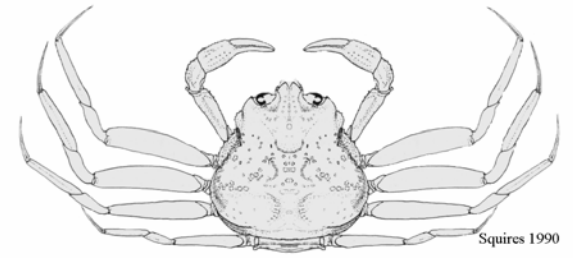


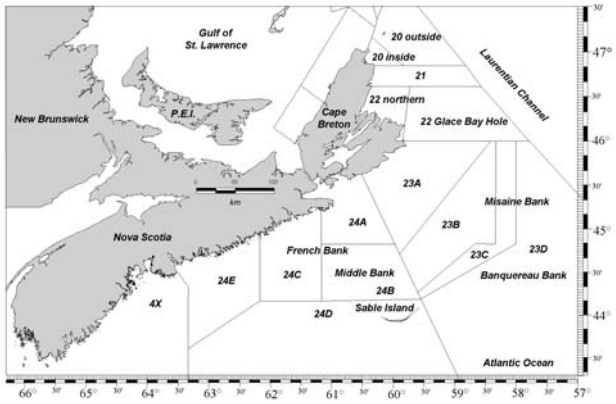
Eastern Nova Scotia Snow Crab

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 moulting. After moulting, crabs have a soft shell for a period of time. Unlike lobsters, male and female snow crab do not continue to moult throughout their lives. Females stop growing after the moult in which they acquire a wider abdomen for carrying eggs. This occurs at shell widths less than 95mm. Male snow crab stops growing after the moult in which they acquire relatively large claws on the first pair of legs. Female crabs 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 95mm, 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 square or conical traps constructed of wire or tubular steel and netting. The traps are set on muddy or sand-mud bottoms at depths ranging from 50 to 280m.

Management areas in eastern Nova Scotia (ENS) do not reflect the biological distribution of the resource. Therefore trawl survey results are shown based on geographical units only: northeastern NS (N-ENS), comprised of areas 20, 21 and 22, and southeastern NS (S-ENS), comprised of areas 23 and 24.



Summary

- Reported landings were 10,608 t against a TAC of 10,606 t for the 2003 fishing season.
- Except for a few localized areas, average CPUE in 2003 declined over that in 2002 in both N-ENS and S-ENS by 24 and 13%, respectively.
- The 2003 annual survey was conducted in October in N-ENS and in November and December in S-ENS. The effect of changes in survey period in S-ENS could not be assessed.
- The rescaled fishable biomass index for 2004 is 2,198 t [1,327 – 3,482 t] in N-ENS and 26,942 t [21,960 – 30,726 t] in S-ENS, a 22% and 10% reduction compared to 2003, respectively.
- Size frequencies and abundance indices from trawl survey indicate continued low recruitment.
- Mature female abundance has been decreasing since 1997-1998 and is currently low, which may impact the reproductive potential of the stock.
- Bottom temperatures in 2003 were colder than in 2002, and the snow crab habitat index increased to the highest level in the 1971-2003 time-series.
- Overall, it is recommended to decrease harvesting levels in 2004.

The Fishery

Harvesting of snow crab off the coast of eastern Nova Scotia (ENS) began in the late 1970's. Landings rose rapidly in phase with effort to a peak of 1,634 t in 1979 but landings and CPUE then collapsed within four fishing seasons. By 1985, this fishery was believed to be near commercial extinction. However, a pulse of pre-recruits reached the commercial size in 1986 in all Crab Fishing Areas (CFAs). From 1986 to 1993, landings again rose rapidly in phase with effort to a peak of 2,016 t in 1993. Management of these competitive fisheries was based strictly on effort controls (seasons, licences and trap limits) from 1982 to 1993.

Substantial changes to management measures were introduced from 1994 to 1999 such as individual boat quota (IBQ), total allowable catch (TAC), 100% dockside monitoring, mandatory logbook, at-sea monitoring by certified observers and the introduction of sub-areas to ensure the distribution of fishing effort. Additional voluntary management measures requested by fishermen were also introduced during that period such as a shortened season (CFA 21), reduced number of traps (CFA 21), no landings on Sunday (CFA 22) and the initiation of tagging projects by snow crab licenses holders (all CFAs).

From 1994 to 1997, landings of snow crab in ENS remained stable at around 1,500 t per year, while the trend in CPUE had been steadily increasing and the trend in fishing effort steadily decreasing. In fact, landings between 1994 and 1999 were mostly limited by TACs, IBQs or fleet caps that were developed based on 'recent landings history' rather than being based on the scientific surveys. The increases in landings observed in 1998 (2,331 t) and 1999 (3,600 t) resulted mainly from to the introduction of new temporary allocations in CFAs 20, 23 and 24 that had to be fished outside of fishing grounds that were being fished at that time.

Starting in 1999, the assessment of the stock status in ENS was based on a trawl survey. Estimated biomass indices and density maps revealed that the geographical distribution of the resource was greater than the area being exploited at the time, especially in south-eastern Nova Scotia (S-ENS). Consequently, TAC increased from 900 t in 1999 to 1,015 t in 2000 in north-eastern Nova Scotia (N-ENS), and from 2,700 t to 8,800 t in S-ENS. IBQs of regular licenses and existing temporary allocations increased as a result.

Abundance indices and distributions from subsequent trawl surveys showed a substantial decrease in adolescent males from 1997 to 2002 in N-ENS and S-ENS, while adult males $\geq$95 mm of carapace width (CW) had remained stable. Trends in average CPUE increased during this period to reach unprecedented levels in all CFAs. From 2000 to 2003, TAC remained near 8,800 t in S-ENS while it increased by 50% in 2002 to reach 1,500 t in N-ENS.

Following a voluntary trap survey by temporary fishermen from sub-areas 23D and 24D in 2000, new temporary allocations (total of 200 t) were given to 4 exploratory permits in 2001 and 2002 to conduct a trap survey along the slope of the Scotian Shelf. A similar survey was repeated in 2003 but with an allocation of 300 t and 5 exploratory permits.

