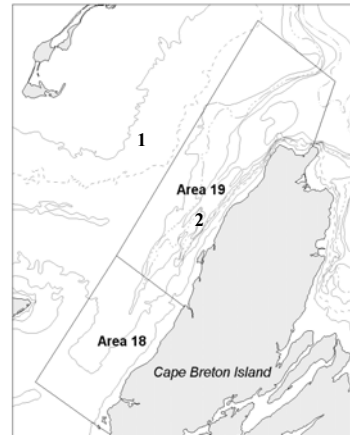


Western Cape Breton Snow Crab (Area 19)



1. Cape Breton Corridor
2. Cape Breton Trough

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 (conditions 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).

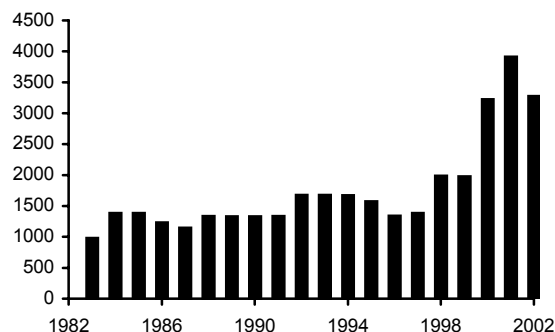
Summary

- Crabs in management Area 19 are part of a larger biological population including crab in adjacent Areas 18, F and Area 12. Any biological key events observed in the southern Gulf of St. Lawrence may have subsequent impacts on the biomass condition in Area 19.
- In 2002, landings were 3,279 t and equaled the quota.
- Catch per unit effort (CPUE) decreased from 88.5 kilograms per trap haul (kg/th) in 2001 to 72.3 kg/th in 2002.
- The mean size of commercial-sized crabs in sea samples has been decreasing since 1995.
- The 2002 survey biomass index of commercial-sized crabs (4,930 t ± 51 %) has decreased by 5 and 20 % compared to 2001 and 2000 respectively, but still above the 1993-1998 levels.
- Sixty percent of this survey biomass index is composed of new recruitment (2,950 t ± 81 %).

- Abundance of prerecruits R-2 is at the highest level observed since the beginning of the trawl surveys. In addition, the abundance of R-3 has just slightly decreased from 2001. These pulses of prerecruits may maintain recruitment to the fishery for the next 2 or 3 years.
- Although the survey biomass index of commercial-sized crabs remained relatively high at a level above the 1993-1998 average, the exploitation strategy for next year should be set to allow an accumulation of residual biomass. It is also important to consider the factors of uncertainty (seasonal movement of crabs, possible overestimation of survey biomass index) and some negative signs of the stock condition (decrease in CPUE and the mean size of commercial-sized crabs).

samples has been decreasing since 1995 from 120.5 to 110.0 mm of carapace width (CW).

Landings (t) in Area 19



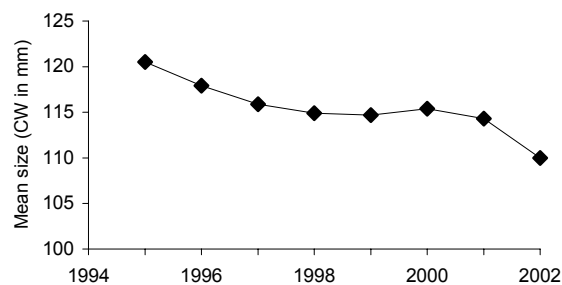
Quotas (t), Landings (t) and Catch Performance in Area 19

	1997	1998	1999	2000	2001	2002
Quota	1,386	1,991	1,986	3,370	3,912	3,285
Landings	1,386	1,988	1,979	3,225	3,910	3,279
CPUE	63.2	63.7	103.7	64.1	88.5	72.3
Soft crab (%)	10.7	11.2	4.1	5.6	6.5	3.5

The Fishery

The 2002 fishing season in Area 19 started July 8 and closed September 11 with a total quota of 3,285 t. Landings have increased since 1982 and reached the highest level ever recorded in 2001 (3,910 t). In 2002, landings decreased by 16 % (3,279 t). The traditional and temporary license holders caught their quota (total of 3,285 t) by the ninth fishing week. Seventy-three temporary license holders started fishing on July 25th (first landings occurred on July 26th) with an individual quota of 7.95 t (17,495 lbs). The average catch rates (CPUE) of traditional fishermen decreased from 88.5 kg/trap haul (th) in 2001 to 72.3 kg/th in 2002.

Mean size of commercial-sized crabs in Area 19



Carapace condition was estimated from sea samples taken from the 2002 fishery. The conditions 3 and 4 represent 91 % of the catches.

