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Prince Edward Island Snow Crab Fishery Stock Assessment for 1986

by

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ABSTRACT

An experimental snow crab fishery was established off northern Prince Edward Island (PEI) in 1985. Sixteen experimental permits were issued in 1985 and an additional 14 were issued for the 1986 season. The fishery has been under no quota limitations.

During the 1986 season, pertinent biological characteristics were obtained through an extensive sea sampling program. Catch, effort and distribution of fishing effort were obtained from fishermen's logbooks.

The distribution of fishing effort indicates the presence of two fishing grounds; the major ground (zone 1) is situated north of central PEI and a smaller ground (zone 2) is directly north of the eastern tip of the island. Both grounds are delimited by the 30 fathom countour and the zone boundaries.

Mean size of male crabs caught increased from 107.8 mm carapace width (CW) in 1985 to 111.8 mm CW in 1986. An increase in the incidence of soft shelled crabs in the mid to late summer led to a temporary closure and indicates a mid-season period of recruitment.

Fluctuations in CPUE coupled with the mid-season closure negated the use of a Leslie analysis in interpreting catch-effort data.

Fishing effort increased 150% in 1986 compared to 1985 (38003 trap hauls versus 15190 trap hauls respectively) resulting in a 54.6% increase in total catch (1239 t in 1986 versus 801.7 t in 1985). If initial biomass had been sufficient, a more proportionate increase in catch would have been realized with the increase in effort. However the increase in effort versus catch resulted in decreased CPUE's compared to 1985. The mean CPUE in Zones 1 and 2 were 35.3 kg/trap haul and 23.6 kg/trap haul respectively, representing 33.1% and 55.3% decreases when compared to the overall 1985 mean CPUE of 52.8 kg/trap haul.

A reduction in effort is suggested if increased CPUE's and long term stock stability are to be realized. Annual closure of the season coinciding with the increased incidence of soft shelled crab would help protect recruitment into the fishery.

RESUME

Une pêche expérimentale du crabe des neiges a été établie au nord de l'Ile-du-Prince-Edouard (I.-P.-E.) en 1985. Seize (16) permis de pêche expérimentale ont été émis en 1985 et 14 de plus en 1986. Aucun contingent n'a été établi pour cette pêcherie.

Durant la saison 1986, des caractéristiques biologiques ont été obtenues grâce à un programme d'échantillonnage intensif. La prise, l'effort et la distribution de l'effort de pêche ont été obtenus grâce aux carnets de bord des pêcheurs.

La distribution de l'effort de pêche indique la présence de deux concentrations de pêche; la principale concentration (zone 1) est située au nord du centre de l'I.-P.-E. et la seconde, plus petite (zone 2), est située directement au nord de la pointe-est de l'I.-P.-E.. Ces deux concentrations de pêche sont délimitées par l'isobath de 30 brasses et la limite de la zone de pêche de l'I.-P.-E..

La taille moyenne des crabes mâles capturés a augmenté de 107,8 mm de la largeur de carapace (LAC) en 1985 à 111,8 mm LAC en 1986. Une augmentation de la présence de crabes à carapace molle de la mi-été jusqu'à la fin de l'été a mené à la fermeture temporaire de la saison de pêche et indique une période de recrutement au milieu de la saison de pêche.

Des fluctuations de la PUE jumellées avec la fermeture en mi-saison ont rendu l'utilisation de l'analyse de Leslie impossible pour interpréter les tendances des prises et de l'effort.

L'effort de pêche a augmenté de 150% en 1986 comparativement à 1985 (38003 casiers levés contre 15190 respectivement) menant à une augmentation de la prise totale de 54,6% (1239 t en 1986 contre 801,7 t en 1985). Si la biomasse initiale aurait été suffisante, une augmentation proportionnelle de la capture aurait été réalisée avec l'augmentation de l'effort. Cependant, l'augmentation de l'effort par rapport à la prise a résulté en une diminution de la PUE à comparer à l'année 1985. Les PUE moyennes des zones 1 et 2 étaient de 35,3 kg/casiers levés et 23,6 kg/casiers levés respectivement, représentant une diminution de 33,1% et 55,3% lorsqu'elles sont comparées à la PUE moyenne de 52,8 kg/casiers levés en 1985.

Si une augmentation de la PUE et une stabilité de la ressource sont visées, une réduction de l'effort de pêche s'impose. Une fermeture annuelle de la saison de pêche coïncidant avec l'augmentation des crabes à carapace molle dans les captures aiderait à protéger le recrutement.

INTRODUCTION

An experimental snow crab fishery was initiated off the coast of Prince Edward Island (PEI) in 1985 and is composed of management areas 25 and 26 (Figure 1). A total of 801.7 t of snow crab was landed by sixteen fishermen in 1985, with a mean catch per unit effort (CPUE) of 52.8 kg/trap haul (Davidson et al., 1986). No assessment related information is available prior to 1985 for these areas.

In 1986, fourteen new experimental permits were given to inshore fishermen from PEI and all fishermen (30) were permitted to fish in either area 25 or 26. The PEI snow crab fishery in 1986 was under no quota limitations. The following paper presents an assessment of fishery and biological trends for the 1986 PEI snow crab fishery.

MATERIAL AND METHODS

Sea sampling/Port sampling

An extensive sea sampling program was initiated in 1986 utilizing DFO sampling personnel and contracted observers. Location of capture, size (carapace width-mm), sex and shell condition (either hard or soft subjectively measured) was noted for all crabs sampled. Chela length and height was measured for males to determine morphometric maturity of males using the method described by Conan and Comeau (1986). The presence/absence of eggs and their state of development (orange, non-eyed or eyed spots discernible) was noted.

Sea samples were obtained from area 26 in weeks 3, 4, 5, 7, 9, 10, 11 and 23 of the fishing season (starting on April 13th). Weekly percentages of undersize males, immature males, females and soft shelled crabs were calculated and plotted (Figure 2). Monthly and seasonal size distributions and statistics were generated for the males.

