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Assessment of the Newfoundland Snow Crab, Chionoecetes opilio, Fishery - 1988

by

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Abstract

Catch effort data from nineteen crab management areas are presented along with comparative (1987-88) size frequency/shell condition, histograms for ten of these areas. Reproductive status of female snow crab (Chionoecetes opilio) from Conception Bay, Bonavista Bay and northeastern Avalon is compared.

Résumé

On présente des données sur l'effort et les prises dans dix-neuf zones de gestion du crabe, des comparaisons sur la fréquence des tailles et la condition de la carapace en 1987-1988 et des histogrammes pour dix des zones considérées. On établit également des comparaisons entre la fonction reproductive du crabe des neiges femelle (Chionoecetes opilio) des baies de Conception et de Bonavista ainsi que du nord-est d'Avalon.

Introduction

The Newfoundland snow crab (Chionoecetes opilio) fishery began in 1968 at Hant's Harbour, Trinity Bay. Development of this fishery proceeded at a moderate pace until the late 1970's when increased demand, processing capacity and harvesting capacity caused landings to increase yearly at a rapid pace until 1982. Since then the fishery in the Southern Zone has been in a state of collapse due to a combination of overexploitation, indicated by declining catch rates and a failure of recruitment mechanisms within the snow crab population.

While the snow crab fishery began to decline in the Southern Zone, the fishery in the Northern Zone began to expand. Although this expansion was rapid beginning in 1982, it proved to be brief and ended in 1985. At present, the Newfoundland snow crab fishery remains in a state of collapse in many areas of the Northern Zone while in the Southern Zone and in 3Ps the fishery is stable or expanding due to increased resource availability.

A blow to the stability of the fishery was the cancellation of the regulation prohibiting the retention of soft-shelled ("white") crabs in 1986 (Taylor and O'Keefe 1987). As most of the molting activity in the Newfoundland Region takes place during the commercial fishing season (April-December) the dropping of this regulation has resulted in fishermen landing both hard- and soft-shelled animals. This de facto mid-season recruitment into the fishery has rendered Leslie analysis useless as an assessment tool in all management areas that experienced such a mid-season pulse of molting. As this phenomenon is common throughout the Northern Zone and the deep water bays of the Southern Zone, we are once again restricted to considering comparative catch/effort and available size-frequency/shell condition data as a means of assessing the general "health" of snow crab stocks.

In 1986 Resource Management Branch imposed quotas on all management zones. These quotas were loosely based on 1985 landings, but in areas where exploitation rates were excessive, quotas were set below 1985 landing levels. While the quotas were overfished in several areas, this management initiative must be viewed as a positive step. Again in 1987 and 1988, Resource Management Branch utilized quotas in order to limit fishing effort and exploitation rates.

Although supplementary crab licences were first issued in the Northern Zone in 1985 resource managers declined to issue similar licences in the Southern Zone citing resource conservation and the failure of the fishery in some management areas. However, in 1988 supplementary licences were issued in all inshore areas of the Newfoundland Region, making the crab fishery a "two fleet fishery".

While there remains a "core" of 71 full-time vessels, these fishing enterprises are now more restricted than in previous years. In the Northern Zone all large full-time vessels have been licenced for the offshore (Area 40) only, while a portion of the fleet, those with smaller, older vessels, are treated in the same fashion as supplementary vessels, retaining only their right to fish 800 traps. Similarly in the

Southern Zone full-time vessels have been given reduced quotas in Trinity and Conception Bays (Areas 20 and 16, respectively) and have been excluded from fishing in St. Mary's Bay (Area 8). A summary of licences by zone is presented in Table 6.

Materials and Methods

For previous assessments all compilation of data and analysis were conducted by the authors due to the fact that Fisheries Statistics and Systems Branch refused to utilize snow crab management areas in emoding landings and effort data. However, in 1988 it was agreed that Fisheries Statistics and Systems Branch, with our assistance, would use snow crab management areas as well as the standard NAFO subareas. Because of this arrangement, and the increased number of licenced vessels participating in the fishery, we abandoned the laborous process of analyzing all logbook data independently. Three vessels from each management area were randomly selected by us and their logbook/sales slip data analyzed to provide an independent estimate of mean CPUE for each area.

In addition to an examination of catch/effort data, several research cruises were conducted using standard crab traps fished at randomly selected locations on the commercial fishing grounds in the Southern Zone. Catches were analyzed and size frequency/shell condition histograms for various management areas (Fig. 1) were drawn. These histograms have been compared to those based on 1987 data and presented in Figures 4-13.

Results and Discussion

CPUE data presented in Table 1 is based solely on the analyses of catch/effort data for three vessels per management area. All landings data presented in Tables 1 and 2 are based on the December 31 quota report.

Southern Zone

The fishery in the Southern Zone was highly successful in 1988. Landings increased from 3083 tons in 1987 to 5903 tons in 1988 (Table 3). Of particular note is the resurgence of the fishery in the offshore (Areas 13 and 19) and off the northeast Avalon (Area 18, Table 1). The introduction of a supplementary fishery in this zone was met with little opposition from the full-time operators and was hailed as having been of great benefit by all participants. The major negative aspect of the fishery in this zone was an apparent inability to enforce quotas in several areas. Quota overruns ranged from 1 to 181% in this zone in 1988.

St. Mary's Bay (Area 8)

In 1988, the fishery in this area was closed to full-time licences and a 200 t quota allocated to the supplementary fleet. Due to severe problems encountered with soft-shell crabs the fishery was closed shortly after the initial opening in order to allow crabs to harden to an acceptable condition. A mean CPUE of 7.2 kg/trap haul is comparable to that achieved in the fishery from 1983 to 1985 (Table 1). Total landings of 266 t indicate a quota overrun of 33.0%.

Southern Avalon (Areas 10 and 12)

These areas were heavily fished in 1988 resulting in a quota overrun of 26%. Catch rates increased in Area 10 to 11.2 kg/trap haul while in Area 12 they fell to 9.9 kg/trap haul. Commercial plant sampling indicates that in excess of 80% of the catch from these areas consisted of new/hard animals with some molting activity occurring in Area 10 in September (Table 5, Fig. 4 and 5).

Eastern Avalon (Area 14)

Fishing activity in this area was minimized in 1988 (Table 1) as vessels concentrated their efforts in Areas 10 and 12.

Northeast Avalon and Offshore (Areas 18, 13, and 19)

Catch rates increased in all areas off the northeastern Avalon (Area 18) and in the offshore (Areas 13 and 19). CPUE in Area 18 doubled from 5.9 kg/trap haul in 1987 to 11.6 kg/trap haul in 1988. Commercial plant sampling of crab from this area in September indicated that 83% were in a new/hard shell condition while 8% were soft-shelled (Table 5, Fig. 6). Commercial catch samples from the offshore indicate that molting activity has resumed in Area 19 (Fig. 7) as well. While catch rates have improved in the Downing Basin (Area 13) commercial catches sampled in July found 42% of the crab to be old-shelled (Fig. 8). At sea research sampling indicates a slight increase in the abundance of soft-shell crabs (Fig. 2).

Until 1988, Areas 13 and 19 had not been fished since 1984 (Table 1). In order to promote exploratory fishing in these areas Fisheries and Habitat Management Branch allocated a quota of 500 t to the offshore, defined as all areas in excess of 50 n mi from shore. Fishing in these areas began in July after the inshore quota for the full-time fleet (2300 t) had been caught.

Conception Bay (Area 16)

Catch rates increased in this area to 11.1 kg/trap haul (Table 1), the highest since 1981. The quota in this area was divided into a full-time quota of 75 t for three small full-time vessels incapable of fishing offshore areas and a supplementary quota of 200 t. The quota for both sectors of the fishery were overrun by 181 and 44%, respectively (Table 4).

While it was not possible to obtain commercial plant samples for this area two research cruises held in May and September found that most commercial-sized snow crab were either new/hard shelled or soft-shelled.

Trinity Bay (Area 20 - inner portion, Area 22 - outer portion)

Landings increased in both areas of Trinity Bay. As in Conception Bay separate quotas were established for the supplementary fleet and selected full-time vessels. Catch rates in this area remain low at 4.3 and 5.1 kg/trap haul for the inner and outer portions, respectively. Supplementary fishermen suspended fishing operations at the beginning of this fall fishery in order to allow abundant soft-shell crab time to harden. Both the full-time and supplementary fishery recorded slight quota overruns.

Bonavista Bay (Area 25)

The fishery in this area continues to improve with landings increasing to 944 t and CPUE increasing to 8.2 kg/trap haul (Table 1).

The fishery is predominantly fished by full-time vessels but a 100 t quota supplementary fall fishery was initiated in 1988. Figures 3 and 9 illustrate yearly variations in the incidence of soft-shell crabs from research cruise catches and commercial catch sampling respectively.

Northern Zone

Most management areas in this zone are continuing to experience extremely low catch rates as a result of excessive fishing pressure (Taylor and O'Keefe 1988). Despite a reduction in overall quota from 4000 t to 2550 t (36%) catch rates dropped slightly in most areas. Virtually all fishermen reported a very high incidence of soft-shell crab during most of the fishing season.

Prior to the opening of the 1988 fishery season Fisheries and Habitat Management Branch divided the Northern Zone into an inshore and offshore zone. The inshore consists of those areas within 30 n mi of land, while the offshore zone extends from 30 n mi to the boundary of NAFO Area 2J. Full-time fishermen with a history of fishing the inshore zone were permitted to remain in these areas or opt for fishing the offshore zone thus relinquishing their right to prosecute the inshore fishery.

An area by area review of Northern Zone catch rates is presented in Table 2.

Commercial catch sampling during the fishing season found that catches consisted largely of new/hard and soft-shell crabs (Table 5, Fig. 10-13).

