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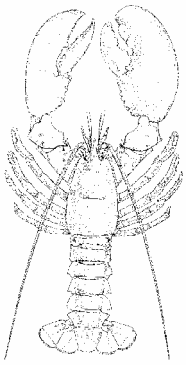

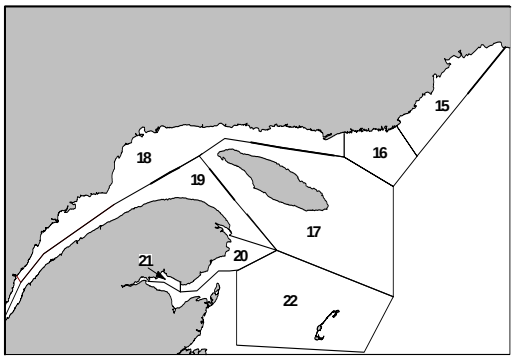

Lobster around the Gaspé Peninsula (LFAs 19, 20AB, 21AB) in 2004

Background

American lobster (Homarus americanus) occurs along the west coast of the Atlantic Ocean, from Labrador to Cape Hatteras. Adult lobster prefers rocky substrates where they can take shelter, but can also live on sandy and even muddy bottoms. Commercial-size lobsters are generally found at depths of less than 35 m. In the Gaspé, females reach sexual maturity around 82 mm (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 extrude 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, meaning that they live hidden in structurally varied habitat providing many shelters. Lobsters are estimated to reach minimum legal size (82 mm) around 8 years of age, after having moulted approximately 15 times since their benthic settlement.

Summary

- In 2004, landings in the Gaspé accounted for 25% of total lobster landings in Quebec. Lobster landings recorded in the Gaspé totalled 837 t in 2004 (preliminary data), down by 6.3% from 2003 levels (893 t). They were however 8.8% higher than the average for the last 25 years (769 t). In 2004, 95% of landings in the Gaspé came from LFA 20AB.
- In 2004, the mean catch per unit effort (CPUE) in number for LFA 20AB as a whole was 0.46 lobsters/trap, corresponding to a CPUE in weight of 0.27 kg/trap, which is slightly lower than 2003 levels. Since 2000, the CPUE in number has been lower than the average for the 1986–2003 period, whereas the CPUE in weight has generally remained above the series average. Trends vary from sector to sector.
- The mean size of landed lobsters for LFA 20AB as a whole increased by approximately 7 mm, while their mean weight increased by 25% between 1996 and 2004, following the minimum legal size increase from 76 mm to 82 mm. The exploitation rate was estimated at 84% in 2003, which is very high and above the series average.

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- The results of a simulation model show that egg production per recruit doubled in the Gaspé following the minimum legal size increase from 76 mm to 82 mm. The CPUE for berried females increased significantly between 1997 and 2001 in LFA 20AB, after the minimum legal size was increased; it was lower between 2002 and 2004. The number of multiparous females (i.e. females that have already spawned at least once) has also increased proportionately since 1996. In 2001, estimated egg production was approximately twice as high as in 1996.

Fishery management

The lobster fishery is managed by controlling fishing effort, regulating minimum legal size and protecting berried females. In 2004, there were 208 active fishers in LFA 19, 20 and 21 (Figure 1). The number of traps is limited to 250. Escape vents on traps have been mandatory since 1994. In 2002, the size of the vertical opening of the escape vents was increased from 43 mm to 46 mm. The lobster fishery takes place in spring and lasts 10 weeks in the Gaspé. From 1997 to 2004, minimum legal size was increased 1-2 mm every 1-2 years with a view to doubling egg production per recruit compared to 1996 levels. In 2004, minimum legal size reached 82 mm. Between 1957 and 1997, minimum legal size was 76 mm. V-notching of berried females is done on a voluntary basis in some areas of the Gaspé Peninsula. The Listuguj First Nation has been practicing a fall subsistence fishery in 21B since 2002.

