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Analysis of the Snow Crab (Chionoecetes opilio) Fishery
in Newfoundland for 1987

by

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Abstract

One population size estimation for snow crab (Chionoecetes opilio) off the east coast of Newfoundland is presented for the 1987 fishing season. Catch/effort data from sixteen crab management areas are presented along with comparative size frequency/shell conditions for northeastern Avalon, 1986-87 and Bonavista Bay 1985-87.

Résumé

On présente une estimation de la population de crabe des neiges (Chionoecetes opilio) au large de la côte est de Terre-Neuve pour la saison de pêche de 1987. On fournit aussi des données sur les prises et l'effort dans seize zones de gestion du crabe et des données comparatives sur la fréquence des tailles et l'état des carapaces pour le nord-est d'Avalon en 1986-1987 et la baie de Bonavista en 1985-1987.

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 (Table 1), 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 (Table 2). At present, the Newfoundland snow crab fishery is in a state of crisis. While most stocks were declining or collapsed, a total of 97 supplementary licenses were issued in the Northern Zone in 1985. Despite a continuing decline in CPUE in this zone, the number of supplementary licenses has increased yearly reaching 175 in 1987.

An additional blow to the stability of the fishery was the dropping of the regulation prohibiting the retention of soft-shelled ("white") crabs in 1986. 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, Resource Management Branch utilized quotas in order to limit fishing effort and exploitation rates. CAFSAC, following the 1986 snow crab assessment, indicated that the quota in the Northern Zone be substantially reduced. The 1987 quotas for the Northern and Southern Zones remain however, essentially the same as those for 1986.

Materials and Methods

Catch/effort data from most fishermen's logbooks were analyzed and data for each management area compared to processors' sales slips 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 most management areas and catch per unit effort (CPUE) plotted against cumulative catch (Fig. 2-17).

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 1986 data and presented in

Figures 18 (Area 18), 19 (Area 25). A comparative summary of the performance of the crab fleet by zone is given in Table 3.

Results and Discussion

Southern Zone

The offshore areas near the southern part of the Avalon Peninsula (Areas 10 and 12, Fig. 1) continue to exhibit comparatively high catch rates which we believe are the result of a large pulse of recruitment which occurred during the fall of 1985 (Taylor and O'Keefe 1986). These areas were fished quite heavily (Table 1) during 1987 resulting in closure of the fishery in August when the quota had been reached. This early closure has presented a problem in assessing the status of the stocks with the object of forecasting the expected fishery performance for 1988. Logbook data for recent years indicates that molting activity is generally restricted to the fall. Up until the fishery was closed, fishermen had not indicated encountering any soft-shelled animals nor had we the opportunity to port-sample landings.

Leslie analysis for Area 12 was possible (Fig. 3). This exercise provides a usable biomass of 1813 t (1515-2530 t). Landings from this area (1129 t) represent an exploitation rate of 62%, slightly above the range recommended by CAFSAC.

In Area 10, fishermen were continually searching the grounds for improved catches. This activity caused CPUE's to fluctuate considerably making Leslie analysis impractical. CPUE's for both Areas 10 and 12 were roughly the same as those for the end of the 1986 fishery, 5.2 and 7.7 kg/trap haul respectively.

Catches from the Eastern Avalon (Area 14) were minimal during 1987 as effort was transferred to Areas 10 and 12.

Effort was also minimal in St. Mary's Bay (Area 8) as it was transferred to Area 10 in response to low CPUE's experienced during 1986 (Taylor and O'Keefe 1987).

The slight resurgence of the Northeast Avalon (Area 18) fishery experienced in 1986 (Taylor and O'Keefe 1987) continued in 1987 with landings and CPUE increasing by 54 t and 1.5 kg/trap haul, respectively.

Although commercial fishing vessels made exploratory voyages to the Downing Basin (Area 13) and the offshore Northeast Avalon (Area 19), catch rates were too low to be economical and the fishery was not prosecuted.

The fishery in Conception Bay (Area 16) continued to improve as landings and CPUE increased by 34 t and 3.3 kg/trap haul, respectively. Large numbers of soft-shelled crabs were encountered during a spring research cruise. It is noteworthy that most of these newly molted animals were from the deepest part (≥ 200 m) of a trough which extends the length of the bay.

Catch rates from Trinity Bay (Areas 20 and 22) continue to be low. This bay is quite important because it is utilized by vessels from Bonavista Bay when the quota for that bay has been reached.

Catch rates in Bonavista Bay (Area 25) continue to improve from the low level reached in 1985 (Table 1). This improvement is apparently the result of the imposition of what was viewed by industry as a meager quota in 1986. Productivity in this bay has always been quite high (Taylor and O'Keefe 1984) with fishermen reporting large numbers of soft-shelled crabs each year, particularly in July and August. During 1987 there appears to have been a shift in the molting cycle. While an annual August survey found fewer soft-shell crabs than previous years (Fig. 19) port sampling conducted in June indicated a considerable proportion of the landed catch was soft-shelled (Fig. 20). The increase in CPUE of 54% over 1986 catch rates is quite encouraging however it is unfortunate that much of the 1987 landings was comprised of soft-shelled crab which produce low yield, non-premium finished product.

Northern Zone

With the exception of the Grey Islands (Area 40) the fishery in the Northern Zone was a failure for the second consecutive year. CPUE'S for all areas except Fogo Island (Area 28) decreased from 1986 levels (Table 2). Despite a high incidence of soft-shelled legal-sized crab in all areas, it is patently obvious that the resource in the Northern Zone cannot sustain present effort levels.

Despite CAFSAC advice that the 1987 Northern Zone quota be substantially reduced from that set for the 1986 fishery, the quota was not reduced.

Catch rates in this zone were so low (Table 2) that most of the full-time fleet diversified effort and prosecuted the groundfish gillnet/otter trawl and capelin fisheries for at least part of the season. As a result of both the low CPUE'S and effort diversion, neither the full-time nor the supplementary fleets reached their allotted quotas of 3,000 t and 1,000 t, respectively (Table 5). Without the significant proportion of landings from Area 40 which was fished by large full-time vessels, the performance of the Northern Zone fleet would have been more abysmal; particularly in view of the fact that the low CPUE values for Areas 32, 34, 36, and 38 include soft-shell landings which two years ago were not permitted. We suggest that the only way to turn around this situation in the Northern Zone is to drastically cut the quota for the 1988 season.

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 Resource Management to transfer the crab licenses 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. While landings and CPUE are both lower (Table 2) than in 1985 and 1986, all parties concerned remain optimistic for the 1988 season.

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 Resource Management Branch.

For the first time, a sufficient number of logbooks were returned and an overall picture of the fishery can be assembled.

Although the quota was caught, 596 of 600 t (Table 3), the mean CPUE was only 3 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.

