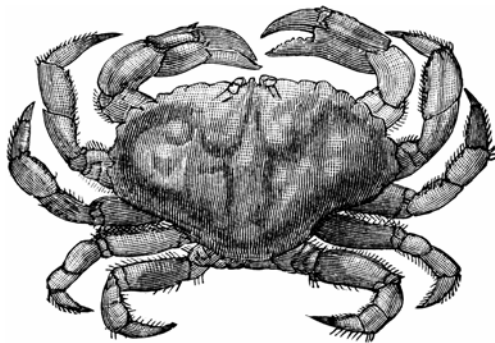




# ASSESSMENT OF THE ROCK CRAB (*CANCER IRRORATUS*) FISHERY IN THE SOUTHERN GULF OF ST. LAWRENCE LOBSTER FISHING AREAS (LFA'S) 23, 24, 25, 26A & 26B FOR 2000 TO 2006



Clipart courtesy FCIT

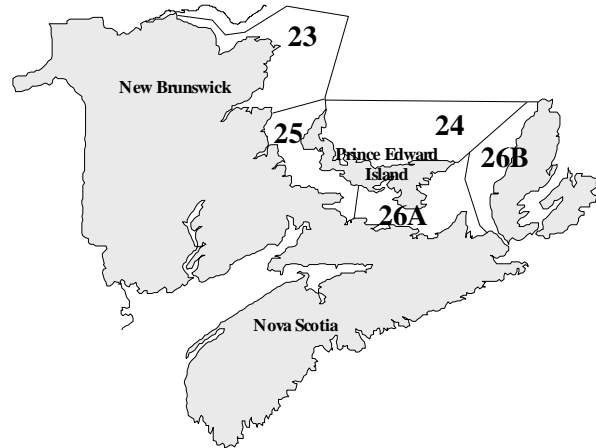


Figure 1: Lobster fishing areas used in the directed rock crab fishery in the Gulf Region.

## Context :

The rock crab fishery was initiated during the 1960's as a by-catch of the lobster fishery, some of which was used as bait. A directed exploratory fishery began in 1974 but was limited until the late 1980's, when expanding markets and increased value resulted in a substantial growth in effort. The five rock crab fishing areas are identical to lobster fishing areas (LFAs): 23, 24, 25, 26A, and 26B (Figure 1). These areas do not reflect the biology of rock crab but are used for management purposes.

The directed fishery is conducted following defined management measures including a minimum legal size (MLS), prohibition to land females, individual allocation (except in LFA 24), limited access to the fishery, and catch-monitoring (mandatory dockside monitoring program and logbook). On the other hand, the by-catch and bait fisheries are only restricted to harvesting male rock crab and no data are available on the removals from the bait fishery.

An assessment of the rock crab fishery was requested by DFO Fisheries and Aquaculture Management. The purpose of this Science Advisory Report is to assess the rock crab fishery in the southern Gulf of St. Lawrence (sGSL) from 2000 to 2006. Fishery dependant indicators are used including landings, catch rates, fishing effort distribution, and individual allocation achievement. The last assessment of this fishery dates to 2001 (DFO 2002).

## SUMMARY

- Rock crab landings from the directed fishery varied between 3,699 and 4,727 t from 2000 to 2006. In all LFAs, the lowest catches were recorded in 2003.
- In 2006, most (70%) of the landings came from LFAs 25 and 26A. Fishing effort was concentrated in the Northumberland Strait and the Miramichi Bay area.
- The directed fishery performance in the southern Gulf of St. Lawrence (sGSL) was relatively stable between 2000 and 2006, but landings and catch rates can be influenced by a number of factors (effort, catchability, market demands, etc.) other than abundance.
- For 2000 to 2006, the percentage of harvesters reaching their individual allocation in LFAs 23, 25, and 26A varied between 23% and 81%. In LFA 26B, no individual allocation has ever been reached whereas there are no individual allocations in LFA 24.
- The potential for an increase in fishing effort on the rock crab resource exists in the by-catch fishery, the bait fishery, and from the latent potential in the directed fishery. An increase in the fishing effort is not recommended, as the consequences to the resource are unknown.
- Concerns to the resource due to removals of undersized crabs in the by-catch and bait fisheries could be reduced by the introduction of a minimum legal size limit as in the directed fishery.

