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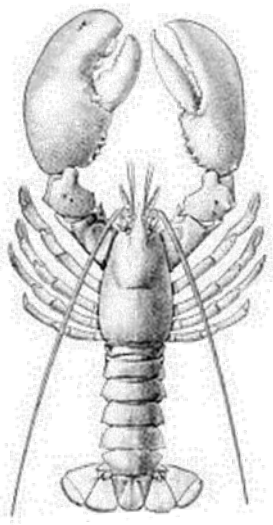
AMERICAN LOBSTER (*HOMARUS AMERICANUS*) STOCK ASSESSMENT IN THE GASPÉ (LFAS 19-21), QUEBEC, IN 2022



*Lobster (*Homarus americanus*)*

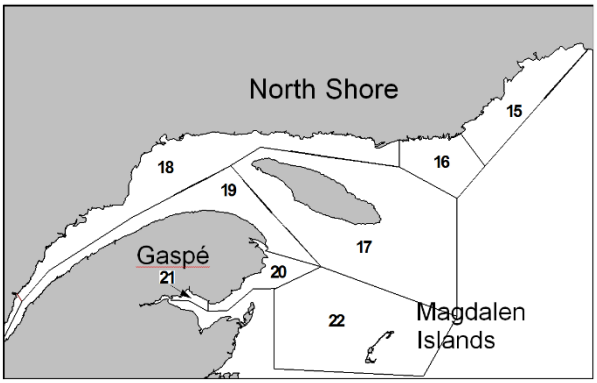


Figure 1. Map showing lobster fishing areas (LFAs) in Quebec (LFAs 15 to 18: North Shore and Anticosti, LFAs 19 to 21: Gaspé and LFA 22: Magdalen Islands).

Context:

Lobster fishing in the Gaspé is practiced by 156 enterprises (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. Fourteen companies fish in LFA 21. In Area 21B, the Listuguj Micmac practice a subsistence fall fishery in addition to a regular spring fishery. 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 28 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 2022 and changes observed since the last stock status assessment in 2018.

SUMMARY

- Landings in the Gaspé increased sharply in 2022, reaching 3,796 t, one of the highest values in the time series. They were 64.1% higher in 2022 than in 2018 and 169.9% higher than the average of the previous 25 years (1,407 t, 1997–2021). Fishing effort has been stable since 2019 at 2.34 million traps, which is 23.1% below the average for the 1994–2005

period. In 2022, 75.6% of landings in Gaspé came from LFA 20, 9.9% came from LFA 21 and 14.5% from Area 19.

- For the entire Gaspé area, the catch per unit effort (CPUE) by weight from commercial sampling has been increasing significantly since 2014. In LFA 19C, the CPUE in 2022 (3.51 kg/trap) was 33% higher than in 2018. In LFA 20, the CPUE rose by 40.8% between 2018 and 2022 (1.22 kg/trap). The logbook CPUEs followed the same trend for the latter. In LFA 21B, the CPUE increased by 13.2% between the fall of 2018 and the fall of 2022 (4.99 kg/trap).
- In LFA 19C, the demographic indicators show that the average size of commercial lobsters sampled was larger in 2022 at 97.6 mm, which is 1.9% greater than the 2018 value. In LFA 20, the average size has also been trending upward, reaching 90.7 mm in 2022, which is more than 1.4% of the 2018 value. In LFA 21B, average sizes have been trending downward in the fall and spring fisheries since 2015, reaching 91.2 mm in 2022, which is 1.7% below the 2018 value.
- Fishing pressure indicators could not be estimated for LFAs 19 and 21. In LFA 20, the exploitation rates have been showing a slight decline since 2008. The rate was 78.1% in 2021, which is above the average for the 2016–2018 period (73.7%).
- In LFA 20, the productivity indicators have remained high. The abundance of berried females has been increasing since 2011. Theoretical egg production was 1.2 times higher in 2022 than in 2018 and 10.3 times higher than during the 1994–1996 period.
- Indicators of fishery pre-recruitment in LFA 20 were stable between 2018 and 2022, at a rate of 3.06 lobsters per trap.
- The number of degree-days of the 2022 fishing season (284 DD) was 7.2% below the average for the previous 25 years.
- Small rock crab are a key prey source for lobster. Despite the low fishing effort observed in recent years in the Gaspé, the size structures of commercial dockside sampling suggest a low abundance of rock crab below the legal size in LFA 19. In addition, the CPUE of rock crab in the commercial fishery has been in decline in that Area since 2017. In 2022, it was below the average for the 2000–2021 period. However, these trends were not observed in LFAs 20 and 21.
- 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.
- The health indicators of rock crab in Gaspé were examined from an ecosystem approach. Unlike in LFAs 20 and 21, the population status of this essential prey for lobster in LFA 19 is of concern.
- To ensure the sustainability of the lobster stock and that of its preferred prey while preserving their trophic link, a low rock crab mortality rate should be favoured.

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 (or cephalothorax 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 or jumbo) 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. 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. After hatching, 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 legal size (MLS) (83 mm CL) 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).

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. Various licence buyback programs and initiatives have been introduced over the years, 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 2022, nominal effort expressed as the number of trap hauls was estimated at 2.34 million for the Gaspé area, a 7.4% increase over 2018 (2.18 million trap hauls).

The minimum landing size (MLS) was increased from 76 mm CL in 1996 to 82 mm in 2004 in order 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 then to 83 mm in 2021. In addition to MLS, a maximum catch size of 155 mm was introduced in LFA 20 in 2008 then reduced to 150 mm LC in 2020 and to 145 mm LC in 2022. In LFAs 19 and 21, a maximum catch size of 155 mm LC was introduced in 2016 and decreased to 150 mm LC in 2018 and to 145 mm in 2020. 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 2002 in response to the increase in minimum catch size. Traps may not be hauled more than once per day and soak time can't exceed 72 hours.

Table 1. Management rules for the Gaspé lobster fishery in 2022. MLS = minimum legal size.

