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Assessment of the fishery for snow crab off the  
Atlantic Coast of Cape Breton Island in 1985

by

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## Abstract

Biological monitoring data (based upon fishermen's logbooks, sales slip statistics, commercial and research catch sampling) were examined for the Cape Breton Island (Atlantic coast, areas 2-6) snow crab fishery in 1985. Assessments for each stock were made by comparison of the monitoring data against historical patterns. Assessment data since 1978 show that the snow crab fisheries in areas 2-6 are based on a resource which has a low productivity and that the accumulated virgin biomass has been drastically reduced by fishing. Management dropped catch controls for the fishery in 1982 to allow existing fishermen to take advantage of whatever productivity occurs from time to time on an opportunistic basis. The minimum legal size (95 mm, carapace width) has been hypothesized to confine exploitation to mature males that have had 1-3 years to mate, and, thus, the reproductive potential of the resource has been believed to be protected.

The overall status of stocks in areas 2-6 in 1985 appears a continuation of the collapsed state noted in previous years. No major pulses of growth and recruitment were detected in any of the commercial stocks during the fishing season. A continuing strong market demand for snow crab failed to maintain effort; consequently, reduced fishing effort coupled with low catch rates resulted in severely curtailed landings. Only 25 vessels out of a potential 120 were active and their recorded catch (84 mt) fell to 60% of the 1984 value (51 vessels: 141 mt) and 27% of the 1983 value (97 vessels: 307 mt). Stock dynamics and/or lack of logbooks precluded use of Leslie analysis to estimate biomass or exploitation rate for any area in 1985.

No fishing activity was reported either in area 2 or the offshore grounds in area 4. Landings of 13.5 mt were recorded in area 3. Logbooks received from all 10 active vessels in area 3 showed total landings of 12.7 mt. Logbooks from all 4 of the vessels active in area 4 recorded total landings of 568 kg, as opposed to 406 kg recorded by sales slips. Mean CPUE ( $3.94 \text{ kg} \cdot \text{trap haul}^{-1}$ ) was close to the mean of  $3.05 \text{ kg} \cdot \text{trap haul}^{-1}$  recorded in 1984.

In area 5, total recorded landings were 29 mt, a decline from 45 mt in 1984. Logbooks from all 5 active vessels showed landings of 20.8 mt. The mean CPUE of  $14.22 \text{ kg} \cdot \text{trap haul}^{-1}$  was below that of 1984 ( $17.68 \cdot \text{trap haul}^{-1}$ ) and the lowest experienced in this area. Although commercial catch sampling and logbooks did not indicate any growth or recruitment, Danish seiners caught quantities of pre-recruit snow crabs in area 5, in July. However a research survey in area 5 in November failed to capture prerecruits. Data from area 5 show a declining incidence of ovigerous females from 96% in July to 77% in November. This parallels a similar phenomenon noted in 1984 and indicates that female fecundity decreases as the brooding period progresses. In addition, 75% of 167 ovigerous females sampled in November appeared to have reduced clutch sizes.

Logbooks recording catches of 32.2 mt were received from 5 out of 6 vessels that fished in area 6. CPUE remained stable through the fishing season around a mean of  $10.21 \text{ kg} \cdot \text{trap haul}^{-1}$ , a similar pattern was observed in 1984 with a mean of  $9.61 \text{ kg} \cdot \text{trap haul}^{-1}$ . The 1985 assessments for areas 2-6 do not appear cause for change in current management strategy. Thus, there appears no rationale for reintroducing

catch controls in the 1986 season. For the future, it appears unlikely that even the present effort and marginal catch rates can be retained in the continued absence of major growth and recruitment. A decrease in price for snow crab could lead to an abandonment of the fishery; on the other hand a continued lack of production must lead to the practical extinction of both resource and fishery.

### Résumé

On a examiné des données d'évaluation biologique (tirées des registres de pêche des pêcheurs, des statistiques sur les bordereaux d'achat, d'échantillonnages de prises commerciales et d'échantillonnages scientifiques) pour la pêche du crabe des neiges à l'île du Cap-Breton en 1985 (Côte atlantique, secteurs 2-6). On a évalué chaque stock en comparant les données d'évaluation avec les données historiques. Les données d'évaluation obtenues depuis 1978 révèlent que les pêches de crabe des neiges dans les secteurs 2-6 reposent sur une ressource qui connaît une faible productivité, et que la biomasse vierge accumulée a été radicalement réduite par la pêche. La gestion a levé les contrôles sur les prises pour la pêche en 1982 afin de permettre aux pêcheurs actuels de tirer profit des hausses de productivité qui peuvent se produire sporadiquement. On a posé comme hypothèse la taille légale minimale (largeur de carapace de 95 mm) pour limiter l'exploitation aux mâles matures ayant disposé de un à trois ans pour s'accoupler, et on pense ainsi avoir protégé le potentiel reproductif de la ressource.

La situation générale des stocks dans les secteurs 2-6 en 1985 ne semble pas s'être rétablie de l'état d'épuisement constaté lors des années précédentes. On n'a remarqué aucun signe de croissance et de recrutement important dans les stocks commerciaux pendant la saison de pêche. Une demande commerciale forte et constante de crabe des neiges n'a pas réussi à maintenir l'effort de pêche. En conséquence, l'effort de pêche réduit associé au faible taux de prise ont donné lieu à une diminution considérable des débarquements. Seuls 25 d'un total possible de 120 bateaux ont participé à la pêche et leurs prises (84 tm) n'ont atteint que 60 % du total de 1984 (51 bateaux : 141 tm) et 27 % de celles de 1983 (97 bateaux : 307 tm). La dynamique des stocks et le manque de registres de pêche ont écarté la possibilité d'utiliser l'analyse de Leslie pour évaluer la biomasse ou le taux d'exploitation dans les secteurs en 1985.

On n'a signalé aucune activité de pêche dans le secteur 2 et dans les zones hauturières du secteur 4. On a enregistré des débarquements de 13,5 tm dans la zone 3. Les registres de pêche reçus des 10 bateaux ayant participé à la pêche dans la zone 3 font état de débarquements totaux de 12,7 tm. Les registres de pêche reçus des quatre bateaux en activité dans la zone 4 indiquent des débarquements globaux de 568 kg alors que les bordereaux d'achat font état de 406 kg. Le taux de prise par unité d'effort moyen (3,94 kg par trait de casier <sup>-1</sup>) se rapproche de la moyenne de 3,05 kg par trait de casier <sup>-1</sup> enregistré en 1984.