While the quota reduction in the Northern Zone was significant we suggest that even greater reductions in all areas except 28 and 30 are needed if the fishery is to regain its viability.

Labrador

The snow crab fishery began in Labrador (Area 41) on an experimental basis in 1985. During 1985 and 1986 the fishery was predominantly prosecuted by Southern Zone vessels in order to determine the extent of the crab resource. In 1987 an attempt was made by Fisheries and Habitat Management Branch to transfer the crab licences to local Labradorians who had been schooled in the "art" of crab fishing by experienced Southern Zone fishermen. For various reasons this technology transfer did not go as smoothly as all parties would have liked. As a result, fishing effort was somewhat sporadic and concentrated in more inshore areas than in the two previous years.

In 1988, the Labrador fishery was prosecuted by both Labradorians and fishermen from the island portion of the province. Overall catch rates and landings improved over 1987 landings even though the area fished is somewhat restricted. Fishermen encountered severe problems with soft-shell crab indicating a high incidence of molting in the area.

3Ps

The fishery in this area is exclusively supplementary. In order to accommodate the groundfish and lobster fisheries which are the mainstay of the local economy the snow crab fishing season is divided into spring (May 1-June 15) and fall (September 1-October 31) with a total quota of 600 t. This quota is divided (spring - 200 t, fall - 400 t) in a manner determined by local fishermen's committees in consultation with officials from Fisheries and Habitat Management Branch.

Although the quota was overrun (quota 600 t, 856 t landed) (Table 3), the mean CPUE was only 3.7 kg/trap haul. Most fishermen reported large numbers of pre-recruit and soft-shelled animals. Catch rates vary widely within Placentia Bay and while the mean CPUE was low many fishermen reported an excellent season.

Reproductivity Capacity

Research cruises were again conducted in three areas (Area 16, 18, and 25) during 1987. Samples of females were collected using small meshed (40 mm stretch measure) traps and examined macroscopically both internally and externally in order to determine reproductive status. Results of these examinations are summarized and presented in Table 7.

As in previous years, approximately 100% of mature females are berried. The phenomenon of primiparous females bearing eggs but not carrying spermatophores (macroscopic examination only) was again seen in 1988. Laboratory experiments monitoring egg development in these females are continuing but initial results indicate the eggs of these females are developing normally.

Summary

While the fishery in the Southern Zone appears to be recovering, as indicated by improved catch rates and increased landings, the fishery in the inshore areas of the Northern Zone continues to decline or remain at a low level. The high incidence of soft-shell crab in the Northern Zone indicates that normal recruitment mechanisms appear to be functioning but yearly growth and recruitment are not sufficient to rebuild snow crab populations at current exploitation rates.

References

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Taylor, D. M., and P. G. O'Keefe. 1988. Analysis of the snow crab (Chionoecetes opilio) fishery in Newfoundland for 1987. CAFSAC Res. Doc. 88/62. 27 p.

Table 1. Summary of statistics for the Newfoundland snow crab fishery, 1980-88. Effort data are incomplete beginning in 1985 so mean CPUE is based on catches where effort is given in logbooks. In 1988 total projected effort is presented. The CPUE is calculated from logbook data of three randomly selected crab vessels.

Area	Year	Reported effort (trap hauls)	Landings (t)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
8	1980	-	-	-	-	-
	1981	11,150	168	15.0	-	-
	1982	48,350	506	10.5	551 (500-646)	92
	1983	37,780	274	7.3	341 (306-409)	80
	1984	35,400	264	7.5	-	-
	1985	23,100	164	7.1	-	-
	1986	19,570	102	4.8		
	1987	140	4	5.8	-	-
	1988	36,924	266	7.2		
10	1983	3,080	43	13.9	-	-
	1984	18,700	175	9.4	-	-
	1985	44,890	385	8.6	-	-
	1986	91,608	930	10.2	-	-
	1987	74,890	765	10.0	-	-
	1988	106,875	1197	11.2		
12	1980	13,825	292	21.1	377 (311-728)	78
	1981	45,455	854	18.9	1291 (1114-1639)	66
	1982	49,975	732	14.7	974 (938-1017)	75
	1983	99,280	955	9.6	1045 (948-1316)	91
	1984	135,883	1068	7.9	-	-
	1985	86,937	627	7.2	-	-
	1986	116,919	1267	10.8	2133 (1752-2965)	59
	1987	85,015	1129	12.2	1813 (1515-2530)	62
	1988	116,162	1150	9.9		
13	1982	7,295	114	15.6	-	-
	1983	61,089	733	12.0	-	-
	1984	41,080	397	9.7	592 (501-790)	67
	1985	-	-	-	-	-
	1986	-	-	-	-	-
	1987	-	-	-	-	-
	1988	47,619	500	10.5		

Table 1. (Cont'd.)

Area	Year	Reported effort (trap hauls)	Landings (t)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
14	1980	5,860	121	20.6	–	–
	1981	27,113	434	16.0	614 (506-1043)	71
	1982	32,320	465	14.4	–	–
	1983	23,165	190	8.2	209 (181-260)	91
	1984	17,340	93	5.4	119 (96-275)	79
	1985	12,710	64	5.0	–	–
	1986	4,690	47	10.0	–	–
	1987	4,300	21	5.0	–	–
	1988	7,609	35	4.6		
15	1981	18,128	404	22.3	–	–
	1982	66,949	1056	15.8	1861 (1465-3024)	56
	1983	1,320	14	10.5	–	–
	1984	–	–	–	–	–
	1985	1,140	6	5.7	–	–
	1986	–	–	–	–	–
	1987	–	–	–	–	–
	1988	4,706	24	5.1	–	–
16	1980	56,393	869	15.4	1571 (1214-2890)	55
	1981	43,546	502	11.2	689 (619-747)	73
	1982	60,753	694	11.4	1073 (951-1255)	65
	1983	64,175	564	8.8	–	–
	1984	52,330	333	6.4	–	–
	1985	26,060	139	5.3	–	–
	1986	32,620	193	5.9	–	–
	1987	20,265	227	9.2	–	–
	1988	44,955	499	11.1	–	–
18	1980	236,417	4944	20.9	14166 (9348-59867)	46
	1981	413,815	6769	16.4	11289 (910-17067)	60
	1982	153,238	1847	12.1	–	–
	1983	71,905	473	6.7	–	–
	1984	38,690	219	5.7	310 (265-402)	70
	1985	10,580	43	4.0	–	–
	1986	22,086	97	4.4	–	–
	1987	17,230	151	5.9	–	–
	1988	59,655	692	11.6		

Table 1. (Cont'd.)

Area	Year	Reported effort (trap hauls)	Landings (t)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
19	1981	65,978	1840	28.0	-	-
	1982	218,356	4194	19.2	7744 (5983-12022)	54
	1983	150,432	1662	11.0	2016 (1684-2739)	82
	1984	47,845	431	9.0	588 (504-811)	73
	1985	5,955	31	5.2	-	-
	1986	-	-	-	-	-
	1987	-	-	-	-	-
	1988	39,733	298	7.5		
	1989			7.6		
20	1980	4,550	59	12.9	-	-
	1981	14,970	110	7.4	-	-
	1982	10,535	65	6.1	-	-
	1983	12,120	72	6.0	-	-
	1984	2,180	17	6.9	-	-
	1985	4,980	19	3.8	-	-
	1986	3,420	18	5.1	-	-
	1987	6,220	44	4.9	-	-
	1988	22,791	98	4.3		
22	1980	58,160	494	8.5	912 (788-1103)	54
	1981	24,782	178	7.2	-	-
	1982	13,755	95	6.9	-	-
	1983	20,065	107	5.3	-	-
	1984	38,240	202	5.3	260 (213-366)	78
	1985	27,560	113	4.1	-	-
	1986	30,725	165	2.9	-	-
	1987	18,040	140	3.8	-	-
	1988	39,216	200	5.1		
	1989			4.9		
25	1980	191,754	1905	9.9	-	-
	1981	171,685	1376	8.0	-	-
	1982	96,330	905	9.4	1391 (1054-2445)	65
	1983	205,353	1101	5.4	1802 (1434-2914)	61
	1984	248,962	1277	5.3	1434 (1220-1903)	93
	1985	251,720	1015	2.9	959 (909-1018)	76
	1986	127,648	648	4.6	-	-
	1987	83,222	602	7.1	-	-
	1988	115,122	944	8.2		
	1989			8.5		

Table 2. Summary of available statistics from full-time crab fishermen for the Newfoundland snow crab fishery (Northern Zone), 1980-88. Effort data are incomplete beginning in 1985 therefore mean CPUE is based on catches where effort is given in logbooks. In 1988 total projected effort is presented. The CPUE is calculated from logbook data of three randomly selected crab vessels.

Area	Year	Reported effort (trap hauls)	Landings (t)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
28	1983	28,169	387	13.7	-	-
	1984	43,583	444	10.2	583 (498-779)	76
	1985	52,615	433	8.2	-	-
	*1986	40,997	360	4.7	640 (463-1304)	56
	1987	59,076	286	4.8	-	-
	1988	119,048	500	4.2		
30	1983	163,138	1470	9.0	-	-
	1984	120,628	1019	8.4	2426 (1876-3765)	42
	1985	88,661	630	7.1	-	-
	*1986	34,666	535	6.0	902 (747-1236)	59
	1987	23,950	138	5.7	-	-
	1988	45,455	300	6.6		
32	1980	33,261	374	9.9	787 (583-1229)	43
	1981	54,416	650	11.9	1845 (1193-6615)	35
	1982	130,305	1352	10.4	2213 (1605-4284)	42
	1983	88,288	537	6.1	1097 (845-1874)	49
	1984	76,491	502	6.6	1037 (821-1526)	48
	1985	81,139	476	5.9	808 (691-1022)	59
	*1986	77,412	938	3.8		
	1987	50,432	303	2.7		
	1988	127,500	255	2.0		
34	1980	7,330	96	14.3	106 (74-273)	91
	1981	19,250	322	16.7	604 (502-792)	53
	1982	51,347	735	14.3	1016 (839-7423)	68
	1983	105,756	1210	11.5	2023 (1632-3023)	60
	1984	173,038	1576	9.1	3092 (2354-5457)	51
	1985	81,655	478	5.9	757 (665-908)	63
	*1986	113,132	654	3.9	-	-
	1987	6,810	63	2.5	-	-
	1988	-	-	-	-	-

Table 2. (Cont'd.)

