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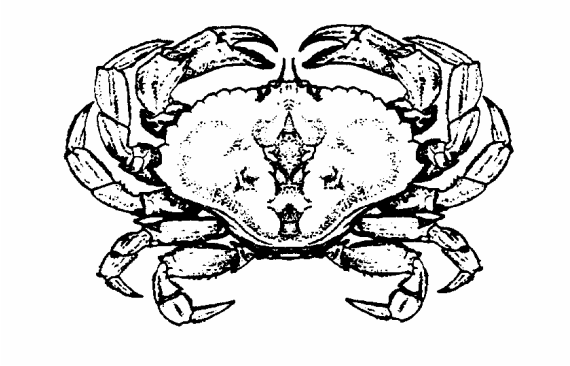
ASSESSMENT OF ROCK CRAB STOCKS IN THE COASTAL WATERS OF QUEBEC IN 2006



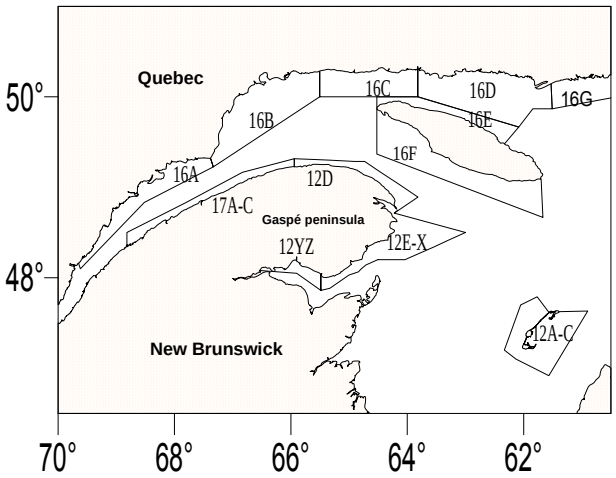


Figure 1: Rock crab fishing areas in Québec.

Context

In Quebec, commercial fishing of rock crab began in 1988, but the fishery did not really begin to take off until 1995. From 1996 to 2002, landings as well as their value gradually increased and then stabilized. The main fishing areas for rock crab in Quebec are the Magdalen Islands (12A–C), Chaleur Bay (12E–Z), the north shore of the Gaspé Peninsula (12D and 17) and, only since 2004, the Middle North Shore and Anticosti Island (16B–E).

As soon as the rock crab fishery began, a management plan was introduced to control the fishery's development and maintain the reproductive potential of rock crab population. Rock crab is a major prey species for lobster; this interaction between the two species justifies very cautious management of the rock crab fishery to prevent any overfishing.

A minimum legal carapace width was set at 102 mm (4 inches), creating an exclusively male-directed fishery. The number of licences and traps are limited, as is the crabbing season. An overall quota has been set for Areas 12Y and 12Z in Chaleur Bay, while individual quotas have been established in the Magdalen Islands.

SUMMARY

- Landings of rock crab in Quebec increased steadily between 1996 and 2002, from 687 t to 1,761 t. Since 2002, landings have remained above 1,500 t. Rock crab is mostly harvested in the Gaspé Peninsula and the Magdalen Islands, which in 2006 accounted for 50% and 40% respectively of total landings in Quebec. In the Magdalen Islands, quotas are usually reached

in the three fishery sub-areas. In 2005 and 2006, landings exceeded the quotas by 13-15% due to by-catches by lobster vessels. On the south shore of the Gaspé Peninsula, landings have remained around 600 t since 2000. On the north shore of the Gaspé Peninsula, the fishery is more recent and since 2005, landings have been around 400 t, twice as much as in 2000. On the North Shore and Anticosti Island, the first significant landings began in 2004 and have since been between 141 and 231 t.

- Catch rates have been relatively unchanged in all areas since 1997. In all areas, the size structure of the crabs caught has remained stable since harvesting began, and average size remains well above the minimum legal size.

- It is recommended that harvesting not be increased in the different areas on account of the uncertainty caused by uncontrolled by-catches. It is also recommended that areas of exclusion be established in proximity or within each area. On the North Shore, we recommend that this new fishery be developed using a prudent and gradual approach compliant with the principles of the precautionary approach.