Stock status

Stock status assessment is based on abundance indicators: 1. landings taken from processing plant purchase slips, 2. catch rates for commercial-size lobsters obtained from at-sea samplings and logbooks kept on a voluntary basis by index fishers and 3. catch rates of berried females obtained from at-sea sampling. The assessment is also based on the size

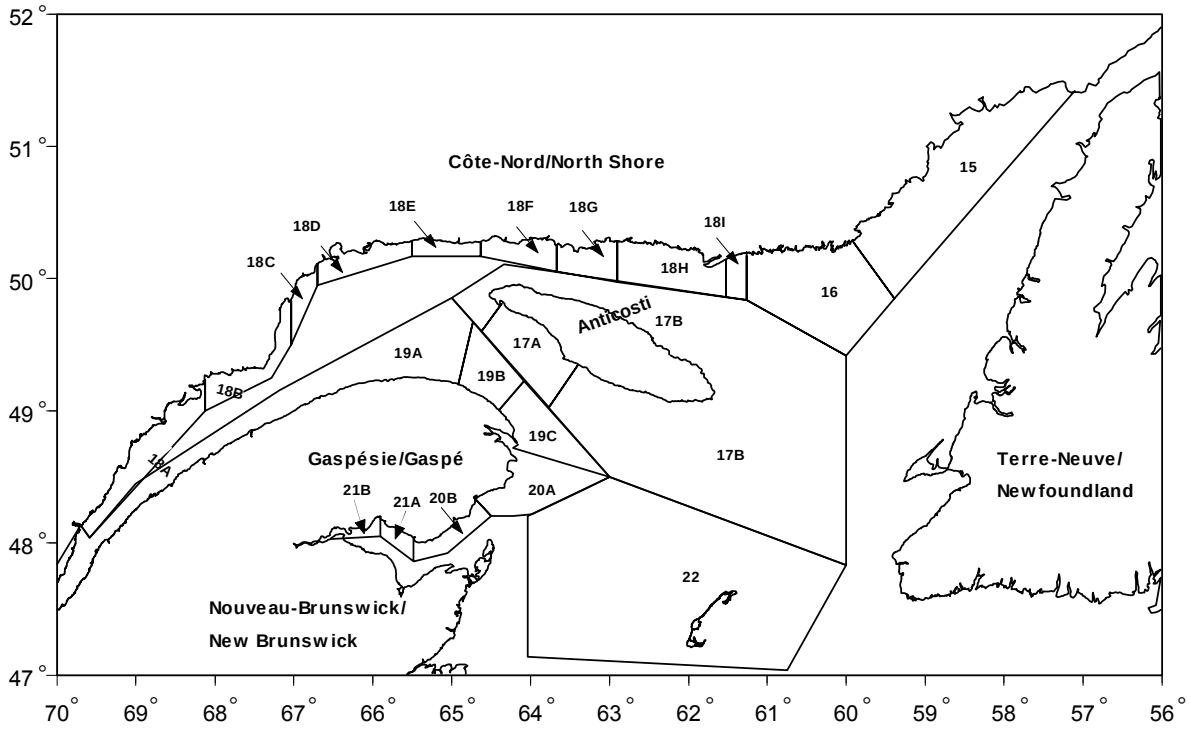

Figure 1. Lobster fishing areas in the Gaspé (LFAs 19, 20 and 21), Quebec.

