Fisheries and Oceans Canada | Pêches et Océans Canada
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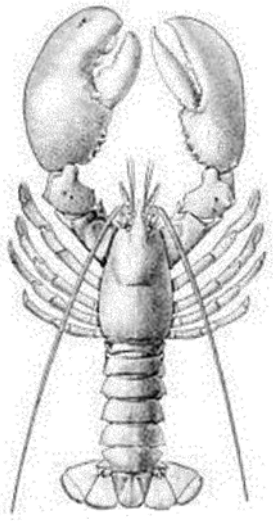
**Canadian Science Advisory Secretariat**
**Quebec Region** **Science Advisory Report 2019/060**

# ASSESSMENT OF LOBSTER (*HOMARUS AMERICANUS*) IN THE GASPÉ (LFAS 19-21), QUEBEC, IN 2018



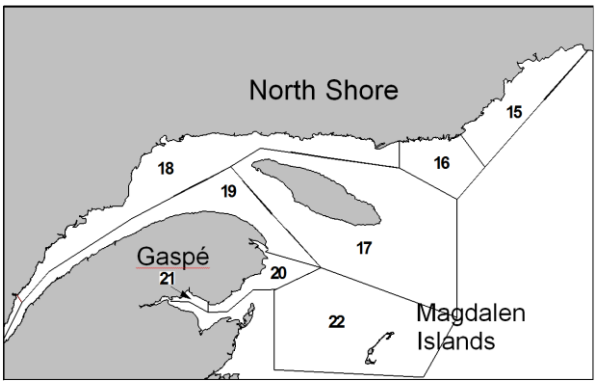



*Figure 1. Map showing lobster fishing areas (LFAs) in Quebec (LFAs 15 to 18: North Shore and Anticosti, LFAs 19 to 21: Gaspé and LFA 22: Magdalen Islands).*

**Context:**

*Lobster fishing in the Gaspé is practiced by 161enterprises (a skipper-owner and one or more fishers' helpers). Fishing effort is distributed among three lobster fishing areas (LFAs 19, 20 and 21) (Figure 1), subdivided into 27 subareas (Figure 2). The largest number of companies operate in LFA 20, 88% of the total number in the Gaspé. A small fleet (eight companies) fishes along the north shore of the peninsula (LFA 19) between Forillon and Grande-Vallée. Thirteen companies fish in LFA 21. In the fall, the Listuguj Micmac fish for subsistence in Area 21B. The fishery is managed through fishing effort control measures (number of licences, number and size of traps, fishing season and daily schedule, organization of trap lines) and escapement measures (escape vents, release of berried females and release of females with a V-notch on their telson, minimum and maximum legal sizes). Management and conservation measures introduced over the past 24 years follow the recommendations of the Fisheries Resource Conservation Council (FRCC). The status of the resource is assessed every three years. This report describes the situation in 2018 and changes observed since the last stock status assessment in 2015.*

## SUMMARY

- **Landings** are up sharply and reached a record 2,509 t in 2017, followed by a decline to 2,315 t in 2018 associated with Right Whale conservation measures. Landings in 2018 were 26% greater than in 2015 and 116% higher than the historical average (1993-2017). Fishing effort has decreased slightly since 2009 and is below the 1994-2004 level. In 2018, 78% of Gaspé landings came from LFA 20, 10% from LFA 21 and 12% from LFA 19.
- For the entire Gaspé area, the **catch per unit effort** (CPUE) in weight from commercial sampling rose sharply from 2015 to 2018. In LFA 19, the CPUE by weight in 2018 was 60%

higher than in 2015 and 202% higher than the historical average (2001-2017). In LFA 20, the CPUE by weight in 2018 was 59% higher than in 2015 and 133% higher than the historical average. In LFA 21B, the CPUE in the fall of 2018 was 74% higher than in 2015 and 162% higher than the historical average (2001-2017). The logbook CPUEs follow the same trend.

- In LFAs 19 and 21, **demographic indicators** showed that the average size of commercial lobsters was large in 2018 (95.8 mm and 92.8 mm respectively), but 4% lower than in 2015, possibly due to increased recruitment. In LFA 20, the average size of commercial lobsters has changed little since 2008 (≈ 88 mm). Commercial lobster size structures are much wider in LFAs 19 and 21 than in LFA 20.
- **Fishing pressure indicators** could not be estimated for LFAs 19 and 21. In LFA 20, exploitation rates were lower between 2015-2017 (76%) than between 2011 and 2014 (81%) but remained very high.
- **Productivity indicators** were high in LFA 20. The abundance of berried females has continued to increase since 2011. Theoretical egg production was 8.6 times higher in 2018 against to 4.6 times higher in 2015 compared to the period 1994-1996. In 2018, the abundance of prerecruits increased by 16% compared to 2015 in LFA 20, suggesting that landings may continue to increase. This information is not available for the other LFAs of the Gaspé.
- High abundance, productivity and landings indicate that the Gaspé lobster stock is in good condition and in the healthy zone according to the **precautionary approach**. In recent years, indicators have remained the same or improved based on prevailing environmental conditions and exploitation levels. However, in LFA 20, the small average size of commercial lobsters suggests that actions on reducing fishing effort must be pursued. Considering the environmental changes, it would be important to rapidly develop or update the biological knowledge essential for the sustainable management of these stocks.

