Western Cape Breton Snow Crab (Area 19)

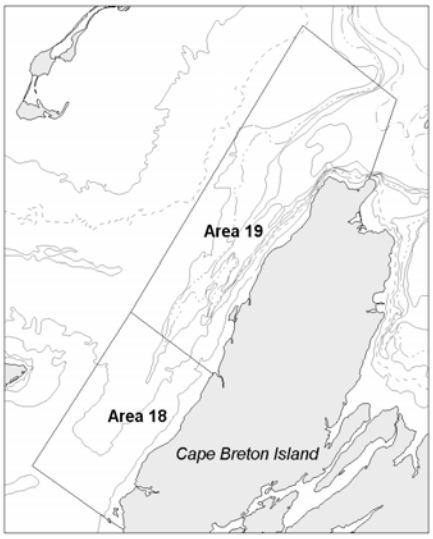
Background

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 moulting. After moulting, 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 moult throughout their lives. Females stop growing after their final moult, in which they acquire a wider abdomen for carrying eggs. This occurs at shell widths less than 95mm. Male snow crab stop growing after their final moult, in which they acquire large claws on the first pair of legs. This can occur at shell widths as small as 40mm. 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 minimum legal shell width is 95mm, and female crabs 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 280m. The fishery takes place in late summer in Area 19. Neither soft-shelled nor white crabs are harvested.

Management of this fishery is based strictly on quotas and effort controls (number of licenses, trap limits and seasons).



Summary

- Crab in the management Area 19 are part of a larger biological population that include crab in adjacent parts of Area 12.

- All indicators are positive:
  - All the 2001 quota of 3,912t was caught.
  - It took less fishing effort to catch a higher quota.
  - The average CPUE among permanent fishermen in 2001 increased significantly compared to 2000.
  - The biomass index is the second highest on record.
  - Recruitment index is the second highest since the survey started in 1991.
  - The relative abundance of pre-recruits R-3 and R-2 is increasing.

- Based on the method used for the past decade, the commercial biomass estimate of 5,200t is comparable to values used in previous years. This commercial biomass is mainly composed of new recruitment (2,900t).

- It is not possible to accurately estimate an exploitation rate; however there is no reason to change the harvest strategy. Stock levels are similar to that available for the 2000 fishery.

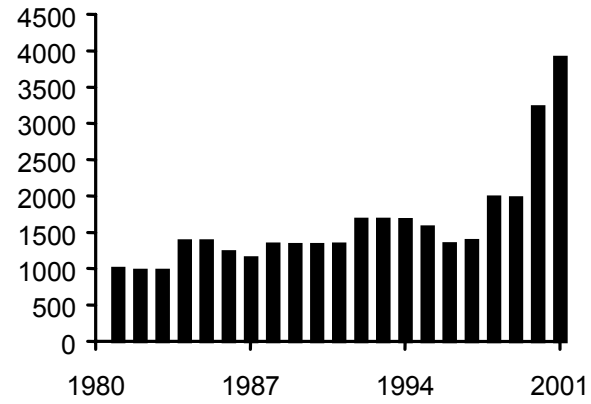
The Fishery

In 1978, **Area 19** was established as an inshore area reserved exclusively for inshore fishermen using vessels under 13.7m (45 feet) in length. Landings, regulated by quotas, fluctuated between 900t and 1,390t from 1979 to 1991. During 1992-94, quotas were set at 1,686t. In 1995, there were 74 permanent and 37 temporary license holders in the fishery with a global quota of 1,575t. In 1996, the quota was 1,343t for the 111 permanent license holders. In 1997, 1998, and 1999, the quotas were caught. In 2000, the quota was shared with temporary fishermen who had an allocation of 668t. The 2000 quota was 3,370t and landings were 3,225t. In 2001, the landings were equal to the quota.