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

Condition	Description	Percentage
1-2	White crab	8.8
3	Intermediate	70.2
4	Old crab	20.6
5	Very old crab	0.5

The percentage of **soft-shelled crabs** in Area 19 was 3.5 %, the lowest level since 1990. The **mean size of commercial-sized crabs** in sea

Resource Status

Stock status is primarily based on a post-fishing season trawl survey, which provides a remaining portion of exploitable biomass index (hard-shelled adult males of legal size) immediately after the fishery. It also provides estimates of soft-shelled adult males larger than 95mm (R-1) that will be new recruits to the fishery the following fishing season. An abundance index is estimated for males as future recruitment index (R-2 and R-3) and females (pubescent and mature) as future and current spawning abundance index. An abundance index of adolescent males larger than 56 mm CW, composed of prerecruits R-4, R-3 and R-2, is also estimated and used as index of the potential presence of soft-shelled crabs that may enter commercial traps the following fishing season.

The terms R-4, R-3 and R-2 represent male crabs with a carapace width range at 56-68, 69-83, and larger than 83 mm, respectively. A portion of these crabs could be available to the fishery in 4, 3 and 2 years, respectively. The term pubescent refers to females with a narrow abdomen and orange gonads that will molt to maturity and mate the following year to become primiparous females (first brood). The term multiparous refers to females which are carrying their second brood or older. The term mature females, also refers to the spawning stock, includes primiparous and multiparous females (excluding senile females).

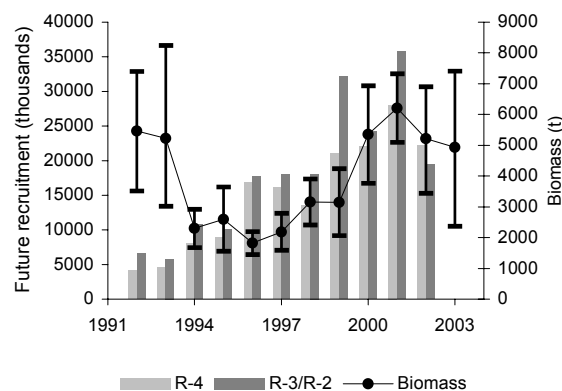
The survey has been conducted each year since 1990. As the concentration of biomass straddles the boundaries of Areas 12, 18 and 19, seasonal movements of crab among these areas

will affect the biomass level in any given area.

Up to 2001, the survey biomass index of commercial-sized crabs (survey biomass index) had often been interpreted as an absolute estimate of biomass. These estimates were based on two assumptions. First, except for very old crabs, there was no loss (mortality) between the time of the survey and the beginning of the fishing season 9 months later. Secondly, the trawl caught 100 % of crabs larger than 40 mm CW. New information has raised the need for further investigations on these assumptions. As a result, the trawl survey estimates should be considered as relative indices of abundance.

The 2002 survey biomass index was estimated at 4,930 t ($\pm 51\%$), which is 5 and 20 % less than 2001 and 2000 respectively, but still above the 1993-1998 average. The recruitment (2,950 t $\pm 82\%$) represents 60 % of this survey biomass index. The three main concentrations were located in the southern, middle and northwestern part of the Area.

Survey biomass index (t) and abundance indices of future recruitment in Area 19



Size frequency distributions of male crabs caught in the trawl survey have been available since 1991. In this area, the size distribution pattern seemed to be different compared to Area 12. The appearance of the recruitment to the population has been observed without interruption throughout the years. The abundance of R-3 for 2002 (19.4 million) slightly decreased compared to 2001 (21.8 million) while the abundance of R-2 in 2002 (14.3 million) remained at the same level as 2001 (14.1 million).

The hypothesis of a **seasonal movement** from Area 12 to 19 through the Cape Breton Corridor was investigated in 2001 by conducting a second survey (54 stations) after the fall survey and prior to the fishing season. The results indicated a significant change in geographic distribution pattern of commercial-sized males, providing a clear evidence of seasonal movement of commercial-sized adult males towards the Cape Breton Trough within Area 19. The fall survey estimated the biomass index of commercial-sized crabs at 5,215 t while the second spring survey (prior to the fishing season) estimated the biomass index at 5,890 t. Therefore, assuming that the efficiency of the trawl is the same during the fall and spring surveys, these results may indicate that the exploitation in 2002 was lower than what was estimated based on the fall biomass index.

Sources of Uncertainty

Research is needed to resolve uncertainties regarding many aspects of the snow crab biology such as growth pattern, skip molters, reproductive output, and natural mortality of commercial crabs. Also, movement of

adult crab in and out of the surveyed areas, environmental factors and the catchability of the trawl need further studies.

