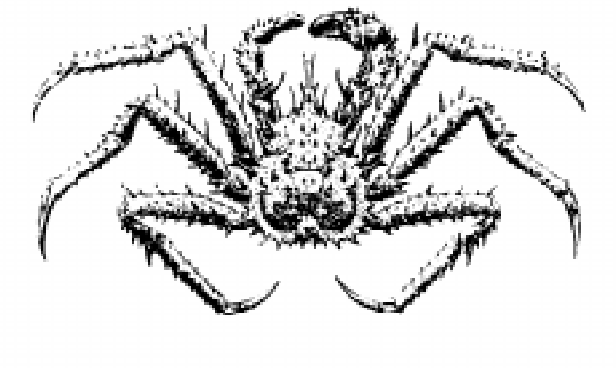


St. Lawrence Estuary and Gulf Northern Stone Crab

Basic Information

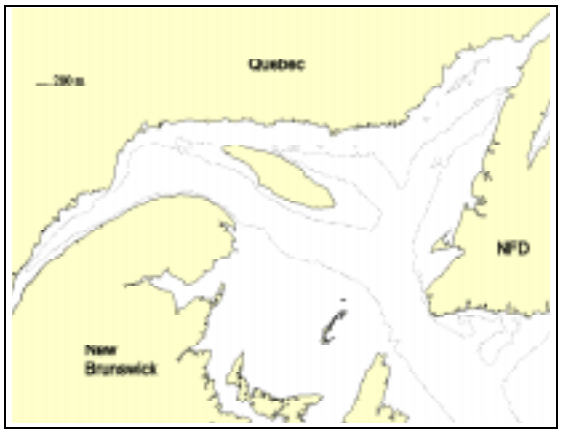
Northern stone crab is not fished commercially on our shores, even though it is related to some species fished in the North and South Pacific. Recurring requests for information have prompted us to update our knowledge of the biology and fishing potential of this species in the St. Lawrence Estuary and Gulf.

Summary

- In the St. Lawrence ecosystem, northern stone crab crab is found of the sandy and clay sea beds in the deep channels (Laurentian, Esquiman and Jacques Cartier). It is commonly found at depths greater than 300 metres where temperatures are above 0 C.
- The species is not very fertile and does not appear to be highly abundant in the Gulf. It can be processed in a plant in the same fashion and with the same equipment as snow crab. Its fine-looking meat, however, is saltier and firmer.
- Specific conservation measures have been suggested should the fishery begin.

Context

Many would be surprised to discover that a species closely related to the king crab family fished on the Alaskan coast lives on this side of the Atlantic. In fact, the northern stone crab, *Lithodes maia*, inhabits the sea bed off Canada's East Coast, where it is regularly caught incidentally by snow crab, northern shrimp, redfish and groundfish fishers. This species can reach approximately the same size as snow crab.



Requests for information on northern stone crab come in regularly, and we thought it would be useful to produce an overview of our current knowledge of the biology and fishing potential of this species in the St. Lawrence Estuary and Gulf.

A major part of our knowledge of this species in the Gulf of St. Lawrence has been gleaned from two reports produced in 1983 and 1988 for the Department of Fisheries and Ocean. This document is based on the results of the two reports, by-catch data from groundfish survey results in the Gulf, and information published on related species fished in the North Pacific and elsewhere in the world.

Overview of the biology

Description of the species

Northern stone crab, *Lithodes maia* (Linnaeus, 1758), is a member of the Lithodidae

(King crabs) family, unique for its pear-shaped shell, covered with strong spines, also found on its legs. The abdomen, folded under the shell, is formed by calcified plates, the alignment of which is symmetrical on males, but highly asymmetrical on females (see Figure 1). Like all crabs, it has five pairs of legs, the fifth pair being atrophied and hidden under the shell. The northern stone crab grows by moulting, which occurs less frequently as it grows older.

Little is yet known about the northern stone crab's biology and ecology, since it lives at great depths and as yet has not been subject to directed commercial fishing. The largest captured males reached a carapace length (CL) of approximately 114 mm, *i.e.* from the eye to the centre of the rear part of the cephalothorax (the front part of the body formed by the joined head and thorax), weighing 1.075 kg. The largest females have never surpassed 93 mm (CL), weighing 0.429 kg.

