

Not to be cited without
permission of the authors¹

Canadian Atlantic Fisheries
Scientific Advisory Committee

CAFSAC Research Document 87/57

Ne pas citer sans
autorisation des auteurs¹

Comité scientifique consultatif des
pêches canadiennes dans l'Atlantique

CSCPCA Document de recherche 87/57

Analysis of the Snow Crab (*Chionoecetes opilio*) Fishery
in Newfoundland for 1986

by

D. M. Taylor and P. G. O'Keefe
Science Branch
Department of Fisheries and Oceans
P. O. Box 5667
St. John's, Newfoundland A1C 5X1

¹ This series documents the scientific basis for fisheries management advice in Atlantic Canada. As such, it addresses the issues of the day in the time frames required and the Research Documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

Research Documents are produced in the official language in which they are provided to the Secretariat by the author.

¹ Cette série documente les bases scientifiques des conseils de gestion des pêches sur la côte atlantique du Canada. Comme telle, elle couvre les problèmes actuels selon les échéanciers voulus et les Documents de recherche qu'elle contient ne doivent pas être considérés comme des énoncés finals sur les sujets traités mais plutôt comme des rapports d'étape sur les études en cours.

Les Documents de recherche sont publiés dans la langue officielle utilisée par les auteurs dans le manuscrit envoyé au secrétariat.

Abstract

Population size estimates for snow crab (Chionoecetes opilio) off the east coast of Newfoundland are presented for the 1986 fishing season. Within given crab management areas estimates of population size ranged from 640 t to 2133 t and exploitation rates from 56 to 59%. Comparison of size frequency/shell conditions for 1985-86 in three management areas is also presented.

Résumé

Les estimations des tailles de populations de crabes des neiges (Chionoecetes opilio) au large de la côte est de Terre-Neuve sont présentées pour la saison de pêche de 1986. Selon les diverses zones de gestion du crabe, les estimations de la taille des populations variaient de 640 t à 2 133 t, et les taux d'exploitation, de 56 à 59 %. La comparaison de la fréquence des tailles et de l'état des carapaces dans trois zones de gestion est aussi présentée pour 1985 et 1986.

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 (Tables 1 and 2), 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 in 1982, it proved to be brief and ended in 1985. At present, the Newfoundland snow crab fishery is in a state of crisis. While stocks were declining or collapsed, a total of 97 supplementary licenses were issued in the Northern Zone in 1985. The new licensees were not issued logbooks and therefore effort data on where and how many traps were hauled in each management area were not available for analysis. A further blow to the stability of the fishery occurred during the latter part of the 1985 season when enforcement of the regulation prohibiting the sale of soft-shelled crabs was relaxed. In 1986 this regulation was dropped altogether.

While it was hoped that conditions in 1986 would improve, the reverse has happened particularly in the Northern Zone. An additional 49 supplementary licenses were issued in this zone and to complicate assessment of the resource most fishermen, including those with full-time status, did not receive logbooks until the fishery had closed.

As a result of all these factors, we feel that with several exceptions, producing reliable biomass estimates for the various snow crab management areas is impossible. The best that can be accomplished is a consideration of the catch/effort trends and available size-frequency data as a means of assessing the general "health" of the stocks in various management areas.

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 (Table 6). While the quotas were overfished in several areas, this management initiative must be viewed as a positive step. It should also be noted that mid-season quota increases in Trinity Bay (Area 22) and for 3L excluding Bonavista, Trinity, and Conception bays were only permitted after available catch/effort data had been reviewed.

Materials and Methods

Catch/effort data from fishermen's logbooks were analyzed and data for each management area compared to processors' sales slips in order to check their veracity. From these data biweekly catch/effort tables were constructed in order to determine whether Leslie analyses were feasible. These tables are summarized for each management area and catch per unit effort (CPUE) plotted against cumulative catch and presented in Figures 2-18.

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 1984 data and presented in Figures 19 (Area 16), 20 (Area 18), and 21 (Area 25). A comparative summary of the performance of the crab fleet by zone is given in Table 4.

Results and Discussion

As previously mentioned the fishery in the Southern Zone has virtually collapsed. In all offshore areas except Areas 10 and 12, CPUE has become so low that it is uneconomical for fishermen to prosecute the fishery (Table 1). Extremely low effort levels, the restriction of this effort to near shore areas and landing of soft-shelled crabs made Leslie analysis impractical for all areas except southwest Avalon.

In Bonavista and Conception bays, the dropping of soft-shell regulations resulted in artificially high CPUEs during the latter half of the season, and made standard Leslie analysis impossible.

Effort levels in Conception Bay (Area 16) were extremely low, although slightly higher than in 1985. Although processors accepted soft-shelled crabs for most of the fishing season, landings were so sporadic and small that a plant sample could not be obtained in order to determine the percentage of soft-shelled landings. Therefore catch/effort data for Conception Bay are not suitable for Leslie analysis.

Only three other areas in the Southern Zone experienced significant effort and landings; Areas 8, 10, and 12. While Area 8 showed a significant decrease in landings, effort and \bar{X} CPUE, Areas 10 and 12 showed an increase. This apparent increase in abundance is probably due to a large pulse of late-season recruitment. Spring port sampling of crabs from Area 10 showed a large percentage of newly hardened animals in the landings.

Recruitment

The abundance of soft-shelled animals on the fishing grounds in many areas of the Southern Zone (Areas 8, 10, 12, 14, 16, 18, 22, and 25) indicate that yearly recruitment continues to occur. It is apparent however, that current recruitment levels are not sufficient to sustain viable catch rates. It is now patently obvious that effort in Areas 8, 16, 22, and 25 should be reduced in an attempt to stabilize the fishery. It has been demonstrated in previous assessments where Leslie analyses have been possible that exploitation rates have been excessive for several years and in the

short term at least, this overexploitation has rendered the fishery non-viable in many areas.

Water Temperature

Water temperatures on the commercial crab fishing grounds of Area 18 warmed considerably in 1986. A research cruise conducted during June of 1986 discovered large numbers of soft-shelled and newly hardened crabs, indicating that growth and recruitment had taken place during the winter and spring of that year (Fig. 20). However, the low catch rates that persisted in this area during 1986 indicate that this recruitment pulse was not sufficient to allow a significant recovery of the fishery.

Size-frequency/Shell Condition Distributions

Comparative size frequency/shell condition histograms for 1985 and 1986 indicate that while Conception Bay remains unchanged from 1985 (Fig. 19), Area 18 (Fig. 20) demonstrates a slight increase in animals just recruited into the fishery. However, in Bonavista Bay (Area 25, Fig. 21) there is a significant decrease in both the proportion of soft-shelled animals available and in the proportion of animals ≥ 95 mm carapace width (CW). The 1985 cruise was conducted after the fishing season had closed so comparison with plant samples is not possible. However, the scarcity of soft-shelled animals is quite probably due to the fact that since the regulation prohibiting the retention of soft-shelled crabs had been dropped, any newly molted crabs were simply retained by fishermen and sold to less than discriminating buyers.

Reproductive Capacity

Research cruises were again conducted in three areas (16, 18 and 25) during 1986. Samples of females were collected using small meshed traps and examined macroscopically both internally and externally in order to determine reproductive status. Results of those examinations are summarized and presented in Table 5.

While the percentage of berried females has remained at the 100% level, one curious development raises concern about the reproductive health of the stock. For the first time berried females have been found to have no spermatophores in their spermathecae (examined macroscopically only). Without exception these females are primiparous. Whether these females have produced nonviable eggs because of a failure to mate successfully or have used all the spermatophores available to fertilize the egg clutch is unclear. However, one primiparous female with no observable spermatophores in the spermathecae was carrying eyed eggs. Additional field work on this phenomenon is planned for 1987. In addition, a number of egg-bearing primiparous females collected in Conception Bay during the November cruise are being held in the laboratory and development of their egg clutches is being monitored.

Northern Zone

CPUE declined in all areas of the Northern Zone except Area 40 (Table 2). Fishermen's logbooks indicated that all areas experienced large catches of soft shelled animals during the summer months. While it appears that recruitment mechanisms are

operating normally, it is becoming evident that yearly growth and recruitment are not sufficient to maintain catch rates in the face of such heavy fishing pressure.

Biomass estimates based on Leslie analyses of catch effort data extracted from all available logbooks indicate that fishable biomass in Areas 28, 30 and 32 (Fig. 11, 12, and 13, respectively) has declined dramatically and current exploitation rates are excessive.

Port sampling conducted in July and October indicates that the reduced availability may be tempting fishermen to land sub-legal animals. In October every fisherman sampled had in excess of 5% undersized in his catch while one fisherman landed a box of crab that was 95% undersized.

Area 40 is the one bright spot in 3K. The grounds are fairly extensive and highly productive. Without the contribution from this area the situation in the Northern Zone would be much bleaker.

Supplementary Fishery

During 1986 an additional 49 vessels participated in the Northern Zone crab fishery bringing the total number of licenses to 146. Of the overall 4,000 t quota for the Northern Zone, supplementary vessels were allotted 1,000 t. Supplementary fishermen requested and were granted a split season with roughly half the quota allocated to a May fishery while the other half was set aside for the month of September.

In 3Ps the number of supplementary vessels was slightly reduced from 64 in 1985 to 62 in 1986. In this area, catches were similar to 1985, exceeding the quota by 51 t (Table 3). Here too, the quota of 600 t was split into a spring/fall fishery.

There was no supplementary crab fishery in inshore Labrador during 1986. This was probably due in part to an excellent 1986 cod fishery and the fact that fishermen were disappointed with inshore crab catches in 1985.

Labrador

A total of 6 vessels, 5 from the Southern Zone and one from Labrador, began to prosecute this fishery in July of 1986. However, low catch rates supposedly caused by "dirty water" forced them to abandon the fishery until early August.

While catch rates throughout the renewed fishing season remained good (Table 2, Fig. 18) bad weather shortened the fishing season significantly. As a result the quota allocated by Resource Management Branch was not caught.

Port sampling conducted during September indicated that there were significant numbers of recently hardened animals, suggesting that recruitment mechanisms are in good health.