The natural mortality for commercial-sized crabs was estimated from 26 to 40 % between the time of the survey and the following fishing season. However, at the present time, the natural mortality is not included in the biomass estimates. Therefore, the trawl survey estimates should be considered as relative indices of abundance.

The relationship between the spawning stock and stock recruitment needs further monitoring and investigations. Computer simulations of current and post-larvae distribution should be continued to determine the relationship between the spawning stock and the future recruitment to stock units in the periphery and outside the southern Gulf of St. Lawrence.

Biological Considerations

Biological characteristics such as **recruitment and growth pattern** in the southeastern Gulf seem to differ from those in the southwestern Gulf. These biological parameters need further investigations.

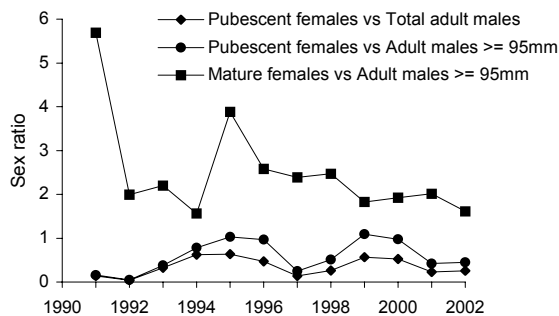
The **reproductive potential of the stock** for Areas 18 and 19 is evaluated as part of larger biological unit that also includes Area F and part of Area 12. This entire area is considered as the unit of the southeastern Gulf of St. Lawrence.

In that large unit, the abundance index of the pubescent females increased from 10 million in 2001 to 12 million in 2002. The main concentrations were

located in Area 18, the northern part of Area 19 and in the Cape Breton Corridor. The abundance index for the **spawning stock** (mature females) also increased from 40 million in 2001 to 43 million in 2002. The main concentration was located in the Cape Breton Trough (Area 19).

The **sex ratio**, within the southeastern Gulf, between pubescent females and all adult males or adult males ≥ 95 mm CW has always been close to or less than 1 female to 1 male (1F:1M) since 1991. For mature females, the ratio was under 3F:1M except for 1991 and 1995.

Sex ratio between different categories of females and males in the southeastern Gulf of St. Lawrence



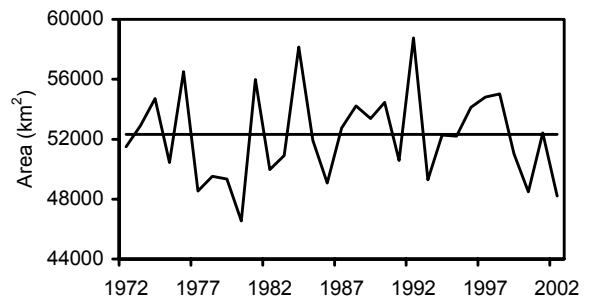
Close monitoring of the key events on population reproductive output (e.g., sex ratio, fecundity, spermathecal load, recruitment to the early benthic stages) is necessary to detect any anomalies on the quality and quantity of the spawning stock and subsequent recruitment.