Distribution and habitat

Northern stone crab has been found in the Northwest Atlantic from Greenland to New Jersey. It mostly inhabits sandy and clay sea beds from 65 to 790 metres in depth. *Lithodes maia* and *Noelithodes grimaldii*, a larger species living in deep waters (deeper than 800 m) along the continental slope, are the only two known representatives of the King crabs family in the Northwest Atlantic.

In the St. Lawrence Estuary and Gulf, the northern stone crab is generally found in the deep channels. Groundfish research surveys conducted in winter on the Gadus Atlantica from 1987 to 1994 and in summer on the Lady Hammond from 1987 to 1990 indicate that the majority of catches take place in the Laurentian, Esquiman and Jacques Cartier channels of the St. Lawrence ecosystem (see Figure 2). The depth of stations where at least one crab was caught varied between 110 and 525 m. Water temperatures registered during these surveys fluctuate between 0 and 9.3 C. Stations where more than 10 specimens were caught accounted for only 4 % of the total of those where the species had been found, and the majority were at depths greater than 300 m. However, groundfish research surveys do not yield adequate results on the absolute abundance of benthic crustaceans like the northern stone crab. In fact, the surveys are conducted with large bottom trawls equipped with rollers on the underside, which may not retain all crabs. Since the surveys covered a large part of the Estuary and Gulf, northern stone crab by-catches help increase our knowledge of the distribution of the species in the area, but do not in themselves constitute a reliable indication of their abundance.

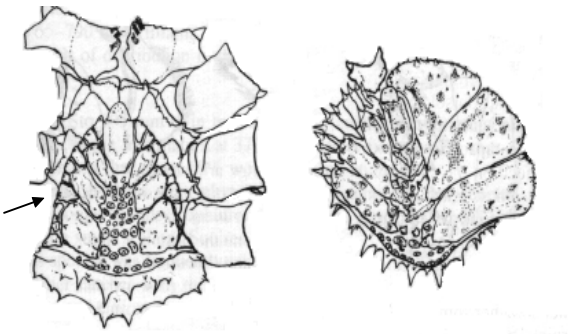
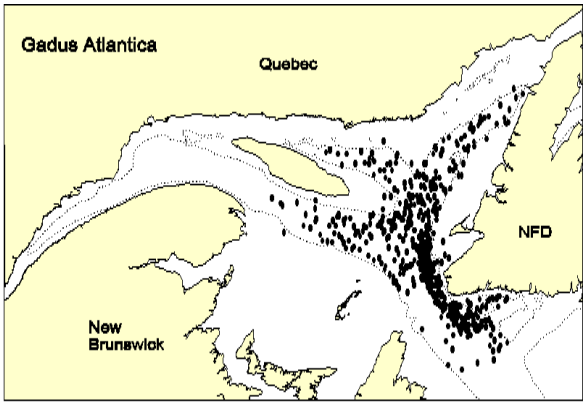


Figure 1. Morphology of the abdomen of the male (left) and female (right) northern stone crab. The abdomen is folded under the shell, and the arrow indicates its position in relation to the other external structures found on males.

Information obtained from experimental fishing indicates a distribution pattern similar to that of groundfish surveys. South of Anticosti, the northern stone crab forms aggregations generally located deeper than 300 m, except on sandy beds, where it can be found in shallower waters. Juveniles are more abundant between 160 and 300 m on bottoms covered with sediment that is coarser than in the remainder of the inventoried area. No mature female catches were

reported at less than 300 m in this area. Along the north shore of the Gaspé, catches are distributed between two layers: between 100 and 160 m, and deeper than 330 m. Not one northern stone crab was caught in the two areas when the sea bed temperature was lower than 2 C. The ratio of four males for every female registered for catches south of Anticosti seems to indicate that males are more abundant and attain a larger size than females in this part of the Gulf.



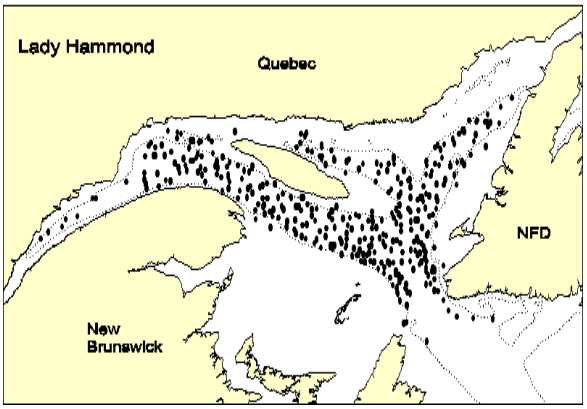


Figure 2. Stations where northern stone crab catches have been reported. The data is from groundfish surveys conducted from the mouth of the Gulf to the Estuary of the St. Lawrence from 1987 to 1994. The surveys on the Gadus Atlantica were conducted in January, and coverage of the western part of the Gulf was limited by ice.

