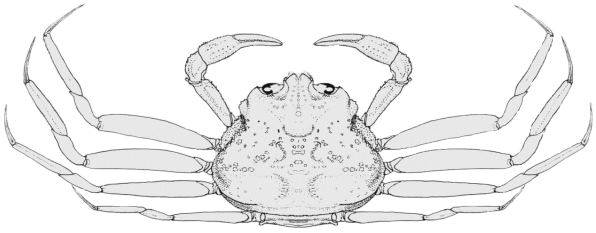


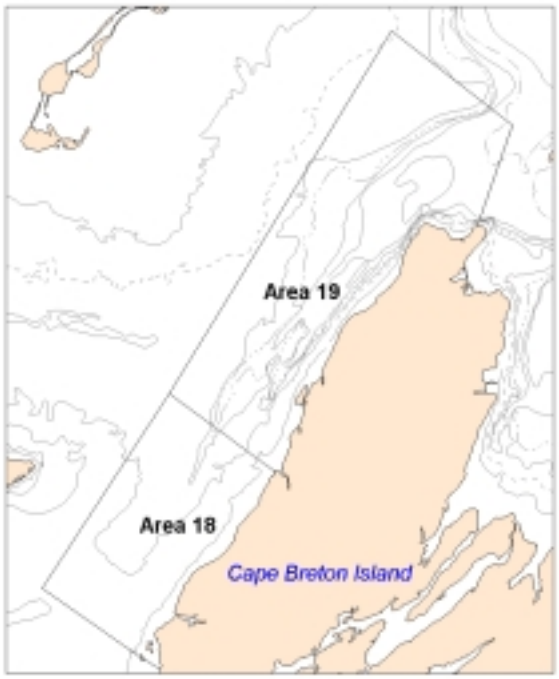
Western Cape Breton Snow Crab

Background

Snow crab (Chionoecetes opilio) is a crustacean like lobster and shrimp, with a flat almost circular body and five pairs of spider-like legs. The hard outer shell is periodically shed in a process called molting. After molting, crabs have a soft-shell for a period of time. Soft-shelled crab is defined by shell hardness (<68 durometer units). The term white crab describes both new-soft and clean hard-shelled crab (categories 1 and 2 respectively).

Unlike lobsters, snow crabs do not continue to molt throughout their lives. Females stop growing after the molt, in which they acquire a wider abdomen for carrying eggs, which occurs at shell widths less than 95 mm. Male snow crab stop growing after the molt, in which they acquire large claws on the first pair of legs, and which can occur at shell widths as small as 40 mm. Female crab produce eggs that are carried beneath the abdomen for approximately 2 years. The eggs hatch in late spring or early summer and the tiny newly-hatched crab larvae spend 12-15 weeks floating freely in the water column. At the end of this period, they settle on the bottom. It takes at least 8-9 years for snow crab males to reach legal size.

The snow crab fishery in western Cape Breton began in the late-1970s. Currently, there are two fishing Areas: 18 and 19. These management areas are part of a larger biological unit namely Area 12+E and Area 18,19+F



Snow crab management areas in Western of Cape Breton.

The minimum legal shell width is 95 mm, and female crab are not kept by industry. Baited traps, constructed of wire or tubular steel, are used to catch crab, mainly on mud or sand-mud bottoms at temperatures ranging from -0.5 to 4.5 °C and depths ranging from 50 to 280 m. The fishery takes place in late summer in Areas 18 and 19. Neither soft-shelled nor white crabs are harvested.

Management of these fisheries is based strictly on quotas and effort controls (number of licenses, trap limits and seasons). In 1999, landings in Area 18 were 407 t (quota of 408 t) and landings in Area 19 were 1,979 t (quota of 1,986 t). No temporary permits were allowed in 1999.