The number of permanent licenses in N-ENS remained unchanged from 1994 to

2003 at 5 licenses in CFA 20, 32 in CFA 21 and 37 in CFA 22. During this period, no temporary access was provided in CFA 21 and 22. Four temporary permits were issued in CFA 20 in 1999, five in 2000 and six in 2002 and 2003. The number of permanent licenses in S-ENS remained unchanged from 1998 to 2001, but a conversion of 'temporary' into 'permanent' status for First Nations in 2002 created 13 new permanent licenses in CFA 23 and 8 in CFA 24. In CFA 24, there are an additional 250 t allocated to a Native band. A decrease in the existing temporary allocations resulted in a decrease of the number of temporary licence holders. In 2002 and 2003, there were 37 permanent licenses and 37 temporary permits in CFA 23 and 34 permanents and 40 temporaries in CFA 24 (excluding slopes permits).

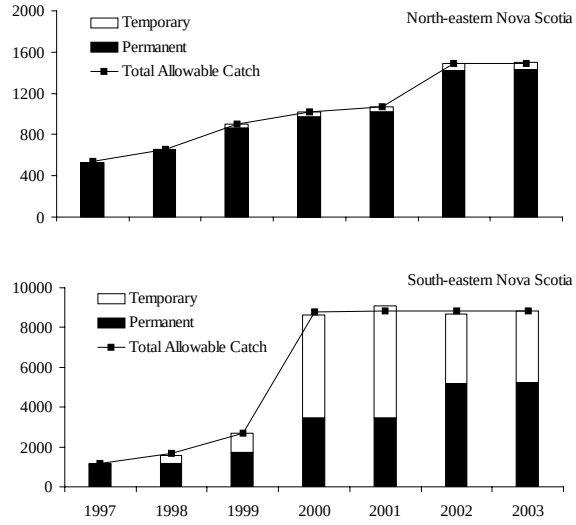
Landings, catch rate (CPUE: kg/trap haul), fishing effort (total catch / CPUE = total number of trap hauls) and fishing locations were derived from the mandatory logbooks completed by all fishermen.

Permanent and Temporary Allocations

	permanent		temporary	
CFA	allocations (t)	licences	allocations (t)	permits
20	102	5	75	6
21	545	32	-	-
22 (northern)	477	21	-	-
22 (GBH)	294	16	-	-
23	2,738	37	2,027	37
24	2,482	34	1,566	40
Total	6,638	145	3,668	84

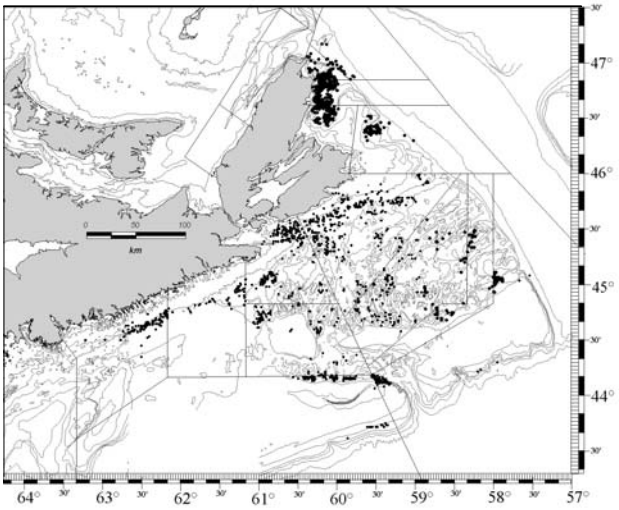
The Management Plan in 2003 was a roll-over from the one in place in 2002. The overall TAC for ENS in 2003 was 10,606 t (including 300 t from slope surveys). Total reported **landings** in 2003 were 10,608 t.

Landings (t)



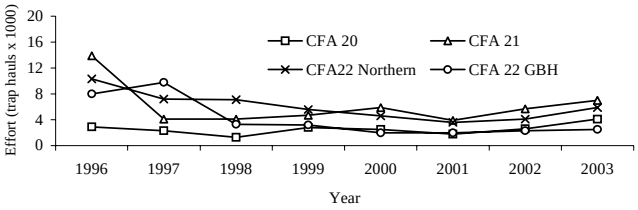
In 2003, fishing effort and distribution in S-ENS was influenced by sub-area boundaries and an imposed arrangement with shrimp fishermen concerning the use of mutual fishing grounds. Accordingly, some areas in S-ENS were closed to the crab fishery for part of the year.

Fishing Positions Reported in 2003 Logbooks



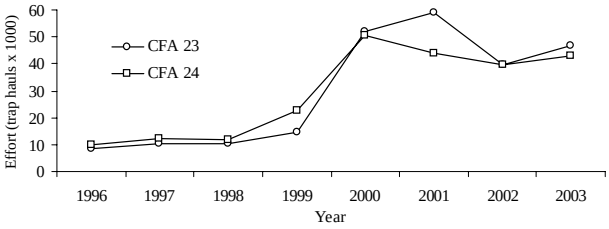
Fishing effort in N-ENS increased by 32% to 19,500 trap hauls in 2003 compared to 2002. Increases in fishing effort were reported for all CFAs.

Fishing Effort for N-ENS



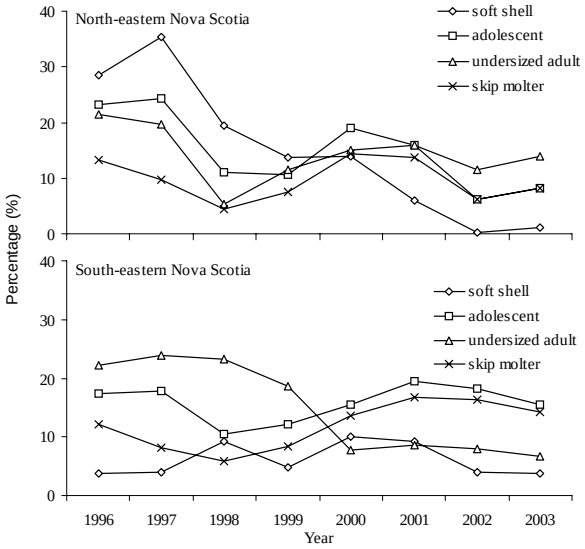
Total effort in S-ENS increased by 13% to 89,600 trap hauls in 2003 compared to 2002, representing a 17% increase in CFA 23 and 8% in CFA 24.

Fishing Effort for S-ENS



According to **at-sea sampling** of the commercial catch in N-ENS in 2003, a total of 115 traps were sampled at sea, corresponding to 0.6% of the total number of trap hauls. The average seasonal percentage of soft-shelled crab and adolescents in 2003 remained low compared to the 1997-2001 time-series. The seasonal average percentage of skip molters was 8.1%, of which 5.9% were of legal size. The 2003 catch composition from the sea sampling in N-ENS had a similar size distribution to that in 2002, but the proportion of carapace condition 3 (41.8%) decreased while 3M (37.7%) and 4 (15.7%) increased relative to 2002 (81.0%, 13.9 % and 2.3%, respectively).

