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Status of the Snow Crab Resource off the Atlantic  
Coast of Cape Breton Island, 1982

by

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### Abstract

Biological assessments are presented for the 1982 Cape Breton Island (Atlantic coast, areas 2-6) snow crab fishery, based on data derived from fishermen's logbooks, tagging studies, and commercial catch sampling.

A marked increase in market demand for crab in 1982 led to an expansion of fishing effort with a subsequent rise in landings over 1981 levels. However, with low catch rates, relative to historical levels, and no major pulses of growth and recruitment detected, the resource remains in a depressed condition.

### Résumé

On présente des évaluations biologiques des pêches de 1982 de crabes des neiges à l'Ile-du-Cap-Breton (côte Atlantique, zones 2-6) basées sur des données provenant du journal de bord des capitaines des bateaux de pêche, d'études d'étiquetage et de l'échantillonnage de prises commerciales.

En raison de l'accroissement marqué de la demande de crabe en 1982, l'effort de pêche s'est accentué, si bien que les débarquements ont dépassé ceux de 1981. Néanmoins, les taux de capture étaient faibles, par rapport aux années précédentes, et on n'a détecté ni croissance, ni recrutement importants de sorte que cette ressource demeure réduite.

## Introduction

The directed fishery for snow crab around Cape Breton Island was started in 1966 by inshore boats trapping off the northwest coast. Between 1977 and 1979, landings rose markedly in phase with effort and the expansion of the fishery to approximately 180 inshore vessels operating around most of the Island's coast (Table 1). Between 1976 and 1978, six inshore areas were defined around Cape Breton Island (Fig. 1) for exclusive exploitation by inshore boats under 45 ft (13.7 m) in length. One hundred and fifty snow crab licenses were issued to inshore boats to fish these areas in 1981. Additionally, 28 licenses were allotted for inshore boats to fish area 7 off the SW coast; area 7 is also open to the New Brunswick and Quebec offshore crab fleets.

By 1982 it became apparent that the snow crab fisheries on the Atlantic coast of Cape Breton Island (areas 2-6) are based on a resource which has a low productivity and that the accumulated virgin biomass had been almost entirely removed by fishing. In contrast, on the Gulf of St. Lawrence coast of the Island (areas 1 and 7) larger production levels have conferred relative stability to the commercial biomass and landings (Elner 1982). As the productivity of the Atlantic coast resource appeared too low and erratic to allow for a strategy of biomass stabilization, management dropped catch controls for the fishery in 1982; thus allowing existing fishermen to take advantage of whatever productivity occurs from time to time on an opportunistic basis. The fact that there is a minimum legal size regulation (95 mm carapace width, CW) confining exploitation to mature males that have had 1-2 yr to mate, protects the reproductive potential of the resource.

Based on fishermen's logbooks, tagging studies and commercial catch sampling, this paper assesses the status of the snow crab fishery in areas 2, 3, 4, 5, and 6.

## Methods

Since 1978, Cape Breton Island snow crab fishermen have been required to maintain logbooks. To improve trap location information in logbooks, fishermen have been given grid maps and requested to indicate the grid number(s) corresponding to their fishing area(s).

Biomass estimates for each area were made, where possible, by Leslie analysis, plotting cumulative catch (x-axis) at weekly intervals against mean CPUE (kg.trap haul<sup>-1</sup>), from logbook data (Ricker 1975). The slope of the linear regression gives an estimate of the catchability (q) of the gear. The intercept of the regression line on the x-axis gives an estimate of the total biomass (B<sub>0</sub>) above legal minimum CW available for the fishing season. Assuming that natural mortality is not significant during the relatively short fishing season (i.e. a type I fishery, Ricker (1975)), the rate of exploitation (U) is given by:

$$U = \frac{Y}{B_0} \dots\dots\dots (1)$$

where Y is the total catch.

If q is assumed to be constant throughout the fishing season, it is possible to calculate the biomass ( $B_t$ ) present at given time, knowing the CPUE value at that time ( $CPUE_t$ ), from:

$$\frac{CPUE_t}{q} = B_t \dots\dots\dots (2)$$

Equation (2) makes it possible to estimate biomass increases from growth and recruitment, through molting, during the fishing season. Significant molting periods are detectable by in-season rises in mean CPUE and simultaneous increases in the observed frequency of soft-shelled crabs in commercial catch samples.

Ricker (1975) gives a detailed account of possible sources of discrepancy in Leslie analyses.

Tag returns from mark-recapture studies were analyzed by Leslie and Peterson techniques to provide supplementary biomass and exploitation rate estimates.

In area 5, between June 23 and 25, a total of 1958 male snow crabs were marked with t-bar tags and released prior to the fishing season (area of release bounded by:

<u>Latitude (N)</u>	<u>Longitude (W)</u>
45°45'00"	59°56'30"
45°43'00"	59°50'50"
45°39'00"	59°55'00"

In area 4, on August 13, 737 male snow crabs were marked with t-bar tags and released within 2 km of latitude 46°25'00", longitude 59°28'00" during the period the fishing season was closed due to a high incidence of soft-shelled crab. The tagging was carried out as part of a charter program to monitor the shell hardness of crabs in the area.

The t-bar tags (molting-cone type) were injected through the right end of the posterior suture-line and designed to be retained through ecdysis. Fishermen were relied upon to return all tags recovered. A \$2.00 reward was given the finder for each tag returned with details of how, where, and when the capture was made. An additional reward of \$2.00 was offered for tagged crabs that were made available for measurement.

Port and at-sea sampling of commercial landings was carried out throughout the fishing season in area 5, and to a more limited extent in areas 2, 3, 4, and 6, to assess catch size-frequency distribution and shell hardness.

## Results

The average CPUE for each grid square and the distribution of fishing effort from logbook data in 1982 is shown in Fig. 2.

A summary of snow crab landings and effort statistics for each area in 1982 is given in Table 2.

Areas 2, 3, and 4 (northeast Cape Breton)

Since 1980, snow crab areas 2, 3, and part of area 4 (being adjacent, relatively small management areas with a paucity of landings and commercial catch statistics) have been treated as a single stock for the purpose of annual assessments.