## BACKGROUND

### Species biology

Rock crab (*Cancer irroratus*) is distributed along the Atlantic coast, from South Carolina to Labrador, from the intertidal zone to a depth of 575 meters. Rock crabs concentrate in shallow waters and seem to prefer sandy bottom, although they can be found on all types of substrate. They grow through the process of moulting where the hard outer shell is periodically shed; the moulting frequency slows once rock crabs become sexually mature. On average, female and male rock crabs mature at 57 and 75 mm carapace width, respectively. Mating occurs during late summer and fall, while the female carapace is still soft from moulting. Generally, female rock crabs extrude eggs soon after mating and carry the eggs beneath their abdomen for about 10 months. The hatching starts as early as mid-June and the pelagic larvae go through six stages and settle to the bottom by mid-September. Male rock crabs take about 6 years to reach commercial size and remain in the fishery for 1-2 years.

### Fishery

The rock crab fishery in the sGSL is comprised of three distinct components: the by-catch fishery, the bait fishery, and the directed fishery. While the by-catch and the bait fisheries are operated during the lobster fishery, by lobster licence holders, the directed fishery is conducted at a different time, by rock crab licence holders.

The management of the directed rock crab fishery is based on effort control (number of licences, individual trap allocation, restrictions on gear characteristics, and limited fishing seasons), with individual catch allocations (except in LFA 24), and by a MLS (Table 1). Females can not be harvested. All rock crab landings from the directed fishery are verified through a

dockside monitoring program (DMP). Logbooks are mandatory and must record daily catch, effort, and fishing locations.

The number of rock crab licences issued (including 25 exploratory licences in 2006) in the recent years was stable around 250 but not all licence holders are active in the fishery. Individual allocations have not changed since 2000 but they vary between LFAs (Table 1) and according to licence type. Most of the licences are classified either as commercial or communal (Aboriginal groups). Partnership and community licences represent a very small fraction of the available licences and were not considered in the calculations of individual allocation achievement.

Table 1. Key management measures in the directed rock crab fishery in the sGSL in 2006.

LFA	Minimum legal size (mm)	Individual trap allocation	Fishing season	Individual allocation (kg)	Number of licenses	
					issued	active
23	102	100	Aug. 7 to Oct. 22	35,000	55	43
24	102	150	July 5 to Oct. 28	NA	17	10
25	102	100	July 1 to July 28 Oct. 16 to Nov. 30	25,000 <sup>1</sup>	71	63
26A	108	90	Aug. 7 to Nov. 11	23,913	95	81
26B	108	100	Aug. 28 to Nov. 24	27,216	12	8

<sup>1</sup> individual allocation for communal licences is 35,000 kg

The by-catch fishery used to operate with daily limits (since 1999) and a MLS but since 2003, lobster licence holders can keep any size male rock crabs without a quantity limit. There are no DMP and logbook requirements in the by-catch and the bait fisheries and the potential number of harvesters is equivalent to the number of lobster licence holders (about 3,260 in the sGSL).

## ASSESSMENT

### Landings

Prior to 2000, rock crab landings were often recorded globally, including by-catch landings. Total recorded landings of rock crab were about 1,000 t annually between 1985 and 1992 but rose to over 4,000 t annually by 1994 (Figure 2). Since 2000, the total recorded landings of rock crab from the directed and the by-catch fisheries has been about 5,000 t. The majority of the recorded landings are from the directed fishery, representing 79% to 87% of the total between 2000 and 2006.

