

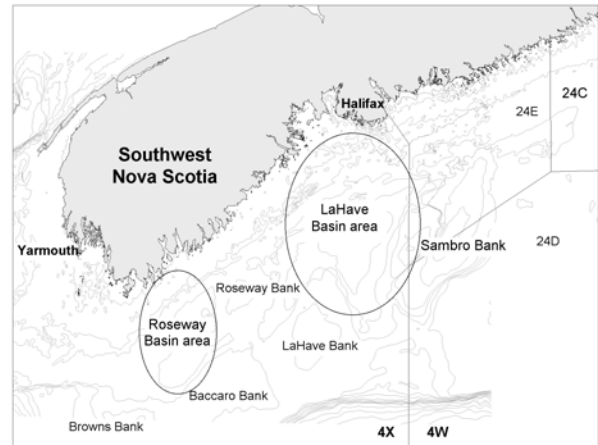
## Southwestern Nova Scotia Snow Crab

### Background

Snow crab (*Chionoecetes opilio*) are crustaceans 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. Unlike lobsters, male and female snow crab do not continue to molt throughout their lives. Females stop growing after the molt in which they acquire a wider abdomen for carrying eggs. This occurs at shell widths less than 95 mm. Male snow crab stops growing after the molt in which they acquire relatively large claws on the first pair of legs. 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 free floating in the water. At the end of this period, they settle on the bottom. It then takes at least 8-9 years for snow crab males to reach legal size.

The minimum legal shell width is 95 mm, and female crabs are not kept by industry. Soft-shelled crab is defined by shell hardness of the right claw (<68 durometer units). The term "white crab" describes both new-soft and clean hard-shelled crab (carapace conditions 1 and 2 respectively). Fishing is by baited conical traps constructed of tubular steel and netting. The traps are set on muddy or sand-mud bottoms.

The range of distribution of this species in the western Atlantic is from Greenland to the Gulf of Maine, and at depth from 20 to 310 m, but mostly from 70 – 280 m. Typical fishing depths of southwestern Nova Scotia are 90 to 180 m. The records of distribution clearly indicate that Area 4X is situated at the most southerly limit for the distribution of this species. Different sources indicate that no snow crab have been captured on Georges Bank (NAFO Area 5ZE, situated immediately west to Area 4X).



### Summary

- During the 2001/02 fishing season, the catch was 376t, representing 77% of total allocated amount of 520t. Overall, landings and total effort (376t, 25,017 trap hauls) increased compared to the same period in 2000/01 (213t, 15,568 trap hauls).
- Average catch rate (CPUE) is not a reliable index of abundance for the snow crab fishery in 4X.
- A trap survey conducted in winter of 2002 confirmed that commercial concentrations are limited to an area north of LaHave Basin. No commercial concentrations were found in the previously fished Roseway Basin.
- The first trawl survey was conducted in September 2002 with an estimated biomass of commercial sized snow crab of  $98 \pm 372t$ .
- Being near the southern limit of snow crab distribution and located in what is considered marginal environmental conditions, the long term stability of this fishery is doubtful.

## The Fishery

Harvesting of snow crab in Area 4X (NAFO Division 4X), off the coast of South West Nova Scotia (SWNS) began in 1994. This fishery was managed as an exploratory fishery from 1994 to 2000. Two temporary permits were issued to native bands in the fall of 1999. In the fall of 2000, the four exploratory permits in existence since 1994 were converted into permanent licenses and the first official fishing season was set for November 1, 2000 to June 1, 2001. The SWNS snow crab industry felt that better quality crab was caught, as well as easier to maintain high quality crab, during the colder months of the year. Only two commercial fishing grounds have been identified in Area 4X: the Roseway Basin area and the region north of LaHave Basin.

This fishery falls under the directives of the developing species policy in use in SWNS since 1998 and follows similar management measures as those of Eastern Nova Scotia (ENS) snow crab fisheries such as: no female retained, snow crab male size greater than 95mm carapace width (CW), no by-catch allowed, mandatory logbook, at-sea observer coverage, and 100% dockside monitoring.