The 1982 fishing season was from July 22 to September 15; however, area 4 was closed during the period July 29-September 2 due to a high incidence of soft-shell crab in the catches. Subsequently, the area 4 season was extended until October 15 to compensate for the lost fishing time. During the 1982 season, the demarcation line between areas 3 and 4 was moved approximately 10 km south, from Cape Smokey (46°37'00" N, 59°37'00" W) to Wreck Cove (46°31'00" N, 59°37'00" W).

No logbook or landings information was forthcoming from area 2; it is doubtful whether any snow crabs were fished in the area during 1982.

Eighteen logbooks, recording landings of 75,295 kg, were received from the 36 licensed fishermen in area 3. Twenty fishermen from area 3 were reported (Area Managers' statistics) to have actually set traps and landed 86,814 kg.

For the purpose of the following Leslie analysis, logbooks from ten fishermen from area 4 who fished in or near to area 3 have been included with the area 3 logbooks: CPUE, plotted against cumulative catch, demonstrates a steady decline throughout the fishing season, indicating that no significant biomass pulse occurred during this period (Table 3, Fig. 3). A linear regression through all data points gives an estimate for total available biomass ( $B_0$ ) of 153.0 MT (95% confidence limits: 140.1 and 170.7 MT). By subtraction of the 1982 catch for area 3 and part of area 4, 100.2 MT (from logbook data), we calculate that 52.8 MT (95% confidence limits: 39.9 and 70.5 MT) of commercial crab were left on the grounds when the fishery closed. Given that natural mortality was not significant during the fishing season, this fishery is experiencing an exploitation rate of 65% (95% confidence limits: 72% and 59%). In comparison for 1980, Elner and Robichaud (1981) observed a similar pattern and level of catch rates and estimated that the total available biomass for the similar area was 225.2 MT (95% confidence limits: 200.1 and 267.5 MT); the exploitation rate was calculated at 80.4% (95% confidence limits: 90.5% and 67.7%). The estimated end of season biomass in 1980 is substantially below the biomass at the start of the 1982 season; this suggests that growth and recruitment levels were above catch levels in 1981.

Twenty fishermen from area 4 returned logbooks detailing catches of 116,243 kg, although 21 out of 37 licensed fishermen actually set traps and landed 165,395 kg according to the Area Managers' statistics. A Leslie analysis for area 4 is impractical because the landings of ten fishermen were included in the area 3 analysis and the landings of the remaining fishermen are incomplete. Table 4 summarizes available logbook data from fishing away from the area 3 boundary in area 4.

#### Port and at-sea sampling

Due to the relatively low landings in areas 2, 3, and 4, sampling effort was largely restricted to the more major area 5 fishery. A single commercial catch size-frequency histogram, from port sampling in area 3, is shown in Fig. 4.

#### Soft-shell problem and tagging (area 4)

Two hundred and fifty-two tags (34.2%, N=737) were recovered during the 1982 season. Most of the tagged crabs were recaptured by a single fisherman and were not made available for measuring. The size frequency of the crabs tagged on August 13 are shown in Fig. 5. Due to the limited landings data from area 4, a biomass estimate based on a Peterson analysis of tag returns was deemed impractical.

The size frequency and shell state of snow crabs caught by trapping from the charter vessel on August 13 and 25 are shown in Fig. 6. Based on the sharp decline in soft-shell incidence between August 13 and 25, the area 4 fishery was reopened on September 3.

Area 5 (southeast Cape Breton)

#### Port and at-sea sampling

Size-frequency histograms from port sampling during July, August, and September and at-sea sampling during August are shown in Fig. 7. Mean carapace widths from port sampling appeared similar between July and August but increased marginally in September.

Comparison of commercial catch size-frequency distributions since 1978 show that mean carapace width in July and August port samples has remained similar (Fig. 8). However, the mean carapace width of 112.8 mm for August 1982 at-sea sampling appears markedly lower than the 121.0 mm value for August 1981; the mechanism accounting for this is uncertain, although the August 1981 sample size (N=203) is relatively small and may have caused bias.

The low incidence of soft-shell crabs (Fig. 9), as determined from port and at-sea sampling, suggests that molting and growth were not prevalent within the 1982 fishing season. This observation is supported by the relatively uniform pattern in CPUE through the 1982 season and the similar lack of observed in-season growth and recruitment over the period 1978-81 (Elner 1982).

### Logbooks

Logbooks were received from 18 of the 19 area 5 fishermen who set traps in 1982. Total landings derived from logbooks were 298,469 kg, as compared to 300,145 kg from the Area Managers' statistics (Table 2). Six licensed snow crab fishermen did not fish during the 1982 season.

CPUE declined only slowly throughout the 1982 fishing season (Table 5, Fig. 10). The CPUE pattern and mean CPUE value for 1982 (33.73 kg.trap haul<sup>-1</sup>) were close to those observed in 1981 (28.9 kg.trap haul<sup>-1</sup>) and considerably below those of 1978-80 (Fig. 11). Landings in 1982 (298.5 MT) exceeded those of 1981 (81.8 MT) by 365% due primarily to an increase in trap hauls of 312% (2835 vs 8848) and a reported extension of fishing grounds into previously unexploited, although marginal, areas. The increase in fishing effort in 1982 was a consequence of a 250% increase in the price paid to fishermen for snow crab (1981: \$0.25/lb (\$0.55/kg); 1982: \$0.65/lb (\$1.43/kg)).

In a Leslie analysis of 1982 logbook data (Fig. 10), a linear regression through all data points gives an estimate of total biomass ( $B_0$ ) available for the season as 670.1 MT (95% confidence limits: 514.5 and 1056.4 MT). Given the value for  $B_0$  and the 1982 catch of 298.5 MT, the estimated exploitation rate was 44.5% (95% confidence limits: 58.0% and 28.3%). Similarly, by subtraction of the catch from  $B_0$ , an estimated 371.6 MT (95% confidence limits: 216.0 and 757.9 MT) would remain on the fishing grounds at the end of the 1982 season. In comparison, 131.2 MT was estimated to remain on the grounds at the end of the 1981 season; however, inter-season biomass comparisons should be viewed with caution due to: a) the probable change in fishing grounds in 1982; and b) the high degree of error associated with the 1981 biomass estimate and the wide confidence limits for the 1982 estimate.