Seasonal % of Different Categories of Snow Crab from Sea Sampling

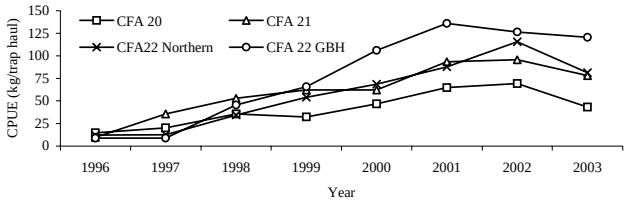


The at-sea sampling in S-ENS in 2003 sampled a total of 1033 traps at sea, corresponding to 1.2% of the total number of trap hauls. The average seasonal percentage of soft-shelled in 2003 fishing season was similar to the 2000-2002 time-series, remaining low compared to 1997-1999. The seasonal average percentage of skip molters was 14.3%, of which 11.3% were of legal size. The 2003 catch composition in S-ENS had a similar size distribution to that in 2002, but the proportion of carapace condition 3 (51.8%) decreased while 3M (26.2%) and 4 (14.3%) increased relative to 2002 (65.2%, 18.7 % and 8.4%, respectively).

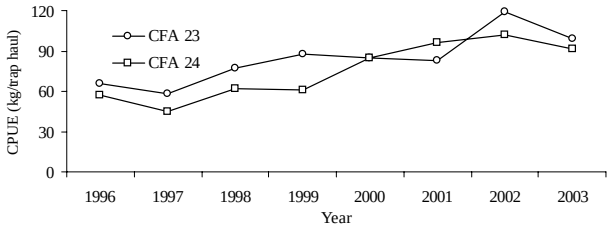
There is uncertainty in using **catch rate (CPUE)** as an index of abundance. Catch rates are affected by changes in fishing gear, season, soak time, fisherman experience, fishing pattern, closures and seasonal movement.

In 2003, the average CPUE of 76.8 kg/th in N-ENS and 95.9 kg/th in S-ENS represented a 24 and 13% decrease compared to 2002, respectively.

CPUE for N-ENS



CPUE for S-ENS



The average CPUE trend in all sub-areas were negative with the exception of sub-areas 23C and 24D.

Average CPUE by Area and Sub-areas in ENS

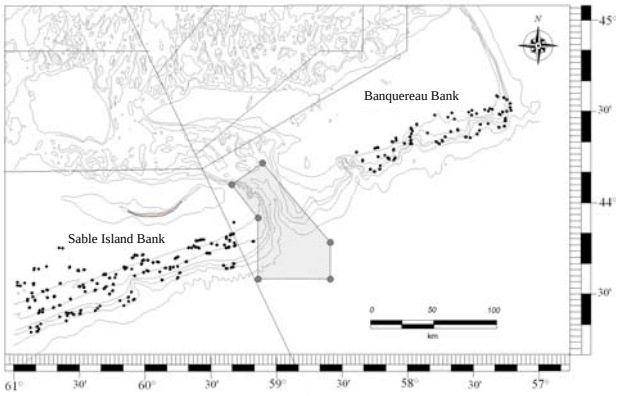
CFA	*2000*	*2001*	*2002*	*2003*	*trend*
N-ENS	68.3	94.1	100.9	76.8	-
20 inside	56.7	92.1	102.2	48.3	-
20 outside	36.3	46.3	38.9	12.9	-
20 all	46.9	66.1	67.8	44.0	-
21	65.4	95.0	96.8	77.7	-
22 northen	68.4	89.9	116.4	81.0	-
22 GBH	104.0	137.0	127.1	120.6	-
22 all	78.4	106.8	120.0	92.6	-
S-ENS	85.0	88.5	110.1	95.9	-
23A	102.6	113.1	141.9	94.5	-
23B	99.9	97.8	134.0	120.1	-
23C	65.6	136.3	108.2	134.8	+
23D	62.4	47.3	76.6	71.8	-
23 all	83.4	82.1	117.2	98.7	-
24A	81.8	108.8	132.1	78.9	-
24B	99.6	126.1	138.1	133.7	-
24C	90.3	97.5	92.9	85.5	-
24D	83.3	88.6	89.4	126.1	+
24E	50.8	65.6	55.1	46.0	-
24 all	86.7	99.3	103.0	92.2	-

Experimental Slope Surveys

The objectives of the experimental trap surveys between 2001 and 2003 were to determine the distribution, density (mean number of crab/trap) and movement pattern (by tagging) of snow crab.

The surveys occurred within the slope of Banquereau and Sable Island banks. No effort was permitted within the proposed Sable Gully candidate marine protected area. From this protected area, the survey extended northward to 45°00' latitude in CFA 23 and westward to the 61°00' longitude in CFA 24.

Trap Survey Locations in Summer 2003



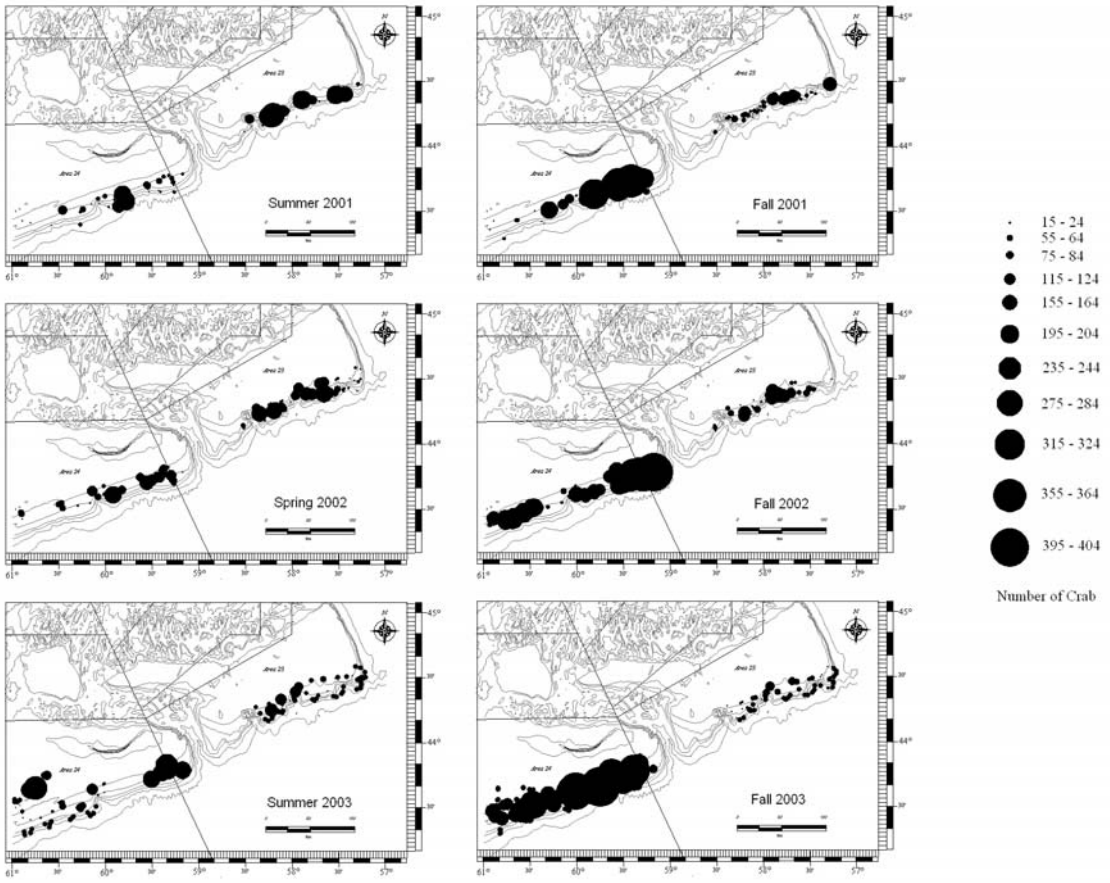
The exploratory trap surveys showed the presence of adolescent and adult male snow crab along the slope of the Scotian Shelf, but mostly at depths of 60 to 200 m.

