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Results of the 1996 Div. 3L Inshore/Nearshore Snow Crab
Time-series Research Cruises

by

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Abstract

Data from trap and trawl catches of snow crab (*Chionoecetes opilio*) obtained during 3 research cruises conducted during 1996 in 3 snow crab management areas in NAFO Division 3L are presented and compared to similar data collected during the 2 years previous in the same areas. Catch rates of legal-sized males caught in commercial-meshed traps were down slightly from 1995 values in Conception Bay and the Northeast Avalon and down sharply in Bonavista Bay (19.2%, 2.3% and 65.2% respectively). Catch rates of small-clawed males captured in small-meshed traps fell in all 3 areas continuing the declining catch rates first reported in 1992.

A modified shrimp trawl was used for the first time in 1996. Tows of 10 minute duration were made contiguous to trap fishing locations. Comparison of the trap/trawl data indicate that the two types of fishing gear may be complementary.

Examination of mature female crab captured during the survey reveal that the vast majority are ovigerous, a situation comparable to all previous years during which the surveys were conducted.

Résumé

Les résultats des captures de crabe des neiges (*Chionoecetes opilio*) effectuées aux casiers et au chalut au cours de trois relevés de recherche réalisés en 1996 dans trois zones de gestion du crabe de la division 3L de l'OPANO sont présentés et comparés aux données correspondantes obtenues au cours des deux années précédentes dans la même région. Les taux de capture des mâles de taille légale, capturés à l'aide de casiers à maillage commercial, étaient légèrement inférieurs à ceux de 1995 dans la baie Conception et le nord-est de la péninsule d'Avalon et fortement à la baisse dans la baie Bonavista (valeurs respectives de 19,2 %, 2,3 % et 65,2 %). Les taux de capture des mâles à petites pinces, capturés à l'aide de casiers à petit maillage, ont diminué dans les trois zones et ainsi poursuivi le déclin tout d'abord signalé en 1992.

Un chalut à crevettes modifié a été utilisé pour la première fois en 1996. Des traits d'une durée de 10 minutes ont été faits à proximité des zones de pêche aux casiers. La comparaison des résultats de la pêche aux casiers et au chalut montre que ces deux types d'engins pourraient être complémentaires.

L'examen des femelles matures capturées pendant le relevé montre que la grande majorité étaient ovigères, ce qui est comparable à la situation notée au cours de tous les relevés des années antérieures.

Introduction

Since 1979, yearly time-series cruises have been conducted in Bonavista Bay, Conception Bay and 3-40 n mi. NE of the Avalon Peninsula - three areas of NAFO Division 3L (Fig. 1). The primary purpose of these cruises has been to: provide an independent index of abundance of snow crab (*Chionoecetes opilio*) on the commercial fishing grounds by using baited commercial traps in a manner consistent with commercial fishing; to provide an indication of potential recruitment as determined by catch rates and catch composition of baited small-meshed traps; and recently, to obtain information on the size-frequency distribution and allometric composition of as comprehensive a size range as possible of male snow crab by utilizing a modified shrimp trawl. In addition to data collected on male crab, information is also collected on the distribution, abundance and reproductive status of female snow crabs. Analyses of these data provide an overview of the status of the snow crab populations in these areas and by inference, an indication of developing trends in Newfoundland snow crab populations in general, at least those in inshore areas. Recently, data from these cruises have been used to develop a predictive model of short-term abundance of male snow crab (Dawe et al. 1996,1997).

Methods

Cruises in all areas are conducted at or near the same time each year, and take place over a 2-3 week period. Sampling sites are selected randomly and stratified to depths greater than 169m. Although Miller and O'Keefe (1981) found significant catches of *C. opilio* at depths ranging from 91 m to 128 m, traditionally commercial fishing, as determined from logbook analysis, occurs at depths greater than 169 m.

Trapping Surveys

Long-line fleets of 12 Japanese-style conical traps (9 commercial and 3 small-meshed), are baited with a combination of squid and mackerel and soaked for approximately 24 h. Catches are sexed and separated, carapace width (CW) and the shell condition determined according to the criteria described by Taylor et al. (1989). In addition, the height of the right chela of male crabs is measured to determine allometric maturity (Conan and Comeau 1986). The reproductive status of female crabs is determined by macroscopically examining the egg clutch to ascertain fullness and the developmental stage of the eggs carried, and by dissecting a subsample of mature individuals to determine recency of mating by examination of the spermathecae.

Shrimp Trawl Surveys

During the 1996 time-series cruises a modified #36 shrimp trawl was used as a sampling tool for the first time. The footgear of the trawl was modified by removing all 12 inch rubber rollers, leaving only 7 1/2 inch long rubber spacers, 4 1/2 inches in diameter. A 17 m long 1/2" galvanized steel tickler chain was attached 1m in front of the foot rope. In addition, the drop chains were reduced in length to 2 links reducing the distance between the foot rope and fishing line to 5 inches. Tows were conducted for 10 minutes bottom time (determined by SCANMAR) at a speed of 2.5 knots. Upon retrieval of the trawl, the entire catch was sampled in the same way as for trap catches.

Results and Discussion

Trapping Survey

Catch rates (CPUE - #'s of legal-sized crabs/trap) in all areas were lower than those experienced in 1995 (Fig. 2). Catch rates in Bonavista Bay decreased by 65.2% while those in Conception Bay and NE Avalon declined by 19.2% and 2.3% respectively.

The 1996 catch rate (#'s/trap) of small-clawed males, both immediate pre-recruits and commercial-sized continued the declining trend (Fig. 3) which began in 1992. This decline (Fig. 4a, b and c and Tables 1-3) since 1992, has prompted a prediction of a decline in recruitment and an eventual resultant decline in the availability of commercial-sized hard-shelled males (Dawe et al. 1996, 1997).

An additional concern for the industry is the increased proportion of the legal-sized component of the population that is becoming old-shelled and hence less valuable to the snow crab sections market. The incidence of old-shelled, legal-sized males captured by commercial traps increased over 1995 levels in both Bonavista Bay and NE Avalon in 1996 but fell in Conception Bay (Fig. 5a, b and c and Table 4). Using small meshed traps, catch rates of old-shelled legal-sized males increased in Bonavista Bay but decreased in Conception Bay and NE Avalon (Fig. 6a, b and c and Table 5).

Trawling Survey

Thirty 10 minute sets were made with the modified shrimp trawl over the 3 survey areas. Catches are summarized in Table 9.

Although 1996 represents the first year that trawling with the modified #36 shrimp trawl was undertaken, it appears to be effective in capturing all size

categories of snow crab (Fig. 7). Figure 7 does not include the size frequency of males caught in Conception Bay due to the small sample size. However, results from the NE Avalon and Bonavista Bay appear to confirm the dearth of pre-recruit-sized male crabs (75-94 mm CW) indicated by the results of the trapping surveys (Fig. 4a, b and c).

Due to the selectivity of baited traps, even small-meshed ones, the relative abundance of crabs <75mm CW is difficult to determine. Hoenig and Dawe (1991) maintained that because of this selectivity baited traps were not reliable indicators of pre-recruit abundance. However, it would appear that in a qualitative way at least, small-meshed trap catches of small-clawed males may serve as rough predictors of short-term recruitment.

