catch size (before 1997) (Figure 7). The increase in the height of the escapement vents from 43 to 46 mm had an impact on the abundance index by allowing a greater proportion of sublegal berried females to escape from the traps. Nonetheless, the CPUEs have remained high, reaching 0.2 l/t in 2008, comparatively to ≤ 0.1 l/t in 1996 and 1997.

The examination of the size structures and abundance of berried females suggests that egg production estimated for years 2006 to 2008 in LFA 20 was higher, by a factor of approximately two, to the production estimated in 1996, before the increase in the minimum catch size (Figure 8). This had also been observed in 2005. 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). In 2008, the proportion of multiparous females (that spawn at least for the second time) increased in number, but their relative contribution to total egg production remained the same as in 1996.

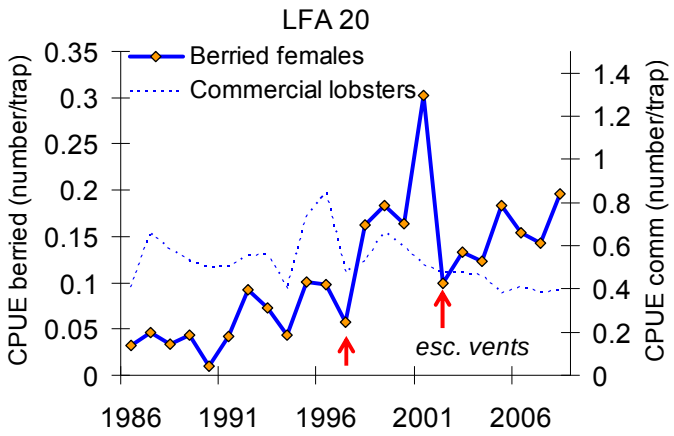


Figure 7. Catch rates (CPUEs) of berried females in LFA 20 from 1986 to 2008. The first arrow indicates the start of the increases in minimum legal size and the second arrow indicates the year when the height of the escape vent was increased from 43 mm to 46 mm. The dotted line represents CPUE trends for commercial-size lobster during the same period.

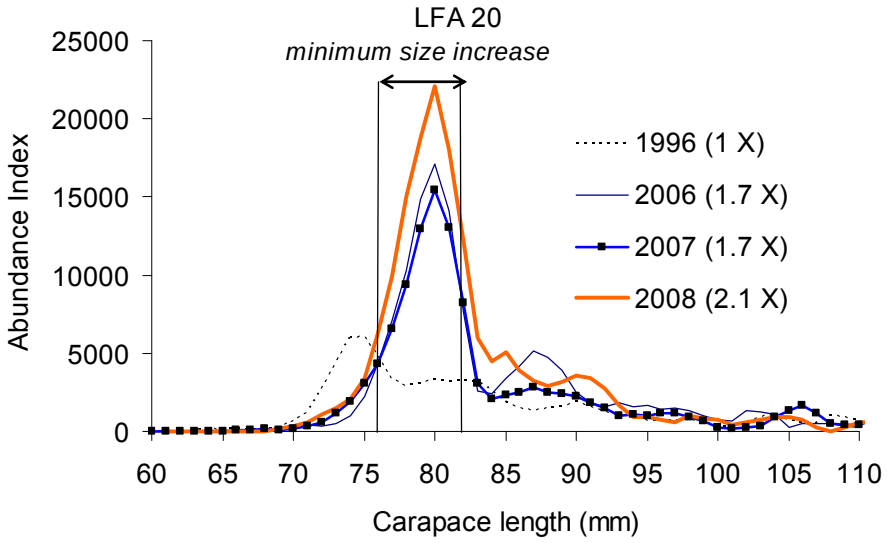


Figure 8. Egg production index calculated for LFA 20 in the Gaspé, for 1996 and from 2006 to 2008. Egg production relative to that in 1996 is indicated in parenthesis.

Recruitment

Observations on prerecruits from modified traps (closed escape vents) showed an increase or a stability of the abundance of prerecruits 70-81 mm CL (one molt below commercial size) in 2008 compared to 2007, in 11 of the 12 sub-areas sampled. The abundance od prerecruits 60-69 mm CL (two molts below commercial size) showed overall the same pattern. Although the recruitment indices appeared positive in 2008, it is not possible to give a forecast for the 2009 and 2010 fishery because the time series is too short.