Catch/effort data for the PEI fishery was obtained from fishermen's logbooks by the Department of Fisheries and Oceans Electronic Data Processing and Statistics Branch. The resulting data set was comprised of entries containing the following information:

a) Canadian Fisheries Vessel (CFV) number;
b) date fished;
c) date landed;
d) fishing position: the geographical fishing position was reported in Loran C or latitude/longitude.

e) number of traps hauled;
f) trap type: box traps (1.2m x 1.2m, 1.5m x 1.5m, 1.8m x 1.8m) or conical traps;
g) catch - estimated by the fishermen (lbs).

From these data, catch (converted to kg) and CPUE (daily catch/# of trap hauls per day) were calculated and summarized into weekly intervals. The weekly data summaries were used in Leslie analysis (Ricker, 1975).

The geographical fishing positions were plotted to identify the major fishing effort concentrations (Figure 3).

RESULTS AND DISCUSSION

The distribution of fishing effort (Figure 3) indicates the presence of two major fishing grounds. The main fishing ground (zone 1, Figure 3) was situated in the middle of area 26, and was delimited by the 30 fathom contour (zone 1). The second fishing ground (zone 2, Figure 3) was located north of the 30 fathom contour in the area 26/25 border region. The two distinct zones of fishing effort have been separated, as suggested by Davidson *et al.*, (1986), and weekly data summaries for Leslie analysis are presented in Tables 1 and 2.

In zone 1, the CPUE increased to a maximum of 47.9 kg/trap haul in the 5th week (Table 1, Figure 4) and then declined to the time of the closure (week 14, Table 1, Figure 4). CPUE's during the second part of the season (weeks 22-30) started at 31.8 kg/trap haul and reached a high of 41.5 kg/trap haul in the 26th week (Table 1, Figure 4). They then declined to 18.0 kg/trap haul in the last week (Table 1, Figure 4).

In zone 2, the CPUE fluctuated from 11.5 kg/trap haul in week 1 to 6.1 kg/trap haul in the 7th week (Table 2, Figure 5). It then increased up to the closure of the first part of the season reaching 41.4 kg/trap haul in week 13 (Table 2, Figure 5). CPUE's during the second part of the season (weeks 23-25) decreased from 26.1 kg/trap haul to 16.6 kg/trap haul (Table 2, Figure 5).

The weekly CPUE and cumulative catch data for the PEI snow crab fishery (Tables 1 and 2, Figures 4 and 5) is not amenable for Leslie analysis, thereby negating the possibility of estimating initial biomass (B_0) and exploitation levels (EL). Mean CPUE for the season was 35.3 kg/trap haul for zone 1 and 23.6 kg/trap haul for zone 2 (Tables 1 and 2). These mean CPUE's are 33.1% and 55.3% respectively lower than the mean CPUE of 52.8 kg/trap haul for the 1985 season. The total catch calculated from logbooks of both zones in 1986 was 1239 t, representing a 54.6% increase from the previous year. An estimation of the total catch from

sale slips indicated a landing of 1327 t in 1986 for PEI snow crab fishery. Unfortunately official data are was not available for analysis.

The increase of fourteen fishermen in 1986 corresponds to a 150% effort increase (from 15190 trap hauls in 1985 to 38003 trap hauls in 1986). If the initial biomass at the start of the season had been sufficient, the effort increase would have resulted in a proportional increase in the total catch. However, the high increase of effort (150%) and low increase of catch (54.6%) resulted in a decrease in CPUE (33.1% for zone 1 and 55.3% zone 2), suggesting that the effort is getting too high for the available biomass.

The overall size frequency distribution for 1986 (Figure 6) shows a mode at 114-116 mm of carapace width (CW) and an average size of 111.8 mm CW. These results show an increase in the average size compared to 1985 (107.8 mm CW). The mode shifted to the right from 109-111 mm CW in 1985 to 114-116 mm CW in 1986. The monthly size distributions (Figure 7) show an increase in the average size for the first part of the season (week 1-13). The average size went from 107.5 mm CW in April to 112.3 mm CW in May and reached 114.0 mm CW in June. The average size for September was 107.4 mm CW. However, in 1985 the average size decreased from 108.1 mm CW in May to 105.4 mm in June. The average size for September 1986 (107.4 mm CW) is lower than that observed in 1985 (116.6 mm CW. This represents two years of historical data, which is not sufficient to hypothesize on the fishing trend.

The percentage of white crabs showed an increase during weeks 10 and 11 (Table 3, Figure 2) indicating a period of recruitment. A high percentage of white crabs (34.1%, Table 3, Figure 2) was still present in the catch when the season reopened in week 22 indicating that recruitment had persisted through the closure.

In summary, a reduction in effort may be in order if increased CPUE's and long term stock stability are to be realized. Permanent annual closure of the season coinciding with the increased incidence of white crabs in the catch would help protect against overfishing of newly molted crabs which constitute a portion of the next year's recruitment. The authors suggest that a season coinciding with that observed by the Gulf's offshore fishery would be preferred over that currently enforced and would be more in keeping with the concept of a supplementary fishery.

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Davidson, K., M. Comeau, P. Mallet and M. Moriyasu. 1986. Fishery trends and stock assessments for four snow crab, Chionoecetes opilio, fisheries in the Gulf of St Lawrence, 1985. Can. Atl. Fish. Sci. Adv. Comm. Res., Doc. 1986/51: 50 pp.

Ricker, W.E. 1975. Computation and interpretation of biological statistics of fish populations. Bull. Fish. Res. Board Can. 91: 382p.

TABLE 1 - Weekly effort and catch data for the 1986 Prince Edward Island snow crab, Chionoecetes opilio, fishery in zone 1.