Area	Year	Reported effort (trap hauls)	Landings (t)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
36	1980	17,864	158	8.8	276 (218-412)	57
	1981	19,840	230	11.6	504 (403-710)	46
	1982	32,917	418	12.7	-	-
	1983	68,497	583	8.5	1619 (1099-4692)	36
	1984	79,401	524	6.6	-	-
	1985	84,153	386	4.6	685 (533-1114)	56
	*1986	108,300	453	3.3	-	-
	1987	111,695	307	2.7	-	-
	1988	168,095	353	2.1		
38	1983	66,123	681	10.3	-	-
	1984	102,102	948	9.3	-	-
	1985	96,796	472	4.9	719 (575-1099)	66
	*1986	49,924	246	2.7	375 (300-574)	-
	1987	20,622	48	2.3	-	-
	1988	12,047	34	2.8		
40	1984	11,035	67	6.1	-	-
	1985	40,420	225	5.6	-	-
	*1986	95,408	772	7.1		
	1987	38,194	594	5.5	-	-
	1988	184,098	1123	6.1		
41	1985	20,419	311	15.2	-	-
	1986	39,695	467	11.8	-	-
	1987	30,060	256	8.5	-	-
	1988	48,495	451	9.3		

* Supplementary licenced vessels are included in the 1986 landings for the Northern Zone

Table 3. Summary of performance of Newfoundland snow crab fishery, 1980-88.

Year	Southern Zone		Northern Zone		Labrador		3Ps		Total Newfoundland	
	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)
1980	8190	527	628	58	-	-	-	-	8818	585
1981	12636	808	1202	94	-	-	-	-	13838	902
1982	10673	762	2505	215	-	-	-	-	13178	977
1983	6188	745	4868	520	-	-	-	-	11056	1265
1984	4476	679	5080	606	-	-	-	-	9556	1285
1985	2605	496	3953	670	311	20	602	-	7471	1186
1986	3467	475	3958	890	467	40	651	-	8543	1405
1987	3083	343	2656	730	256	30	596	199	6591	1302
1988	5903	641	2565	656	451	48	856	231	9775	1576

Table 4. Summary of Canadian Atlantic Quota Report for the Newfoundland snow crab fishery, December 31, 1987 compared to December 31, 1988.

Management zone	Quota allocated (t)		Reported landings (t)		Amount over/under quota (%)	
	1987	1988	1987	1988	1987	1988
Labrador	925	926	254	451	under 671 (73)	under 475 (51)
Northern Zone (full-time)	3000	1900	1939	1398	under 1061 (35)	under 502 (26)
(suppl.)	1000	650	917	1167	under 83 (8)	over 517 (80)
Bonavista Bay (full-time)	500	600	602	735	over 102 (20)	over 135 (23)
(suppl.)	-	100	-	209	-	over 109 (109)
Trinity Bay (full-time)	100	75	253	76	over 153 (153)	over 1 (1)
(suppl.)	-	200	-	222	-	over 22 (11)
Conception Bay (full-time)	200	75	272	211	over 72 (36)	over 136 (181)
(suppl.)	-	200	-	288	-	over 88 (44)
St. Mary's Bay (suppl.)	-	200	-	266	-	over 66 (33)
Southern Zone (full-time)	2000	2300	2006	2897	over 6 (-)	over 597 (26)
(offshore)	-	500	-	798	-	over 198 (40)
(suppl.)	-	200	-	201	-	over 1 (-)
3Ps (suppl.)	600	600	562	856	under 38 (6)	over 256 (43)

Table 5. Summary of shell condition of commercially sampled snow crab, Chionoecetes opilio, 1987-88.

Management area	Month	No. sampled	% soft shell	New/hard shell	Old/hard shell	Month	No. sampled	% soft shell	New/hard shell	Old/hard shell
10	June	493	0.6	92.5	6.9	May	1336	0.1	84.0	15.9
						August	271	0.0	83.8	16.2
						Septebmer	237	3.0	97.0	0.0
12	April	538	0.0	97.8	2.2	May	249	0.8	95.6	3.6
	June	268	0.0	91.0	9.0					
13	n/a	n/a	n/a	n/a	n/a	July	245	0.8	57.1	42.0
18	n/a	n/a	n/a	n/a	n/a	September	641	8.6	83.3	8.1
19	n/a	n/a	n/a	n/a	n/a	August	313	1.3	85.3	13.4
25	June	936	39.6	50.4	9.9	May	1410	4.3	87.6	8.1
						September	404	3.2	90.8	5.9
28	n/a	n/a	n/a	n/a	n/a	July	204	17.2	70.6	12.3
30	July	207	0.0	80.7	19.3	July	235	27.2	44.7	28.1
36	July	529	8.1	83.4	8.5	July	296	0.7	67.5	31.8
	September	269	1.1	87.4	11.5					
40	July	451	1.1	60.3	38.6	July	277	8.7	35.4	56.0

Table 6. Summary of licences prosecuting the snow crab Chionoecetes opilio fishery, Newfoundland Region, 1988.

Zone	# Full-time	# Supplementary	Total
Labrador	5	1	6
Northern Zone	25	184	209
Southern Zone	41	286	327
3Ps	0	75	75
Total	71	546	617*

* While not all licenced vessels participated in the fishery, an accurate figure of total participants is not yet available.

Table 7. Summary of reproductive status of female snow crab, Chionoecetes opilio in three management areas in Newfoundland, 1984-88.

Area	Year	Month	# in sample	% berried females	Spermataphore type			% None*
					% Old	% New	% Both	
16	1984	October	57	99	14	-	86	0
	1985	November	45	989	7	40	53	0
	1986	November	72	100	28	26	28	18
	1987	May	109	97	75	1	2	22
	1988	September	301	99	21	32	5	42
18	1984	May	37	100	97	-	3	0
	1985	June	55	89	42	4	55	0
	1986	June	60	98	70	7	3	20
	1987	July	53	98	56	6	34	4
	1988	June	553	94	30	26	12	32
25	1984	August	131	99	22	1	77	
	1985	August	106	100	8	22	70	
	1986	August	83	100	35	25	8	31
	1987	August	134	99	27	22	41	10
	1988	August	322	100	36	19	29	16

* most females without spermatophores macroscopically evident were primiporous

Table 8. Performance of Newfoundland snow crab Chionoecetes opilio fishery under quota management.

Management areas	1985		1986			1987			1988		
	landings (t)	CPUE	Quota (t)	landings (t)	CPUE	Quota (t)	landings (t)	CPUE	Quota (t)	landings (t)	CPUE
Labrador (41)	311	15.2	925	467	11.8	925	256	8.5	926	451	9.3
Northern[1]	3953	5.9	4000	3958	3.7	4000	2656	3.7	2550	2565	3.9
Bonavista Bay (25)	1015	2.9	500	648	4.6	500	602	7.1	700	944	8.2
Trinity Bay (20/22)	132	4.1	200	183	3.0	100	184	4.0	275	298	4.8
Conception Bay (16)	139	5.3	200	193	5.9	200	227	9.2	275	499	11.1
Southern Zone[2]	1320	6.7	2400	2443	9.5	2000	2070	11.0	3000	4162	9.6
3Ps	602	-	600	651	-	600	596	3.0	600	856	3.7

[1] Management Areas 28, 30, 32, 34, 36, 38, 40
[2] Management Areas 8, 10, 12, 13, 14, 15, 18, 19