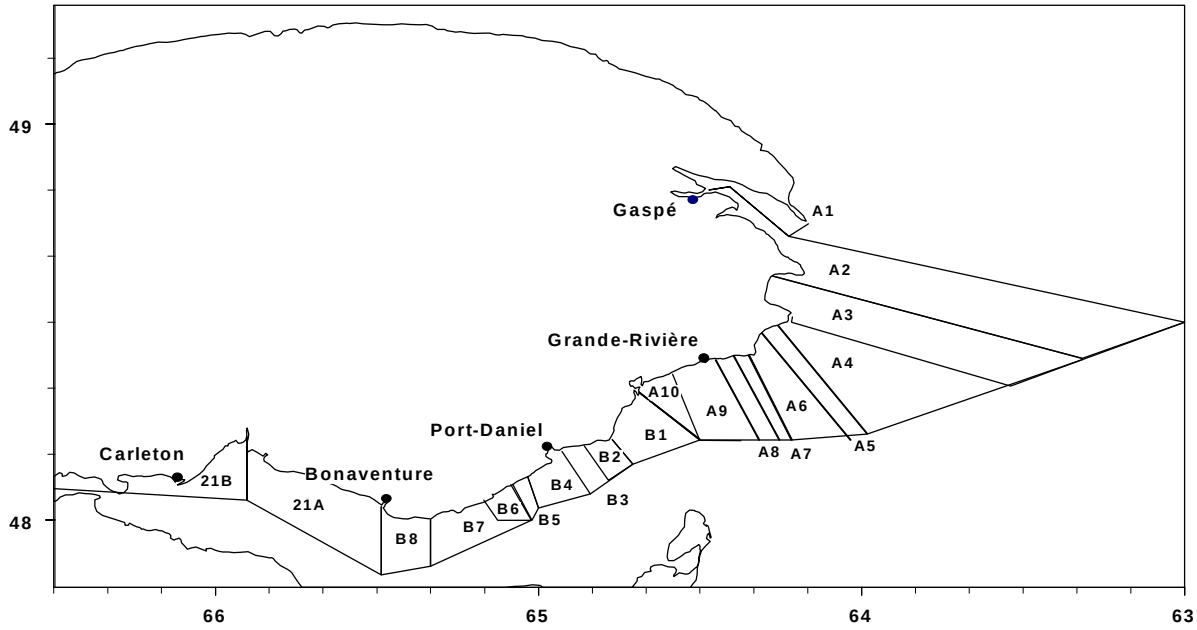

Figure 2. Lobster fishing sub areas in the southern Gaspé, LFA 20A (A1 to A10), LFA 20B (B1 to B8) and LFA 21 (A and B).

structures of lobster caught at sea, which are used to estimate exploitation rates, determine the male-to-female ratio per size class and calculate a relative index of egg production. At-sea sampling has been conducted annually since 1986 at La Malbaie (20A2), St. Thérèse/Grande-Rivière (20A8-A9) and Shigawake/St. Godefroi (20B5-B6), since 1997 in LFA 21B and since 2000 in LFA 19C (Figures 1 and 2). In 2004, additional sampling was conducted at sea and in processing plants to assess the abundance and distribution of large lobsters with a view to establishing a maximum legal size.

Landings

In 2004, lobster landings (preliminary data) in the Gaspé totalled 837 t, a decrease of 6.3% from 2003 levels (893 t). However, the landings were 8.8% higher than the average for the last 25 years (769 t) (Figure 3). The last five-year landing average was 938 t, which is equivalent to the five-year average (1992–1996) preceding the increase in minimum legal size (935 t).

In 2004, 95% of landings in the Gaspé were from LFA 20, 3% from LFA 19 and 2% from LFA 21. In 2004, landings in LFA 19 totalled 28 t (Figure 4). Levels have remained relatively steady since 2001 and were slightly above the average for the 1984–2003 series (26 t). Landings from LFA 21 were lower than those recorded in the early 1990s. Data for LFAs 21A and 21B in 2004 are currently incomplete. Landings recorded in 2004 in LFA 21A totalled 14 t. In LFA 21B, 4.2 t and 5 t were recorded for the spring and fall fisheries, respectively. Landings for the fall fishery totalled 8.2 t in 2003.

The 2004 fishing season was characterized by the coldest waters on record since 1996. Data obtained from index fishers show that fishing effort in 2004 was slightly lower than that in the last six years. These factors, along with the 1 mm increase in the minimum legal size, may account for the smaller landings. In LFA 21B, fishing effort during the spring fishery was lower. However, it is likely that landing levels were affected by the fishery of the previous fall.