Quotas (t) and Landings (t) in Area 19

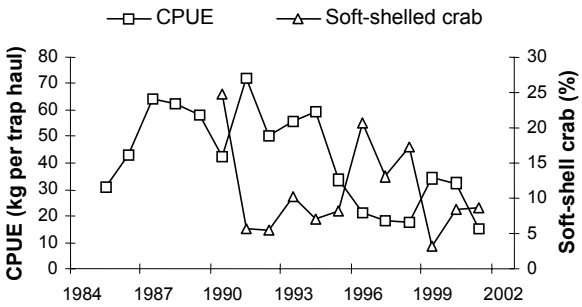
	1996	1997	1998	1999	2000	2001
Quota	1,343	1,386	1,991	1,986	3,370	3,912
Landings	1,343	1,386	1,988	1,979	3,225	3,910
CPUE	54.6	63.2	63.7	103.7	64.1	88.5
Soft crab (%)	10.8	10.7	11.2	4.1	5.6	6.5
Mean size (mm)	117.9	115.9	114.9	114.7	115.4	114.3

Landings (t) in Area 19



The average catch rate (CPUE) of traditional fishermen in Area 19 increased from 64.1 kg/trap in 2000 to 88.5 kg/trap haul in 2001.

CPUE (kg per trap haul) and Soft-Shelled Crab Percentage in Area 19



The percentage of **soft-shelled crab** in Area 19 was 6.5 %. The percentage of soft-shelled crabs in this Area has increased since 1999. The mean size of commercial-sized crabs has been decreasing since 1996.

Carapace condition was estimated from sea samples taken from the 2001 fishery. The category-4 crab was 60% of the catch, which is the highest percentage reached since 1994. However, it has been noted that there was a discrepancy between the trawl survey and the observer program that needs to be investigated.

Percentage of the Catch of Commercial-Sized Adult Crab by Carapace Condition

Category	Description	19
1-2	White crab	8.3
3	Intermediate	31.3
4	Old crab	60.1
5	Very old crab	0.3

Resource Status

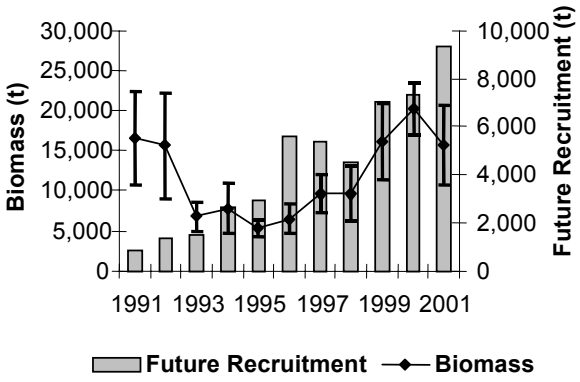
Stock status is primarily based on a trawl survey, which provides an exploitable biomass index (hard-shelled adult males of legal size) immediately following the fishery. It also provides estimates of soft-shelled adult males larger than 95mm (R-1) that will be new recruits in the following year. Abundance is also estimated for pre-recruits (R-2 and R-3) and females (preprimiparous, primiparous, and multiparous). The term R-2 represents crabs with a carapace width larger than 83mm. A portion of these crabs could be available to the fishery in two years. The term R-3 represents crabs with a carapace width between 69-83mm. A portion of these crabs may be available to the fishery in three years. The term preprimiparous refers to the females with a narrow abdomen and orange gonads that will moult to morphometric maturity the following year as primiparous females (first brood). The term multiparous refers to the females, which are in their second brood or older.

The survey has been conducted each year since 1990. As the concentration of biomass straddles the boundaries of Areas 12, 18 and 19, seasonal movements of crab among these areas will affect the biomass level in any given area.

Up to now, the commercial biomass index has been interpreted as absolute. However, this is based on two important assumptions. First, except for very old crab, there was no loss (natural mortality) between the survey and the beginning of the fishing season 9 months later. Second, the catchability of the trawl was equal to 100%. Until these factors are assessed, the survey estimate should be considered as a relative index of abundance.

The commercial biomass index remains high at 5,214t (±32%), which represents a decrease of 16% from the peak biomass in 2000. Recruitment represents 56% of this biomass index. The biomass index of very old crab, estimated at 206t (±96%), has shown a continuous increase since 1999. The concentrations of commercial crabs are throughout the area. The relative abundance of pre-recruits (R-3 and R-2) was at the highest observed level.

Commercial Biomass Index (t) and Abundance Index of Future Recruitment (Adolescent Crabs ≥56 mm) in Area 19



Sources of Uncertainty

Research is needed to resolve uncertainties in the population model due to the unknown catchability of the trawl, movement of adult crab in and out of the surveyed area, unknown natural mortality of commercial crabs, errors in the classification of carapace condition and statistical errors in the forecast.