Although the modified shrimp trawl successfully captured snow crab of all size groups the sea bottom type and topography off the NE Avalon and Bonavista Bay are quite different and could have affected catches. While the bottom type on the commercial fishing grounds off the Avalon Peninsula consists primarily of sand or mud/sand, that in Bonavista Bay largely consists of mud. Additionally, the bottom off the Avalon is relatively smooth while that in Bonavista Bay is extremely rough and uneven.

The modified shrimp trawl appears to effectively sample much smaller crabs than do small-meshed traps and may serve to augment information on prerecruit abundance and distribution. It is noteworthy that in both Bonavista Bay and NE Avalon there appears to be a large pulse of male snow crab at 11 mm CW and 17 mm CW respectively. These modes should be monitored to attempt to determine trends in distribution and abundance which may be instrumental in predicting future recruitment.

Both the trapping and trawling components of the time-series cruises appear to provide valuable information, useful in discerning what is transpiring in the snow crab populations in terms of short-term expectations (predicted CPUE) and in terms of long-term recruitment prospects. Both survey methodologies appear to be complementary and given the ease with which the small shrimp trawl can be deployed, they can easily be used together.

Acknowledgements

M. Rees typed the manuscript while E. Seward assisted in preparing some of the figures.

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Table 1. Summary of data from snow crab allometric measurements (chela height versus carapace width) obtained during time-series research surveys in Bonavista Bay using 1" meshed Japanese conical traps.

Year	No. measured	Small clawed		Large clawed	
		No.	%	No.	%
1989	1408	466	33.1	942	66.9
1990	1077	508	47.2	569	52.8
1991	1553	636	41.0	917	59.0
1992	748	191	25.5	557	74.5
1993	857	103	12.0	754	88.0
1994	4116	257	6.2	3859	93.8
1995	2464	135	5.5	2329	94.5
1996	1607	50	3.1	1557	96.9

Table 2. Summary of data from snow crab allometric measurements (chela height versus carapace width) obtained during time-series research surveys in Conception Bay using 1" meshed Japanese conical traps.

Year	No. measured	Small clawed		Large clawed	
		No.	%	No.	%
1991	2094	517	24.7	1577	75.3
1992	630	178	28.3	452	71.7
1993	602	42	7.0	560	93.0
1994	3281	300	9.1	2981	90.9
1995	2952	60	2.0	2892	98.0
1996	2362	34	1.4	2328	98.6

Table 3. Summary of data from snow crab allometric measurements (chela height versus carapace width) obtained during time-series research surveys in Northeast Avalon using 1" meshed Japanese conical traps.

Year	No. measured	Small clawed		Large clawed	
		No.	%	No.	%
1989	805	81	10.1	724	89.9
1990	1342	636	47.4	706	52.6
1991	1036	377	36.4	659	63.6
1992	1094	316	28.9	778	71.1
1993	378	81	21.4	297	78.6
1994	2659	260	9.8	2399	90.2
1995	2248	200	8.9	2048	91.1
1996	2655	147	5.5	2508	94.5

Table 4. Summary of the proportion (%) of old-shelled male crabs by size group caught in commercial crab traps during 3L research surveys, 1992-96.

Northeast Avalon					
Size group	1992	1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)	4.8	6.3	13.5	24.4	26.7
Legal size (≥ 95 mm CW)	1.9	1.7	2.1	6.6	10.2
Bonavista Bay					
Size group	1992	1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)	6.1	21.7	40.0	47.0	46.9
Legal size (≥ 95 mm CW)	3.9	7.1	11.9	14.0	19.0
Conception Bay					
Size group	1992	1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)	22.7	28.0	30.1	67.8	39.0
Legal size (≥ 95 mm CW)	1.5	0.9	2.8	15.4	10.8

Table 5. Summary of the proportion (%) of old-shelled male crabs by size group caught in small meshed crab traps during 3L research surveys, 1993-96.

Northeast Avalon						
Size group			1993	1994	1995	1996
Immediate	prerecruits	(75-94mm CW)	13.9	17.4	23.9	19.4
	Legal size (≥ 95 mm CW)		3.7	3.8	9.1	8.4
Bonavista Bay						
Size group			1993	1994	1995	1996
Immediate	prerecruits	(75-94mm CW)	21.7	36.8	43.3	44.6
	Legal size (≥ 95 mm CW)		8.3	11.7	15.6	20.4
Conception Bay						
Size group			1993	1994	1995	1996
Immediate	prerecruits	(75-94mm CW)	32.6	32.2	79.2	38.2
	Legal size (≥ 95 mm CW)		1.0	1.6	20.6	12.0

Table 6. Summary of the proportion (%) of old-shelled small clawed male crabs (skip-moulters) in two size groups caught in small meshed crab traps during 3L research surveys, 1993-96.

		Northeast Avalon			
Size group		1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)		6.8	1.6	3.5	28.8
Legal size (≥ 95 mm CW)		0	7.0	2.9	31.0
		Bonavista Bay			
Size group		1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)		6.2	-	15.9	74.2
Legal size (≥ 95 mm CW)		0	-	3.7	50.0
		Conception Bay			
Size group		1993	1994	1995	1996
Immediate prerecruits (75-94mm CW)		0	6.5	64.5	50.0
Legal size (≥ 95 mm CW)		0	2.0	11.5	53.9

Table 7. Number of female snow crab and percent ovigerous () collected from crab trap catches in three management areas in Newfoundland, 1994-96.

Year	Bonavista		Conception Bay		Northeast Avalon	
	# examined	(% ovig.)	# examined	(% ovig.)	# examined	(% ovig.)
1994	108	79.6	113	98.2	-	-
1995	46	89.1	170	96.5	193	98.5
1996	311	97.1	131	99.2	867	91.4

Table 8. Number of female snow crab and percent new shelled () collected from crab trap catches in three management areas in Newfoundland, 1994-96.

Year	Bonavista		Conception Bay		Northeast Avalon	
	# examined	(% new)	# examined	(% new)	# examined	(% new)
1994	108	4.6	113	34.5	-	-
1995	46	89.1	170	0.6	193	10.4
1996	311	7.1	131	0.0	867	27.8

Table 9. Number of modified trawl sets and catches of snow crab in three areas of Newfoundland, 1996.

Area	No. of sets	No. caught		No. sampled	
		Male	Female	Male	Female
NE Avalon	18	558	301	558	301
Bonavista Bay	6	341	273	132	87
Conception Bay	6	64	1	64	1