Ecosystem Considerations

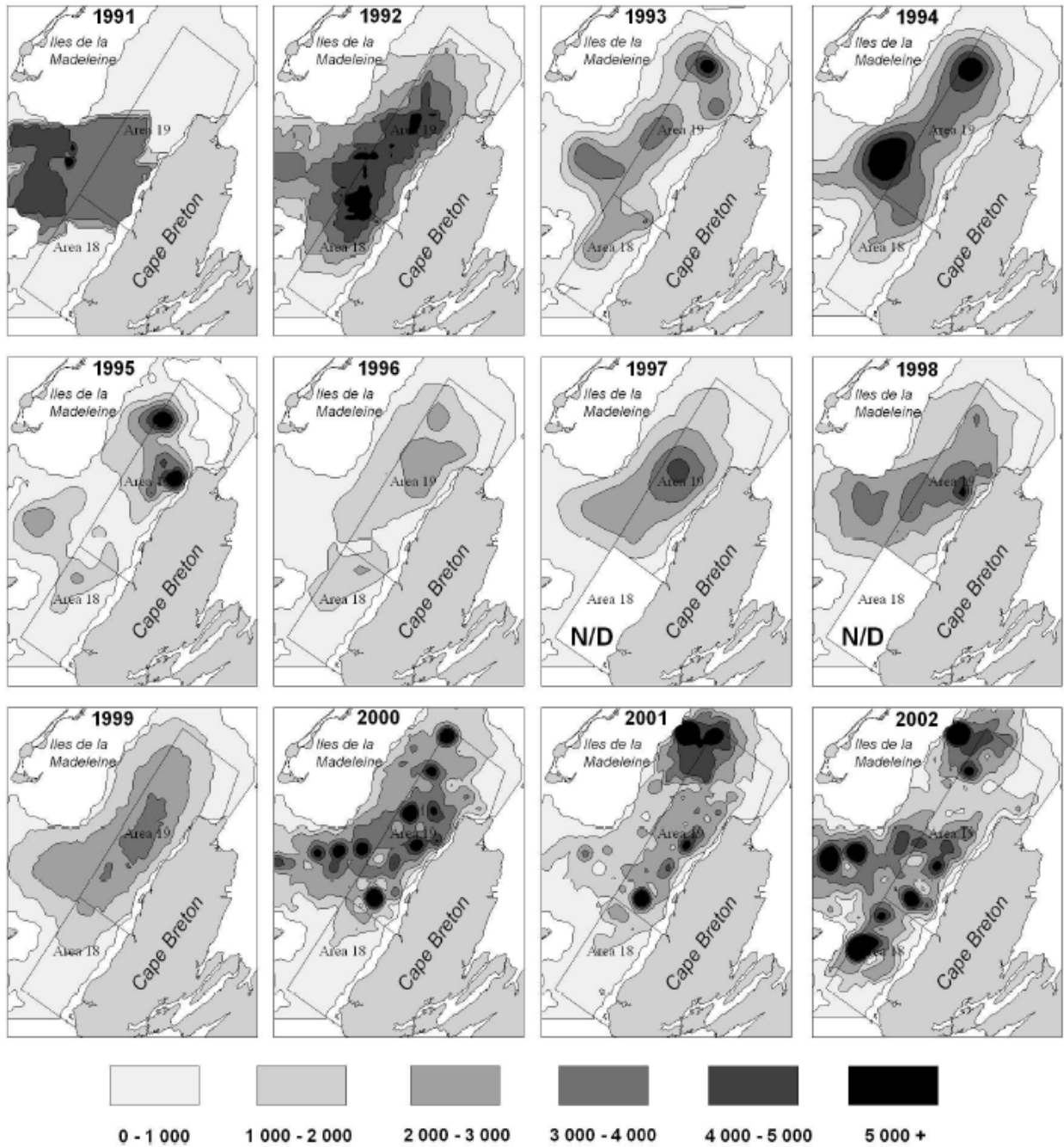
Environmental factors, such as the water temperature, can affect the molting and reproductive dynamics as well as the movement of crab. Bottom temperatures over most of the southern Gulf of St. Lawrence are $<3^{\circ}\text{C}$, which is considered ideal thermal habitats for snow crab. Bottom temperatures in

Areas 18 and 19 are typically $1^{\circ}\text{--}2^{\circ}\text{C}$ warmer than the traditional crab grounds in Area 12. For example, approximately 80 % of the trawled area during the snow crab survey in Area 12 in 2002 was covered by temperatures of $<1.5^{\circ}\text{C}$ whereas in Areas 18-19 it was $<3^{\circ}\text{C}$. Near-bottom temperatures at most depths in Areas 18-19 during 2002 were generally observed to be warmer than the long-term (1971-2000) average. This is consistent with the decrease in the Gulf wide snow crab habitat index (area of the bottom covered by water temperatures between -1 and 3°C) and the increase in the average temperature within this area. In spite of the increase, the temperature conditions are still considered favorable for snow crab.