Dans la zone 5, les débarquements globaux enregistrés s'élèvent à 29 tm alors qu'ils atteignaient 45 tm en 1984. Les registres de pêche des cinq bateaux en activité donnent des débarquements de 20,8 tm. Le taux de prise moyen par unité d'effort de 14,22 kg par trait de casier <sup>-1</sup> est inférieur à celui de 1984 (17,68 kg par trait de casier <sup>-1</sup>) et constitue le taux le plus bas jamais connu dans ce secteur. Bien que les registres de pêche et les échantillonnages des prises commerciales n'aient révélé aucune croissance et aucun recrutement, des pêcheurs à la senne danoise ont pris en juillet des quantités de crabe des neiges prérecrues dans la zone 5. Cependant, aucune prérecrue n'a été capturée lors d'un recensement effectué dans la zone 5 en novembre. Les données recueillies dans la zone 5 indiquent que la présence de femelles ovigères a chuté de 96 % en juillet à 77 % en novembre. Le même phénomène s'est produit en 1984, ce qui indique qu'il y a baisse de fécondité à mesure qu'avance la période de production des oeufs. De plus, on a constaté que chez 75 % des 167 femelles ovigères échantillonnées en novembre, la masse d'oeufs semble être plus petite.

Des registres de pêche faisant état de prises de 32,2 tm ont été reçus de cinq des six bateaux en activité dans la zone 6. Le taux de prise par unité d'effort est demeuré stable pendant toute la saison de pêche, soit d'environ 10,21 kg par trait de casier <sup>-1</sup>. On a observé une tendance similaire en 1984 avec des prises moyennes par unité d'effort de 9,61 kg par trait de casier <sup>-1</sup>. Les évaluations de 1985 dans les zones 2 à 6 ne semblent pas justifier l'apport de modifications à la stratégie de gestion actuelle. En conséquence, il ne semble avoir aucune raison de rétablir de contrôles sur les prises pour la saison de 1986. Pour ce qui est de l'avenir, il semble peu probable qu'on puisse maintenir l'effort de pêche et les taux de prise actuels, aussi faibles qu'ils soient, à cause du faible taux de croissance et de recrutement. Une diminution dans le prix du crabe des neiges pourrait donner lieu à l'abandon de cette pêche. Par contre, un manque de production persistant mènera inévitablement à l'extinction de la ressource et de la pêche.

## Introduction

The directed inshore fishery for snow crab off Cape Breton Island was started in 1966 off the northwest coast. 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. 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 (Elner 1982b). One hundred and fifty inshore snow crab licenses were issued in 1981. Additionally, 28 licenses were allotted for inshore boats to fish area 7 off the SW coast. Area 7 was open to the New Brunswick and Quebec offshore crab fleets until 1980.

By 1982 it became apparent that the snow crab fishery on the Atlantic coast of Cape Breton Island (areas 2-6, Scotia-Fundy Region) is based on a resource which has a low productivity and that the accumulated virgin biomass had been drastically reduced by fishing. In contrast, on the Gulf of St. Lawrence coast of the Island (areas 1 and 7, Gulf Region) larger production levels have conferred relative stability to the commercial biomass and landings (Elner 1982a; Davidson et al. 1985). 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 to allow existing fishermen to take advantage of whatever productivity occurs from time to time on an opportunistic basis. The minimum legal size regulation (95 mm carapace width, CW) confined exploitation to mature males that had 1-3 yr to mate, thus, theoretically protecting the reproductive potential of the resource (Elner and Robichaud 1983a; Elner and Gass 1984 ).

The present paper assesses the status of the snow crab fishery in areas 2, 3, 4, 5, and 6 for 1985.

## Methods

Cape Breton Island snow crab fishermen have been required to maintain logbooks for each fishing season since 1978. The logbooks from the 1985 season were analysed to provide catch, effort and CPUE data for each area (Area 2-6) over time. In 1985, in contrast to previous years, Leslie analyses of catch and effort data to estimate exploitation rates and biomass were not possible for any area because of catch rate dynamics and or lack of logbook returns. Data from sales slips provided supplementary landing statistics and also served to check logbook coverage. To improve trap location information given in logbooks, fishermen have been provided large-scale grid charts since 1983 and requested to indicate the grid number(s) corresponding to their fishing area(s). (For more detailed accounts of snow crab logbook format and Leslie analysis see Elner (1982b)).

Port and at-sea sampling was carried out on an opportunistic basis throughout the fishing season in area 3 and 5 to monitor the size-frequency distribution and shell-hardness profile of commercial catches. Snow crab size was determined by measurement of carapace width (CW) across the widest part of the carapace; shell hardness was assessed subjectively as "hard", "intermediate" or "soft" on the basis of manual pressure applied across the chela. Manpower and resource shortages precluded sampling in area 2, 4 and 6.

Whenever possible chela width (Fig. 11) was recorded, in addition to CW, for male snow crabs sampled, to further continue research into morphometrics and size at maturity. Conan and Comeau (1986) and O'Halloran (1985) detailed the relationship between chela allometry and maturity.

A research cruise, from a commercial vessel under charter, was conducted in November 1985, to: 1) monitor the reproductive condition of female snow crabs in area 5; and 2) attempt to relocate a concentration of pre-recruits that were sampled previously from the by-catch of a Danish seiner in July.

We recorded recoveries of tagged male and female snow crabs in area 5 during 1985. These crabs were marked and released in previous years as part of longer-term studies into snow crab movement, growth and reproductive biology.

The status of snow crab stocks in area 2, 3, 4, 5 and 6 for 1985 was assessed on the basis of fishermen's logbooks, sales slips, commercial and research catch sampling as well as historical monitoring data.

## Results

The 1985 fishing season extended between July 22-September 15 for areas 2, 3, 4, and 5, and August 1-September 31 for area 6. The distribution of fishing effort and average CPUE for each grid square from logbook data in 1985 is shown in Fig. 2. A summary of snow crab landings, effort statistics, and assessment estimates for each area since 1978 is presented in Tables 1 and 2.

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

### Port and at-sea sampling

Due to shortages in our resources, port samples were taken only in area 3. Size frequency histograms (Fig. 3) indicate that the mean CW of landed crabs was similar in July and August 1985 (112 and 109 mm, respectively) to July and August 1984 (111 and 109 mm, respectively). No data were taken on shell hardness, however, fishermen and processors gave no indication of problems with soft-shelled crabs.