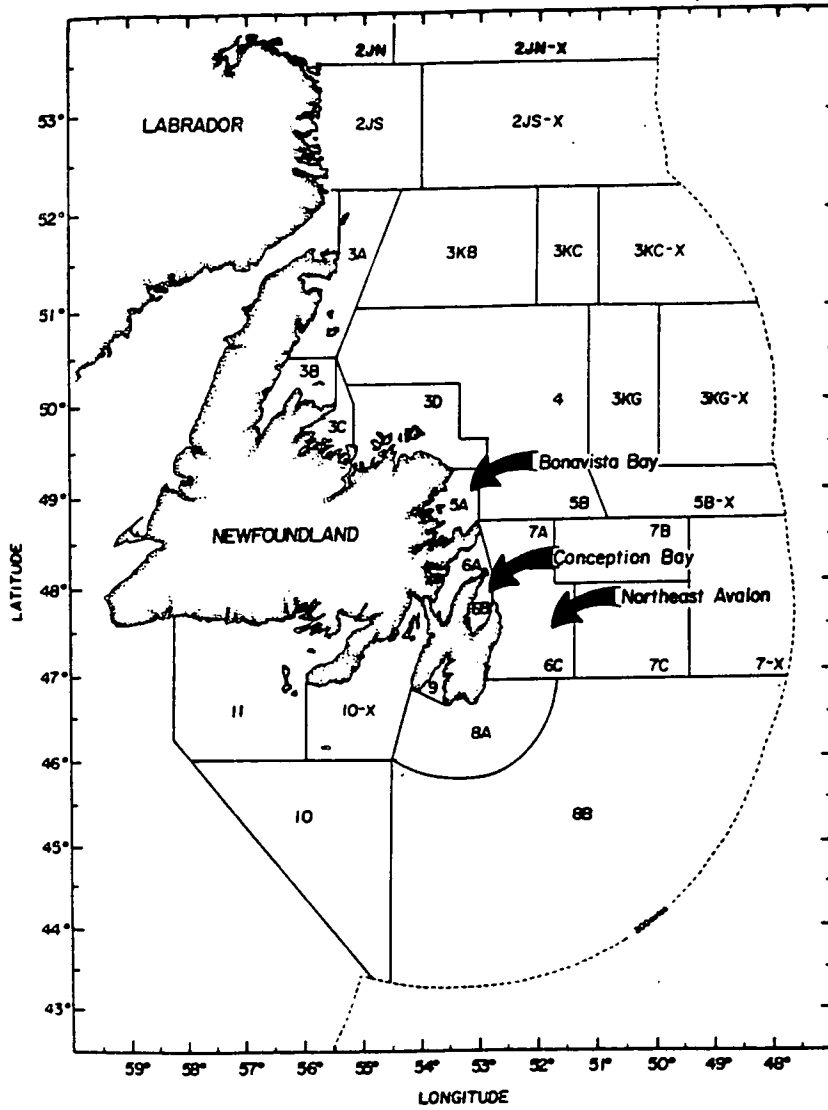


Figure 1. Snow crab management areas; those three which represent the survey areas are identified by dark arrows.

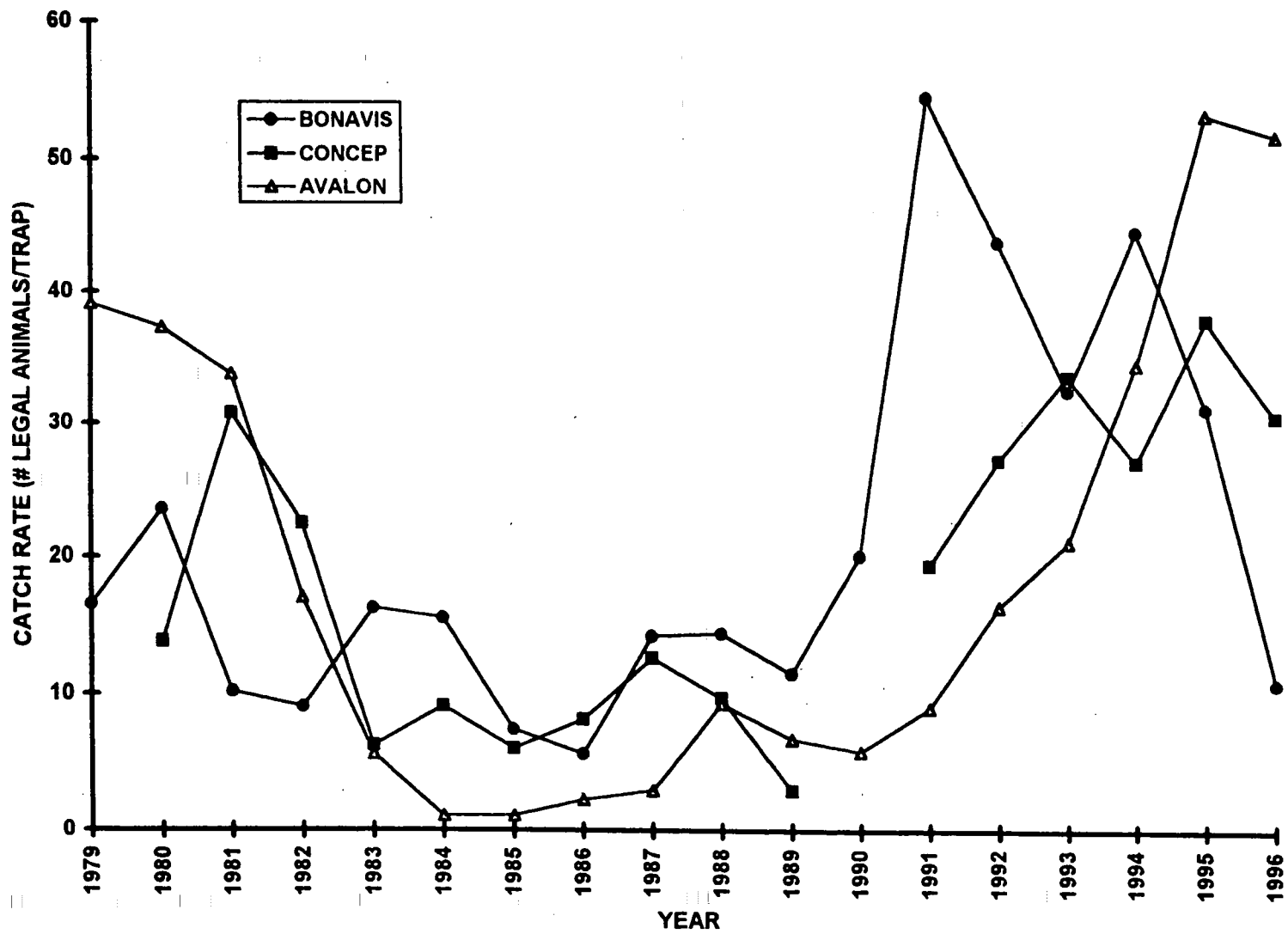


Figure 2. Summary of changes in NAFO division 3LNO catch rates (# legal animals/trap), 1979-1996.