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	145	250	92 x 61 x 50	2 circulars (65 mm) or 1 rectangle (127 x 46 mm)	8
20	69	83	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)	134
21	69	83	145	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)	14

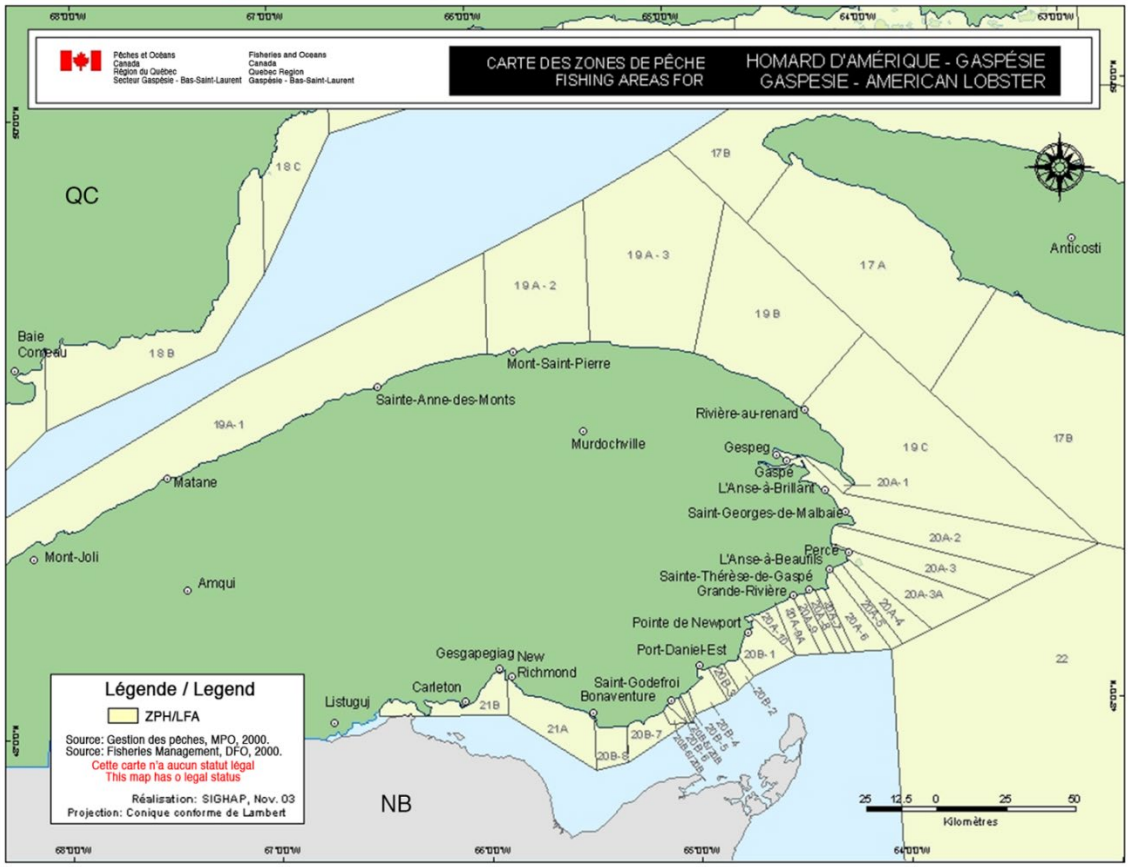


Figure 2. Map of the Gaspé Peninsula showing the different sub-areas of LFA 19 (19A1 to 19C), LFA 20 (20A1 to 20A10 and 20B1 to 20B8) and LFA 21 (21A and 21B).

ASSESSMENT

Source of data

Lobster

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 Saint-Georges-de-Malbaie (20A2), Ste-Thérèse/Grande-Rivière (20A8–A9) and Shigawake/St-Godefroi (20B5–B6). At-sea sampling was also conducted between Miguasha and Maria (subarea 21B) from 1997 to 2004 during the spring fishery and 2017–2022 during the spring and fall fishery (scientific data collected by the Listuguj Indigenous community, not presented). In subarea 19C, at-sea sampling was conducted from 2001 to 2004, 2011 and 2016 to 2022 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 2022 (except 2020 and 2021), 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 2022 data are compared with the average of the pre-2022 data series. When the data are more variable, the average for the current assessment period (2018–2022) is compared to the average for the previous period (2016–2018).

Rock crab

This advisory report represents an initial attempt to incorporate an ecosystem approach into the lobster stock assessment. In this approach, water temperature and rock crab stocks are now considered as a key components of the environment. The rock crab stock assessment is based on a review of an indicator of abundance (processing plant purchasing slips) and a demographic indicator (the size structures obtained from commercial fishery dockside sampling).

Abundance indicators

Landings

Landings for the entire Gaspé area reached 3,796 t in 2022 (Figure 3). They increased by 64.1% compared to 2018 (2,313 t) and were 169.9% higher than the 1997–2021 average of 1,407 t. In 2022, 75.6% of total landings in the Gaspé came from LFA 20, 14.5% from LFA 19 and 9.9% from LFA 21. Lobster landings from the Gaspé accounted for 32% of total landings in Quebec (11,984 t). In LFA 20, 2022 landings reached 2,868 t, a 58.4% increase over 2018

(1,812 t) and 136.1% over the 1997–2021 average (1,215 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 reach an historic high of 550 t in 2022 (Figure 3). They increased by 104.4% compared to 2018 (269 t) and were 488.2% above the 1997–2021 average (93 t). Landings in LFA 21 increased by 62.2% between 2018 (232.7 t) and 2022 (377.5 t) (Figure 3) and the 2022 value is 292.6% higher than the 1997–2021 average (96 t).