In 2001/02, two permanent licenses were issued to native bands, therefore bringing the total to 6 permanent licenses. Fishermen were allowed either a trap limit of 60 large traps or of 145 Japanese traps and 30 large traps. For the first time in SWNS, a cap of 75t was imposed on the permanent licenses, while two exploratory licenses with a combined allocation of 70t were issued to conduct a trap survey along

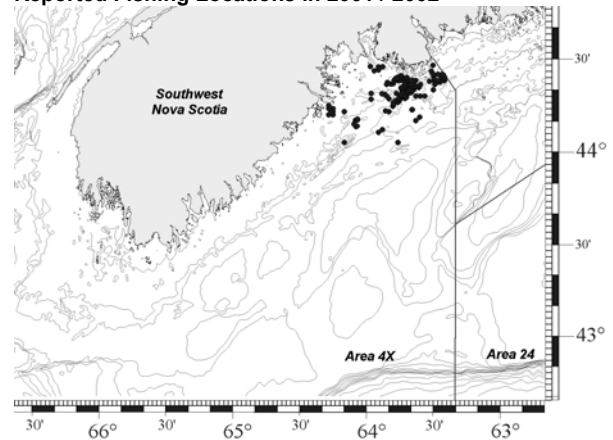
the near shore area of SWNS and between the two known fishing grounds. Total allocation was therefore set at 520t in 2001/02 without scientific justification.

## Fishery Statistics

Season	Licenses	TAC (t)	Landings (t)	CPUE (kg/trap haul)	Total Effort (trap haul)
1994/1995	4	-	17	1.8	9,406
1995/1996	4	-	11	1.0	11,146
1996/1997	4	-	4	1.0	3,475
1997/1998	4	-	42	5.3	7,893
1998/1999	4	-	70	11.8	5,986
1999/2000	4	-	119	9.8	12,038
2000/2001	6	-	213	13.7	15,568
2001/2002	8	520	376	15.0	25,017

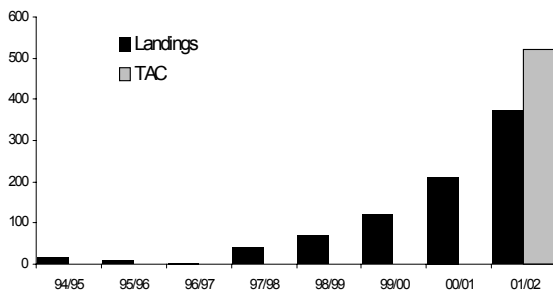
The commercial fishing effort was directed exclusively towards the LaHave area during the 2001/02 season.

## Reported Fishing Locations in 2001 / 2002



Following an initial period with low catch (1994-1997), a high concentration of snow crab was found along the NAFO fishing boundary 4W/4X in 1998 and most of the fishing effort shifted from the Roseway Basin area to the LaHave fishing grounds. Landings have been increasing steadily since the fishing period of 1997/98. The catch of 376t during the 2001/02 fishing season represented 77% of the total allocated amount of 520t.

**Landings (t)**

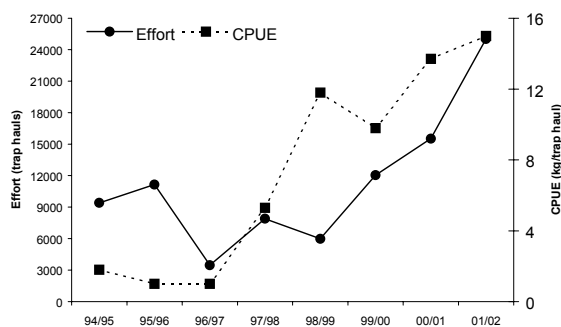


Logbook data did not suggest any stock decline during the 2001/02 season. However, the 2002/03 snow crab season in SWNS had a much slower start compared to 2001/02 with 50% less landings and 60% decrease in the CPUE reported during the first 2 1/2 month of the season. Landings and CPUE may have been affected by bad weather in 2002/03 with strong wind making the gear less effective compared to 2001/02.

**Resource Status**

The evaluation of stock status for the fishing season of 2001/02 is based primarily on fishery information, at-sea observer data, biological sampling and an exploratory trap survey. Catch-per-unit-effort (CPUE: kg/trap haul) and effort (total catch / CPUE = total number of trap hauls) were derived from fishing logs. Catch rates were not adjusted for soak time or gear type.

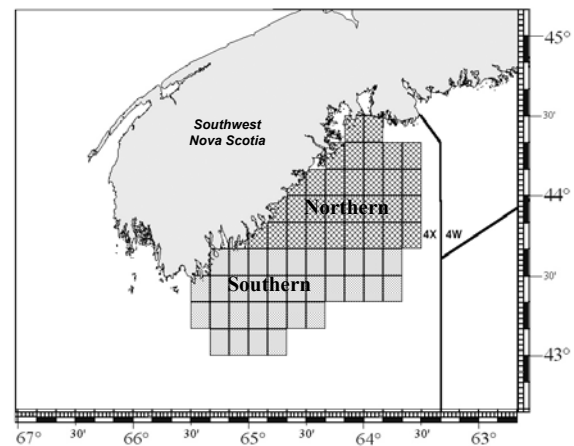
**Fishing Effort and CPUE**



Overall, landings (376t), average CPUEs (15 kg/trap haul) and total effort (25,017 trap hauls) have increased during the 2001 / 2002 fishing season compared to the same period in 2000/01 (213t, 13.7 kg/trap haul and 15,568 trap hauls, respectively).