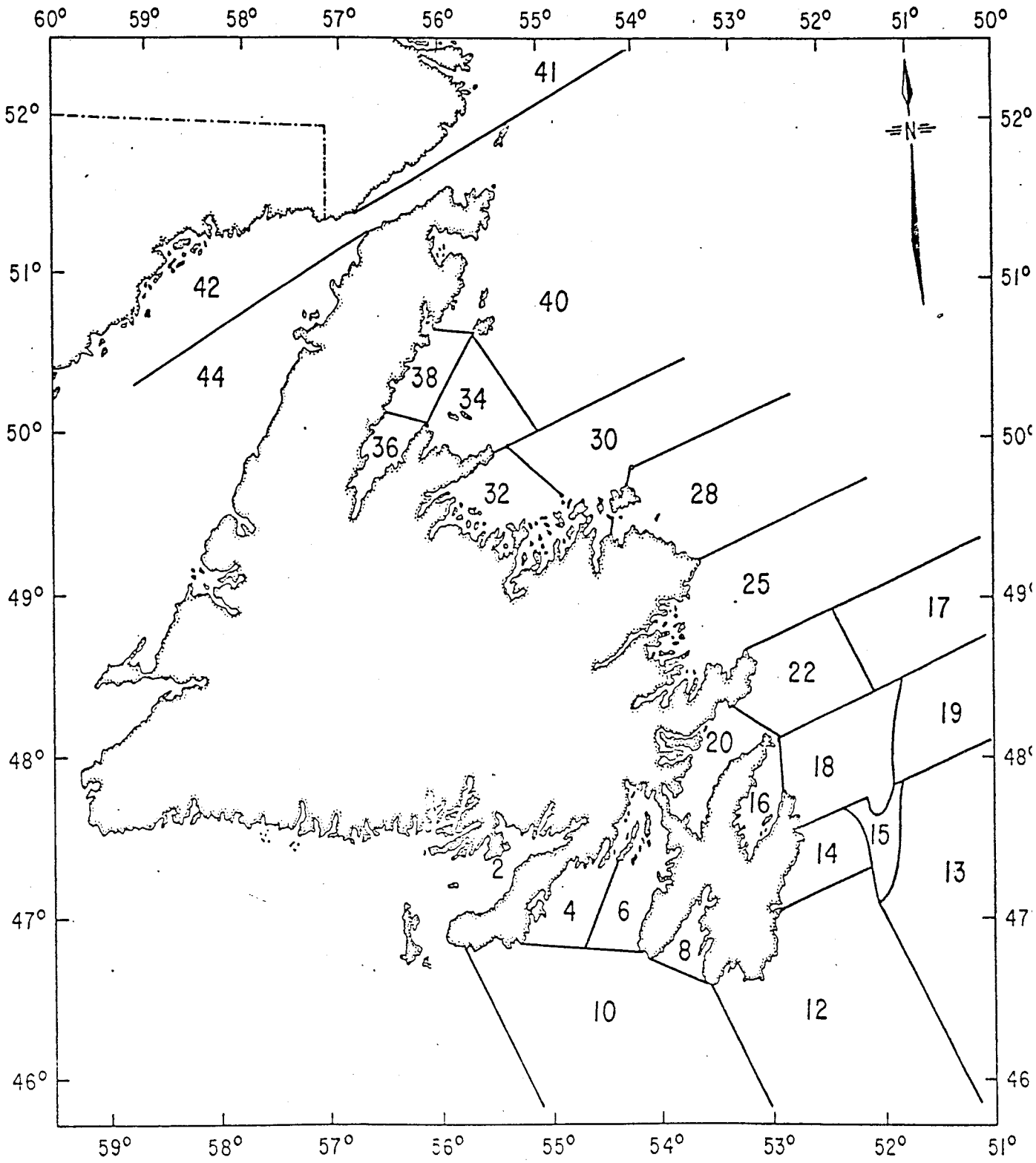

Fig. 1. Newfoundland snow crab management areas.

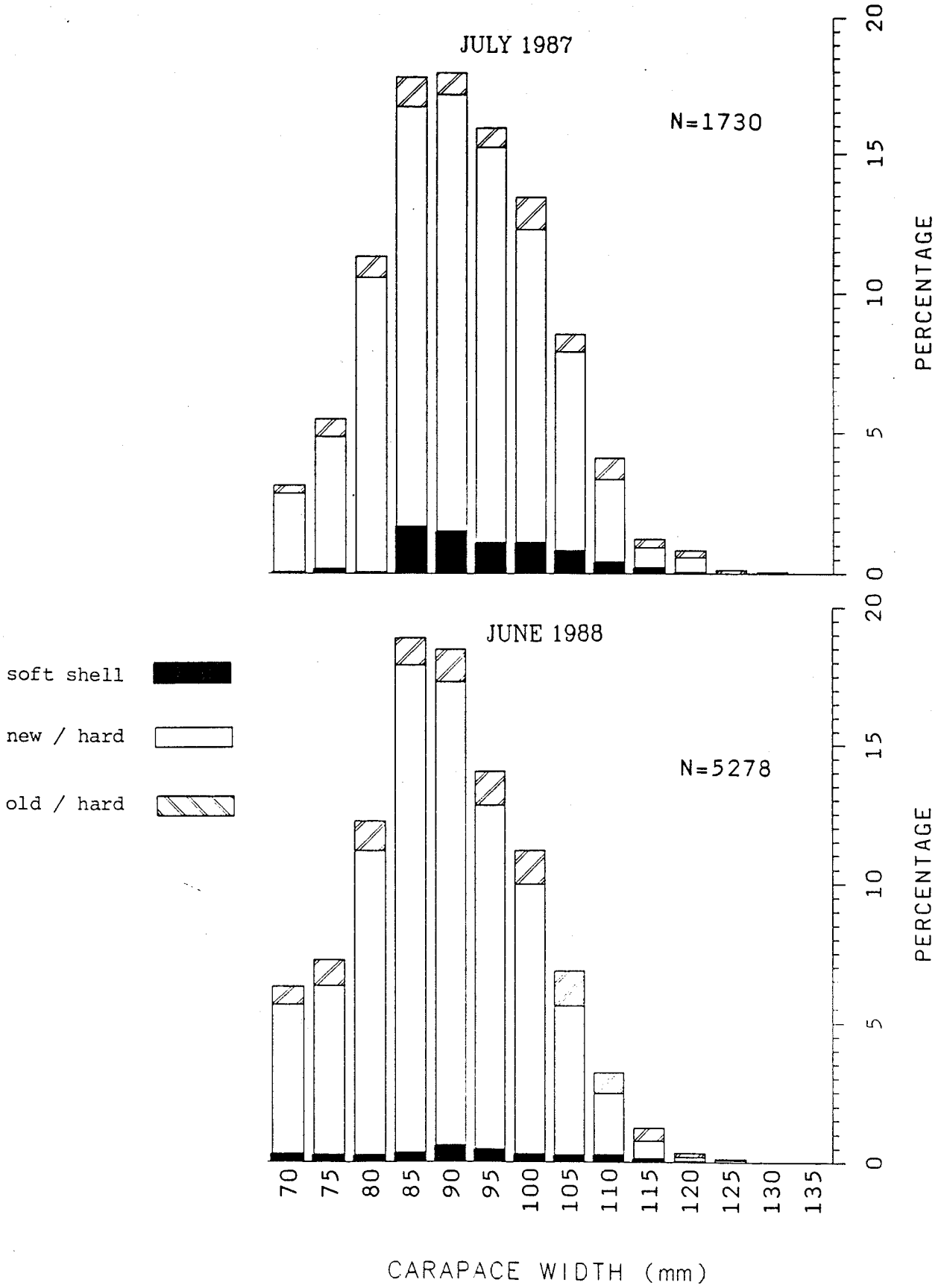

Fig. 2. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from at-sea research sampling in Management Area 18, 1987-88.

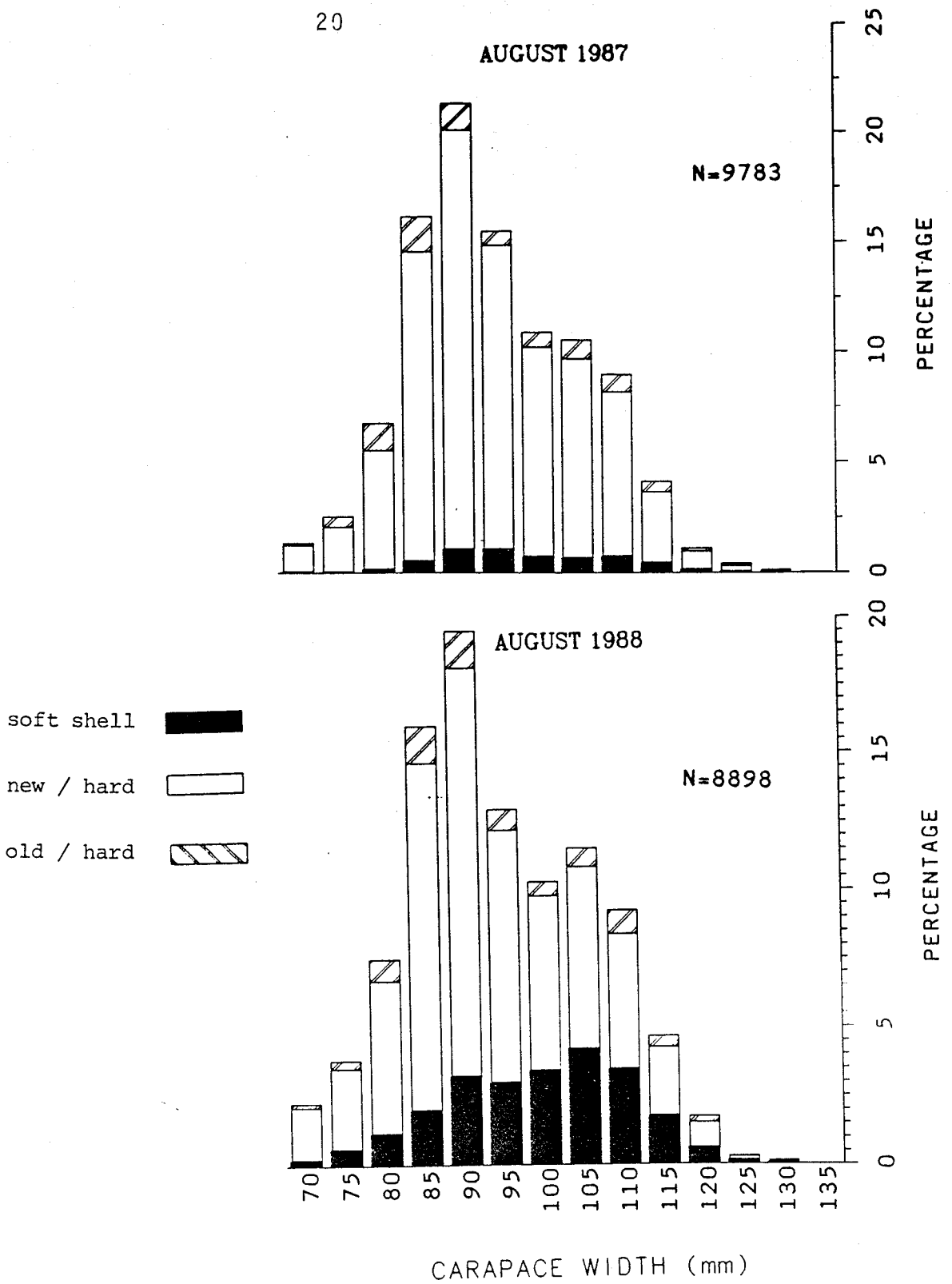

Fig. 3. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from at-sea research sampling in Management Area 25, 1987-88.