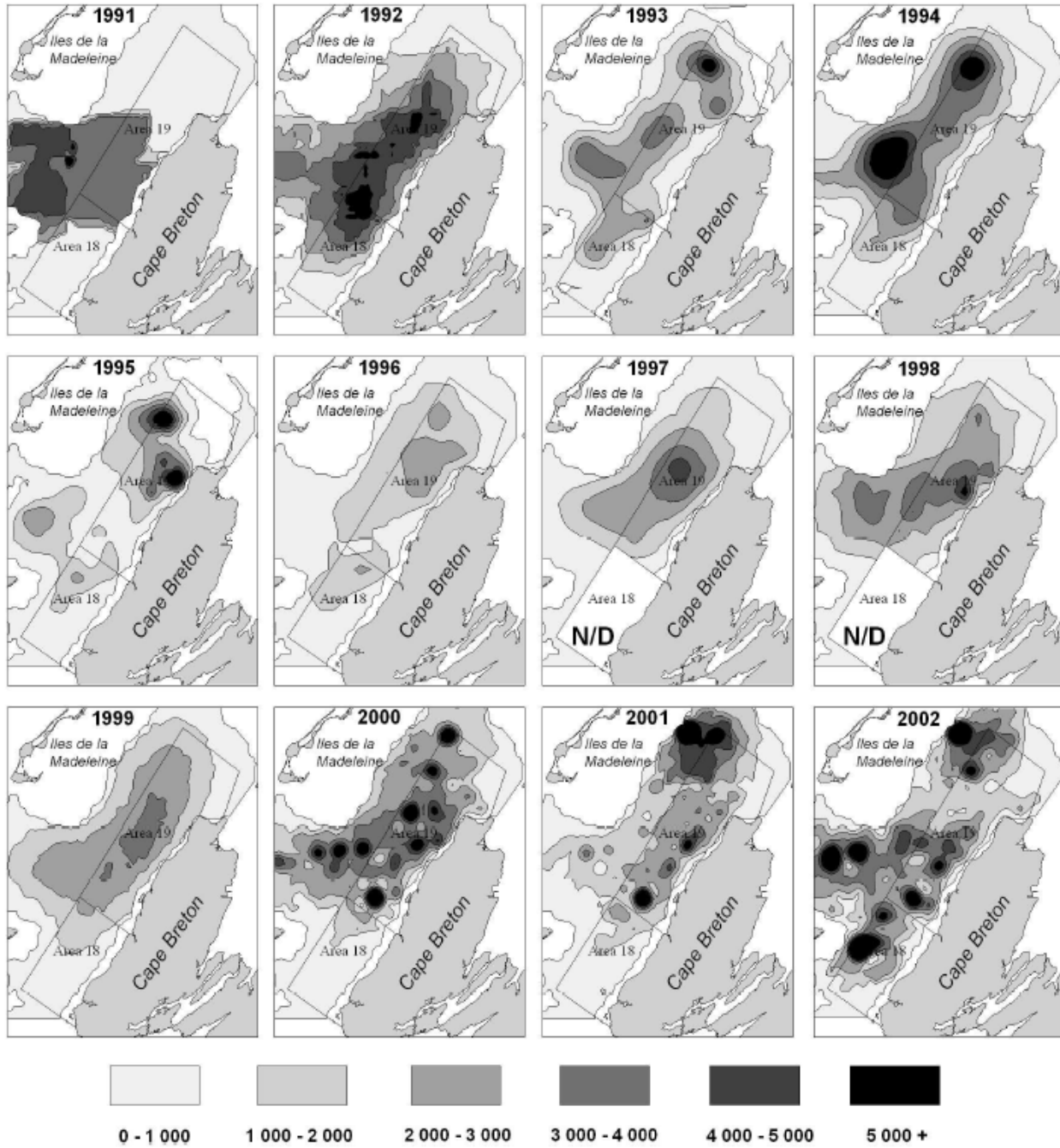
Snow crab habitat index



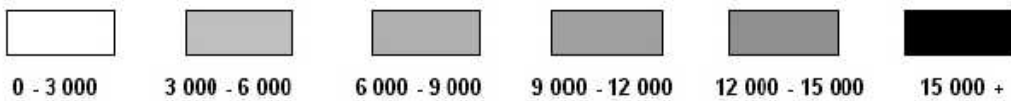
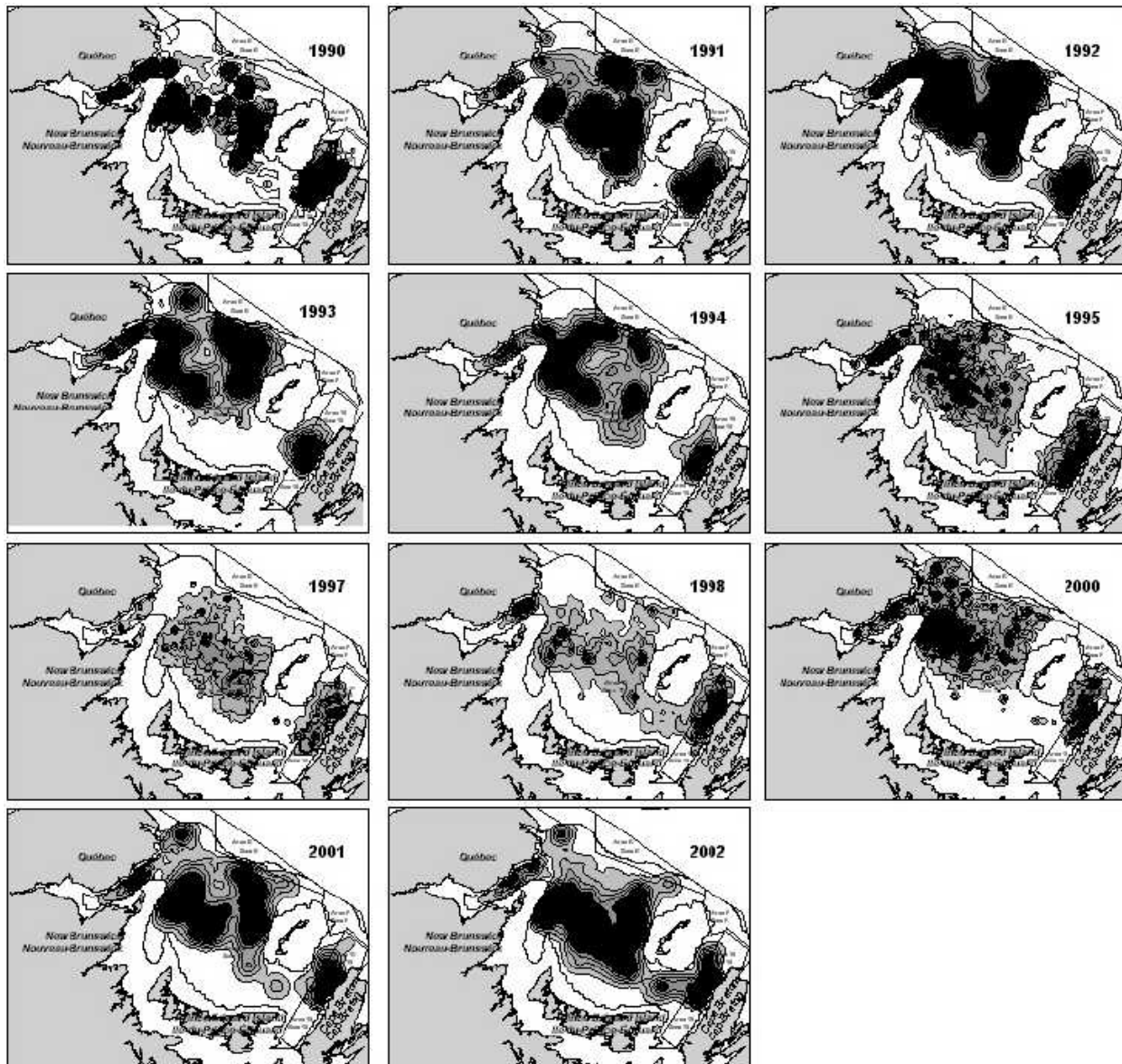