Summary

With the exception of the southwestern portion of the Avalon Peninsula in the Southern Zone, the crab fishery remains in a depressed state. However, the presence of many recently molted pre-recruits points to a potential revival of the crab fishery.

In the Northern Zone, with the exception of Area 40 and Labrador, the fishery is in a state of near collapse. Management should give serious consideration to reducing quotas in this zone in an attempt to stabilize the fishery.

References

Taylor, D. M., and P. G. O'Keefe. 1986. Analysis of the snow crab (Chionoecetes opilio), fishery in Newfoundland for 1985. CAFSAC Res. Doc. 86/57.

Table 1. Summary of statistics for the Newfoundland Snow Crab fishery, 1979-86.

Area	Year	Effort (trap hauls)	Landings (mt)	CPUE kg/trap haul	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
8	1979	1,260	8	6.7	-	-
	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	23,300	164	7.1	-	-
	1986	19,570	102	4.8	-	-
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	-	-
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
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	-	-	-	-	-
14	1979	37,950	762	20.1	1095 (891-1681)	70
	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	-	-
15	1981	18,128	404	22.3	-	-
	1982	66,949	1056	15.8	1861 (1465-3024)	56
	1983	1,320	138	10.5	-	-
	1984	-	-	-	-	-
	1985	1,140	6	5.7	-	-
	1986	-	-	-	-	-
16	1979	28,845	464	16.1	1351 (951-3204)	34
	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	-	-

Table 1. (Cont'd.)

Area	Year	Effort (trap hauls)	Landings (mt)	CPUE kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
18	1979	398,939	6870	17.2	14359 (11,778-19,792)	44
	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	-	-
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	-	-	-	-	-
20	1979	4,165	67	16.0	-	-
	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	-	-
22	1979	56,887	569	9.9	1467 (1011-3233)	39
	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	-	-
25*	1979	173,305	1586	9.2	-	-
	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	1327	5.3	1434 (1220-1903)	93
	1985	251,720	728	2.9	959 (909-1018)	76
	1986	127,648	626	4.6	-	-

¹ In areas indicated by an asterisk (*), logbook data are incomplete. Therefore effort figures are incomplete. Mean CPUE is based on catches where effort is given in logbooks.

Table 2. Summary of statistics for the Newfoundland Snow Crab fishery (Northern Zone - all vessels¹), 1979-86.

Area	Year	Effort (trap hauls)	Landings (mt)	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
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
32*	1979	46,183	491	10.6	882 (76-1077)	56
	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	-	-
34*	1979	11,830	141	11.9	-	-
	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	-	-
36*	1979	21,298	156	7.3	383 (265-887)	41
	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	-	-
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)	-
40*	1984	11,035	67	6.1	-	-
	1985	40,420	225	5.6	-	-
	1986	95,408	772	7.1	-	-
41	1985	20,419	311	15.2	-	-
	1986	39,695	467	11.8	-	-

¹ In areas indicated by an asterisk (*), logbook data are incomplete. Therefore effort figures are incomplete. Mean CPUE is based on catches where effort is given in logbooks.

Table 3. Landings of snow crab by supplementary crab licensed vessels.

Area	Vessels	Landings (t)
3K	146	1411
3Ps	62	651
TOTAL		2062

Table 4. Summary of performance of Newfoundland snow crab fishery, 1979-86.

Year	Southern Zone		Northern Zone		Total Newfoundland	
	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)	Catch (t)	Effort ('000 trap hauls)
1979	9,426	666	788	79	10,214	745
1980	8,190	527	628	58	8,818	585
1981	12,636	808	1,202	94	13,838	902
1982	10,673	762	2,505	215	13,178	977
1983	9,182	745	4,868	520	14,050	1,265
1984	4,526	679	5,080	606	9,606	1,285
1985	2,673	496	4,274 ^a	546	6,947 ^c	1,042 ^b
1986	3,406	449 ^b	4,425 ^a	560 ^b	7,831	1,009 ^b

^aIncludes Labrador and supplementary landings

^bFigures are minimal as incomplete logbook returns made calculations incomplete.

^cDoes not include 3Ps supplementary landings

Table 5. Summary of reproductive status of female snow crab, Chionoecetes opilio, in three management areas in Newfoundland, 1984-86.

Area	Year	Month	# in sample	% berried females	Spermataphore type			
					% Old	% New	% Both	% None
16	1984	October	57	99	14	-	86	0
	1985	November	45	98	7	40	53	0
	1986	November	72	100	28	26	28	18
18	1984	May	37	100	97	-	3	0
	1985	June	55	89	42	4	55	0
	1986	June	60	98	70	7	3	20
25	1984	August	131	99	22	1	77	0
	1985	August	106	100	8	22	70	0
	1986	August	83	100	35	25	8	31

Table 6. Summary of Canadian Atlantic Quota Report for the Newfoundland Snow¹ Crab Fishery, December 31, 1986.

Management zone	Quota allocated (t)	Reported landings (t)	Amount over/under quota (%)
Labrador	925	515	under 410 (44)
Northern Zone (full time)	3000	2702	under 298 (10)
Northern Zone (suppl.)	1000	1447	over 447 (45)
Bonavista Bay	500	588	over 88 (18)
Trinity Bay	200	208	over 8 (4)
Conception Bay	200	198	under 2 (1)
Southern Zone (excluding bays)	2400	2329	under 71 (3)
3Ps (suppl.)	600	616	over 16 (3)

¹ Figures presented for Bonavista Bay are those of the authors. Other figures are taken directly from the quota report.

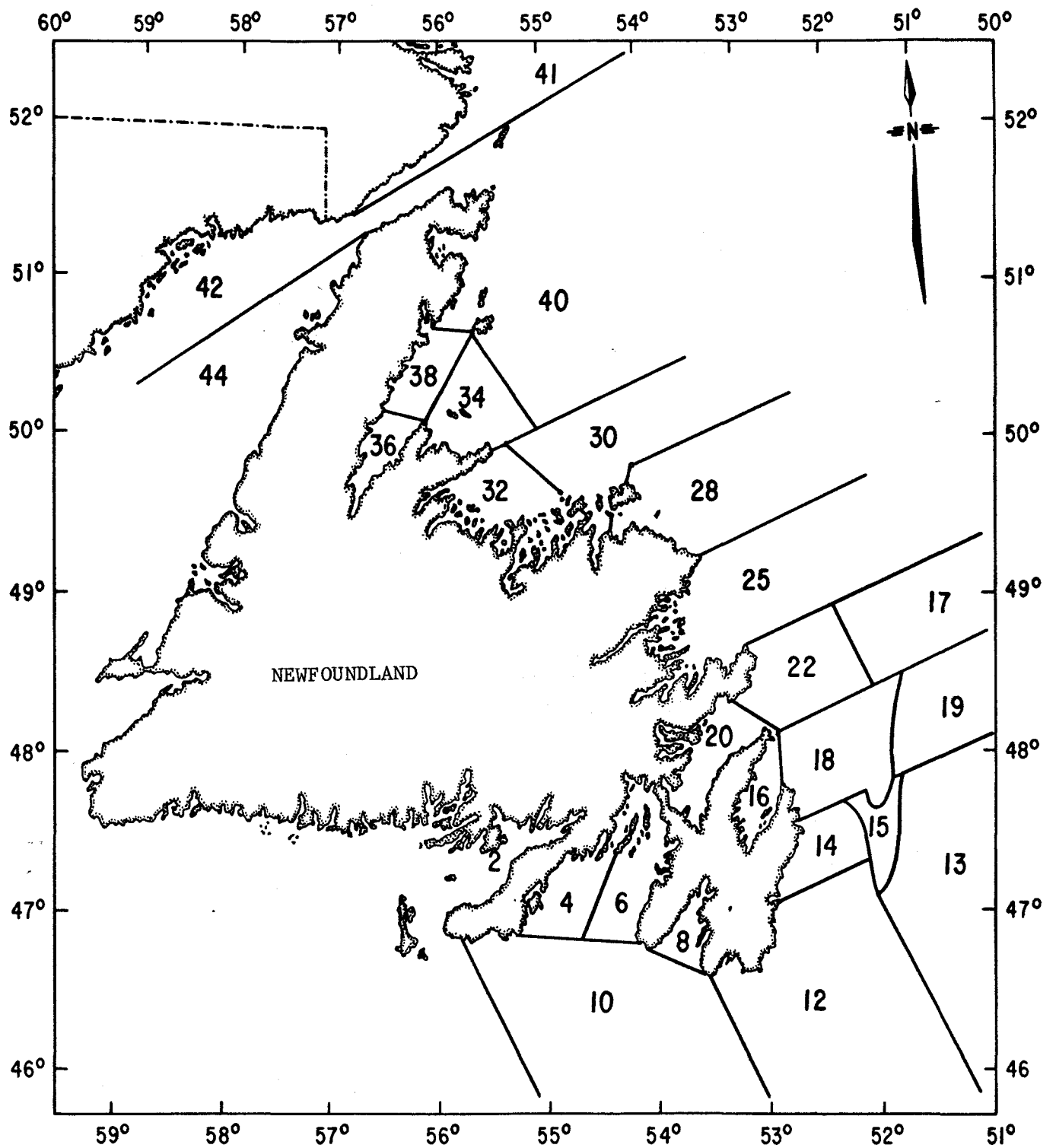


Fig. 1. Newfoundland snow crab management areas.

FIG. 2. BIWEEKLY CATCH/EFFORT DATA FROM ST. MARY'S BAY (AREA 8) 1986.