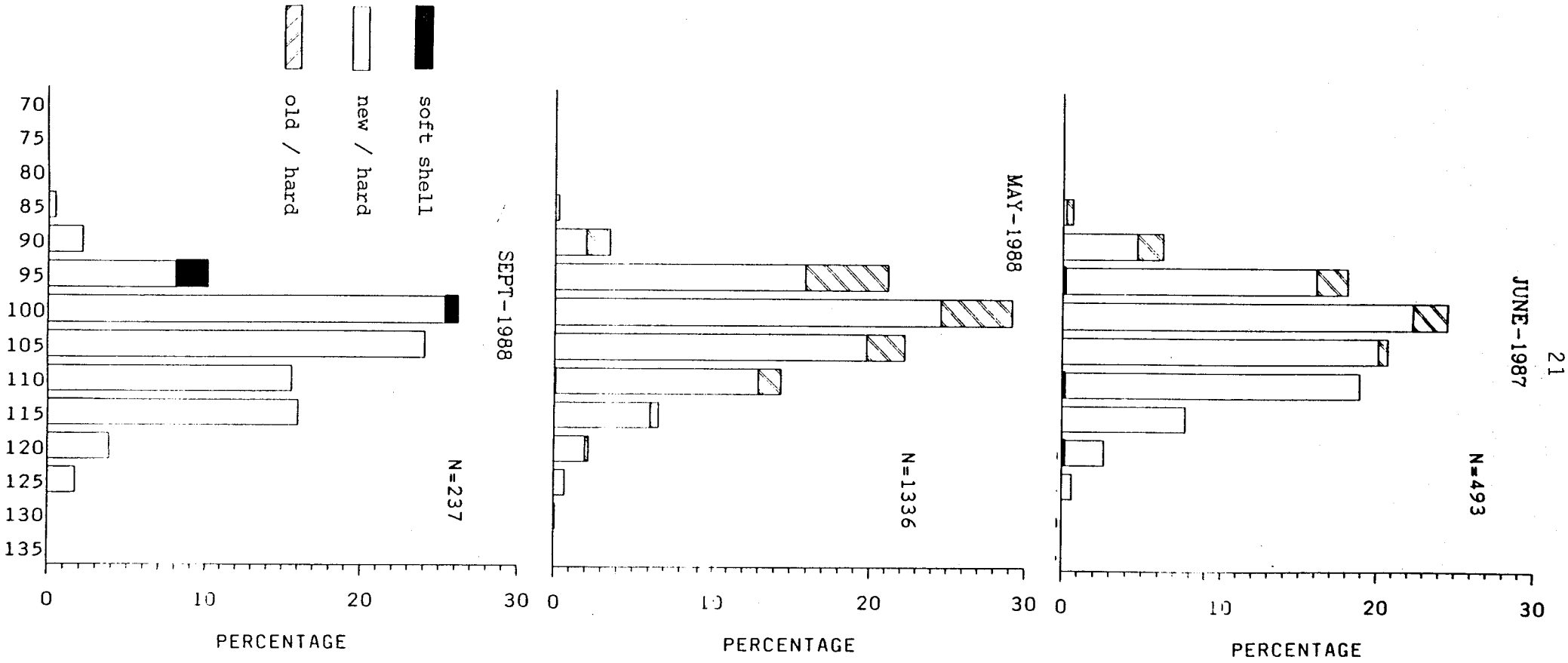

Fig. 4. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 10, 1987-88.

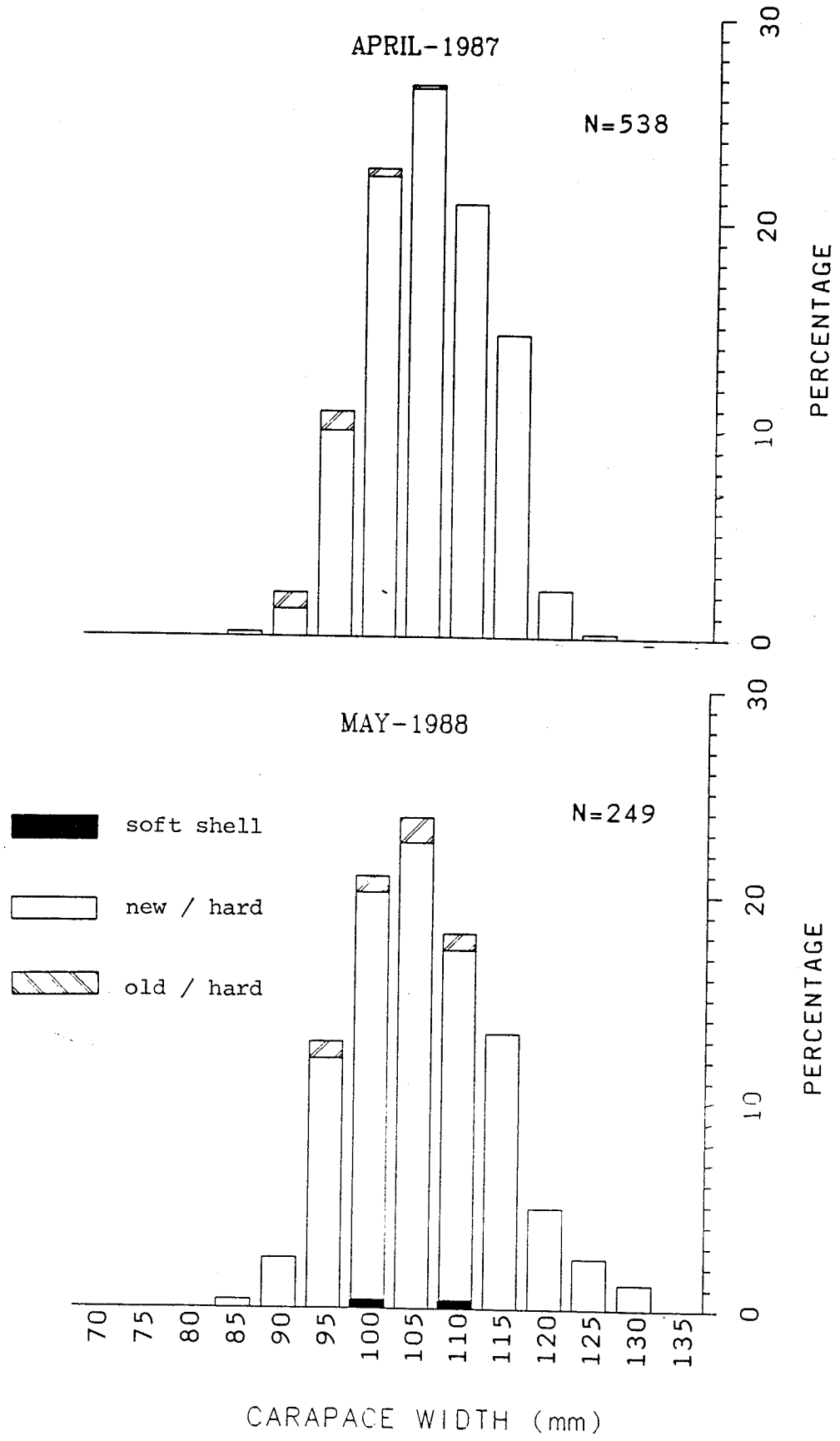

Fig. 5. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 12, 1987-88.