Logbooks

The quality of data supplied by fishermen through their logbook returns has deteriorated markedly since 1986. Particularly alarming has been the poor quality or lack of information from full-time fishermen. Often logs are submitted with little more than the date and vessel name supplied. If the fishery is to be analyzed as thoroughly as possible, there must be improvements.

As the number of fishermen/logbooks increases through the expansion of the supplementary fishery, this exercise becomes increasingly time-consuming and, in our opinion, the results less reliable. It is hoped that a solution to this situation will be found before 1988 assessments are due.

Reproductive Capacity

Research cruises were again conducted in three areas (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 4.

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 1987. Laboratory experiments monitoring egg development in these females are continuing.

Due to difficulties experienced in obtaining vessel time the yearly fall cruise in Conception Bay (Area 16) was not conducted in 1987. However, results from a spring cruise indicate that reproductive capacity remains high.

Summary

While there is evidence that the fishery remains stable in the Southern Zone and, in fact, is improving in several areas, the fishery in the Northern Zone is in a state

of collapse. It is recommended that the Northern Zone quota be drastically reduced in an attempt to stabilize the fishery and begin rebuilding the commercial stocks.

References

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Table 1. Summary of statistics for the Newfoundland Snow Crab fishery, 1980-87. Effort data are incomplete beginning in 1985 so mean CPUE is based on catches where effort is given in logbooks.

| 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 | - | - |
| 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 | - | - |
| 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 |
| 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 | - | - | - | - | - |
| 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 | - | - |

Table 1. (Cont'd.)

| Area | Year | Reported effort (trap hauls) | Landings (t) | CPUE (kg/trap haul) | Estimated biomass (mt) (confidence limits) | Exploitation rate (%) |
|------|------|------------------------------|--------------|---------------------|--|-----------------------|
| 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 | - | - | - | - | - |
| | 16 | 1980 | 56,393 | 869 | 15.4 | 1571 (1214-2890) |
| 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 | - | - |
| 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 | - | - |
| 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 | - | - | - | - | - |

Table 1. (Cont'd.)

| Area | Year | Reported effort (trap hauls) | Landings (t) | CPUE (kg/trap haul) | Estimated biomass (mt) (confidence limits) | Exploitation rate (%) |
|------|------|------------------------------|--------------|---------------------|--|-----------------------|
| 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 | - | - |
| 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 | - | - |
| 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 | - | - |

Table 2. Summary of available statistics from full-time crab fishermen for the Newfoundland Snow Crab fishery (Northern Zone), 1980-87. Effort data are incomplete beginning in 1985 therefore mean CPUE is based on catches where effort is given in logbooks.

| 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 | - | - |
| 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 | - | - |
| 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 | - | - |
| 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 | - | - |
| 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 | - | - |

Table 2. (Cont'd.)

| Area | Year | Reported effort (trap hauls) | Landings (t) | CPUE (kg/trap haul) | Estimated biomass (mt) (confidence limits) | Exploitation rate (%) |
|------|-------|------------------------------|--------------|---------------------|--|-----------------------|
| 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 | - | - |
| 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 | - | - |
| 41 | 1985 | 20,419 | 311 | 15.2 | - | - |
| | 1986 | 39,695 | 467 | 11.8 | - | - |
| | 1987 | 30,060 | 256 | 8.5 | - | - |

(Supplementary licenced vessels are included in the 1986 landings for the northern zone.)

Table 3. Summary of performance of Newfoundland Snow Crab fishery, 1980-87.

| 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 |

* Beginning in 1985, effort figures are estimated.

Table 4. Summary of reproductive status of female snow crab, Chionoecetes opilio, in three management areas in Newfoundland, 1984-87.

| Area | Year | Month | # in sample | % berried females | Spermatophore 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 |
| | 1987 | May | 109 | 97 | 75 | 1 | 2 | 22 |
| 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 |
| 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 |

Table 5. Summary of Canadian Atlantic Quota Report for the Newfoundland Snow¹ Crab Fishery, December 31, 1986 compared to December 31, 1987.

| Management zone | Quota allocated (t) | | Reported landings (t) | | Amount over/under quota (%) | |
|--------------------------------|---------------------|------|-----------------------|------|-----------------------------|-----------------|
| | 1986 | 1987 | 1986 | 1987 | 1986 | 1987 |
| Labrador | 925 | 925 | 515 | 254 | under 410 (44) | under 671 (73) |
| Northern Zone (full time) | 3000 | 3000 | 2702 | 1939 | under 298 (10) | under 1061 (35) |
| Northern Zone (suppl.) | 1000 | 1000 | 1447 | 917 | over 447 (45) | under 83 (8) |
| Bonavista Bay | 500 | 500 | 588 | 602 | over 88 (18) | over 102 (20) |
| Trinity Bay | 200 | 100 | 208 | 253 | over 8 (4) | over 153 (153) |
| Conception Bay | 200 | 200 | 198 | 272 | under 2 (1) | over 72 (36) |
| Southern Zone (excluding bays) | 2400 | 2000 | 2329 | 2006 | under 71 (3) | over 6 (-) |
| 3Ps (suppl.) | 600 | 600 | 616 | 562 | over 16 (3) | under 38 (6) |

¹ Figures presented for Bonavista Bay only are those of the authors.