WEEK*	Total Catch C_t (kg)	$C_t/2$ (kg)	#traps hauls	CPUE (kg/trap haul)	Cumulative catch K_t (t)
1 Apr. 13-19	5293	2646	353	15.0	2.6
2 Apr. 20-26	75754	37877	2293	33.0	43.2
3 Apr. 27-May 3	76710	38355	2381	32.2	119.4
4 May 4-10	117438	58719	2884	40.7	216.5
5 May 11-17	107600	53800	2245	47.9	329.0
6 May 18-24	76390	38195	2321	32.9	421.0
7 May 25-31	83733	41866	2196	38.1	501.1
8 June 1- 7	63972	31986	2093	30.6	574.9
9 June 8-14	82263	41131	2057	40.0	648.0
10 June 15-21	95918	47959	2356	40.7	737.1
11 June 22-28	39894	19947	1491	26.8	805.0
12 June 29-July 5	9843	4922	731	13.5	829.9
13 July 6-12	2926	1463	165	17.7	836.3
14 July 13-19	-	-	-	-	-
15 July 20-26	-	-	-	-	-
16 July 27-Aug.2	-	-	-	-	-
17 Aug. 3- 9	-	-	-	-	-
18 Aug. 10-16	-	-	-	-	-
19 Aug. 17-23	-	-	-	-	-
20 Aug. 24-30	-	-	-	-	-
21 Aug. 31-Sept 6	-	-	-	-	-
22 Sept 7-13	954	477	30	31.8	838.2
23 Sept 14-20	24430	12215	888	27.5	850.9
24 Sept 21-27	45964	22982	1324	34.7	886.1
25 Sept 28-Oct 4	43775	21888	1197	36.6	931.0
26 Oct 5-11	28648	14324	690	41.5	967.2
27 Oct 12-18	24230	12115	705	34.4	993.6
28 Oct 19-25	24755	12377	770	32.1	1018.1
29 Oct 26-Nov 1	1814	907	60	30.2	1031.4
30 Nov. 2- 8	1082	541	60	18.0	1032.8

Total catch=1033 386 kg; Total traps hauls=29 290;
Mean CPUE=35.3 kg/trap haul

* The season was officially opened April 1st 1986 and closed November 31st 1986. The fishermen fished from April 13 to November 8.
There was a closure from the 14th to the 22nd week (July 9th to September 13th) due to a high incidence of white crabs in the catch.

TABLE 2 - Weekly effort and catch data for the 1986 Prince Edward Island snow crab, Chionoecetes opilio, fishery in zone 2.

WEEK*	Total Catch C_t (kg)	$C_t/2$ (kg)	#traps hauls	CPUE (kg/trap haul)	Cumulative catch K_t (t)
1 Apr. 13-19	-	-	-	-	-
2 Apr. 20-26	-	-	-	-	-
3 Apr. 27-May 3	4382	2191	380	11.5	2.2
4 May 4-10	11390	5695	676	16.8	10.1
5 May 11-17	6696	3348	542	12.6	19.1
6 May 18-24	3851	1926	570	6.8	24.4
7 May 25-31	5453	2726	895	6.1	29.0
8 June 1- 7	12423	6212	767	16.2	38.0
9 June 8-14	19670	9835	711	27.7	54.0
10 June 15-21	26512	13256	684	38.8	77.1
11 June 22-28	27250	13625	658	41.4	104.0
12 June 29-July 5	35060	17530	957	36.6	135.2
13 July 6-12	17315	8657	418	41.4	161.3
14 July 13-19	-	-	-	-	-
15 July 20-26	-	-	-	-	-
16 July 27-Aug.2	-	-	-	-	-
17 Aug. 3- 9	-	-	-	-	-
18 Aug. 10-16	-	-	-	-	-
19 Aug. 17-23	-	-	-	-	-
20 Aug. 24-30	-	-	-	-	-
21 Aug. 31-Sept 6	-	-	-	-	-
22 Sept 7-13	-	-	-	-	-
23 Sept 14-20	11705	5852	449	26.1	175.9
24 Sept 21-27	20230	10115	785	25.8	191.8
25 Sept 28-Oct 4	3679	1840	221	16.6	203.8

Total catch=205 616 kg; Total traps hauls=8 713;
Mean CPUE=23.6 kg/trap haul

* The season was officially opened April 1st 1986 and closed November 31st 1986. The fishermen fished from April 13 to November 8. There was a closure from the 14th to the 22nd week (July 9th to September 13th) due to a high incidence of white crabs in the catch.

TABLE 3 - Biological characteristics of snow crab, Chionoecetes opilio, present in sea samples during the prince Edward Island, area 26 snow crab fishing season - 1986

WEEK*	% of imm. ≥ 95mm (N)	% of white crab (N)	% of undersize (N)	% of female (N)
1 Apr. 13-19	-	-	-	-
2 Apr. 20-26	-	-	-	-
3 Apr. 27-May 3	8.3% (315)	-	15.8% (387)	1.5% (393)
4 May 4-10	15.6% (508)	-	13.7% (600)	0.5% (603)
5 May 11-17	9.5% (928)	3.2% (189)	15.6% (115)	2.9% (1142)
6 May 18-24	-	-	-	-
7 May 25-31	15.3% (1193)	13.1% (398)	5.7% (1284)	0% (128)
8 June 1- 7	-	-	-	-
9 June 8-14	7.4% (470)	0% (29)	8.8% (520)	2.3% (532)
10 June 15-21	11.1% (198)	79.1% (225)	5.6% (215)	0% (215)
11 June 22-28	7.0% (142)	76.2% (146)	2.7% (146)	0% (146)
12 June 29-July 5	-	-	-	-
13 July 6-12	-	-	-	-
14 July 13-19	-	-	-	-
15 July 20-26	-	-	-	-
16 July 27-Aug.2	-	-	-	-
17 Aug. 3- 9	-	-	-	-
18 Aug. 10-16	-	-	-	-
19 Aug. 17-23	-	-	-	-
20 Aug. 24-30	-	-	-	-
21 Aug. 31-Sept 6	-	-	-	-
22 Sept 7-13	14.1% (198)	34.1% (261)	20.3% (261)	0% (261)
23 Sept 14-20	-	-	-	-

* The season was officially opened April 1st 1986 and closed November 31st 1986. The fishermen fished from April 13 to November 8. There was a closure from the 14th to the 22nd week (July 9th to September 13th) due to a high incidence of white crabs in the catch.

