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Assessment of the Areas 18 and 19, western Cape Breton Island snow crab, Chionoecetes opilio, fisheries, 1987.

by

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ABSTRACT

Assessments of the 1987 snow crab season for the western Cape Breton Island, Areas 18 and 19, are presented based on data derived from fishermen's logbooks. Initial biomass (B_0) and exploitation levels (E.L.) were estimated using Leslie analysis of catch/effort trends. Biological characteristics were obtained from port samples and sea samples of the catches.

Area 19

The historic trends of decrease in the catch rates initiated by the increased effort in 1984 continued for the 1987 season. The mean CPUE for 1987 decreased 5% from the 1986 level (30.3 kg/trap haul versus 32.0 kg/trap haul respectively). The estimated B_0 was 9% lower in 1987 than in 1986 (2126 t versus 2343 t respectively). A total landing of 1116 t after a decreased TAC at 1150 t resulted in an estimated E.L. of 52.5%. The 1987 fishery was less dependent on morphometrically immature males in comparison with 1986 (18.6% versus 22.1% of the crabs landed respectively). Seasonal mean size of landed crabs decreased from 110.3 mm CW in 1986 to 106.3 mm CW in 1987. Up to 51% of undersized males in the catch is of concern since the survival rate of those crabs thrown back at sea is unknown.

A decrease in TAC to the 980 to 1000 t level is recommended in order to increase the catch rates and stabilize the fishery.

Area 18

The estimated B_0 for 1987 (1315 t) represents an increase of 14 % over that estimated for 1986 (1153 t). The exploitation level decreased from 59.7% in 1986 to 47.4% in 1987 with a total catch of 623.6 t. Mean CPUE, declining from 1982 to 1985, increased to its highest historic value of 64.1 kg/trap haul. Although the fishery was less dependent on morphometrically immature males in 1987 compared to 1986 (34.3% versus 39.9% of the landed crabs respectively), the area has a potential for producing a higher biomass if these immature individuals reach morphometric maturity.

It is recommended that the same TAC (626 t) remains in effect for the 1988 season in order to ensure future high catch rates.

RESUME

Les évaluations de la pêcherie de crabe des neiges en 1987 sur la côte ouest du Cape-Breton, régions 18 et 19, sont présentées à partir des données dérivées des carnets de bord des pêcheurs. La biomasse initiale (B_0) et les taux d'exploitation (E.L.) sont estimés en utilisant l'analyse de Leslie des fluctuations de prises/effort. Les caractéristiques biologiques ont été extraites à partir d'échantillonnages de la prise en mer et au port.

Région 19

La tendance historique à la baisse des taux de capture déclenchée par l'augmentation de l'effort en 1984 a continué pour la saison de pêche de 1987. La PUE moyenne en 1987 a diminué de 5% de la valeur de 1986 (30,3 kg/casiers levés contre 32,0 kg/casiers levés respectivement). L'estimation de B_0 était 9% plus basse en 1987 qu'en 1986 (2126 t contre 2343 t respectivement). Un débarquement total de 1116 t, faisant suite à la baisse de la PTA à 1150 t en 1986, a résulté en un taux d'exploitation de 52,5%. La pêcherie de 1987 était moins dépendante sur les mâles morphométriquement immatures comparé à 1986 (18,6% contre 22,1% des crabes débarqués respectivement). La taille saisonnière moyenne des crabes débarqués a diminué de 110,3 mm de largeur du céphalothorax (LAC) en 1986 à 106,3 mm LAC en 1987. Le niveau de mâles sublégaux dans les prises a atteint 51% en 1987, ce qui est préoccupant puisque le taux de survie de ces crabes rejetés à la mer est inconnu.

Une baisse de la PTA au niveau de 980 à 1000 t est recommandée afin d'augmenter les taux de capture et de stabiliser la pêcherie.

Région 18

La B_0 estimée pour 1987 (1315 t) représente une augmentation de 14% comparé à l'estimation de 1986 (1153 t). Le taux d'exploitation a diminué de 59,7% en 1986 à 47,4% en 1987, avec une prise totale de 623,6 t. La PUE moyenne qui avait connu une baisse continuelle de 1982 à 1985, a augmenté à sa plus haute valeur historique de 64,1 kg/casiers levés. Même si la pêcherie était moins dépendante sur les mâles morphométriquement immatures en 1987 comparativement à 1986 (34,3% contre 39,9% des crabes débarqués respectivement), la région a un potentiel pour produire une biomasse plus élevée si les individus immatures peuvent atteindre la maturité morphométrique.

Il est recommandé que la même PTA (626 t) demeure en vigueur pour la saison de 1988 afin d'assurer de hauts taux de capture.

INTRODUCTION

The snow crab grounds off Cape Breton Island were first commercially exploited in the late 1960's by a group of fishermen based in Cheticamp, and the New Brunswick and Quebec offshore boats started to fish the same area soon after. The fishery gradually expanded to cover all the snow crab grounds off the western coast of the Island. Between 1976 and 1978 two inshore fishing areas were established on the western coast of the Island to be eventually used exclusively by inshore vessels of under 13.7 m (45 ft) in length (Elner and Robichaud, 1981).

The fishery began in Area 19, off the northwest coast (Fig. 1), which has been the most productive of Cape Breton's snow crab areas. The area was closed to offshore vessels in 1978, at which time only 14 inshore boats were licensed for the area with a maximum of 30 traps per license. The catches in this fishery have been regulated by a TAC derived from Leslie analyses of yearly biomass additions and by boat quotas (Davidson and Comeau, 1987). Additional licenses were issued in 1979 and again in 1984 at which time the maximum number of traps per license was set to 20 and the quota per boat reduced from 80,000 lbs (36,288 kg) to 50,000 lbs (22,680 kg), which resulted in an increase of the TAC from 980 t in 1982 to 1385 t in 1984 (Table 1). In 1987, the quota per boat was lowered to 43,000 lbs (19,505kg, which reflected into a decrease of 14% in the TAC) in order to decrease the fishing pressure and stabilize the catch rates as proposed by Davidson and Comeau (1987).

Area 18 has been commercially exploited by the New Brunswick, Quebec and PEI offshore vessels since the early to mid 1960's (Elner and Robichaud, 1981). In 1979, 14 permits were issued to inshore vessels (maximum of 30 traps per permit). These permits were upgraded to licenses the following year and 9 additional licenses were issued (Table 3). In 1984, the offshore vessels were excluded from the zone and northwestern and southwestern boundaries were established (Davidson and Comeau, 1987). In 1986, the TAC was reduced by 25% (626 t in 1986 compared to 835 t since 1981) which represents a reduction in boat quota to 60,000 lbs (27,216 kg) from 80,000 lbs (36,288 kg) in place since 1981 (Table 3).

Since 1983, the opening of the fishing season has been coordinated with the monitoring of the incidence of newly molted (white) crabs in order to avoid the problem of poor quality of the catch (Table 3).

This document presents a review of biological characteristics and catch trends for Area 18 and 19 snow crab fisheries for 1987 and gives recommendations for the 1988 fishing season for both areas.

MATERIALS AND METHODS

Port sampling and sea sampling

In Areas 18 and 19, port sample and sea sample data were collected during the 1987 fishing season. In Area 19, port samples were obtained in weeks 1 to 6 and sea samples were obtained in weeks 2, 3, 5 and 6. In Area 18, port samples were obtained during weeks 1, 2 and 6 and a sea sample was carried out in week 6. Weekly

percentages of soft (white) shelled males, morphometrically immature males (Conan and Comeau, 1986) and undersize males were calculated for the sea samples (Tables 5 and 6, Fig. 3). Weekly percentages of soft (white) shelled males and immature males were obtained from the port samples (Tables 5 and 6, Fig. 2). Weekly and overall size distributions and statistics were generated for both sea and port sampling data (Figs 4 to 8). The percentages of mature and immature male crabs in the port and sea samples were plotted according to their carapace size (Figs 4 to 8).

Logbook/sales slip data

The logbook and sales slip data were acquired and compiled on computer by the EDP and Statistics Branch of the Department of Fisheries and Oceans. The weekly and cummulative catch statistics for use in the Leslie analysis (Ricker, 1975) and the CPUE (catch in kg for a given time/number of traps hauled during the same time) were calculated directly from the logbook data and the CPUE's were summarized into weekly intervals for both areas (Tables 7 and 8).

The sales slip data, usually more representative of the real catch (Davidson and Comeau, 1987), were not used in either area because the logbook data was more complete. The total catches calculated with the logbooks (1116 t in Area 19 and 623.6 t in Area 18) were higher than the catches reported in the sales slips (937 t in Area 19 and 422 t in Area 18).

The overall distribution of fishing effort obtained from the logbook data was plotted by sub areas of 3 min. of latitude x 3 min. of longitude for Area 19 (Fig. 11) and by sub areas of 2 min. of latitude x 2 min. of longitude for Area 18, (Fig. 9). The fishing positions were then plotted for weeks 1-3, 4-7 and 8-10 for Area 19 (Fig. 10) and for weeks 1-3, 4-6, 7-8 for area 18 (Fig. 9).

RESULTS

Area 19

The size distributions for the sea samples show a decrease in the mean size of male crabs from 98.1 mm carapace width (CW) in week 2 to 93.5 mm CW in week 5, which corresponds to an increase in the percentage of undersized crabs from 41.3% in week 2 to 51.0% in week 5 (Figs 3 and 5, Table 5). The seasonal mean size was 97.8 mm CW (Fig. 6). The mean size from the port sample data remained relatively constant throughout the season (Fig. 4), with a seasonal mean of 106.3 mm CW (Fig. 6).

In the sea samples, a low percentage of white/soft crabs (2.4%) was recorded during week 2 and no soft crabs were recorded in weeks 3, 5 and 6 (Fig. 3, Table 5). The same trends were observed in the port samples (Fig. 2).

The percentage of morphometrically immature males (MI-males) in the sea samples shows an increase from weeks 2 to 5 followed by a decrease to the week 2 level for week 6 (Fig. 3, Table 5). The port sampling data show fluctuations during the first three weeks followed by an increase of 10.1% from week 4 to week 6 (Fig. 2, Table 5). The mean percentage of MI-males for the season was 14.6% in the sea samples and 18.6% in the port samples.

The distribution of fishing effort shows some degree of movement throughout the fishing season with a larger dispersion during the mid-season (Fig. 10). The overall distribution for the season shows a concentration on the southern limit of the zone (Fig. 11).

The weekly CPUE dropped for the first five weeks of the season to the lowest seasonal value of 20.5 kg/trap haul (60% less than week 1) during week 5 (Table 7). From weeks 5 to 10, the CPUE fluctuated and showed an increase during the last three weeks of the season. The CPUE for week 10 was close to the value of week 3. The mean seasonal CPUE was 30.3 kg/trap haul.

The estimation of initial biomass (B_o) and exploitation level (E.L.) using the Leslie analysis (Fig. 13) are as follows:

$$CPUE = 46.09 - 0.02\ K_t$$
$$r = -0.82$$
$$B_o = 2125\ (1917t - 2420.5t,\ P < 0.05)$$
$$E.L. = \frac{Tc}{B_o} = 53\%$$

Area 18

The mean carapace size of male crabs in the port samples increased from 105.8 mm CW in week 1 to 107.2 mm CW in week 2 and to 107.2 mm CW in week 6 (Fig. 7) with a seasonal mean of 106.4 mm CW (Fig. 8) for the three weeks sampled. The mean size for the sea sample taken in week 6 was 102.8mm CW (Fig. 8).

No white/soft crabs were recorded in the three port samples and the same results were found in the sea sample for week 6 (Figs 7 and 8).

The proportion of MI-males in the sea sample for week 6 was 51.4%. The results for the port samples showed a decrease from 36.1% in week 1 to 30.8% in week 2 and an increase to 41.6% in week 6 (Figs 7 and 8, Table 6). An overall seasonal percentage of 34.3% was calculated from the three samples.

The fishing effort distribution indicates very little movement of the fishing fleet throughout the season with a concentration on the northern portion of the zone (Fig. 9).