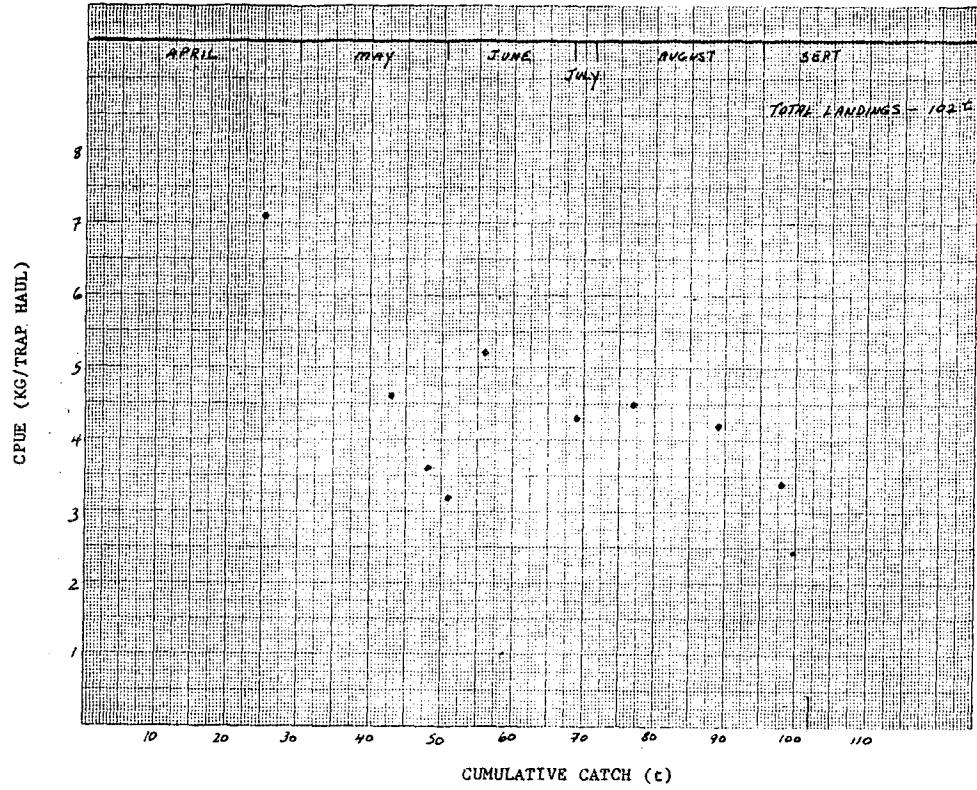


FIG. 3. BIWEEKLY CATCH/EFFORT DATA FROM CAPE RACE (AREA 10) 1986.

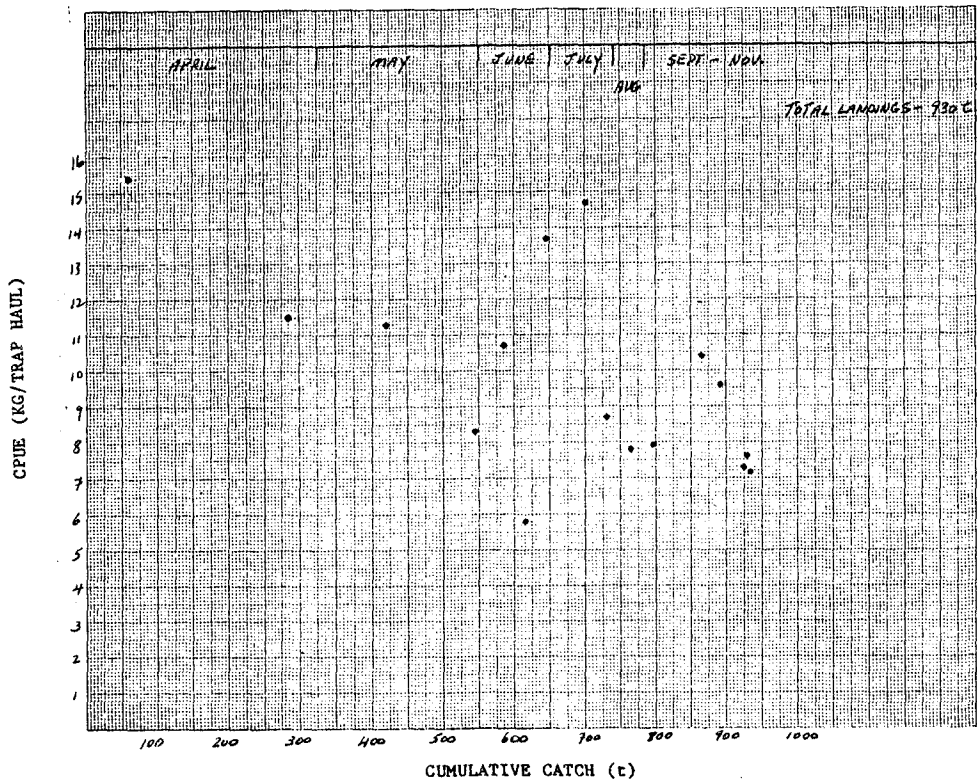


FIG. 4. LESLIE GRAPH OF BIWEEKLY CATCHES OF SNOW CRAB FROM SOUTHEASTERN AVALON (AREA 12) 1986.

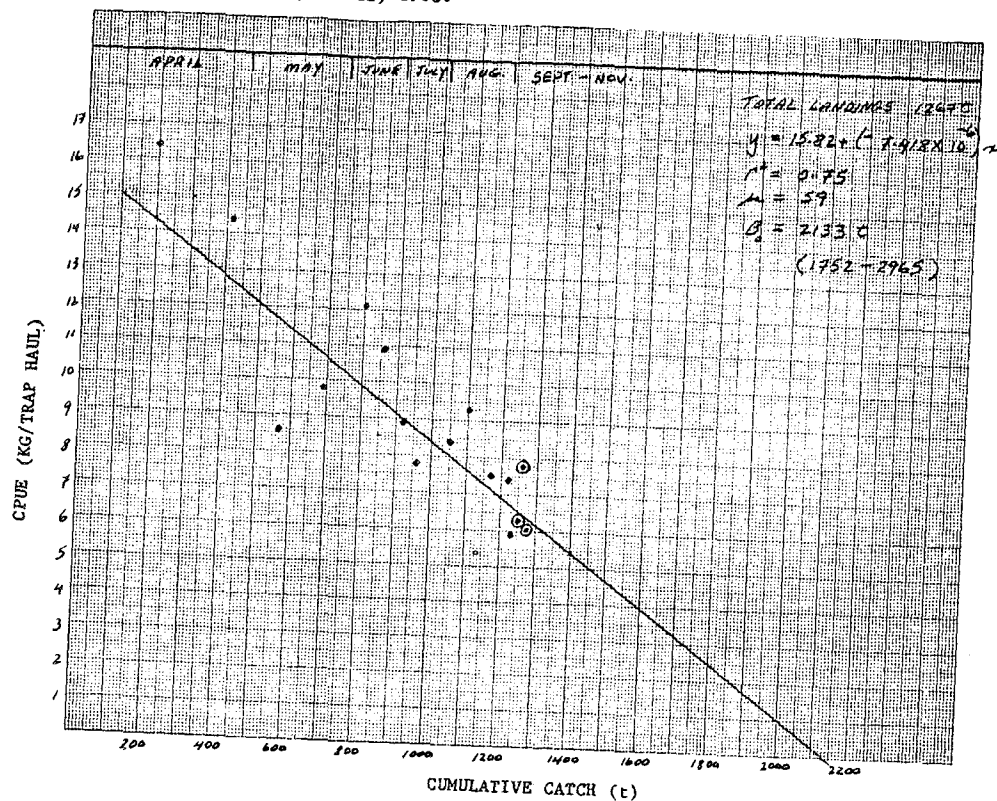


FIG. 5. BIWEEKLY CATCH/EFFORT DATA FROM EASTERN AVALON (AREA 14) 1986.

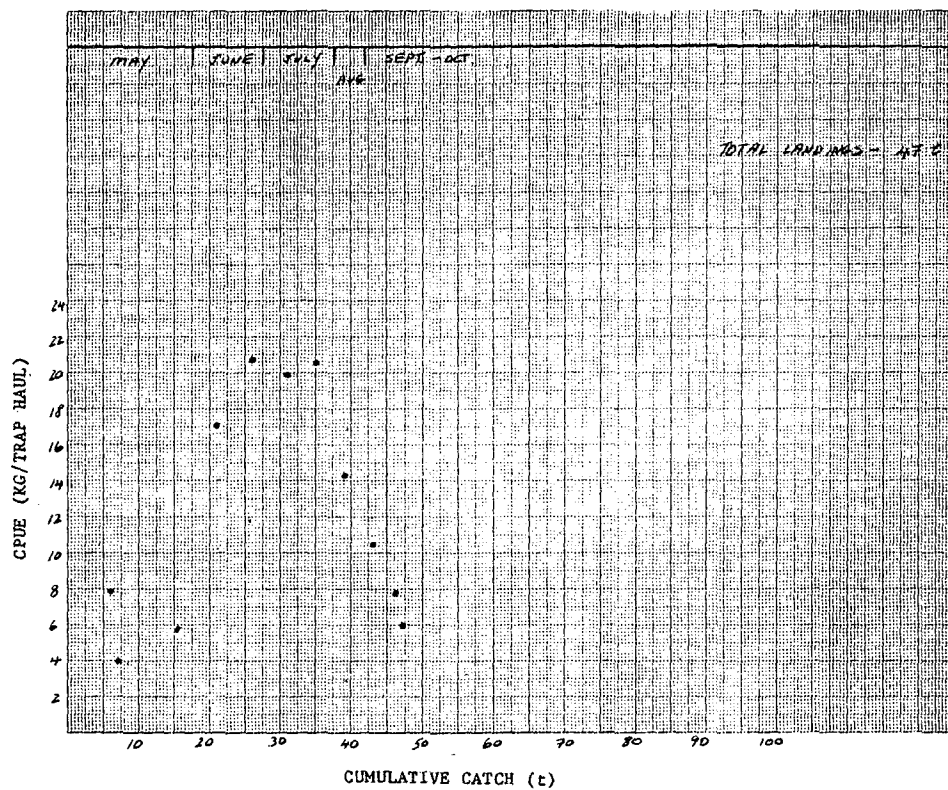


FIG. 6. BIWEEKLY CATCH/EFFORT DATA FROM CONCEPTION BAY (AREA 16) 1986.