Spatial plot of the snow crab counts per trap showed the apparent seasonal movement of the crab stock which seems more pronounced on the slope of Sable Island Bank. Over the three year study, the number of crab observed in the spring and summer on the slope of Sable Island Bank is less than that observed in the fall, while the contrary seemed to be occurring on the slope of Banquereau Bank. This variation may be accounted for by seasonal migration from other areas.

The finding of the trap surveys and restricted commercial fisheries between 2001 and 2003 were limited to showing only the presence of adolescent and adult snow crab along the two slopes. Some areas had relatively high abundance of commercial crab concentrations. However, there was no sound scientific basis to provide any direction concerning the potential, if any, of these areas. Therefore, a total of 78 trawl stations were sampled on the slope of the Scotian Shelf between June

27 and 30 2003, and the trawl sampling methodology and the mapping and abundance estimation by kriging were exactly the same as those used during the annual trawl survey in ENS.

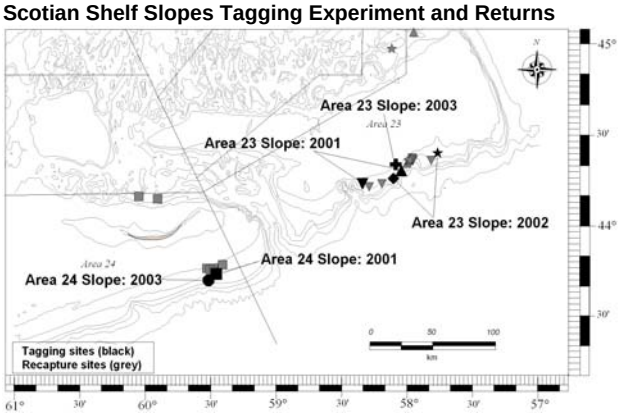
Snow Crab Counts per Trap During the Trap Survey from 2001 to 2003



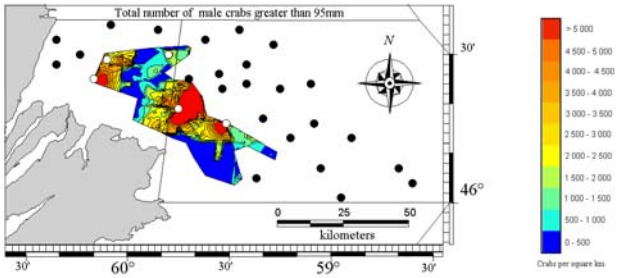
The trawl survey identified a comparable abundance of hard-shelled adult males between the two areas, but recruitment represented 10% of the commercial biomass on the slope of CFA 23 compared to 58% in CFA 24. Furthermore, there was a much higher concentration of pre-recruits found on the slope of CFA 24 relative to the slope of CFA 23. Based on one trawl survey and the 2001-2003 trap surveys, it could be argued that the population on the slope of CFA 23 is currently at the end of a wave of recruitment, while the population on the slope of CFA 24 may be currently at its peak. However, it may be premature to make any conclusions since different temperature profiles have been observed on the slopes of CFAs 23 and CFA 24 that may result in a different distribution of the snow crab population on the bank and slope of Banquereau than on the bank and slope of Sable Is. Bank. The snow crab biomass for the slopes of CFAs 23 and 24 remains unknown.

In addition, the level of crab movement between the slope areas and the nearest fishing grounds (i.e. area 23D, 23C and 24D) remains unknown. However, four of the 27 tags returned from the slopes tagging experiments were captured on the nearest fishing grounds.

Scotian Shelf Slopes Tagging Experiment and Returns



Snow Crab Density Distribution from the Video Survey



N-ENS Video Camera Survey

An experiment was conducted in N-ENS in 2003 to establish the distribution, biomass and other biological parameters of the snow crab population over a large area of soft and hard bottom by mean of simultaneous trawl, video camera and trap surveys. The selected region, the Glace Bay Hole (GBH), is a relatively small area of muddy bottom that is bounded to the north, west and south by the shallow hard bottom of Smokey and St. Ann's banks, and to the east by the deeper, warmer water of the Laurentian Channel.

The experiment indicated that at the time of the surveys in July 2003, the highest abundance (density) of adult ≥95 mm CW was located on the hard bottom immediately surrounding the soft bottom area. Although some of these grounds are covered by the trawl survey, the results also indicated that parts of Smokey Bank judged untrawlable because of rocky bottom were harbouring medium to high densities of commercial crab (i.e. 1000-4000 crabs/km^2). It is unclear however if this distribution is typical for the month of July of every year, or an oddity for 2003. Fishermen from CFA 22 GBH reported fishing in shallower water and on hard bottom in 2003 compared to recent years.

This experiment supported the rationale for changing the 2002 trawl survey from spring to fall to avoid the seasonal movement in winter and early spring towards the shallower and colder areas of the banks to moult and mate.