Reproduction and life cycle

The size at which 50 % of northern stone crabs reach sexual maturity has been estimated at a carapace width (CW) of 98.6 mm (a CL of approximately 85 mm) for males and a CW of less than 65 mm (a CL of approximately 60 mm) for females south of Anticosti. Females carried between 1500 and 4900 eggs with a diameter of 2.55 mm at an advanced stage of development. A diameter of 2.1 mm has been reported in the literature. The smallest mature female encountered had a CL of 37 mm. Young crabs hatch in the form of larvae, which are quite different from adults. The larvae spend the first three months of their lives in the plankton and swim in surface waters, where they feed. During this period, they go through three very different stages, called Zoea I and II and Glaucothea, before taking adult form, migrating to the sea bed and starting a new life at great depths.

Like the scarlet king crab, which lives in deep waters (380 to 1125 m) in the North Pacific (see Table 1), northern stone crab is not a very fertile species. Females of both these species lay large eggs in relatively small numbers. However, females of related species living in shallower waters in the North Pacific, such as the red king crab and blue king crab, are more fertile. They lay smaller eggs, which they bear under the abdomen in larger numbers. Females from this large crab family do not have spermatheca (internal pouches that store sperm) like the snow crab, limiting the availability of sperm to fertilize female eggs when males are heavily fished.

The following equations have been used to convert carapace width (CW) into carapace length (CL), depending on the case :

Northern stone crab: $CL = 0.49 + 0.92\ CW$

Snow crab: $CL = 3.4 + 0.96\ CW$

Lithodes maia and *Lithodes couesi* possess characteristics unique to deep sea crabs, such as a bright red colour, long legs and a highly developed branchial chamber, but they seem to differ in at least one respect : *L. couesi* females can attain a larger size than *L. maia* females. The largest *L. maia* caught in the northwest of the Gulf did not surpass a CW of 101 mm (a CL of approximately 93.4 mm), while the *L. couesi* in the North Pacific can reach over 120 mm.

Fishery

Of the 79 crab species belonging to the King crabs family inventoried across the world, only a few are subject to directed commercial fishing : *Paralithodes camtschaticus*, *Paral-ithodes platypus*, *Lithodes aequispina* and *Lithodes couesi* in the North Pacific, and *Lithodes antarctica* and *Lithodes santolla* in Argentina and Chile. The lack of commercial interest in this large crab family is intriguing. Twenty-two of the 79 known species have been inventoried only since the 70s.

The northern stone crab does not seem to be highly abundant in the Gulf. Exploratory fishing since the early 80s in the northern Gulf has reported only very low yields : on average, from two to three northern stone crabs per trap. These yields appear to be very low, especially since this was the first time this virgin biomass was fished. Yields of two related species, *Lithodes santolla* in the Beagle channel in Argentina (1975) and *Paralithodes camtschaticus* near Kodiak (1973) and in Norton Sound (1977) in Alaska, were 11.5, 22 and 36 crabs per trap respectively when these species were first fished.

Moreover, problems surfaced with regard to conservation of the bait, which disappears rapidly (in less than 2.5 hours in some cases) at great depths, owing to the high abundance of scavengers (amphipods and hagfishes). Several attempts to develop a more effective container to protect the bait have not been successful to date, and the development of a

*Table 1. Comparison of biological characteristics of deep sea crabs : the northern stone crab (*Lithodes maia*) and scarlet king crab (*Lithodes couesi*); and of shallow sea crabs : the red king crab (*Paralithodes camtschaticus*) and blue king crab (*Paralithodes platypus*). The snow crab (*Chionoecetes opilio*) does not belong to the same crab family and is only listed for comparison purposes Adapted from Gagnon and Hovington 1983.*

	Northern stone crab	Scarlet king crab	Red king crab	Blue king crab	Snow crab
Size (CL) at 50 % of maturity :					
males	85.0	91.4	102.8	-	40.4
females	60.0	80.2	101.9	-	51.4
Fertility :					
No. eggs/female	1,500-4,900	2,500-5,500	25,000-390,000	50,000-300,000	12,000-140,000
Diameter of eggs	2.1-2.6	2.3	1.0	≤ 1.0	0.6-0.8

CL : Carapace length from the eye to the centre of the rear part of the

fishery using these traps to capture the species must resolve this major problem before higher fishing yields can be expected. Strong currents have also influenced catches north of the Gaspé peninsula. In addition, the abundance of northern stone crab is probably low in the Gulf, which could be closely related to the species low fertility and uneven distribution on the sea bed.