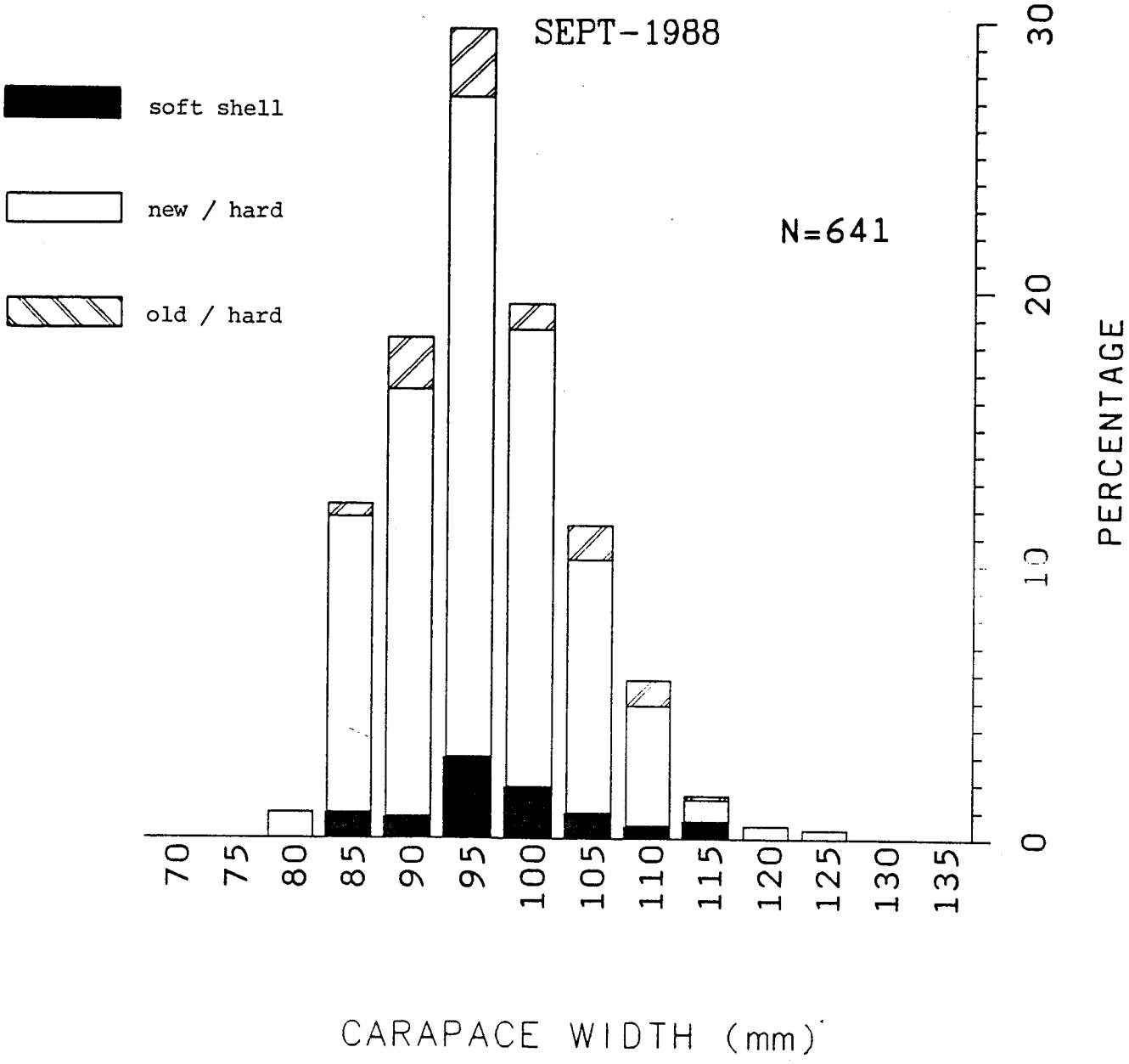

Fig. 6. Size frequency distribution and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 18, 1988.

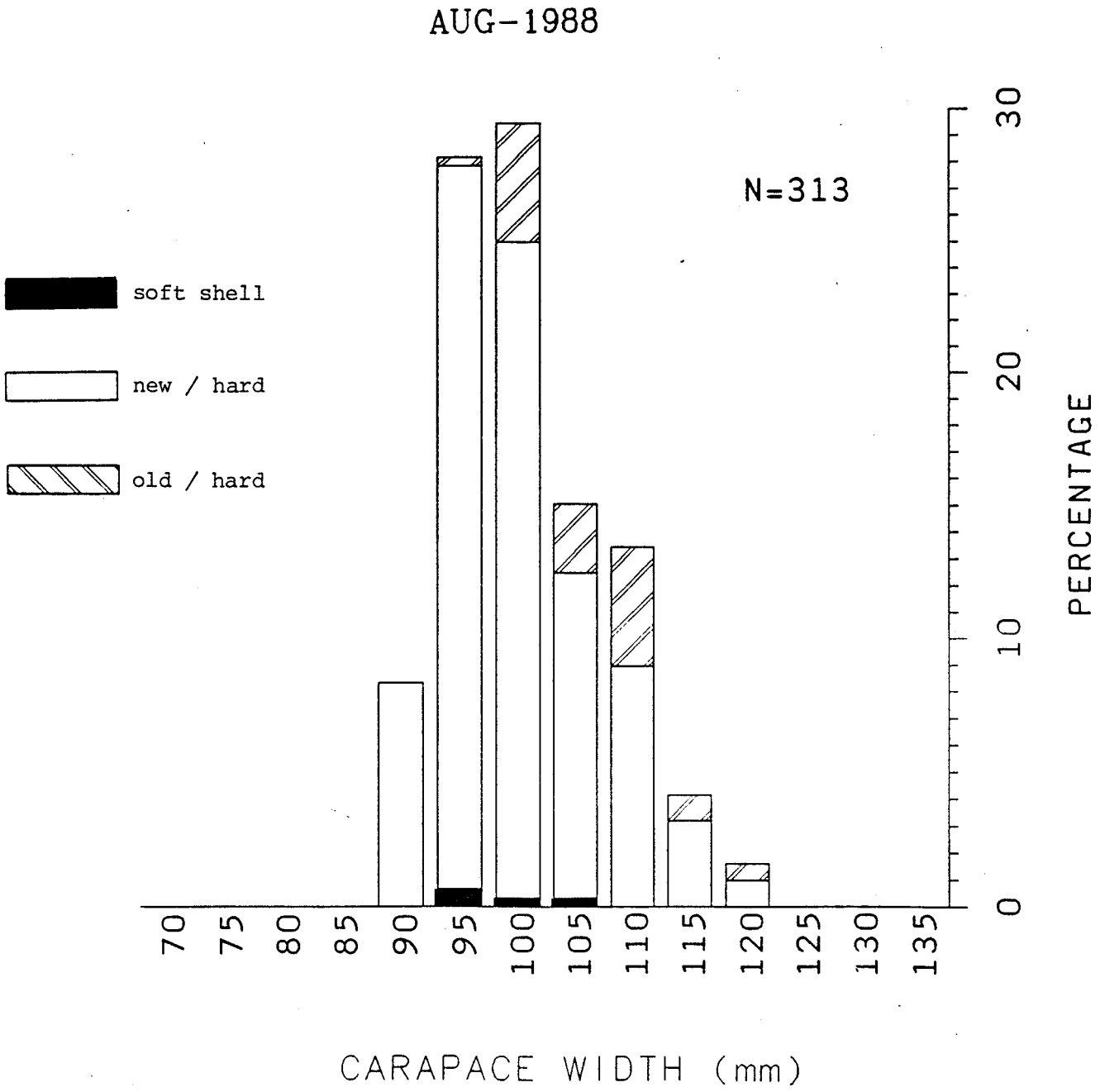

Fig. 7. Size frequency distribution and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 19, 1988.

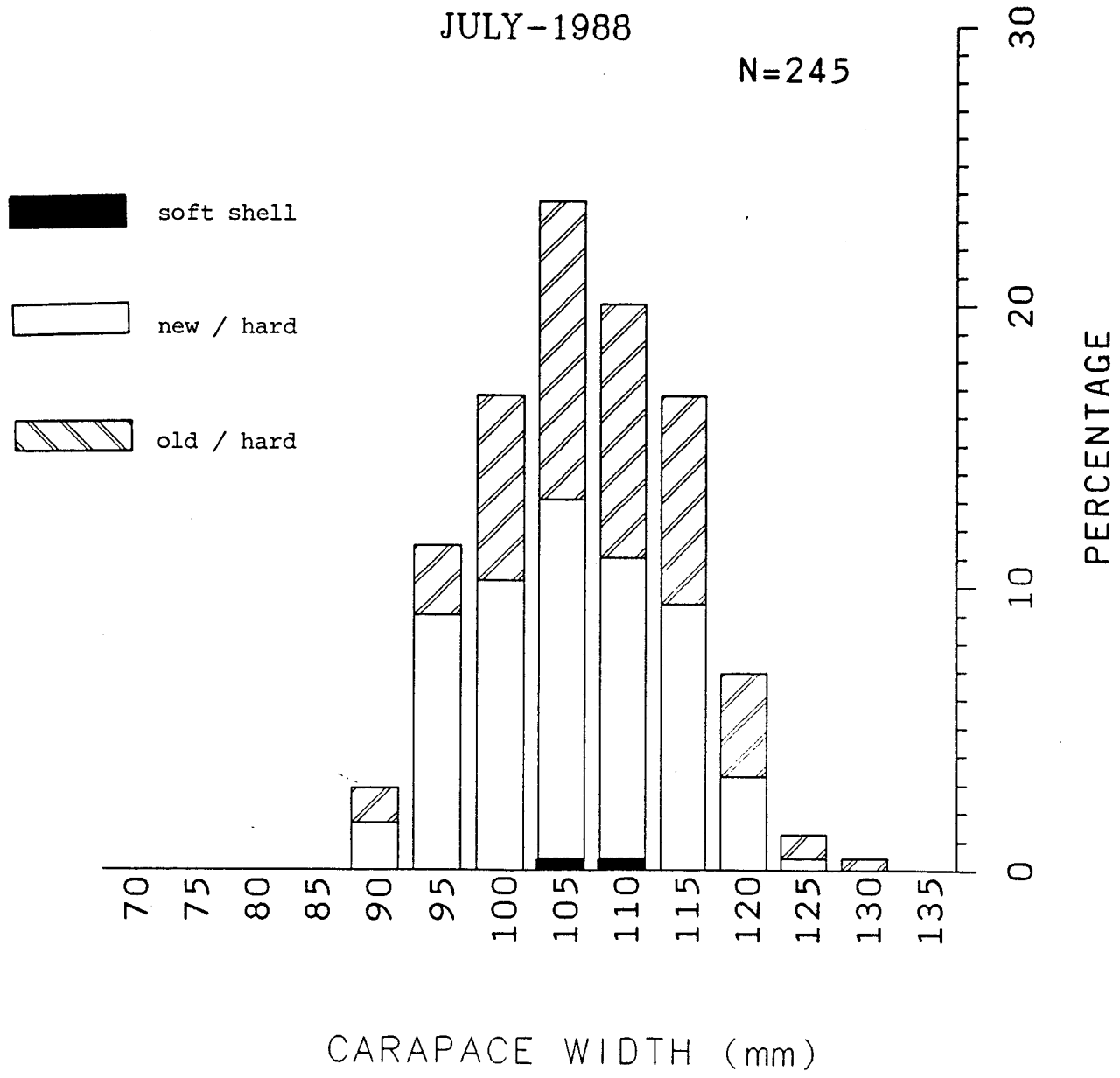

Fig. 8. Size frequency distribution and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 13, 1988.