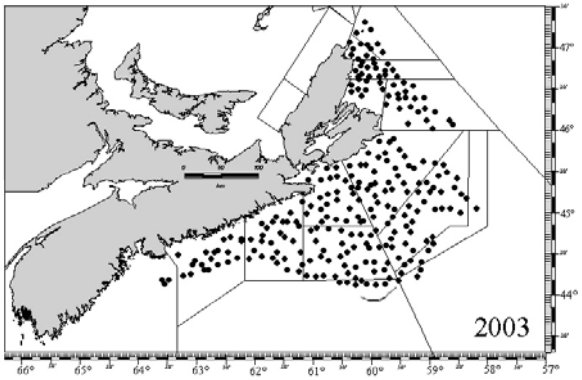
Some general conclusions that can be drawn from this video camera survey are: 1) Overall trends calculated for N-ENS are apparently representative of the stock since the survey covers the major portion of the highest crab density grounds; 2) excluding the surface of the banks from kriging has produced an overly conservative biomass index; 3) the apparent resilience of N-ENS to the current historical harvesting level might have been caused by a limited concentration of snow crab unaccounted for and located in the untrawlable perimeter of the surveyed area; and 4) inter-annual fluctuations in bottom temperature at the time of the survey may affect to a certain degree the magnitude of any perceived fluctuation in the population by affecting the distribution of snow crab between trawlable and untrawlable grounds.

Resource Status

Stock status for ENS is based on an annual **trawl survey** that was introduced in 1997. In 2003, the annual survey for ENS was carried out between Oct. 13 to 26 for N-ENS (59 tows) and Nov. 3 and Dec. 21 for S-ENS (199 tows), and encompassed areas of the

Cabot Strait, Sydney Bight and Scotian Shelf.

Distribution of Trawl Survey Stations in 2003



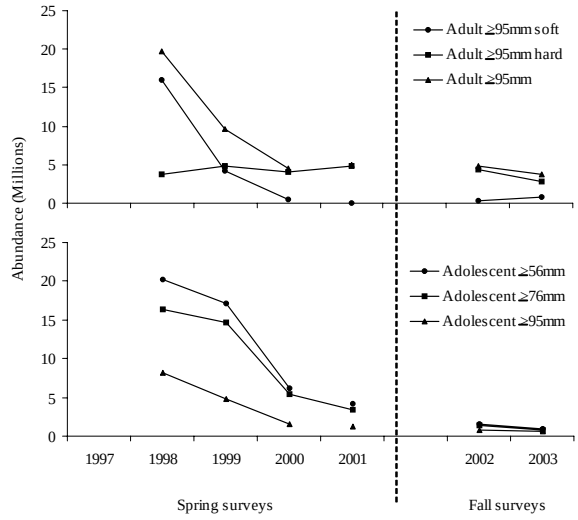
Between 1997 and 2003, the size, shape and number of stations of the surveyed area changed with the knowledge gained during the previous survey and at the request of the industry to have all known fishing grounds surveyed. Areas that were added to the survey and found to have limited snow crab habitat were withdrawn the following year (e.g., Laurentian Channel, Western Bank, Emerald Basin). The number of trawl stations sampled during the annual survey has increased from 150 in 1997 to 322 in 2000, but steadily decreased to 258 by 2003. Consequently, variations in total surveyed area rendered comparison difficult between years. In order to allow for comparison among years, the overall trends of pre-recruits and commercial-sized adult males have been reported based on the original surface that was surveyed in 1997 for S-ENS and 1998 for N-ENS.

In 2003, 35 of the 234 trawl stations planned for the annual survey in S-ENS had to be abandoned due to poor weather conditions. Because some of these stations were located in the originally surveyed area, calculations of the overall trends of pre-recruits and commercial-sized adult males for the 1997-2002 time-series were rescaled based on the surface covered in 2003.

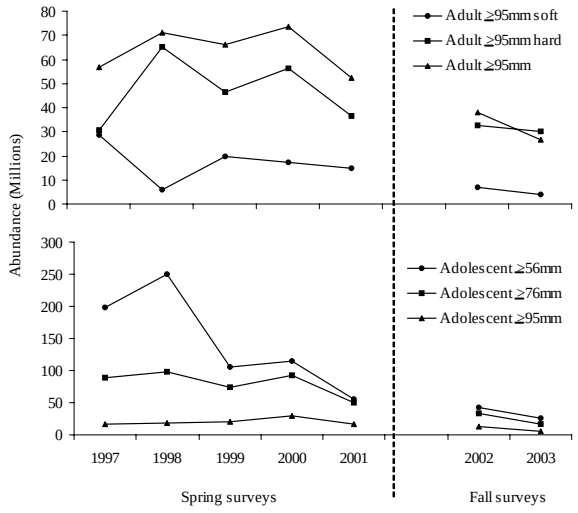
In N-ENS, the abundance index of soft-shelled adult males has decreased from 1998-99, while the abundance index of hard-shelled adult male has remained constant during the same period. In S-ENS, the abundance index of commercial size adult males has been slowly decreasing since its high abundance period of 1998-2000. In both regions, abundance indices of adolescent males and females were similar to those in 2001, with low recruitment in comparison to earlier years.

Abundance Indices of Commercial-Sized Adult and Pre-recruits Male Snow Crab.