The northern stone crab can be processed in a plant in the same manner and with the same equipment as snow crab. Strong spines on its shell, however, may cause minor problems when it is handled and shelled. Meat yields in a plant during shelling attempts co-ordinated by the firm Biorex reached 26 %, regardless of the size of the crabs submitted for testing, and are comparable to snow crab yields, which are generally 20 to 30 % in Eastern Canadian plants. In addition, its meat is saltier and firmer than that of snow crab and has a nice appearance, especially meat from the legs.

Development context

Developing new fisheries of underutilized marine species demands a cautious approach. Knowledge of these new species, which include the northern stone crab, is often poor or inadequate, and information is often sketchy on the distribution of the animals or plants and their biology and ecology. The relationship between biological communities and their habitat is often delicate, and protection of these species should be ensured by minimizing the impact of new fishing gear or activities on the habitat.

Increasing pressure from the fishing industry to fish new resources, combined with a lack of biological information, may greatly compromise a rational development of the fishery. It could be sustainable in the long term if the fishing effort and the size of catches are balanced with production of the stock. Developing new fisheries should be well managed to ensure conservation of the resource, while obtaining information required to evaluate the status of the stocks and the impact of fishing, or making recommendations on conservation and catch strategies.

For the northern stone crab, on which only partial information is available, managing the development of a new fishery should be ongoing; ie a cautious initial fishery, based on the best information available on the biology of the resource and on potential markets and the socio-economic context. The approach should also be flexible and evolve as new knowledge is acquired. Planned development in stages would enable us to evaluate, at the end of each stage, data accumulated during biological, technological or economic activities. This cautious, step-by-step approach should ensure conservation of the resource and the recoverability of the stocks by protecting the growth and reproductive potential of the species, as well as the habitat and its communities.

Low yields obtained to date with traps during northern stone crab exploratory campaigns indicate that the virgin biomass is insufficient to ensure the long-term viability of a fishery based only on this species. Even though the prospect of a directed fishery is low, high concentrations may nevertheless exist in small or unexplored areas. If this were the case and we wanted to make the most of the situation, we would recommend the following :

Conservation measures

Limiting the fishing effort :

Fishing effort is controlled to limit access to the resource, thereby controlling pressure on the stock. This is the primary tool used to ensure development of the fishery's potential in terms of the ability of the resource to support the fishery. Methods used to control the fishing effort are numerous and varied, and include limiting the number of fishing

licences, and therefore the number of active fishing units; the type of gear used, such as numbers and dimensions of traps; and the number of fishing days by imposing a season when activities are allowed. Another method involves spatially distributing the fishing effort by limiting fishing units per sector to curb local effects of overfishing. These methods have already been put into practice to manage well-established commercial and developing fisheries. Fishing effort should initially be set at a minimum level so the fishery can be developed. It may subsequently be increased in relation to success achieved and the response of the stock to fishing.

Encouraging the use of traps :

Traps are very selective when used with the appropriate mesh size. They are easy to use and may be employed even when the surface of the sea bed is uneven, without greatly altering the bottom. The number of traps used may be adjusted to tailor the fishing effort to the existing biomass. Northern stone crab is not a very productive species, and its deep-water, offshore habitat will engender operating costs greater than those of the snow crab fishery. Using traps as fishing gear should optimize yields while minimizing operating costs.

Setting a minimum legal size :

Adopting regulations to set a minimum legal size would protect smaller specimens, which, as they grow, will increase the yield per recruit. In addition, a certain number of breeders may be protected, increasing the fertility potential of the stock. However, if possible, the minimum legal size should be greater than 85 mm (CL) or 99 mm (CW), ie the size at 50 % mature males. Therefore, many breeding females would be protected, since they become mature at a much smaller size.

Management measures

Encouraging the use of logbooks : Regardless of the type of intended activity, be it exploration, incidental catches or directed fishery, keeping a logbook should be mandatory to gather information on the position, fishing effort and catches when the fishery begins. Unfished stocks, possess specific characteristics, which often differ greatly from fished stocks. Fishing effects on a resource may generally be better interpreted when we have information on yields and the type of catches when the fishery begins.

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