### Logbooks

Ten (10) fishermen were active in area 3 and only four (4) fishermen fished in area 4. Logbooks were received from all four (4) area 4 fishermen fishing in or adjacent to area 3 and from all ten (10) area 3 fishermen (Table 3). No area 4 fishermen fished in the offshore areas as in previous years (Elner and Robichaud 1985). Landings from sales slips for areas 3 and 4 were 13,537 kg and 406 kg, respectively. No fishermen were reported active in area 2.

The general dearth of catch and effort data precluded generation of exploitation rate and biomass estimates by Leslie analysis. The mean catch rate in area 3 (Table 3) is similar to 1984 and reflects the depressed state of the fishery noted in previous years (Tables 1 and 2).

## Area 5 (southeast Cape Breton)

### Port and at-sea sampling

Size-frequency histograms from port sampling during July and August and at-sea sampling during July and November (post-season charter) are shown in Fig. 4. Mean CW's from port sampling appeared stable through the fishing season. Figure 4 also shows a bimodal distribution with peaks at approximately 90 and 115 mm CW. Catch size-frequency distributions since 1978 are compared in Fig. 5.

The presence of intermediate-shell state crabs, as determined from port sampling at the beginning of the fishing season (Fig. 6), suggests that molting could have occurred just prior to the 1985 fishing season. However, we believe the phenomenon could be due to the initial lack of experience of the port samplers in subjectively judging shell hardness. Since soft-shell crabs were not found during the fishing season (Fig. 6) it appears that no in-season growth and recruitment occurred. [Such has been the case in area 5 since 1978 (Elner 1982b; Elner and Robichaud 1983b; Elner and Robichaud 1984; Elner and Robichaud 1985)].

### Logbooks

Logbooks were received from all five (5) area 5 fishermen who set traps in 1985. Total landings derived from logbooks were 20,833 kg, as compared to 29,171 kg from sales slips statistics (Table 2). After the first four weeks of the 1985 snow crab fishing season three (3) of the five (5) fishermen stopped trapping because of low catch rates. The remaining two (2) fishermen made their operations more profitable by fishing alone from smaller boats and using Japanese conical traps. In addition, they were catching their own bait to further reduce costs. The area 5 snow crab stock has suffered a prolonged recruitment failure with yields far exceeding production and the stock must still be considered collapsed. However, according to a sea sample taken during the second week of July by a Danish seiner (Fig. 2 and 7) there is a pulse of small, pre-recruit crabs that may eventually recruit into the fishery. The crabs were caught on commercial snow crab fishing grounds, on muddy bottom at approximately 120 m. The mean size of the males in the sample was 58.5 mm (Fig. 7). Based on this mean, according to Robichaud (1985), it would take at least two-years and two to three molts for the crabs to attain commercial size (95 mm). Nevertheless, based on a single sample, it is impossible to determine the actual magnitude of the potential recruitment. (The charter vessel in November trapped over the adjacent grounds but failed to capture any pre-recruits.)

Mean CPUE fluctuated through the 1985 fishing season (Table 5). The overall mean CPUE value for the season ( $14.2 \text{ kg} \cdot \text{trap haul}^{-1}$ ) dropped below mean values estimated for previous years (Table 2). Landings in 1985, according to sales slips, were 35% lower than the previous all time low for 1984 (46.2 mt) landings (Fig. 8). Landings and effort further decreased in 1985 despite higher prices [ $\$0.77/\text{lb}$  ( $\$1.69/\text{kg}$ )] than in 1984: [ $\$0.65/\text{lb}$  ( $\$1.43/\text{kg}$ )].

### Tagging (growth and reproduction studies)

With the collapse of the Atlantic coast of Cape Breton snow crab stocks we have shifted emphasis from annual stock monitoring and assessment programs to longer-term, basic research into the biological basis of stock/recruitment dynamics. Hence, mark-recapture techniques are being utilized

to elucidate growth and reproduction biology rather than provide biomass estimates. The following summarizes aspects of the longer-term tagging data for 1985:

Four (4) and thirteen (13) male snow crabs marked with t-bar tags and released in 1982 and 1983, respectively, were recaptured during the 1985 fishing season in area 5 (Table 4). Of the nine crabs measured (range: 99-127 mm CW) for the 1983 returns and the four crabs measured (range: 80-121 mm CW) for the 1982 returns, none had grown. Of 504 mature females tagged with t-bar tags during September 1984, only two (67 and 72 mm CW) were recaptured during August of the 1985 fishing season; both females were carrying new orange eggs. They must have hatched the 1984 brood (orange at tagging) and extruded a new egg batch in 11 month intervening between release and recapture.

Two hundred and thirty-three (233) male and 217 mature female snow crabs were trapped during a post-fishing season charter in November 1985 (Figs. 4 and 8). In the sample, 23% (50) of the females trapped were barren (Fig. 9). There appeared no relationship between female size and barren state (Fig. 9). The percentage of barren females is the same as obtained for an at-sea sample obtained in area 5 in September, 1984. In November 1985, 75% of the 167 ovigerous females appeared to have reduced clutch sizes: We estimated that, 14% of the berried females had 70-90% of their eggs remaining, 34% had 20-70% of their eggs remaining and 26% had < 20% of their eggs remaining. In addition, most of the females had old, heavily fouled carapaces; many had missing appendages. Only three (3) of the 217 were judged, from their shell condition, to be primiparous. Elner and Robichaud (1983a) noted a reduction in ovigerous female incidence (to 90%) in area 5 for July 1983; the 1985 data appears to confirm a trend for decreasing egg incidence (Fig. 10). However, an at-sea sample taken in July 1985 showed that 94% of the females were ovigerous, an increase over samples taken at the same time of year in 1983. Since the November 1985 sample shows the same percentage of ovigerous females (77%) as in September 1984 we are probably observing a seasonal trend, with ovigerous females losing their eggs as the brooding season progresses. In-depth analyses of reproduction data are underway and we should eventually have improved understanding of the reproductive biology of females in area 5.

To determine the maturity of males in commercial catches, chela width measurements (Fig. 11) were taken from at-sea samples in area 5 (Fig. 12) and port samples in areas 3 and 5 (Figs. 13 and 14). By relating the natural logarithm of the chela width against the natural logarithm of the carapace width, it is possible to distinguish morphometrically immature and mature male snow crabs (Fig. 12).

#### Area 6 (south Cape Breton)

Six (6) area 6 fishermen were active during the 1985 fishing season. In terms of landings, area 6 eclipsed area 5 for the second year in succession to become the major snow crab producing area on the Atlantic coast of Cape Breton Island. However if CPUE is considered as a relative abundance index, CPUE values in Table 2 suggest that area 5 still retains a denser population of commercial-sized snow crab than area 6.



### Port and at-sea sampling

No port or at-sea samples were obtained from area 6 during the 1985 fishing season.