N-ENS

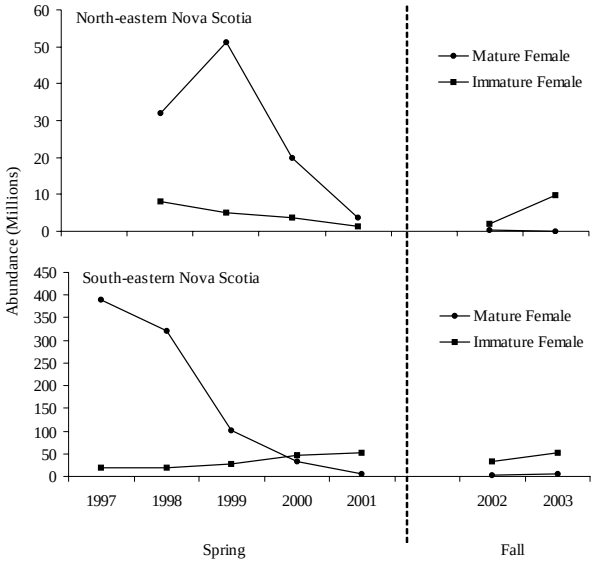


S-ENS



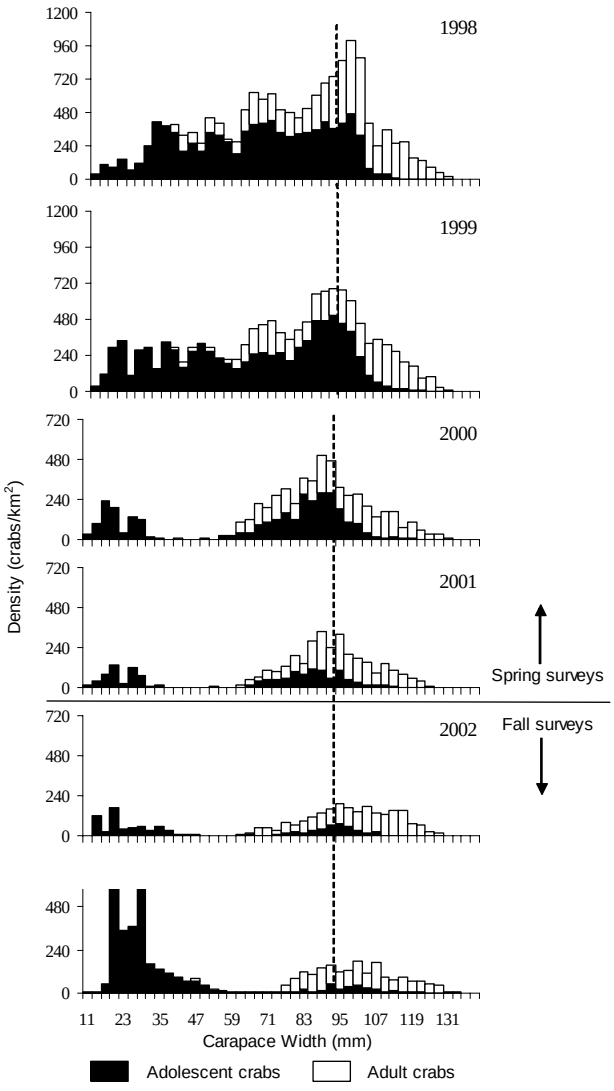
Adult female abundance and distribution were generally low and almost exclusively comprised of multiparous females.

Abundance Indices of Females Snow Crab.



While abundance indices were based on a common surveyed area since 1997-1998, the following size frequency histograms were based on all the trawl stations covered in a given year.

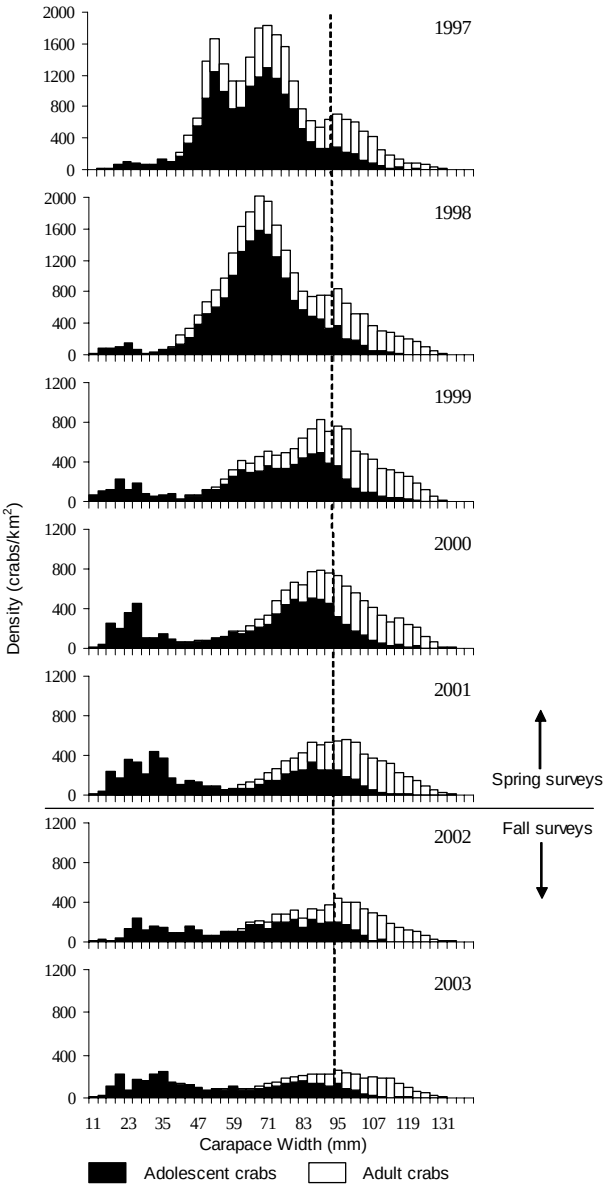
Survey Size Frequencies of Male Crab in N-ENS



The size frequencies distributions in N-ENS and S-ENS show a substantial decrease in adolescent males from 1997 / 1998 to 2003. Overall, the size frequencies and abundance index from trawl surveys indicate a continued decrease in recruitment.

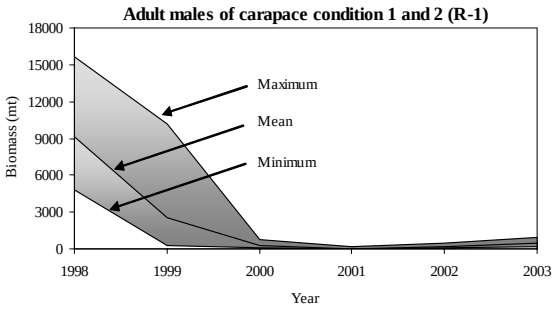
Snow crab of carapace condition 5 (very old crab) are not expected to contribute to the 2004 fishery due to high natural mortality. In 2003, the amount of old category 5 crabs has been estimated at 3 t [0 – 20 t]* (*95% confidence intervals) in N-ENS and 443 t [212 – 823 t] in S-ENS.

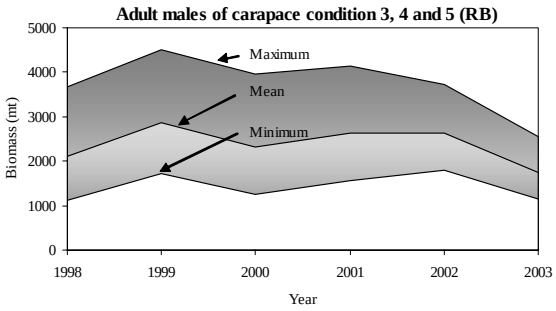
Survey Size Frequencies of Male Crab in S-ENS



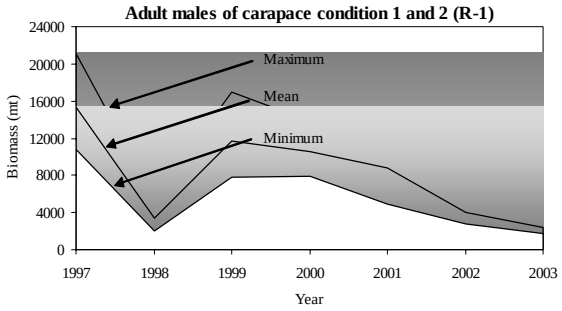
The biomass index for 2003 was 2,201 t [1,327 – 3,502 t] in N-ENS and 27, 385 t [22,172 – 31,549 t] in S-ENS. Assuming no other losses than category-5 crab in the mean time, the available biomass index for the 2004 fishery is 2,198 t [1,327 – 3,482 t] (2,201 t –3t of category-5) in N-ENS and 26,942 t [21,960 – 30,726 t] (27,385 t – 443 t of category-5) in S-ENS.