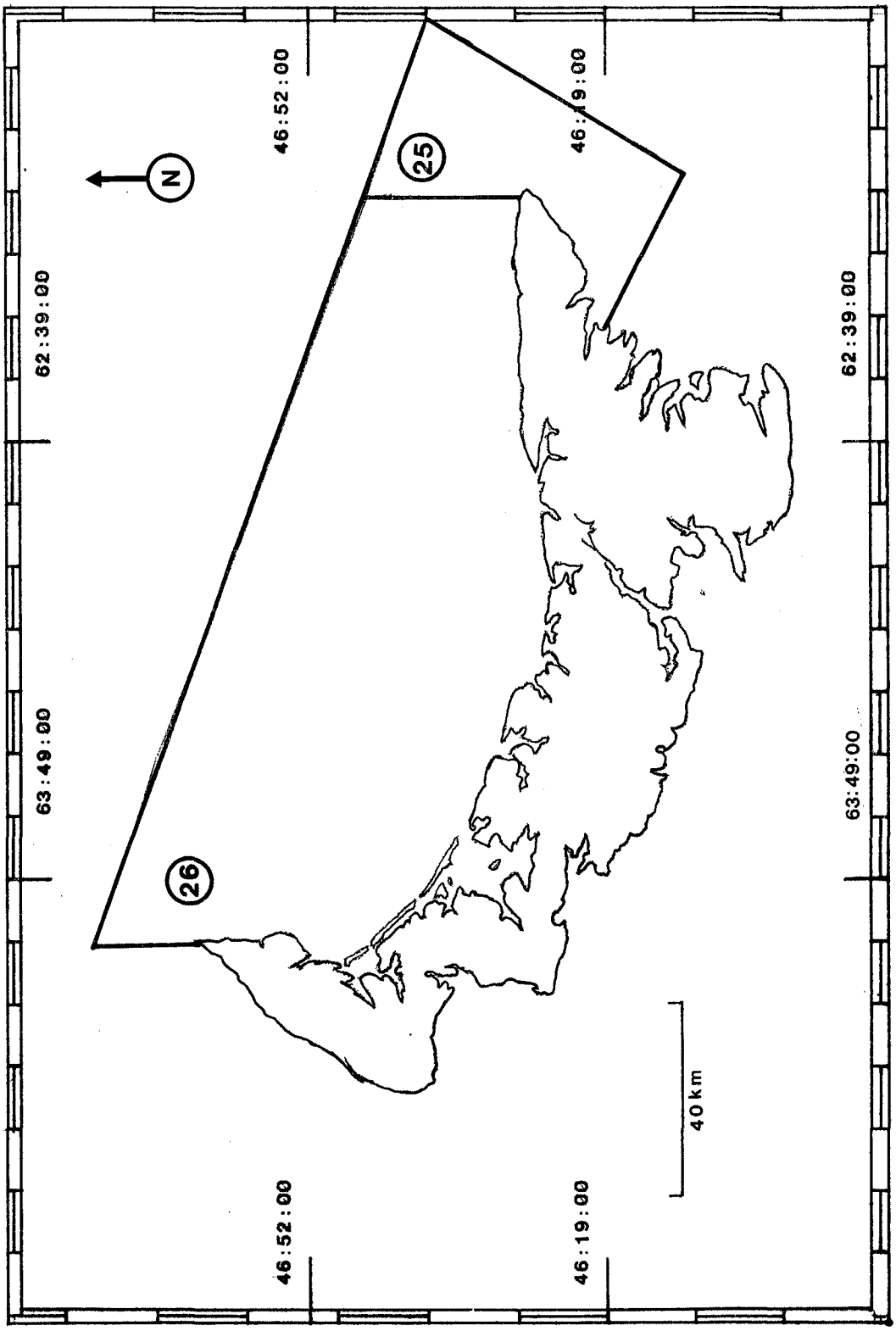

Figure 1: Prince Edward Island fishing areas 25 and 26.