The weekly CPUE fluctuated from week 1 to 4 with the highest value (87.0 kg/trap haul) in week 2 (Table 8). It decreased from weeks 4 to 8, with its lowest value (26.4 kg/trap haul) occuring during week 8 (70% less as compared to week 2). The seasonal mean CPUE was 64.1 kg/trap haul).

The estimation of initial biomass (B_o) and exploitation level (E.L.) using the Leslie analysis (Fig. 14) are as follows:

$$CPUE = 85.08 - 0.06\ K_t$$
$$r = -0.72$$
$$B_o = 1315t\ (856t - 32035t,\ P < 0.05)$$
$$E.L. = \frac{Tc}{B_o} = 47.4\%$$

DISCUSSION

Area 19

The TAC for the 1986 season was 1338t which represented a reduction of 14% for 1987 (Table 1). The total catch according to the logbooks was 1116t which represents 97.6% of the TAC set for the season. The estimated B_o of 2126 t is 9% lower than the 1986 value (Table 2, Fig. 13). The exploitation level (52.5%) is in the same range as the 1986 value (52.7%).

The mean CPUE which has declined drastically since 1982 (Fig. 12, Table 2) shows a slight decrease of 5% for the 1987 season (30.3 kg/trap haul in 1987 and 32.0 kg/trap haul in 1986). The shifting of fishing effort and a diminution of fishing effort resulted in an increase of the CPUE (Table 7) during the last 3 weeks of the season. The total number of trap hauls (36832) decreased by 9% over the 1986 value (37613, Table 2).

Data from the port and sea samples (Table 5, Figs 2 and 3) suggests that the 1987 fishery was less dependent on the MI-males than for 1986 (14.6% and 18.6% for the sea samples and port samples respectively for 1987; 24.4% and 22.1% for the sea samples and port samples respectively for 1986; Davidson and Comeau, 1987).

The mean size of crabs in the port samples (Fig. 4) remained relatively constant throughout the season (105.9 mm CW in week 5 to 106.9 mm CW in week 4) with a seasonal mean of 106.3mm. The seasonal mean size for 1986 was 110.3 mm CW (Davidson and Comeau, 1987). The decrease in the mean size for weeks 3 and 5 in the sea samples coincides with the increase of the percentage of undersized crabs for the same period (Table 5).

The percentage of undersize crabs (up to 51%) caught in the traps (Table 5) is of great concern since the survival of those small crabs thrown back at sea is unknown. The development of an escape mechanism or the implentation of a larger mesh size could be of interest in order to avoid this problem and to diminish the tedious task of sorting crabs on board vessels.

A comparative absence of newly molted soft shelled crabs is noted in the 1987 sea samples as opposed to the 1986 samples (69.7% in week 5; Davidson and Comeau, 1987). The same observation was made during the 1984 season for the Atlantic coast of Cape Breton snow crab fishery (Elner and Robichaud, 1985).

The mean CPUE, mean size of crabs in the landed catch and estimated initial biomass decreased for the third consecutive year (Table 2; Davidson and Comeau, 1987). It is therefore recommended that the present TAC (1150 t) be reduced to the 980 to 1000 t level which had insured good catch rates during the 1980-1983 period.

Area 18

The total catch was 623 t according to the logbooks which represents 99.5% of the TAC set for the 1987 season (626 t). The same TAC was in place for 1986 (Table 3). The Leslie analysis gives an estimated B_o of 1315 t, 14% higher than the 1986 value (Table 4, Fig. 14). The exploitation level (47.4%) is lower than the 59.7% value for 1986.

The mean CPUE, which was declining from 1982 to 1985 increased to a record high of 64.1 kg/trap haul in 1987 over the 1982 value (62,0 kg/trap haul; Table 4, Fig. 12). The total number of trap hauls (9729) decreased by 17% over the 1986 value (11767 trap hauls, Table 4).

The seasonal proportion of MI-males in the port samples (34.3%) is lower than the 1986 value (39.9%; Davidson and Comeau, 1987). The figures indicate that the fishery is highly dependent on the recruitment (i.e. 1986 was considered a good year of recruitment; Davidson and Comeau, 1987) and a high proportion of the male population is not able to contribute to the reproductive potential of the stock. A high proportion of immature crabs in the catch is also an indication that the area has a potential for producing a higher biomass if the immature crabs could undergo the molt to maturity (Conan and Comeau, 1986).

The quasi absence of newly molted soft shelled crabs in the samples is probably due to the fact that the opening of the season is coordinated with the monitoring of the newly molted crabs.

In summary, it is recommended that the same TAC (626 t) remains in effect for the 1988 season in order to insure high catch rates for the next season.

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TABLE 1- Number of participants, trap quotas, seasons, TAC regulations and total catch for the Area 19, Cape Breton Island snow crab, Chionoecetes opilio, fishery: 1978-1987.

YEAR	# of licensed boats	# traps/ boats *	Season	TAC (kg/license) (t)	Catch (t)
(1) 1978	14	30	May 13-Sept 30	-	1941
(1) 1979	27	30	June 16-Sept 16	1406	1390
(1) 1980	27	30	June 15-Sept 15	980(36,288)	1158
(1) 1981	27	30	July 15-Sept 15	1002	913
(1) 1982	27	30	July 15-Sept 15	980(36,288)	953
(1) 1983	27	30	July 15-Sept 15	980(36,288)	906
(1) 1984	61	20	July 15-Sept 15	1385(22,680)	1315
(1) 1985	61	20	July 15-Sept 15	1385(22,680)	1234
(1) 1986	59	20	July 15-Sept 15	1338(22,680)	1235
1987	59	20	July 15-Sept 15	1150(19,505)	1116**

(1) Davidson and Comeau, 1987
* Standard box traps - 1.5m x 1.5m x 0.6m or 1.8m x 1.8m x 0.6m
** According to the log book data

TABLE 2- Trends in exploitation level, initial (B_o) and final (Bf) biomass estimates, and initial ($CPUE_o$), final ($CPUE_f$) and mean ($\overline{CPUE}$) catch per unit effort for the Area 19 snow crab, Chionoecetes opilio, fishery: 1978-1987.

YEAR	Exploitation level (%)	B_o (t)	B_f (t)	Estimated production * (t)	Trap hauls	$CPUE_o$ (kg/trap/haul)	$CPUE_f$ (kg/trap/haul)	$\overline{CPUE}$ (max-min) (kg/trap haul)
(1)1978	64	3016	1075	-	26301	86.4	55.0	73.8(86.4-51.8)
(1)1979	62	2239	848	1164	20436	69.3	45.2	68.0(75.1-45.2)
(1)1980	60	1838	733	990	12360	112.0	52.6	89.4(112.0-52.6)
(1)1981	47	1690	894	957	13413	-	-	59.3
(1)1982	44.7	2282	1329	1388	9896	114.0	45.0	96.0(114.0-45.0)
(1)1983	54.7	1654	748	325	10541	98.5	36.3	81.8(98.5-32.8)
(1)1984	67.2	2240	925	1492	26034	93.2	51.5	50.5(93.2-33.9)
(1)1985	34.8	3291	2057	2366	35503	47.1	26.3	34.8(47.1-26.3)
(1)1986	52.7	2343	1108	286	37613	49.8	22.1	32.0(49.8-22.1)
1987	52.5	2126	1010	1018	36832	51.6	29.8	30.3(134.8- 1.7)

* $B_o^t - Bf^{t-1}$ - where t = year

(1) Davidson and Comeau, 1987

TABLE 3- Number of participants, trap quotas, seasons, TAC regulations and total catch for the Area 18, Cape Breton Island snow crab, Chionoecetes opilio, fishery: 1979-1987.

YEAR	# of licensed boats	# traps/ boats *	Season	TAC (kg/license) (t)	Catch (t)
(1) 1979	14	30	July 1-Sept 30	-	213
(1) 1980	23	30	July 15-Sept 15	-	519
(1) 1981	23	30	April 15-June 15	835(36,288)	494
(1) 1982	23	30	July 22-Oct. 13	835(36,288)	824
(1) 1983	23	30	Aug. 15-Nov. 3	835(36,288)	822
(1) 1984	23	30	Aug. 25-Nov. 10	835(36,288)	722
(1) 1985	23	30	Aug. 3-Oct. 31	835(36,288)	537
(1) 1986	23	30	Aug.4-8;28-Oct 28	626(27,216)	618
1987	23	30	Aug. 16-Oct. 10	626(27,216)	624**

(1) Davidson and Comeau, 1987
* Standard box traps - 1.5m x 1.5m x 0.6m or 1.8m x 1.8m x 0.6m
** According to the logbook data

TABLE 4- Trends in exploitation level, initial (B_o) and final (B_f) biomass estimates, and initial ($CPUE_o$), final ($CPUE_f$) and mean ($\overline{CPUE}$) catch per unit effort for the Area 18 snow crab, Chionoecetes opilio, fishery: 1978-1987.

YEAR	Exploitation level (%)	B_o (t)	B_f (t)	Estimated production * (t)	Trap hauls	$CPUE_o$ (kg/trap/haul)	$CPUE_f$ (kg/trap/haul)	$\overline{CPUE}$ (max-min) (kg/trap haul)
(1)1978	-	-	-	-	-	-	-	
(1)1979	49.7	428	215.7	-	4449	37.3	30.7	47.9(61.0-37.3)
(1)1980	-	-	-	-	10242	61.2	47.7	48.3(61.2-39.4)
(1)1981	-	-	-	-	7554	-	-	48.4
(1)1982	-	-	-	-	13365	98.0	23.0	62.0(122.0-23.0)
(1)1983	45.8	1577	854	-	16669	41.4	34.0	43.4(49.9-33.8)
(1)1984	40.1	1147	687	293	12877	41.9	27.2	35.8(41.9-27.2)
(1)1985	71.3	753	216	66	17109	49.1	24.1	31.4(49.1-17.2)
(1)1986	59.7	1153	465	937	11767	61.8	55.3	43.0(61.8-26.6)
1987	47.4	1315	691	850	9729	64.5	26.4	64.1(140.2-11.0)

* $B_o^t - B_f^{t-1}$ - where t = year

(1) Davidson and Comeau, 1987

TABLE 5 - Biological characteristics of snow crab, Chionoecetes opilio, present in the sea samples and port samples during the Cape Breton Island, Area 19 snow crab fishing season 1987.

WEEK*	SEA SAMPLES					PORT SAMPLES	
	Total # of observations	Mean size (mm)	% of IMMATURE crab (N)	% of WHITE crabs	% of undersized crabs	Total # of observations	% of IMMATURE crabs (N)
1- July 12-18	-	-	-	-	-	611	14.4 (604)
2- July 19-25	906	98.1	14.1(902)	2.4	41.3	850	17.3 (821)
3- July 26-Aug 1	153	96.0	15.1(152)	0.0	44.4	578	15.9 (567)
4- Aug. 2-8	-	-	-	-	-	638	14.6 (629)
5- Aug. 9-15	102	93.5	17.6(102)	0.0	51.0	957	21.1 (943)
6- Aug. 16-22	214	100.3	14.8(210)	0.0	29.4	870	24.7 (853)
7- Aug. 23-29	-	-	-	-	-	-	-
8- Aug. 30-Sept 5	-	-	-	-	-	-	-
9- Sept 6-12	-	-	-	-	-	-	-
10- Sept 13-19	-	-	-	-	-	-	-
Total	1375	97.8	14.6(1366)	1.6	40.5	4504	18.6(4417)

TABLE 6 - Biological characteristics of snow crab, Chionoecetes opilio, present in the sea samples and port samples during the Cape Breton Island, Area 18 snow crab fishing season 1987.

	SEA SAMPLES					PORT SAMPLES	
WEEK*	Total # of observations	Mean size (mm)	% of IMMATURE crab (N)	% of WHITE crabs	% of undersized crabs	Total # of observations	% of IMMATURE crabs (N)
1- Aug. 16-22	-	-	-	-	-	319	36.1 (313)
2- Aug. 23-29	-	-	-	-	-	618	30.8 (613)
3- Aug. 30-Sept 5	-	-	-	-	-	-	-
4- Sept 6-12	-	-	-	-	-	-	-
5- Sept 13-19	-	-	-	-	-	-	-
6- Sept 20-26	511	102.8	51.4(262)	0.0	18.8	214	41.6 (214)
7- Sept 27-Oct.3	-	-	-	-	-	-	-
8- Oct. 4-10	-	-	-	-	-	-	-
9- Oct. 11-17	-	-	-	-	-	-	-

TABLE 7 - The 1987 Cape Breton Island, Area 19 snow crab, Chionoecetes opilio, fishery CPUE and cumulative catch (K) statistics used in Leslie analyses.