### Tagging

Nine hundred and twenty-four (47.2%) of the 1958 tagged crabs released in 1982 were recovered during the 1982 fishing season. The size frequency of the crabs tagged and returned is shown in Fig. 12.

Assuming a 20% mortality from the tagging process (4 crabs out of 20 untagged control crabs and 4 tagged crabs out of 20 tagged crabs died in a trap set over a 24-h soak time) and no in-season additions to the commercial population, the 1982 tag return data has been analyzed:

A Leslie analysis of tag return data (Table 6, 7, Fig. 13) gives an exploitation rate of 84% (95% confidence limits: 119% and 4%). A Peterson estimate of biomass ( $B_1$ ) can be obtained for the initial week of the fishery from:

$$B_1 = \frac{C_{1-q} \times M_1}{R_{1-q}} = \frac{298,456 \text{ kg} \times 1105}{924} = 356.9 \text{ MT}$$

where  $C_{1-q}$  = catch in weeks 1-8 of the fishing season;

$M_1$  = apparent number of crabs tagged, from Leslie analysis of tagging data;

$R_{1-q}$  = number of tags returned during weeks 1-8 of the fishing season.

In comparison, a straight Peterson estimate of biomass, utilizing the actual number of crab tagged (1566):

$$\frac{298,469 \text{ kg} \times 1566}{924} = 505.8 \text{ MT}$$

gives a closer approximation to the biomass estimate ( $B_0$ ) derived from Leslie analysis of logbook data.

A total of 13 crabs out of the 364 measured appeared to have grown (Fig. 14). However, it should be noted that a further 10 crabs measured appeared to have decreased in carapace width due probably to sampling error.

During 1982, 12 tags were returned from a 1979 study. In 1979, D. A. Robichaud tagged 2010 male snow crabs with a non-molt retainable vinyl body tag. One thousand, four hundred and forty-four tagged crabs were returned in 1979, 169 in 1980 and 19 in 1981. The sizes of the tagged animals returned in 1982 (100, 105, 107, 107, 108, 110, 113, 114, 116, 117, 118, 123 mm) are indicative of the slow growth of some individuals (the largest animal sampled from area 5 during 1982 was 157 mm carapace width).

Area 6 (south Cape Breton)

#### Port and at-sea sampling

A single port sample was collected from area 6 during the 1982 fishing season (Fig. 15).

#### Logbooks

The total landings from logbooks of all 7 of the area 6 fishermen who fished during 1982 amounted to 63,133 kg, as opposed to the 63,072 kg recorded through the Area Managers' statistics system. Four licensed snow crab fishermen from area 6 did not set their traps in 1982.

CPUE declined slowly through the 1982 fishing season (Table 8; Fig. 16); a similar CPUE pattern has been observed each year since 1979. CPUE values dropped under 10 kg.trap haul<sup>-1</sup> for the first time since the fishery opened, and the overall mean CPUE value for the season (9.77 kg.trap haul<sup>-1</sup>) was 63% below the 1981 value of 15.46 kg.trap haul<sup>-1</sup>. In a Leslie analysis of 1982 logbook data, a linear regression through all data



points gives an estimate of total available biomass ( $B_0$ ) of 175.0 MT (95% confidence limits: 125.0 and 346.8 MT). Given this value for  $B_0$ , the 1982 catch of 63.1 MT and assuming no in-season growth and recruitment, an exploitation rate of 36% (95% confidence limits: 50% and 18%) is indicated. Similarly, by subtraction of the total catch from  $B_0$ , 111.9 MT (95% confidence limits: 61.9 and 283.7 MT) of commercial crab is estimated to have remained on the fishing grounds at the end of the 1982 season. In comparison, 15.4 MT (95% confidence limits: 7.9 and 41.6 MT) was estimated to remain on the grounds at the end of the 1980 season.

#### Note: Leslie Analysis

The Leslie estimates of biomass for areas 3, 5, and 6 should be viewed with caution as it is probable that, when a stock is reduced beyond a critical level, fishing patterns and the dispersed, low density of the resource lead to a depressed but generally uniform CPUE throughout the fishing season. Such a trend in CPUE can produce an excessive value for  $B_0$  when data are analyzed by the Leslie technique (Mohn and Elner, unpublished computer model).

#### Discussion

In 1982, CAFSAC determined, given the low catch rates prevailing in areas 2-6, the resultant scanty data produced for assessment purposes, and limitations in the assessment techniques themselves, that provision of advice to management on annual TAC levels was not feasible. Certainly, the assessments for the 1982 season do not appear cause for change in CAFSAC's decision and thus, there appears no rationale for re-introducing catch controls for the 1983 season.

Overall, the 1982 stock status for areas 2-6 appears similar to the depressed state noted in 1981 in that no major pulses of growth and recruitment were detected in the system. However, the significant increase in price paid for snow crab created a large increase in effort which resulted in a corresponding increase in landings, notwithstanding the fact that mean CPUE remained low compared to historical levels.

Although (given the sparsely distributed stocks and poor statistics) our assessments are at the boundaries of feasibility, it appears unlikely that even the present CPUE can be retained in the face of sustained high effort levels and the continued absence of major growth and recruitment. The 1982 fishery was made viable only by a fortuitous increase in world market demand for crab.\* The future of the snow crab fishery on the Atlantic coast of Cape Breton Island will depend on the world market situation and recruitment patterns; with the present CPUE levels, a decrease in the price paid to fishermen could lead to a virtual abandonment of the fishery.

\*Due largely to a collapse of the Alaskan king and tanner crab fisheries.

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Table 1. Snow crab statistics for the Atlantic coast of Cape Breton Island, 1978-82.