### Logbooks

The total landings from five (5) logbooks received from the six (6) area 6 fishermen in 1985 amounted to 32,219 kg, as apposed to the 40,844 kg recorded through the sales slips statistics system.

There were slight fluctuations of the CPUE during the 1985 fishing season but overall CPUE remained low and relatively stable (Table 6; Fig. 15). The mean CPUE value was over 10.0 kg.trap haul<sup>-1</sup> for the first time in four years. A Leslie analysis of the 1985 logbook data is impractical due to the shape of the mean CPUE vs cumulative catch pattern (Fig. 15). As noted for previous assessments (Elner and Robichaud 1983b, 1984 and 1985), the failure of CPUE to decline through the season may be an artifact of fishing dynamics on a low-density, dispersed resource: fishermen are obliged to continually move their traps in search of small "pockets" of crab, resulting in a flat CPUE pattern that is not amenable to resolution by Leslie analysis.

Total landings and effort were reduced in 1985 compared to previous years (Table 2). Nevertheless, historical mean CPUE trends, suggest that either there is some production in the grounds or new fishing areas are still being discovered. Indeed, whilst CPUE values in areas 2, 3, 4, and 5 have now fallen to approximately 25% of their historical maximums (Table 2), CPUE in area 5 has declined by less than 50%.

### Discussion

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, CAFSAC determined in 1982 that provision of advice to management on annual TAC levels was not feasible. The assessments for the 1985 season do not appear cause for change in CAFSAC's decision and, thus, there appears no rationale for re-introducing catch controls for the 1986 season.

The 1985 stock status for the Atlantic-coast of Cape Breton Island continues to degenerate as it has since 1981 (Elner and Robichaud 1984, 1985). No major growth and recruitment pulses were detected in the system during the fishing season. The price paid for snow crab failed to maintain effort. This and reductions in CPUE resulted in a further decline in total landings.

Although our assessments are at the boundaries of feasibility (given sparsely distributed stocks and incomplete statistics), it appears unlikely that even the present marginal CPUEs can be retained in the face of yield outweighing production. The viability of the 1985 fishery was considerably enhanced by the continued strong world market demand for crab which maintained relatively high prices.<sup>1</sup> The future of the snow crab fishery on the Atlantic coast of Cape Breton Island will depend on the world market

<sup>1</sup>Due largely to collapses of the Alaskan king and tanner crab fisheries.

situation and recruitment patterns. With the present low CPUE levels, a decrease in the price paid to fishermen could lead to the cost of fishing rising above income and an abandonment of the fishery. On the other hand, notwithstanding prices, a continued lack of growth and recruitment must lead to the practical extinction of the resource and fishery.

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Table 1. Snow crab statistics for the Atlantic coast of Cape Breton Island, 1978-85.

Area	Year	No. of boats licensed	No. of active boats	No. of logbooks received	Landings Statistics		Actual effort in traps hauled (from logbook data) (all trap types combined)
					Area Managers (kg)	Logbooks (kg)	
2	1978	-	-	-	-	-	-
	1979	12	8	3	108,005	14,129	1,739
	1980	12	8	3	46,919	10,240	1,276
	1981	13	6	-	4,695	-	-
	1982	13	-	-	-	-	-
	1983	13	12	2	7,130	248	150
	1984	5	2	-	9,593	-	-
	1985	5	-	-	-	-	-
3	1978	36	16	16	-	91,118	7,863
	1979	36	27	27	185,101	164,110	18,124
	1980	36	31	25	139,686	73,988	13,835
	1981	36	22	1	31,215	816	60
	1982	35	20	18	86,814	75,295	9,388
	1983	35	27	27	40,058	40,172	8,217
	1984	37	19	13	14,649	12,839	4,346
	1985	40	10	10	13,537	12,732	3,220
4	1978	38	11	11	-	305,076	11,268
	1979	38	35	26	624,029	591,580	22,775
	1980	38	26	18	181,241	136,605	7,543
	1981	37	11	3	61,476	6,545	520
	1982	37	21	20	165,395	116,243	6,138
	1983	38	24	18	44,199	31,612	4,341
	1984	37	7	6	17,581	18,141	2,173
	1985	37	4	4	406	568	156
5	1978	15	15	15	-	250,076	6,165
	1979	25	24	23	679,504	682,731	15,382
	1980	26	24	21	395,855	324,786	9,261
	1981	25	11	10	90,463	81,819	3,135
	1982	25	19	18	300,145	298,469	9,931
	1983	22	21	21	151,296	148,827	8,146
	1984	24	10	6	45,215	41,295	2,220
	1985	24	5	5	29,171	20,833	1,465
6	1979	8	4	4	24,868	27,351	1,880
	1980	11	10	9	58,586	69,136	5,246
	1981	11	5	5	15,896	20,350	1,316
	1982	11	7	7	63,072	63,133	6,462
	1983	14	13	12	64,084	64,461	7,733
	1984	14	13	12	53,889	50,239	5,229
	1985	14	6	5	40,844	32,219	3,157
	TOTAL	1978	89	42	42	-	646,270
1979		119	98	83	1,621,507	1,479,901	59,900
1980		123	99	76	822,287	614,755	37,161
1981		122	55	19	203,745	109,530	5,031
1982		121	67	63	615,426	553,140	31,919
1983		122	97	80	306,767	285,320	28,587
1984		117	51	37	140,927	122,514	13,968
1985		120	25	24	83,958	66,352	7,998

Table 2. Comparison of assessment data for Cape Breton Island snow crab (Areas 2-6), 1978-85.