WEEK	CPUE (kg/trap haul)	# trap hauls	weekly logbook catch, C_{t1} (kg)	$C_{t1}/2$ (kg)	K_t (t)	% of total C_{t1}/C total
1- July 12-18	51.6	4214	228725	114363	114.4	20.50
2- July 19-25	35.5	6310	246604	123302	352.0	22.10
3- July 26-Aug. 1	31.1	5401	181323	90662	566.0	16.25
4- Aug. 2- 8	25.3	5089	145741	72871	729.5	13.06
5- Aug. 9-15	20.5	5362	118800	59400	834.9	10.65
6- Aug. 16-22	23.2	3903	91989	45995	967.2	8.24
7- Aug. 23-29	22.1	1433	33081	16541	1029.7	2.96
8- Aug. 30-Sept 5	24.5	1076	28074	14037	1060.3	2.52
9- Sept 6-12	26.9	1231	35516	17758	1092.1	3.18
10- Sept 13-19	29.8	196	6036	3018	1112.9	0.54
TOTAL	mean= 30.3	34215	1115889			

TABLE 8 - The 1987 Cape Breton Island, Area 18 snow crab, Chionoecetes opilio, fishery CPUE and cumulative catch (K) statistics used in Leslie analyses.

WEEK	CPUE (kg/trap haul)	# trap hauls	weekly logbook catch, C_{t1} (kg)	$C_{t1}/2$ (kg)	K_t (t)	% of total C_{t1}/C total
1- Aug. 16-22	64.5	2910	202177	101088	101.1	32.42
2- Aug. 23-29	87.0	540	46999	23499	225.7	7.54
3- Aug. 30-Sept 5	59.1	1044	63030	31515	280.7	10.11
4- Sept 6-12	71.4	2347	203530	101765	413.9	32.64
5- Sept 13-19	58.3	782	60419	30209	545.9	9.69
6- Sept 20-26	48.0	529	28221	14110	590.3	4.53
7- Sept 27-Oct. 3	46.4	334	17244	8622	613.0	2.77
8- Oct. 4-10	26.4	76	2014	1007	622.6	0.32
TOTAL	mean= 64.1	8562	623634			

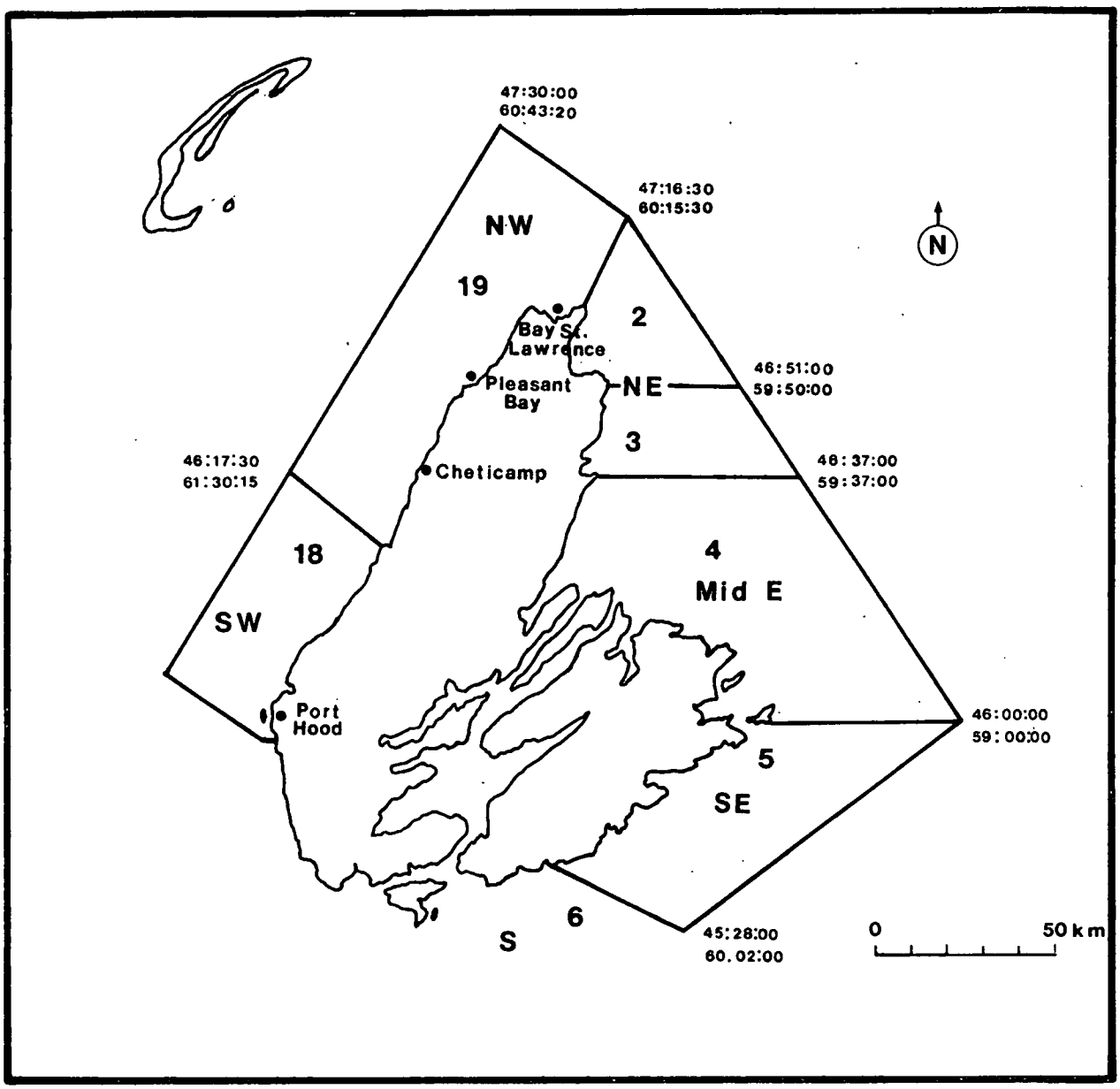


Figure 1: Cape Breton Island snow crab management areas.

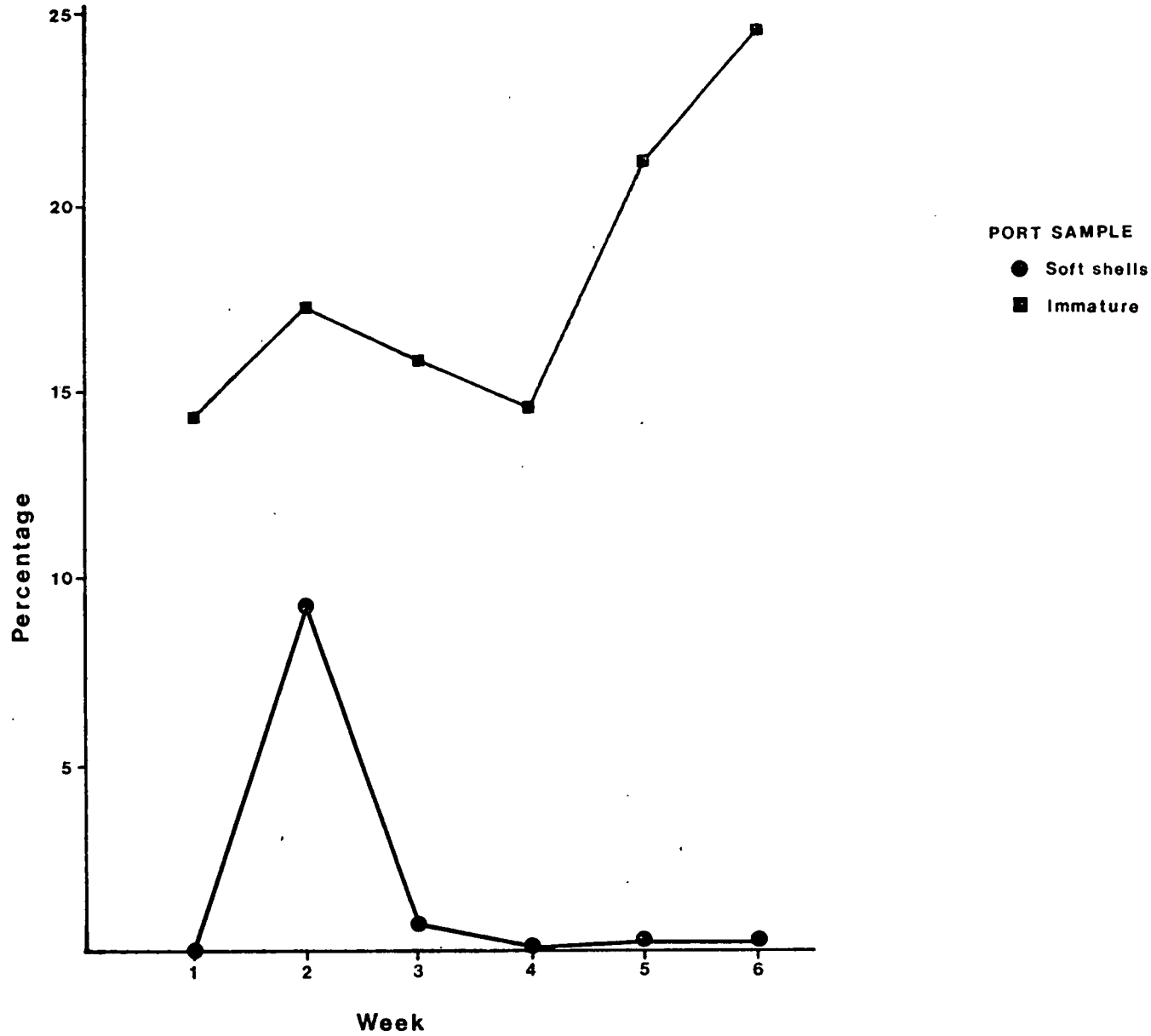


Figure 2 : Weekly fluctuations in the percentage of immature male and white/soft shelled snow crab, C. opilio, present in port samples taken during the 1987, Area 19 Cape Breton snow crab fishery.