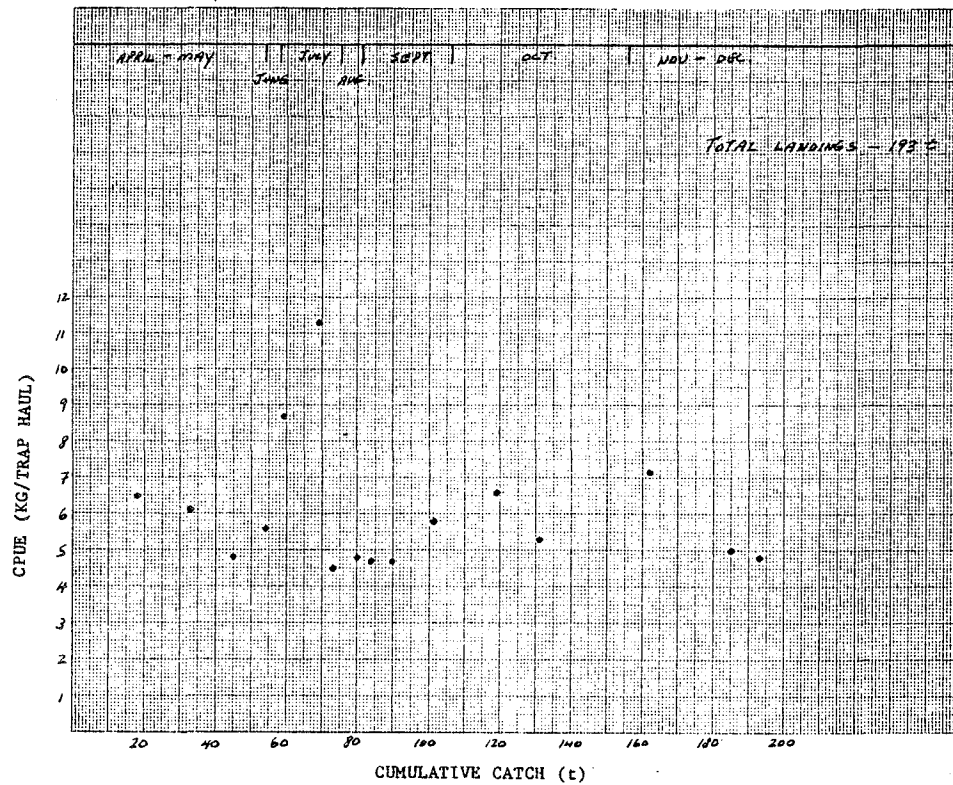


FIG. 7. BIWEEKLY CATCH/EFFORT DATA FROM NORTHEASTERN AVALON (AREA 18) 1986.

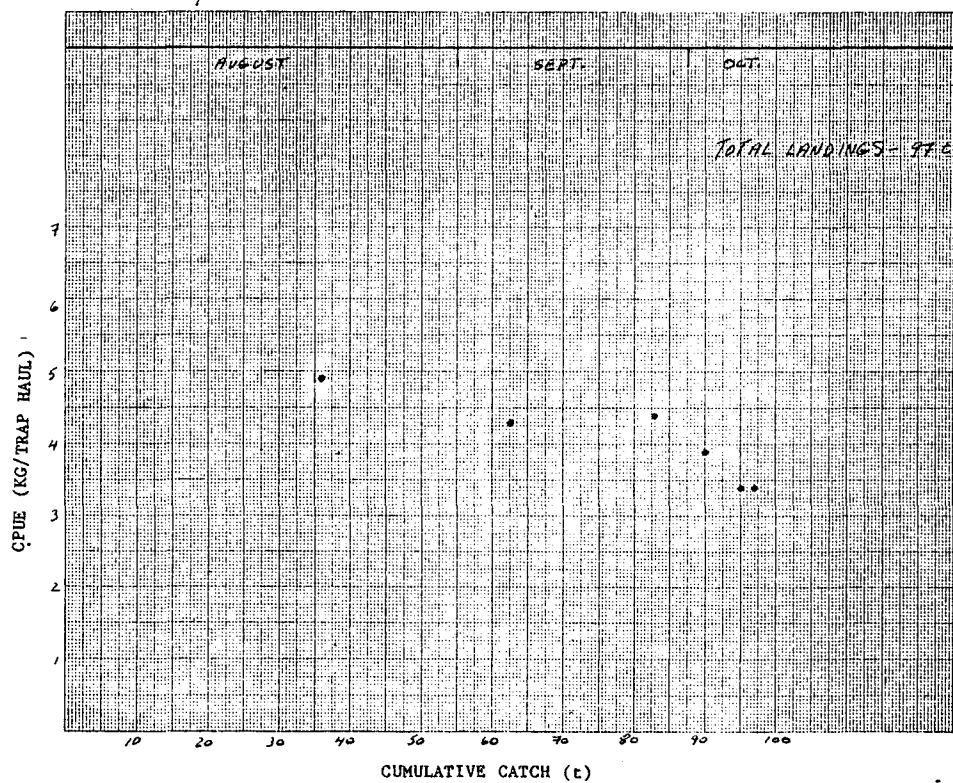


FIG. 8. BIWEEKLY CATCH/EFFORT DATA FROM INNER TRINITY BAY (AREA 20) 1986.

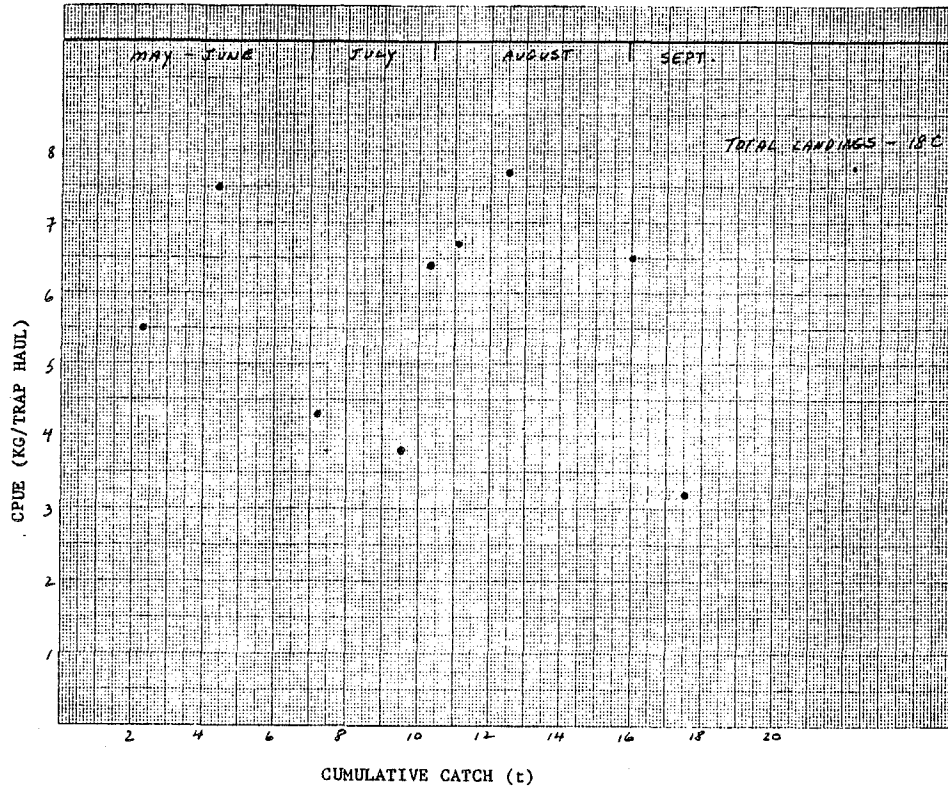


FIG. 9. BIWEEKLY CATCH/EFFORT DATA FROM OUTER TRINITY BAY (AREA 22) 1986.

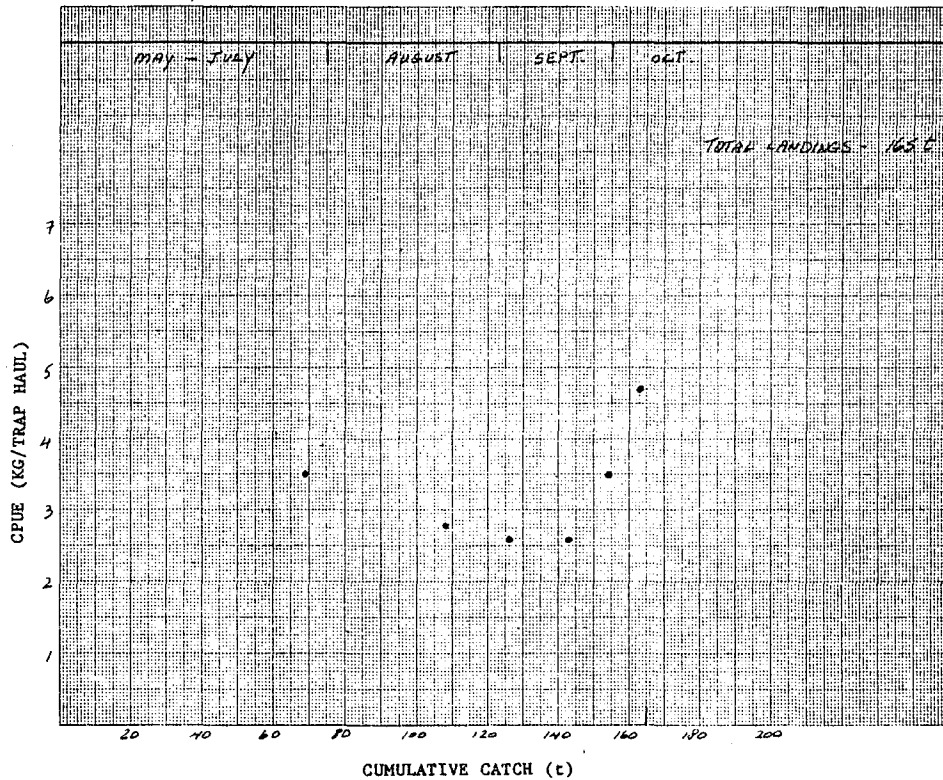


FIG. 10. BIWEEKLY CATCH/EFFORT DATA FROM BONAVISTA BAY (AREA 25) 1986.