Area	Year	No. of boats licensed	Kg landed (logbooks)	Kg landed (Area Mgr's statistics)	Effort in traps hauled from logbook (trap type)	CPUE (kg/trap haul)
2&3	1978	36	192,228	-	17,258 (1.2 x 0.9 x 0.8 m)	11.14
	*1979	48	262,250	293,106	25,660 ( " )	10.22
	*1980	48	181,033	186,605	17,499 ( " )	10.34
	1981	49	816	35,910	32 (1.5 x 1.5 x 0.5 m)	25.50
	*1982	49	100,161	-	13,971 (1.2 x 0.9 x 0.8 m)	7.17
4	1979	38	507,569	624,029	10,546 (1.5 x 1.5 x 0.5 m)	48.13
	1980	38	39,800	181,241	827 ( " )	48.13
	1981	37	6,545	61,476	315 ( " )	20.78
	**1982	37	91,377	-	2,875 ( " )	31.78
5	1978	15	250,076	-	4,531 ( " )	55.19
	1979	25	682,731	679,504	14,747 ( " )	46.30
	1980	26	324,786	395,855	7,341 ( " )	44.24
	1981	25	81,819	90,463	2,835 ( " )	28.86
	1982	25	298,469	-	8,848 ( " )	33.73
6	1979	8	27,351	24,868	1,880 ( " )	14.55
	1980	11	69,136	58,586	5,246 ( " )	13.18
	1981	11	20,350	15,896	1,316 ( " )	15.46
	1982	11	63,133	-	6,462 ( " )	9.77
Total	1978	51	442,304	-	21,789 (all trap types combined)	-
	1979	119	1,479,901	1,621,507	52,833 ( " )	-
	1980	123	614,755	822,287	30,913 ( " )	-
	1981	122	109,530	203,745	4,498 ( " )	-
	1982	122	553,140	-	32,152 ( " )	-

\*The logbook estimates include some boats from area 4 which fished the area immediately adjacent to area 3.

\*\*These estimates are for boats that fished in area 4 away from area 3.

Table 2. Snow crab statistics for Cape Breton Island, 1982.

Area	No. of boats licensed	No. of boats* active (Area Mgr's statistics)	No. of logbooks received	Kg landed (Area Mgr's statistics)	Kg landed (logbooks)	Fishing season
2	13	-	-	-	-	22/7-15/9
3	36	20	18	86,814	75,295	22/7-15/9
4	37	21	20	165,395	116,243	22/7-29/7 & 3/9-15/10
5	25	19	18	300,145	298,469	22/7-15/9
6	11	7	7	63,072	63,133	1/8-30/9
Total	122	67	63	615,426	553,140	-

\*Boats reporting snow crab landings or otherwise known to have fished snow crabs during 1982.

Table 3. Catch and effort statistics from logbook data for the snow crab fishery in area 3 and part of 4, 1982.

Week period	Trap hauls			Catch (kg)	Cumulative catch (kg)	CPUE kg/trap haul (wooden traps)	Estimated biomass (MT)
	Steel traps (1.5x1.5x0.5 m)	Conical and wooden traps (1.2x0.9x0.8 m)	All traps converted into wooden traps				
22/7-28/7		1,668	1,668	18,517	9,258.5	11.10	147.4
29/7-4/8	15	1,809	1,829	16,916	26,975.0	9.25	122.8
5/8-11/8	202	3,186	3,806	27,785	49,325.5	7.30	96.9
12/8-18/8	221	2,352	2,708	17,981	72,208.5	6.64	88.2
19/8-25/8	208	1,862	2,361	12,086	87,242.0	5.12	68.0
26/8-1/9	212	445	831	4,032	95,301.0	4.85	64.4
2/9-8/9	78	140	336	1,307	97,970.5	3.89	51.6
9/9-15/9	145	108	432	1,537	99,392.5	3.56	47.3
Total	1081	11,570	13,971	100,161	100,161.0	-	-

Table 4. Catch and effort statistics from logbook data for the snow crab fishery in area 4, 1982 (not including data from area 4 boats which fished adjacent to or in area 3).

Week period	Steel traps (1.5x1.5x0.5 m)	Catch (kg)	CPUE (kg/trap haul)
22/7-28/7	622	30,088	48.37
2/9-8/9	448	16,298	36.38
9/9-15/9	594	21,386	36.00
16/9-22/9	437	9,343	21.38
23/9-29/9	387	9,020	23.31
30/9-6/10	297	4,083	13.75
7/10-13/70	90	1,159	12.88
Total	2,875	91,377	-

Table 5. Catch and effort statistics from logbook data for the snow crab fishery in area 5, 1982.

Week period	Steel traps (1.5x1.5x0.5 m)	Conical traps	All traps converted into steel traps	Catch (kg)	Cumulative catch (kg)	CPUE (kg/trap haul)	Estimated biomass (MT)
22/7-28/7	666	244	746	32,386	16,193.0	43.41	653.1
29/7-4/8	1,146	248	1,257	47,190	55,981.0	37.53	564.7
5/8-11/8	1,200	320	1,345	52,854	106,003.0	39.30	591.3
12/8-18/8	1,132	299	1,251	43,810	154,335.0	35.01	526.8
19/8-25/8	1,412	313	1,542	51,652	202,066.0	33.49	503.9
26/8-1/9	769	165	836	27,449	241,616.5	32.83	494.0
2/9-8/9	735	143	825	20,229	265,455.5	24.53	369.1
9/9-15/9	905	234	1,046	22,899	287,019.5	21.89	329.3
Total	7,965	1,966	8,848	298,469	298,469.0	-	-

Table 6. Tag returns from the snow crab fishery in area 5, 1982.

Week period	No. of tag returns	Cumulative recaptures	Effort (trap hauls)	No. recapture/effort
22/7-28/7	206	103	746	0.276
29/7-4/8	142	277	1,257	0.113
5/8-11/8	147	421.5	1,345	0.109
12/8-18/8	108	549	1,251	0.086
19/8-25/8	80	643	1,542	0.052
26/8-1/9	79	722.5	836	0.094
2/9-8/9	33	778.5	825	0.040
9/9-15/9	129	859.5	1,046	0.123
Total	924	924	8,848	-



Table 7. Survival and mortality estimates for tagging study in area 5, 1982.