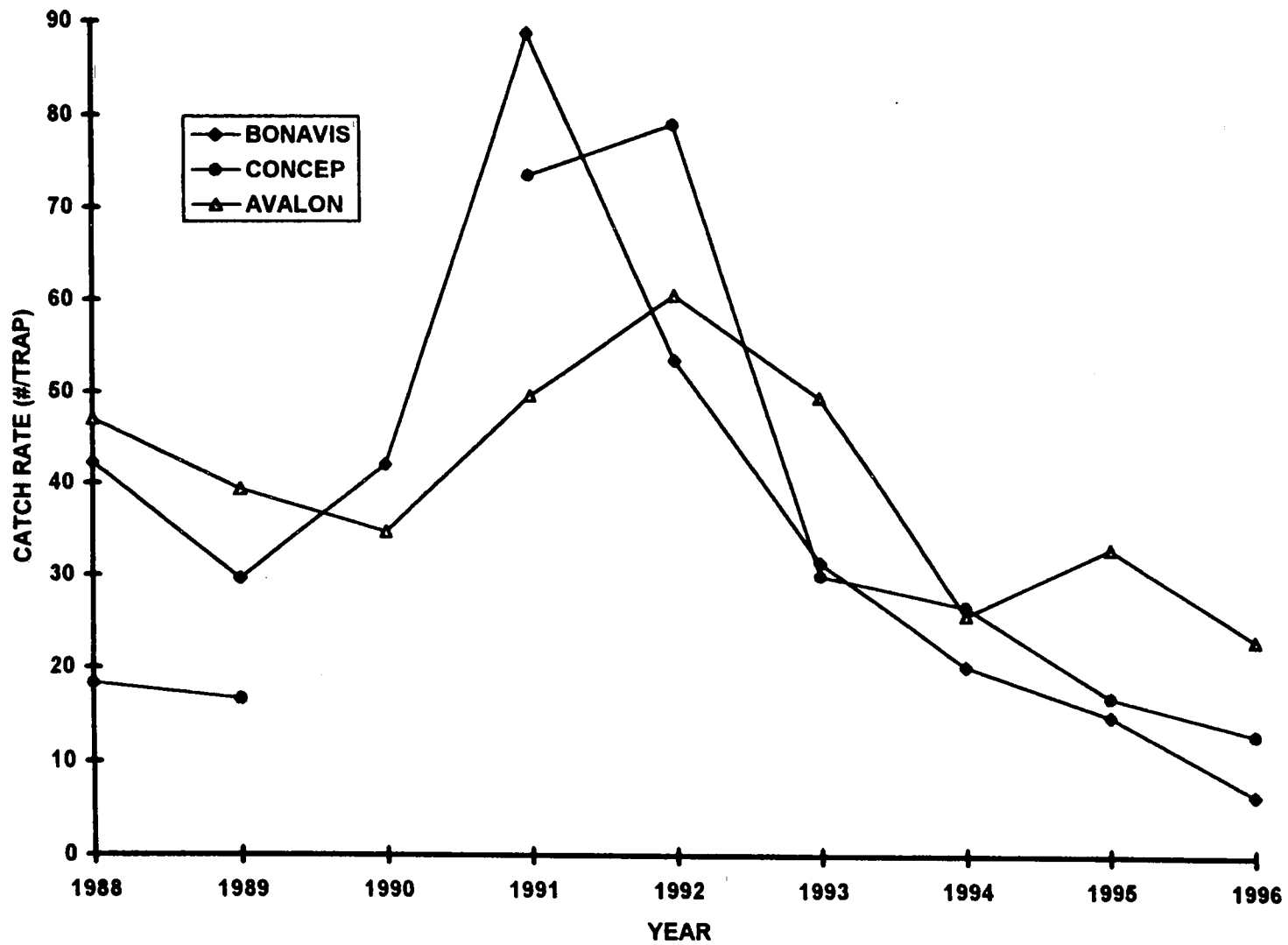


Figure 3. Summary of changes in abundance (#/trap) of immediate pre-recruits in NAFO division 3LNO, 1988-1996.

Bonavista Bay - Small-meshed traps 1989 - 1996.

Large claw
 Small claw

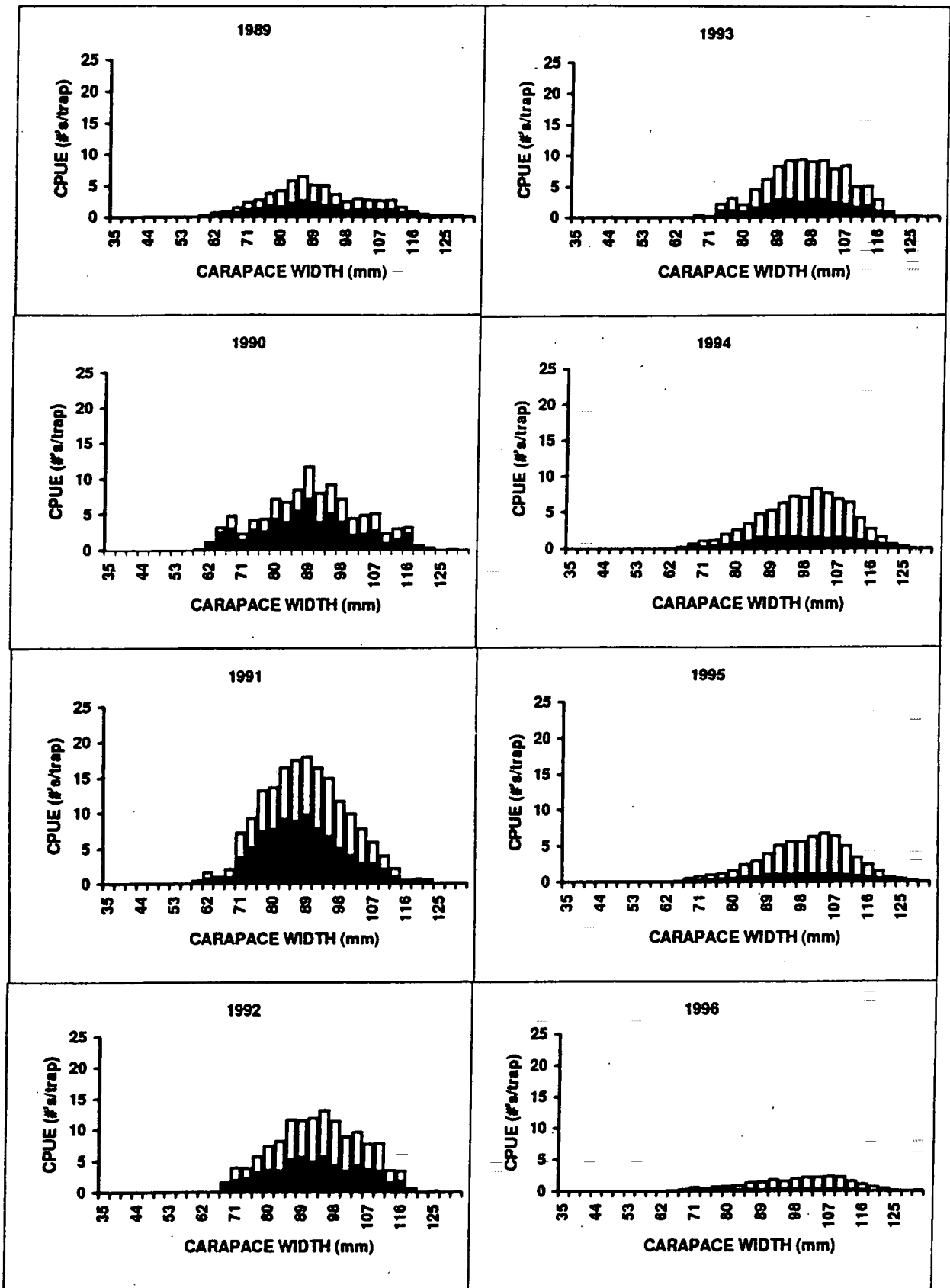


Figure 4a. Comparison of the proportion of small clawed versus large clawed snow crab in Bonavista Bay, 1989-96.