Density (crab/km²) Contours of Adult Male Crab ≥95mm CW



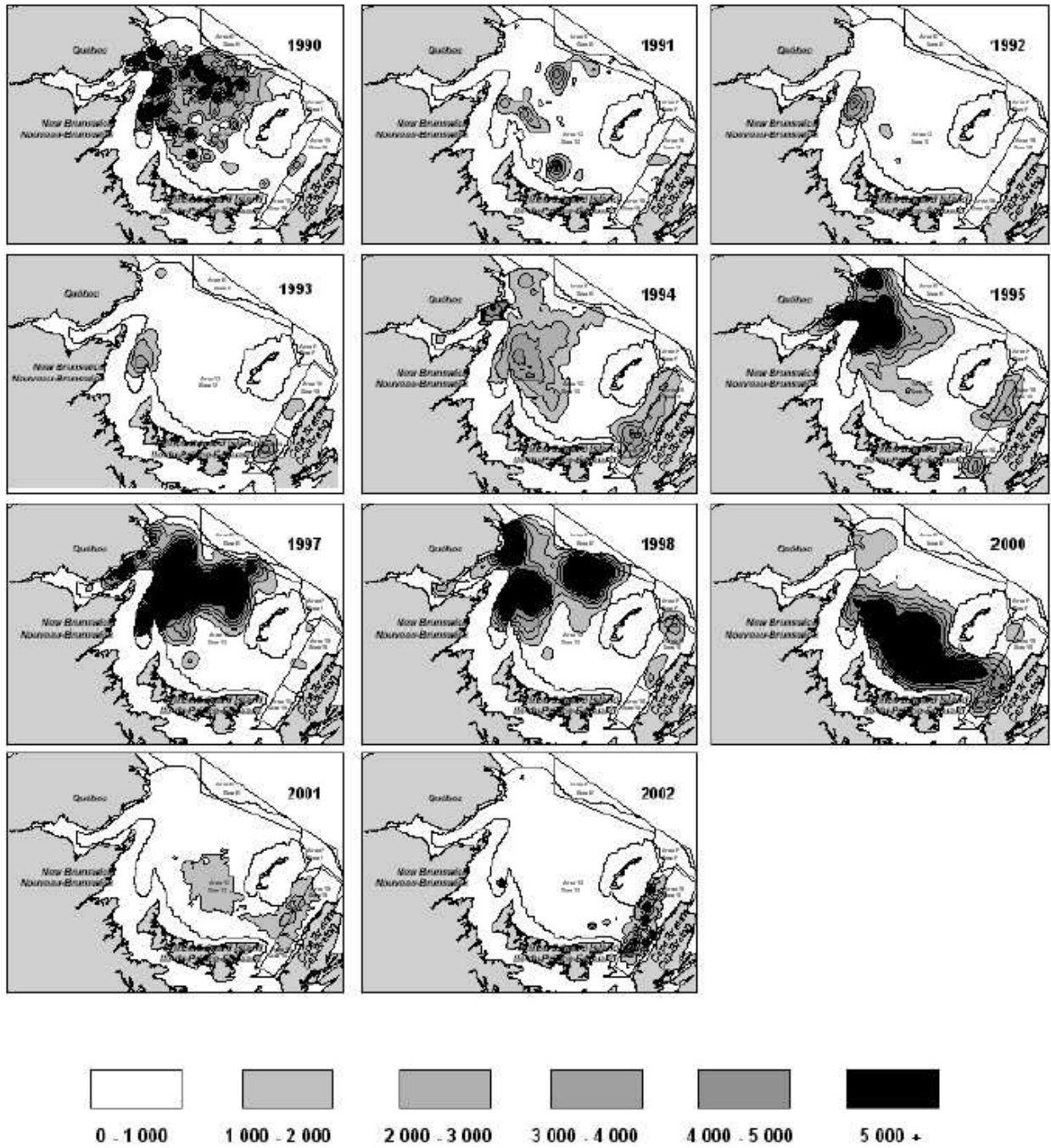
Density (crab/km²) Contours of Adolescent Male Crab ≥56mm CW