Estimates	Total no. of tagged crab returns
Initial number marked: (M)	1958
Mortality (No.) from marking: (X) (rate observed experimentally during tagging)	392 (.20)
Actual number marked: (M-X)	1566
Apparent number marked (M') (limits of confidence at P=.05)	1105 (777-21432)
Number recaptured: (R)	924
Rate of fishing: (R/M-X)	59%
Estimated rate of fishing: (R/M') (from Leslie regression)	84% (119%-4%)
Estimated number remaining: (M'-R)	181
Survival rate ( $S' = M'-R/M-X$ )	0.12
Instantaneous rate of total mortality ( $X' = -\ln S'$ )	-2.16
Disappearance (No.) from other causes ( $X' = M-X-R-(M'-R)$ )	461
Rate of disappearance from other causes ( $X'/M-X$ )	0.29

Table 8. Catch and effort statistics from logbook data for the snow crab fishery in area 6, 1982.

Week period	Steel traps (1.5x1.5x0.5 m)	Catch (kg)	Cumulative catch (kg)	CPUE (kg/trap haul)	Estimated biomass
29/7-4/8	512	5,684	2,842	11.10	161.5
5/8-11/8	930	11,102	11,235	11.94	173.8
12/8-18/8	840	9,345	21,458.5	11.13	162.0
19/8-25/8	1,233	10,616	31,439	8.61	125.3
26/8-1/9	771	7,698	40,596	9.98	145.2
2/9-8/9	773	6,535	47,712.5	8.45	123.0
9/9-15/9	729	7,206	54,583	9.88	143.8
16/9-22/9	551	4,111	60,241.5	7.46	108.6
23/9-29/9	123	836	62,715	6.82	99.3
Total	6,462	63,133	63,133	-	-

Fig. 1. 1982 Cape Breton Island snow crab fishing areas and landings.

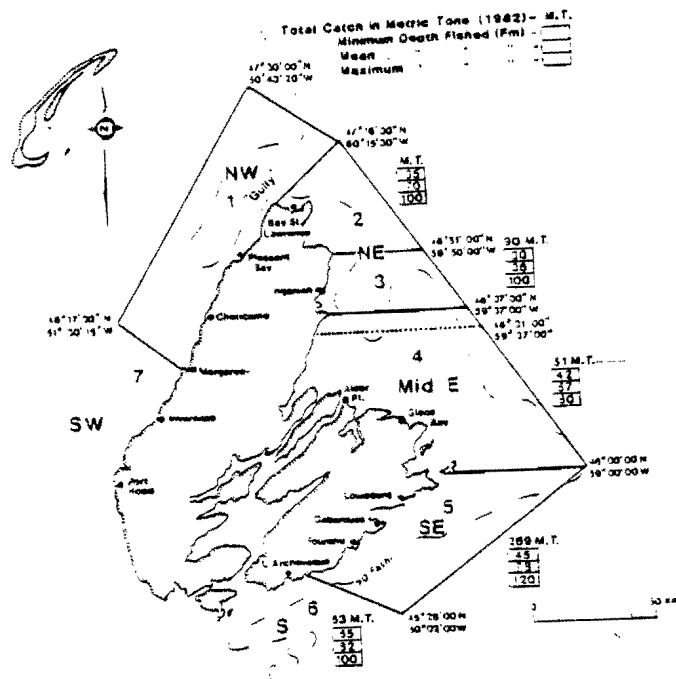


Fig. 2. Distribution of snow crab fishing effort on the Atlantic side of Cape Breton Island during the 1982 season, as derived from logbook grid map data.

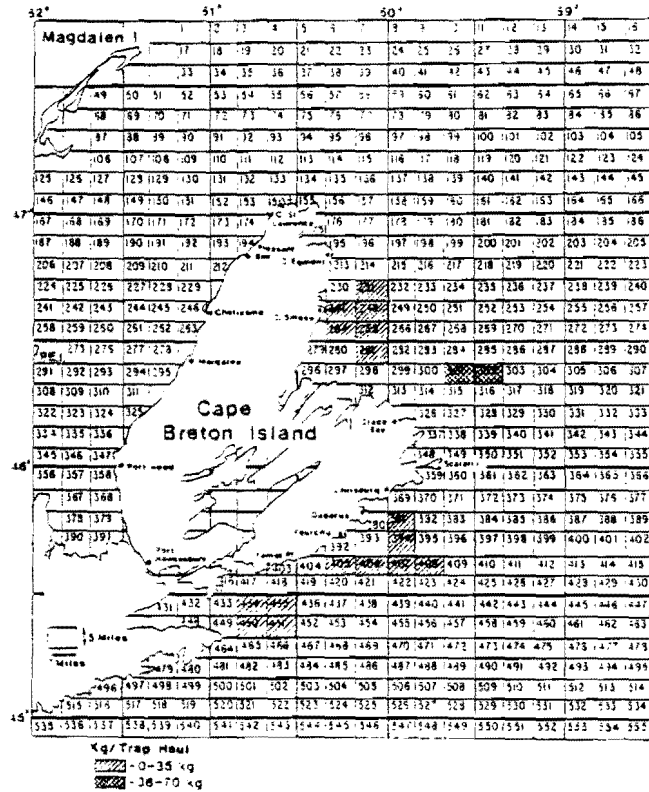


Fig. 3. Leslie graph of cumulative weekly landings against CPUE, from logbook data, for area 3 and part of area 4 in 1982.

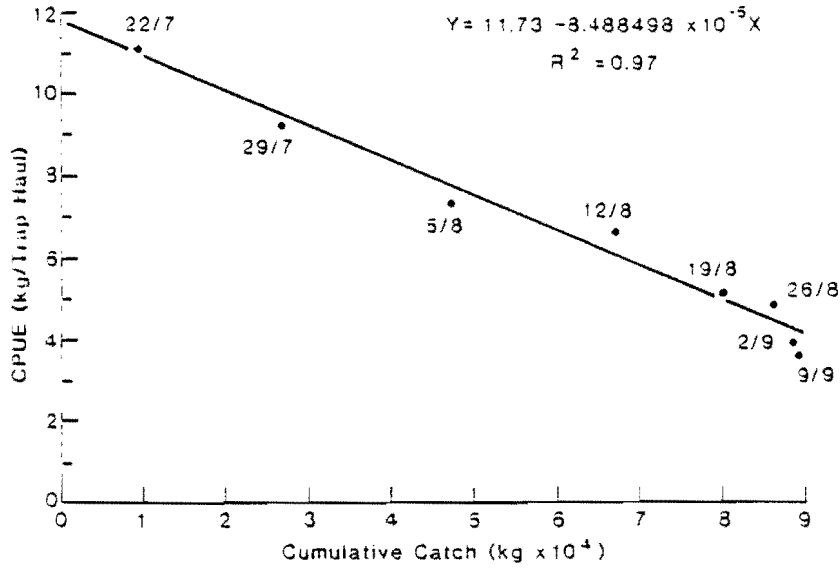


Fig. 4. Size-frequency histogram for landed male snow crabs sampled in area 3, September 1982.