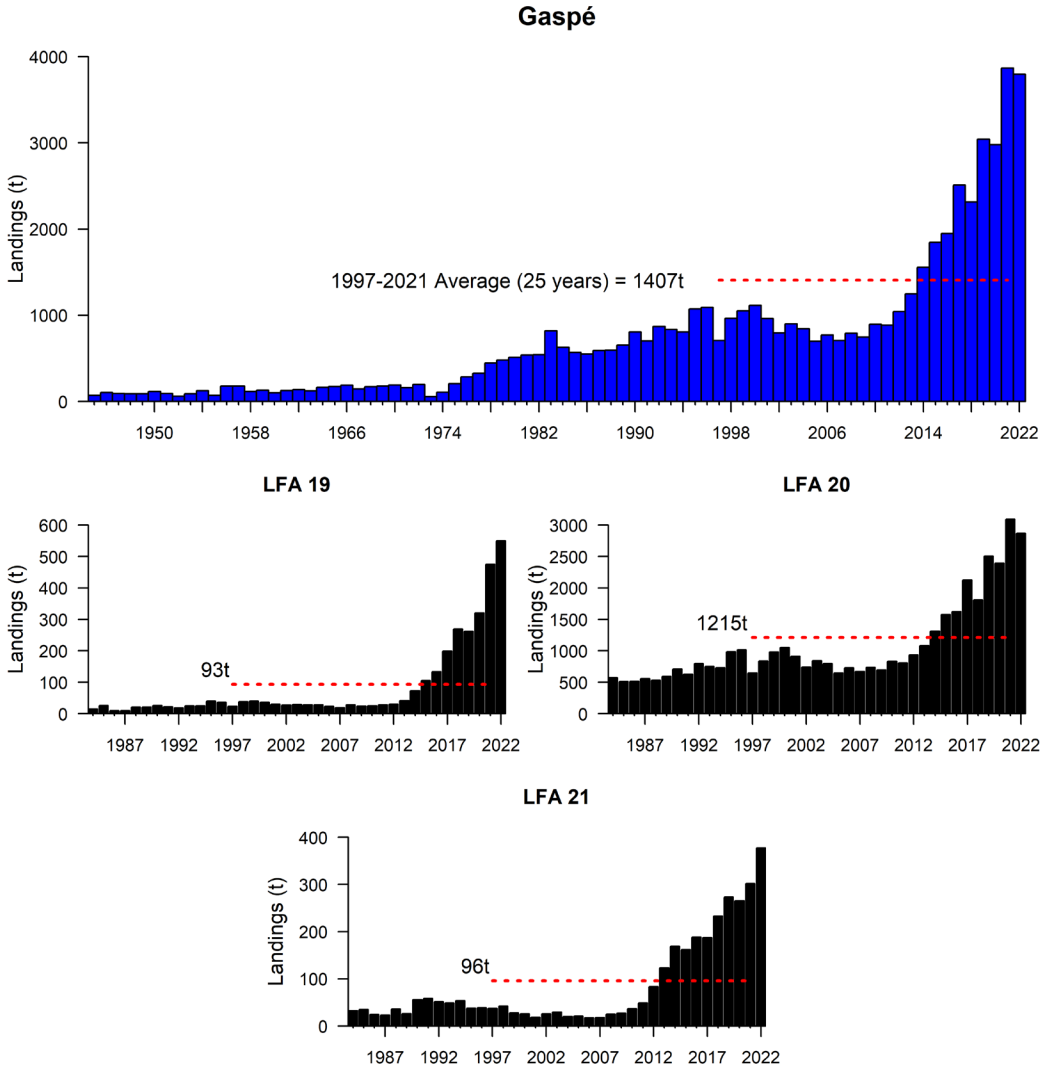


Figure 3. Lobster landings in the Gaspé from 1945 to 2022 and from 1984 to 2022 for LFAs 19, 20 and 21. Dotted lines refer to the average value of the last 25 years, excluding 2022.

Commercial lobster catch rates

Catch rates are equal to catches per unit effort (CPUEs) expressed in number or weight of lobster per trap. In 2022, the CPUE for commercial-size lobsters (≥ 83 mm) in LFA 20 was 2.07 lobster per trap (lobster/trap), which works out to 1.22 kg of lobster per trap (kg/trap) (Figures 4A and B). The CPUE in number was 36.3% higher than in 2018 (1.52 lobster/trap) and 143.8% above the 1993–2021 average (0.85 lobster/trap). The CPUE in weight was 40.8%

higher than in 2018 (0.87 kg/trap) and 162.5% above the 1993–2021 average (0.47 kg/trap). An increase in CPUEs was observed in the three groups of subareas sampled, especially in 20A1-A2. CPUEs in LFA 19C were 3.68 lobster/trap and 3.51 kg/trap in 2022, a 4.8% and 33% respective increase over 2018 (3.51 lobster/trap et 2.64 kg/trap) (Figures 4C and D). The average CPUE measured during the fall fishery in LFA 21B was 4.99 kg/trap (Figure 4E) which represent an increase of 13.2% compared to 2018 (4.41 kg/trap). This is the highest values observed since the start of the fall fishery in 2001, an increase of 126.8% relative to the 2001 to 2021 average (partial data in 2001 and 2014), which was 2.20 kg/trap. Traditionally, average CPUEs observed during the spring fishery in LFA 21B are always about 0.25 kg/trap.

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 2018, 2019 and 2022 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) then increased significantly until 2022 (90.7 mm and 612 g).

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. The average size and average weight of landed lobsters are increasing from 95.8 mm (723 g) in 2018 to 97.6 mm (765 g) in 2022. The increase in average size is due to the increase in size of the strong recruitment between 2012 and 2017 observed in 2018–2022 (Figure 5B).

The average size of lobsters landed in LFA 21B (dockside sampling) in the spring and fall of 2022 respectively was 90.6 mm and 91.8 mm. Size structures were slightly less truncated than those observed in LFA 20. Lobster sampling in this sub-area has been carried out in collaboration with the community of Listuguj, and a much greater effort has been made recently than in previous years.

Fishing pressure and sex ratio

Truncated size structures are indicative of high exploitation rates. In LFA 20, the calculated exploitation rate for commercial-sized males is not available for 2019 and 2020. For 2015–2018, the average exploitation rate was 75.1%, which is slightly lower to the 1986–2020 average (77.4%). In 2021, the exploitation rate (78.1%) is similar to the average.

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 2006, 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 in LFA 21B were quite often strongly biased towards males (> 2.0).