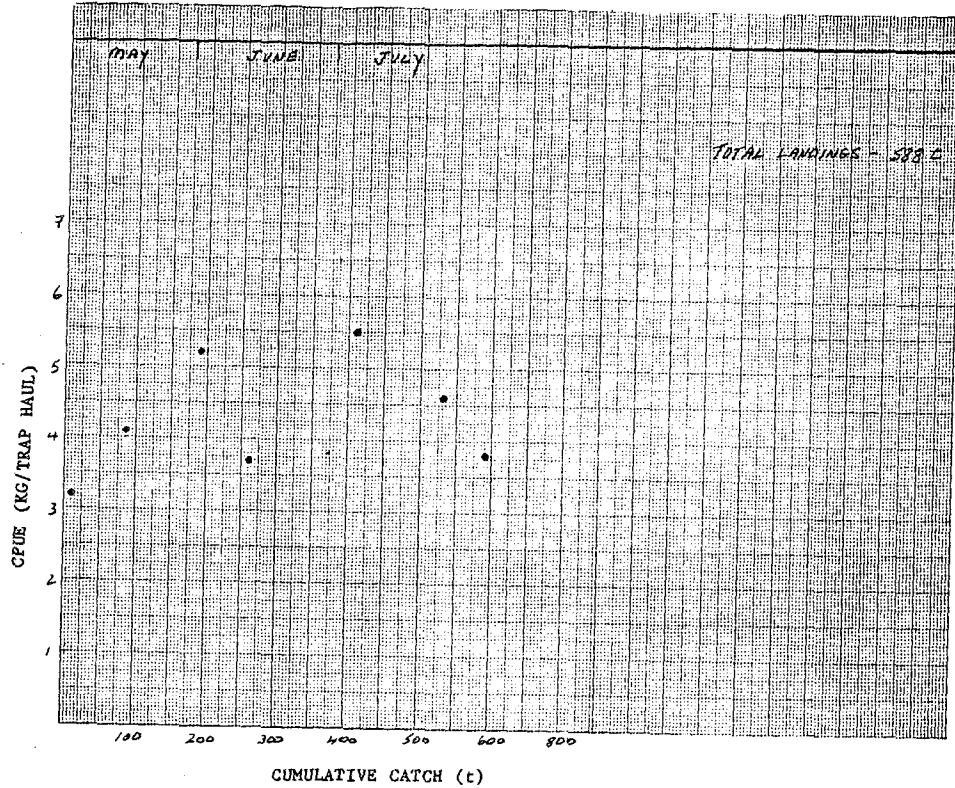


FIG. 11. LESLIE GRAPH OF BIWEEKLY CATCHES OF SNOW CRAB FROM FOGO (AREA 28) 1986.

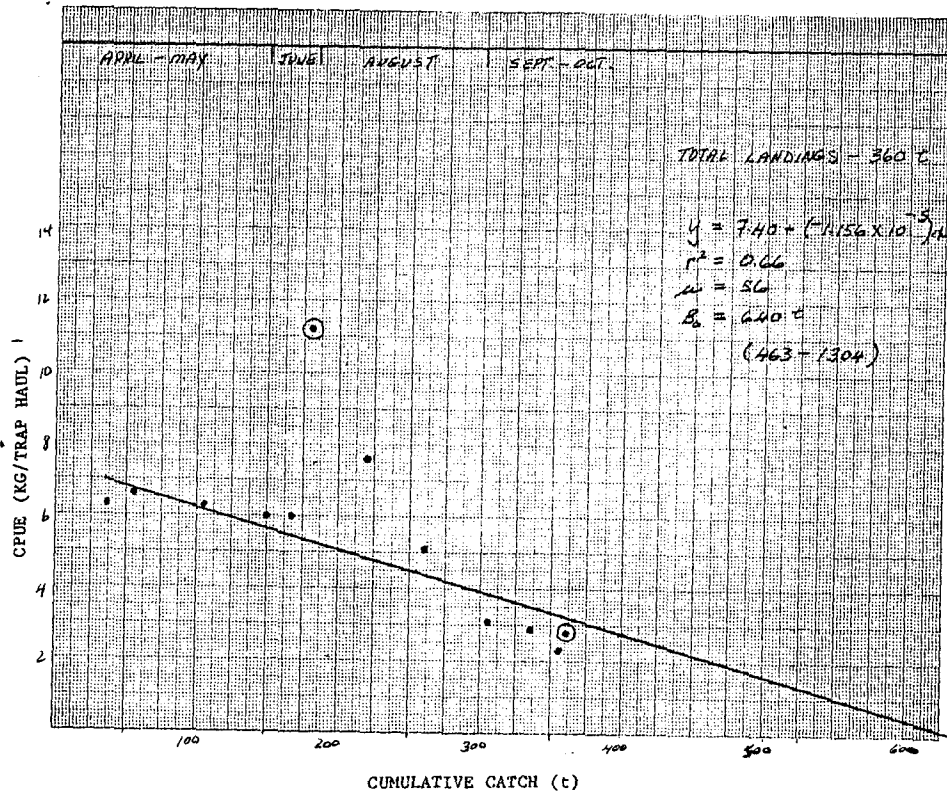


FIG. 12. LESLIE GRAPH OF BIWEEKLY CATCHES OF SNOW CRAB FROM TWILLINGATE (AREA 30) 1986.

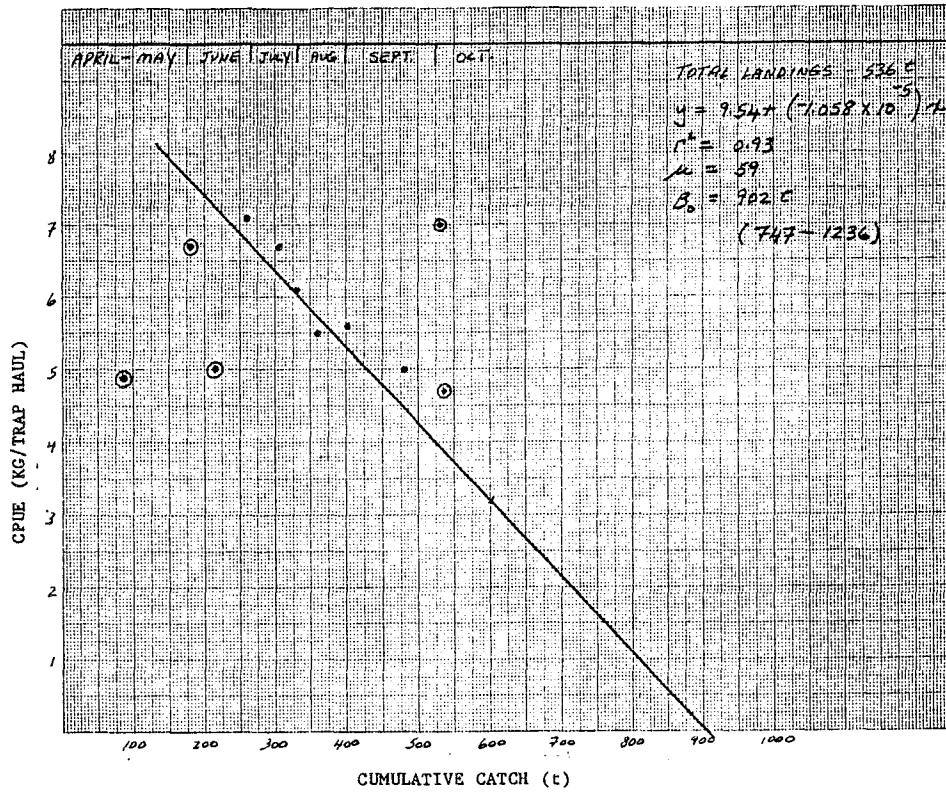


FIG. 13. BIWEEKLY CATCH/EFFORT DATA FROM NOTRE DAME BAY (AREA 32) 1986.

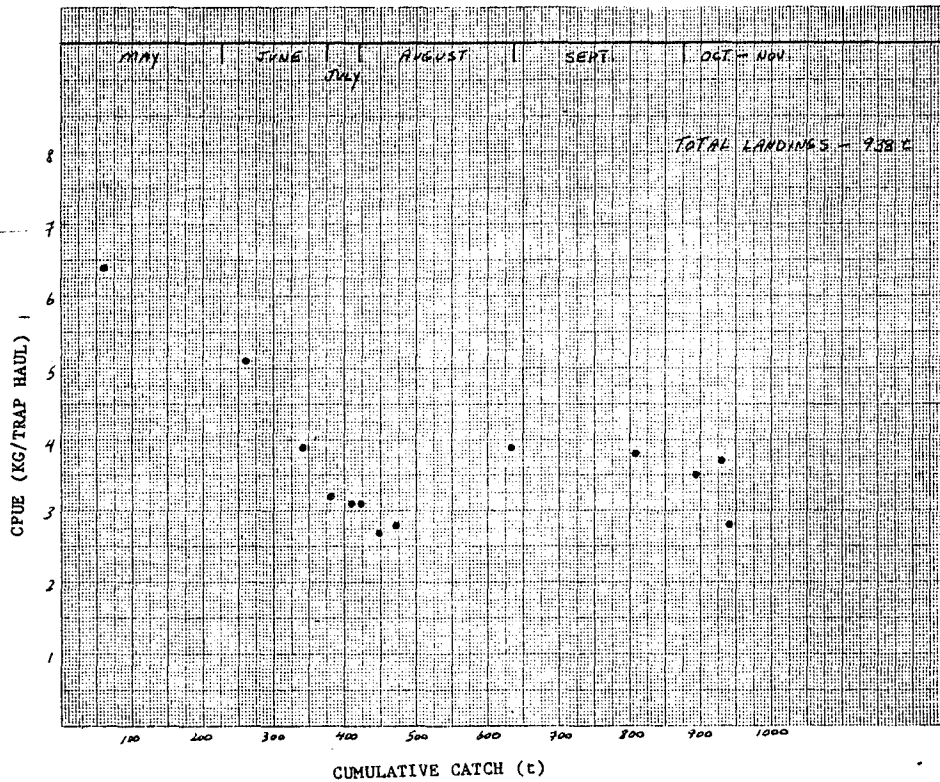


FIG. 14. BIWEEKLY CATCH/EFFORT DATA FROM HORSE ISLANDS (AREA 34) 1986.