BACKGROUND

Species Biology

The rock crab *(Cancer irroratus)* is found along the east coast of North America, from Labrador to South Carolina. This species is associated with various bottom types, ranging from bedrock to soft bottoms. Commercial-size crabs and, more generally, those larger than 50 mm (size corresponds to carapace width) live on sandy or muddy bottoms, while a smaller portion of the adult population share rocky bottoms, where lobster also occur, with individuals smaller than 50 mm. Berried female rock crabs show a marked preference for soft bottoms, where they can bury themselves and where they form their aggregations.

Males and females grow to different sizes. Males can reach 140 mm, while females rarely exceed 100 mm. Reproduction occurs in the fall after the females have moulted and while their carapaces are still soft. Males moult in winter so that their carapace has fully hardened by spawning season. Carapace hardens completely in two to three months. Females reach sexual maturity at about 60 mm, while males do so at a slightly larger size (≈70 mm). Females lay their eggs, and then keep them under their abdomen for nearly 10 months. A 60-mm female can lay 125,000 eggs, while a 90-mm female can lay up to 500,000. The eggs hatch the summer after they are laid, and the larvae remain in the water column from mid-June to mid-September. In the fall, the larvae metamorphose into tiny crabs (megalops) and begin their benthic life shortly thereafter. Juveniles (15 mm) are found mainly at shallow depths on bottoms that offer shelter from predators and water turbulence. Growth data for rock crab in the Gulf of St. Lawrence are sparse. Data from regions further south suggest that rock crab may attain commercial size at about five or six years of age and live to about seven years.

The rock crab is omnivorous and displays a certain amount of opportunism in its diet. Lobster has never been shown to constitute a significant portion of the rock crab's diet, but analyses of lobster stomach contents indicate that rock crab is a major prey for lobster throughout the lobster's life cycle, even from the earliest larval stage.

The Fishery

The rock crab-directed fishery management plan is intended to control the fishery's development and protect the reproductive potential of rock crab populations. The rock crab fishery is managed by controlling fishing effort. The number of licences and traps is limited, as is the crabbing season. The fishery is also managed by fishing areas (Figures 1, 2 and 3), so that fishing effort can be distributed more evenly. Quotas have also been set in the Gaspé Peninsula (Areas 12Y–Z only) and the Magdalen Islands (individual quotas). A minimum legal carapace width of 102 mm is in effect. Females are thus excluded from the fishery, because they rarely reach this size. Rock crab is harvested by a variable number of lobster fishers during lobster season, when rock crab is an authorized by-catch. Outside the lobster season, rock crab can be taken only by rock crab licence holders who practise a directed fishery. The directed fishing season begins in July and ends in October. Directed fishing licences have been permanent in the Magdalen Islands since 2003, while in other areas, they remain exploratory. In the Magdalen Islands in 2006, 14 fishers held directed fishing licences for rock crab, with individual quotas of 45.5 t. An overall quota of 681 t was set, which included not only individual quotas from the directed fishery, but also a reserved quota of 45.5 t to account for rock crab by-catch landed by lobster fishers. This quota can be attributed to the directed fishery only if there has been no by-catch during the year. Each fisher could use 75 (1.219 m [4 feet] in diameter) or 125 (0.914 m [3 feet] in diameter) traps or any combination of these two types of traps, calculated according to an equivalency factor of 1 large trap for 1.66 small traps, based on a measurement of their relative effectiveness. The fishers were allowed to fish in one, or in some cases two of the three areas. A control area (12C1) (Figure 2), closed to the directed rock crab fishery, was created in 2000 between Areas 12C and 12B to protect a portion of the reproductive stock so that its natural processes could be monitored. In the Gaspé Peninsula in 2006, in the northern (Areas 17A to 17C and 12D1 to 12D7) and southern areas (Areas 12E to 12Z) (Figure 3), there were 9 and 26 active fishers respectively. An annual quota of 375 t was authorized for the entirety of Areas 12Y and 12Z. There are no other quotas in the Gaspé Peninsula, and the number of traps per fisher ranges from 75 to 150, according to the areas. On the Upper and Middle North Shore and in Anticosti Island (Areas 16A to 16E), 16 licences were issued in 2006 and each fisher could use 150 traps.