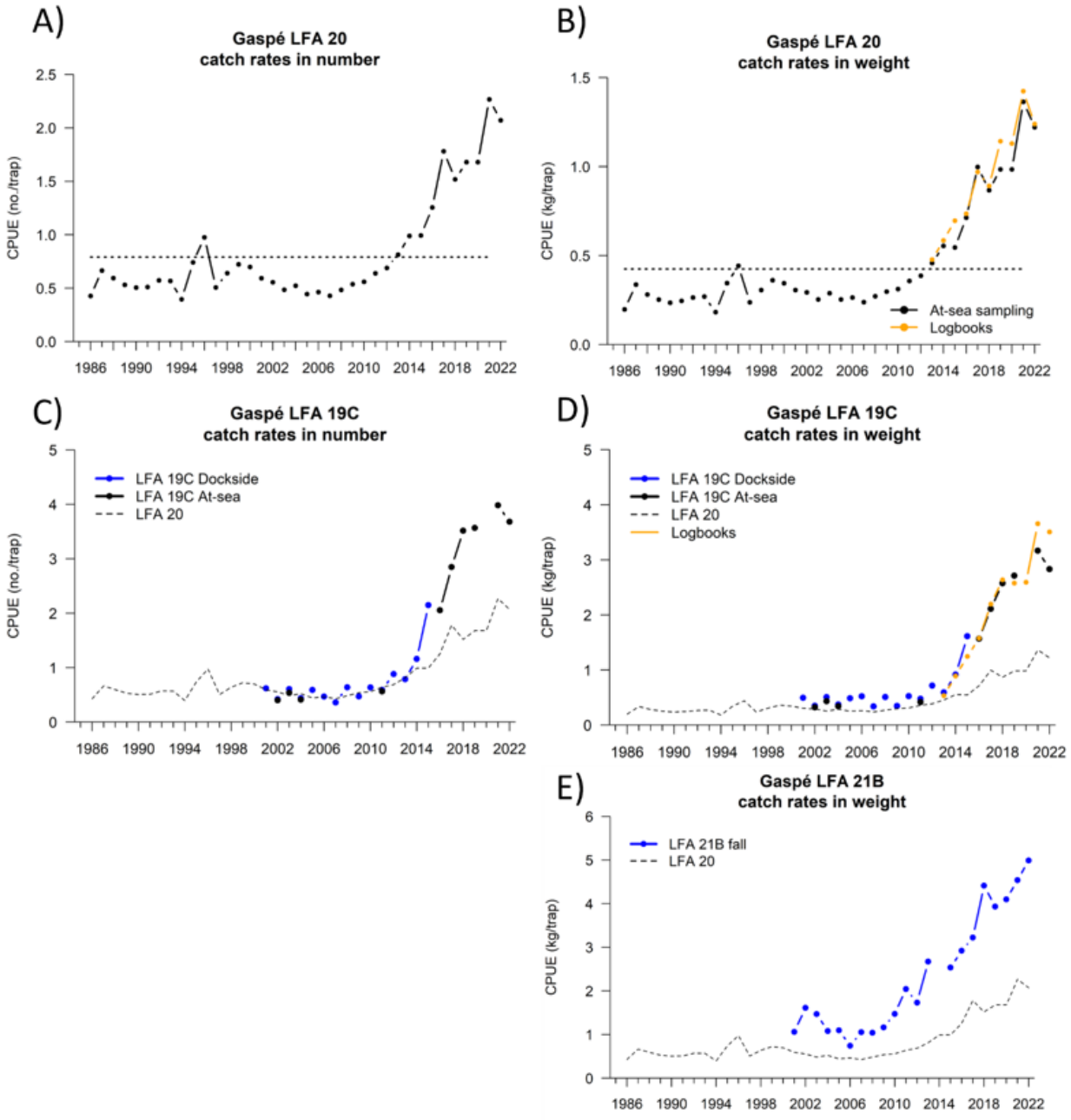


Figure 4. Catch rates (CPUEs) of commercial-size lobsters for LFA 20 in the Gaspé from 1986 to 2022 in number (A) and weight (kg) (B) per trap, for LFA 19C from 2001 to 2022 in number (C) and weight (kg) (D) and for LFA 21B in the fall from 2001 to 2022 in weight (kg) (E) per trap. For (A) and (B), the dotted line indicates the average CPUE for the last 25 years excluding 2022.