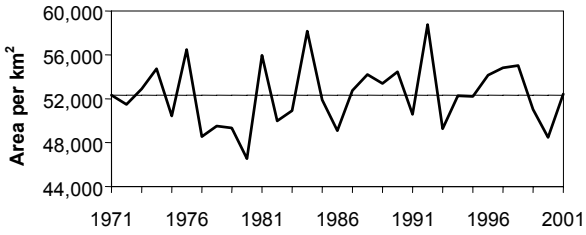
There is a discrepancy in the proportion of old crabs (category-4) found in the trawl survey and the observer program. The classification of carapace condition by observers needs to be verified.

Seasonal movement between areas may occur from the time of the trawl survey and the beginning of the subsequent fishing season (especially adult crabs of commercial size that have recently moulted). Movement of crabs between Areas 12, 18 and 19 is assumed, but not explicitly taken into account in the assessment.

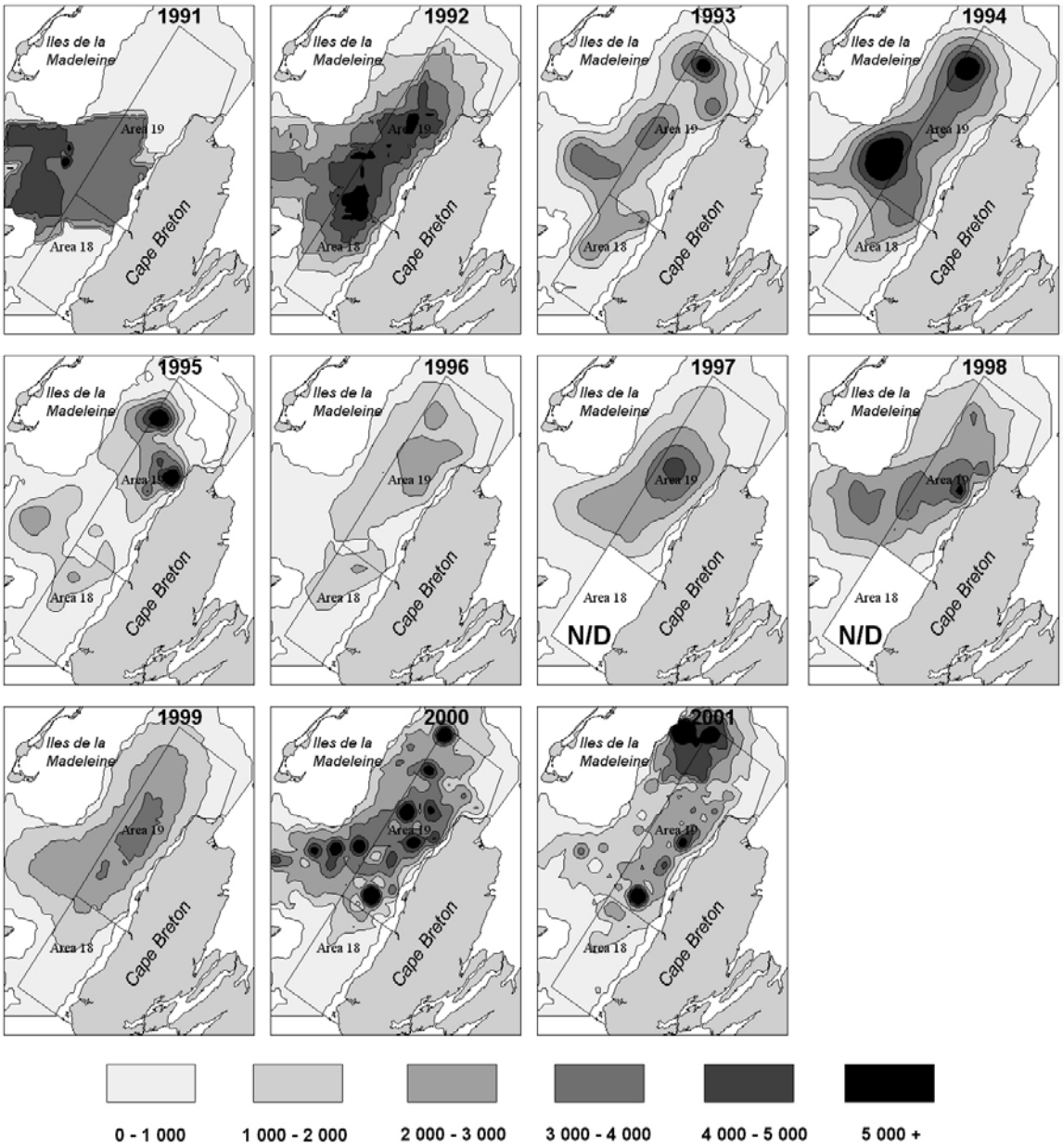
Ecosystem Considerations

Environmental factors such as water temperature, can affect the moulting and reproductive dynamics as well as the movement of crab. Bottom temperatures in the southern Gulf of St. Lawrence and in the northern Scotian Shelf have been generally less than 3°C, which are ideal conditions for snow crab. Bottom temperatures within the snow crab areas of the southern Gulf were generally colder than the average in 2001. There was an increase in the snow crab habitat index during the September groundfish survey. This was largely due to a significant increase in area covered by temperatures of 0-1°C and more crabs were caught in the annual snow crab survey at these temperatures. In spite of the generally colder conditions, there was a decrease in the area of the bottom covered by temperatures less than 0°C compared to 2000. Lower water temperatures in 2001 are possibly due to cold water advected into the Gulf of St. Lawrence from Labrador Shelf through the Strait of Belle Isle. The present temperature conditions are considered favorable for snow crab.