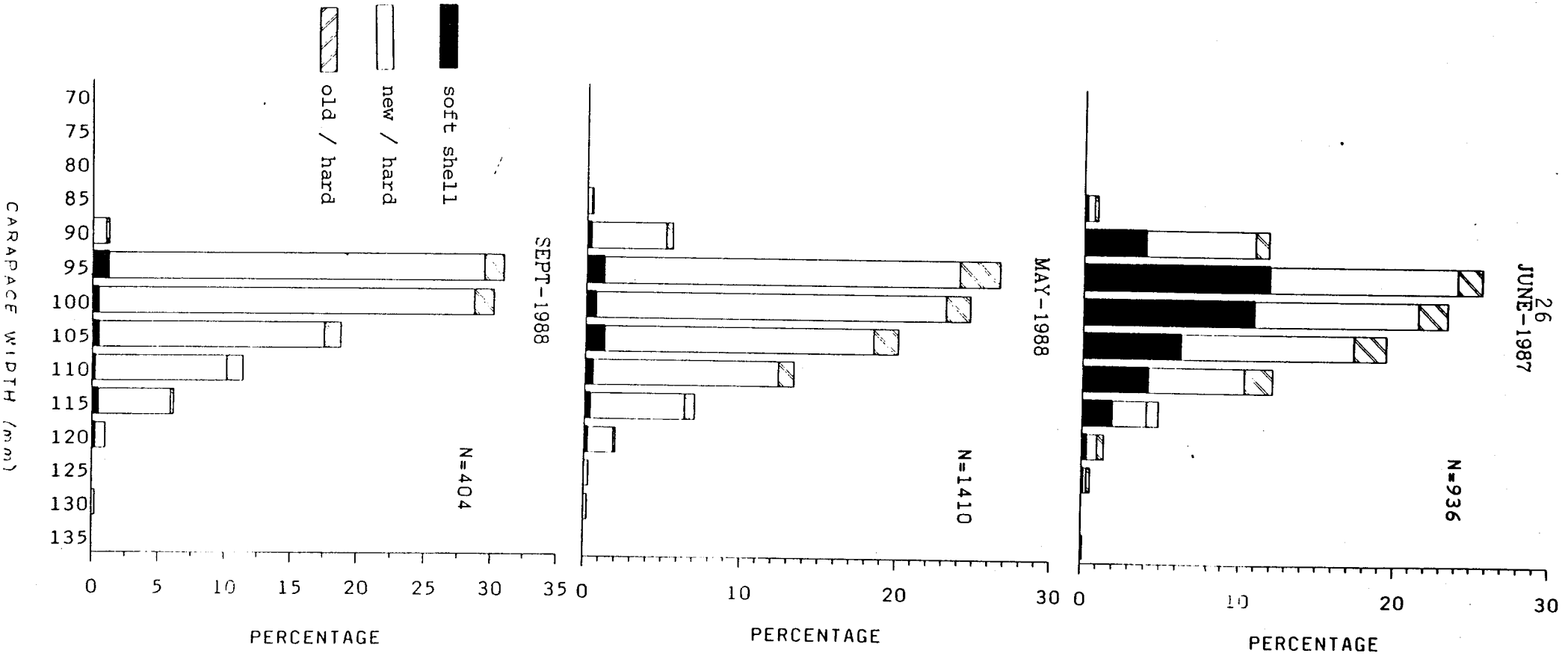

Fig. 9. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 25, 1987-88.

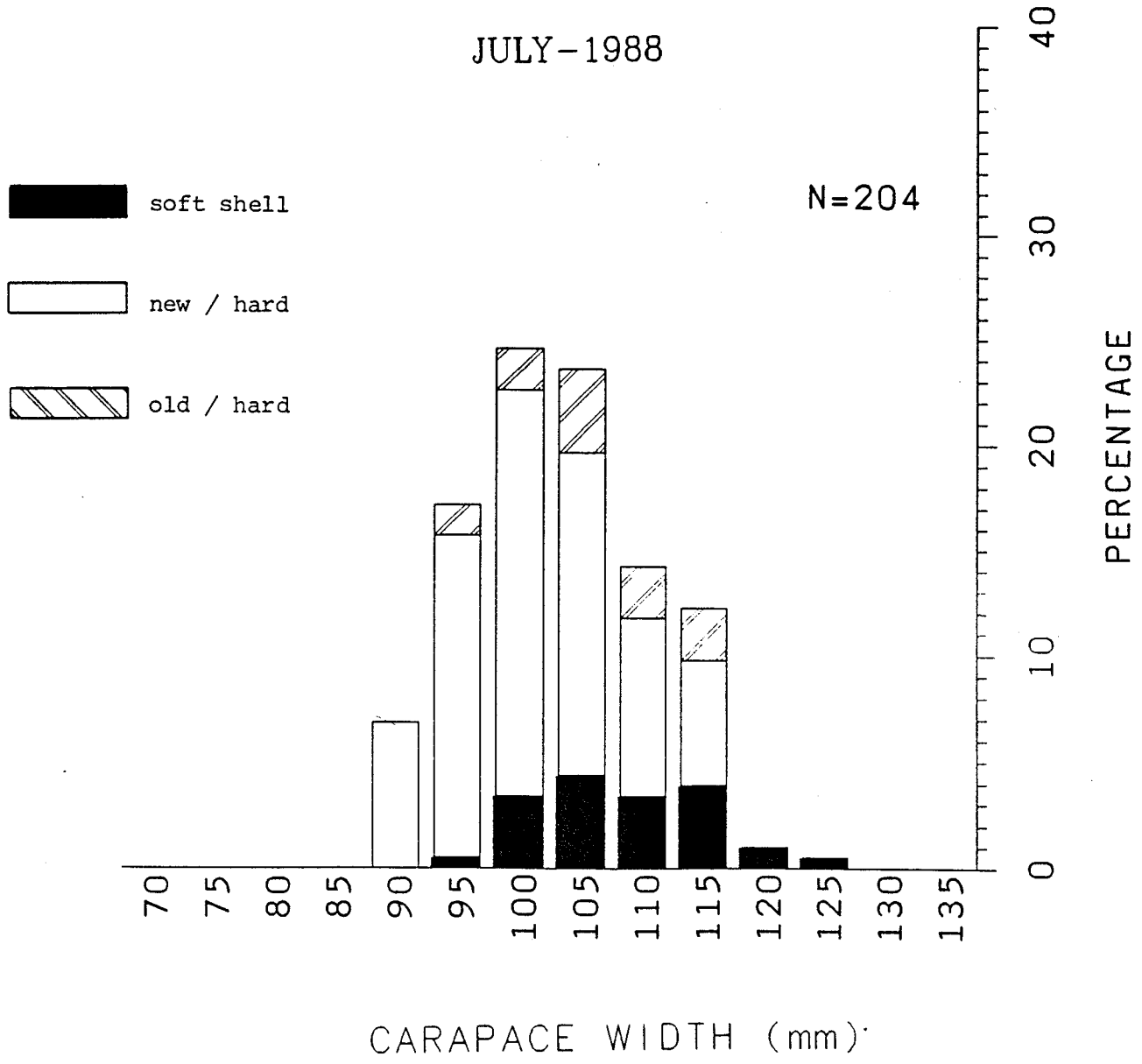

Fig. 10. Size frequency distribution and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 28, 1988.