Two exploratory licenses were issued in 2002 to conduct an extensive trap survey. The objectives were to determine snow crab distribution and gather biological information on areas not fully exploited by the existing fleet. There were sixty 10' latitude by 10' longitude grids to be surveyed along the near shore area of SWNS

**Grids Fished During the 2002 Trap Survey**



The trap survey conducted between January and May 2002, clearly indicated that snow crab was mostly distributed in the northern portion, more specifically in the area between LaHave Basin and the near shore. The highest density was observed near the 100m depth contour, with more or less, smaller concentrations trailing along that depth towards Roseway Basin area. No new fishing grounds were discovered. The distribution of snow crab was consistent with the distribution of cold water in SWNS. The trap survey in 2002 in

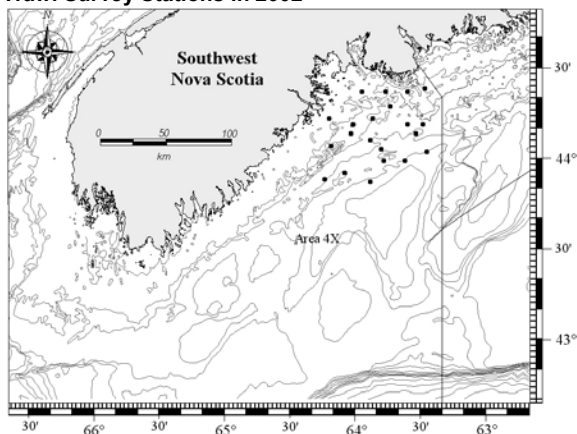
## Gulf Region

Roseway Basin showed no commercial concentration.

The majority of adult male snow crab sampled during the commercial fishery and the trap survey were of carapace condition 3 with very little older carapace stages. Only the Roseway fishing grounds, which were not exploited in 2002, seem to have more variation in the distribution of the carapace conditions. This may imply a high rate of removal of legal sized adults by the commercial fishery.

The trawl survey for SWNS comprised 21 trawl stations and was conducted between September 22-24, 2002. It encompassed most of the fishing grounds in LaHave area. The total biomass estimation for commercial-sized adult male was  $98 \pm 372t$ , and was comprised of  $13 \pm 22t$  of soft shell and  $85 \pm 350t$  of hard shell crab.

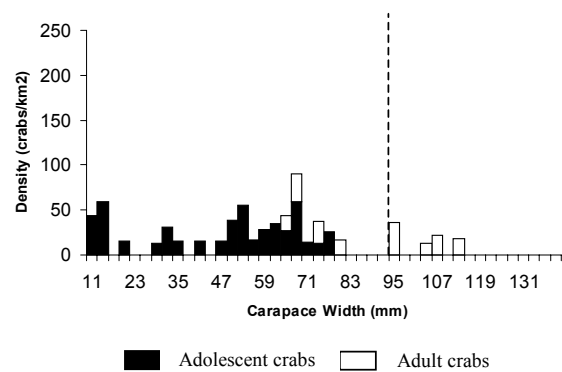
Trawl Survey Stations in 2002



Very little commercial snow crab was caught during the trawl survey. This resulted in a low biomass estimate with and rather large confidence limit.

## Southwestern Nova Scotia Snow Crab

Survey Size Frequency of Male Crab in Area 4X



### Sources of Uncertainty

Average CPUE is not a reliable index of abundance for this fishery because CPUEs were affected by factors such as soak time, a change of gear toward bigger traps that continued in 2001/02 and an increase of 'inexperienced' fishermen (5 out of 8 fishermen). Standardization of the CPUE was not believed possible due to the low saturation point of the Japanese trap and the fact that most fishermen used a mixture of traps for each reported landing.

At-sea sampling in 2001/02 was mostly limited to two vessels sampled in March and April. Although these data are comparable to the sampling that occurred in 2000/01 (in terms of sample size, timing and gear types sampled), it did not represent well the 2001/02 fishery considering that 50% of the landing occurred in November and December.

The trawl survey in 2002 must be underestimating the commercial biomass. At the time of the survey, water temperature was warm for most of the surveyed area (4-9°C), while the coldest bottom temperatures were observed near the coast. It is likely that crabs were distributed outside the area

surveyed, in the untrawlable near shore area. In general, most of the area surveyed was comprised of hard bottom, and two grids originally selected in the near shore area were abandoned for lack of trawlable bottom. There is a possibility that *Nephrops* trawl, constructed so that the foot-rope digs into the bottom sediment, may be performing differently on hard bottom.