Summary

Area 18

- The management area does not reflect the biological distribution of the resource.
- The average CPUE (35 kg/trap haul) in 1999 was at the highest level since 1994 (59 kg/trap haul).
- The quota (408 t) was caught for the first time since 1996.
- The catch composition was at 85 % new hard-shelled crab.
- The average percentage of soft-shelled crab was low (3 %).
- The projected exploitable biomass for 2000 is 593 t and the recruitment is uncertain because of movement of crab.
- Fishing at levels comparable to previous years should not result in a stock decline overall.

Area 19

- The management area does not reflect the biological distribution of the resource.
- The 1999 quota (1,986 t) was caught after only five weeks.
- The average catch per trap was 104 kg.
- The average percentage of soft-shelled crab was low (4 %).
- The projected exploitable biomass for 2000 is 5,350 t.
- Fishing at levels comparable to previous years should not result in a stock decline overall.

The Fishery

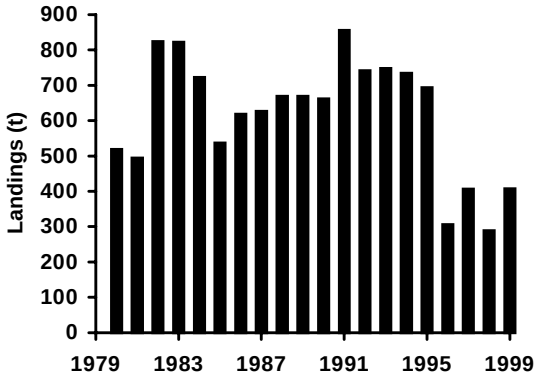
Areas 18 and 19, Western Cape Breton - The fishing grounds along the west coast of Cape Breton were initially fished by a group of fishermen based in Cheticamp. Subsequently, fishermen from Quebec and New Brunswick sporadically fished in the area. With the increase in the commercial value of snow crab in the late 1970s, the fishery gradually expanded to cover all fishing grounds along the west coast of Cape Breton.

Area 18 was fished for the first time in 1979 by 14 inshore vessels with exploratory licenses and a trap limit of 30 traps per license. In 1984, Area 18 was reserved exclusively for inshore fishermen. The overall quota, which had initially been set at 835 t in 1981, was reduced to 626 t in 1986 and then increased to 674 t in 1988, where it remained until 1990. In the spring of 1991, a quota of 200 t was set to promote a spring fishery in the area. Later that year, a quota of 674 t was set for the 1991 fall fishery and 1992 spring fishery. The quota was raised to 749 t for 1992-93, and remained at that level for 1993-94 and 1994-95. Since 1992-93, 30 fishermen have participated in this fishery. In 1995, the quota was 705 t of which 109 t were allocated to 30 temporary license holders. In 1996, no temporary licenses were issued and a quota of 340 t was allocated to 30 fishermen. In 1997, the quota was set at 580 t. Landings were 406 t, which correspond to 70 percent of the total quota. In 1998, landings were 289 t, which correspond to 70 percent of the total quota of 411 t. In 1999, the quota was reached for the first time since 1996 (408 t).

Quotas (t) and landings (t) in Area 18.

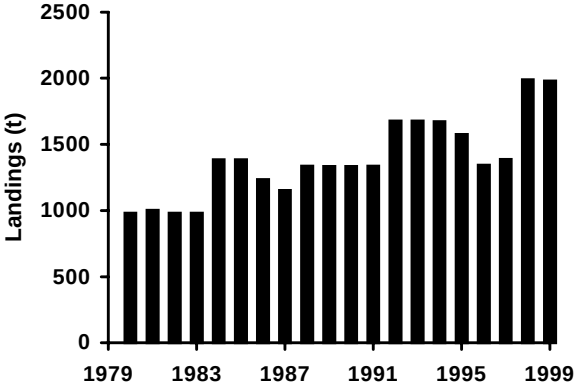
	Average 1990-94	1995	1996	1997	1998	1999
Quota	759	705	340	580	411	408
Landings	748	693	306	406	289	407
CPUE	51.7	33.5	21.2	18.1	18.0	34.5
Soft crab (%)	10.4	8.2	20.5	13.1	17.1	3.2