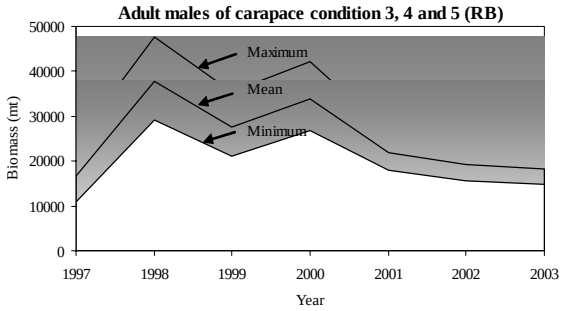
Biomass Indices for N-ENS



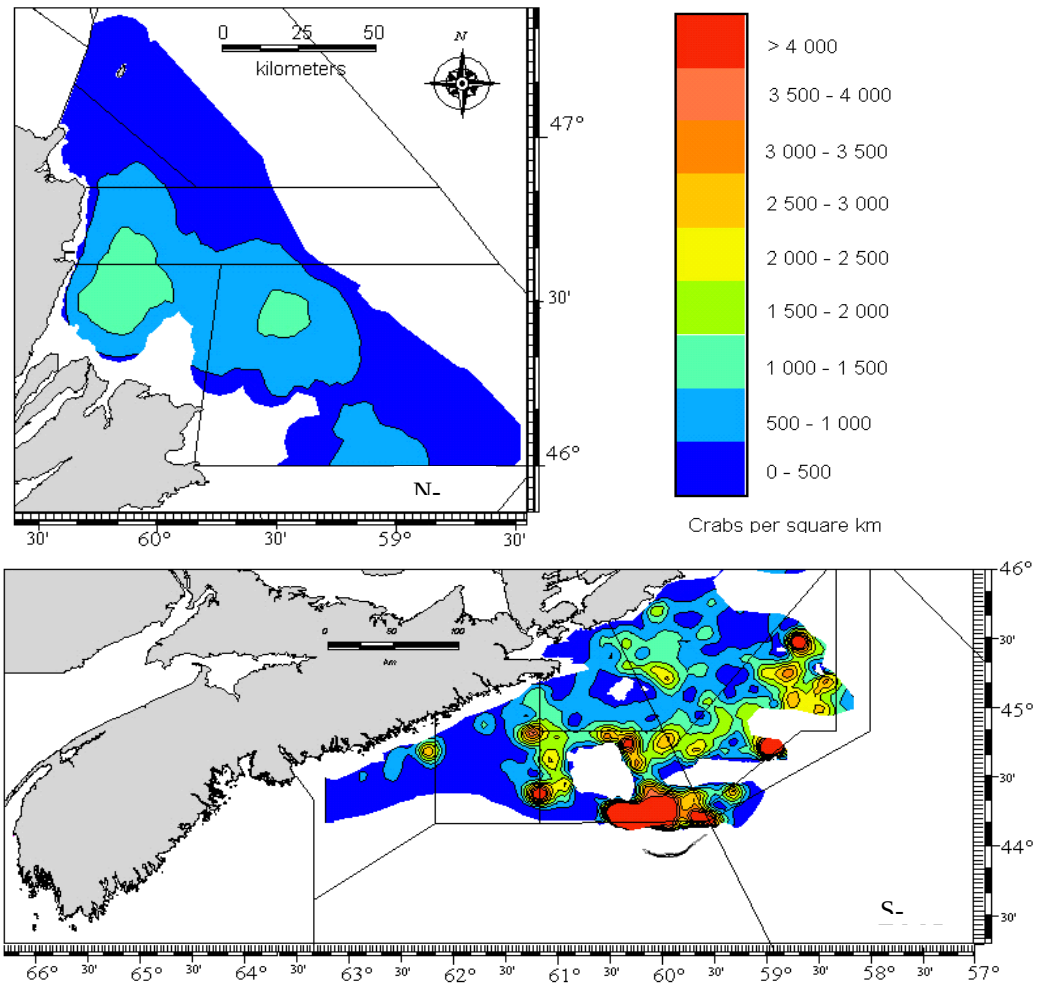


Biomass Indices for S-ENS





Density Contours of Commercial-sized Adult Males in Eastern Nova Scotia from



Sources of Uncertainty

The current biomass estimates provided should not be considered as absolute because the total mortality (e.g. predation, diseases, discards, by-catch in other fisheries, etc.) of commercially exploitable crab between the time of survey and the fishing season has not been taken into account. The estimation of "biomass" was also based on the assumption that the catchability of commercial sized male crab in front of trawl net foot rope was 100%. Until these uncertainties are assessed, the estimates are considered as relative.

Since its beginning in 1997, the annual trawl survey has been inconsistent from year to year with respect to timing, area surveyed and vessels used. The number of trawl stations and surface surveyed has changed every year. Four vessels have been used in seven years. The timing of the trawl survey has changed from spring to fall, i.e. from a pre-season survey between 1997 to 2001 to a post-season survey in 2002 and 2003. The effects of these changes were not assessed.

Movement of crab amongst CFAs is expected but was not explicitly considered in this assessment. Some areas such as Glace Bay Hole seemed to be more dynamic in their movement pattern.

The geographic distribution of females, juveniles, adolescents and undersized adult males is different from that of commercial-sized adults. Further studies are required to improve our knowledge on the distribution of all size-classes of male and female snow crab. The categorisation of older crab (category 5) based on the carapace condition index developed for the southern Gulf of St. Lawrence may not be directly applicable in ENS.