# INTRODUCTION

## Biology

American Lobster (*Homarus americanus*) is found along the Atlantic coast, from Labrador to Cape Hatteras. Adult lobsters prefer rocky bottoms 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 (CL) in the southern part of the Gaspé Peninsula. Size structures of berried females suggest that they reach sexual maturity at a larger size along the north shore than on the south shore. In general, 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 (primiparous) can produce nearly 8,000 eggs while large females (127 mm CL) 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. Differences exist between primiparous and multiparous females. In addition to being more fertile, some jumbo females can spawn two years in a row 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. It has also been observed that spawning and hatching can occur earlier in the season and that larvae can be larger upon emergence for multiparous females (having already spawned) than for primiparous females. The larvae's planktonic phase lasts from 3 to 10 weeks, depending on

the temperature of the water and goes through three stages of development before undergoing metamorphosis. Following metamorphosis, postlarval lobsters (stage IV), which now resemble adult lobsters, leave the surface waters to settle on the sea floor, initiating the benthic phase. The survival of lobsters from their larval stage to their initial benthic stages is impacted by predation as well as hydrodynamic factors that determine the advection or retention of the larvae near areas that are favourable for benthic settlement. During the first few years of their benthic life, until they reach a size of approximately 40 mm, lobsters are cryptic ; i.e. they live hidden in habitats that provide sheltered spaces.Lobsters are estimated to reach the minimum catch size (82.55 mm) at around 8-9 years of age after having moulted approximately 16 times since their benthic settlement, and recruit to the fishery the following year.

## Description of the fishery

The lobster fishery is managed using fishing effort controls to regulate the number of licences, number and size of traps and the duration of the fishing season (Table 1).

*Table 1. Fishing rules in 2018*

| LFA | Duration (days) | MLS (mm) | LC max (mm) | No. traps | Trap size (cm) (Length x Width x Height) | Escape vents | No. licences |
|---|---|---|---|---|---|---|---|
| 19 | 71 | 83 | 150 | 250 | 92 x 61 x 50 | 2 circulars (65 mm) or 1 rectangle (127 x 46 mm) | 8 |
| 20 | 69 | 82.55 | 145 | 235 to 435 with licences merger | Wire: 92 x 54 x 39 Others: 92 x 61 x 46 | 2 circulars (65 mm) or 1 rectangle (127 x 46 mm) | 140 |
| 21 | 69 | 82.55 | 150 | 235 to 335 with licences merger | Wire: 92 x 54 x 39 Others: 92 x 61 x 46 | 2 circulars (65 mm) or 1 rectangle (127 x 46 mm) | 13 |

In 2006, the number of traps per licence was reduced from 250 to 235 in LFAs 20 and 21 (Figure 2) and the fishing season was shortened from 71 to 69 days. A number of licence buyback programs and other initiatives have been introduced, and 57 out of a total of 218 licences have been withdrawn since 2003. Buybacks were mainly in areas where yields were low, such as subareas 20B5–B6, where 13 of 29 licences (45%) were withdrawn. In 2018, nominal effort expressed as the number of trap hauls was estimated at 2.38 million for the Gaspé area, a 27% decrease from the 1994–2005 average (3.05 million trap hauls).

The minimum landing size (MLS) was increased from 76 mm CL in 1996 to 82 mm in 2004 to increase egg production per recruit. The objective of the increase in MLS was to double egg production per recruit from the 1994-1996 level. In 2006, the MLS in LFA 19 increased from 82 mm to 83 mm. In LFAs 20 and 21, the MLS increased to 82.55 mm in 2018. In addition to MLS, a maximum catch size was introduced in LFA 20 in 2008. It was initially 155 mm LC and has been 145 mm LC since 2012. In LFAs 20 and 21, a maximum catch size of 155 mm LC was introduced in 2016 and decreased to 150 mm LC in 2018. Berried females must be released. In addition, fishers cut a v-notch into the telson of berried females, on a voluntary basis. The

number of v-notched berried females varies and is not recorded. However, their release is mandatory.

Escape vents have been mandatory since 1994. The size of the vertical opening was increased from 43 mm to 46 mm in 2004 in response to the increase in minimum catch size. Traps may not be hauled more than once per day and soak time can exceed 72 hours.