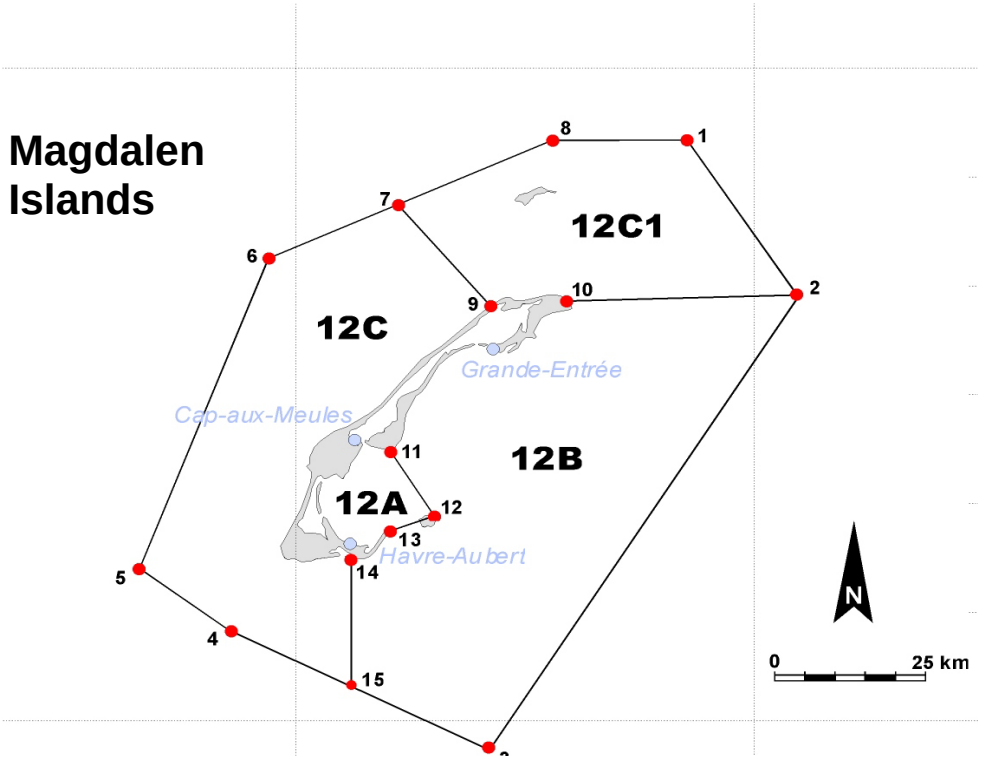


Figure 2. Rock crab fishery sub-areas at the Magdalen Islands (12 A, 12B and 12C) and the exclusion area (12C1).

Figure 3. Rock crab fishery sub-areas in the Gaspé Peninsula.

ASSESSMENT

Landings

In Quebec, rock crabs are harvested mainly off the Gaspé Peninsula and in the Magdalen Islands, which accounted for 50% and 40% respectively of the total landings in Quebec in 2006. In 2006, landings of rock crab in Quebec totalled 1,916 t. In 2004 and 2005, they totalled 1,690 and 2,036 t respectively (Figure 4). The rock crab fishery only truly took off in Quebec in 1995, when 829 t were landed. Landings increased gradually, from 687 t in 1996 to 1,761 t in 2002. Since 2002, they have remained stable and over 1,500 t. Landings mostly stem from the directed fishery. In 2006, by-catches made in the lobster fishery represented 7.5% of the total landings, which is above the 5.7% average over the ten previous years (1996 to 2005). In 2004, landings in Quebec represented 19% of Canadian landings.