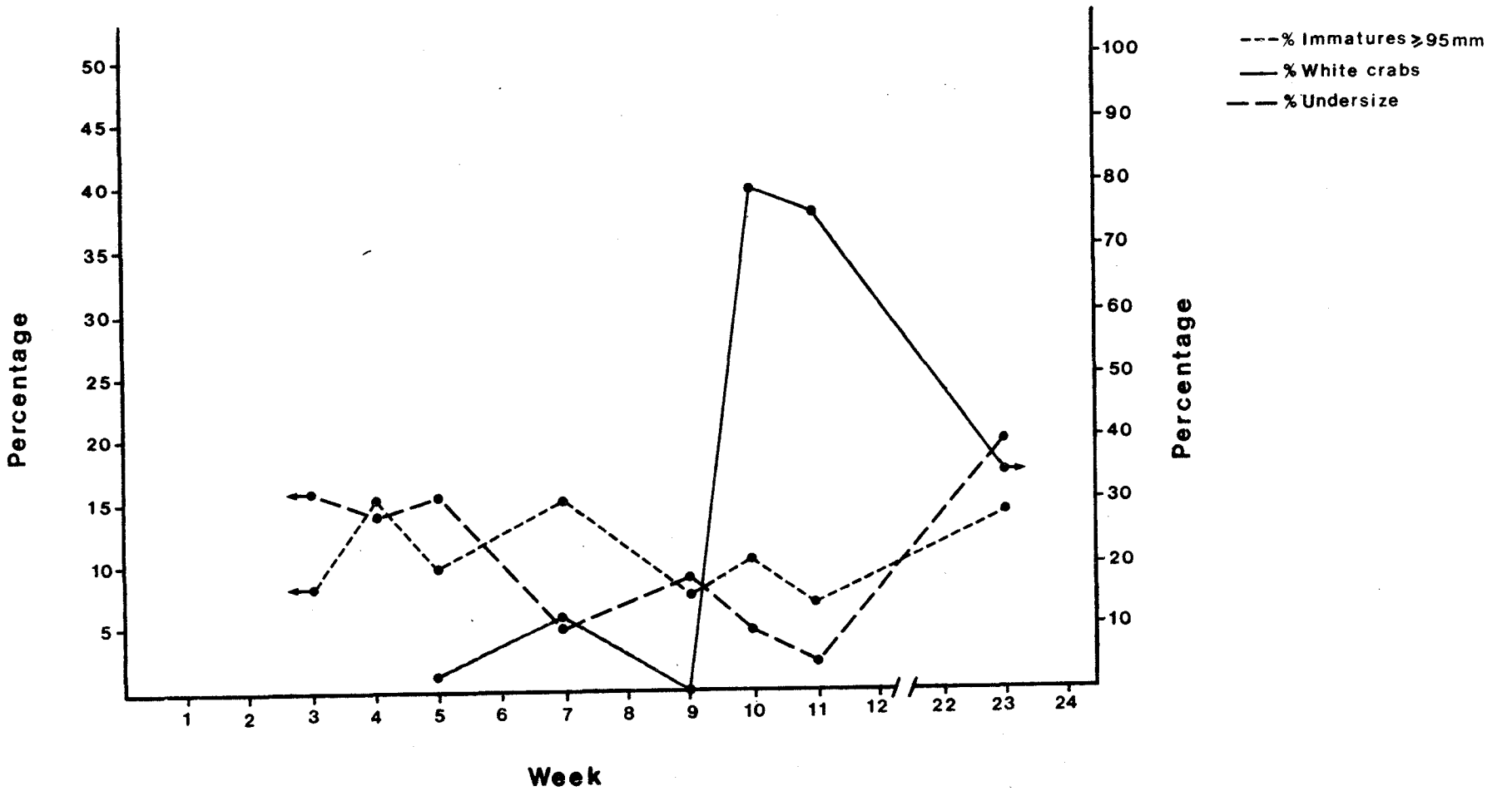

Figure 2: Weekly fluctuations, during 1986 snow crab fishing season, of the percentage of immatures (≥ 95 mm), undersize and white/soft shelled snow crab, Chionoecetes opilio, present in sea samples of area 26 (Prince Edward Island).