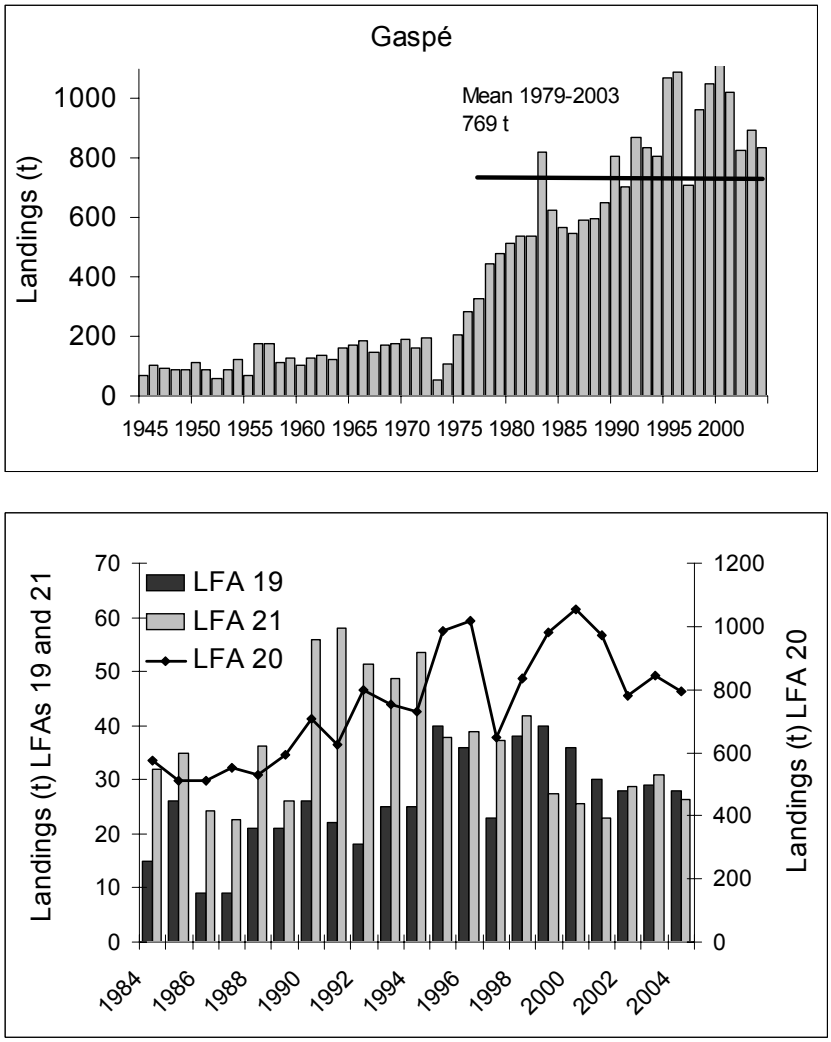

Figure 3. Lobster landings in the Gaspé, 1945–2004 and in LFAs 19, 20 and 21, 1984–2004.

Commercial-size lobsters are recruited to the fishery every year after the summer moulting period. The fall fishery therefore intercepts annual recruitment, causing the spring fishery to be dependent on fishing intensity during the previous fall.

Catch rates for commercial-size lobsters

Catch rates correspond to the catch per unit effort (CPUE). Since 1986, the mean annual CPUEs for market-size lobster for LFA 20AB have ranged from 0.41 to 0.85 lobsters/trap (Figure 4). In 2004, the CPUE was 0.46 lobsters/trap, down by 2.1% from 2003 levels and down by 16.4% from the 1986–2003 series average of 0.55 lobsters/trap. A decrease in the CPUE (10% to 15%) was expected with the increase in minimum legal size, equivalent to annual natural mortality, as the lobsters would remain on the seafloor an extra year before being harvested. Larger lobsters partly offset the decrease in the number of lobsters caught. Thus, the mean CPUE expressed in weight was 0.27 kg/trap in 2004, which is equal to the series average. The CPUEs of index fishers indicate the same trends.

The overall trend reflects the situation in the St. Thérèse/Grande Rivière area (20A8-A9).

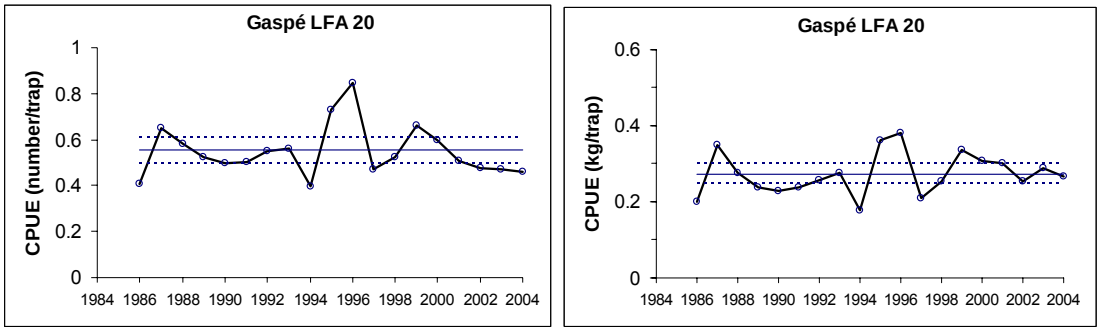

Figure 4. Catch rates (CPUE) in number and weight of commercial-size lobsters per trap for the Gaspé (LFA 20AB), 1986–2004. The solid line represents the mean for 1986–2003; the dotted lines represent the ±10% interval around the mean.