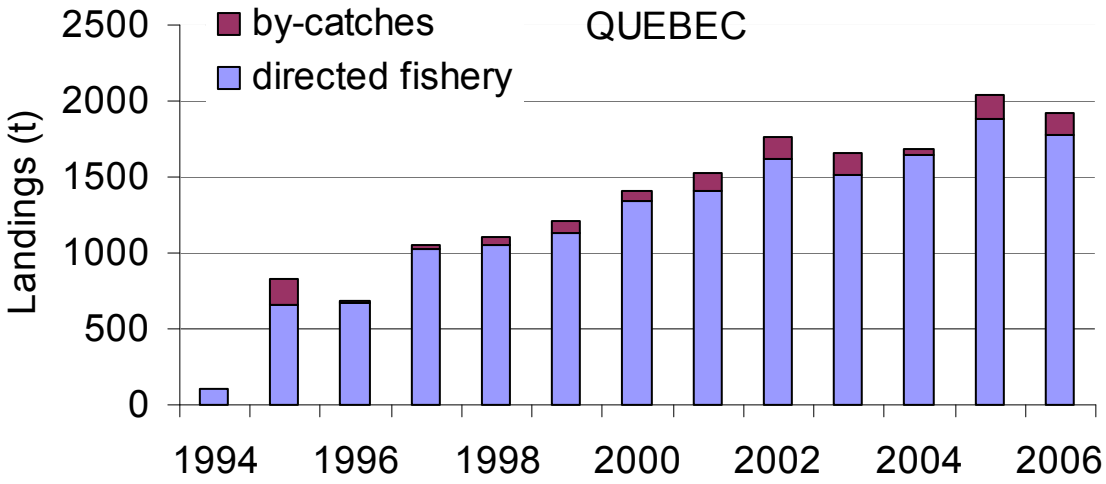


Figure 4. Total rock crab landings (t) in Quebec, 1994 to 2006. 2006 values are preliminary.

In the Magdalen Islands, landings totalled 769 t in 2006, and individual directed fishery quotas were reached. Rock crab by-catches by lobster vessels increased over the last two years, exceeding the Islands' overall quota (681 t) by 13% in 2006. They reached 154 t and 131 t in 2005 and 2006 respectively, whereas the mean by-catch total for the 1995-2004 period was only 43 t.

In the Gaspé Peninsula, rock crab landings totalled 961 t in 2006, compared with 966 t in 2005 and 895 t in 2004 (Table 1). In the southern Gaspé Peninsula, directed fishery landings remained stable at around 600 t since 2000. In 2006 however, landings were a little lower at 579 t. Over the last six years, in the four areas in the southern Gaspé Peninsula (12E-P, 12Q-Z, 12Y and 12Z), catches have always remained at a high level. By-catches have not been very significant and in 2006, they represented less than 1% of the total landings.

The fishery developed a little later in the northern Gaspé Peninsula. Since 2005, landings have remained around 400 t, twice as much as they were in 2000. The bulk of the landings (97.5%) are from the eastern part of the area (12D). By-catches only accounted for 2% of the landings in 20006.

On the North Shore, the fishery began developing seriously in 2004. Over the last three years, from 2004 to 2006, landings totalled 141 t, 231 t and 186 t respectively. Landings totalling 54 t and 57 t were recorded for 2005 and 2006 respectively for Area 16E, north of Anticosti Island.

Table 1. Rock crab landings (t) in Quebec, 2000 to 2006 (directed fishery).

Area	2000	2001	2002	2003	2004	2005	2006*
12A+12B (south)	407	400	457	440	426	414	409
12 C (north)	181	224	260	266	228	223	229
Magdalen Islands	**588**	**624**	**717**	**706**	**653**	**637**	**638**
17	15	19	40	29	17	11	10
12D	167	218	327	263	268	416	373
12E-P	172	161	161	172	154	164	153
12Q-X	170	189	192	145	152	150	158
12Y	145	130	149	112	119	110	112
12Z	152	166	175	211	186	115	156
Gaspé	**820**	**882**	**1043**	**931**	**895**	**966**	**961**
16A		0,3			0,5		
16B	3	15	1	1	83	125	84
16C			0,4		3	6	4
16D				14	53	46	41
16E					0,1	54	57
16G		3		1	2		
North Shore	**3**	**18**	**1**	**16**	**141**	**231**	**186**
Total Quebec	**1412**	**1524**	**1761**	**1653**	**1690**	**1834**	**1785**

*** preliminary data**

Catch Rates

The yields for standard traps increased steadily from 1995 to 2004 in sub-areas 12A and 12B, from 15 to 22-26 kg/trap. In 12C, yields also increased between 1997 and 2003, from 12.5 to 19 kg/trap. In 2005 and 2006, total yields with this type of trap remained stable in 12A but dropped by more than 20% in 12B compared with 2004. In 12C, fishers have for the most part been using larger traps since 2004 (83% in 2006), which has increased catch rates to more than 30 kg/trap over recent years (Table 2).