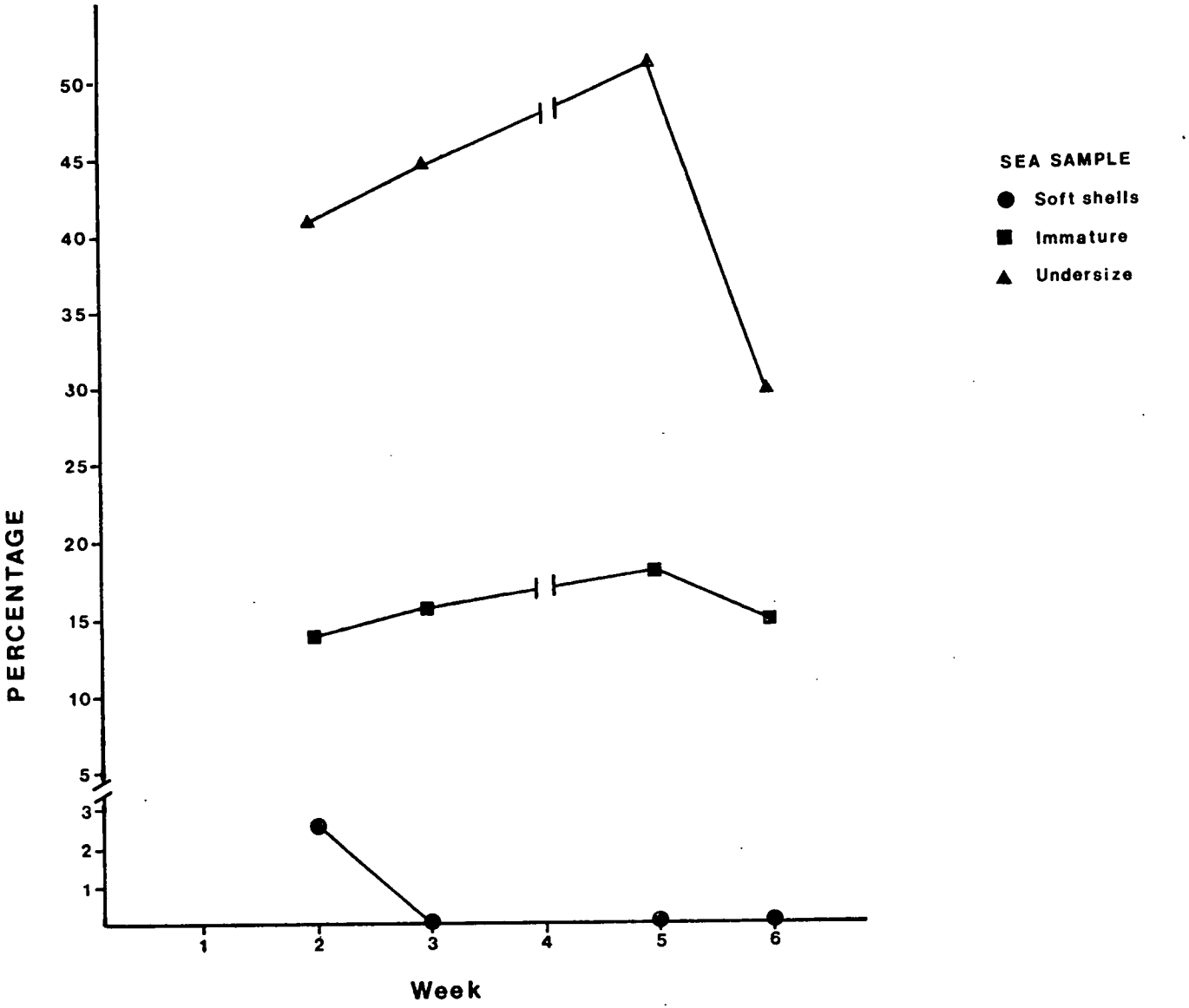


Figure 3 : Weekly fluctuations in the percentage of immature male, undersize male and white/soft shelled male snow crab, C. opilio, present in the sea samples taken during the 1987, Area 19 Cape Breton Island snow crab fishery.

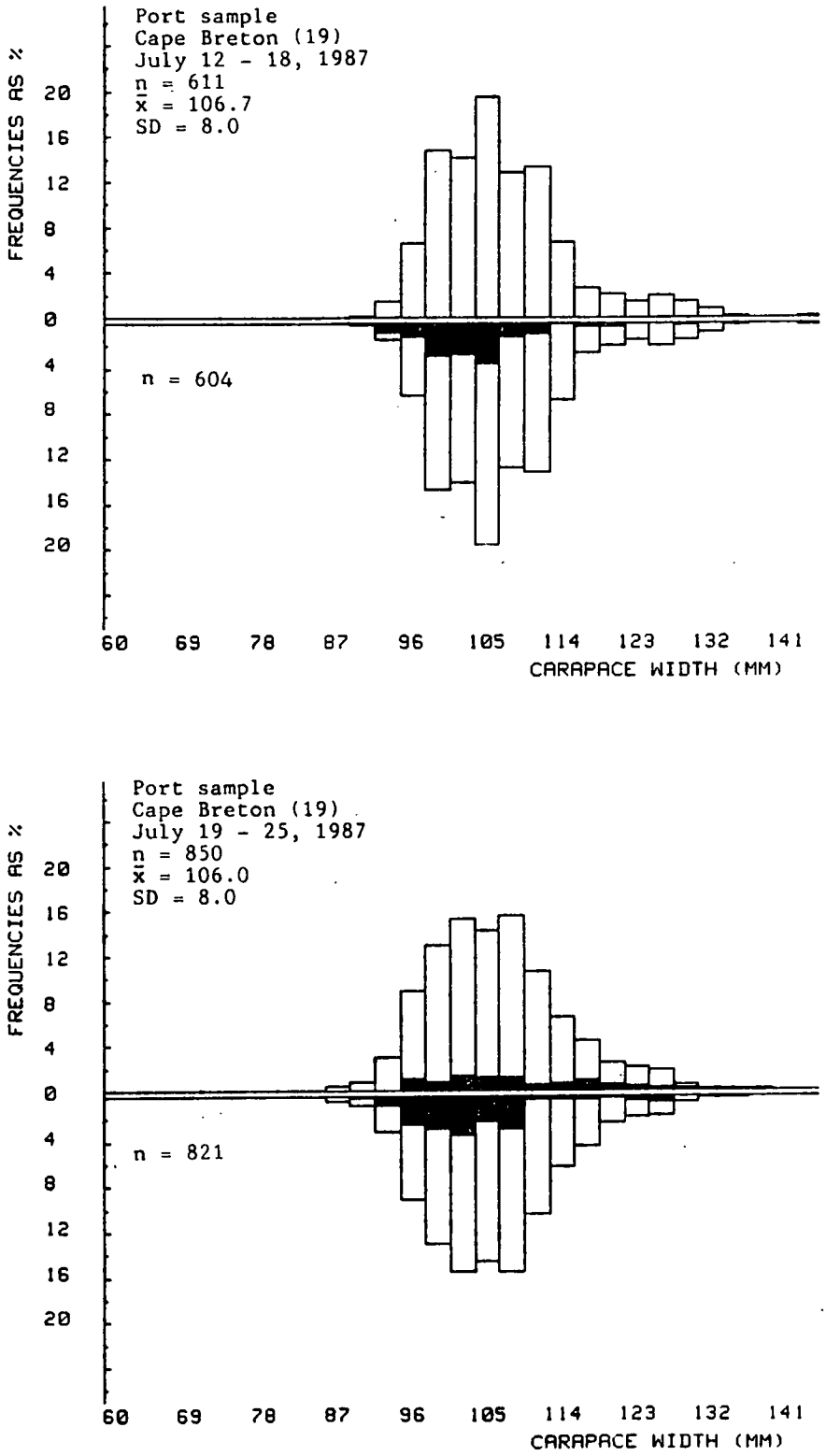
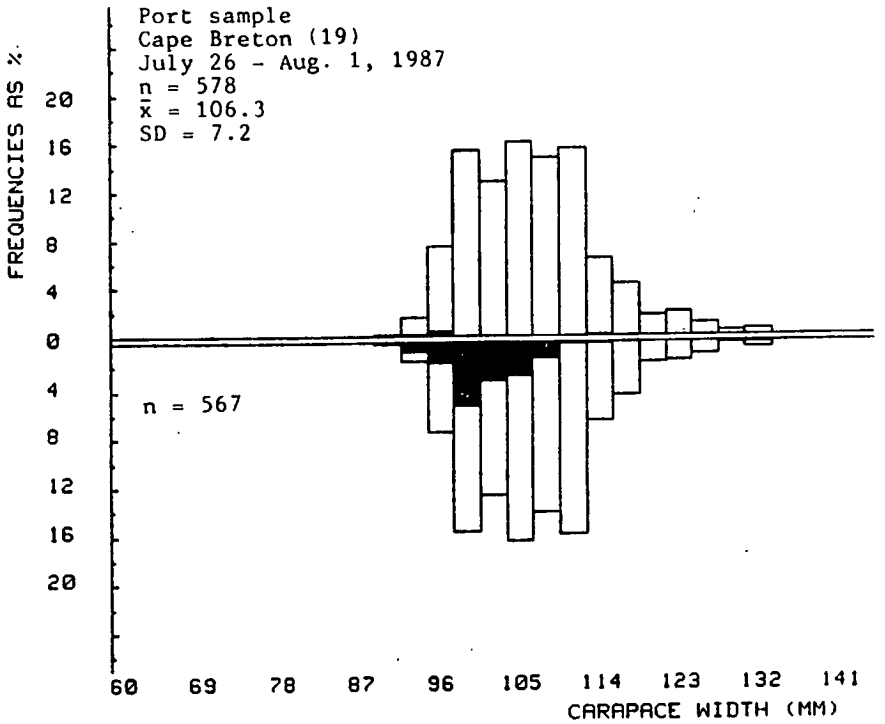
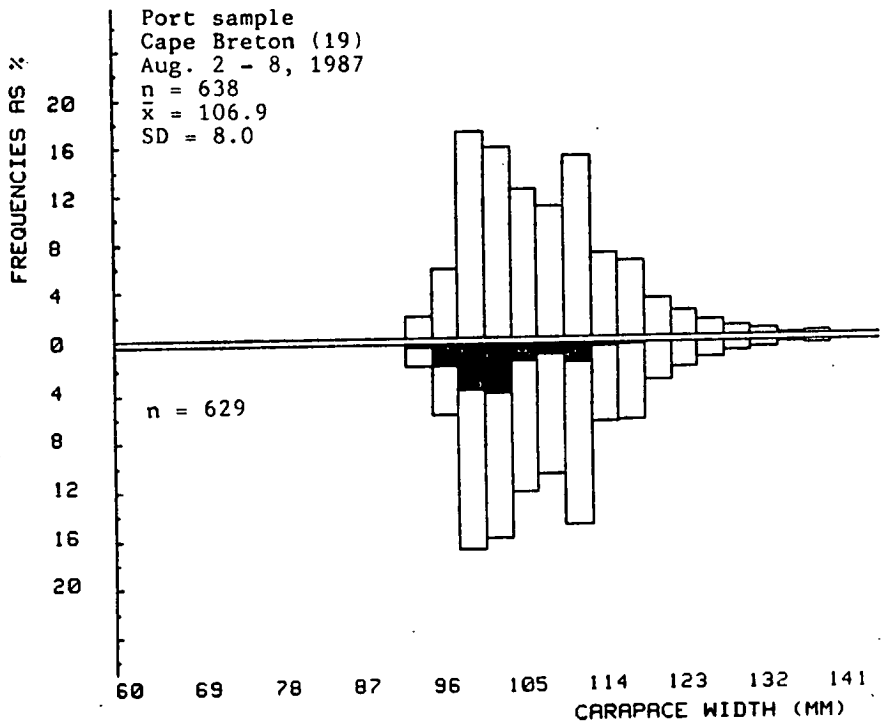


Figure 4 : Weekly size distributions of male snow crabs, C. opilio , present in port samples taken during the 1987, Area 19 Cape Breton Island snow crab fishery.

Positive field : Total number of observations (%), white/soft shelled crabs in black.
Negative field : Percentage of mature crabs in white, percentage of immature crabs in black.