Between 1999 and 2002, significant drops in CPUEs were noted in the areas of St. Godefroi/Shigawake (20B5–B6) and La Malbaie (20A2), which could indicate a drop in recruitment or overly intense exploitation. A slight increase in CPUE was observed in these areas in 2003 and 2004. However, in LFAs 20B5-B6, CPUEs (in weight) still remain below (10%) the series average. CPUEs in LFA 19 are among the highest recorded in the Gaspé (around 0.44 lobster/trap and 0.38 kg/trap). CPUE in weight dropped by 34% in 2004 compared to 2003. CPUEs in LFA 21B (spring fishery) were low in 2004, compared with 2003 levels. CPUEs recorded during the 2004 fall fishery were on average seven times higher than those recorded in spring 2004. Lobster catchability is higher in the fall than in the spring because lobsters are in a postmoult phase. After moulting, lobsters are looking for food and are more easily attracted to bait in traps.

Catch composition and exploitation rates

Following the increase in minimum legal size changes have been noted in size composition for lobster landed in the Gaspé (Figure 5). The mean size of lobsters landed in LFA 20AB as a whole increased by almost 7 mm, from 82.5 mm in 1996 to 89.1 mm in 2004. The trend was observed in each of the sub-areas sampled (Figure 6). During the same period, mean weight rose by 25.4%, from 477 g to 598 g.

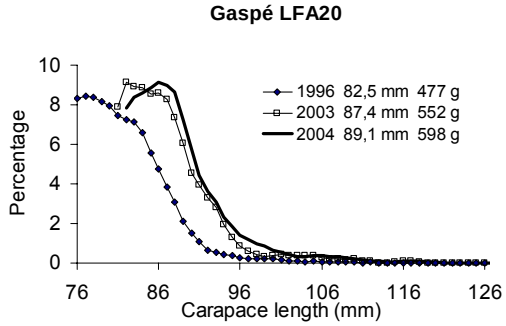

Figure 5. Size frequency distribution for lobster caught (commercial fraction) in 2003 and 2004, compared with 1996, in the Gaspé (LFA 20AB). The mean length and weight of the lobsters caught is indicated.

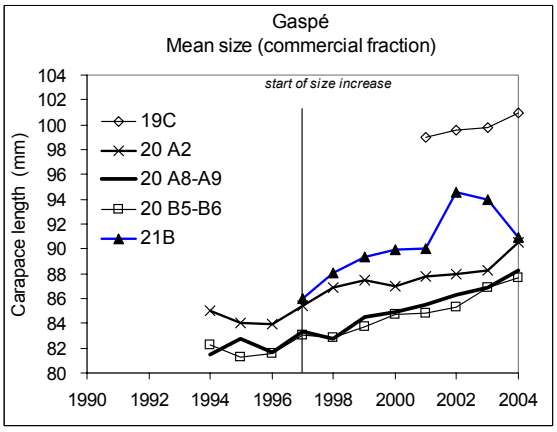

Figure 6. Trends in the mean size of commercial-size lobsters for each sampled sub-area in the Gaspé.

However, size structures remain just as highly truncated, which is an indication of high exploitation rates. The exploitation rate calculated for commercial-size lobsters in

LFA 20AB remains high, reaching 84% in 2003 (Figure 7). It is above the average for 1986–2002, which was 74%. Exploitation rates 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 is calculated solely for commercial-size males. However, the exploitation rate for males ≥ 76 mm has decreased since the increase in minimum legal size, and is now around 50%. 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. It has been impossible to calculate this index since the size of escape vents was increased in 2002, because small lobsters on which this index is based are no longer caught. The mortality of females is however lower because they are protected when berried.