Area	Year	No. of active boats	No. of logbooks received	Landings Statistics		Effort (standardized trap hauls)	Mean CPUE	Available biomass for season (mt)	Exploitation rate (%)	Standardized trap type
				Area Managers (kg)	Logbooks (kg)					
2, 3 & 4 (inshore)	1978	27	23	-	192,228	17,258	11.14	-	-	(1.2x0.9x0.8 m, wood)
	1979	70	40	917,136	262,250	25,660	10.22	324.9	81	"
	1980	65	42	367,846	181,033	17,499	10.35	225.2	80	"
	1981	39	4	97,386	7,361	580	12.69	-	-	(1.5x1.5x0.5 m, steel)
	1982	41	28	252,209	100,161	13,971	7.17	153.0	65	(1.2x0.9x0.8 m, wood)
	1983	63	41	91,387	55,242	11,780	4.69	76.5	72	"
	1984	28	18	41,823	16,423	5,382	3.05	24.2	68	"
	1985	14	14	13,943	13,300	3,376	3.94	-	-	"
4 (offshore)	1978	*	4	-	203,966	4,916	41.49	-	-	(1.5x1.5x0.5 m, steel)
	1979	*	16	*	507,569	10,546	48.13	790.0	64	"
	1980	*	4	*	39,800	827	48.13	-	-	"
	1981	*	-	*	-	-	-	-	-	"
	1982	*	10	*	91,377	2,875	31.78	-	-	"
	1983	*	6	*	16,790	1,454	11.55	-	-	"
	1984	*	2	*	14,557	1,159	12.56	28.3	51	"
	1985	*	-	*	-	-	-	-	-	"
5	1978	15	15	-	250,076	4,531	55.19	440.0	57	"
	1979	24	23	679,504	682,731	14,747	46.30	1185.0	58	"
	1980	24	21	395,855	324,786	7,341	44.24	543.0	60	"
	1981	11	10	90,463	81,819	2,835	28.86	-	-	"
	1982	19	18	300,145	298,469	8,848	33.73	356.9**	84	"
	1983	21	21	151,296	148,827	7,261	20.50	176.0**	85	"
	1984	10	6	45,215	41,295	2,336	17.68	55.3	75	"
	1985	5	5	29,171	20,833	1,465***	14.22	-	-	"
6	1979	4	4	24,868	27,351	1,880	14.55	69.44	39	(1.5x1.5x0.5 m, steel)
	1980	10	9	58,586	69,136	5,246	13.18	177.0	39	"
	1981	5	5	15,896	20,350	1,316	15.46	35.8	57	"
	1982	7	7	63,072	63,133	6,462	9.77	175.0	36	"
	1983	13	12	64,084	64,461	7,614	8.47	102.7	63	"
	1984	13	12	53,889	50,239	5,229	9.61	-	-	"
	1985	6	5	40,844	32,219	3,157	10.21	-	-	"
TOTAL	1978	46	42	-	646,270	26,705	24.20			All trap types combined
	1979	98	83	1,621,507	1,479,901	52,833	28.01			"
	1980	99	76	822,287	614,755	30,913	19.89			"
	1981	55	19	203,745	109,530	4,731	23.15			"
	1982	67	63	615,426	553,140	32,156	17.20			"
	1983	97	80	306,767	285,320	28,109	10.15			"
	1984	51	37	140,927	122,514	14,106	8.69			"
	1985	25	24	83,958	66,352	7,998	8.30			"

\*Included in area 2, 3 &amp; 4.

\*\*From tagging estimate, all other estimates from Leslie analysis of logbook data.

\*\*\*Japanese conical traps combined with steel straps (1.5x1.5x0.5 m)

Table 3. Catch and effort statistics from logbook data for the snow crab fishery in area 3 and part of area 4 adjacent to area 3 in 1985.

Week period	Trap hauls (conical and wooden traps combined)	Catch (kg)	CPUE (kg/trap haul)
26/7-4/8	708	2970	4.2
5/8-11/8	555	2210	4.0
12/8-18/8	584	2228	3.8
19/8-25/8	643	2071	3.2
26/8-1/9	428	1765	4.1
2/9-8/9	285	1011	3.6
9/9-15/9	173	1045	6.0
TOTAL	3376	13300	3.9

Table 4. Summary of mark-recapture data for male snow crabs tagged in area 5 with t-bar tags, 1982-85.

Date	1982 (Study)	1983 (Study)	Total
No. male crabs tagged	1958	1288	3246
1982 - No. recaptured	924 (47.2%)	-	924
No. measured	364	-	364
No. grown	13 (3.6%)	-	13 (3.6%)
1983 - No. recaptured	158	624 (48.4%)	782
No. measured	121	566	687
No. grown	5 (4.1%)	7 (1.2%)	12 (1.7%)
1984 - No. recaptured	17	94	111
No. measured	1	7	8
No. grown	0	1 (14.3%)	1 (12.5%)
1985 - No. recaptured	4	13	17
No. measured	4	9	13
No. grown	0	0	0

Table 5. Catch and effort statistics from logbook data for the snow crab fishery in area 5, 1985.

Week period	Trap hauls	Catch (kg)	CPUE (kg/trap haul)
22/7-28/7	* 146	2,374	16.3
29/7-4/8	* 270	5,086	18.8
5/8-11/8	* 270	2,806	10.4
12/8-18/8	* 298	3,359	11.3
19/8-25/8	* 191	2,423	12.7
26/8-1/9	* 138	2,523	18.3
2/9-8/9	* 98	1,482	15.1
9/9-15/9	* 54	780	14.4
TOTAL	1,465	20,833	14.2

\*Steel traps (1.5 x 1.5 x 0.5 m) combined with Japanese conical traps.

Table 6. Catch and effort statistics from logbook data for the snow crab fishery in area 6, 1985

Week period	Steel traps (1.5x1.5x0.5 m)	Catch (kg)	Cumulative catch (kg)	CPUE (kg/trap haul)
1/8-7/8	493	4,983	2,491.5	10.1
8/8-14/8	540	5,414	7,690.0	10.0
15/8-21/8	553	6,280	13,537.0	11.4
22/8-28/8	448	4,412	18,883.0	9.9
29/8-4/9	326	3,438	22,808.0	10.6
5/9-11/9	266	2,554	28,804.0	9.6
12/9-18/9	227	2,682	28,422.0	11.8
19/9-25/9	222	1,933	30,729.5	8.7
26/9-30/9	82	523	31,957.5	6.4
TOTAL	3,157	32,219	32,219.0	10.2

Fig. 1. Cape Breton Island snow crab fishing areas and landings for 1985.

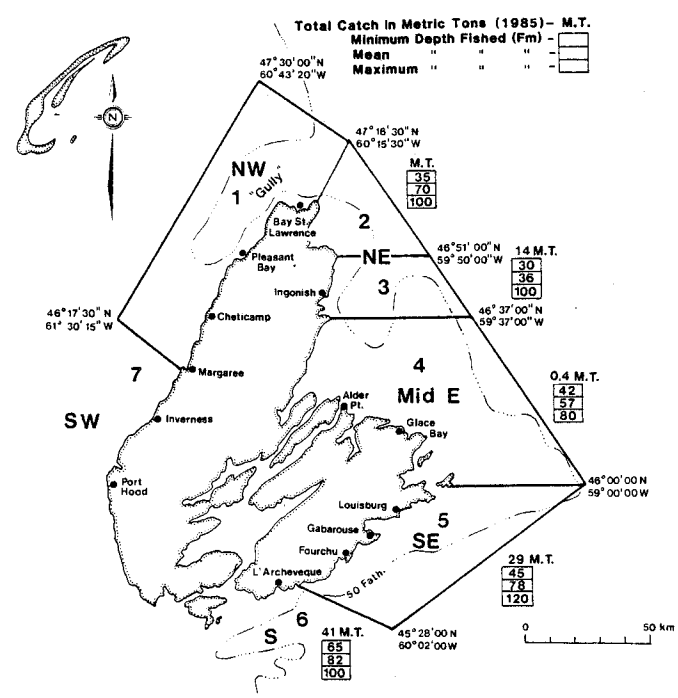




Fig. 2. Distribution of snow crab fishing effort off the Atlantic coast of Cape Breton Island during the 1985 season, as derived from logbook data.