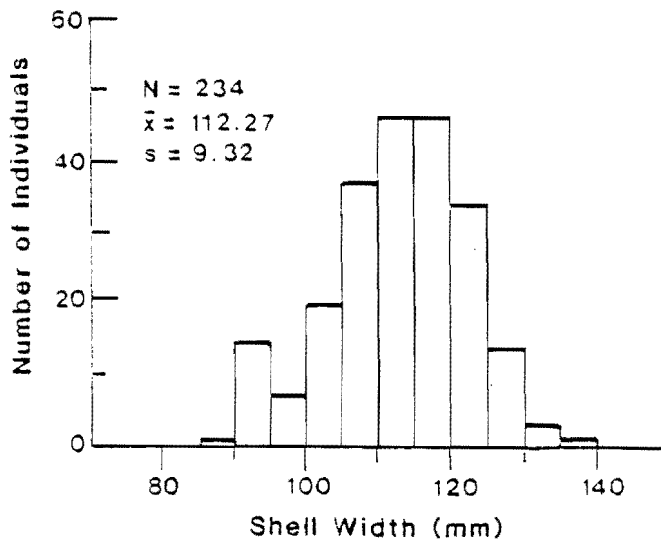


Fig. 5. Size frequency of male snow crabs tagged and recaptured during the 1982 fishing season in area 4.

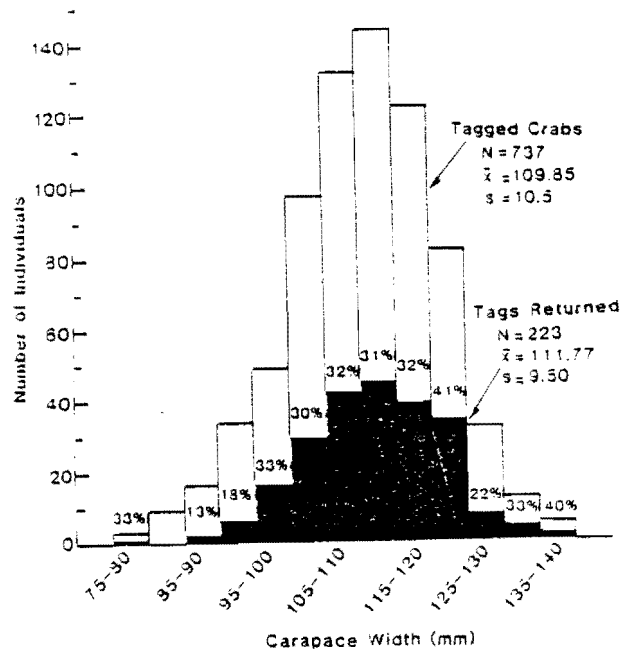


Fig. 6. Size frequency and shell state of male snow crabs sampled at sea in area 4, August 13-25, 1982.

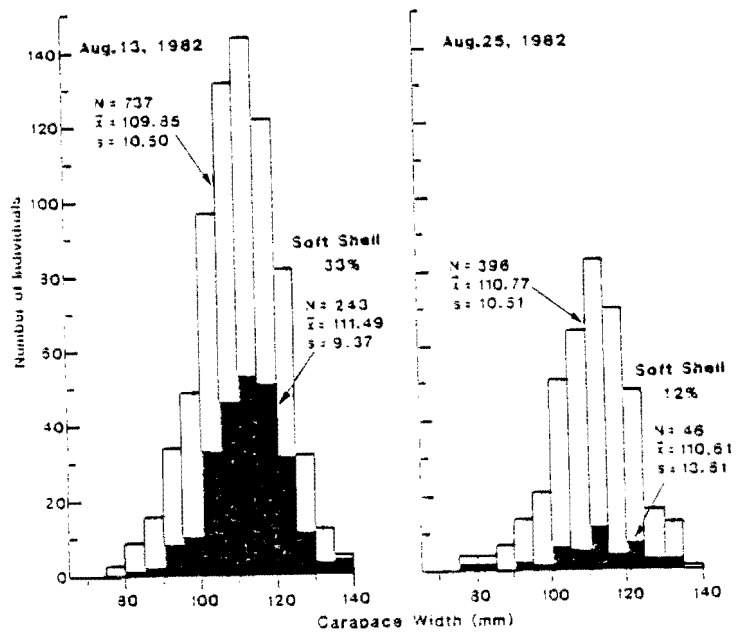


Fig. 7. Size frequencies for male snow crabs sampled from commercial boats in area 5 during the 1982 fishing season.

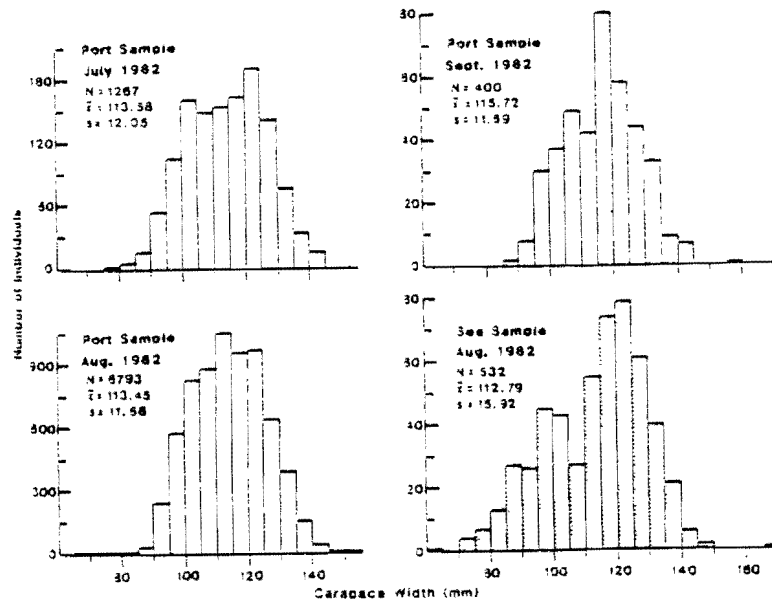


Fig. 8. Historical monthly mean carapace widths for male snow crabs from in-port and at-sea sampling of commercial catches in area 5.