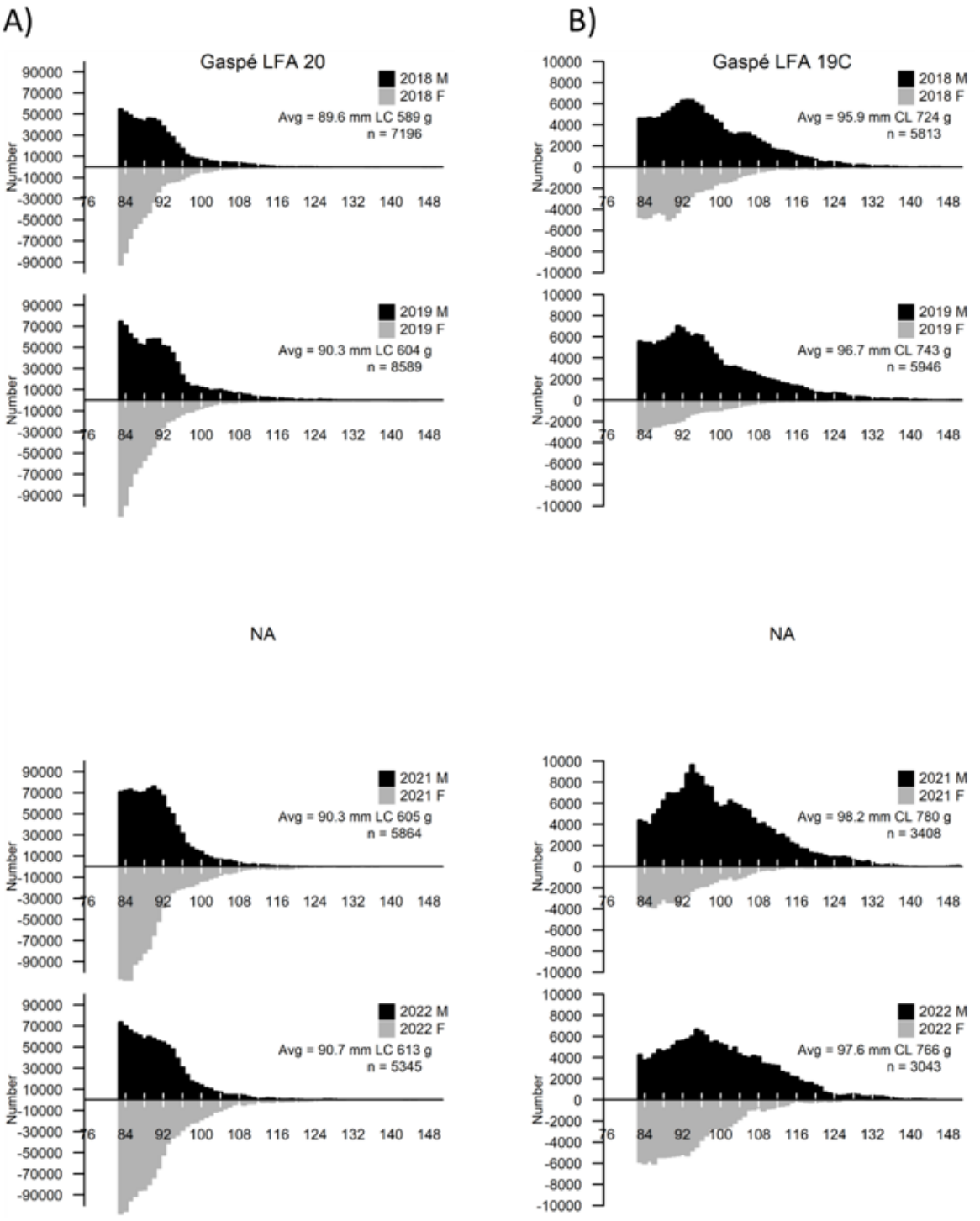


Figure 5. Size frequency distributions of commercial male (black) and female lobsters (grey) in the Gaspé from 2018 to 2022 for (A) LFA 20 and (B) LFA 19C. Frequencies are weighted by landings. The average size and weight (Avg) and the number of lobsters measured (n) are indicated. Data are not available for 2020 due to the pandemic.

Productivity indicators

Berried females and egg production

In 2022, the CPUE for berried females in LFA 20 reached 0.83 lobster/trap compared to 0.66 lobster/trap in 2018, an increase of 25.2%. Since 2017, the abundance of berried females has been at least ten times higher than the average for the period from 1986 to 1996 (0.06 lobster/trap) when the MLS was 76 mm (Figure 6).

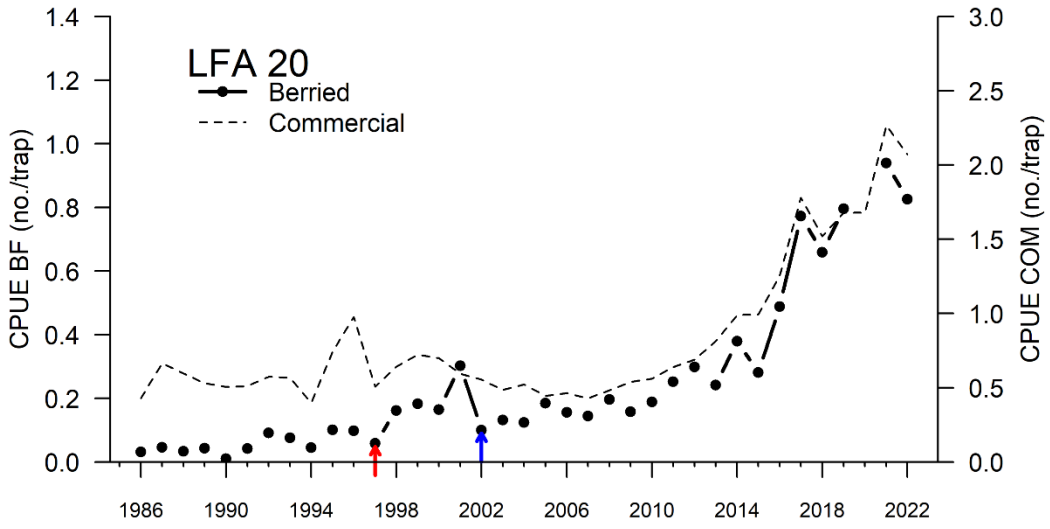


Figure 6. Catch rates (CPUEs) for berried females and commercial size lobsters in LFA 20 from 1986 to 2022. The red arrow indicates the start of the increase in minimum catch size and the blue arrow indicates the year when the height of the escape vents was increased from 43 mm to 46 mm. Data for berried females are absent for 2020 due to the pandemic.

Size structures of berried females in LFA 20 showed a strong modal value under the MLS (Figure 7). Sixty-five percent of berried females are below the MLS. Before the MLS was increased, most of these females did not contribute to egg production. In 2022, the average size of berried females was 82.7 mm CL and multiparous females represented 18% 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 2022, the egg production index for all of LFA 20 was 10.3 times higher than that calculated for 1994–1996, prior to the introduction of the increase in the MLS, and multiparous females accounted for 26% of total egg production.

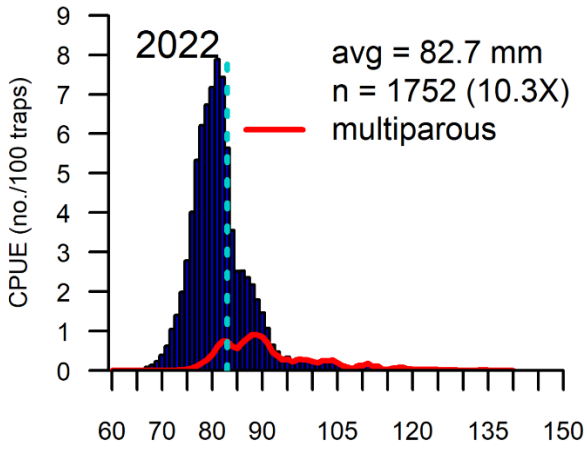


Figure 7. 2022 size frequency distributions of berried females in LFA 20. The red line represents multiparous females. Distributions are weighted by abundance indices (annual CPUEs). The average size (avg), total number of berried females (n) and the rate of increase in egg production compared to the 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 remained relatively stable, at a value close to three lobsters per trap between 2018 and 2022 in LFA 20 (Figure 8). However, this trend can vary between subareas. For LFA 20, the abundance of prerecruits observed in 2022 suggests that landings observed over the past two years could be maintained in 2023 if catchability remains similar. Short- and medium-term forecasts (1-2 years) are still uncertain due to the nature of the data. Inter-annual variations in moult timing and mean temperature affect lobster catchability, limiting the link between prerecruit abundance observed one year and landings one or two years later.