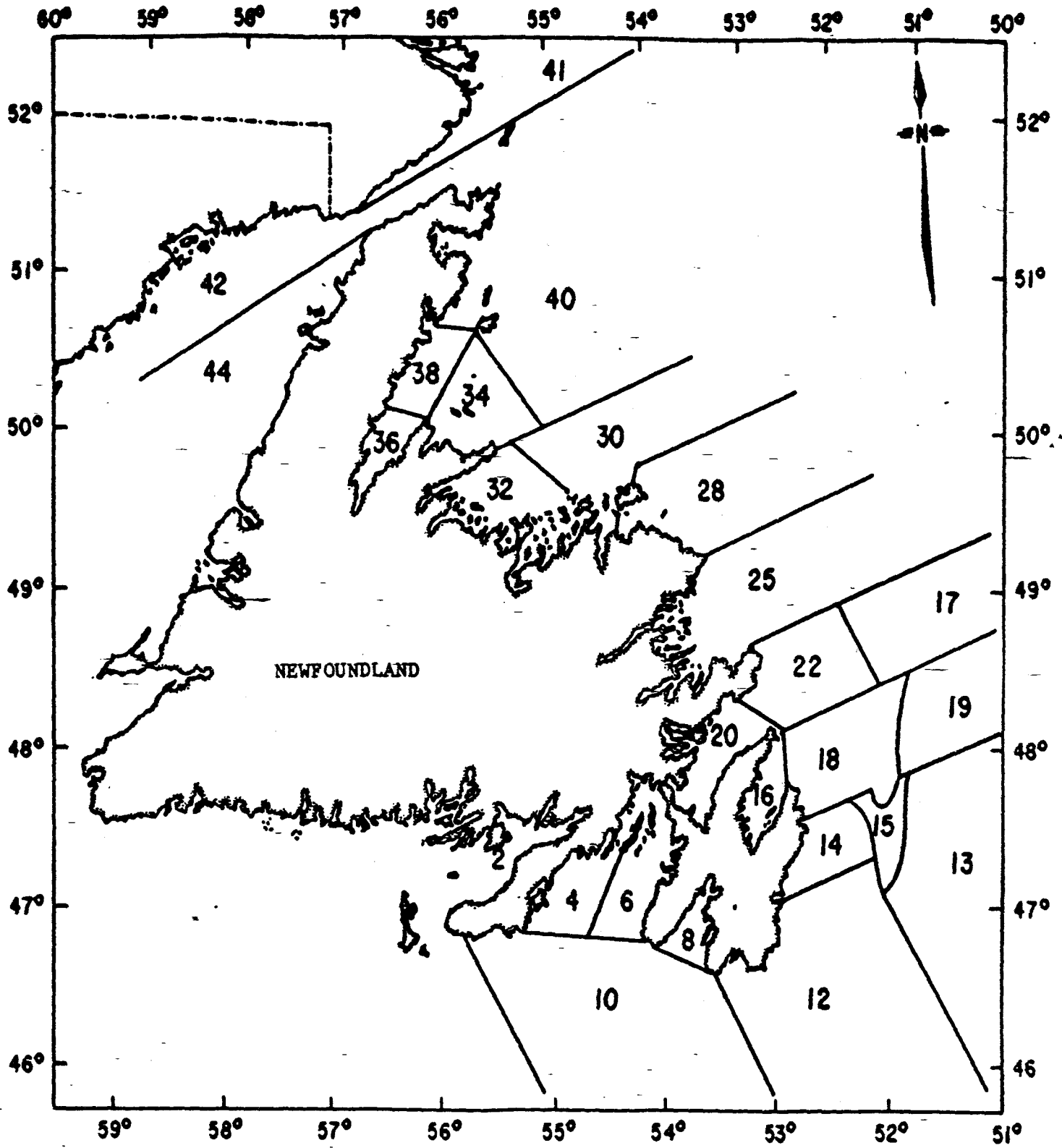


Fig. 1. Newfoundland snow crab management areas.

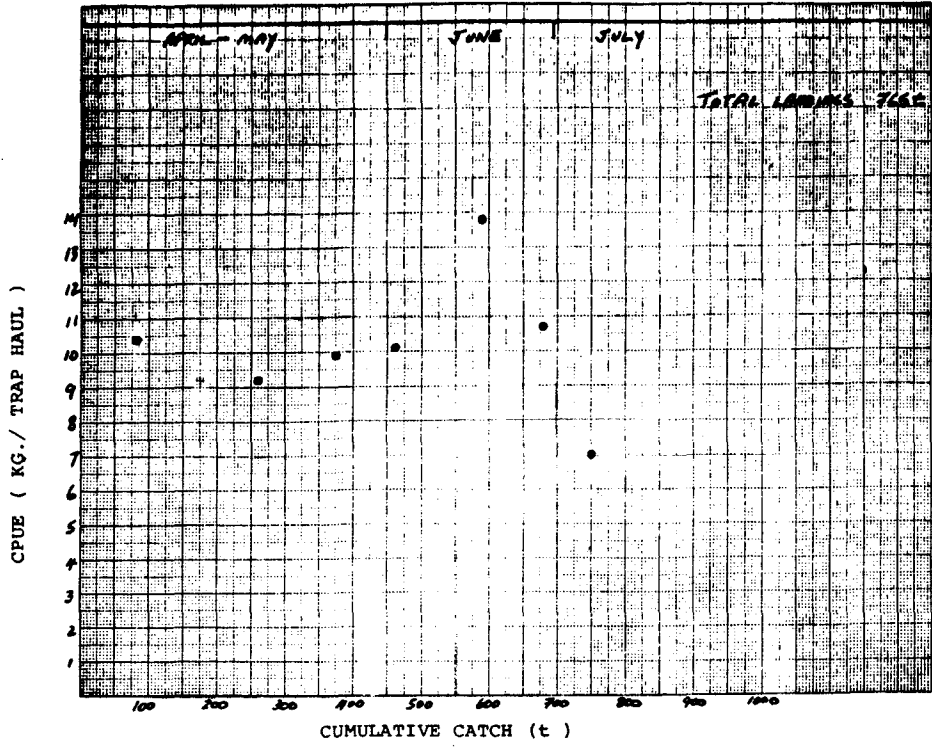


Fig. 2. Biweekly catch/effort data from Cape Race (Area 10), 1987.

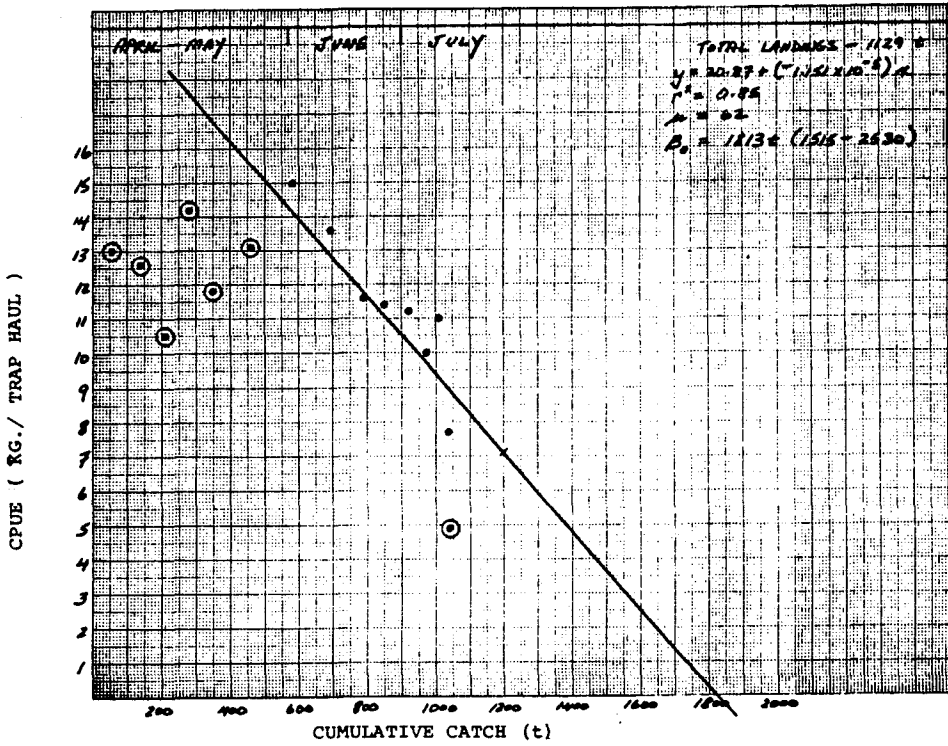


Fig. 3. Leslie graph of weekly catches of snow crab from southeastern Avalon (Area 12), 1987.