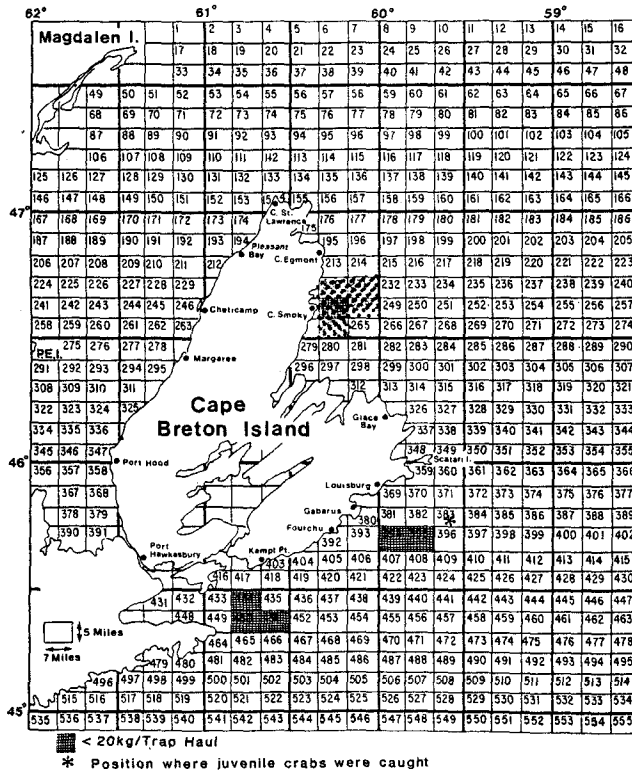


Fig. 3. Size-frequency histograms for male snow crabs sampled from commercial vessels in area 3 during the 1985 fishing season.

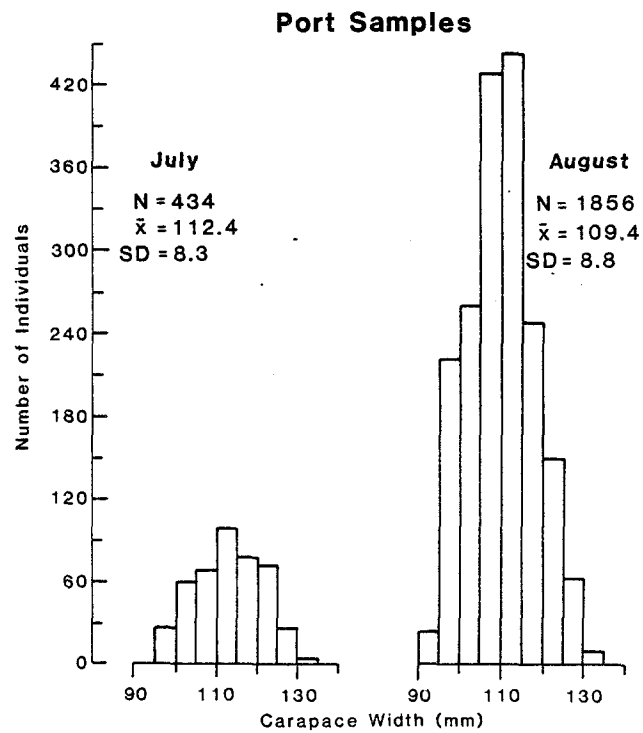


Fig. 4. Size-frequency histograms for male snow crabs sampled from commercial vessels in area 5 during the 1985 fishing season.

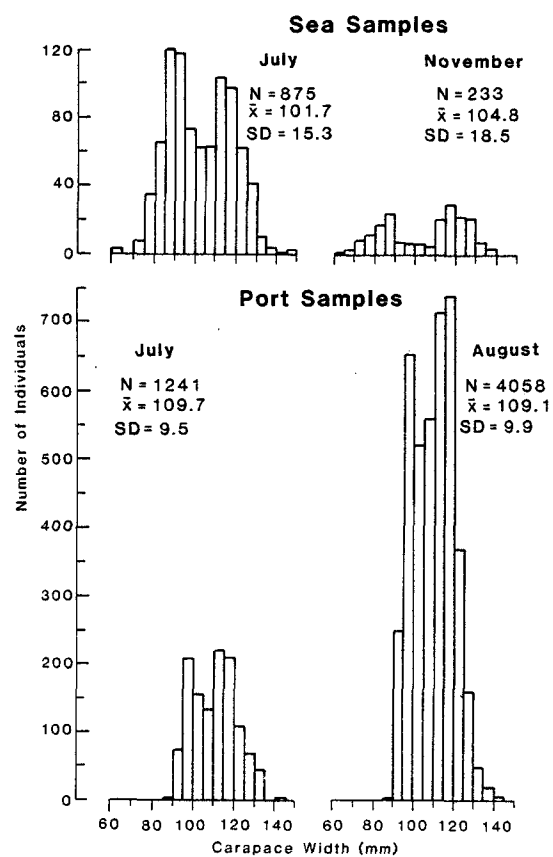


Fig. 5. Historical monthly mean carapace widths for male snow crabs from port and at-sea sampling in area 5.