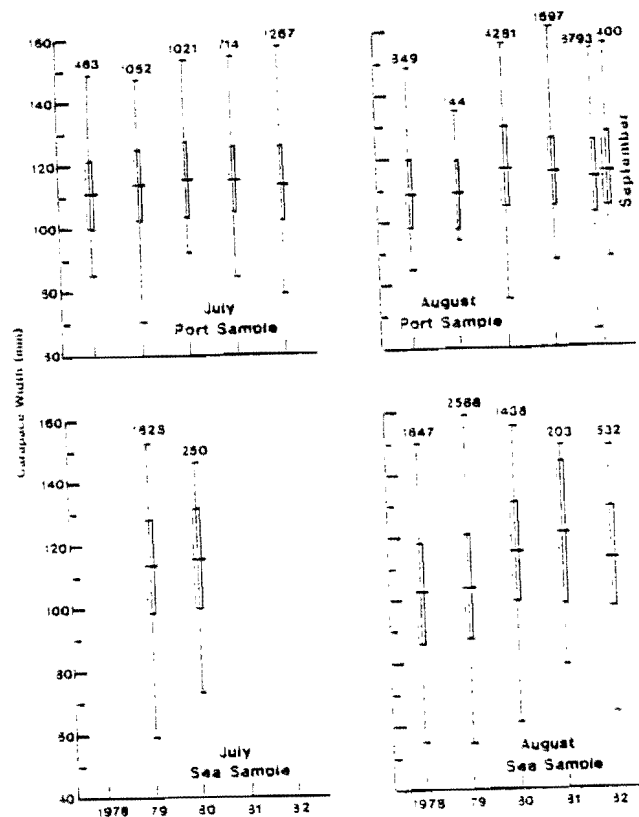


Fig. 9. Percentage frequency of occurrence of shell states throughout the 1982 fishing season in area 5.

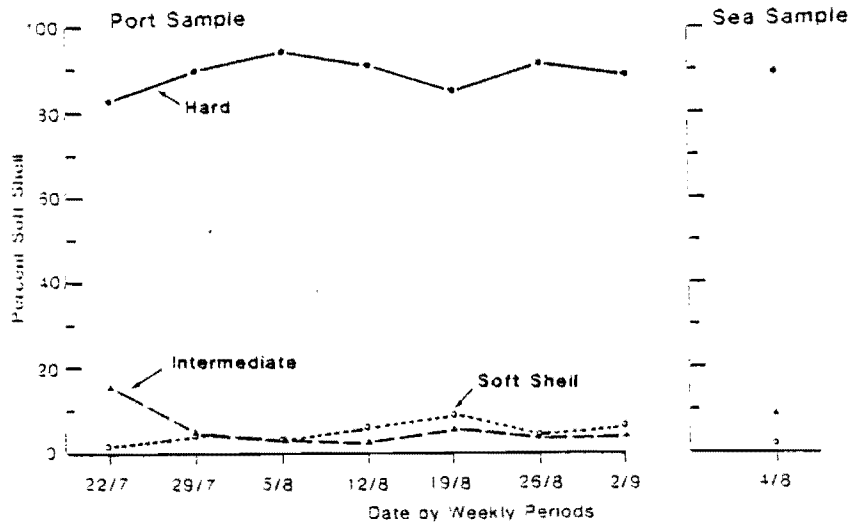


Fig. 10. Leslie graph of cumulative weekly landings against CPUE, from logbook data, for area 5 in 1982.

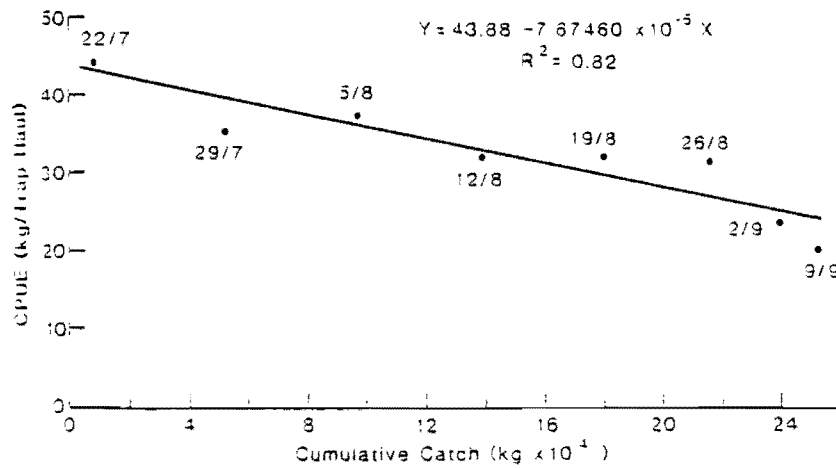




Fig. 11. Historical trends of CPUE against cumulative catch in area 5 from logbook data.

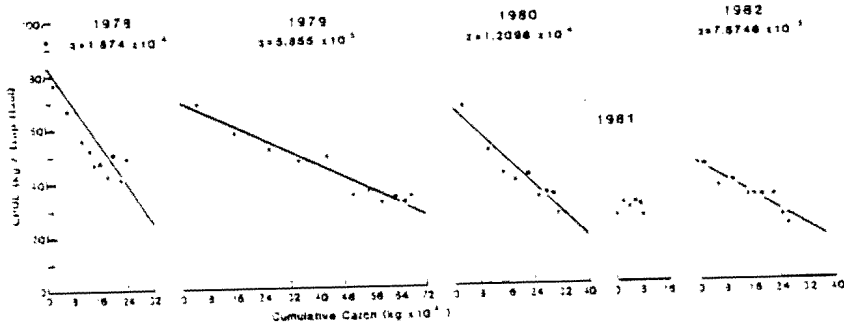


Fig. 12. Size frequency of male snow crabs tagged in 1982 and recaptured during the 1982 fishing season in area 5.