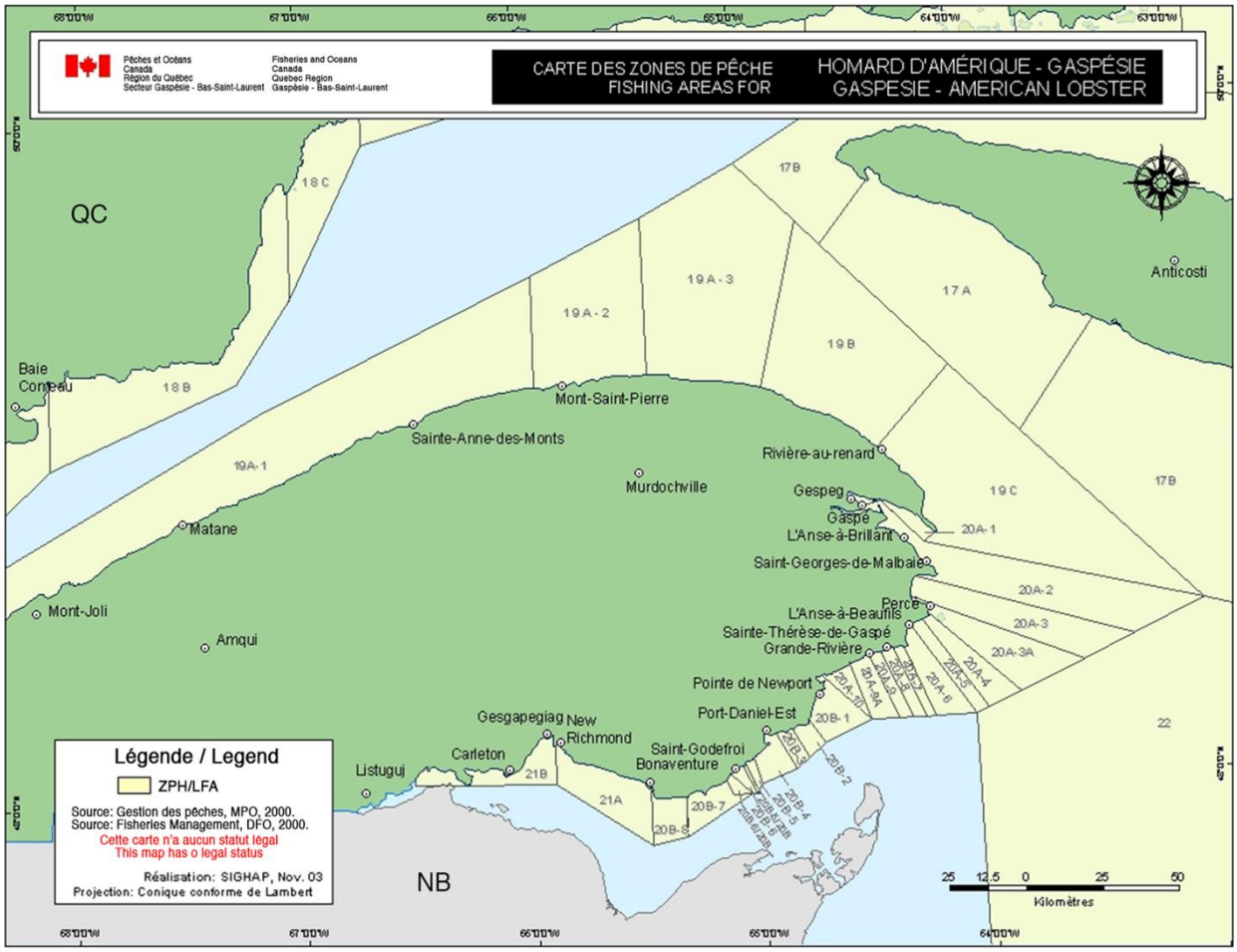



*Figure 2. Map of the Gaspé Peninsula showing the different sub-areas of LFA 19 (19A1 to 19C), LFA 20 (20A1 to 20A10 and 20B1 to 20B8) and LFA 21 (21A and 21B).*

# STOCK STATUS ASSESSMENT

## Source of data

The stock status assessment is based on abundance, demographic, fishing pressure and stock productivity indicators. Abundance indicators include landings recorded on processing plant purchase slips and catch rates of commercial-size lobsters obtained mainly from at-sea samplings of commercial catches. Demographic indicators are taken from lobster size structures and include mean size and weight, jumbo abundance (≥ 127 mm) and sex ratios based on the abundance of commercial lobsters (male/non-berried females). The fishing pressure index (exploitation rate) was determined by calculating the ratio between the number of individuals (males) from the first moult class recruited to the fishery in a given year and the number of

individuals from the second moult class recruited to the fishery one year later. Productivity indicators are based on abundance of berried females and egg production (reproduction) as well as abundance of prerecruits (recruitment). At-sea sampling has been conducted aboard fishing vessels since 1986 in La Malbaie (20A2), Ste-Thérèse/Grande-Rivière (20A8–A9) and Shigawake/St-Godefroi (20B5–B6). At-sea sampling was also conducted between Miguasha and Maria (subare 21B) from 1997 to 2004 during the spring fishery and from 2002 to 2004 and 2017-2018 during the spring and fall fishery (scientific data collected by the Listuguj Aboriginal community, not presented). In subarea 19C, at-sea sampling was conducted from 2001 to 2004, 2011 and 2016 to 2018 in Shiphead to Rivière-au-Renard area. Since 2005, dockside sampling has replaced at-sea sampling in Areas 21B and 19C during years when at-sea sampling has not been carried out. From 2008 to 2018, Parks Canada conducted additional sampling at sea in the Forillon National Park area (subareas 19C and 20A1).

Since 2011, a postseason (September) survey using modified traps (without escape vents) has been conducted at five sites in the Gaspé (LFA 20) to develop a new fishery recruitment index. The survey is conducted in the fall, after moulting, and the sampled population represents the population that will be available to the fishery the following year.

Data from the three previous years are examined for each indicator, and 2018 data are compared with the average of the pre-2018 data séries. When the data are more variable, the average for the current assessment period (2016-2018) is compared to the average for the previous period (2012-2015).

## Abundance indicators

### Landings

Landings for the entire Gaspé area reached 2,315 t in 2018 (Figure 3). They increased by 25.6% compared to 2015 (1,844 t) and were 116.2% higher than the 1993-2017 average of 1,071 t. In 2018, 78% of total landings in the Gaspé came from LFA 20, 12% from LFA 19 and 10% from LFA 21. Lobster landings from the Gaspé accounted for 28% of total landings in Quebec (8,127 t). In LFA 20, 2018 landings reached 1,813 t, a 15% increase over 2015 (1,577 t) and 88% over the 1993-2017 average (962 t). The upward trend observed since 2011 was noted in the majority of LFA 20 subareas. Keep in mind that landings in LFA 20 had dropped significantly between 2000 and 2005 and did not increase between 2005 and 2009. Landings in LFA 19 totalled 269 t in 2018 (Figure 3). They increased by 155% compared to 2015 (106 t) and were 498% above the 1993-2017 average (45 t). Landings in LFA 21 increased by 44% between 2015 (162 t) and 2018 (233 t) (Figure 3) and the 2018 value is 285% higher than the 1993-2017 average (60 t).