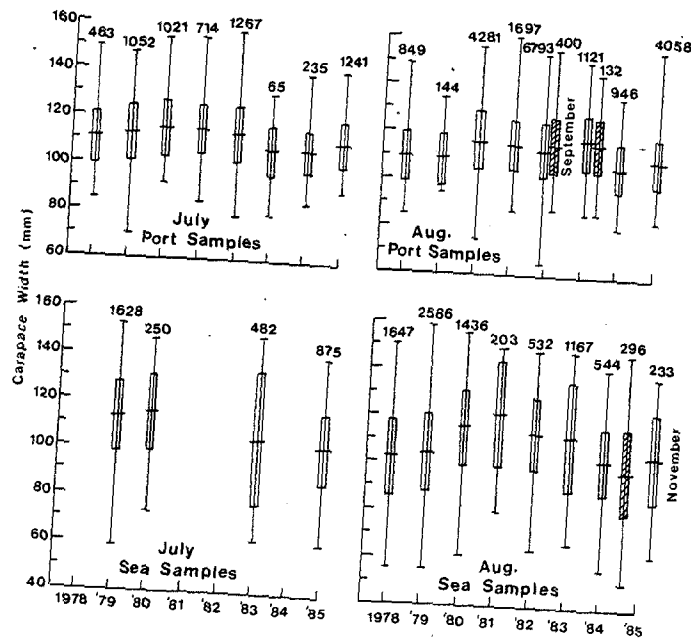


Fig. 6. Percentage frequency of occurrence of shell states for male snow crabs throughout the 1985 fishing season in areas 5.

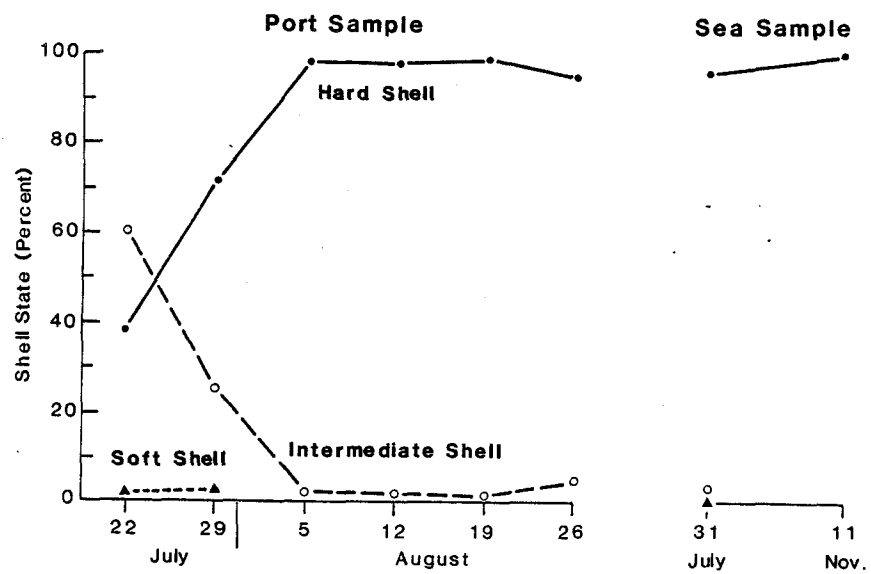


Fig. 7. Size-frequency histograms for immature snow crabs taken by commercial Danish seiners in area 5 during July 1985. (Latitude 45°48'00", Longitude 59°38'00", at a depth of 120 m).

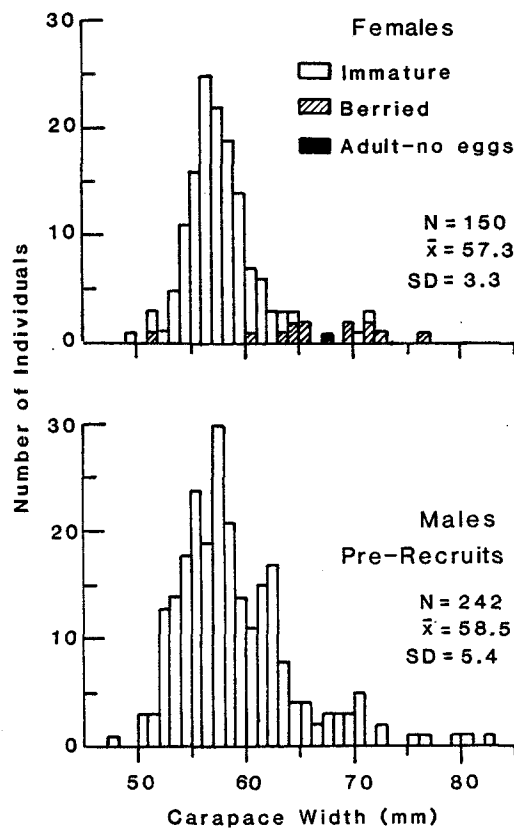


Fig. 8. Historical trends of CPUE against cumulative catch in area 5 from logbook data.

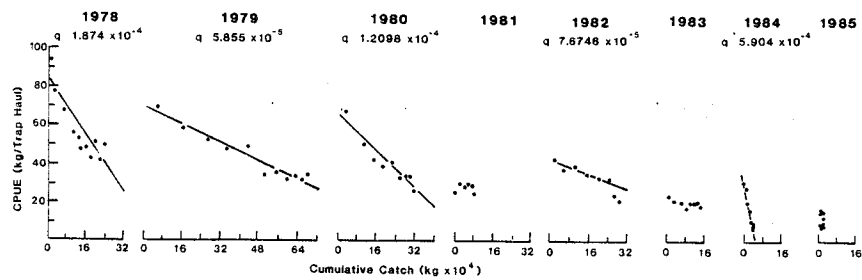


Fig. 9. Size-frequency histograms for mature female snow crabs sampled in area 5 from a commercial vessel during the 1985 fishing season and from a commercial vessel under charter in November, 1985.

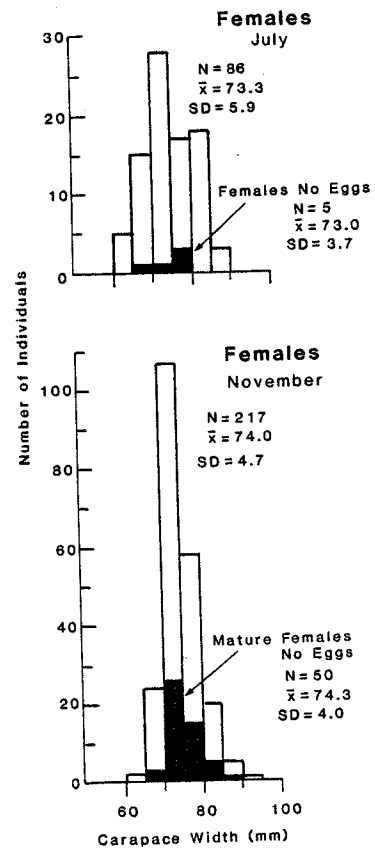




Fig. 10. Percentage of ovigerous mature female snow crabs by monthly periods for area 5 from 1978-85.