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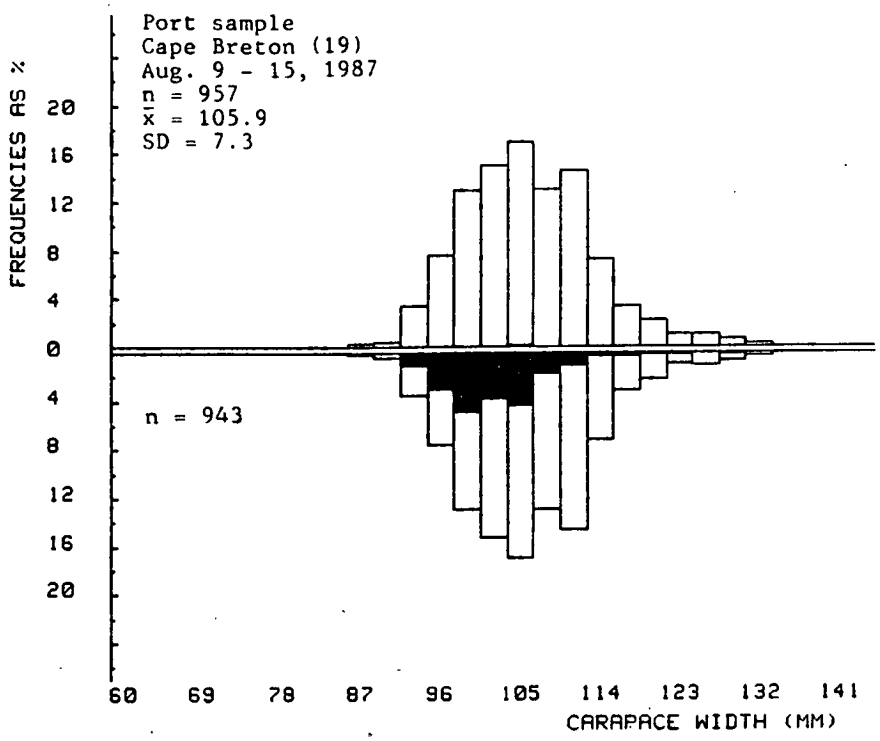

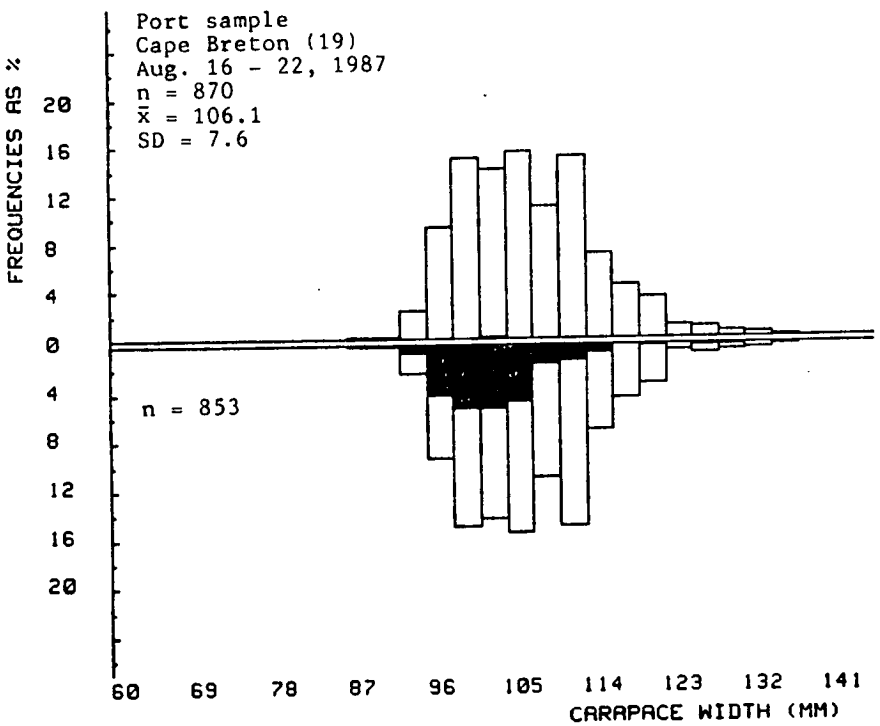

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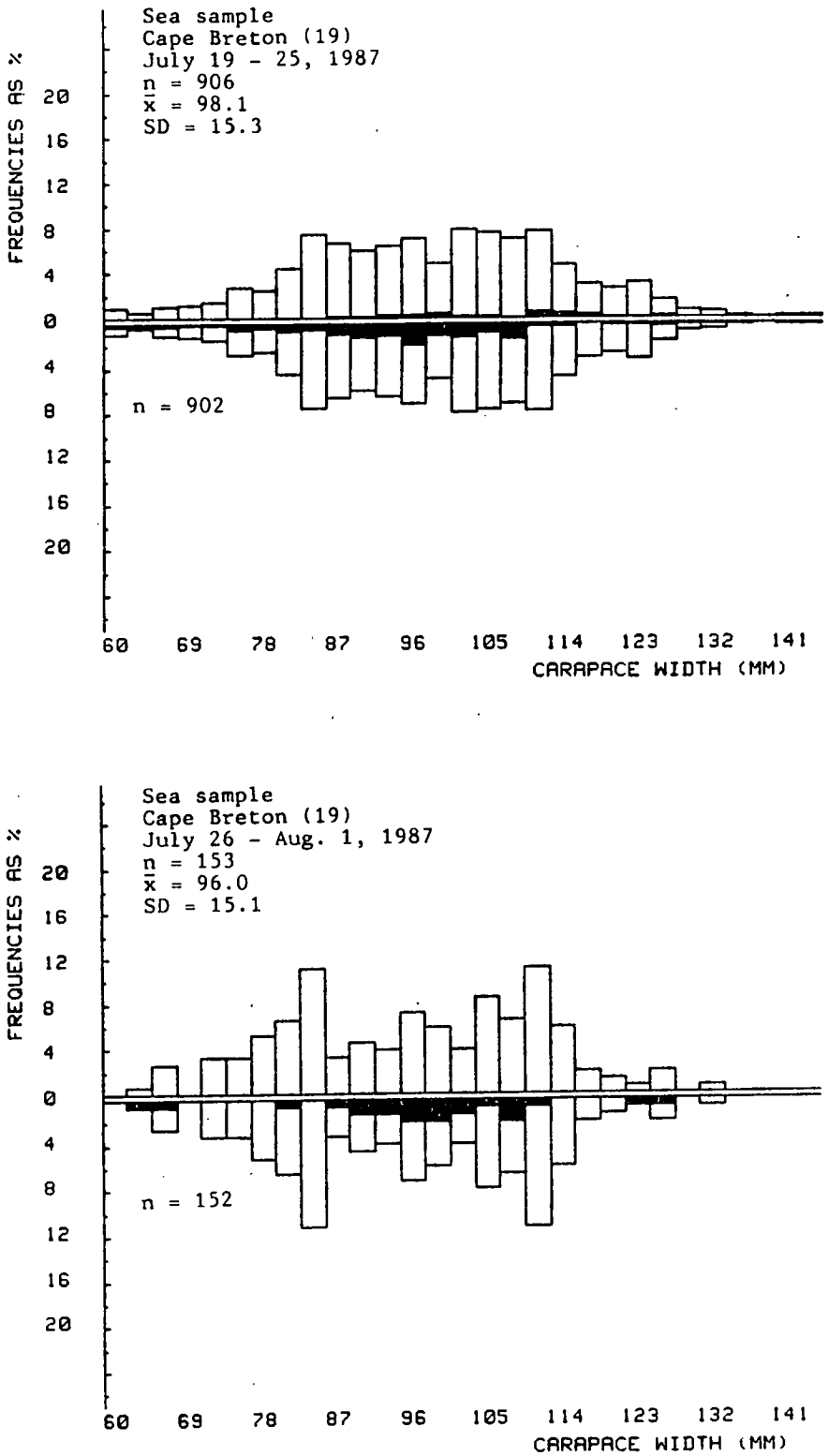
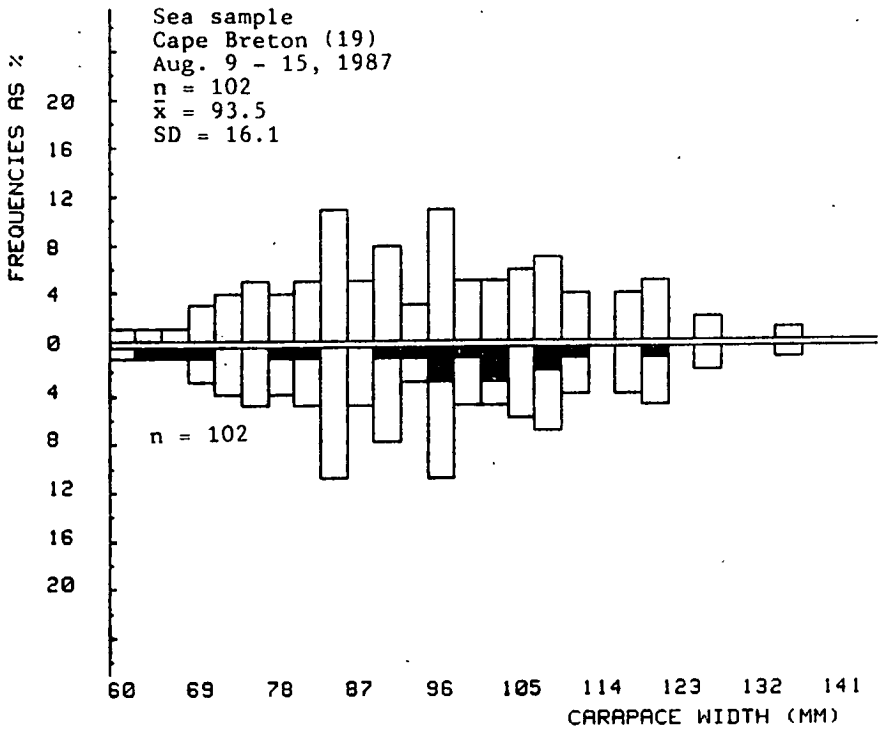
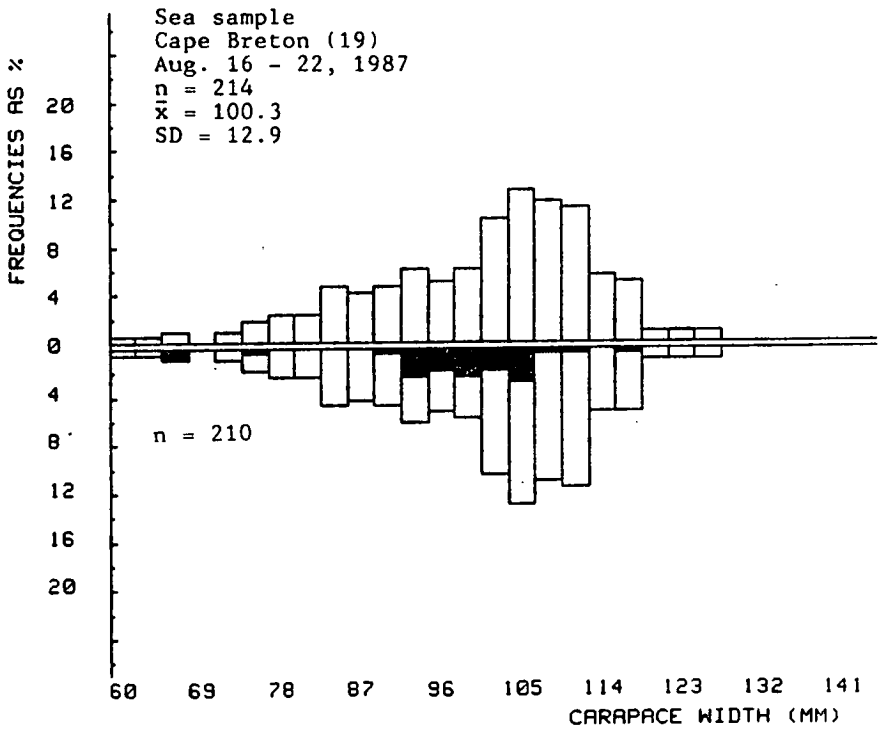


Figure 5 : Weekly size distributions of male snow crabs, C. opilio , present in sea samples taken during the 1987, Area 19 Cape Breton Island snow crab fishery.

Positive field : Total number of observations (%), white/soft shelled crabs in black.
Negative field : Percentage of mature crabs in white, percentage of immature crabs in black.