Conception Bay - small-meshed traps - 1989-96

Large Claw
 Small Claw

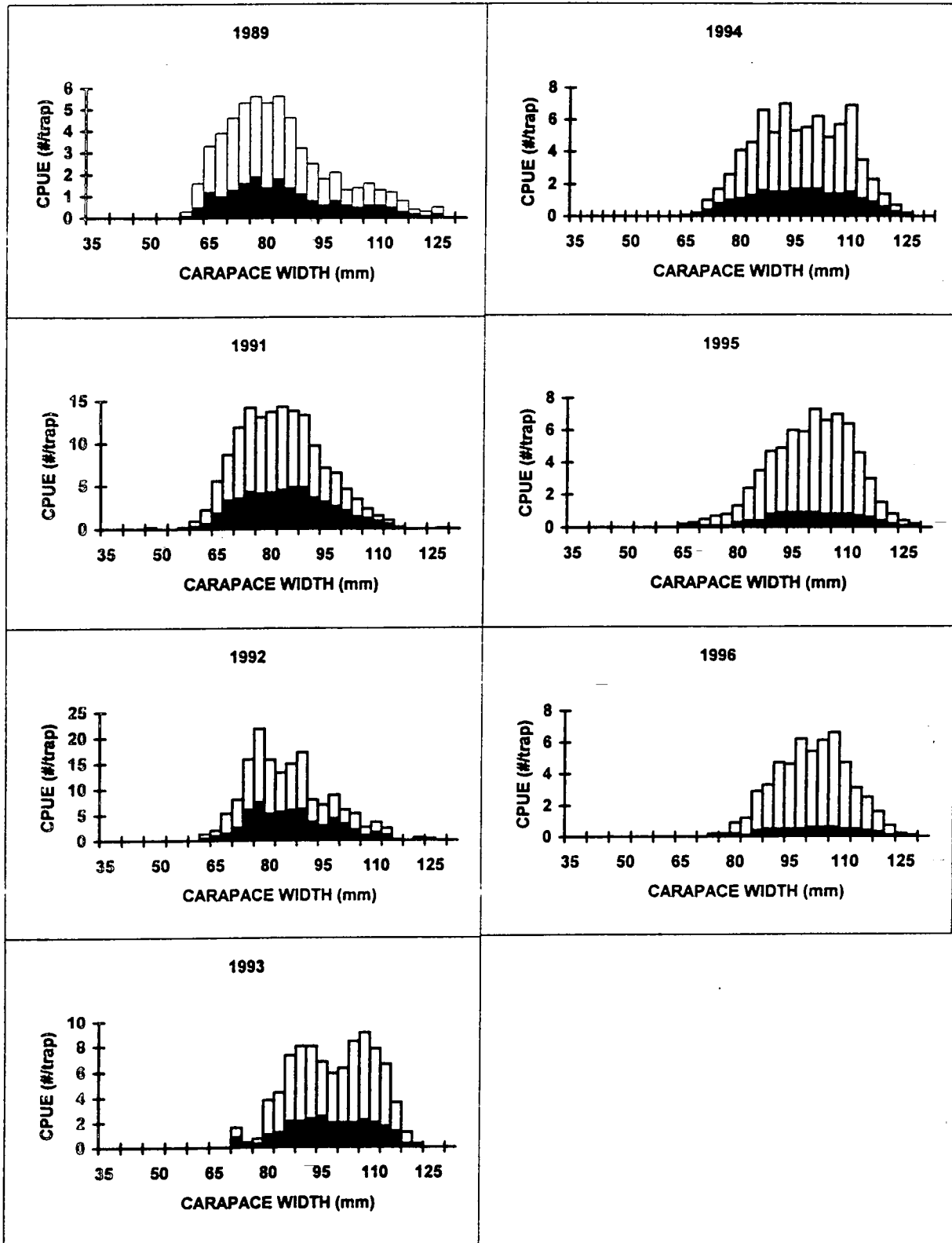


Figure 4b. Comparison of the proportion of small clawed versus large clawed snow crab in Conception Bay, 1989-96.

NE Avalon - small-meshed traps - 1989-96

Large claw
 Small claw

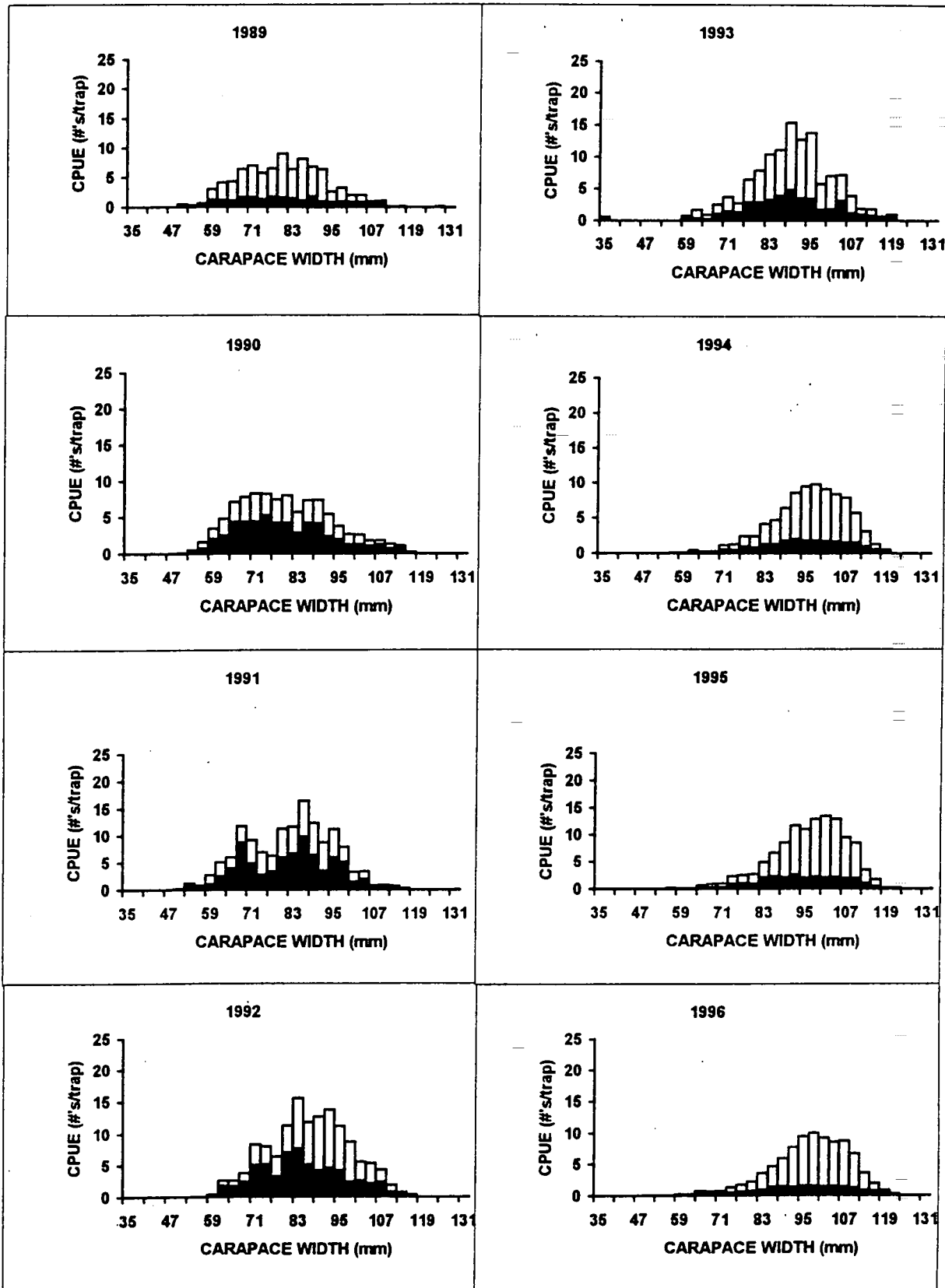


Figure 4c. Comparison of the proportion of small clawed versus large clawed snow crab in NE Avalon, 1989-96.