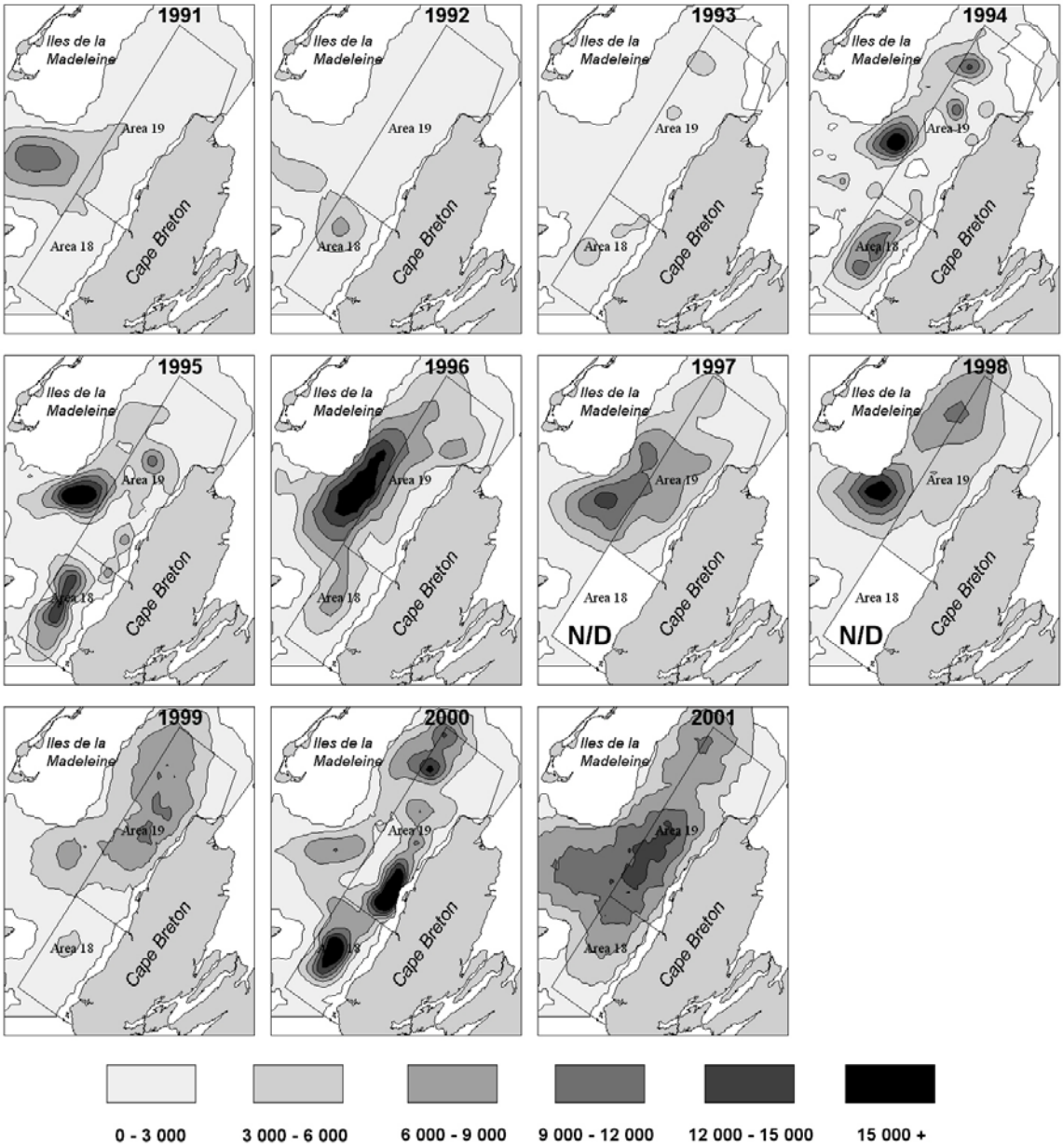
Snow Crab Habitat Index