Catch rates in the Gaspé Peninsula have always remained stable since 1995. In 2006, they were above the averages calculated for the 1995-2005 period, except in 12Y where a 21% drop was recorded compared with 2005. Catch rates range between 6 and 7 kg/trap between 12E and 12Y, and around 12-13 kg/trap for 12Z. Yields show an increasing gradient from the eastern tip of the Peninsula (12E-P) to the head of Chaleur Bay (12Z). In the northern Gaspé sector, catch rates have been increasing throughout the area over the last three years. However, yields are twice as low in the west (17 up to 12D3) with 6.7 kg/trap, as in the east (12D4 to 12D7) with 14.1 kg/trap in 2006.

Average catch rates for the North Shore total 7 kg/trap, but vary from single to double according to the area.

Table 2. Estimated rock crab catch rates (kg/trap) based on logbook data.

Area	2000	2001	2002	2003	2004	2005	2006 standard	2006 large
12A	20.3	21.8	22.4	21.8	26.0	26.8	26.8	34.6
12B	16.7	18.0	17.1	20.1	21.9	18.2	16.2	30.6
12C	12.7	13.8	17.2	18.7	17.0	25.0	12.3	31.4
17-12D1-D3	4.3	3.8	4.9	2.5	5.7	6.2	6.7	
12D4-D7		9.7	11.0	10.0	12.4	14.6	14.1	
12E-P	5.6	5.0	5.4	6.1	6.4	7.1	6.1	
12Q-X	5.4	4.8	4.6	4.6	5.2	5.7	6.1	
12Y	8.1	7.3	7.3	7.3	8.0	8.3	6.5	
12Z	11.7	13.7	11.1	13.0	12.0	15.9	13.5	
16B-E	11.5	12.9			6.1	6.7	7.2	

Size Structures

The size structure of rock crabs taken in the Magdalen Islands has varied little since 1997 in both southern (Areas 12A and 12B) and northern (12C) areas. The average size of rock crab (carapace width) landed in 2006 was still large at 121 mm in 12A, 124 mm in 12B and 122 mm in 12C (Figure 5). The 2006 values were above average for the last ten years for all areas except 12A.

The average size of rock crab landed in the Gaspé Peninsula in 2006 was below what was recorded when the fishery began. Nevertheless, it remained very stable in most areas during the 2000s. However, in 2006 a drop of around 1-2 mm was recorded in 12Y and in 12E-P in 2004 and 2005. Average sizes range between 111 mm and 114 mm. Rock crab in Area 17 are large and their average size has been increasing steadily since 2000. This could partly be due to smaller legal size crabs being thrown back. In 2006, the average size was 122 mm (Figure 6). In Area 12D, the average size has dropped by 1.2 mm since 2004 and was 118 mm in 2006.

On the North Shore, the average size of crabs landed was around 115 mm in 2006.