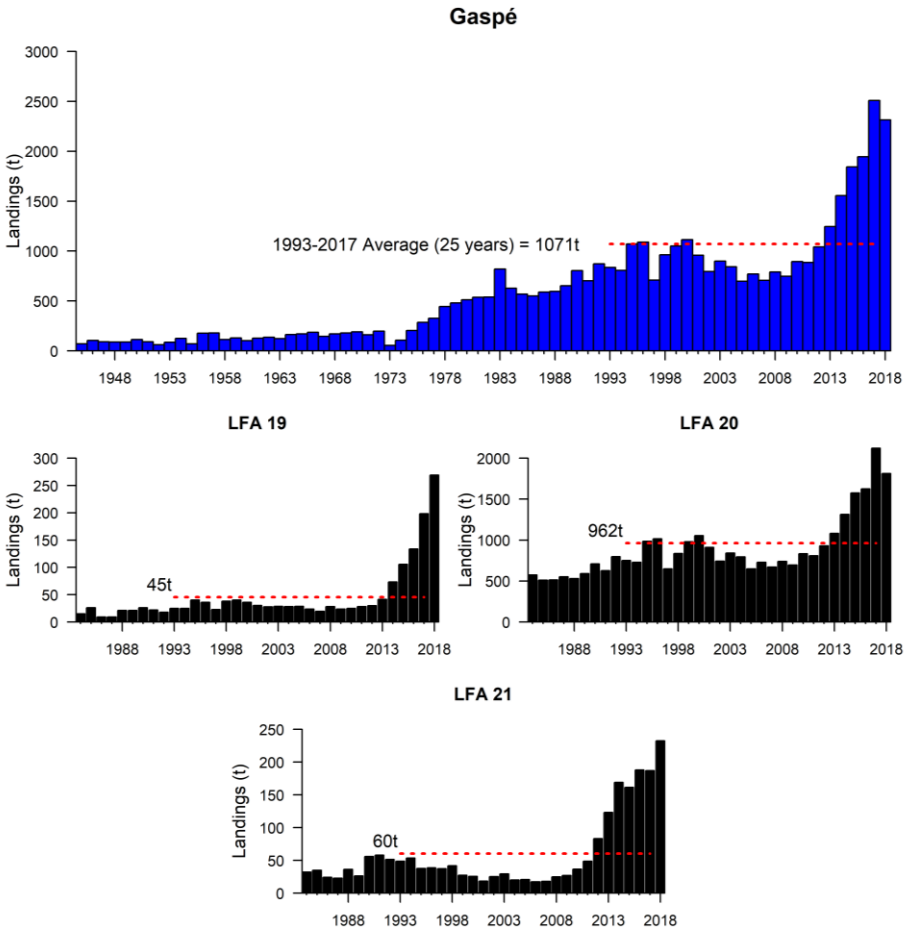



*Figure 3. Lobster landings in the Gaspé from 1945 to 2018 and from 1984 to 2018 for LFAs 19, 20 and 21. Dotted lines refer to the average value of the last 25 years, excluding 2018).*

### Commercial lobster catch rates

Catch rates are equal to catches per unit effort (CPUEs) expressed in number or weight of lobster per trap. In 2018, the CPUE for commercial-size lobsters (≥ 82,55 mm) in LFA 20 was 1.52 lobster per trap (lobster/trap), which works out to 0.87 kg of lobster per trap (kg/trap) (Figures 4A and B). The CPUE in number was 53% higher than in 2015 (1.00 lobster/trap) and 117% above the 1993-2017 average (0.70 lobster/trap). The CPUE in weight was 59% higher than in 2015 (0.55 kg/trap) and 133% above the 1993-2017 average (0.37 kg/trap). An increase in CPUEs was observed in the three groups of subareas sampled, especially in 20A2 and 20A8–A9. CPUEs in LFA 19 were 3.51 lobster/trap and 2.57 kg/trap in 2018, a 64% and 60% respective increase over 2015 (2.15 lobster/trap et 1.61 kg/trap) (Figures 4C and D). The average CPUE measured during the fall fishery in LFA 21B was 4.41 kg/trap (Figure 4E) which represent an increase of 74% compared to 2015 (2.54 kg/trap). This is one of the highest values observed since the start of the fall fishery in 2001. The 2002 to 2017 average (partial data in 2001 and 2014) was 1.43 kg/trap. Traditionally, average CPUEs observed during the spring fishery in LFA 21B are always about 0.25 kg/trap.