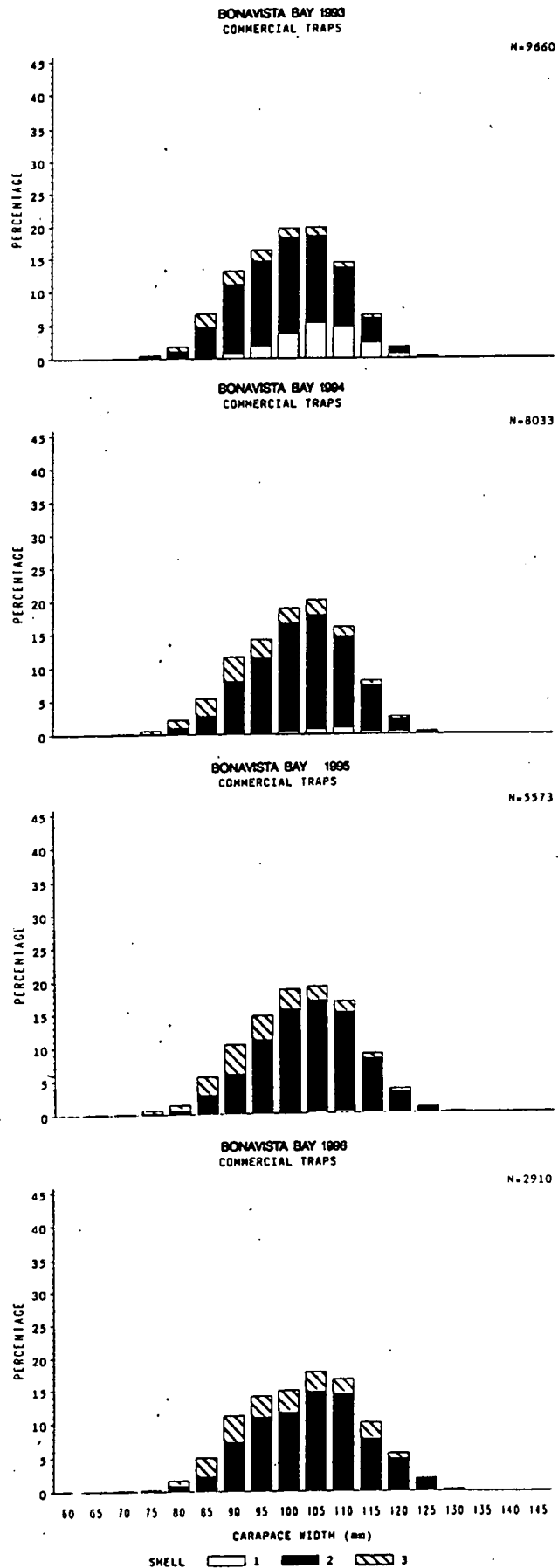


Figure 5a. Comparison of size-frequency/shell condition for snow crab from commercial traps Bonavista Bay, 1993-1996.

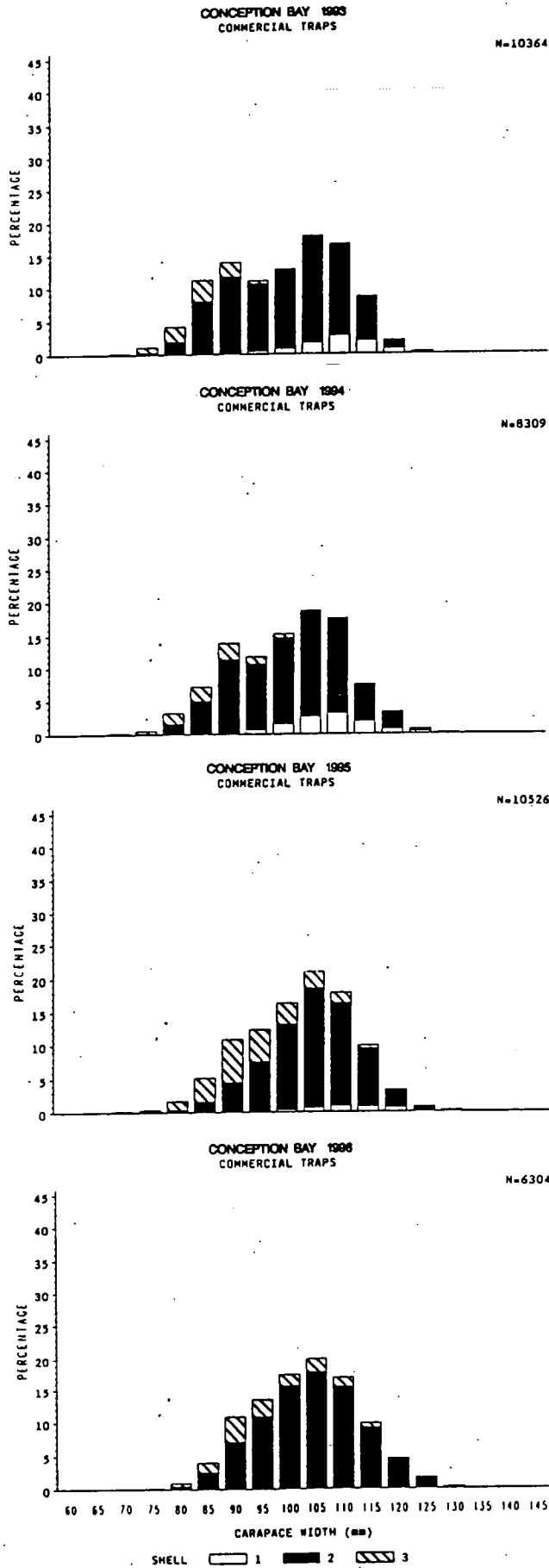


Figure 5b. Comparison of size-frequency/shell condition for snow crab from commercial traps Conception Bay, 1993-1996.