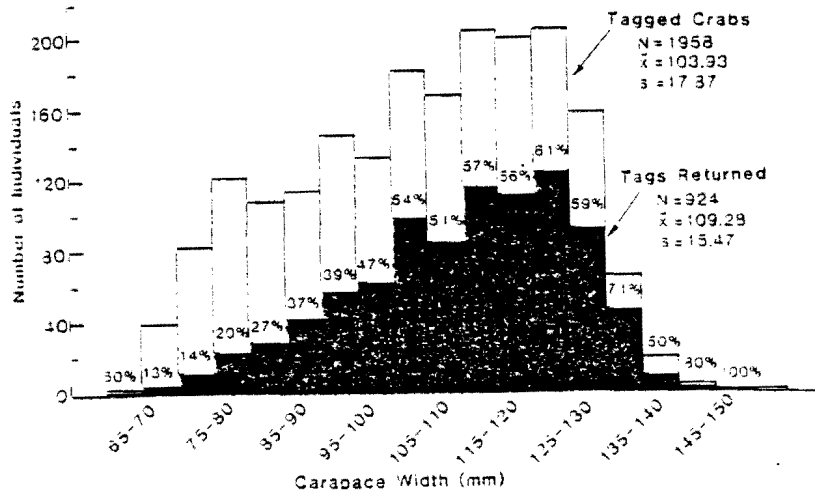


Fig. 13. Leslie graph of weekly tag returns against tag returns/unit of effort in area 5 in 1982.

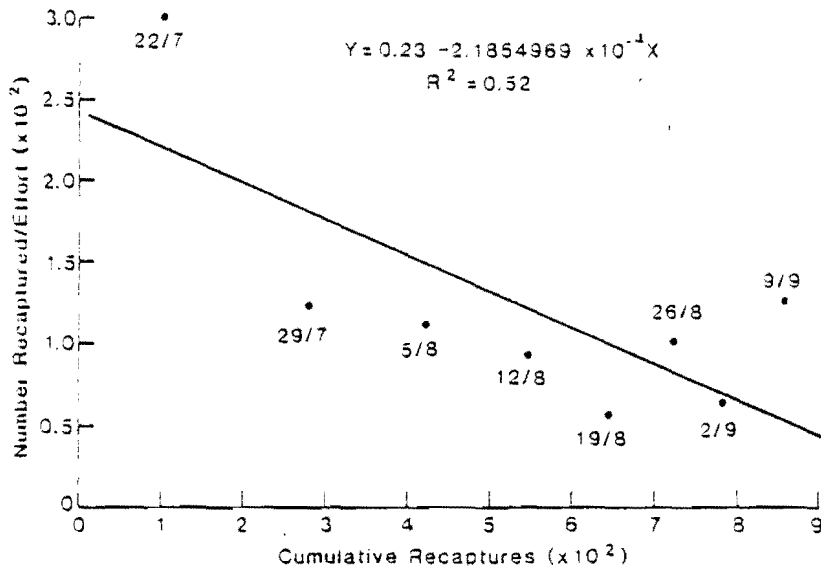


Fig. 14. Information on snow crab growth from crabs tagged in area 5 and returned in 1982.

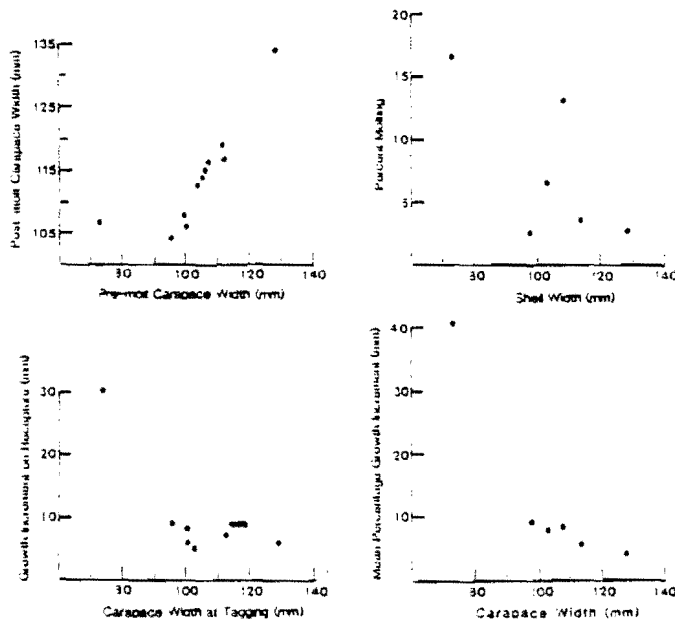


Fig. 15. Size-frequency histogram for landed male snow crabs sampled in area 6 during the 1982 fishing season.

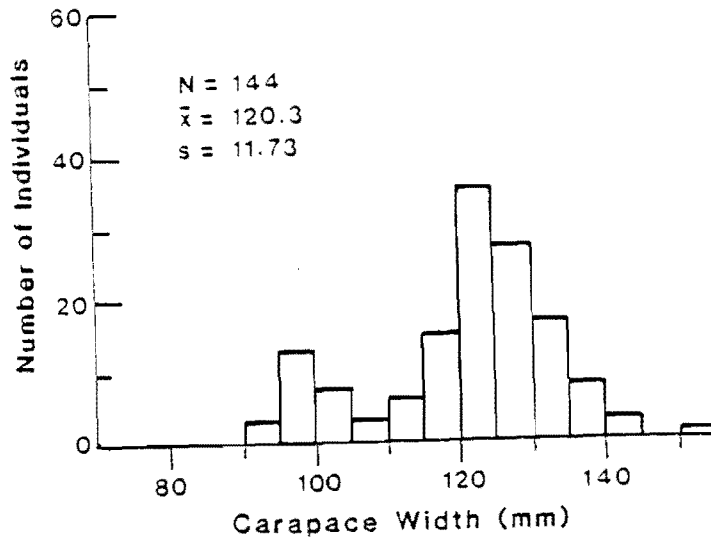


Fig. 16. Leslie graph of cumulative weekly landings against CPUE, from logbook data, for area 6 in 1982.