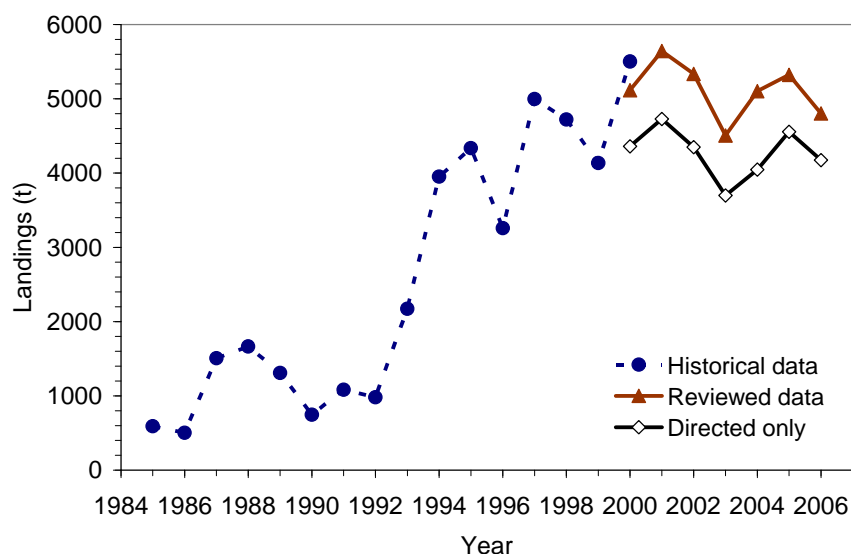


Figure 2. Total recorded rock crab landings (t) in the sGSL, 1985 to 2006 and reviewed data since 2000 with landings from the directed fishery.

## **By-catch fishery**

By-catch landings of rock crab during the lobster fishery were negligible in LFA 26B but were more important in LFAs 23, 25, and 26A. From 2000 to 2005, by-catch landings averaged 23% of the total reported landings in LFA 23 and reached 11%, 15%, and 16% in LFAs 24, 25, and 26A, respectively. For the whole sGSL, rock crab by-catches peaked at 1,056 t in 2004 (Table 2). On average, over 950 lobster licence holders participated in the by-catch fishery every year (out of 3,260). Generally, catches were highest in LFAs 23, 26A, and 25 with catches from LFA 24 being one order of magnitude below. However, there are no estimates of quantities of rock crab caught and used as bait during the lobster fishery.

Table 2. Rock crab landings (t) as by-catch during the lobster fishery.

LFA	2000	2001	2002	2003	2004	2005	2006 <sup>1</sup>
23	284	244	352	269	326	246	174
24	18	22	17	16	20	39	60
25	230	278	272	192	206	175	77
26A	223	370	344	330	504	307	317
26B	0	0 <sup>2</sup>	0	0 <sup>2</sup>	0	0 <sup>2</sup>	0 <sup>2</sup>
Total	755	914	985	807	1056	768	629

<sup>1</sup> preliminary data; <sup>2</sup> less than 0.5 t

## Directed fishery

Data used in the following section originate from the DMP and logbooks.

### Landings

Between 2000 and 2006, most of the rock crab landed during the directed fishery was from LFAs 25 and 26A (Table 3). These two areas accounted for 70% of the catches in 2006 while catches in LFAs 23, 24, and 26B represented 24%, 5%, and 1%, respectively. From 2000 to 2002, landings were at their highest level since the inception of the directed fishery (Fig. 2). Reduce effort (interest) in the fishery as shown by the reduced number of fishing outings, active harvesters, and total traps hauled resulted in decreased landings in all LFAs in 2003 (Table 3). The low effort was attributed to a drop in price paid to the harvesters that year. Total landings increased to 4,046 t in 2004, 4,555 t in 2005, and decreased to 4,173 t in 2006.

*Table 3. Rock crab landings (t) by LFA from the directed fishery.*

LFA	2000	2001	2002	2003	2004	2005	2006
23	995	1,128	1,007	665	957	1,028	982
24	237	211	177	139	183	159	212
25	1,186	1,300	1,378	1,295	1,292	1,470	1,361
26A	1,917	2,063	1,769	1,592	1,594	1,869	1,574
26B	24	25	18	8	21	29	43
Total	4,360	4,727	4,349	3,699	4,046	4,555	4,173

### Fishing effort distribution

The rock crab fishery is widely distributed in coastal waters of less than 30 m. In 2006, only 60% of trips had information on fishing locations compared to 81% in 2002 even though recording daily fishing effort information in a logbook is mandatory. Over the years, the absence of fishing location data in logbooks has been problematic in 4 regions: Chaleurs Bay, middle portion of LFA 25 from N.B. harvesters, the Malpeque Bay area, and in Pictou County (elliptical areas on Figure 3).

The majority of the fishing activities has always been located in the Northumberland Strait (LFAs 25 and 26A), and in the Miramichi Bay area in LFA 23 (Fig. 3).