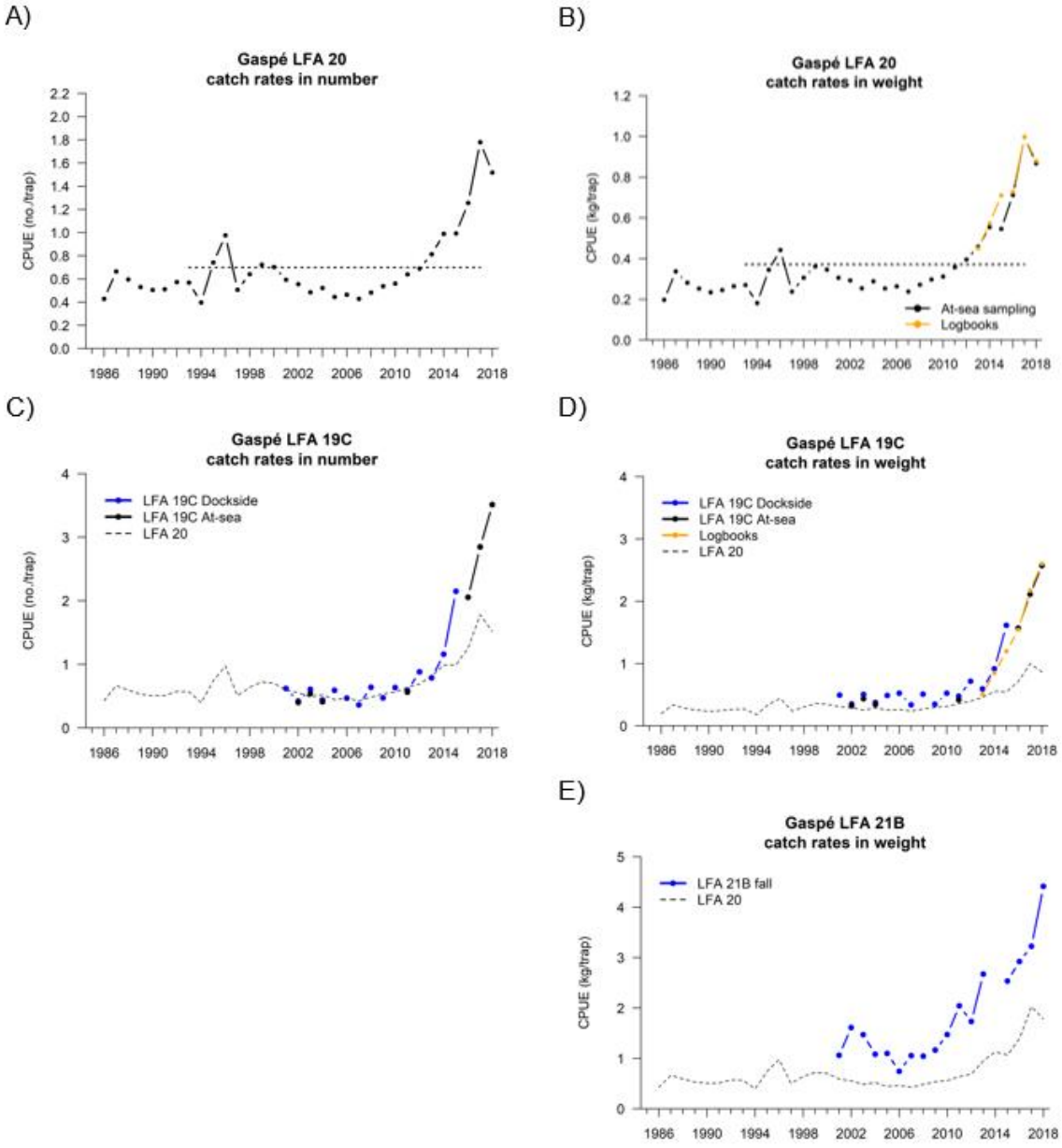



*Figure 4. Catch rates (CPUEs) of commercial-size lobsters for LFA 20 in the Gaspé from 1986 to 2018 in number (A) and weight (kg) (B) per trap, for LFA 19C from 2001 to 2018 in number (C) and weight (kg) (D) and for LFA 21B in the fall from 2001 to 2018 in weight (kg) (E) per trap. For (A) and (B), the dotted line indicates the average CPUE for the last 25 years excluding 2018.*

## Demographic indicators

In LFA 20, size structures appear truncated and are dominated by a moult class (82–93 mm for males and 82–89 mm for females) reflecting the year's recruits (Figure 5A). Female size distributions are more truncated toward small sizes than male size distributions, reflecting a decrease in the growth of females as they reach sexual maturity. Peaks in abundance at 82-84 mm in 2015 and 2017 indicate a particularly large influx of recruits (Figure 5A). The mean size and weight of landed lobsters has remained stable between 2007 and 2016 (88 mm and 590 g).

The proportion of jumbo lobsters observed in at-sea sampling is quite low, fluctuating between 0.2% and 0.3% from 2015 to 2018.

Size structures were more spread out in LFA 19C compared to LFA 20 (Figure 5B). Several moult classes are noticeable. It was also characterized by a much higher percentage of jumbo lobsters. However, there is a downward trend, with jumbo lobsters dropping from 2.2% in 2015 to 2.0% in 2018. The average size and average weight of landed lobsters also decreased from 97 mm (751 g) in 2015 to 95.9 mm (724 g) in 2018. The relative decline of jumbos and the decrease in average size is due to an increased number of smaller commercial lobsters (recruits) in the fishery, as evidenced by the significant increase in the number of lobsters <96 mm between 2015 and 2018 (Figure 5B).

The average size of lobsters landed in LFA 21B (dockside sampling) in the spring and fall of 2018 respectively was 92.8 mm and 92.7 mm. Size structures were slightly less truncated than those observed in LFA 20. From 2015 to 2018, the percentage of jumbos fluctuated between 2.1% and 5.5%. The number of lobsters sampled in this LFA remains low, which makes size structures difficult to interpret.

## Fishing pressure and sex ratio

Truncated size structures are indicative of high exploitation rates. Exploitation rates calculated for commercial-size males in LFA 20 were variable. For 2014–2017, the average exploitation rate was 76.1%, which is comparable to the 2011-2014 average (76.6%) and lower than the 1986-2016 average (77.4%). However, the exploitation rate at 81% in 2017 is high.

In general, female mortality was not as high because females are released when berried. As a result, the sex ratio for lobsters left on the sea floor could shift towards females, which is more likely when exploitation rates are high. For the time being, the sex ratio (number of males/number of non-berried females) seems appropriate to ensure mating (≥ 1).

The situation is different in LFA 19C, where wide size structures indicate that exploitation rates are lower (around 30%). Since 2015, sex ratios have always been greater than one and seem suitable for mating.

Exploitation rates could not be calculated in LFA 21B, but size structures suggested that they were rather high. Sex ratios observed over the past few years were quite often strongly biased towards males (> 2.0).