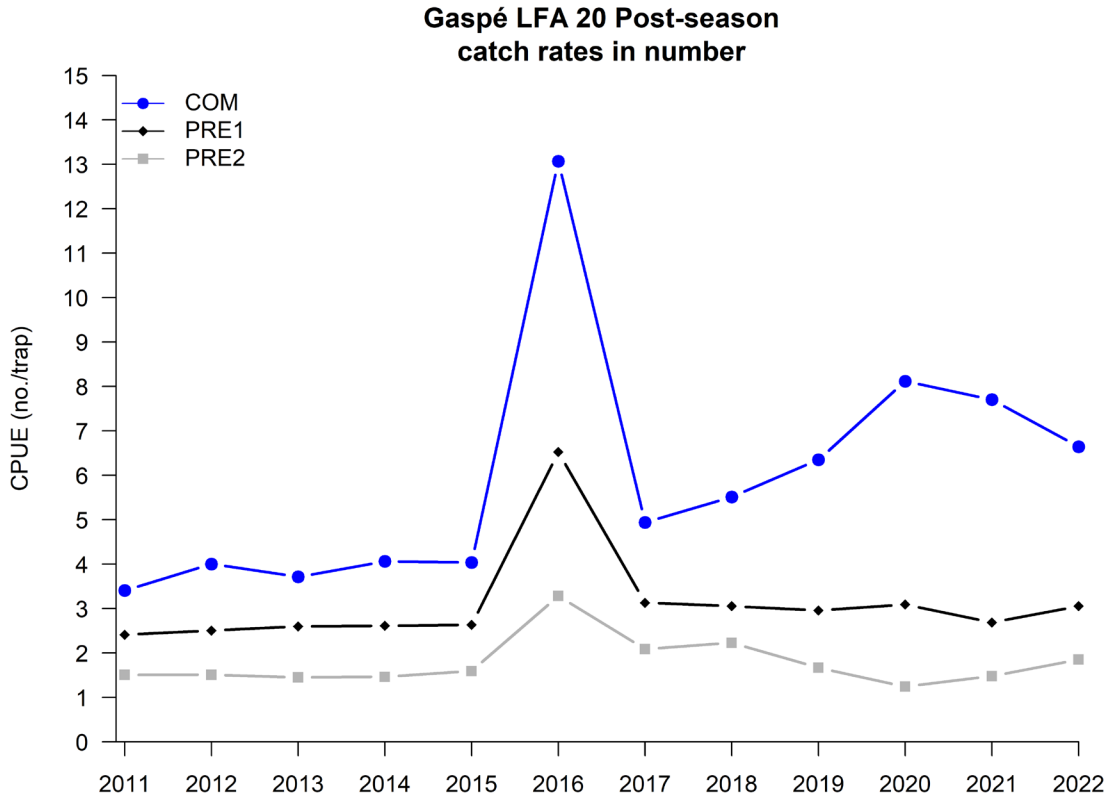


Figure 8. Catch rates (CPUE) for commercial-size lobsters, for prerecruits 1 (PRE1: 72–81 mm, one moult below commercial size) and prerecruits 2 (PRE2: <72 mm, more than one moult below commercial size) from 2011 to 2022 for all of LFA 20.

Ecosystem

Temperature

The temperatures recorded at the Grande Rivière station (10 m depth) have tended to be variable because of the frequent cold deep water upwellings. This phenomenon was particularly noticeable in 2020. In 2021, the temperatures at the start of the fishing season were above the historical average. In 2022, the temperatures in the first half of the fishing season tended to be lower than the average, while those in the second half tended to be higher (Figure 9). In 2022, the number of degree-days (284 DD) was 7.2% lower than the average of the previous 25 years (1996–2021) (306 DD).

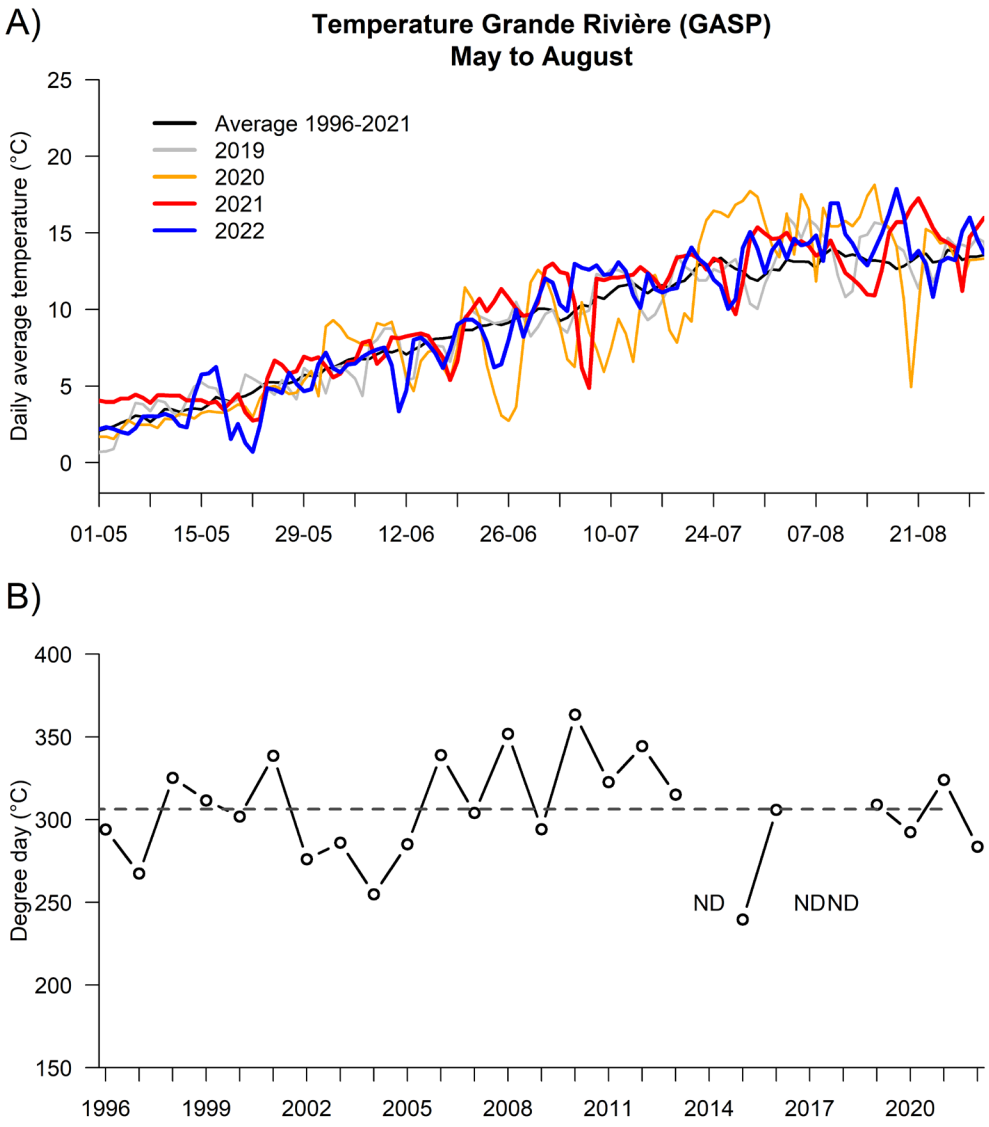


Figure 9. Water temperatures at a depth of 10 m at Grande Rivière in Gaspé A) for the May to August period since 2019, B) in degree-days for the same period of the year since 1996. In A, the average from 1996 to 2022 is indicated by a black line. In B, the data are not available for 2014, 2017 and 2018.