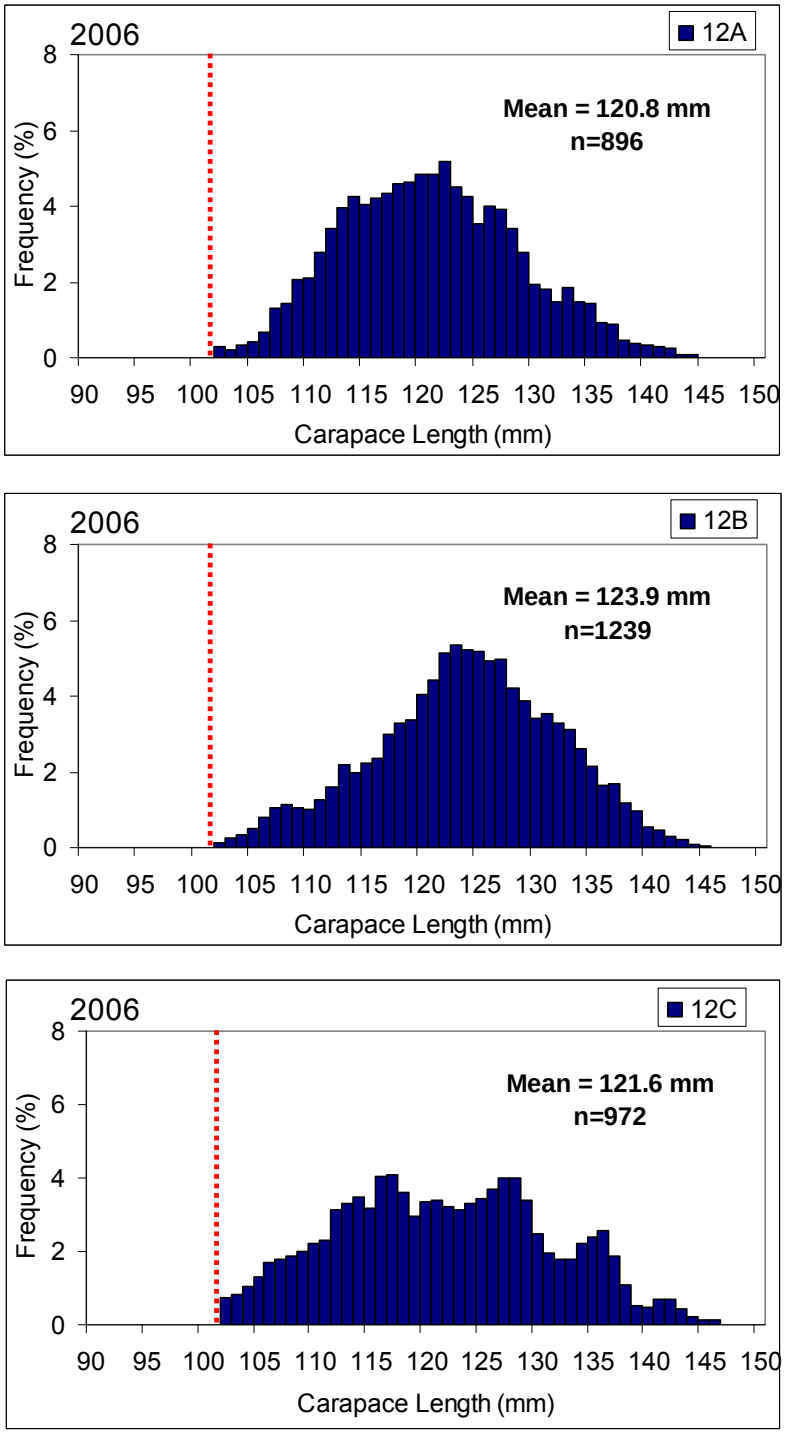


Figure 5. Size structures of rock crab landed in the Magdalen Islands in 2006 in subareas 12A, 12B and 12C. The numbers correspond to the number of crabs measured during dockside sampling. The dotted vertical line indicates minimum legal size.