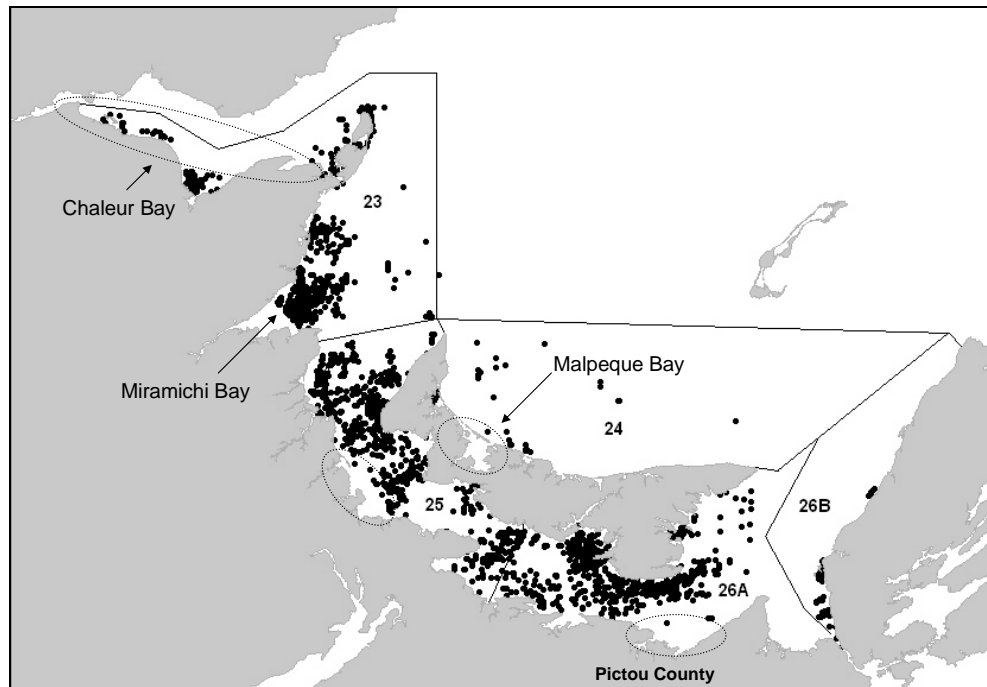


Figure 3. Distribution of fishing effort during the 2006 rock crab directed fishery in the sGSL.

### Catch rate

Several trap types are used in the directed fishery, the most common type being the conical trap; however, catch rates have not been standardized according to the type of trap used or for any other variables. Therefore, part of the variation in the catch rate undoubtedly results from factors other than the abundance of rock crab.

In most of the LFAs, mean annual catch rates increased from 2000 to 2005, varying between 9.8 and 17.3 kg/trap (Table 4). In LFA 23, the highest annual catch rate was observed in 2003, the year the least effort was put in the fishery. In 2006, the lowest catch rate was seen in LFA 26B with 6.1 kg/trap while in the other LFAs catch rates varied between 9.9 and 12.2 kg/trap.

Table 4. Mean annual catch rate (kg/trap) and 95% confidence intervals (in parentheses) of rock crab in the directed fishery.

LFA	2000	2001	2002	2003	2004	2005	2006
23	7.5 (0.3)	7.8 (0.3)	8.0 (0.3)	12.5 (0.5)	10.8 (0.3)	10.6 (0.3)	9.9 (0.3)
24	6.1 (0.5)	5.8 (0.5)	6.7 (0.5)	7.8 (0.6)	10.2 (0.7)	10.1 (0.8)	10.6 (0.7)
25	11.2 (0.4)	10.6 (0.7)	12.2 (0.4)	12.7 (0.4)	12.1 (0.4)	14.1 (0.6)	11.3 (0.3)
26A	13.2 (0.3)	11.6 (0.3)	13.7 (1.4)	14.1 (0.4)	11.6 (0.2)	17.3 (0.6)	12.2 (0.3)
26B	4.4 (0.6)	4.3 (0.8)	5.5 (1.0)	5.4 (1.2)	9.5 (1.1)	9.8 (1.2)	6.1 (0.6)

### Individual allocation

Percentages of harvesters (commercial and communal licences) reaching at least 90% of their individual allocation for 2006 were 29.5%, 40%, and 58.5% for LFAs 23, 25, and 26A respectively (Table 5). From 2000 to 2006, the percentages were variable and without any trend. In LFA 26B, no one ever came close to reaching the individual allocation. There is no

individual allocation in LFA 24. Commercial licence holders had higher percentages of individual allocation reached than communal licence holders.

Table 5. Percentages of active fishermen reaching at least 90% of their individual allocation.