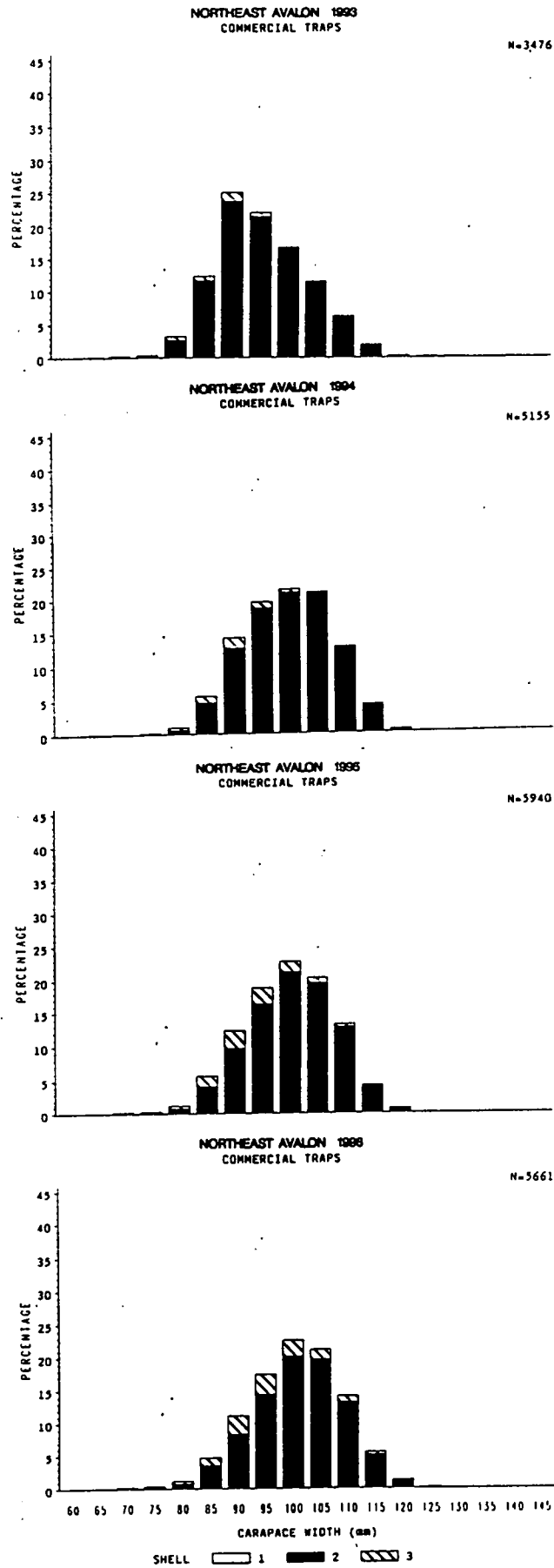


Figure 5c. Comparison of size-frequency/shell condition for snow crab from commercial traps NE Avalon, 1993-1996.

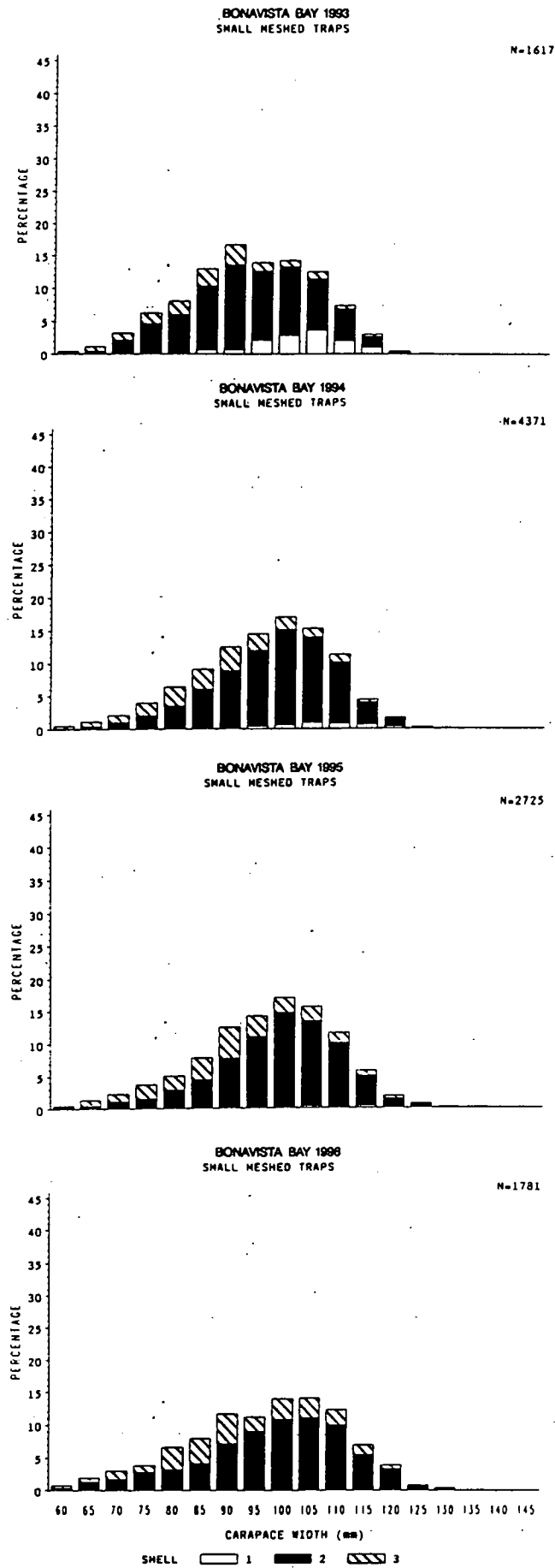
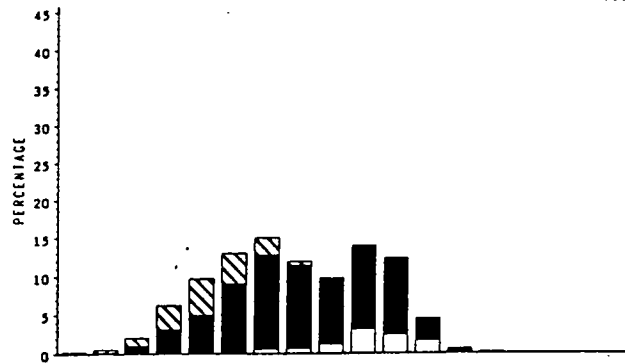


Figure 6a. Comparison of size-frequency/shell condition for snow crab from small mesh traps Bonavista Bay, 1993-1996.

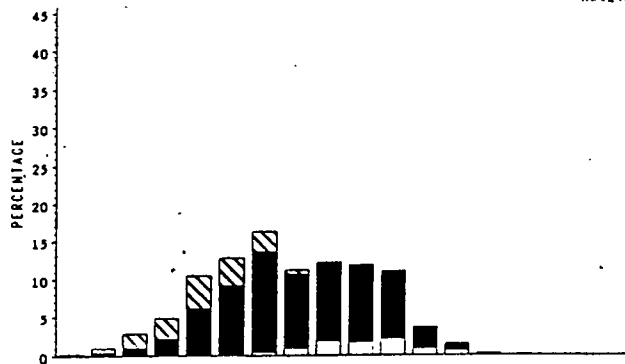
CONCEPTION BAY 1993
SMALL MESHED TRAPS

N=1103



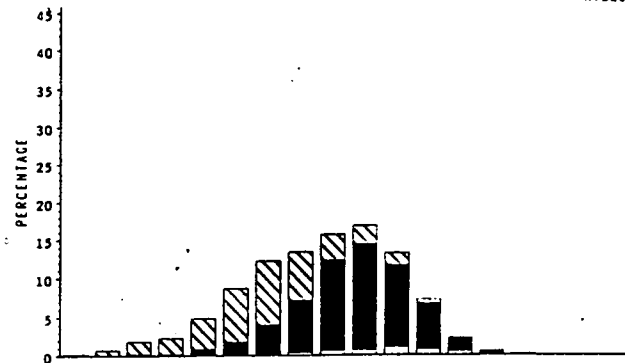
CONCEPTION BAY 1994
SMALL MESHED TRAPS

N=4240



CONCEPTION BAY 1995
SMALL MESH TRAPS

N=3207



CONCEPTION BAY 1996
SMALL MESHED TRAPS

N=2624

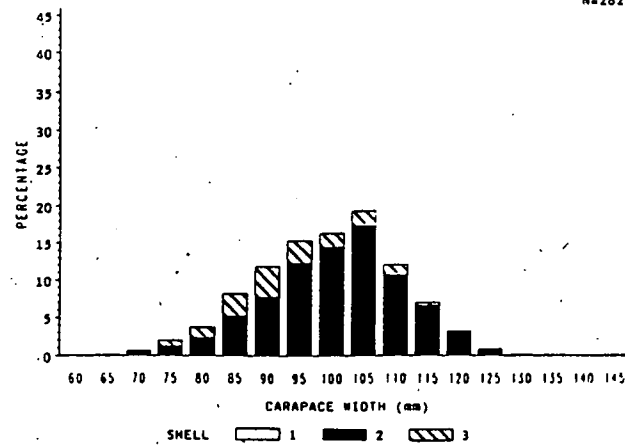


Figure 6b. Comparison of size-frequency/shell condition for snow crab from small mesh traps Conception Bay, 1993-1996.