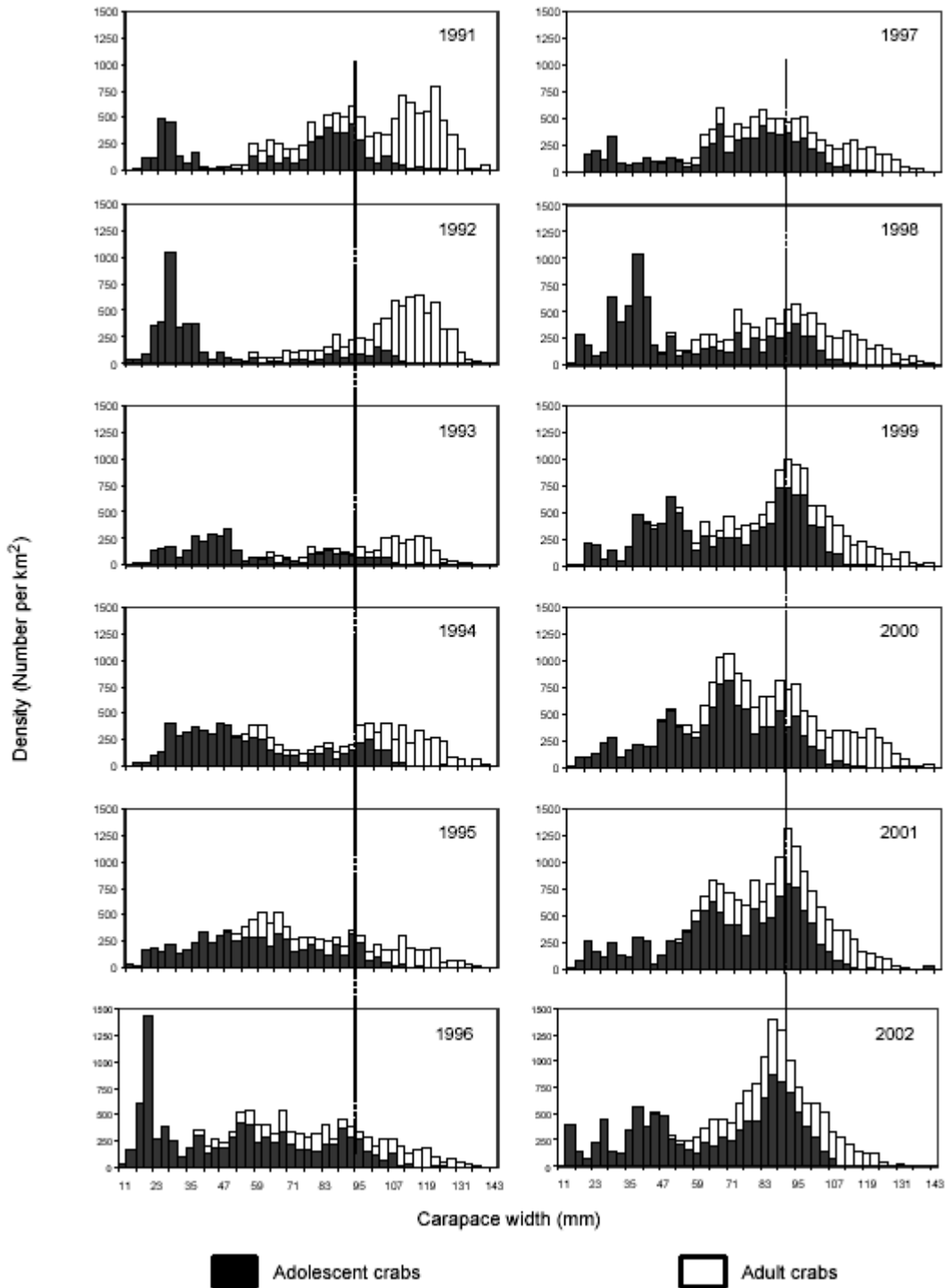
Density (crab/km²) Contours of Mature Females