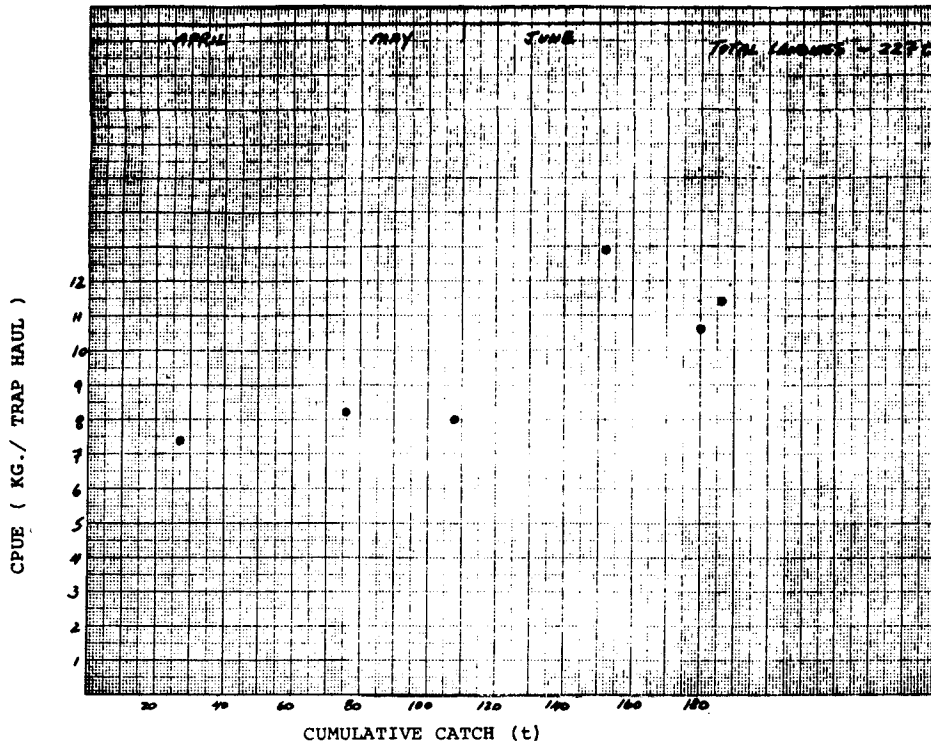


Fig. 4. Biweekly catch/effort data from Conception Bay (Area 16), 1987.

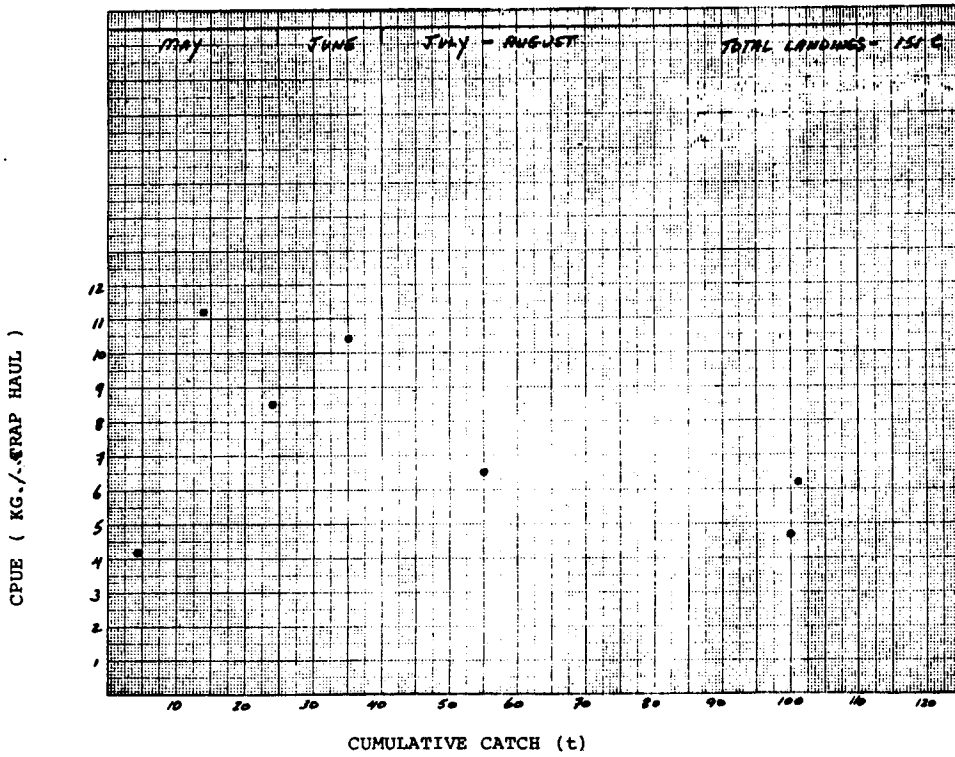


Fig. 5. Biweekly catch/effort data from northeastern Avalon (Area 18), 1987.

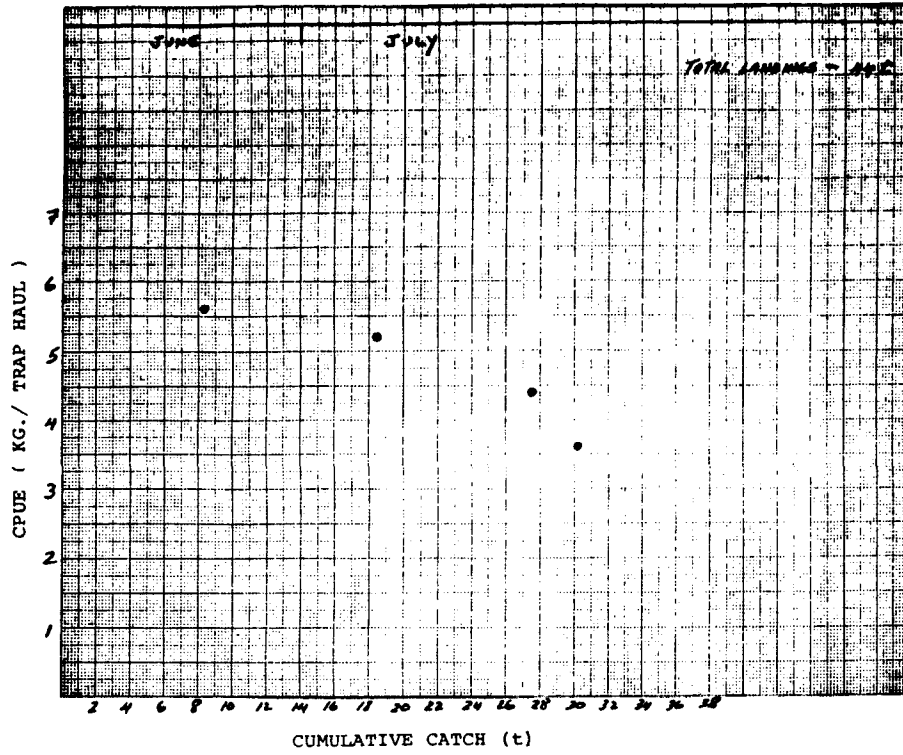


Fig. 6. Weekly catch/effort data from inner Trinity Bay (Area 20), 1987.