LFA	2000	2001	2002	2003	2004	2005	2006
23	26.7	42.6	31.8	22.9	30.2	37.2	29.5
24 <sup>1</sup>	NA	NA	NA	NA	NA	NA	NA
25	62.7	57.8	60.9	53.3	56.1	67.8	40.0
26A	76.4	80.6	52.2	57.0	50.0	75.6	58.5
26B	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<sup>1</sup> no individual allocations in LFA 24

## **Sources of uncertainty**

Rock crab fishery data are obtained through several unconnected processes that result in duplication of effort, which increases the chance of data errors as well as substantial delays.

The quantity of rock crab harvested and used as bait is unknown. In some areas, that practice is common and could represent significant amounts of unaccounted-for removals.

The fishable and population biomasses of rock crab in the sGSL are unknown and our knowledge of rock crab demographics, population structure and recruitment dynamics is very limited.

Any changes in fishing efficiency (or “effective effort”, from larger vessels, better navigation or improved fishing strategies) have not been accounted for. Hence, any fishery-dependant catch rate indicators may be biased and possibly unrelated to abundance of the resource.

## **CONCLUSIONS AND ADVICE**

At the present time, the status (total biomass, exploitation rates, demography, recruitment, natural mortality) of the rock crab resource could not be assessed. All data used in the fishery assessment were obtained from mandatory logbooks and official catch statistics; no fishery-independent indicators were available to complement this assessment. The fishery indicators used may not entirely reflect changes in resource abundance as changes in the management regime and market forces have and continue to influence catch and effort trends.

The directed fishery in the sGSL has been relatively stable between 2000 and 2006 but landings and catch rates can be influenced by a number of factors (effort, catchability, market demands, etc.).

The potential for an increase in fishing effort on the rock crab resource exists in the by-catch fishery, the bait fishery, and from the latent potential in the directed fishery. Fishing effort is linked closely to market conditions and an increase in the value of rock crab could lead to substantially higher landings in a short period of time with unknown consequences on the rock crab population. In consideration of these elements, increasing the fishing effort is not recommended.

The by-catch and bait fisheries allow the removal of any size male rock crab. Concerns to the resource from increased removals in these fisheries could be reduced by the introduction of a MLS like in the directed fishery.

There are no fisheries-independent indices of abundance or population structure for rock crab populations in the sGSL. Additional assessment and research efforts would be required to properly evaluate the rock crab stock's response to changes in fishing pressure.

## ECOSYSTEM CONSIDERATIONS

Rock crab diet and predator-prey relationships were examined based mainly on samples collected during the May, July, August, and October trawls surveys carried out in Northumberland Strait. Rock crabs (n=282) were primarily carnivorous and mainly eat fish and crustaceans (respectively 41% and 38% of prey biomass). It is unknown whether rock crabs captured their prey alive or were scavenging dead specimens. No lobster remains were detected in the rock crab stomach samples.

Benthic stages of rock crab were an important prey of four demersal fish species (shorthorn sculpin, winter skate, longhorn sculpin, and cunner) and all three species of large decapod crustaceans (lobster, rock crab, and lady crab) that occur in Northumberland Strait. Rock crab is the most important prey of lobster, representing 52.5% of prey biomass in the studied area (n=2,390).

Due to their presumed high biomass, carnivorous feeding habits, and use as prey by many predators, rock crab is likely have a major role in structuring the community and in energy transfers through the food web in the sGSL coastal ecosystems.

## SOURCES OF INFORMATION

DFO. 2002. Southern Gulf of St. Lawrence, Rock Crab (Lobster Fishing Areas 23, 24, 25, 26A and 26B). Sci. Stock Status Report C3-04(2002).

## FOR MORE INFORMATION

Contact: Amélie Rondeau  
Fisheries and Oceans Canada  
Gulf Fisheries Centre  
P.O. Box 5030  
Moncton New Brunswick E1C 9B6

Tel: (506) 851-2650

Fax: (506) 851-2147

E-Mail: [Amelie.Rondeau@dfo-mpo.gc.ca](mailto:Amelie.Rondeau@dfo-mpo.gc.ca)



This report is available from the:

Centre for Science Advice  
Gulf Region  
Fisheries and Oceans Canada  
P.O. Box 5030  
Moncton, New Brunswick  
Canada E1C 9B6

Tel.: 506-851-2022

Fax: 506-851-2147

E-mail: [CSAS@dfo-mpo.gc.ca](mailto:CSAS@dfo-mpo.gc.ca)

Internet address: [www.dfo-mpo.gc.ca/csas](http://www.dfo-mpo.gc.ca/csas)

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