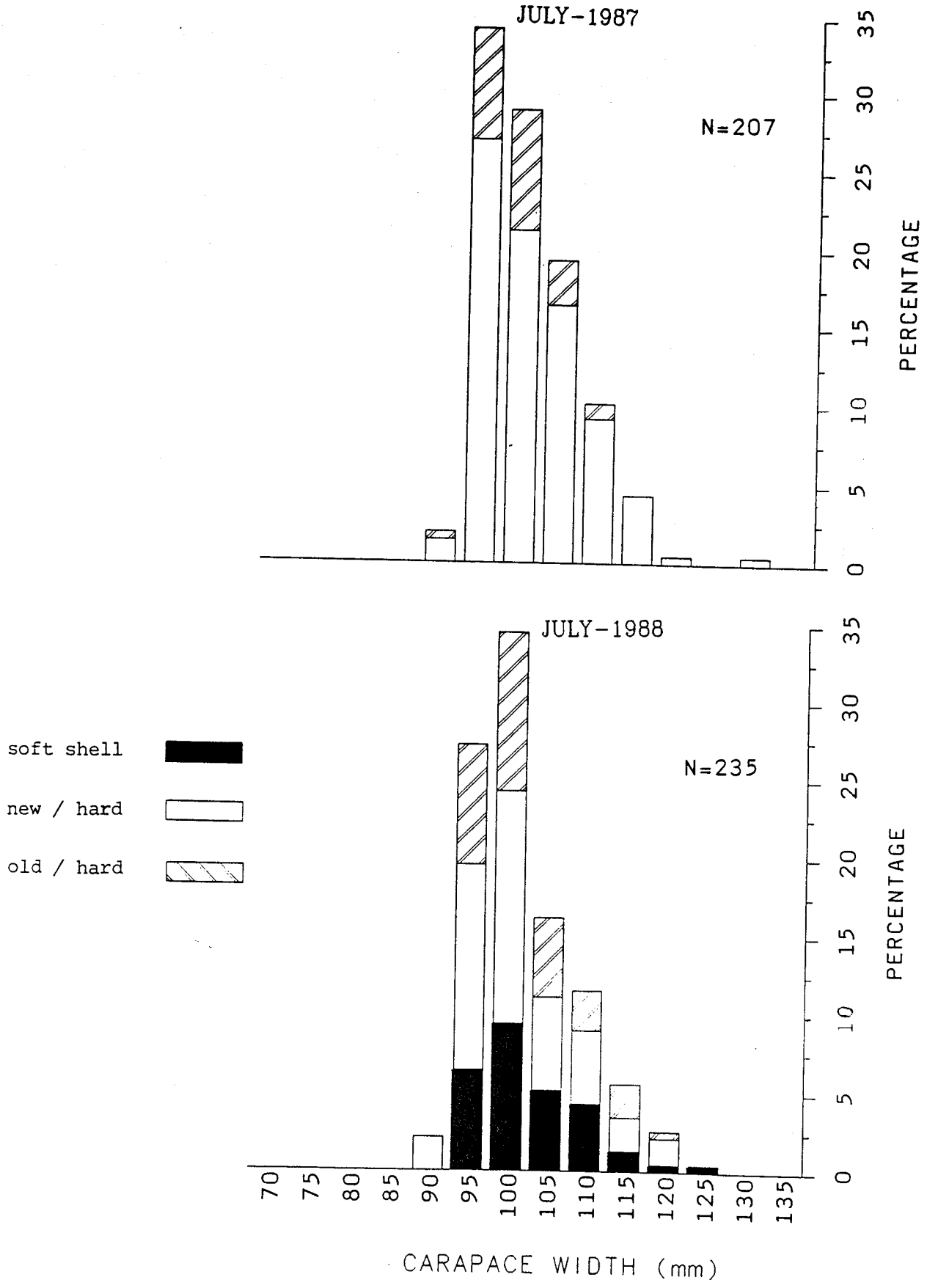

Fig. 11. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 30, 1987-88.

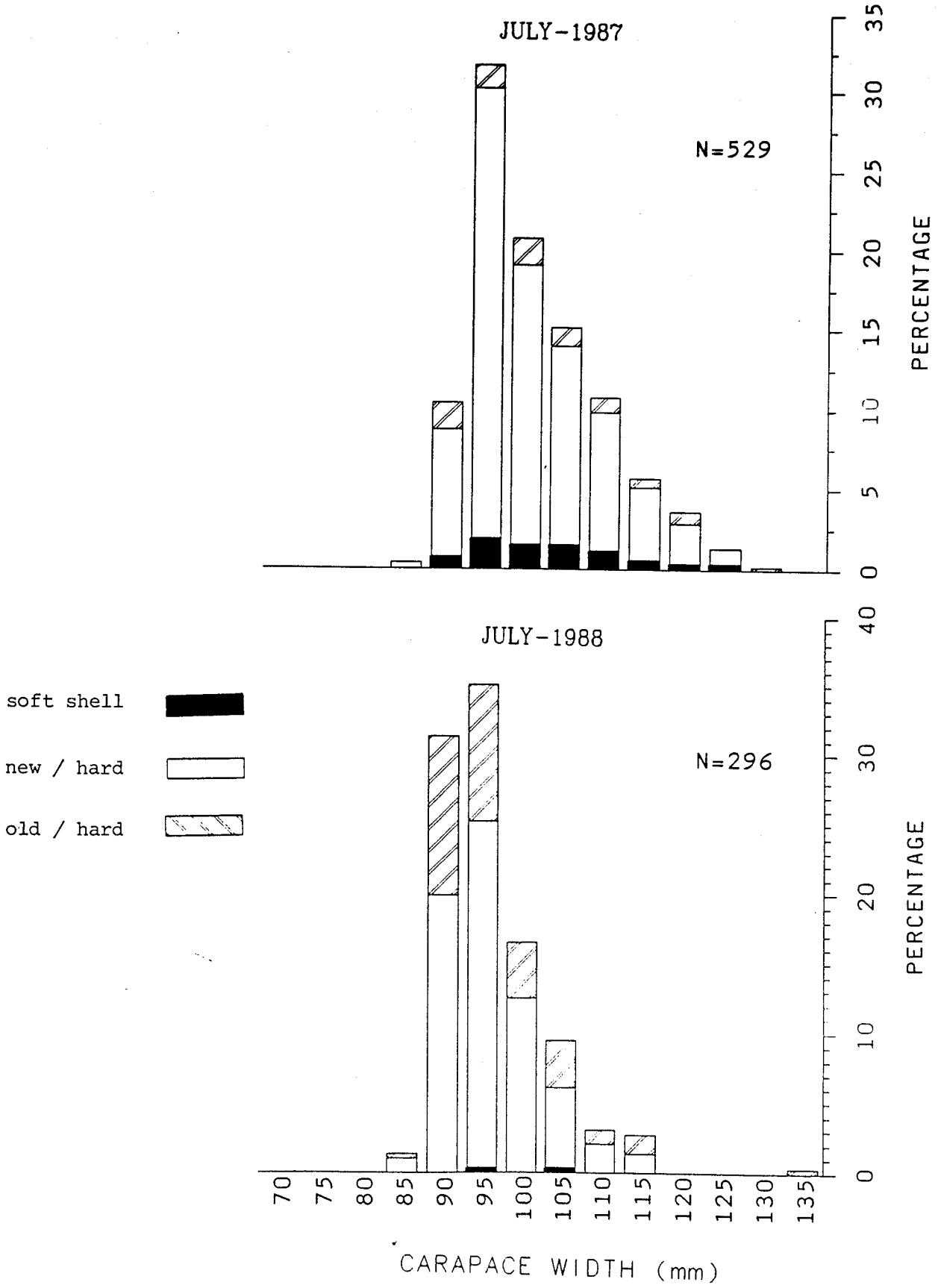

Fig. 12. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 36, 1987-88.

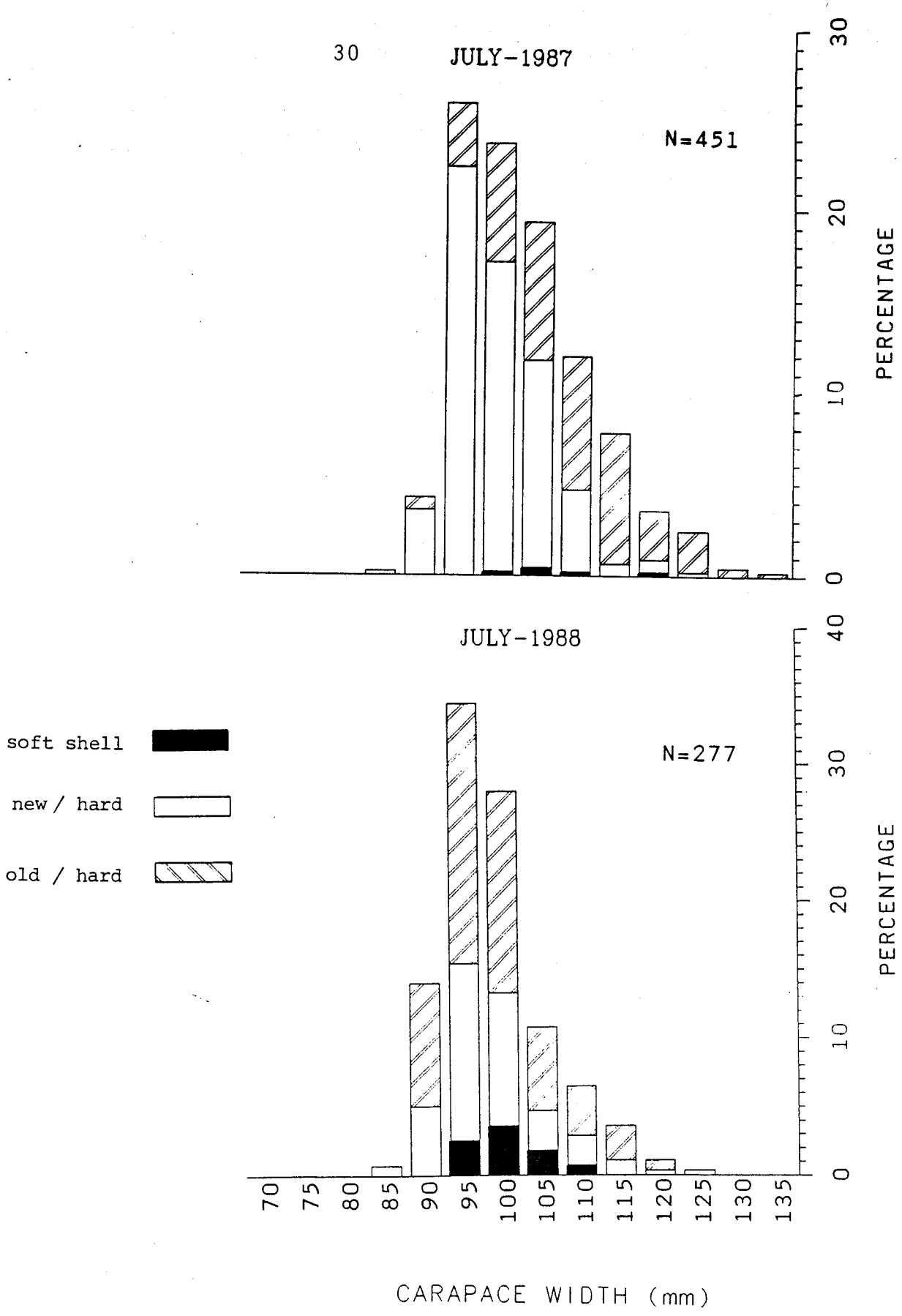

Fig. 13. Size frequency distributions and shell conditions for catches of Chionoecetes opilio males obtained from commercial plant sampling in Management Area 40, 1987-88.