Exploratory scuba-diving surveys revealed for the first time the presence of lobster benthic settlement grounds in the Grande-Rivière area. These nursery grounds seem to support lobsters for their 2-3 first years of benthic life. Monitoring of the abundance of lobster in those nurseries and localization of other nurseries along the Gaspé coast could help better understand the recruitment dynamics of lobster in the Gaspé.

Sources of uncertainty

The landing data 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.

The lack of logbooks prevents the calculation of precise abundance indices for each fishing sub-areas. Abundance indices are derived from at-sea sampling of commercial catches that covers 0.13% of all fishing activities, from data gathered by index-fishermen, which represent between 2-3% of all fishermen, and special science projects trying to involve a greater proportion of fishermen. The work carried out by all these fishermen is done strictly on a volunteer basis and in some years, for different reasons, they may not collect the data. The low sampling effort creates uncertainty on the representativeness of the estimates.

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, while reductions in fishing effort can, locally, increase catchability for the remaining traps. These effects are difficult to quantify and introduce uncertainty into the interpretation of catch rates. In addition, fishing patterns can also have an impact on the abundance index of berried females if, for instance, fishermen avoid the sectors where they concentrate. Changes in catchability can also create uncertainty in the calculation of exploitation rate indices.

CONCLUSIONS AND ADVICE

The abundance indicators measured in the Gaspé, and more particularly in LFA 20 have shown a downward trend over the past recent years. Unfavourable conditions for lobster catchability as well as reduction of recruitment may explain the trend. However, on the whole, the productivity indicators were positive, suggesting that recruitment can be maintained. It is important to mention that if the downward trend reflects a reduction of lobster recruitment along the Gaspé coast, the increase in the minimum catch size has certainly help attenuate the drop in landings because the weight of 82-mm CL lobsters is approximately 25% higher than that of 76 mm CL 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 expected benefits of the increase in egg production in terms of recruitment, if the case arises, could be perceptible only as of 2010-2011.

Despite the efforts and some positive signs, improvements to the size structure of the stocks appear necessary in LFA 20. This will help reduce the dependence of the fishery on the annual recruitment and will also help increase the proportion of multiparous females in the population and ensure their reproductive success by maintaining suitable sex-ratios, according to the recommendations by the FRCC (2007). Thus, it is important to continue the program for reducing the fishing effort introduced in 2006.

In LFA 21B, fishing effort remained under historic levels, as recommended. Catch rates (CPUE) during the fall fishery remained stable since 2004. It is recommended to maintain the minimum legal size at 82 mm CL and to continue the limitation of the annual fishing effort so that it does not exceed the historical levels for this area.

In a long term outlook, it is important to identify some biological reference points in developing a formal precautionary approach for this fishery.

SOURCES OF INFORMATION

FRCC. 1995. A Conservation framework for Atlantic Lobster. Report to the Minister of Fisheries and Oceans. November 1995. 49 p. + appendices.

FRCC. 2007. Sustainability framework for Atlantic Lobster 2007. Report to the Minister of Fisheries and Oceans. July 2007. 54 p. + appendices.

FOR MORE INFORMATION

Contact : Louise Gendron
Maurice Lamontagne Institute
850 route de la Mer
Mont-Joli (Québec)
G5H 3Z4

Telephone : (418) 775-0617
Fax : (418) 775-0740
E-mail : louise.gendron@dfo-mpo.gc.ca

This report is available from the:

Center for Science Advice (CSA)
Quebec Region
Fisheries and Oceans Canada
Maurice Lamontagne Institute
P.O. Box 1000, Mont-Joli
Quebec (Canada)
G5H 3Z4

Telephone: (418) 775-0825
Fax: (418) 775-0679
E-Mail: Bras@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-5079 (Print)
ISSN 1919-5087 (Online)

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

CORRECT CITATION FOR THIS PUBLICATION:

DFO. 2009. Assessment of the Lobster Stocks of the Gaspé (LFAs 19, 20 and 21) in 2008. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2009/017.