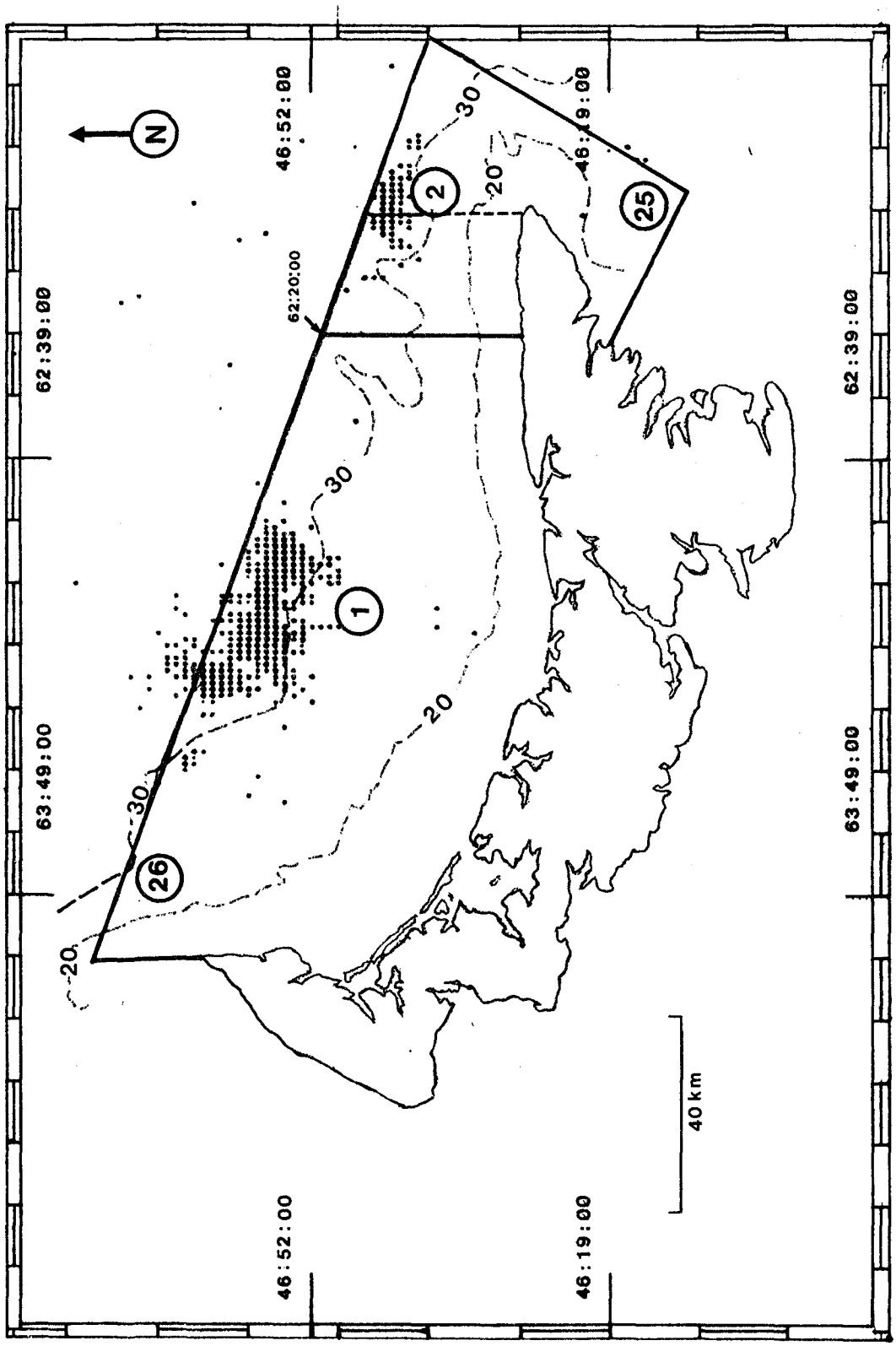

Figure 3: Overall distribution of fishing effort seperated into two major fishing grounds (zones 1 and 2) for the Prince Edward Island snow crab, Chionoecetes opilio, fishery- 1986.

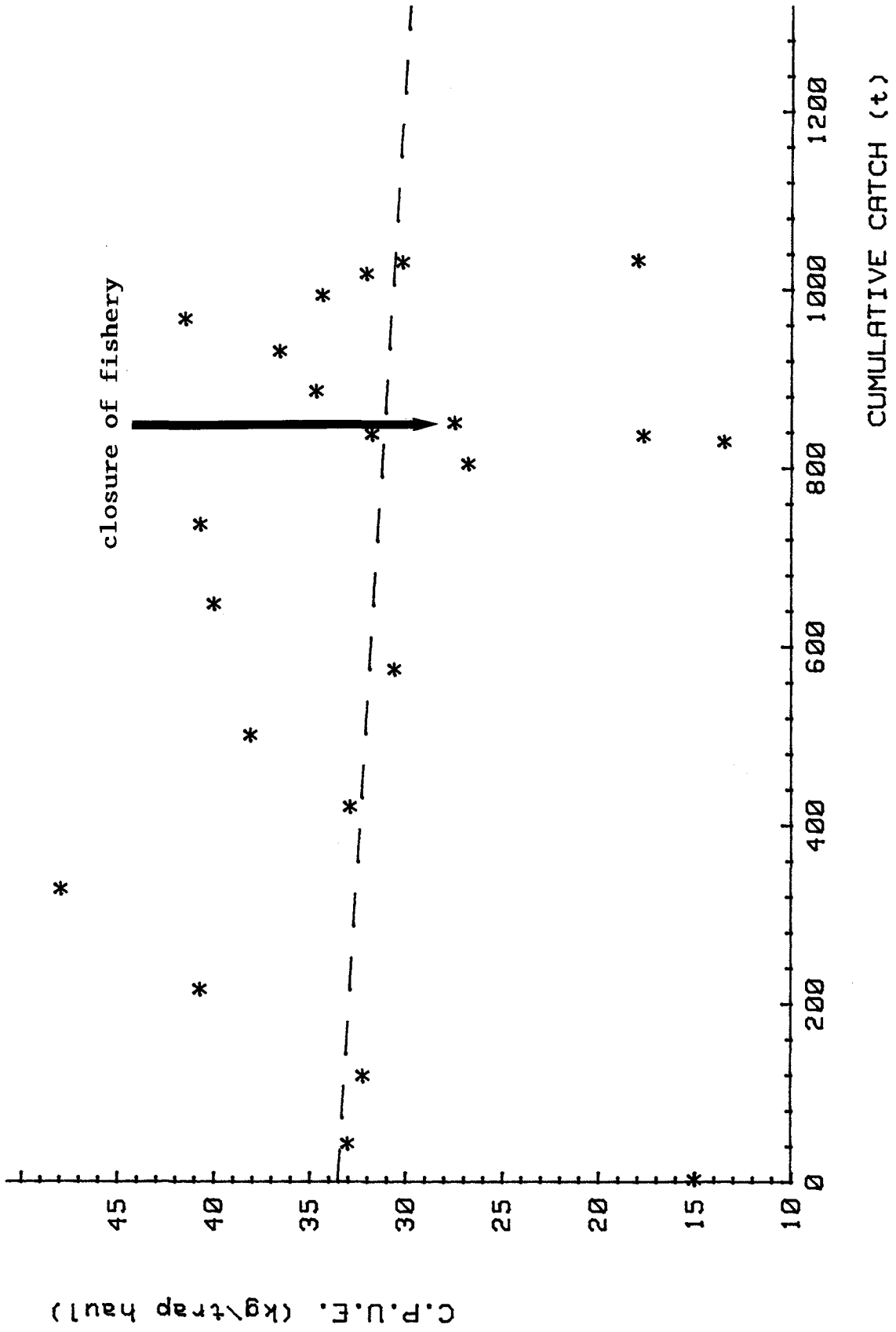

Figure 4: Cumulative catch (t) versus mean weekly catch per unit effort (C.P.U.E. kg/trap haul) for the 1986 Prince Edward Island snow crab, Chionoecetes opilio, fishery - zone 1.