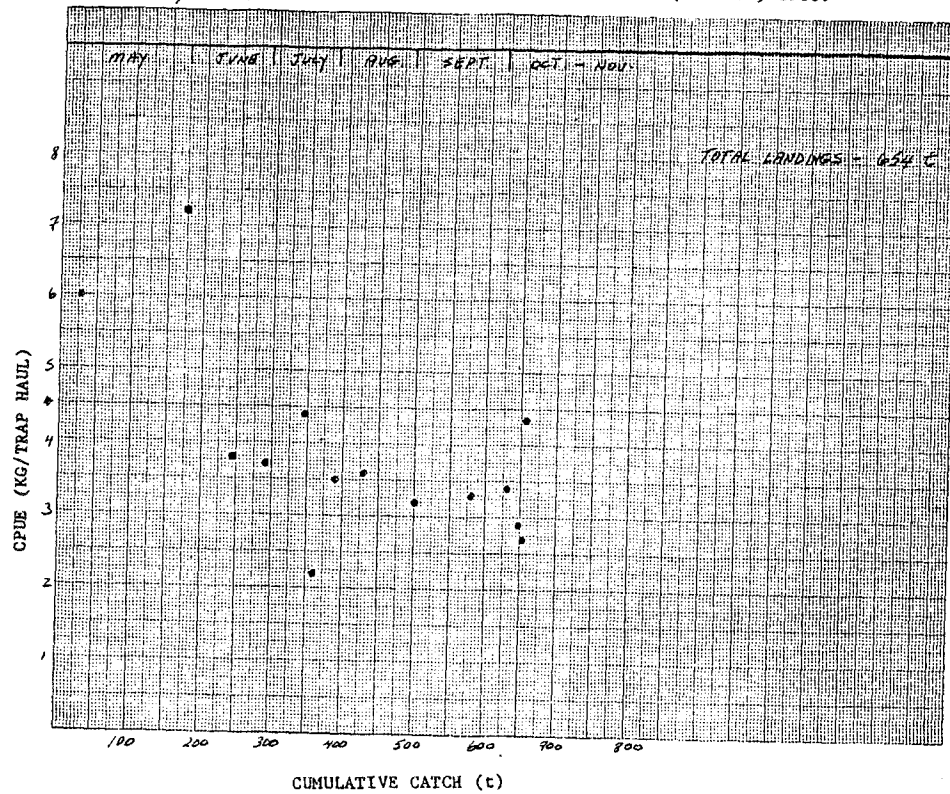


FIG. 15. BIWEEKLY CATCH/EFFORT DATA FROM WHITE BAY (AREA 36) 1986.

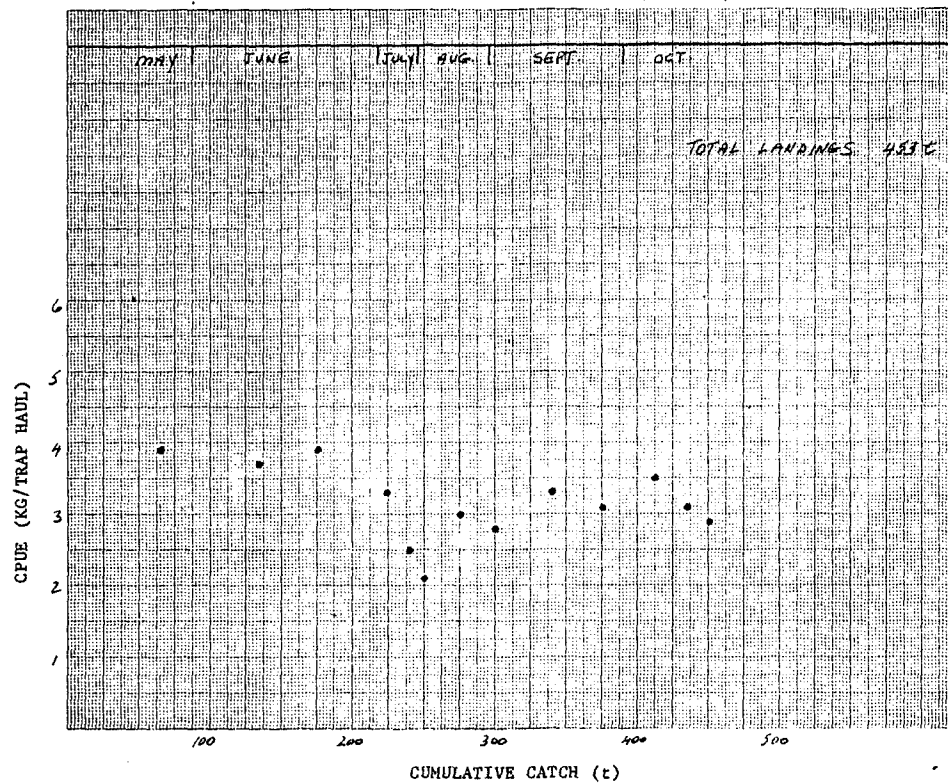


FIG. 16. LESLIE GRAPH OF BIWEEKLY CATCHES OF SNOW CRAB FROM CANADA BAY (AREA 38) 1986.

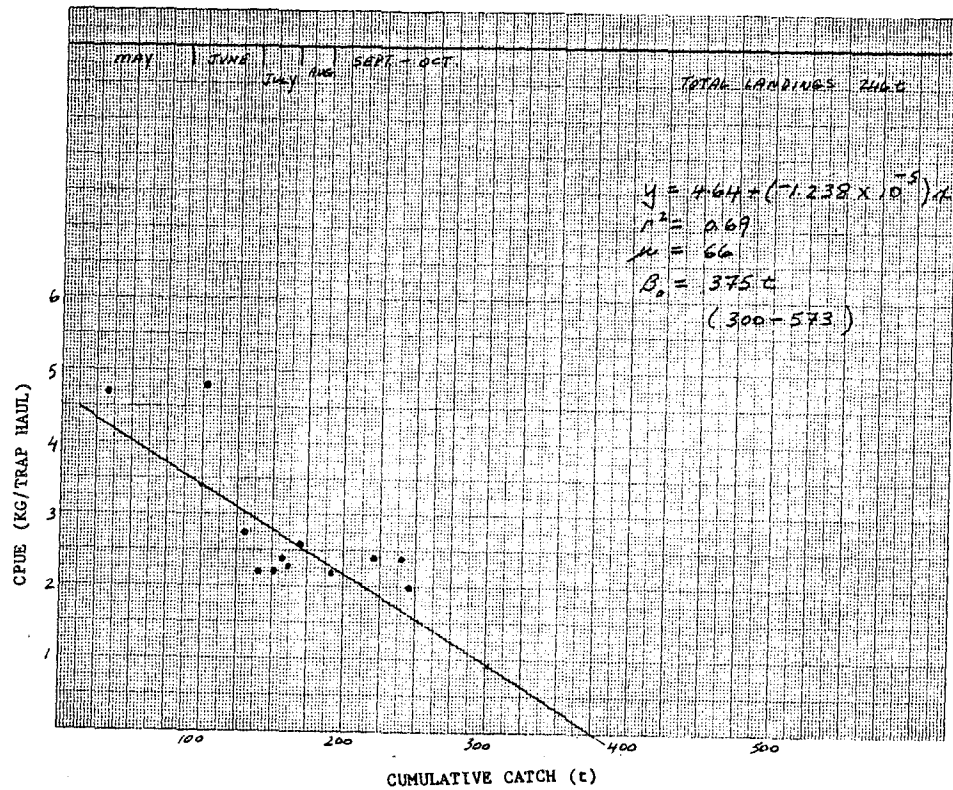


FIG. 17. BIWEEKLY CATCH/EFFORT DATA FROM GREY ISLANDS (AREA 40) 1986.

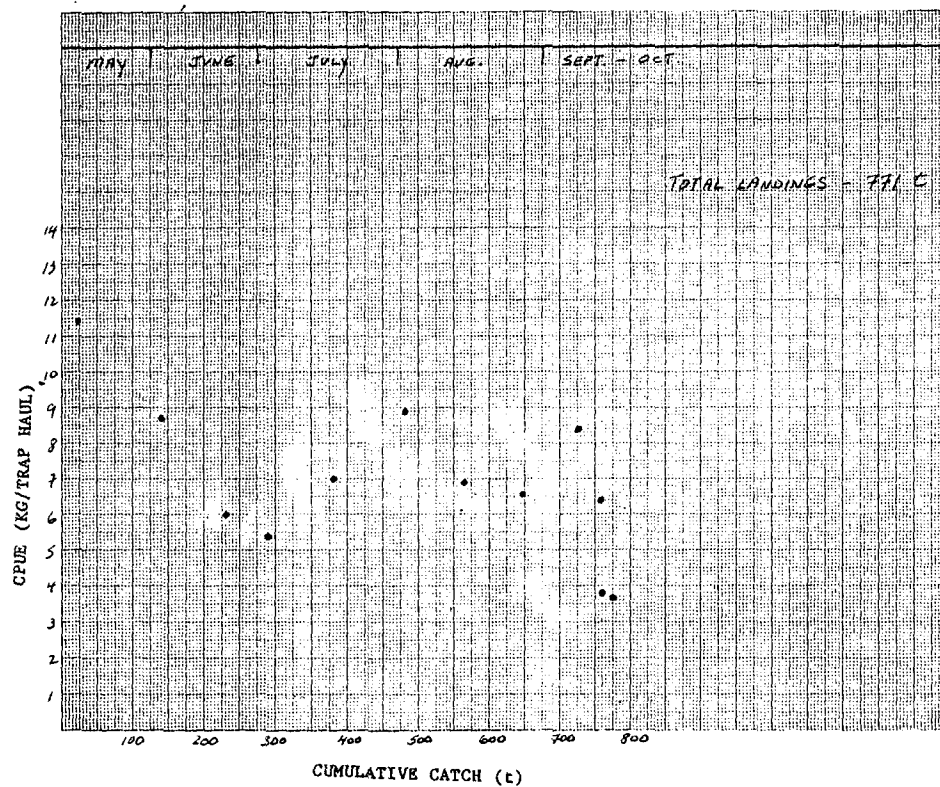


FIG. 18. BIWEEKLY CATCH/EFFORT DATA FROM LABRADOR (AREA 41) 1986.