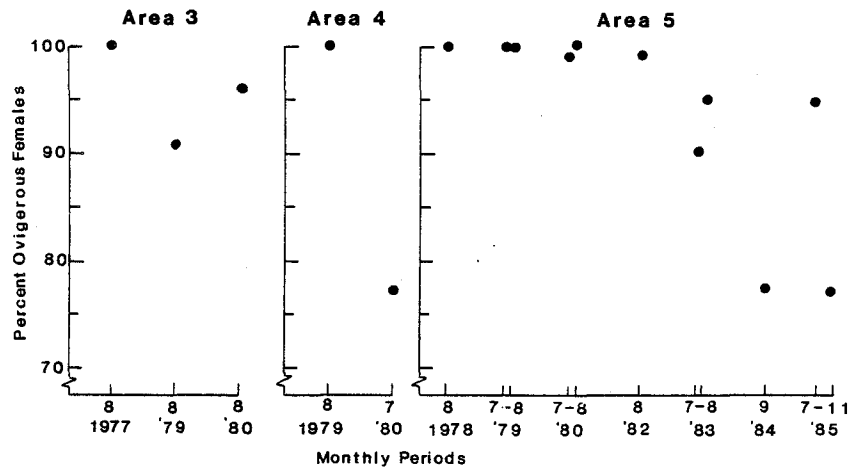


Fig. 11. Diagram showing a snow crab chela and the chela width dimension.

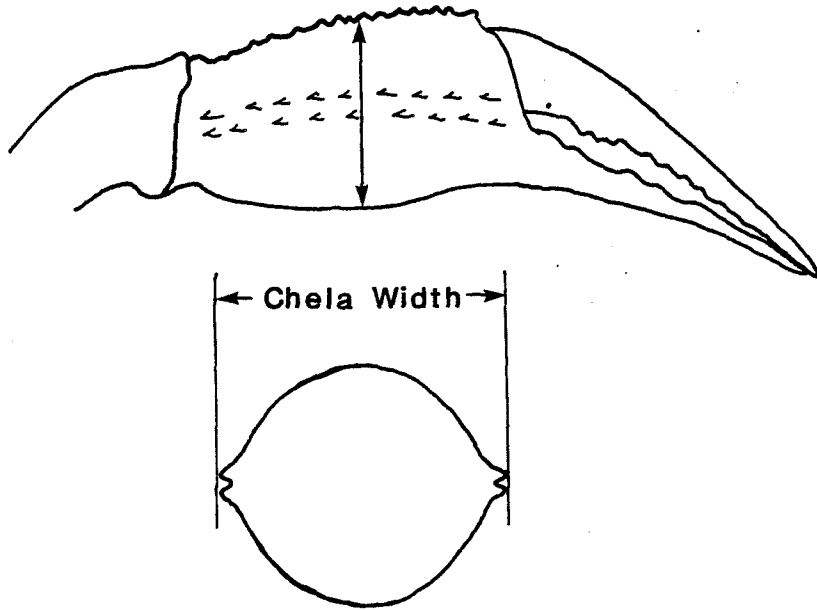


Fig. 12. Graph showing the relationship between the natural logarithm of the chela width and the natural logarithm of the carapace width of snow crabs sampled at-sea in area 5 during 1985.

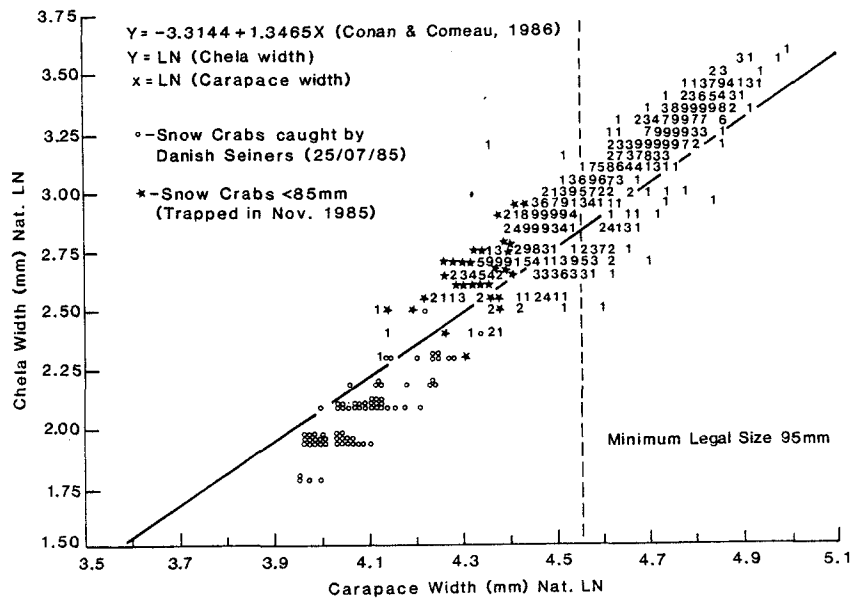




Fig. 14. Graph showing the relationship between the natural logarithm of the chela width and natural logarithm of the carapace width of snow crabs taken from port samples in area 3 during 1985.

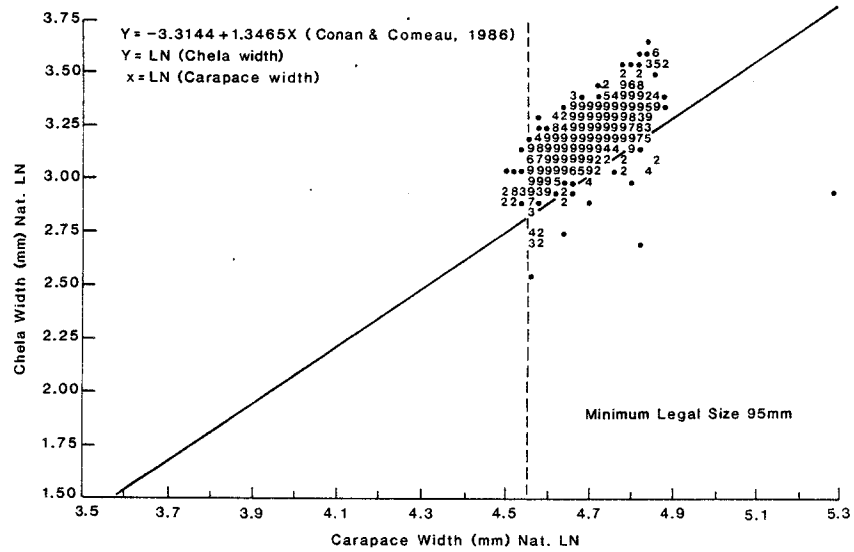


Fig. 15. Graph of cumulative weekly landings against CPUE, from logbook data for area 6 in 1985.