Prey availability

The small rock crab is a key prey source for lobster. Monitoring of this species is therefore essential to determine the health of lobster populations from an ecosystem perspective.

In 2022, there was a near absence of small classes of rock crabs in the size structures of dockside sampling, close to the minimum catch size for LFA 19 (Rock Crab Fishing Areas [RCFAs] 17 to 12D7; Figure 10), which was not the case in previous years. The CPUEs have remained above the 2000–2021 average in LFA 21 (RCFA 12YZ) since 2018, except in 2020, when it was equal to the average (Figure 11). In LFAs 19 (RCFA 17_12D7) and 20 (RCFA 12EX), the CPUEs for 2022 are slightly below and above the average, respectively.

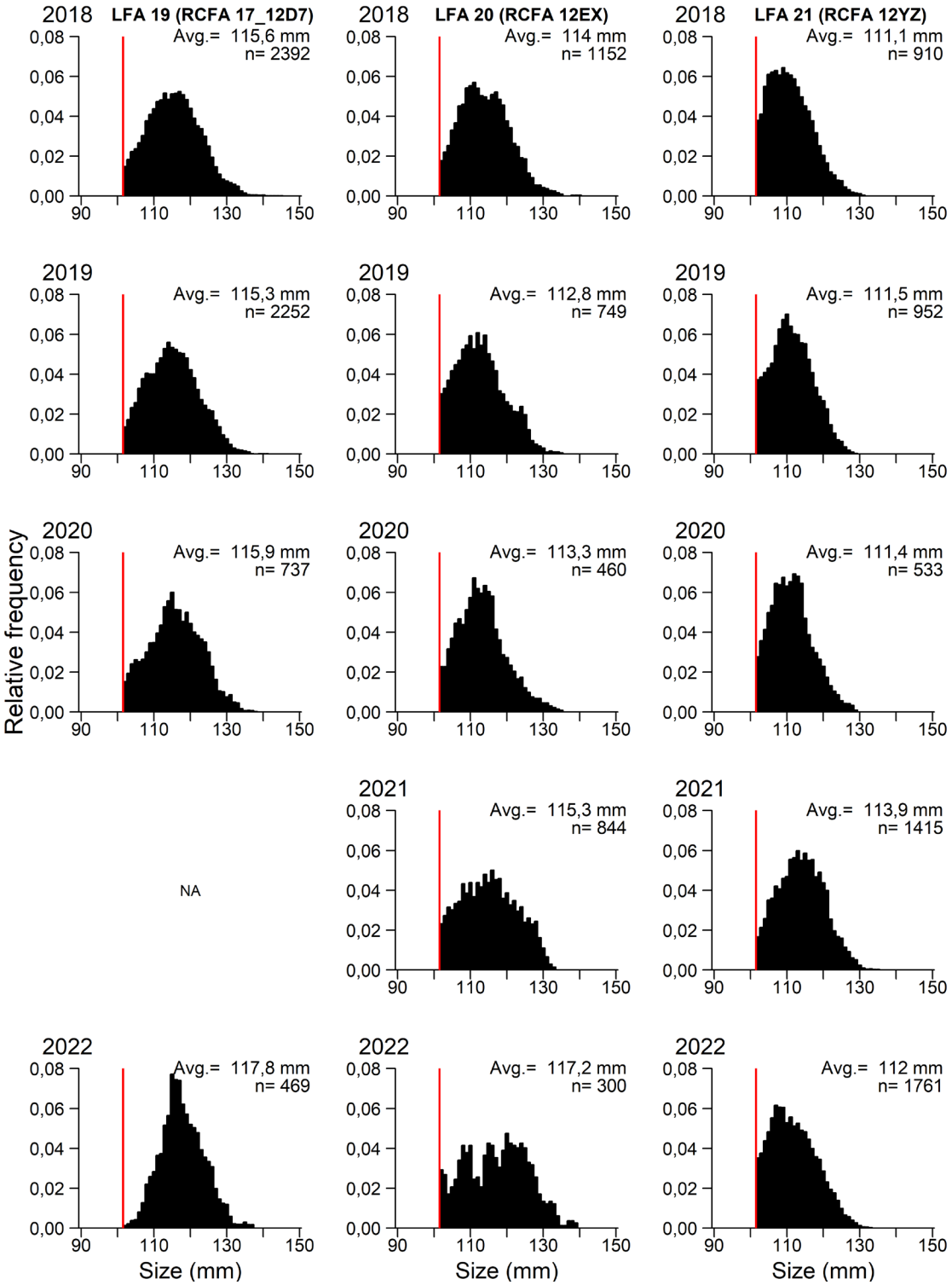


Figure 10. Size structure of rock crabs in dockside sampling for LFAs 19, 20 and 21. The minimum catch size of 102 mm carapace width is indicated by the red line. The average (Avg.) and sample size (n) are presented in the upper right-hand corner.