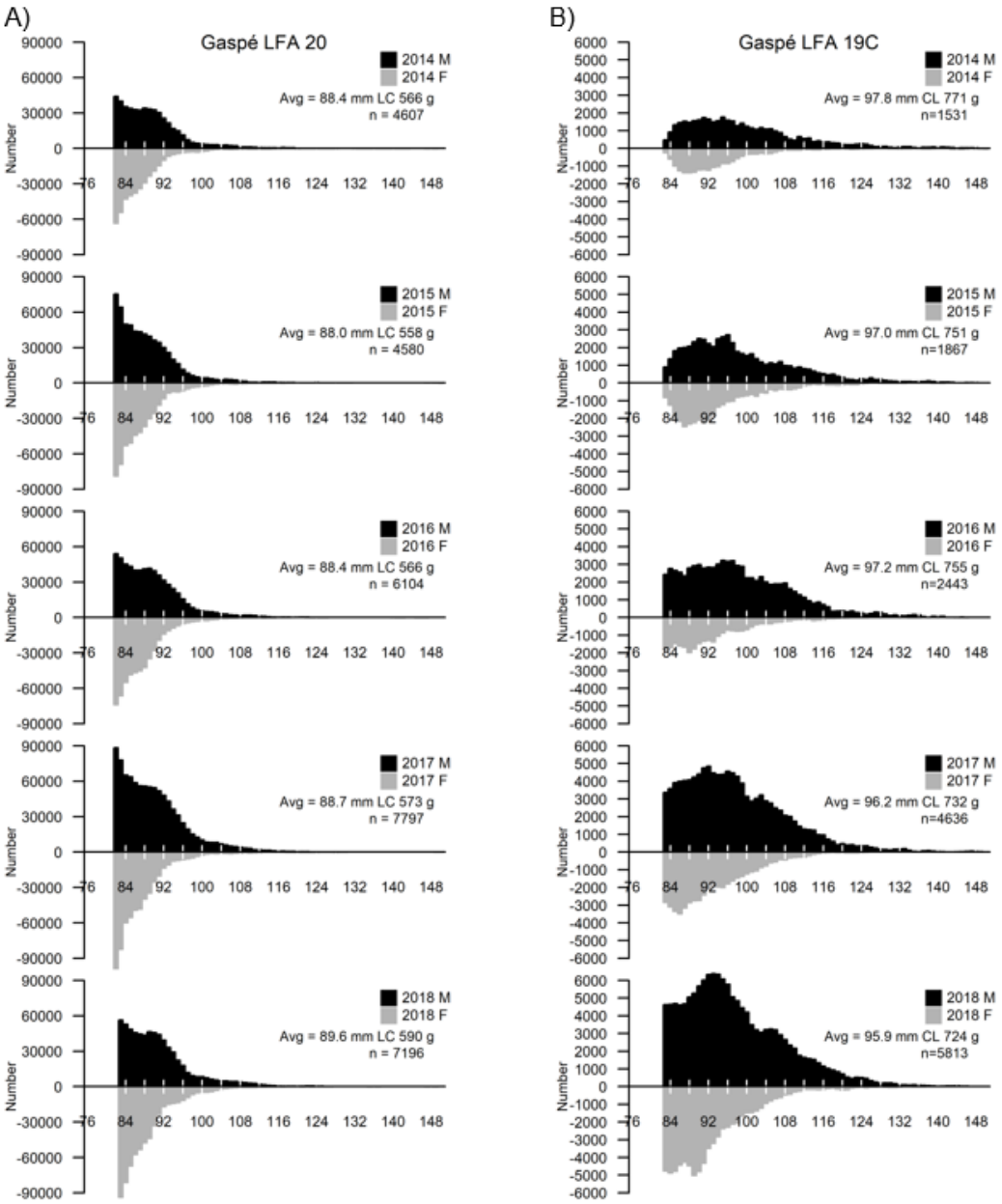



*Figure 5. Size frequency distributions of commercial male (black) and female lobsters (grey) in the Gaspé from 2014 to 2018 for (A) LFA 20 and (B) LFA 19. Frequencies are weighted by landings. The average size and weight (Avg) and the number of lobsters measured (n) are indicated.*

## Productivity indicators

### Berried females and egg production

In 2018, the CPUE for berried females in LFA 20 reached 0.68 lobster/trap compared to 0.28 lobster/trap in 2015. Since 2015, the abundance of berried females has been at least five times higher than it was when the MLS was 76 mm (Figure 6). The average CPUE from 1986 to 1996 was 0.06 lobster./trap.

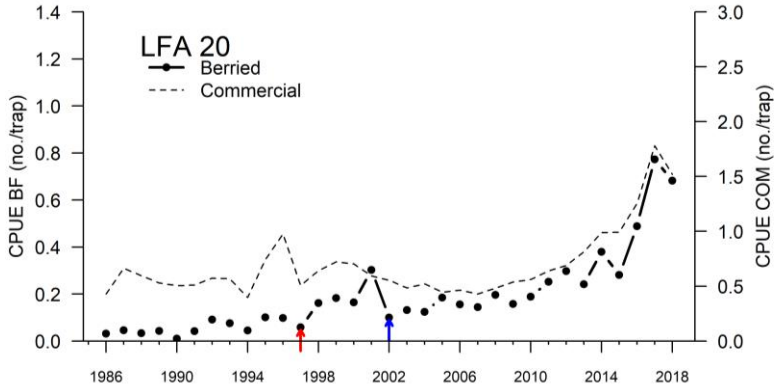



*Figure 6. Catch rates (CPUEs) for berried females and commercial size lobsters in LFA 20 from 1986 to 2018. The first arrow indicates the start of the increase in minimum catch size and the second arrow indicates the year when the height of the escape vents was increased from 43 mm to 46 mm.*

Size structures of berried females in LFA 20 showed a strong modal value under the MLS (Figure 7). Seventy-two percent of berried females are below the MLS. Before the MLS was increased, most of these females did not contribute to egg production. In 2018, the average size of berried females was 80.4 mm CL and multiparous females represented 13% of berried females. An egg production index was calculated by multiplying the abundance index of berried females for each 1-mm size class by the size-specific fecundity. In 2018, the egg production index for all of LFA 20 was 7.7 times higher than that calculated for 1994–1996, prior to the introduction of the increase in the MLS, and multiparous females accounted for 19% of total egg production.