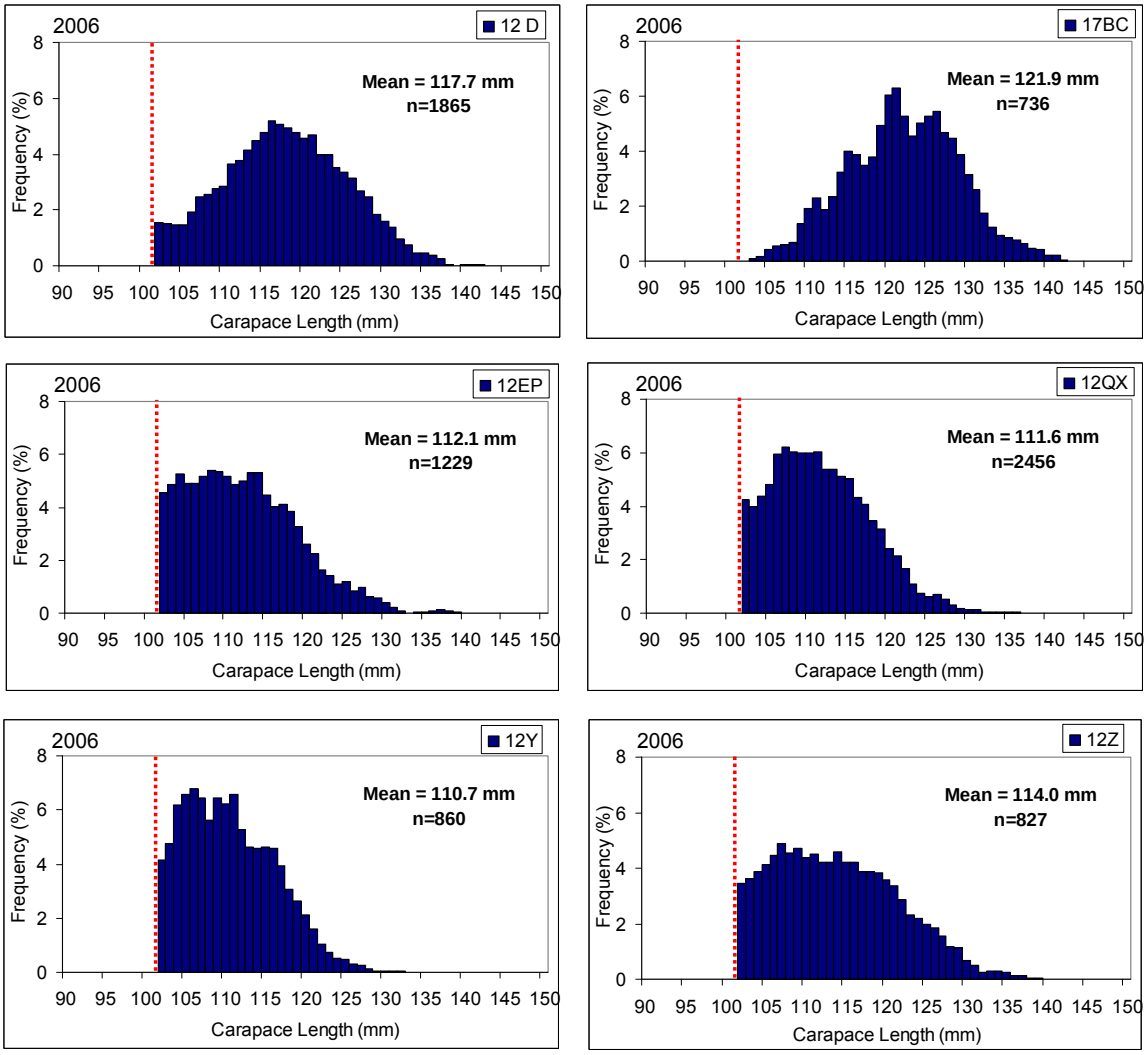


Figure 6. Size structures of rock crab landed in the northern areas (Areas 12D and 17) and in the southern Gaspé Peninsula (12E-P, 12Q-X, 12Y and 12Z) in 2006. The numbers correspond to the number of crabs measured during dockside sampling. The dotted vertical line indicates minimum legal size.

Sources of uncertainty

Rock crab landings presented here do not take into account the by-catches made by lobster fishers who use them as bait. In certain areas, this practice is quite common and could represent significant quantities. It is also possible that the rock crab targeted for baiting traps include females and males under the legal size. We also don't really know the harvesting strategies used by the fishers. They might move around in their area in order to maintain good catch rates which could, if any, conceal a drop in stock abundance. Finally, our knowledge on the dynamics of rock crab stocks is weak. We don't know if recruitment dynamics are cyclical as is the case with other crab species, and whether they are mostly regulated by ascending factors (e.g. hydrodynamics) or descending (e.g. predation).