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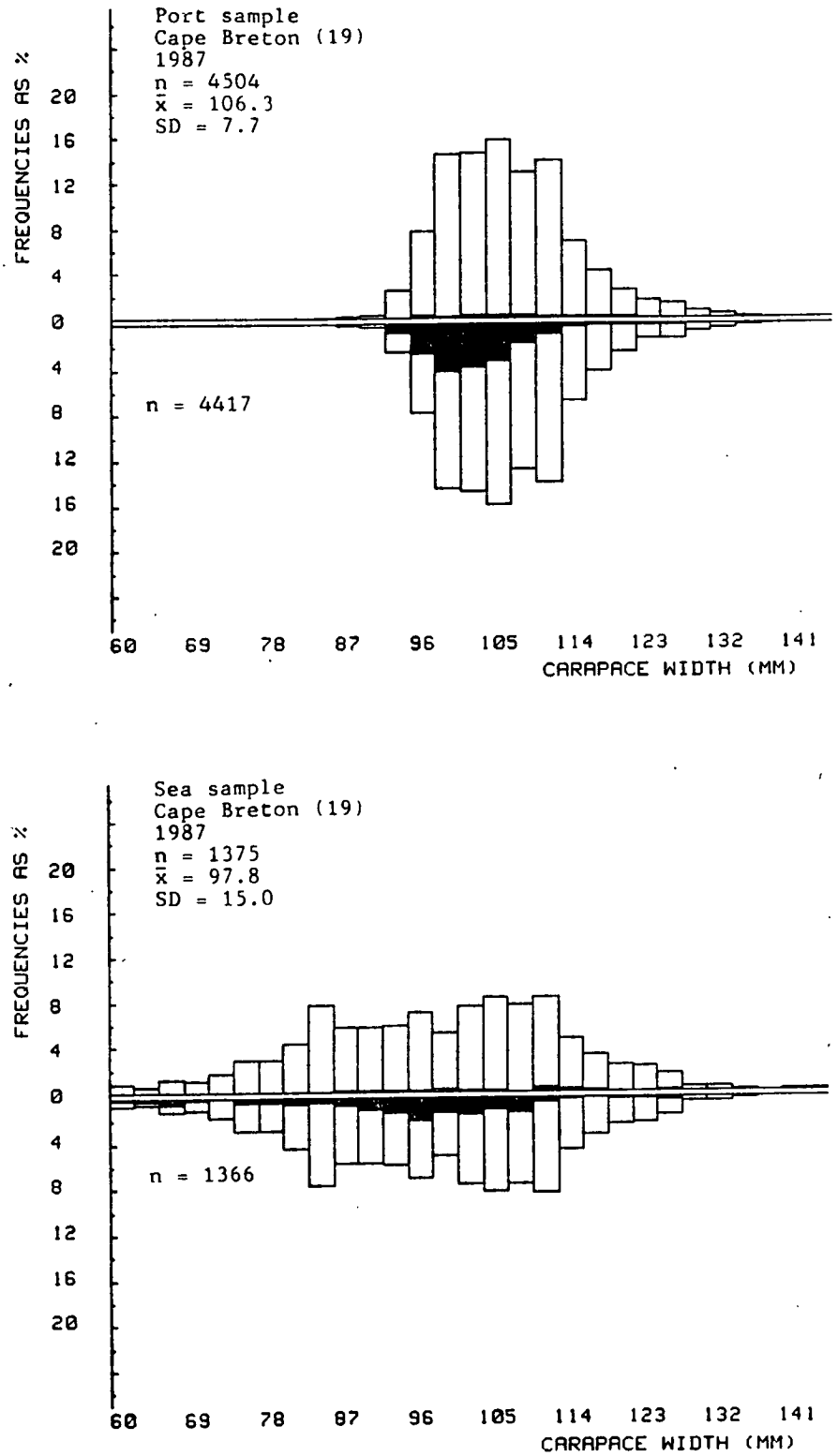
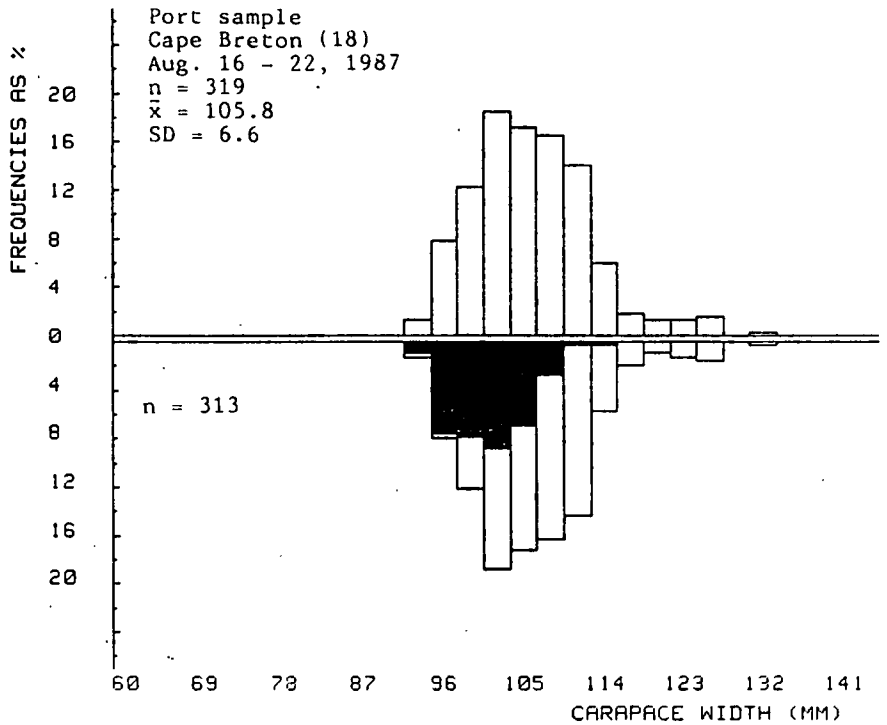


Figure 6 : Overall size distributions of male snow crab, C. opilio , present in sea and port samples taken during the 1987, Area 19 Cape Breton Island snow crab fishery.

Positive field : Total number of observations (%), white/soft shelled crabs in black.

Negative field : Percentage of mature crabs in white, percentage of immature crabs in black.



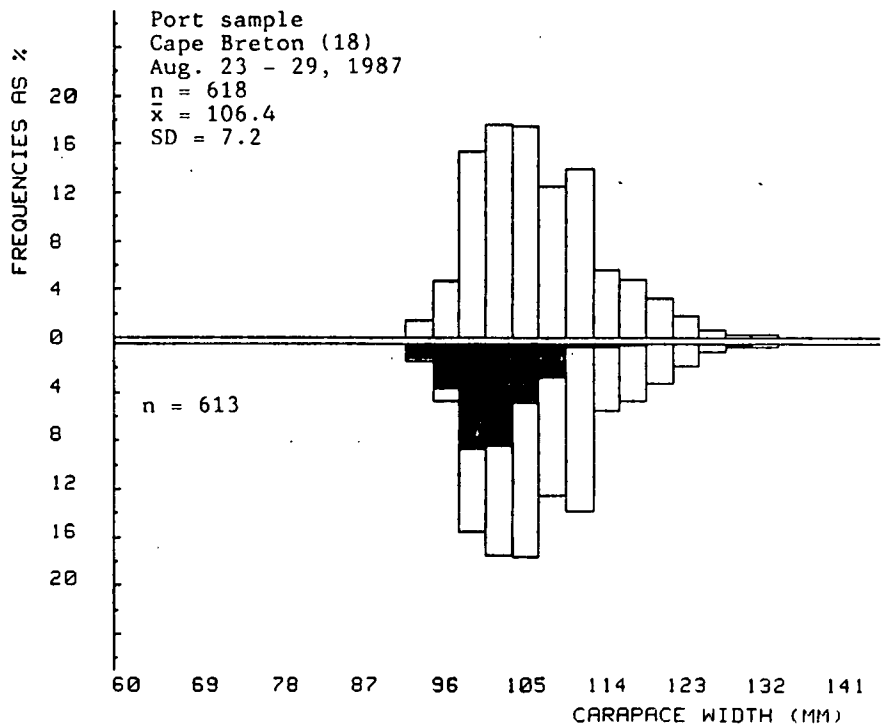
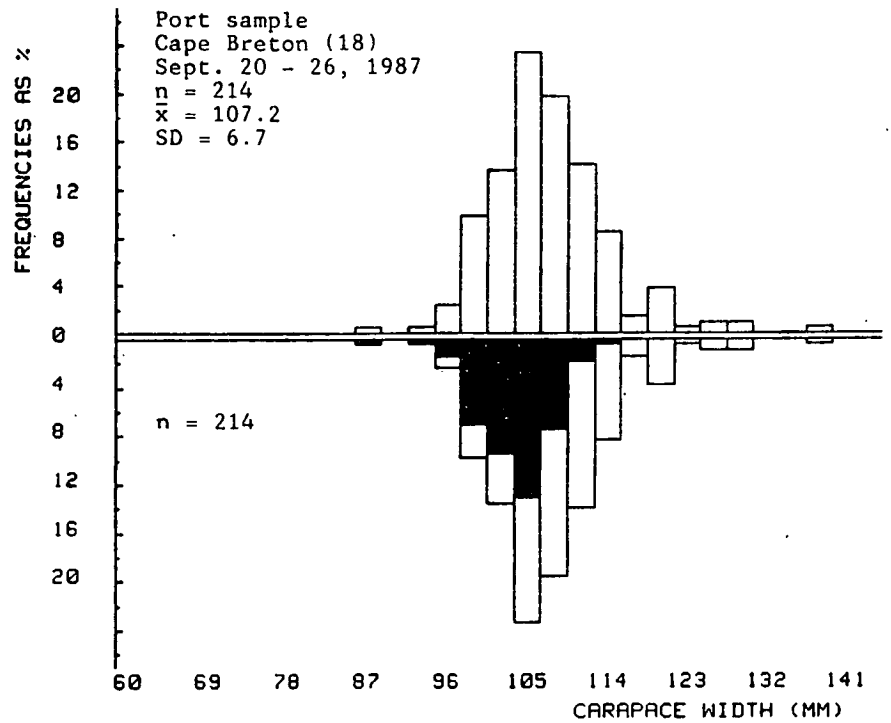


Figure 7 : Weekly size distributions of male snow crabs, C. opilio , present in port samples taken during the 1987, Area 18 Cape Breton Island snow crab fishery.

Positive field : Total number of observations (%), white/soft shelled crabs in black.
Negative field : Percentage of mature crabs in white, percentage of immature crabs in black.



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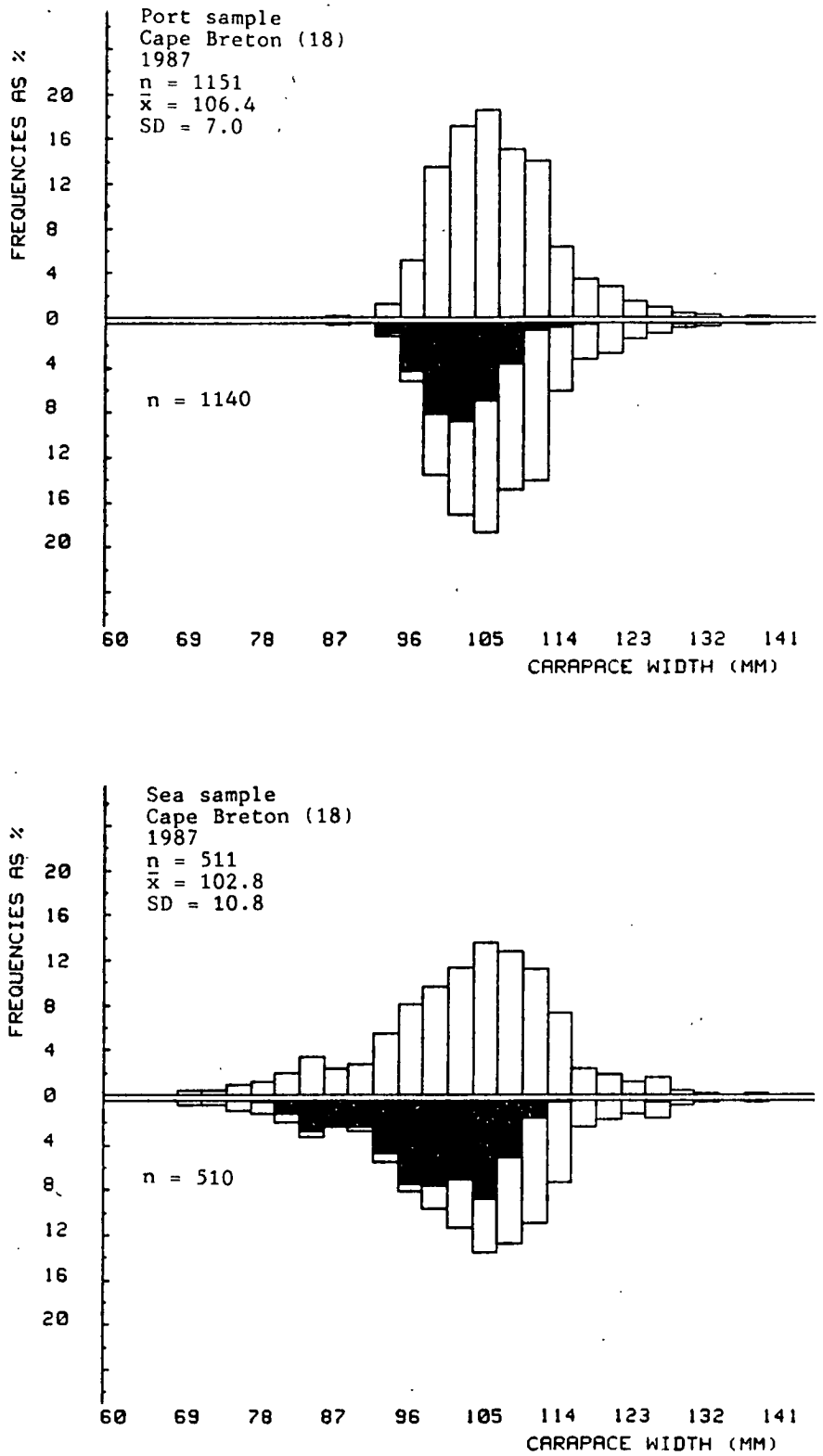

Figure 8 : Overall size distributions of male snow crab, C. opilio , present in sea and port samples taken during the 1987, Area 18 Cape Breton Island snow crab fishery.