Landings (t) in Area 18



In 1978, **Area 19** was established as an inshore area reserved exclusively for inshore fishermen using vessels under 13.7 m (45 feet) in length. Landings, regulated by quotas, fluctuated between 900 t and 1,390 t from 1979 to 1991. During 1992-94, quotas were set at 1,686 t. In 1995, there were 74 permanent and 37 temporary license holders in the fishery with a global quota of 1,575 t. Since 1996, the 37 temporary licenses have become permanent. In 1996, the quota was 1,343 t for the 111 permanent license holders. In 1997, the quota was set at 1,386 t. In 1998, the quota increased to 1,991 t (landings of 1,988 t). In 1999, the quota (1,986 t) was set at the same level of exploitation since 1997 (63 % of the exploitable biomass). In 1999, the quota was reached.

Landings (t) in Area 19

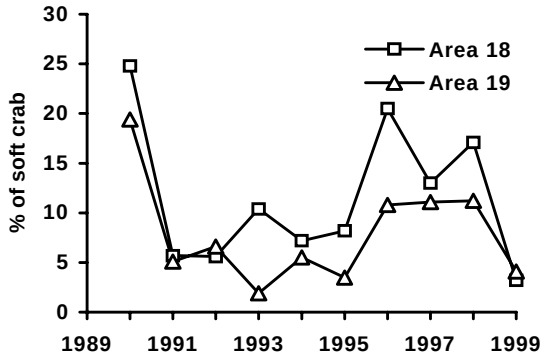


Quotas (t) and landings (t) in Area 19.

	Average 1990-94	1995	1996	1997	1998	1999
Quota	1546	1575	1343	1386	1991	1986
Landings	1540	1575	1343	1386	1988	1979
CPUE	77.0	63.4	54.6	63.2	63.7	103.7
Soft crab (%)	7.7	3.5	10.8	10.7	11.2	4.1

In 1999, the percentage of **soft-shelled crab** decreased significantly compared to the previous year in both areas. In part, this was due to improvements in fishing gear, namely high-cone traps, and avoidance of areas with high concentrations of soft-shelled crab. The percentage of soft-shelled crab in Areas 18 and 19 were 3.2 % and 4.1 % respectively.

Percentage of soft-shelled crab in Areas 18 and 19



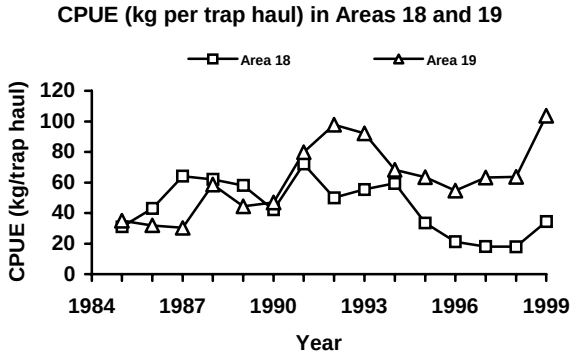
Carapace condition was estimated from sea samples taken from the 1999 fishery. Crab with carapace category 3 comprised the bulk of the fishery in all areas.

Carapace condition of commercial-sized adult crab in the catch (%)

Category	Description	18	19
1-2	White crab	6.7	4.5
3	Intermediate	78.6	85.5
4	Old crab	13.2	9.5
5	Very old crab	1.5	0.5

Resource Status

Logbook data were used to describe the general distribution of fishing effort per section (5 minutes of longitude by 5 minutes of latitude). In Area 18, the average CPUE increased from 18.0 kg/trap haul in 1998 to 34.5 kg/trap haul in 1999. In 1999, the average CPUE in Area 19 (103.7 kg /trap haul) increased considerably compared to 1998 (63.7 kg/trap haul).



The evaluation of stock status is based on a trawl survey, which provides estimates of exploitable biomass (hard-shelled adult males of legal size) immediately following the fishery, plus estimates of soft-shelled adult males larger than 95mm that will be new recruits in the following year. The method assumes that there is no natural mortality and no movement between the time of the survey and the beginning of the fishery nine months later, except for very old crab. Abundance is also estimated for smaller size crab or pre-recruits.