### ***Environmental Factors***

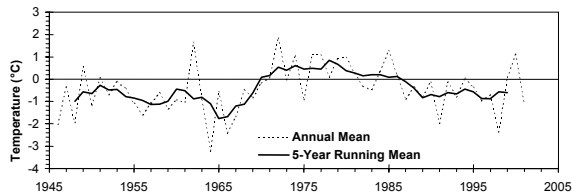
Compared to other snow crab fishing areas on the Scotian Shelf, the waters in LaHave and Roseway Basins tend to be warmer. Annual mean near-bottom temperatures in these regions vary with depth. In LaHave Basin at 100 m, they are near 4.5°C with a typical seasonal range from approximately 3.5° to 5.5°C. They tend to be 1°-2°C cooler than those found at similar depths in Roseway Basin. Temperatures increase to 8°-10°C in the deeper reaches of the Basins. The annual changes in the water temperatures can originate for several different reasons. Local atmospheric heating and cooling can influence the upper 50-100 m but has been shown not to play a major role in the observed longer-term temperature trends over the shelf. A second cause is the advection of shelf waters from the northeast. This is the direction of the mean currents and thus any changes in the waters to the northeast eventually are transported into 4X. The final possible origin of year-to-year temperature changes is the advection of offshore Slope Water onto the shelf and into the Basins. During the past 30 years, the waters offshore of the Scotian Shelf have had temperatures typically >8°C and salinities above 34.8‰. These are known as Warm Slope Waters. These Slope Waters penetrate

onto the Shelf through the channels and gullies. The waters in the deep basins and much of the southwestern Shelf thus reflect the presence of these Warm Slope Waters. At times, however, cold (4°-8°C) Labrador Slope Water flows into the region from the north and replaces the Warm Slope Water. Once along the shelf edge, the cold Labrador Slope Water eventually flows onto the shelf, cooling the waters there. Such an event occurred in 1998 and persisted for approximately 1 year. That year, the central and southwestern Scotian Shelf experienced the coldest near-bottom temperatures in the then 29-year record of groundfish surveys. In 1999, the Labrador Slope Water retracted northward and was again replaced by Warm Slope Water. Gradually the shelf waters began to warm up and by late 1999 or early 2000, the near-bottom temperatures in the central and southwestern Scotian Shelf had returned to above average levels.

During 2002, temperatures in the LaHave and Roseway Basins varied relative to their long-term averages (1971-2000). In the LaHave area, the estimated annual near-bottom temperatures (below 100 m) were near to or slightly colder-than-average and near their 2001 values. They were much cooler than the peak temperatures in 2000. It is noted, however, that the annual mean was dominated by cool conditions during the first half of 2002 while in the second half of the year these temperatures warmed to above normal values. Temperatures in Roseway Basin, available primarily from the latter half of the year, were warmer-than-average and rose compared to 2001. Given that snow crabs generally inhabit cooler waters than those normally found in 4X, this suggests that

the near to or slightly colder-than-average conditions in these regions during 2002 and 2001 might be more favourable for snow crab than those observed in 2000 when temperatures were warmer-than-average. We note that snow crabs in 4X appear to be in waters of temperatures near their upper thermal limit.

LaHave Area Bottom Temperatures



### Outlook

Distribution of snow crab is currently limited to the Roseway Basin and an area north of LaHave Basin, but only the LaHave fishing grounds were of commercial value for the fishermen in 2001/02. SWNS is at the southern limit of snow crab distribution and environmental conditions, especially temperature, are not favorable for a large sustainable population.

### Management Considerations

There currently is limited information available to properly assess the stock status of snow crab in Area 4X. This first trawl survey did not produce enough results for stock assessment purpose. Average CPUE from the fishery will remain uninformative in Area 4X as long as factors influencing it keep changing every year, or until proper standardisation methods can be developed. Therefore, at-sea observer data are very important. At-sea observer coverage should be, as in eastern Nova Scotia, proportional to the

progression of the landings and with a minimum 10% coverage.

The first trawl survey was carried out in SWNS in 2002. Due to the lack of a time series, the management of this fishery must still primarily rely on the fishery-related data. This fishery may have reached its potential under current environmental conditions and further expansion is not recommended at this time.

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### References

Biron, M., C. Sabeau, L. Savoie, and M. Moriyasu. 2003. Assessment of the 2001/2002 snow crab (*Chionoecetes opilio*) fishery off southwestern Nova Scotia (NAFO

Division 4X). DFO Can. Sci. Advis.  
Sec. Res. Doc. 2003/013.

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. Advis. Sec. Res. Doc.  
2003/014.

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