CONCLUSIONS AND ADVICE

The rock crab fishery has developed well in the Magdalen Islands and stock status indicators suggest that harvesting levels are not causing any major problems for populations. This complies with the management objectives established for this species and that attempt to maintain moderate harvesting levels. However, landings have exceeded quotas by 13-15% in 2005 and 2006 due to by-catches by lobster vessels. The management objectives of maintaining moderate harvesting levels are threatened by a lack of control of the by-catches. It is essential that all landings be controlled for the sustainable development of this fishery. In the mean time, due to the existing uncertainty created by unregulated by-catches, it is recommended that the capacity of the directed fishery not be increased. Science agrees that the exclusion area (12C1) should still be maintained in order to monitor natural stock fluctuations. Rock crab by-catches by other fleets should also be prohibited in the exclusion area.

The rock crab fishery has developed well in the Gaspé Peninsula over the last ten years. The stability of the indicators over the last decade suggests that harvesting only has a minor impact on populations. This indicates that the type of management that has been practiced so far for this new fishery is achieving the conservation objectives. This fishery is limited by the effort and by a preventive quota in 12YZ. There still exist a latent effort in most sub-areas and, if it was fully achieved, could lead to increased harvesting rates and possibly affect the stability that has been recorded to date. We therefore recommend that the harvesting capacity in the different areas not be increased and that the preventive quota of 375 t in 12YZ be maintained as a ceiling in case of an eventual increase in fishing effort. Furthermore, in compliance with a recommendation from a national committee on the development of emergent species, we recommend that exclusion areas be established within or adjacent to harvesting areas. This will help protect a part of the reproductive stock and help to follow the natural evolution of populations. For the same reason, it would be advisable to convert into exclusion areas, those areas in the southern Gaspé Peninsula where there is currently no rock crab fishery.

As for the North Shore and Anticosti Island, the fishery is still too recent and the data insufficient to determine the future of this fishery. We recommend a prudent and gradual approach to the development of this fishery, as was done in other areas.

OTHER CONSIDERATIONS

We would like to reiterate the need to develop the rock crab fishery slowly and cautiously in order to ensure a sustainable harvest and to respond to the concerns expressed by many stakeholders as to the possible consequences the rock crab fishery could have on lobster. Harvesting rock crab will reduce the abundance of large crab in these waters. This decreased abundance should not have any immediate negative impact on lobster, since lobster does no prey on legal size crab (102+ mm). Negative impacts on lobster could be expected only if the numbers of small crab, on which lobster do feed, were to drop to a point that lobster found them harder to come by. This situation could arise if recruitment overfishing occurred. Thus, protecting the reproductive potential with the maintenance of a minimal catch size greater than the size at sexual maturity, as well as the control measures implemented to uphold moderate harvesting levels are measures that could help prevent any overfishing. The two species

interact sufficiently to justify tight, cautious management of the rock crab fishery so as to prevent any overfishing.

Our knowledge of the rock crab's ability to withstand fishing pressure over the long term is still limited. The fishery will have to be monitored regularly to assess the status of the resource and the impacts of fishing operations on rock crab populations. The logbook system is essential for determining resource status. It is therefore imperative that fishers keep proper logs.

SOURCES OF INFORMATION

DFO, 2004. Rock Crab of the Coastal Waters of Quebec in 2003. DFO Can. Sci. Advis. Sec. Stock Status Rep. 2004/029.

Gendron, L., S. Brulotte, C. Cyr and G. Savard. 1998. Développement de la pêche et état de la ressource de crabe commun (*Cancer irroratus*) en Gaspésie et aux Îles-de-la-Madeleine (Québec) de 1995 à 1997. Rapp. tech. can. sci. halieut. aquat. 2248 : viii + 37 p.

Gendron, L. and P. Fradette. 1995. Revue des interactions entre le crabe commun (*Cancer irroratus*) et le homard américain (*Homarus americanus*), dans le contexte du développement d'une pêche au crabe commun au Québec. Rapp. manus. can. sci. halieut. aquat. 2306: vii + 47p.

Gendron, L. and S. Robinson (eds) 1994. The development of underutilized invertebrate fisheries in Eastern Canada. Workshop proceedings. Can. Manuscr. Rep. Fish. Aquat. Sci. 2247: vii+129 p.

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