Density (crab/km²) Contours of Pubescent Females



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



Outlook

The 2002 survey biomass index of commercial-sized crabs (4,930 t \pm 51 %) has decreased by 5 % from 2001 (5,215 t \pm 32 %) and 20 % from 2000 (6,210 t \pm 18 %). The recruitment to the fishery index (2,950 t \pm 82 %) represents 60 % of the biomass index.

The annual CPUE (72.3 kg/th) decreased compared to the 2001 season (88.5 kg/th) and the mean size of commercial-sized crabs in catches has been decreasing since 1995. High abundance of adolescent males larger than 56 mm CW along with a decreasing trend in survey biomass index may result in a high incidence of soft-shelled/white crabs for the next 2 years.

On the positive side, the relative abundance of adolescent crabs R-2 reaching its highest recorded level, combined with the R-3 having just slightly decreased from 2001, may contribute to maintain the level of recruitment to the fishery for the next 2 or 3 years.

Management Considerations

Although the survey biomass index of commercial-sized crabs remained relatively high at a level above the 1993-1998 average, the exploitation strategy for next year should be set to allow an accumulation of residual biomass. It is also important to consider the factors of uncertainty (seasonal movement of crabs, possible overestimation of survey biomass index) and some negative signs of the stock condition (decrease in CPUE and the mean size of commercial-sized crabs).

Management measures are necessary to protect the soft-shelled crabs (the future recruitment to the fishery).

For more Information

Contact:

Marcel Hébert
Science Branch
Dept. of Fisheries and Oceans
Gulf Region
P. O. Box 5030
Moncton, N.B. E1C 9B6

Tel: (506) 851-6074
Fax: (506) 851-3062
E-mail:hebertm@dfo-mpo.gc.ca

Or:

Mikio Moriyasu
Science Branch
Gulf Region
P. O. Box 5030
Moncton, N.B. E1C 9B6

Tel: (506) 851-6135
Fax: (506) 851-3062
E-mail:moriyasum@dfo-mpo.gc.ca

References

- Drinkwater, K.F., R.G. Pettipas, and W.M. Petrie. 2003. Temperature Conditions on the Scotian Shelf and in the southern Gulf of St. Lawrence during 2002 Relevant to Snow Crab. DFO Can. Sci. Adv. Sec. Res. Doc. 2003/014.
- Hébert, M., E. Wade, D. Giard, and M. Moriyasu. 2003. Assessment of the western Cape Breton Snow crab (Chionoecetes opilio) fisheries

(Areas 18 and 19) in 2002 /
Évaluation des pêcheries de crabe
des neiges (Chionoecetes opilio) de
l'ouest du Cap-Breton (zones 18 et
19) en 2002. DFO Can. Stock Adv.
Sec. Res. Doc. 2002/018.

Squires, H.J. 1990. Decapod Crustacea
of the Atlantic Coast of Canada. Can.
Bull. Fish.. Aquat. Sci. 221.

Wade, E., T. Surette, J. Apaloo, and
M. Moriyasu. 2003. Estimation of
mean annual natural mortality for
adult male snow crab (Chionoecetes
opilio) in the southern Gulf of St.
Lawrence. DFO Can. Sci. Adv.
Sec. Res. Doc. 2003/017.

Correct citation for this publication:

DFO, 2003. Western Cape Breton Snow
Crab (Area 19). DFO Science Stock
Status Report 2003/034.

This report is available from the:

Maritime Provinces
Regional Advisory Process
Fisheries and Oceans Canada
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Phone number: 902-426-7070
Fax Number: 902-326-5435
e-mail address: myrav@mar.dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1480-4913
© Her Majesty the Queen in Right of Canada, 2003

*La version française est disponible à l'adresse
ci-dessus.*