The stock assessment in Areas 18 and 19 was based on a 1999 trawl survey. As the concentration of biomass is found between Areas 12, 18 and 19, the seasonal movement of crab towards Area 19 has a positive impact on the biomass level in this area.

Exploitable biomass estimates (t) in western Cape Breton (Areas 18 and 19) (with 95 % confidence intervals)

Year	18	19
1992	-	5,500 (± 36 %)
1993	1,300 (± 92 %)	5,200 (± 42 %)
1994	1,300 (± 83 %)	2,300 (± 27 %)
1995	1,200 (± 89 %)	2,600 (± 40 %)
1996	600 (± 39 %)	1,800 (± 21 %)
1997	1,000 (± 54 %)	2,200 (± 27 %)
1998	-	3,160 (± 24 %)
1999	-	3,150 (± 35 %)
2000	590 (± 72 %)	5350 (± 30 %)

- No survey.

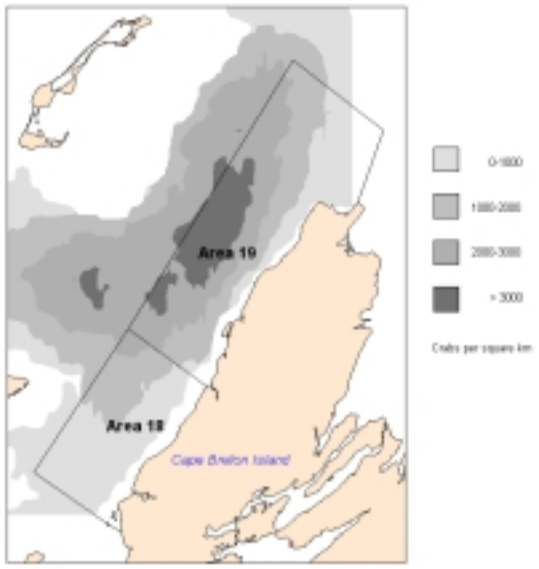
Area 18:

The survey in 1999 found an exploitable biomass of 593 t and assuming no large movement, this crab will be available for the 2000 fishery. It was also noted that the largest increase in adolescent crab has been seen since the beginning of this fishery.

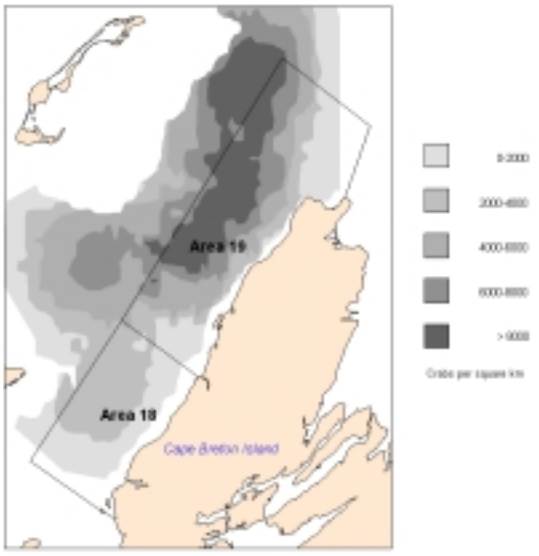
Area 19:

The survey indicated an exploitable biomass of 5,350 t and would be available for the 2000 fishing season, an increase of 70 % from the previous year. About 30 % of this biomass is new recruitment.