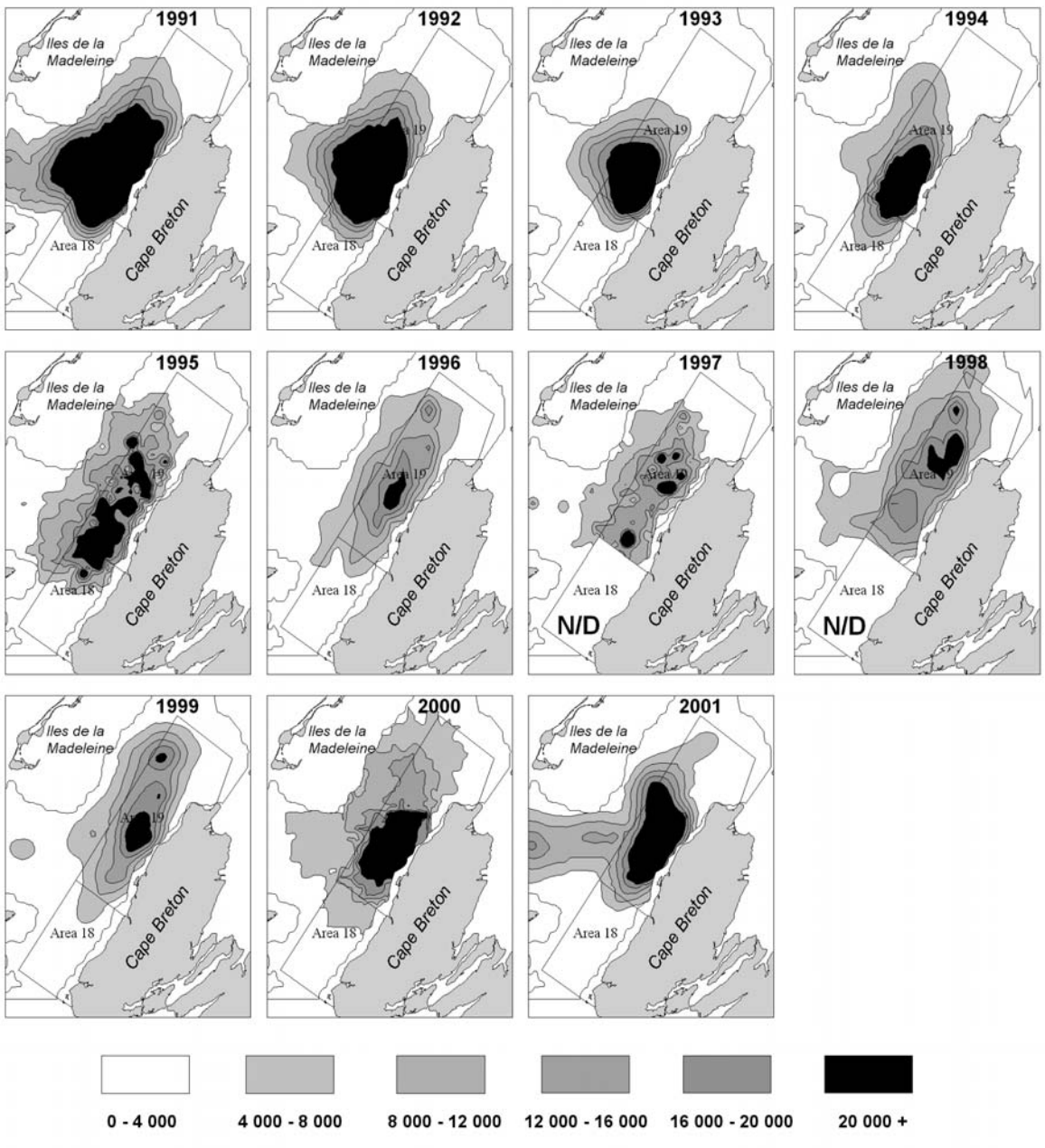
Density (crab/km^2) Contours of Adult Male Crab ≥95mm CW