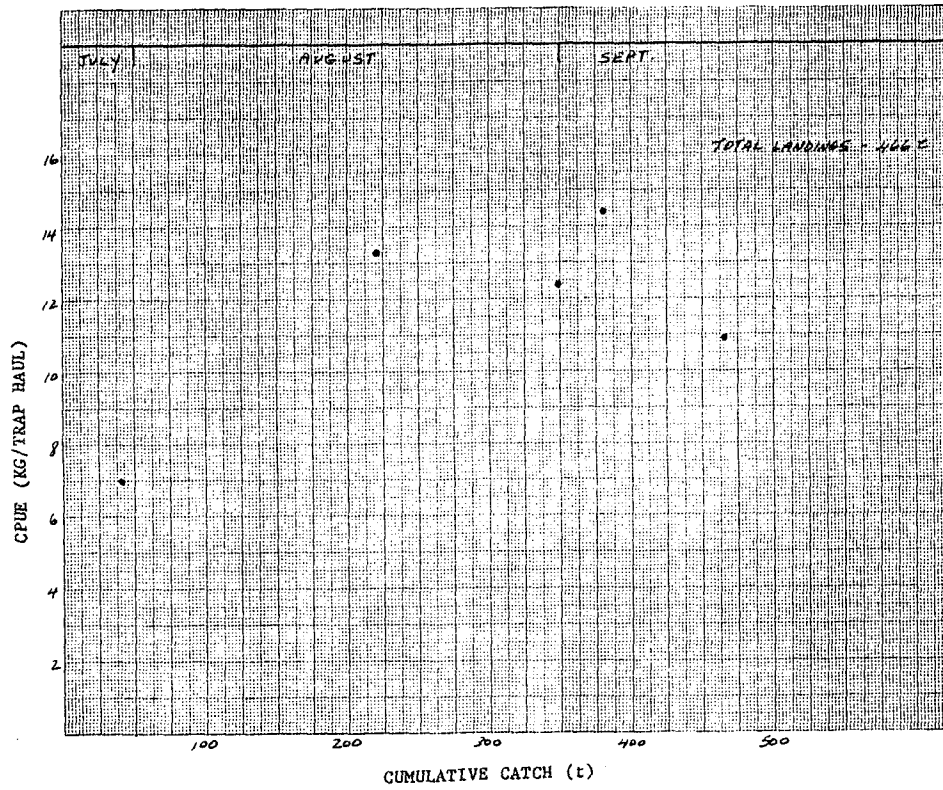
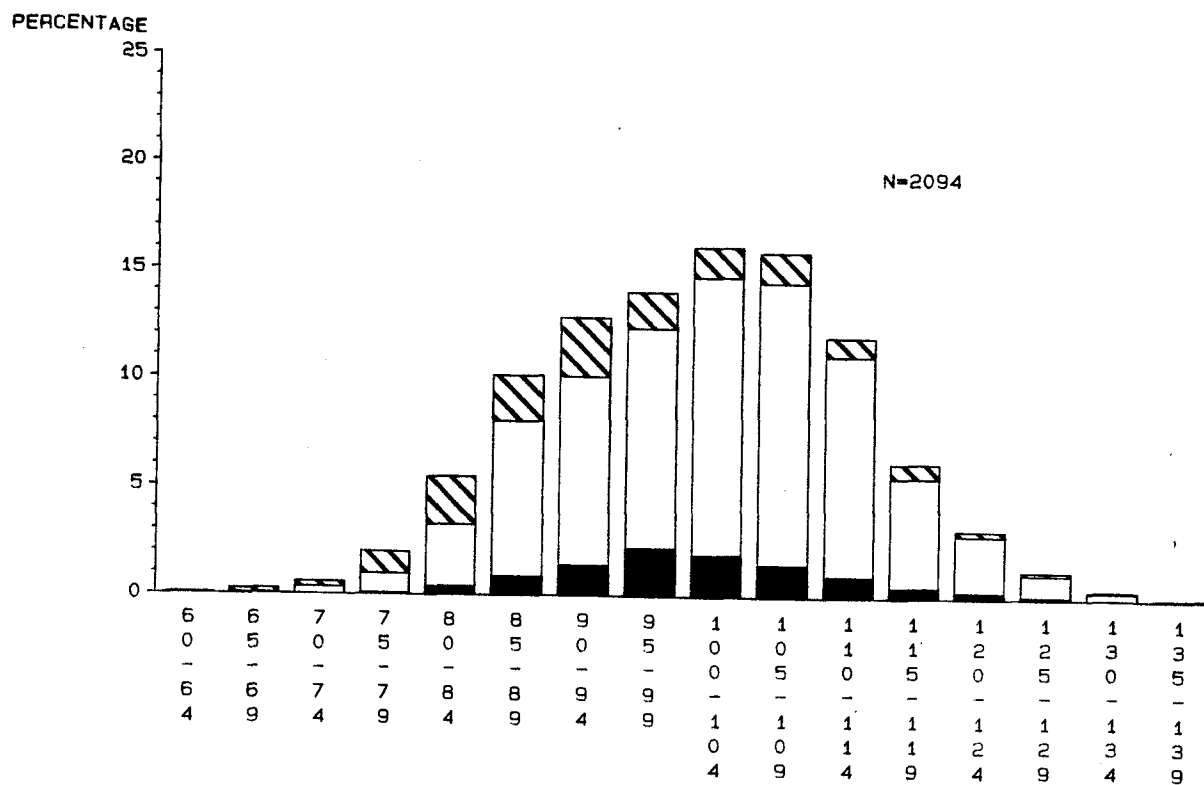


FIG. 19.

SNOW CRAB SIZE FREQUENCY DISTRIBUTION
 CONCEPTION BAY SEA SAMPLE NOV 1985-MALES
 VESSEL=SHAMOOK TRIP=123 GEAR=1



SNOW CRAB SIZE FREQUENCY DISTRIBUTION
 CONCEPTION BAY RESEARCH SAMPLE NOV-86 MALES
 VESSEL=SHAMOOK GEAR=1

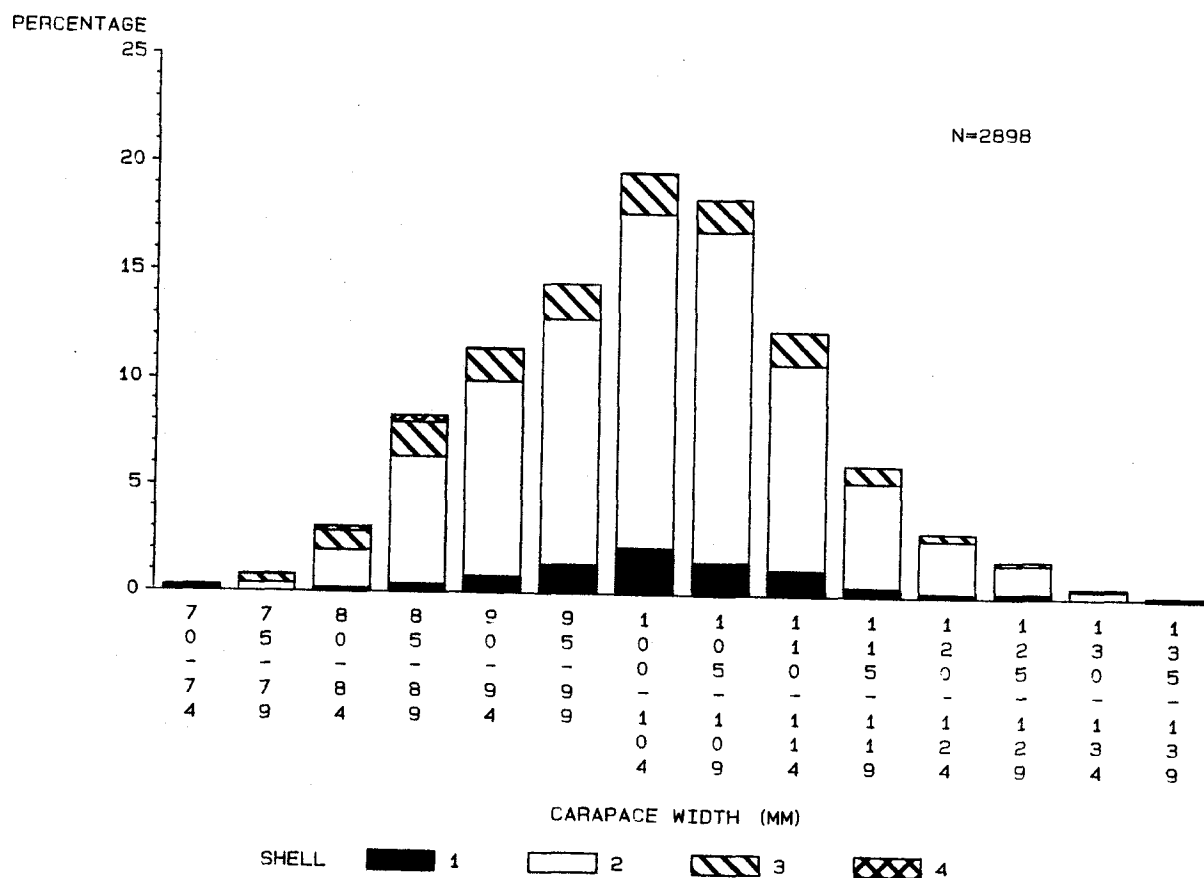
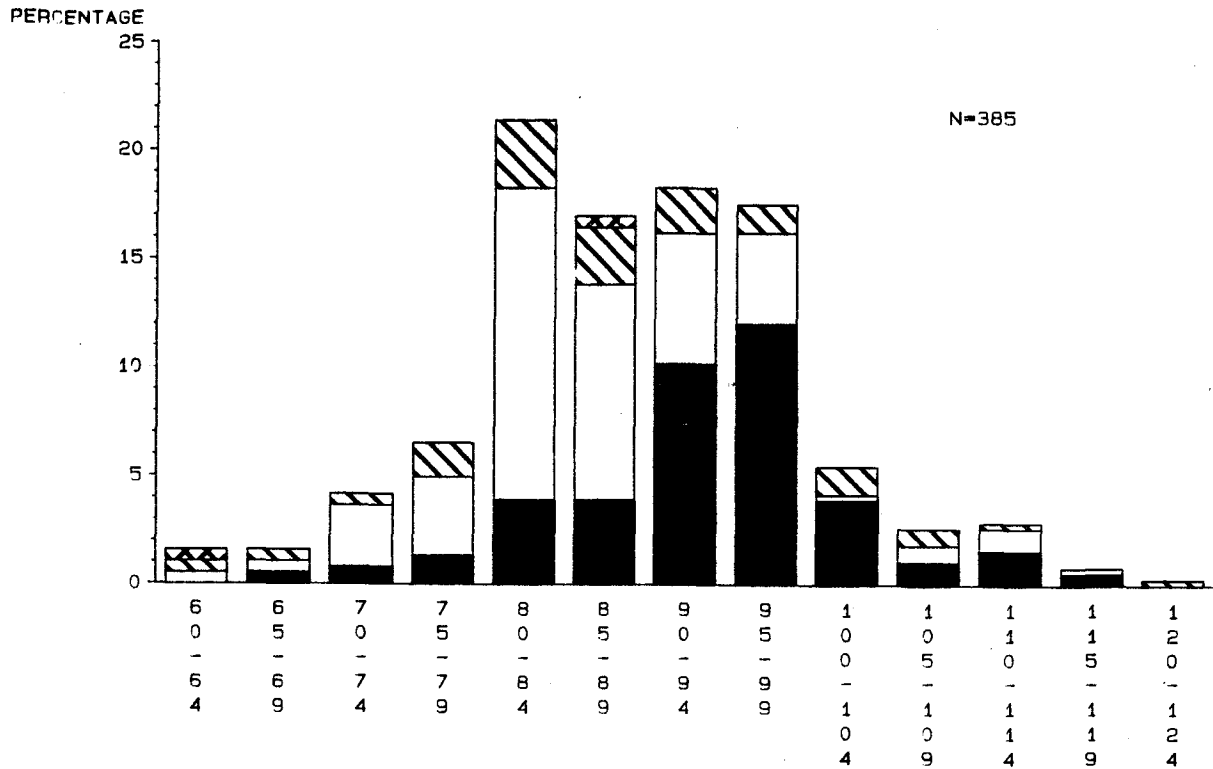