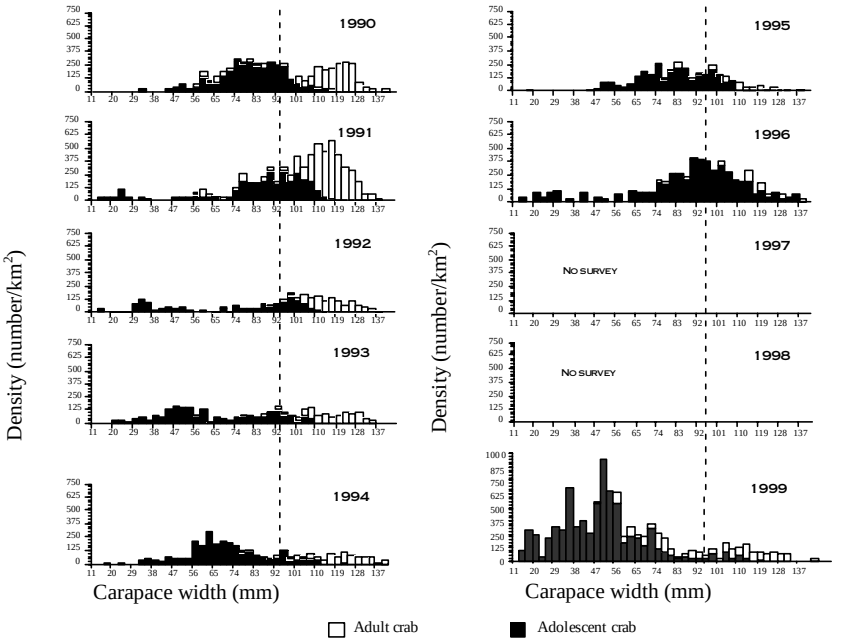
Projected density contours of adult male crab ≥ 95 mm CW.



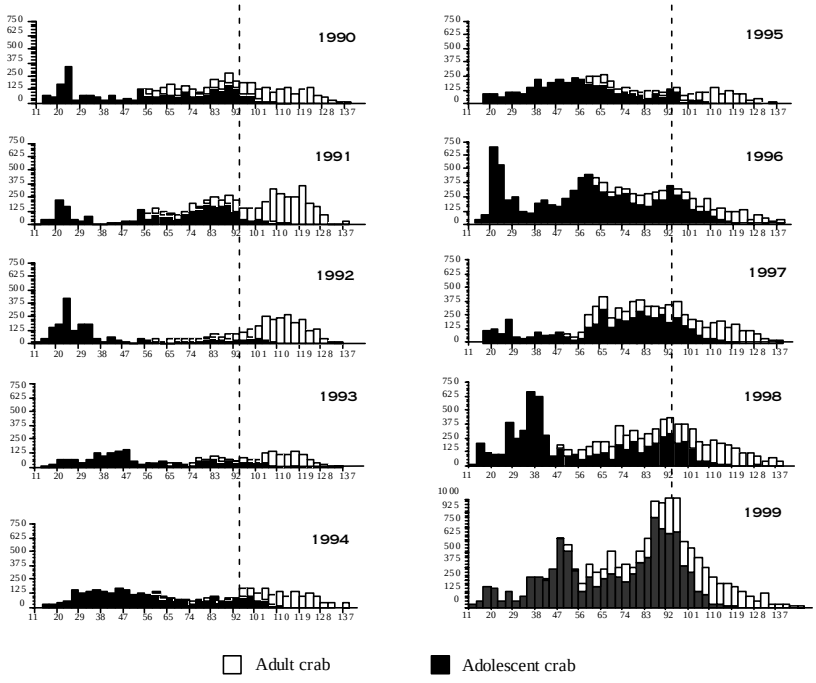
Projected density contours of adult male crab ≥ 56 mm CW



Size frequency distributions of male crab sampled during the trawl Survey in Area 18 after the fishing season.



Size frequency distributions of male crab sampled during the trawl Survey in Area 19 after the fishing season.



Exploitation rate in Area 19 remained at 63 % in 1999. It should be noted that the movement of crab into and out of these areas influence the exploitation rates in Areas 18 and 19.

Exploitation rates (%) in Areas 18 and 19

Year	Area 18	Area 19
1993	58	32
1994	58	73
1995	58	61
1996	53	74
1997	42	63
1998	-	63
1999	-	63

Sources of Uncertainty

The lack of knowledge on the growth of the pre-recruits is a source of uncertainty of this assessment. The size at which skip molting occurs and its causes are not well known. Therefore, the forecast of the timing for the next wave of recruitment into the fishery should be interpreted with caution.