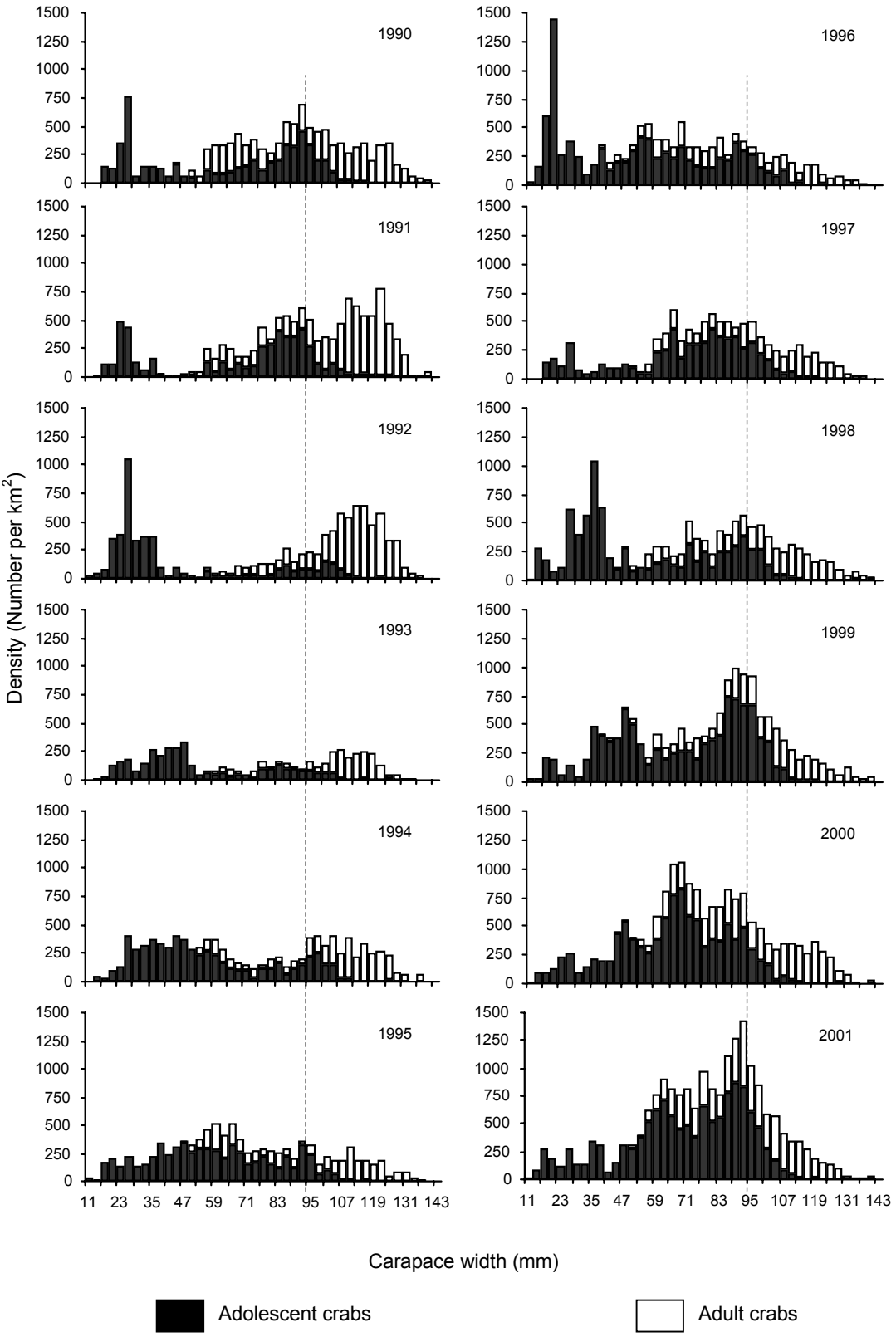
Density (crab/km^2) Contours of Adolescent Male Crab ≥56mm CW