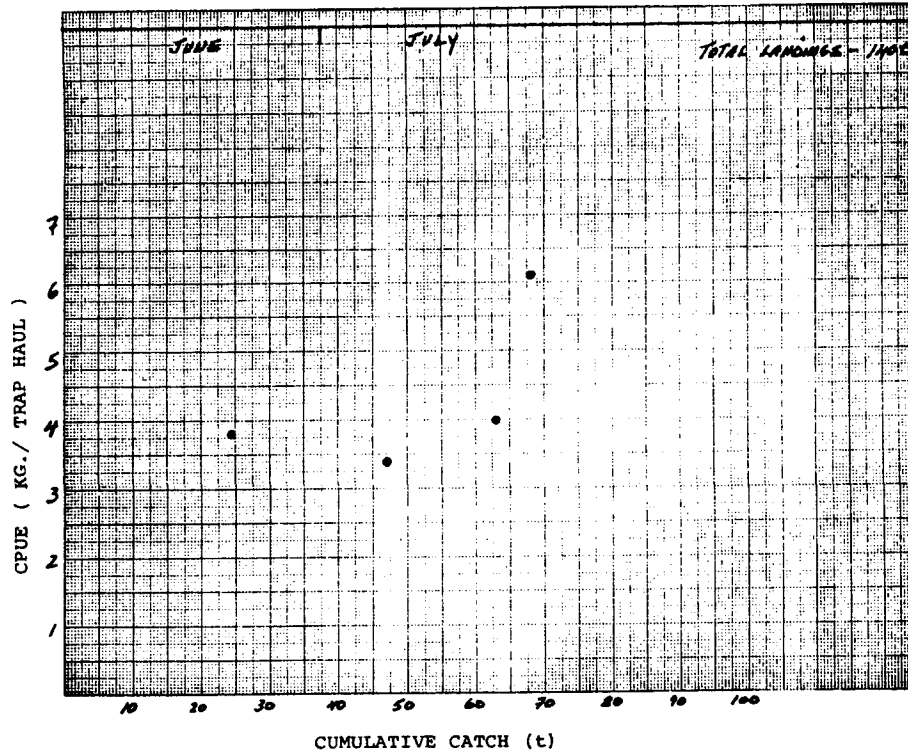


Fig. 7. Weekly catch/effort data from outer Trinity Bay (Area 22), 1987.

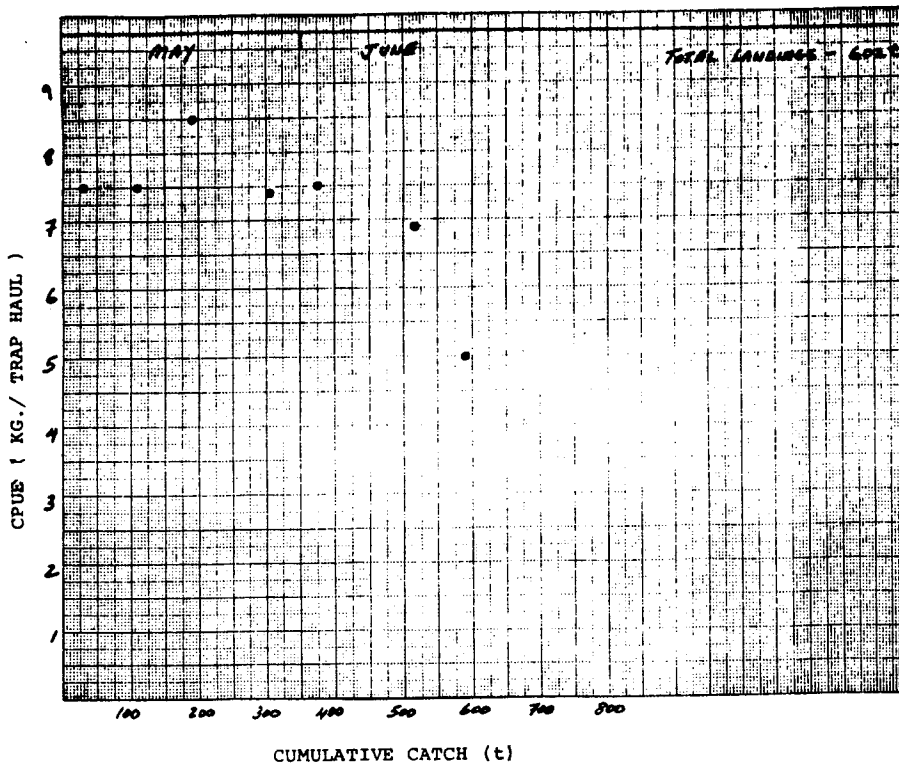


Fig. 8. Weekly catch/effort data from Bonavista Bay (Area 25), 1987.