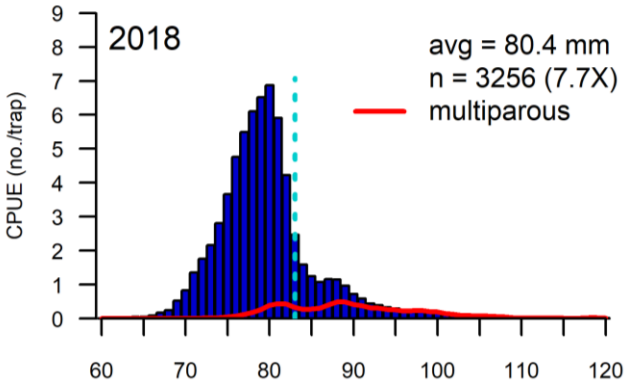



*Figure 7. 2018 size frequency distributions of berried females in LFA 20. The red line represents multiparous females. Distributions are weighted by abundance indices (annual CPUEs). The average size (avg), total number of berried females (n) and the rate of increase in egg production compared to the 1994–1996 average (in parentheses) are indicated. The dotted line indicates the MLS.*

### Recruitment

Abundance indices of prerecruits 1 (Pre1: 72–81 mm, one moult below commercial size) from modified traps (blocked escape vents) used in the postseason survey increased slightly since 2011 in LFA 20 (Figure 8). However, the relationship can vary between subareas. For LFA 20, the abundance of prerecruits observed in 2018 suggests that landings observed over the past two years could be maintained in 2019 if catchability remains similar. Medium-term forecasts (two years) are still inaccurate because of the short data series. Development of a longer time

series should, in the medium term, enable us to establish a connection between the abundance of prerecruits one year and landings one or two years later.

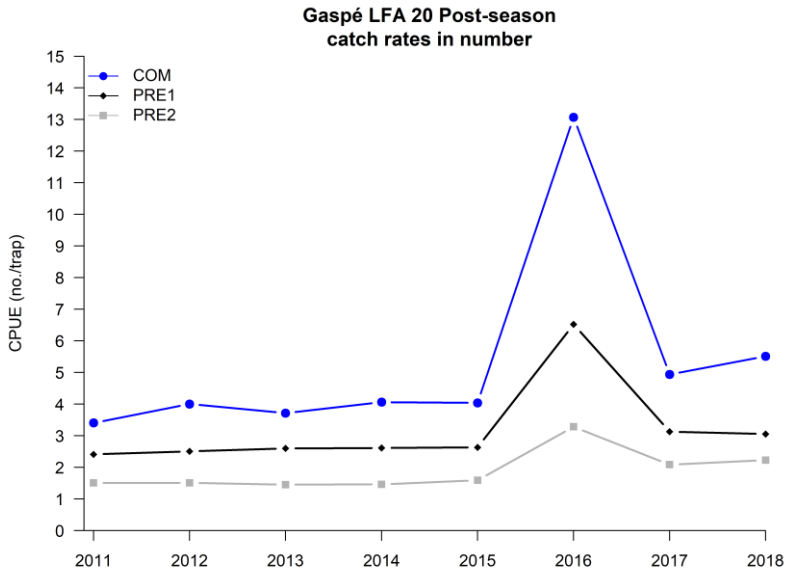



*Figure 8. Catch rates (CPUE)for commercial-size lobsters, for prerecruits 1 (PRE1: 71–81 mm, one moult below commercial size) and prerecruits 2 (PRE2: <72 mm, more than one moult below commercial size) from 2011 to 2018 for all of LFA 20. Preliminary data.*

## Precautionary approach

A precautionary approach (PA) based on an empirical method was used for the lobster fishery in the Gaspé. The limit and upper reference points (LRP and URP) and the stock status zones (healthy, cautious and critical) were defined from a stock biomass indicator and in compliance with the DFO operational policy framework. According to the definition in framework, reference points are defined in relation to the maximum sustainable yield ($B_{MSY}$). As in the case of the Magdalen Islands and the Maritimes, average landings from 1985 to 2009 were used as an approximate $B_{MSY}$. At least two large cohorts of lobster were produced during these 25 years. Average landings from 1985 to 2009 were 810 t. The LRP (40% x average) was 325 t and the URP (80% x average) was 650 t. (Figure 9). In 2018, with landings of 2,315 t, the stock was considered in the healthy zone (Figure 9).