Density (crab/km^2) Contours of Mature Females



Size Frequency Distributions of Male Crab Sampled During the Trawl Survey in Area 19 after the Fishing Season



Outlook

The outlook is positive. The biomass index from the 2001 trawl survey is 5,214t, which is the second highest on record. The stock appears to be at the same size and condition as in 2000. The relative abundance of pre-recruits R-3 and R-2 is increasing. The mean CPUE increased in 2001 by 38% compared to 2000 while the mean size of commercial sized males has decreased since 1996. For the 2002 fishery, there is no reason to change the harvest strategy from previous years.

The migration of crabs among Areas 12, 18 and 19 make it impossible to project fishable biomass with certainty.

Management Considerations

The area is not based on a biologically differentiated stock. Movement of crabs between the survey and the following fishery could modify the exploitable biomass in these small areas.

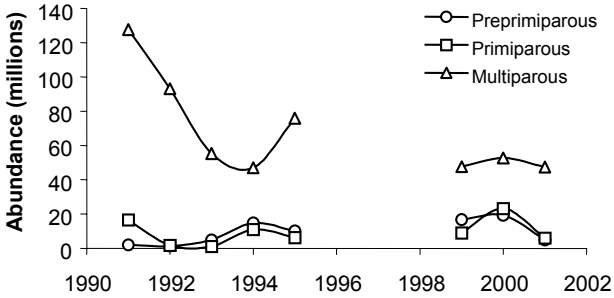
The relative abundance of pre-recruits was also at their highest level in the 2001 trawl survey. This may result in a high incidence of soft-shelled crab in the catches during the next couple of years. The soft-shelled crab protocol should be maintained.

Biological Considerations

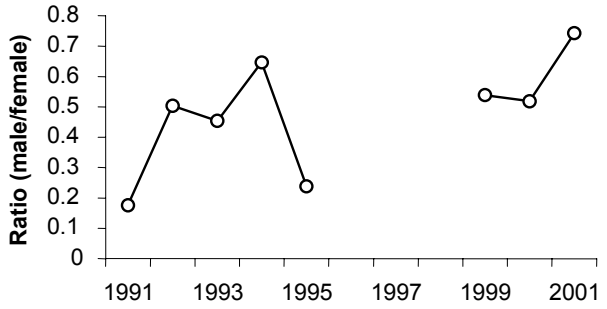
The abundance of preprimiparous, primiparous and multiparous females have been estimated through the years using the data gathered during the trawl survey in the southeastern unit of the southern Gulf (Areas 18 and 19). Compared to the abundance of males ≥95mm CW, this allows assessment of the reproductive potential of the stock. Close monitoring of the parental stock is necessary during the periods when an increase in abundance of preprimiparous females is observed. This stock is unique considering the continuous presence of small crabs of carapace widths between 15 to 50mm observed in all surveys since 1990.

Adult Male ≥95mm

Female Abundance



Adult Males (≥95mm) vs. Mature Females



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References

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Hébert, M., E. Wade and M. Moriyasu. 2002. Assessment of the western Cape Breton Snow crab (Chionoecetes opilio) fisheries (Areas 18 and 19) within the southeastern Gulf of St. Lawrence unit in 2001 / Évaluation des pêcheries de crabe des neiges (Chionoecetes opilio) de l'ouest du Cap-Breton (zones 18 et 19) dans l'unité sud-est du golfe du St.-Laurent en 2001. DFO Can. Sci. Adv. Sec. Res. Doc. 2002/014.

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