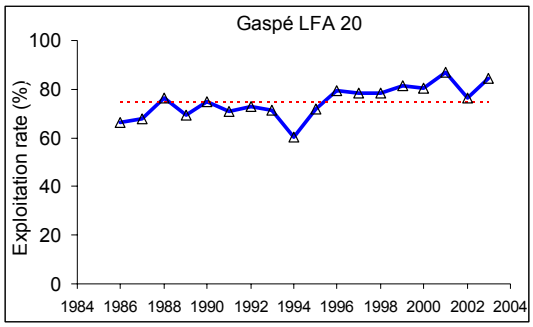

Figure 7. Exploitation rate index for the Gaspé (LFA 20AB), 1986–2003. The index is calculated based on the population fraction made up of commercial-size males. The dotted line represents the mean for 1986–2002.

Large lobsters

The proportion of large lobsters observed during at-sea samplings remains low. In 2004, jumbo lobsters (≥ 127 mm CL) accounted for only 0.5% of the Gaspé lobster population. More than 15,000 lobsters at sea and more than 13,000 lobsters in processing plants in Gaspé sub-areas located between 19C and 21A were measured for a study conducted in 2004 on the economic and biological impact of the imposition of a maximum legal size. At-sea sampling revealed that the proportion of harvested lobsters that are larger than 120 mm, 127 mm and 140 mm was 2.0%, 0.7% and 0.2%, respectively. A similar pattern was observed in processing plant samplings. The distribution of large lobsters is not consistent in the area under study. Large lobsters were most often observed in sub-areas 19C, 20A2 and 21A. Lobsters ≥120 mm can account for up to 10% of stocks in these sectors. Large lobsters consist of both males and females. Preliminary calculations indicate that protecting them would increase egg production in the area, but only marginally in the entire area under study (7%, 3.4% and 0.5% depending on whether the maximum legal size were set at 120 mm, 127 mm or 140 mm). The increase at the local level could be much more significant.

Sex ratio

The overall male-to-female ratio for commercial-size lobster is close to 1:1 (Figure 8). For sizes larger than 90 mm, males outnumber females. The male-to-female ratio has been lower in recent years. In 2004, the male-to-female ratio was 0.77:1.0 for all commercial-size lobsters, and 1.15:1.0 for lobsters ≥90 mm. It is essentially in LFA 20A8–A9 that the sex ratio has shifted in favour of females in recent years. An unbalanced sex ratio could impact the mating rate and the mating success, which could in turn affect the number of eggs produced.

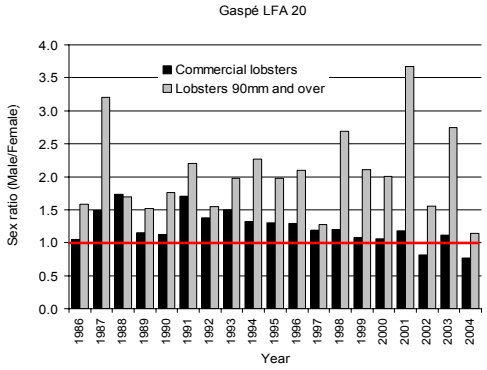

Figure 8. Male-to-female ratio for the commercial fraction and lobsters ≥ 90 mm for the Gaspé Peninsula (LFA 20AB), 1986–2004.

Berried females and egg production

The results of a simulation model show that, with the 6 mm increase in minimum legal size (76 to 82 mm), egg production per recruit would have increased by 100% from 1996 levels, thereby meeting the objective of doubling egg production per recruit. These theoretical results suggest 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.

At-sea sampling data show that the abundance of berried females increased significantly between 1996 and 2001, despite a slight drop in the abundance of commercial-size lobsters (Figure 9). However, abundance decreased in 2002, partly due to the increase in the size of escape vents. The examination of the size structures and abundance of berried females suggests that egg production doubled between 1996 and 2001 (Figure 10). 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 against abundance indices (CPUE, annual mean). The number of multiparous females has also increased proportionately since 1996.