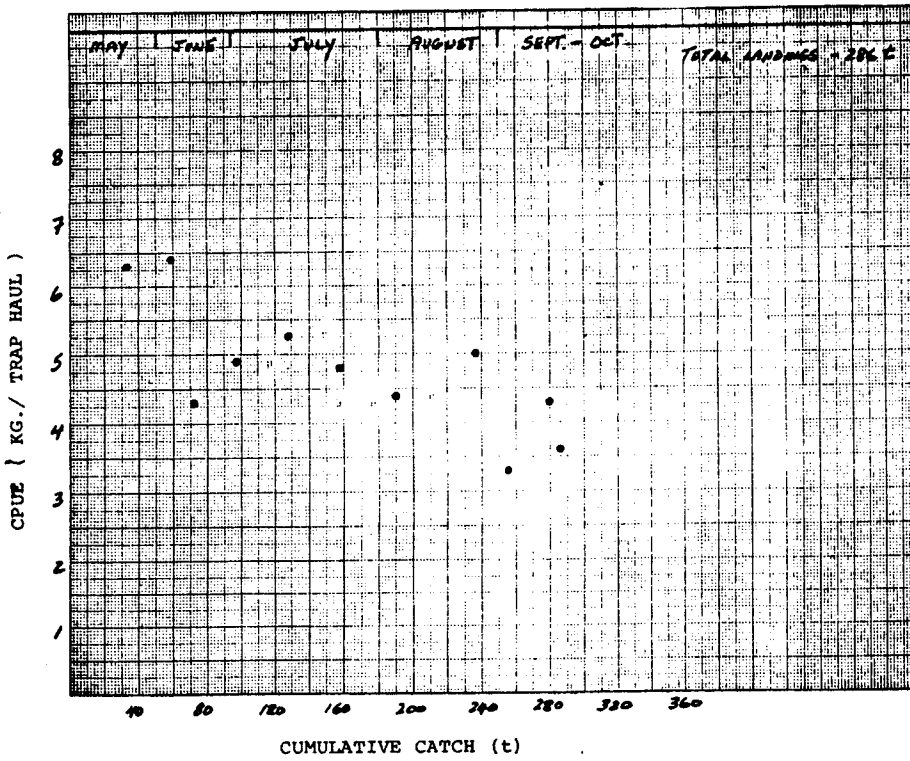


Fig. 9. Biweekly catch/effort data from Fogo (Area 28), 1987.

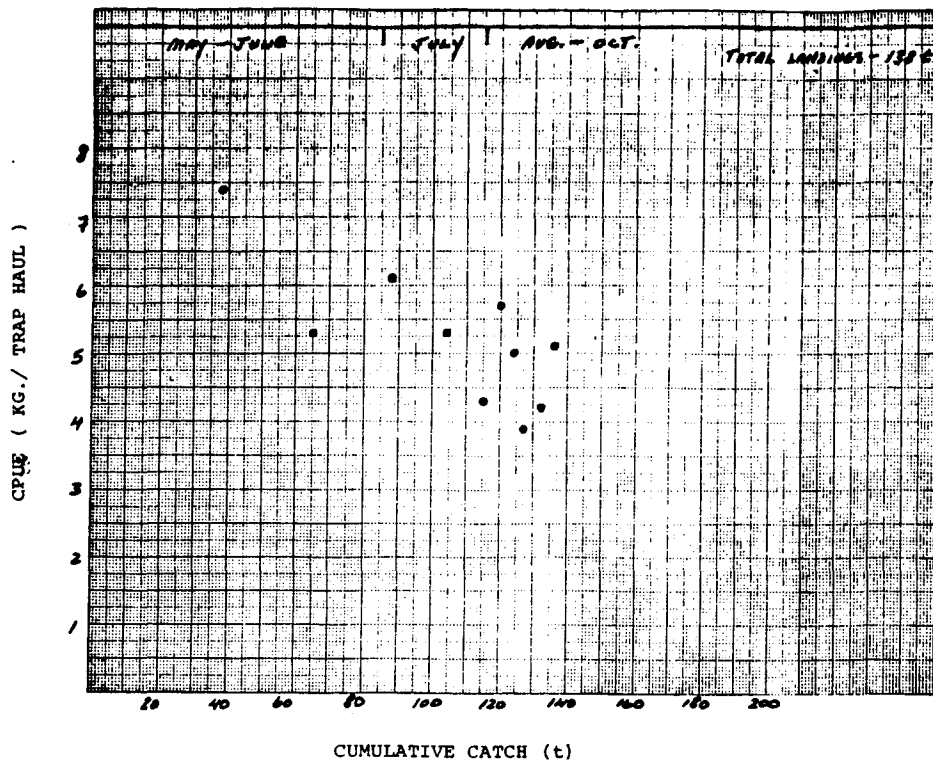


Fig. 10. Biweekly catch/effort data from Twillingate (Area 30), 1987.

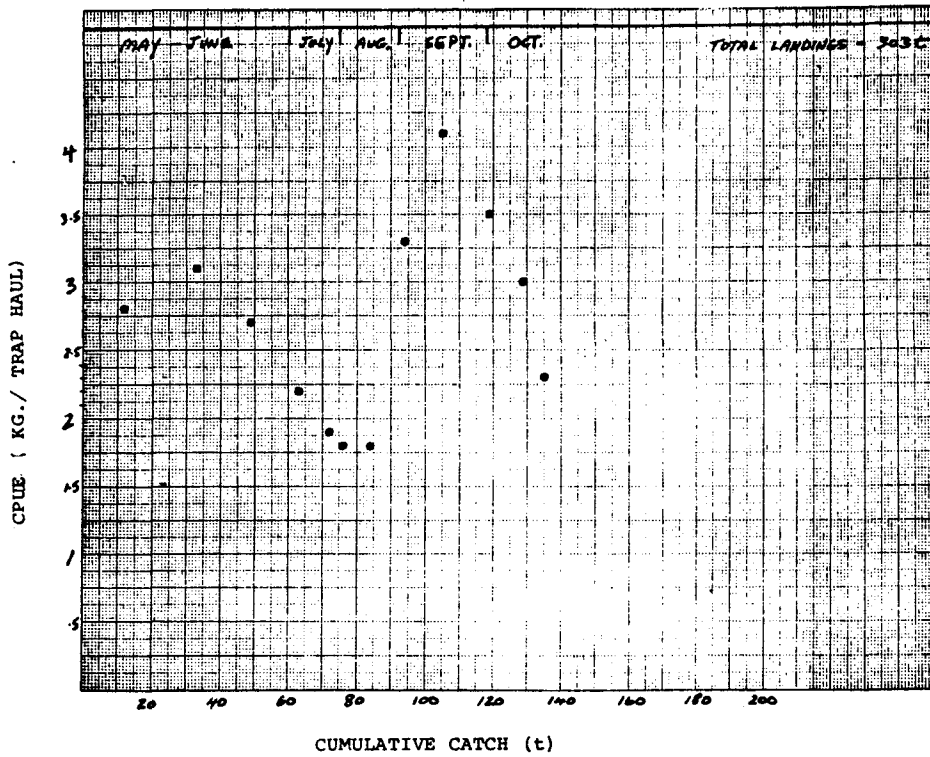


Fig. 11. Biweekly catch/effort data from Notre Dame Bay (Area 32), 1987.