FIG. 20.

SNOW CRAB SIZE FREQUENCY DISTRIBUTION

N E AVALON RESEARCH SAMPLE JUNE-85 MALES

VESSEL=SHAMOOK GEAR=1



SNOW CRAB SIZE FREQUENCY DISTRIBUTION

N E AVALON AT SEA SAMPLE JUNE 1986-MALES

VESSEL=SHAMOOK TRIP=126 GEAR=1

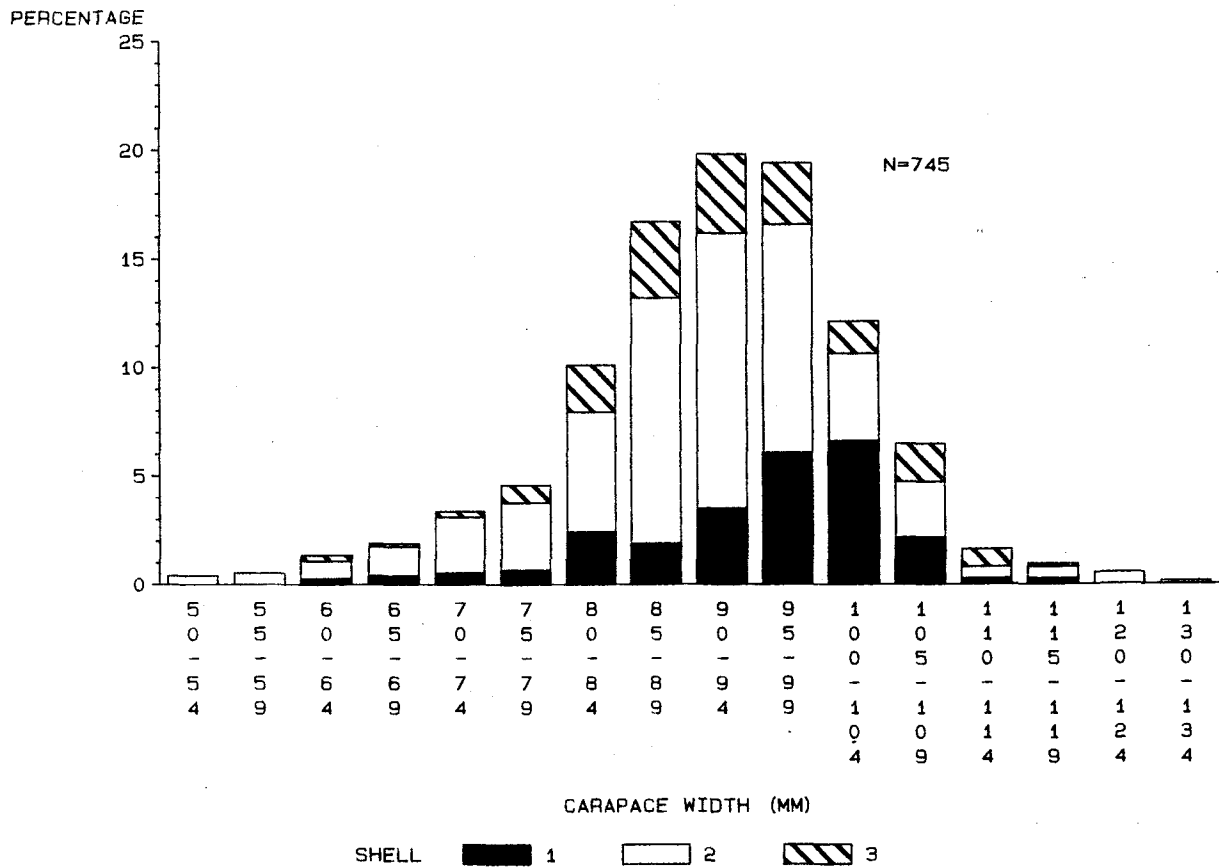
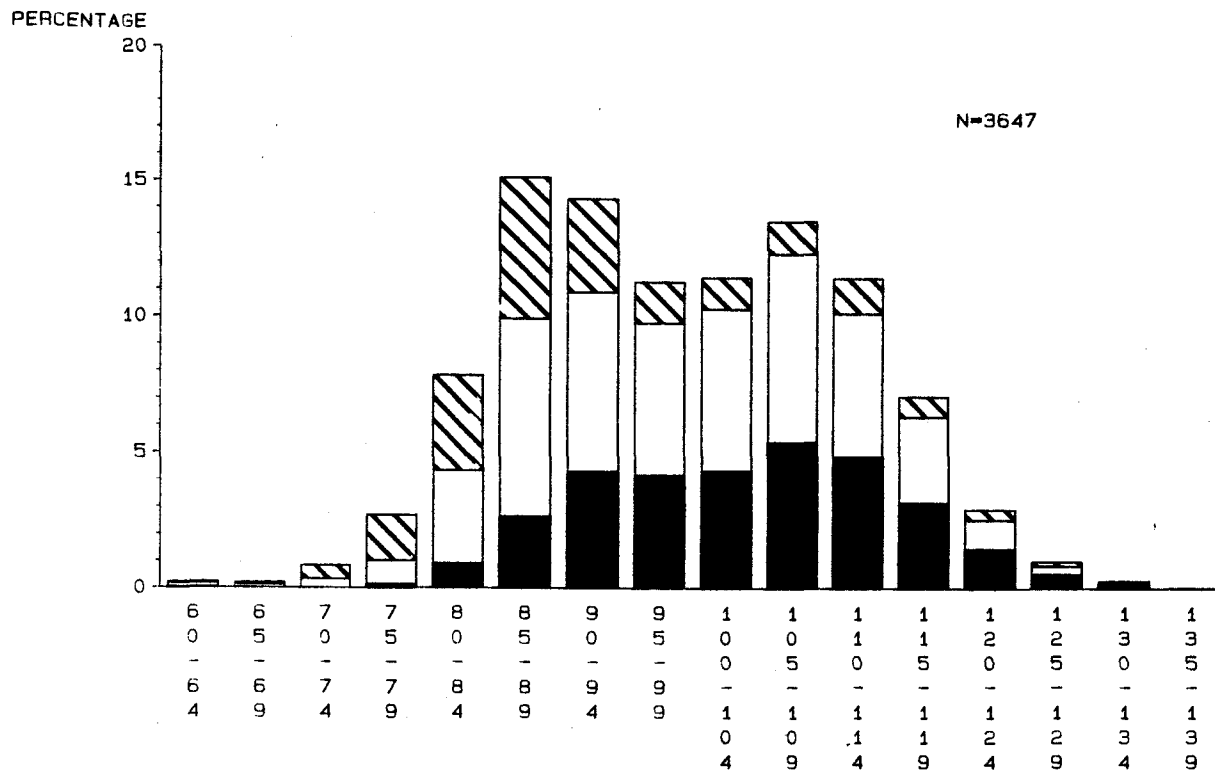


FIG. 21.

26
 SNOW CRAB SIZE FREQUENCY DISTRIBUTION
 BONA VISTA BAY RESEARCH SAMPLE AUG-85 MALES
 VESSEL=MARINUS GEAR=1



SNOW CRAB SIZE FREQUENCY DISTRIBUTION
 BONA VISTA BAY AT SEA SAMPLE AUG. 1986-MALES
 VESSEL=MARINUS TRIP=89 GEAR=1