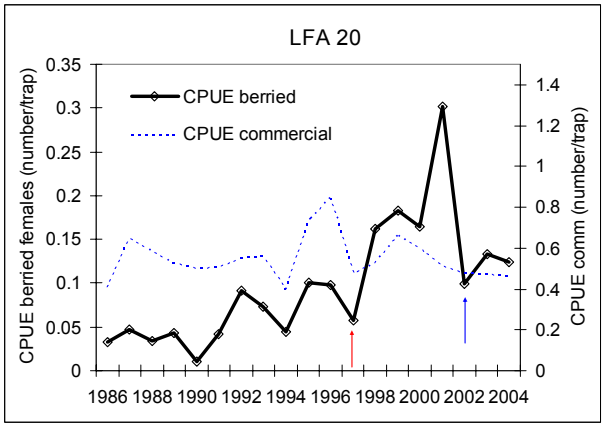

Figure 9. Catch rates (CPUE) of berried females for the Gaspé (LFA 20AB), 1986-2004. The first arrow indicates the start of increases in minimum legal size; the second arrow indicates the year when the height of escape vents was increased from 43 mm to 46 mm. The dotted line represents CPUE trends for commercial-size lobster during the same period.

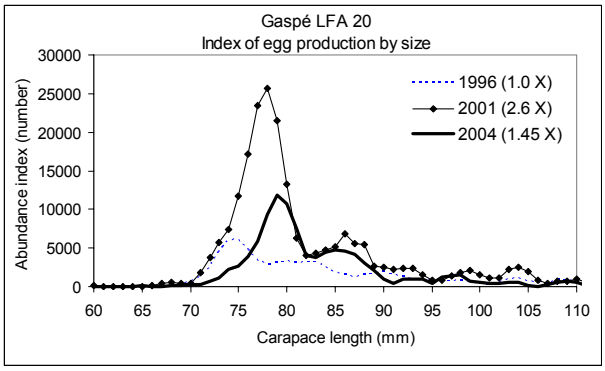

Figure 10. Egg production index calculated for the Gaspé (LFA 20AB) in 1996, 2001 and 2004. Egg production in 2001 and 2004 relative to that in 1996 is indicated in parentheses.

Recruitment

Sampling with traps whose escape vents are blocked was not done in 2004, making it impossible to predict landings for the coming year. However, the benefits of having increased the minimum legal size in 2004 will be seen in 2005. Lobsters that were returned to the water in 2004 will be

larger and heavier by the time they are caught again in 2005. A trawl test was conducted off the coast of Cap d'Espoir and on Pabos Bank in September 2004. The objective was to obtain an abundance index of prerecruits as a tool to forecast landings 1-2 years in advance. The uneven seafloor makes it impossible to sample these areas with this type of gear.

Conclusion

The increase in minimum legal size contributed to the increase in egg production and helped correct the problem of growth overfishing. The increase in minimum legal size has helped to reduce fishing pressure on immature lobster, promoting the production of eggs by primiparous females (i.e. females that are spawning for the first time). The objective of doubling egg production per recruit was met.

Although it is difficult to establish a direct link between the quantity of eggs produced and recruitment to the fishery, higher egg production should at least ensure that this factor does not become limiting. When environmental conditions are favourable, increased egg production could translate into improved recruitment. In unfavourable environmental conditions, higher egg production could reduce the risk of the stock collapsing.

Recent studies have shown that it would also be advantageous to increase the number of multiparous females (i.e. females that have already spawned once). The larvae of multiparous females are larger and heavier at emergence, which may indicate better survival potential. Additional measures could be implemented to increase multiparous females' contribution to egg production (e.g. V-notching, maximum size).

To date, very few measures have been implemented to reduce fishing effort and exploitation rates. The fishery remains just as dependent as before on annual recruitment. Moreover, the anticipated benefits of increasing the minimum legal size are reduced if the exploitation rate is increased, in terms of increasing egg production per recruit. It would be advantageous to reduce fishing effort, as the greater protection of females tends to create asymmetry between the exploitation rates for males and females. If exploitation rates are too high, the sex ratio could shift in favour of the females. Consequently, the number of large lobsters could drop even further, which would impact females' capacity to reproduce normally.

For more Information

Contact: Louise Gendron
Maurice Lamontagne Institute
850 Route de la Mer
P.O. Box 1000
Mont-Joli, Québec
G5H 3Z4

Tel: (418) 775-0618
Fax: (418) 775-0740
E-Mail: gendronl@dfo-mpo.gc.ca

This report is available from the:

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

Phone Number : 418-775-0825
Fax Number : 418-775-0740
E-Mail address : Bras@dfo-mpo.gc.ca
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