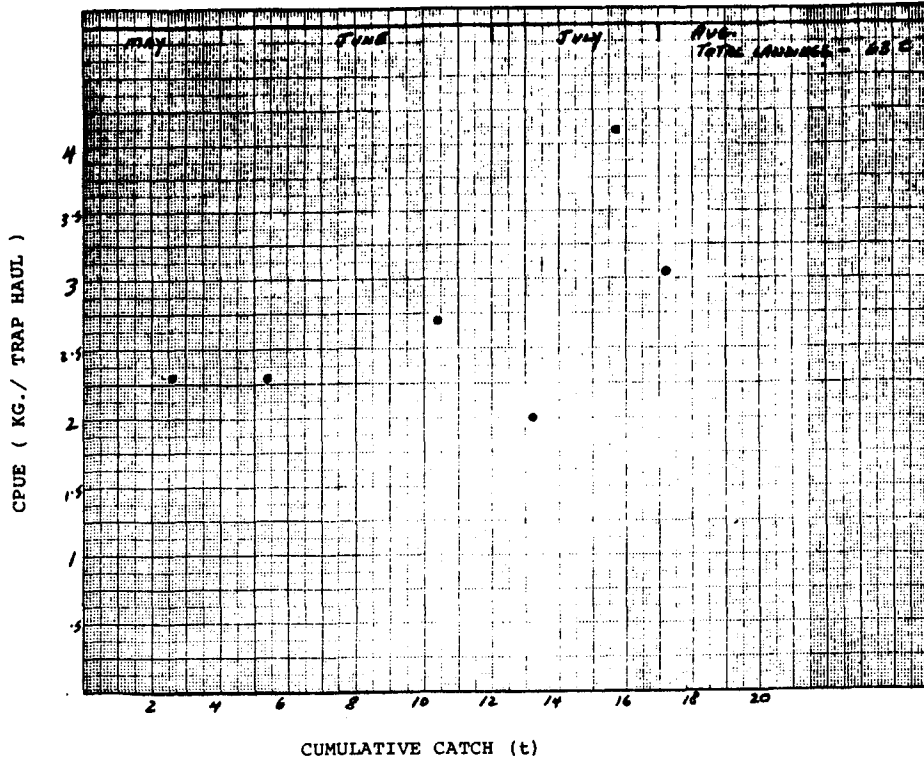


Fig. 12. Biweekly catch/effort data from Horse Islands (Area 34), 1987.

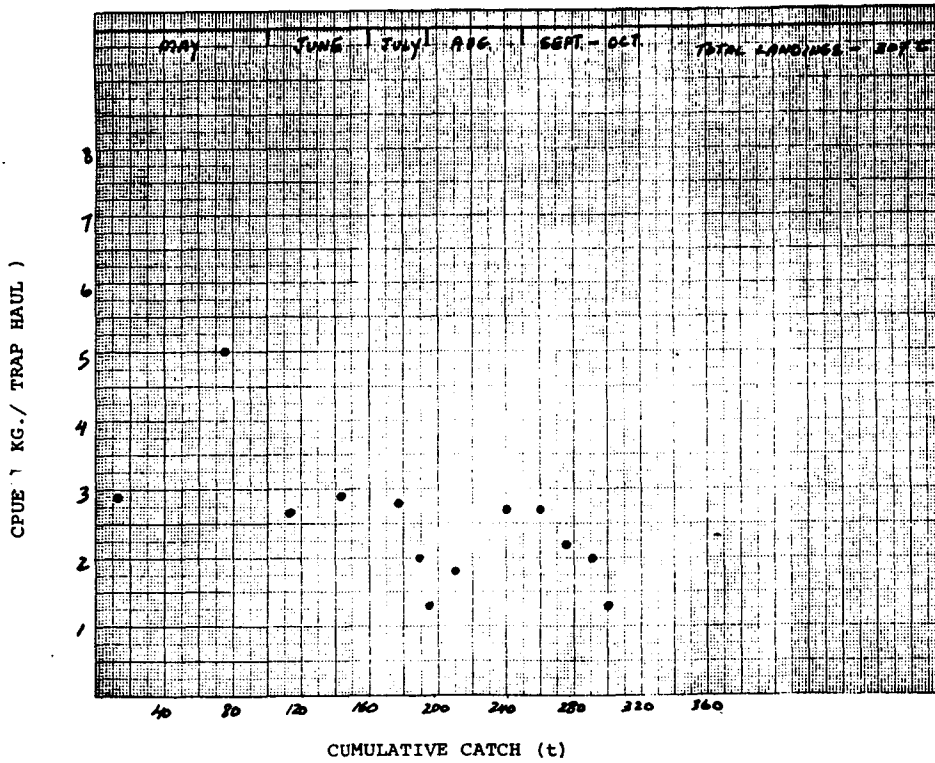


Fig. 13. Biweekly catch/effort data from White Bay (Area 36), 1987.

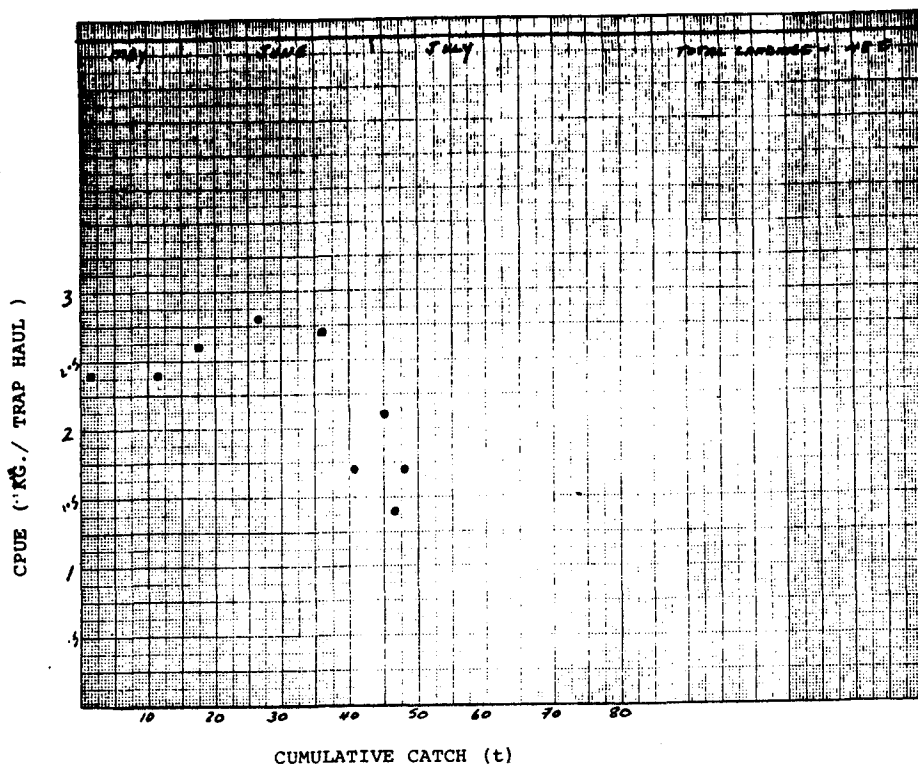


Fig. 14. Weekly catch/effort data from Canada Bay (Area 38), 1987.