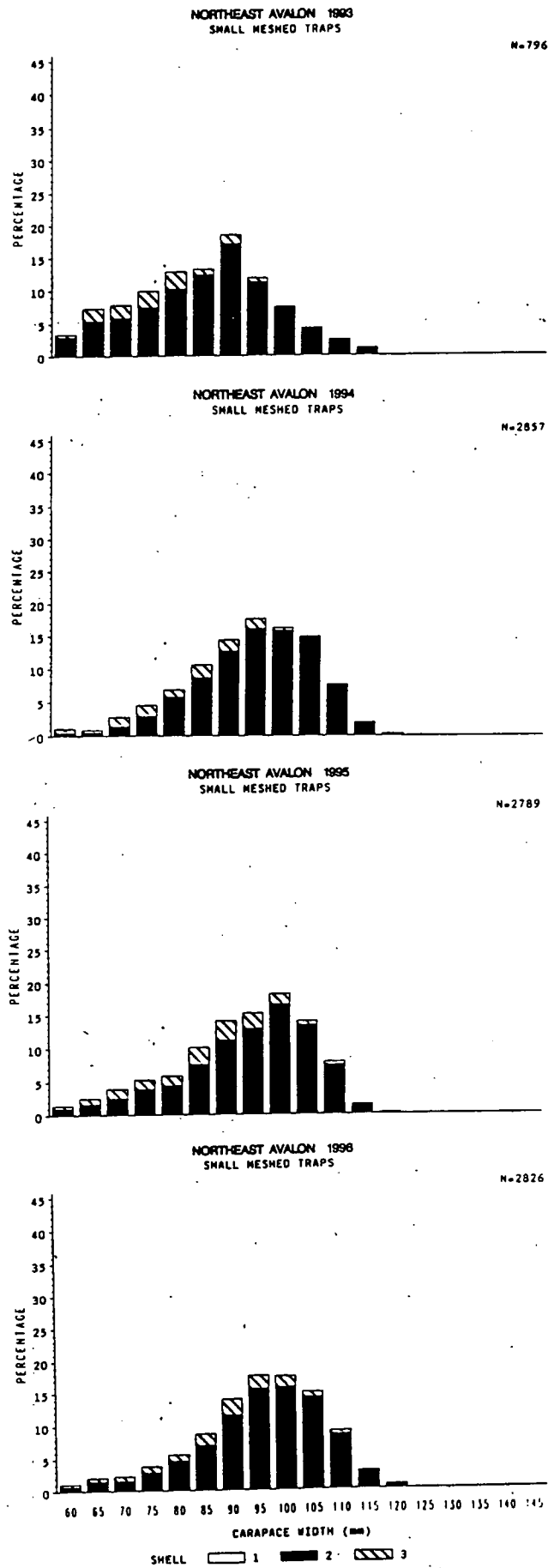


Figure 6c. Comparison of size-frequency/shell condition for snow crab from small mesh traps NE Avalon, 1993-1996.

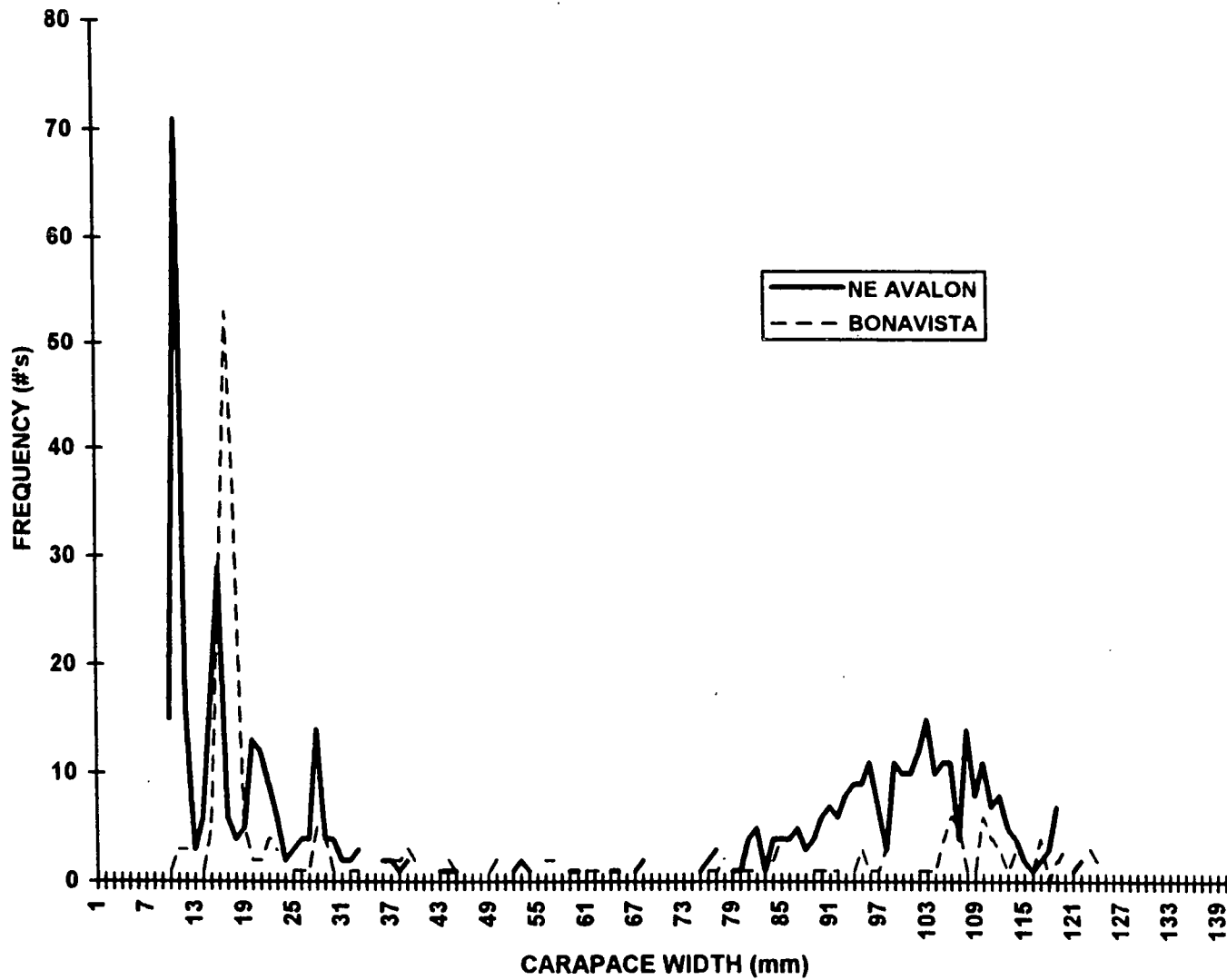


Figure 7. Size-frequency of trawl-caught male snow crab.