For the Scotian Shelf stock assessment, no monitoring of reproductive output has been done and the reaction of the snow crab population to the current exploitation level is unknown. The abundance of adult females decreased significantly through the last 3-4 years and currently their abundance remains at the lowest level since the trawl survey has begun. If the Scotian Shelf is a self-reproducing system, this decline of female spawning stock may result in a serious stock decline in the future. The appearance of immature females in 2003 may indicate the beginning of a new recruitment pulse of females in the snow crab population, while the adult male population is declining and the fishing effort is increasing. An understanding of relationships between females abundance (or total egg production), sex-ratio requirement and future recruitment to the population is needed to evaluate the viability of fishing strategies.

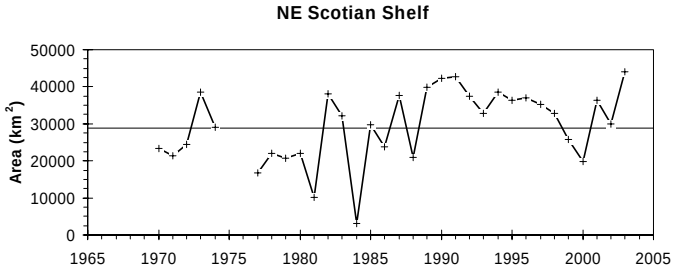
Ecosystem Considerations

Cold bottom temperatures (<4°C) typically exist year-round in the deeper area northeast of French, Middle and Banquereau banks (CFAs 20 to 23, with 24A and 24B), as well as in a narrow band along the shore (24C and E) that extended into southwestern Nova Scotia (4X fishery). At the time of the trawl surveys in 2003, the coldest bottom temperatures (less than 1°C) were found over Misaine and Canso banks. Temperatures gradually increased to 3°-5°C towards the east in Laurentian Channel and to 3°-4°C on the shallow areas of Banquereau and Middle banks to the south and west. Bottom temperatures in the vicinity of Sable

Island were around 5°-7°C. The warmest temperatures in 2003 (7° to greater than 9°C) were in the southwestern portion of CFA 24 (Emerald Basin, Emerald and Western banks). Although colder in 2003, this spatial pattern in near-bottom temperatures is typical of that seen in most years.

Bottom temperatures in the northeastern Scotian Shelf were typically warmer-than-average during the late -1970s and early 1980s. In the mid-1980s they declined reaching a minimum in the early 1990s. Temperatures then rose gradually until 1999 when they reached above average values for the first time since the mid-1980s. Temperatures continued to rise through to 2000 but dropped below average in 2001 and rose again above the mean in 2002. During 2003, temperatures were significantly colder than the long-term average (1971-2000) having cooled relative to observations in 2002. On the Northeastern Scotian Shelf, the snow crab habitat index, defined by the area of the bottom with temperatures of -1° to 3°C, increased to above average and represents the highest value of the time-series. The average temperature within the habitat is at its lowest point (1.1 °C). Although not as extreme, similar conditions were present in the Sydney Bight area. This is consistent with the observed colder temperatures in 2003. Given that colder conditions in these regions are considered to be advantageous for snow crab, the higher snow crab habitat index and the below-average bottom temperatures indicate that bottom conditions were significantly more favorable for the adult snow crab in 2003 compared to conditions observed during 2002.

Snow Crab Habitat Index



Outlook

The biomass estimate indices of hard-shelled adults in S-ENS apparently peaked in 1998-2000 and decreased at a 10% rate in 2003. Except for the Sable Island region, the trawl survey indicated that S-ENS was at the end of a wave of pre-recruits (R-4, R-3, R-2) and recruitment (R-1). In N-ENS, the end of the recruitment pulse apparently came in 2000-2001, and has remained low since 2001. The hard-shelled adult abundance in N-ENS peaked in 2001-2002, and decreased by 22% in 2003. The estimated abundance of recruits has been at low levels for the past 2-3 years and indications are that the abundance of crab expected to recruit in 2-3 years will also stay at low levels, therefore it is likely that the abundance of the resource will continue to decline for a few more years. However, the presence of small crab (15-50 mm CW) was detected and if they survive they could recruit to the fishery in 5 to 7 years.

Management Considerations

Since the beginning of the snow crab fishery in ENS, CFA and sub-areas have been created and modified to ensure the distribution of effort in ENS. In that respect, the current management lines succeeded in spreading the effort over the entire fishing grounds with snow crab in ENS. However,

management lines should have a certain flexibility to adapt to a dynamic fishery, and dynamic the fishery has been in ENS since 1997.

The N-ENS area is assumed to contain a single population since the habitable bottom is continuous between all inshore areas and snow crab movement occurs between areas. The current management lines do not allow for effort distribution if abundance changed disproportionately between areas. The resultant localized high fishing pressure could be associated with additional mortality. Consideration should be given to the removal of the lines or the introduction of specific measures which will allow the fishing industry to react to negative indicators (e.g. high incidence of soft-shelled crab, adolescents) during the season.

Rigidly monitored and enforced protocols to control the capture of soft and white crab are required in order to minimize the mortality of these crabs and to protect future recruitment to the fishery. Although the crab population is aging, there is a possibility of increased incidence of soft-shelled crab, particularly if the commercial biomass reaches low levels. Furthermore, considering that new pre-recruits will start to enter R-3/R-2 categories in the near future, therefore it may be especially important to protect soft and white crab, or any adolescents during low recruitment periods.

The areas most affected by the decline in CPUE and biomass indices were the fishing grounds situated near shore (i.e. CFAs 20 inside, 21, 22 northern, 23A and 24A) that have seen the highest increase in fishing pressure in terms of fishing effort and landings since 1999. In S-ENS, fishermen landed less crab in CFAs 23A and 24A in 2003 compared to 2002 with the difference having been landed in 23B and 24B instead. However, the fishing effort (total trap hauls) increased in both sub-areas A and B in 2003. In S-ENS, actions should be taken to reduce fishing pressure in these near shore areas.

Due to the uncertainty described above together with some negative signs of reproductive potential of the Scotian Shelf snow crab population, it is recommended to decrease harvesting levels in 2004 so that the long-term sustainability of the snow crab fishery can be protected.

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References

Biron, M., L. Savoie, C. Sabean, E. Wade, M. Hebert, and M. Moriyasu. 2004. Historical review (1996-2002) and assessment of the 2003 snow crab (*Chionoecetes opilio*) fishery off eastern Nova Scotia (CFAs 20 to 24). DFO Can. Sci. Advis. Sec. Res. Doc. 2004/034.

Chassé, J., K.F. Drinkwater, R.G. Pettipas, and W.M. Petrie. 2004. Temperature Conditions on the Scotian Shelf and in the southern Gulf of St. Lawrence during 2003 Relevant to Snow Crab. DFO Can. Sci. Adv. Sec. Res. Doc. 2004/002.

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