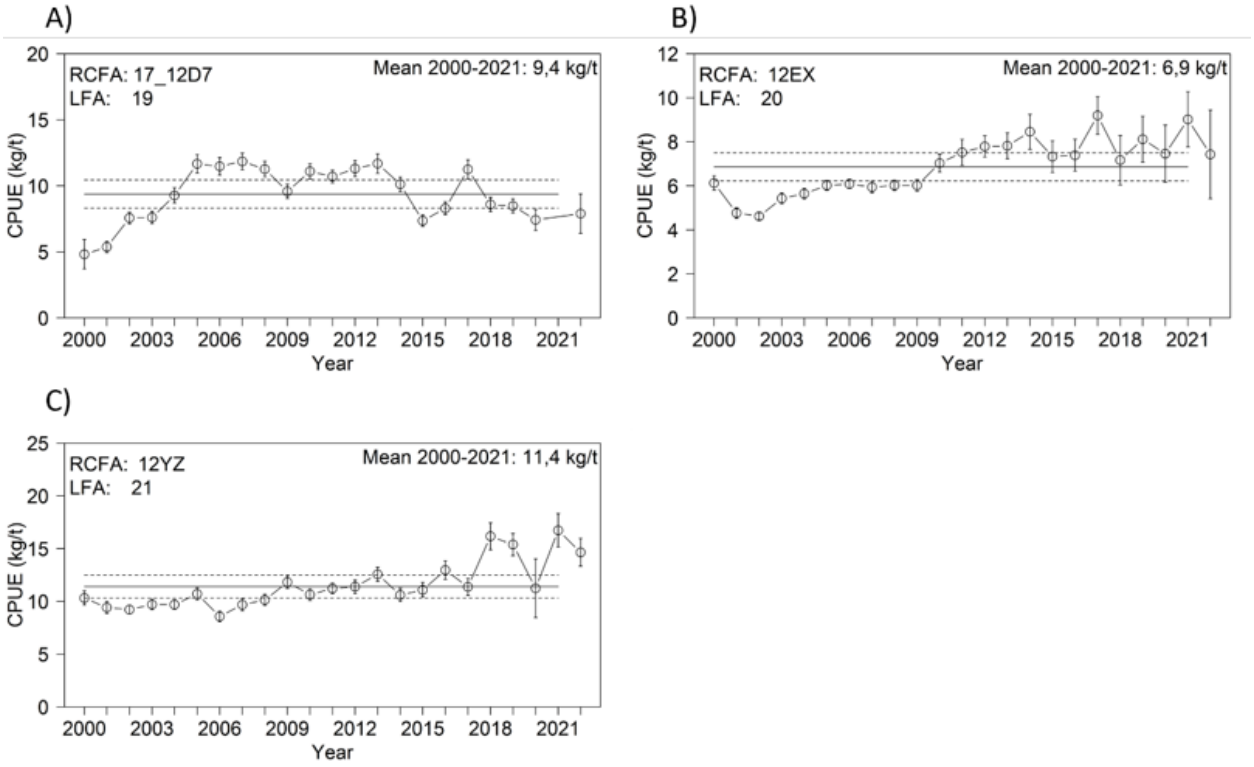


Figure 11. Rock crab standardized catches per unit of effort (CPUE) with standard error for a number of rock crab fishing area (RCFA) grouped for A) LFA 19, B) LFA 20 and C) LFA 21. The solid and dotted lines represent the 2000–2021 average and the confidence interval on the average, respectively.

Precautionary approach

A precautionary approach (PA) based on an empirical method was used for the lobster fishery in the Gaspé. The lower and upper reference points (LRP and URP) and the stock status zones (healthy, cautious and critical) were defined from a stock biomass indicator (landings) 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}). 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, which correspond to a productive period for lobster. 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 12). In 2022, with landings of 3,796 t, the stock was considered in the healthy zone (Figure 12).

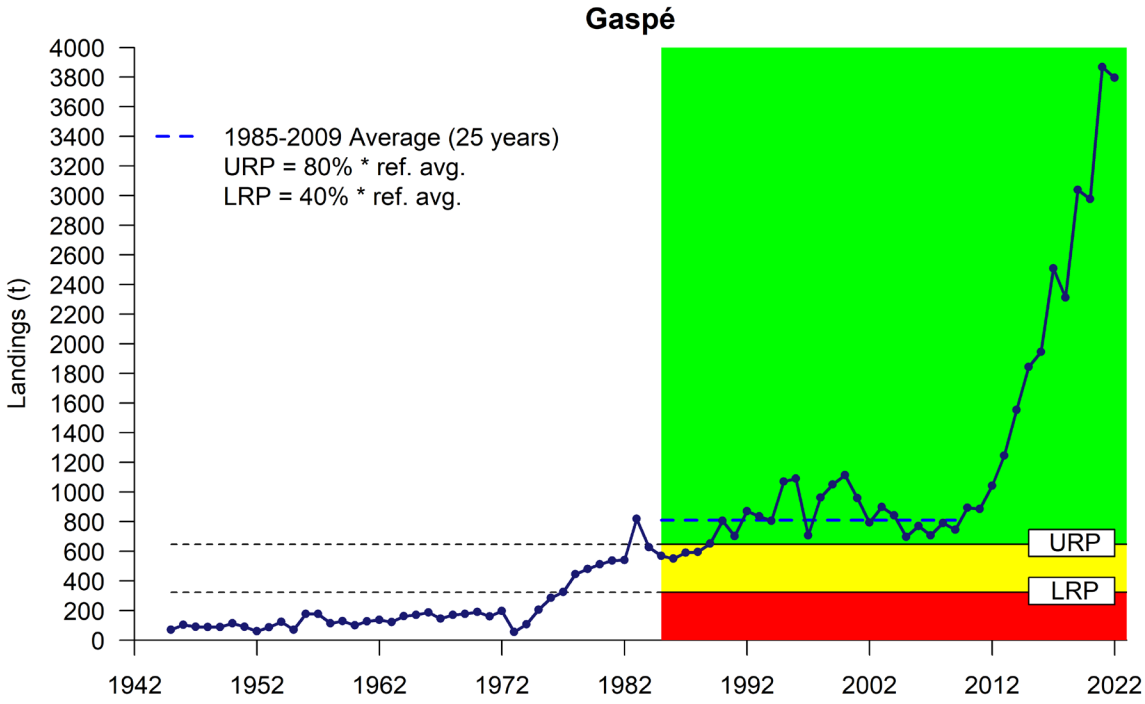


Figure 12. Lobster landings in the Gaspé from 1945 to 2022. Healthy zone is green. Cautious zone is yellow, and the Critical zone is red. The dotted line from 1985 to 2009 corresponds to the average value that approximates the B_{MSY}.

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, productivity and landings indicate that the Gaspé lobster stock is in good condition and in the healthy zone according to the precautionary approach.

Indicators of the health status of the rock crab population in Gaspé were examined from an ecosystem approach. Unlike in LFA 20 and 21, the population of this key prey species for lobster in LFA 19 seems to be of concern.

In order to ensure the sustainability of the lobster stock and that of its preferred prey while maintaining their trophic link, low rock crab mortality should be favoured.

LIST OF MEETING PARTICIPANTS

Name	Affiliation	Feb 28	March 1	March 2	March 3
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SOURCES OF INFORMATION

This Science Advisory Report is from the February 28-March 3, 2023 regional peer review on the Assessment of lobster in Quebec's inshore waters in 2022 and advice for the 2023 to 2025 fishing seasons. 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)

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