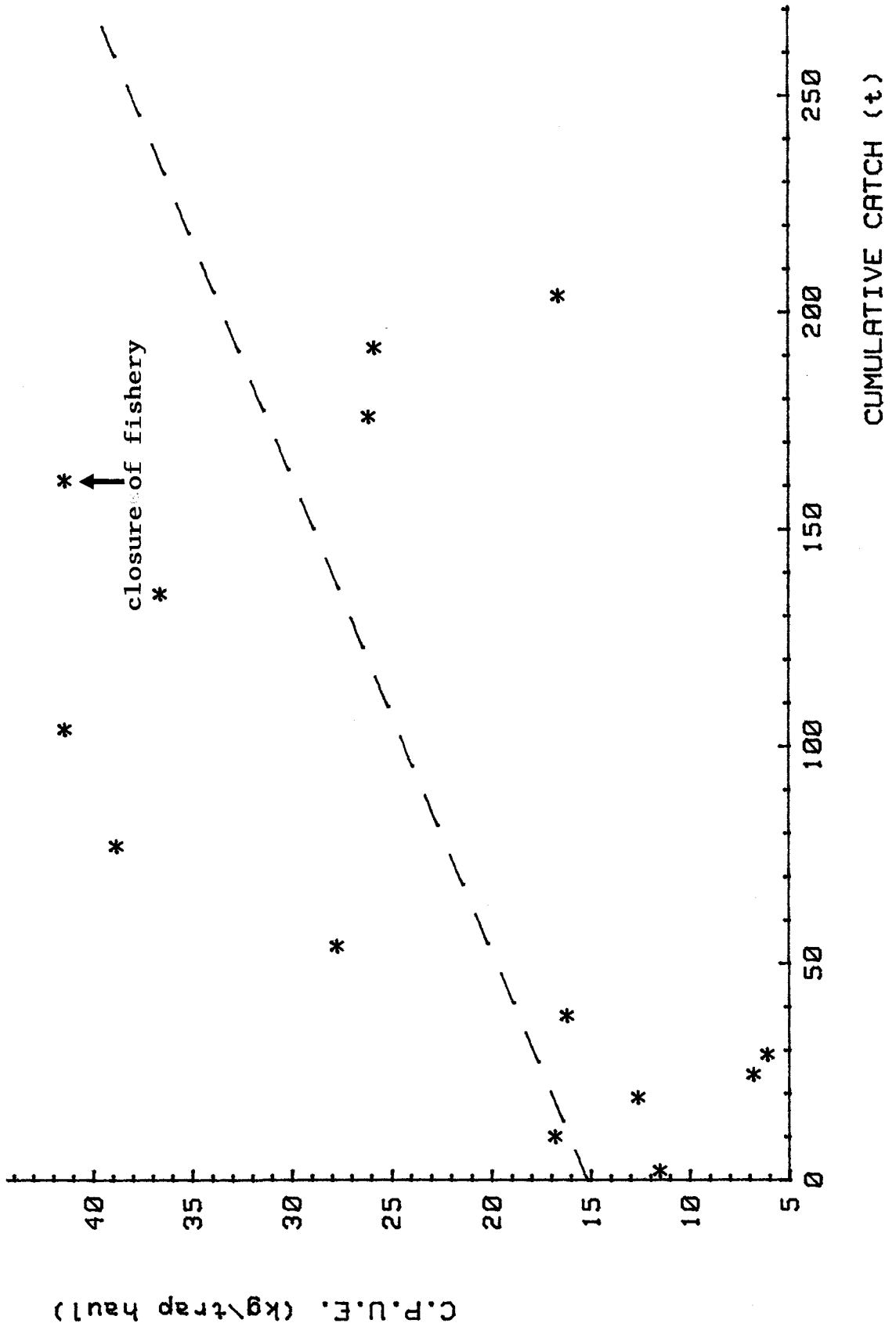

Figure 5: Cumulative catch (t) versus mean weekly catch per unit effort (C.P.U.E. kg/trap haul) for 1986 Prince Edward Island snow crab, Chionoecetes opilio, fishery - zone 2.