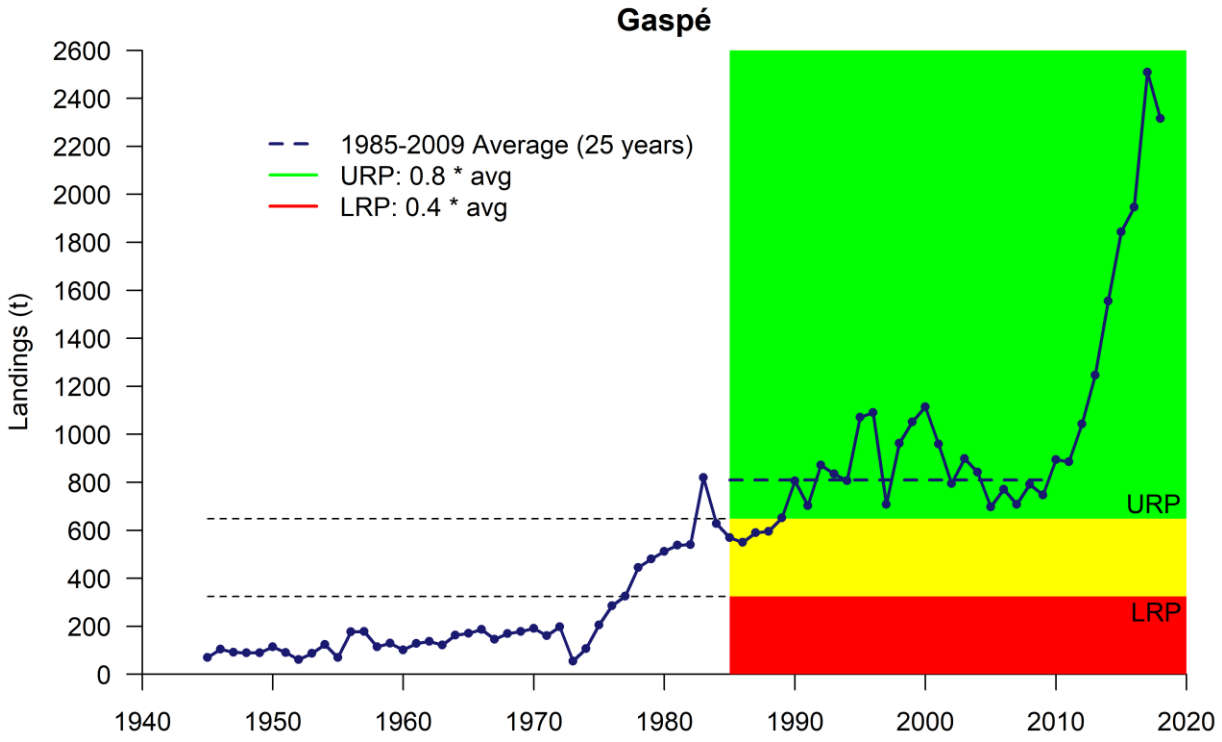



*Figure 9. Lobster landings in the Gaspé from 1945 to 2018. Healthy zone is green. Cautious zone is yellow, and the Critical zone is red. The dotted line from 1985 to 2009 corresponds to the average value that approximates the $B_{MSY}$.*

## Sources of uncertainty

The climate (long term) and weather conditions (short term) have significant impacts on all stages of lobster development. The climate determines periods of migration, moulting, reproduction, larval release and benthic settlement. It also conditions feeding and growth rates and periods. Weather conditions (temperature and wind) can affect lobster catchability. For example, when the water temperature is slow to increase in the spring or if it falls rapidly due to cold water upwelling, lobster catchability will be lower. Interannual or seasonal variability in climate and weather conditions can therefore have impacts on several demographic assessment indicators, including trawl and commercial fishery catch rates, which are considered to be abundance indicators and which are used in calculating indexes of exploitation rates.

Coverage of at-sea sampling is low (0.13% of fishing activities), which gives rise to uncertainties in the representativeness of the CPUEs estimated. Spatial fishing patterns can affect the abundance index of berried females if, for example, fishers avoid areas where these females can gather. There is also uncertainty as to the representativeness of small-scale observations for the entire population.

# CONCLUSION

High abundance and productivity indicate that the Gaspé lobster stock is in good condition and that current exploitation levels are generally adequate. According to the precautionary approach, the Gaspé stock is in the healthy zone. In recent years, indicators have remained the same or improved based on prevailing environmental conditions and exploitation levels. However, in Area 20, the small average size of commercial lobsters and the high exploitation rate suggest that reducing fishing effort must be pursued. In the context of changes in the environment, it would be important to rapidly develop or update the biological knowledge essential for the sustainable management of these stocks.

# LIST OF MEETING PARTICIPANTS

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|---|---|---|---|---|
| Arseneau, Cédric | DFO – Fisheries management | x | x | - |
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| Belley, Rénald | DFO – Science | x | x | x |
| Bernier, Denis | DFO – Science | x | x | x |
| Bouchard, Danielle | MAPAQ | x | - | - |
| Bruneau, Benoit | DFO – Science | x | x | x |
| Coté, Jean | RPPNG | x | x | x |
| Couillard, Catherine | DFO – Science | - | x | x |
| Cyr, Charley | DFO – Science | x | x | x |
| Deraspe, Norman (tel) | Fisher from Iles-de-la-Madeleine | - | x | - |
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| Gillis, Carole Anne | Listuguj Fisheries | - | - | x |
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| Tremblay, Claude | DFO – Science | x | - | - |
| Turbide, Carole | DFO – Science | x | x | x |
| Two-Axe, Tara | Gesgapegiag | x | - | x |

## SOURCES OF INFORMATION

This Science Advisory Report is from the March 12-14, 2019 regional peer review meeting on the Assessment of the lobster in Quebec's inshore waters. Additional publications from this meeting will be posted on the Fisheries and Oceans Canada (DFO) Science Advisory Schedule as they become available.

DFO. 2009. A fishery decision-making framework incorporating the precautionary approach. (assessed on February 20, 2016)

DFO. 2014. Development of reference points in the context of a precautionary approach (PA) for lobster of the Gaspé (LFAs 19, 20 and 21). DFO Can. Sci. Advis. Sec. Sci. Resp. 2013/027.

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