Classification of carapace condition during the trawl survey is another source of uncertainty. Exploitable biomass is composed of the recruitment to the fishery (shell conditions 1 and 2) and residual biomass (shell conditions 3, 4 and 5). Uncertainty of carapace condition may result in overestimation of recruitment biomass. Finally, it is assumed that the survey gear catches 100 percent of crab > 50 mm, but this is unlikely to be always true and therefore the survey would tend to underestimate abundance and overestimate exploitation rate.

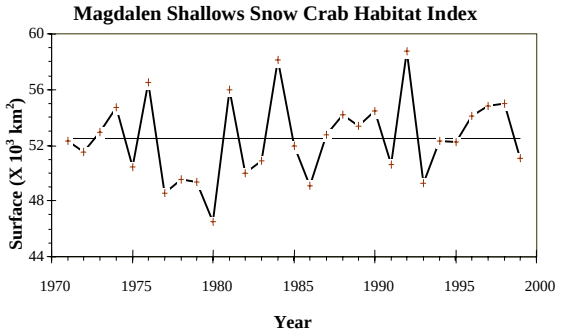
The survey sampling intensity and coverage have increased over time. The impact of this is not yet known. There was some concern that the fixed station design could be affected by local depletion. The result would be to underestimate abundance. This source of error would depend on how much crab redistributed themselves between surveys.

Seasonal movement between fished areas may occur (especially adult crabs of commercial size that have just molted) between the time of the trawl survey and the beginning of the subsequent fishing season. This movement is most apparent in the smaller areas. Another source of uncertainty is the movement of adult crab of commercial size when the biomass is increasing or decreasing. When the biomass is increasing, crabs tend to spread over a larger surface. By contrast, when biomass is decreasing, crabs tend to be concentrated in a smaller area. Movement of crab among Areas 12, 18 and 19 is assumed but not explicitly taken into account in the stock status.

Natural mortality of adult crabs was assumed to be negligible. Old carapace crabs are most certainly dying. The magnitude of this mortality by shell condition is unknown.

Ecosystem Considerations

Snow crab prefers cold water temperatures. Bottom water temperatures in the southern Gulf have generally been colder than the long-term average since the late 1980s. During 1995 and 1996, subzero bottom water temperature were seen to be at the greatest extent since these measurements began in 1971. Southern Gulf waters at 50 to 150 meters have been predominantly below normal in temperature since mid to late 1980s. The area of ocean bottom with water temperatures between -1 and 3 degrees Celsius is an index of snow crab habitat, and was high since late 1980s to 1998. This index declined in 1999, to just below the long-term mean.



Outlook

In Area 18, the projected biomass for 2000 is tentative because of movement in and out of the area. There is a large concentration of adolescent crabs inside the area that will not necessarily contribute to the commercial biomass in the future. We will look at the whole biological stock unit next year. It would be appropriate to close the fishery as soon as the catches of soft-shelled crab exceed 20 % in order to continue to protect the future recruitment to the fishery.

In Area 19, there was no reason to change the exploitation rate for the year 2000 fishing season. We are in a phase of good recruitment to the fishery. However, the high density of commercial crab and pre-recruits in Area 12 adjacent to Areas 18 and 19 could affect the level of exploitable biomass and recruitment to the fishery in Area 19 for the coming years.

Management Considerations

The management areas are not based on the biology of the stocks and movement of crab between the time of the survey and the fishery could modify the exploitable biomass in these small areas. Fishing activities should be avoided in areas of high concentration of soft-shelled crab in order to minimise the mortality of the future recruitment.

It is difficult to suggest a sound long-term fishing strategy because the main fishing activities in Area 18 occur in about a quarter of the area available and a high activity of seasonal movement towards deeper waters (Area 19) is suspected.

The application of the soft-shelled protocol since 1997 has been a success and fishers collaboration has been good.

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