Positive field : Total number of observations (%), white/soft shelled crabs in black.
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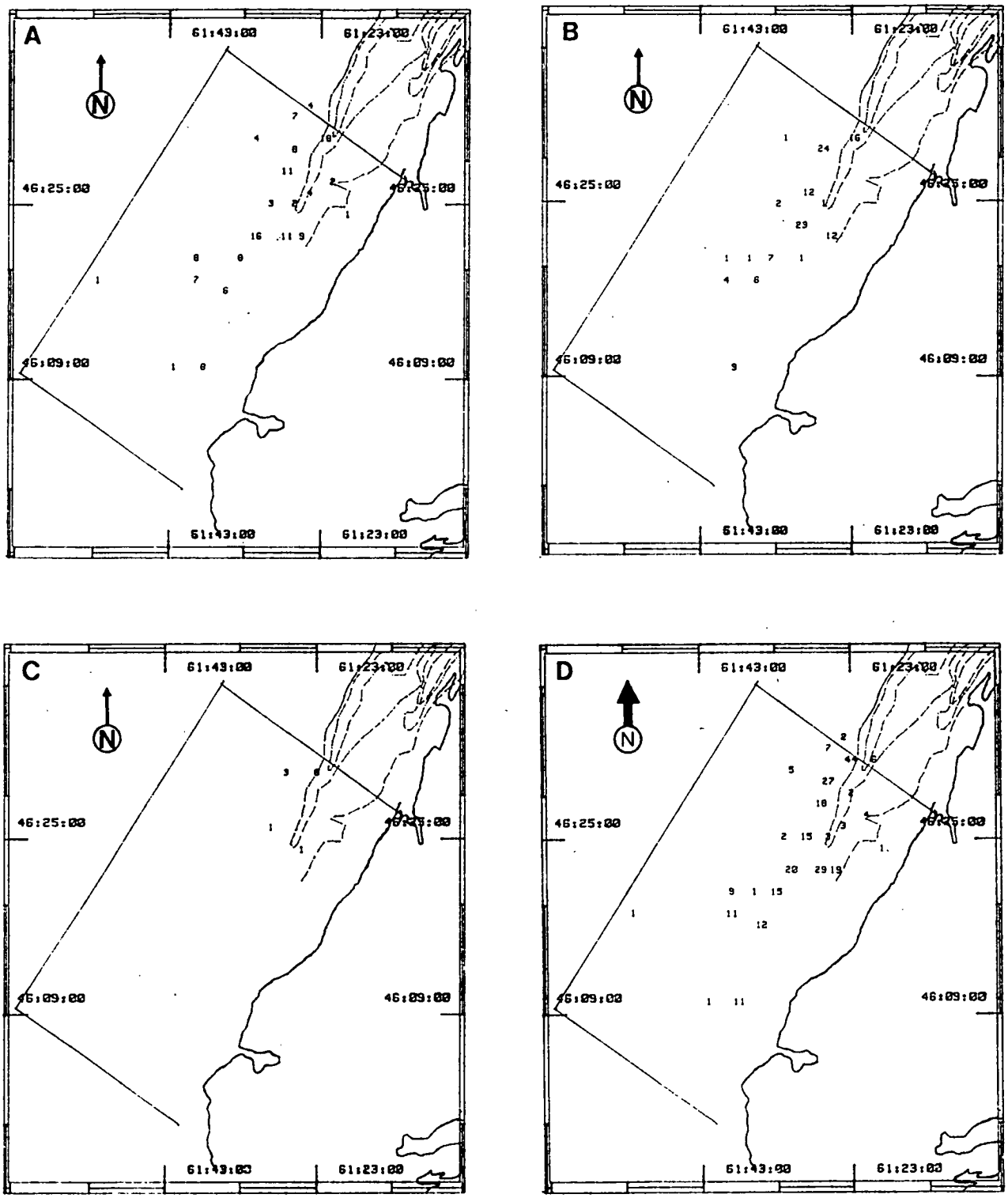

Figure 9: Distribution of fishing effort for the Area 18 Cape Breton Island snow crab, Chionoecetes opilio, fishery - 1987.
A: weeks 1-3, B: weeks 4-6, C: weeks 7-8, D: Overall
#: number of positions reported by fishermen

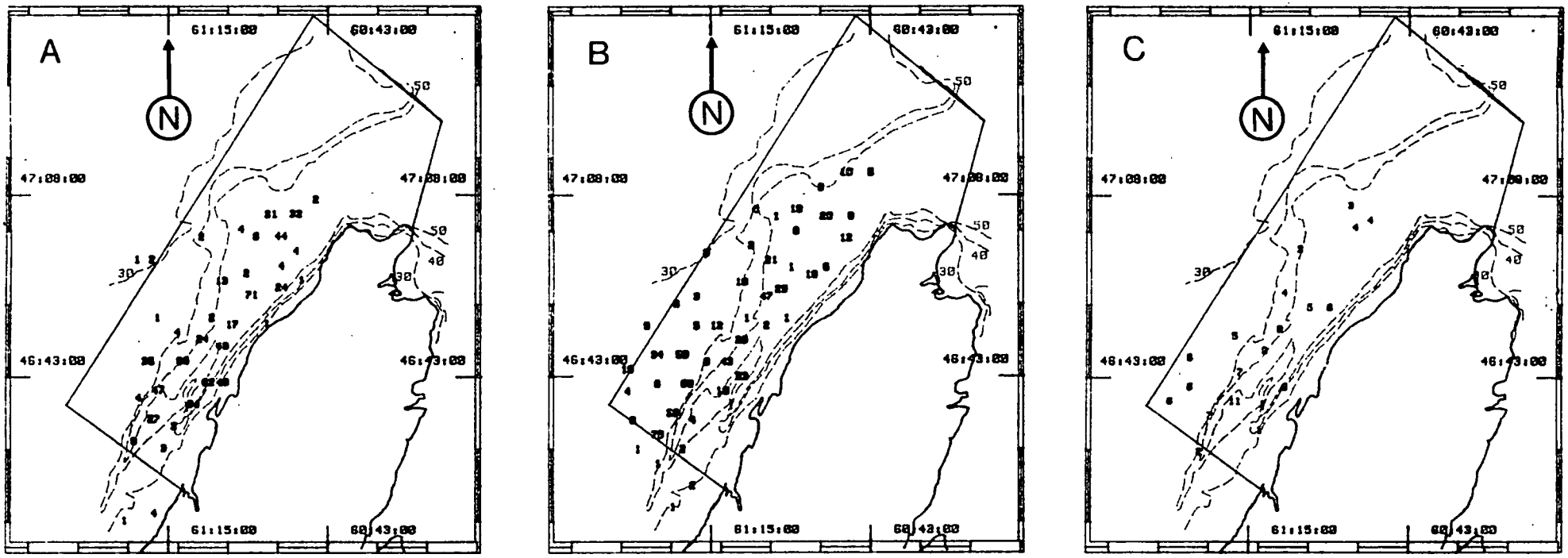

Figure 10: Distribution of fishing effort for the Area 19 Cape Breton Island snow crab, Chionoecetes opilio, fishery - 1987
A: weeks 1-3, B: weeks 4-7, C: weeks 8-10
#: number of positions reported by fishermen

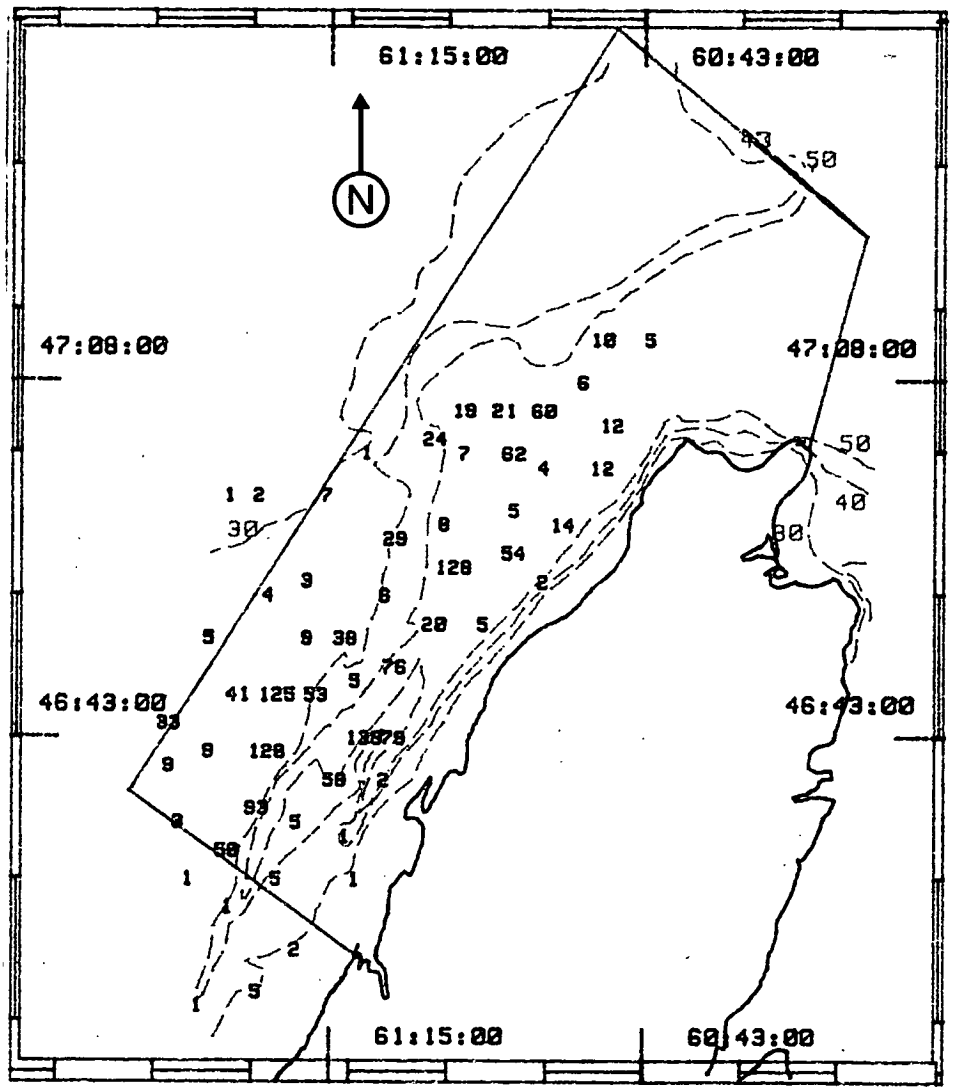

Figure 11 : Overall distribution of fishing effort for the Area 19 Cape Breton Island snow crab, C. opilio, fishery - 1987.