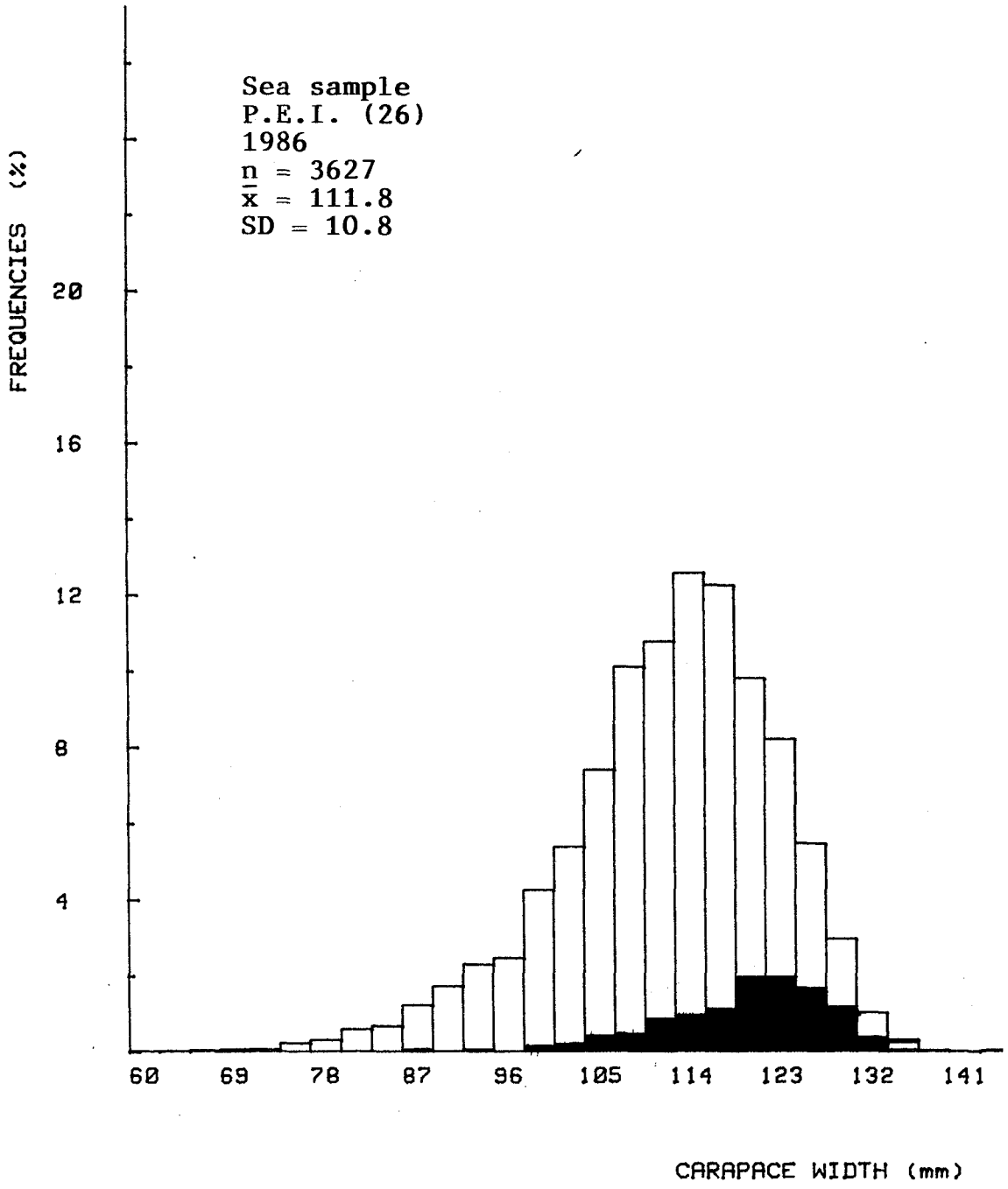

Figure 6: Seasonal size distribution of male snow crab, Chionoecetes opilio, present in sea samples taking during the 1986, area 26 Prince Edward Island snow crab fishery.

■ = white/soft crab

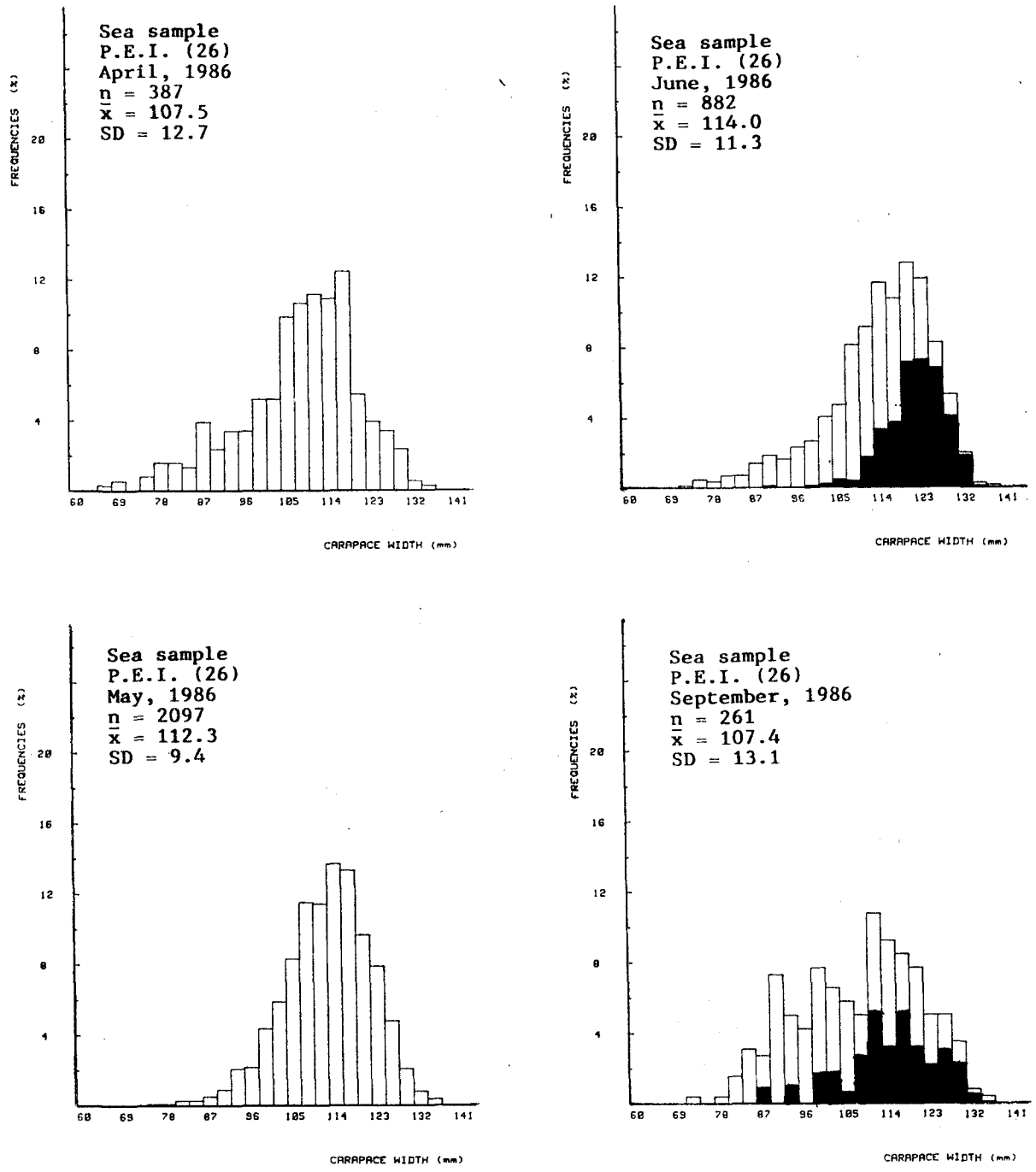

Figure 7: Monthly size distributions of male snow crab, Chionoecetes opilio, present in sea samples taking during the 1986, area 26 Prince Edward Island snow crab fishery.

■ = white/soft crab