: Number of positions reported by fishermen

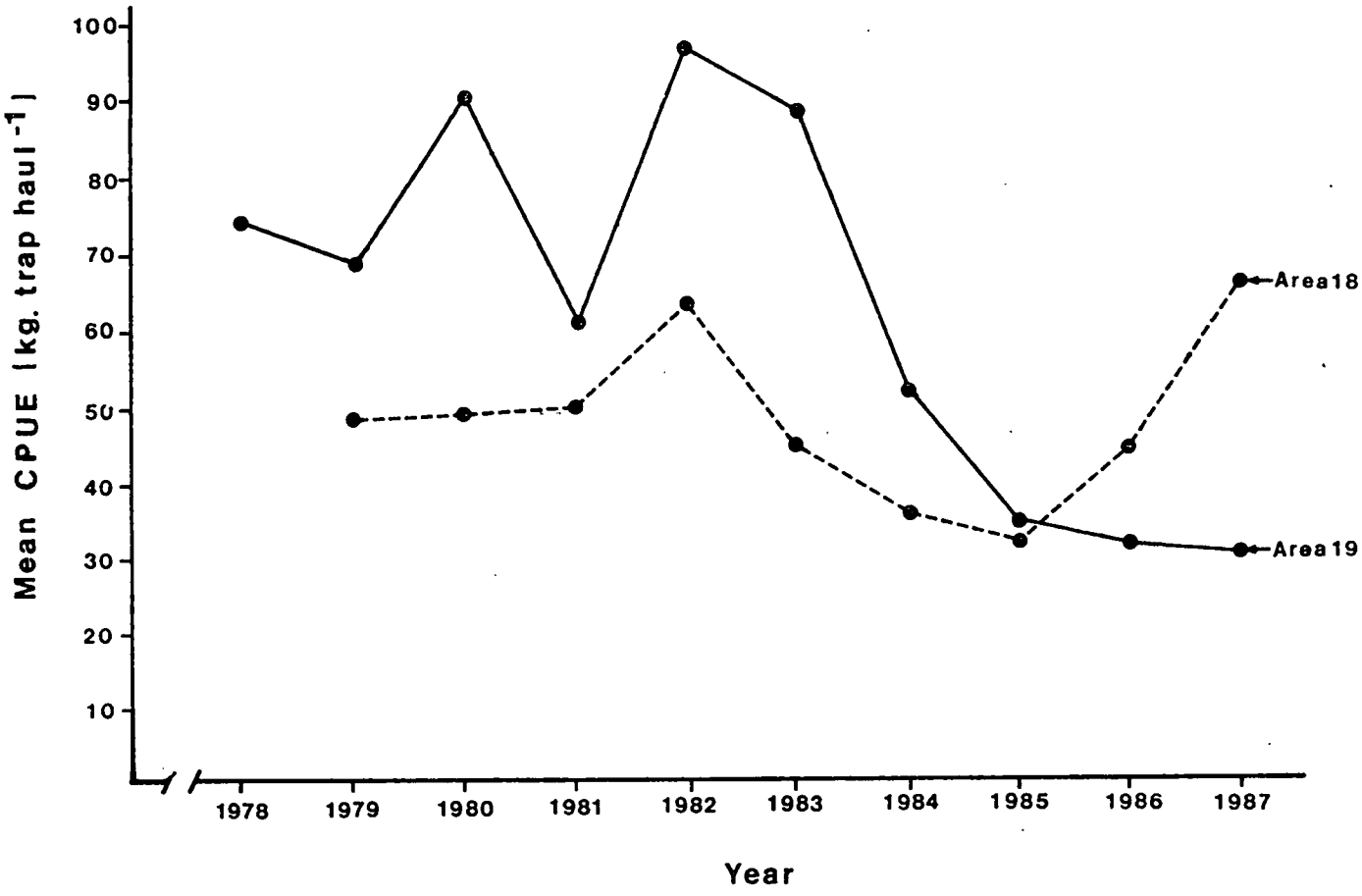

Figure 12 : Trends in mean CPUE (kg/trap haul) for the snow crab, Chionoecetes opilio, fishery off western Cape Breton Island (Areas 18 and 19) from 1978 to 1987.

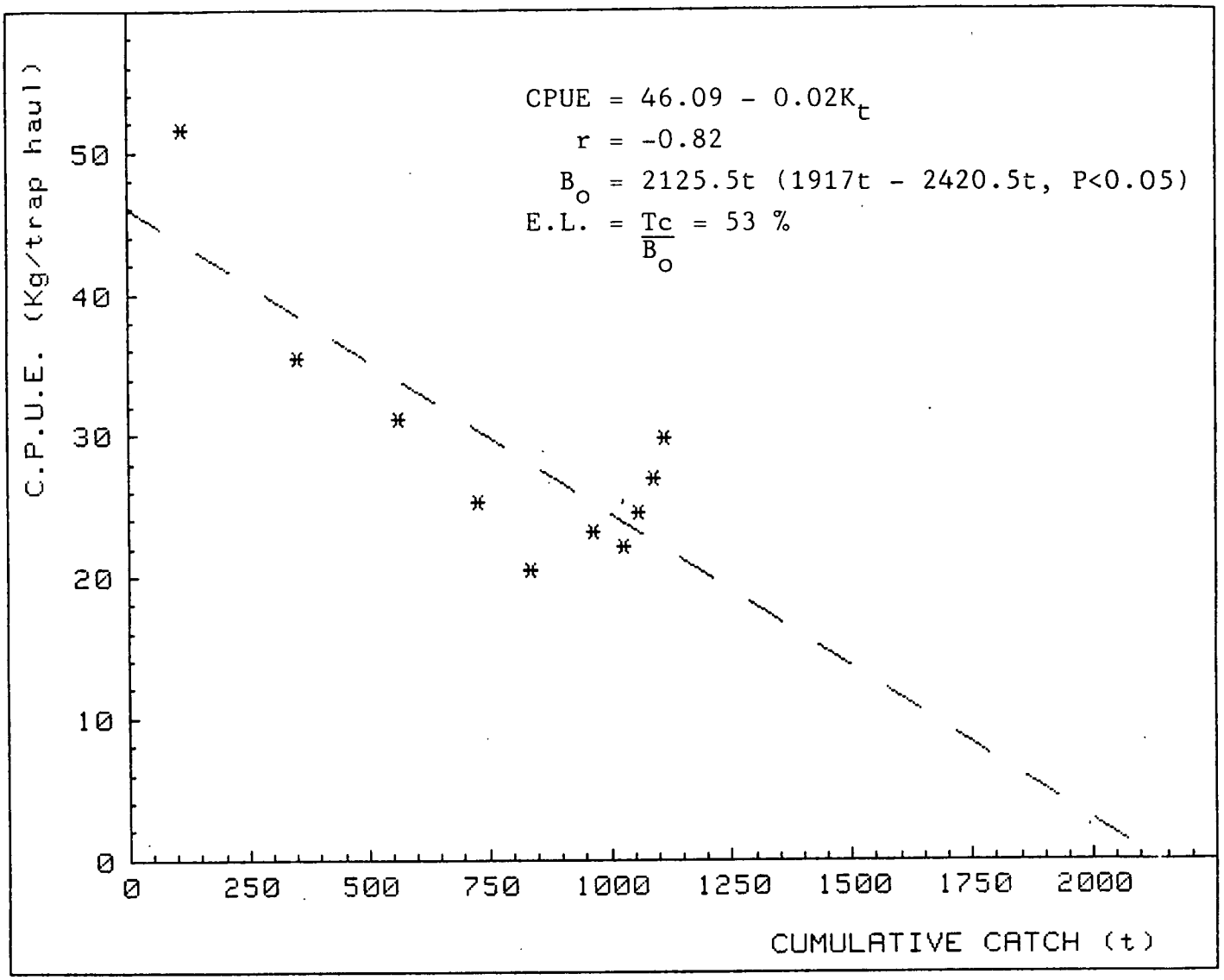

Figure 13 : Cumulative logbook catch (t) versus mean weekly catch per unit effort (kg/trap haul) and Leslie analysis results for the 1987 Area 19 Cape Breton Island snow crab, C. opilio, fishery.

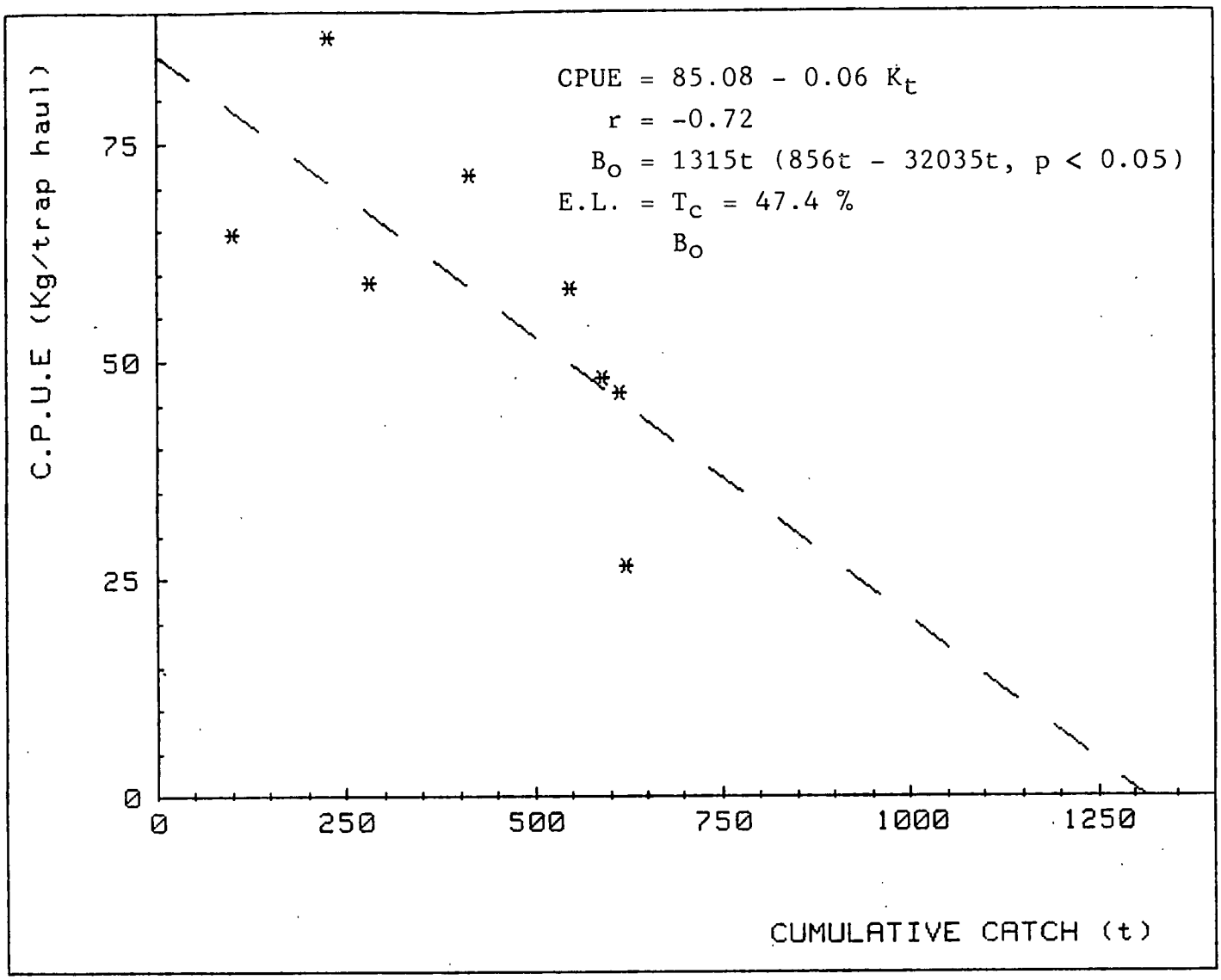

Figure 14 : Cumulative logbook catch (t) versus mean weekly catch per unit effort (kg/trap haul) and Leslie analysis results for the 1987 Area 18 Cape Breton Island snow crab, C. opilio, fishery.