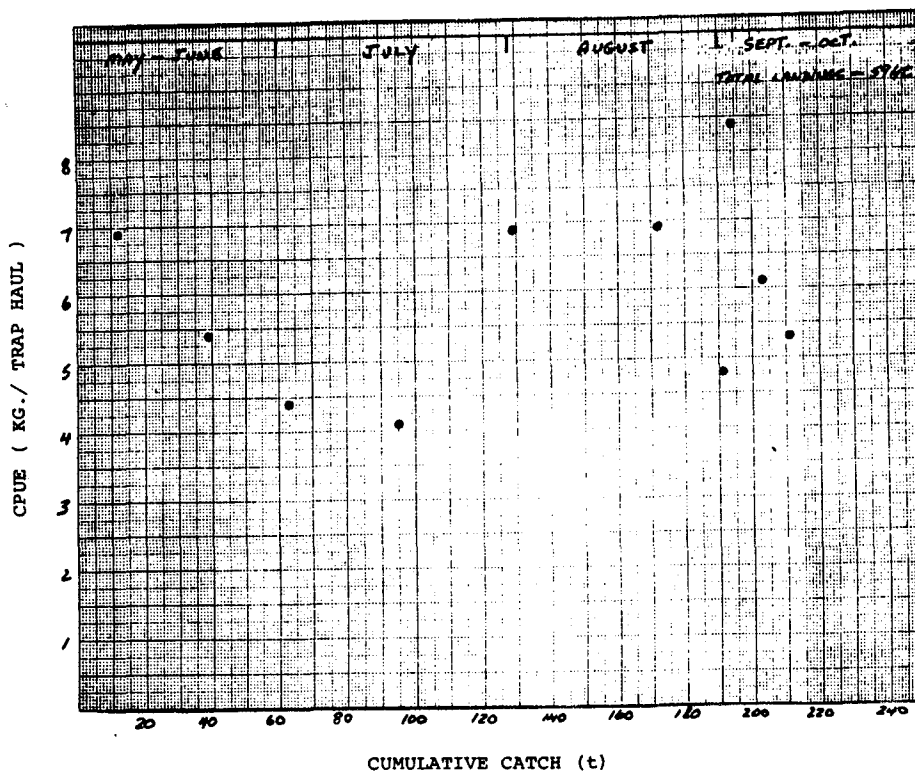


Fig. 15. Biweekly catch/effort data from Grey Islands (Area 40), 1987.

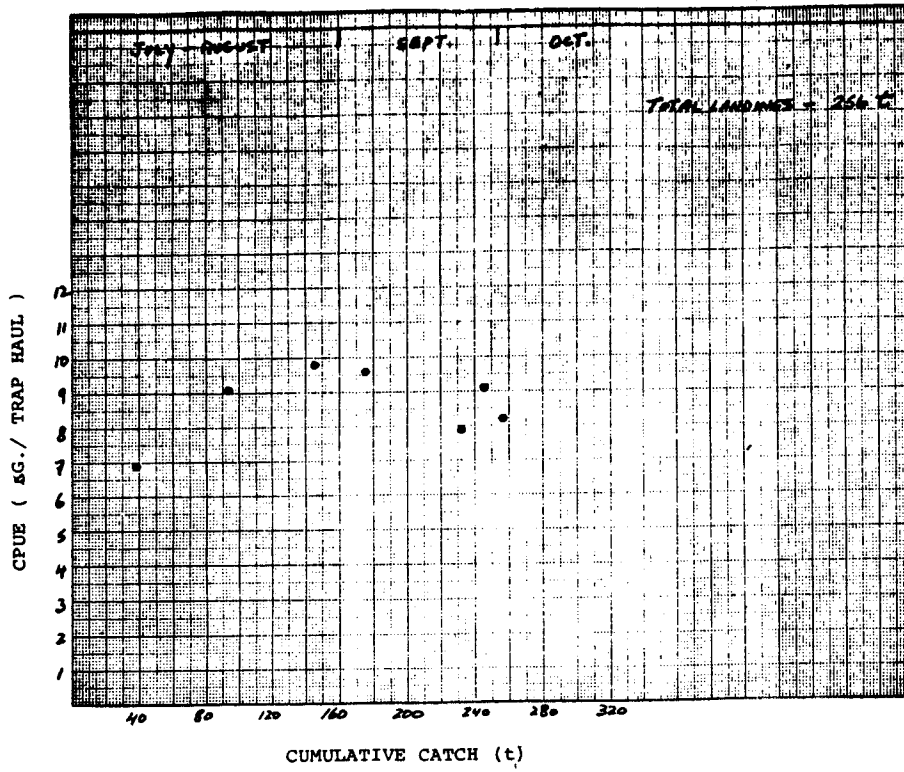


Fig. 16. Biweekly catch/effort data from Labrador (Area 41), 1987.

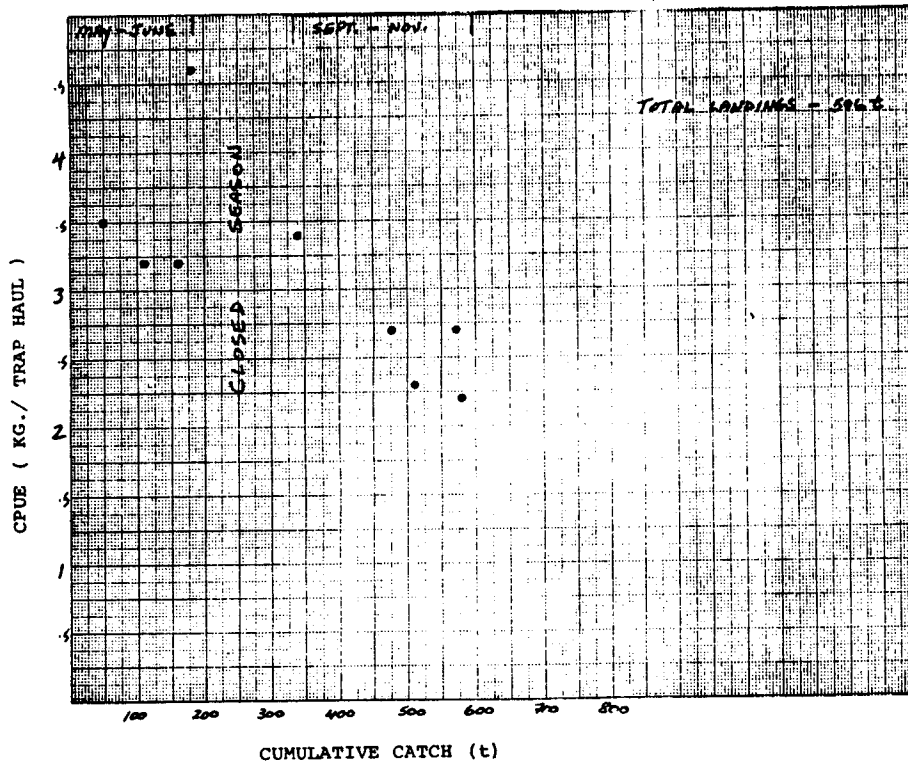


Fig. 17. Biweekly catch/effort data from Placentia Bay (Area 3Ps), 1987.

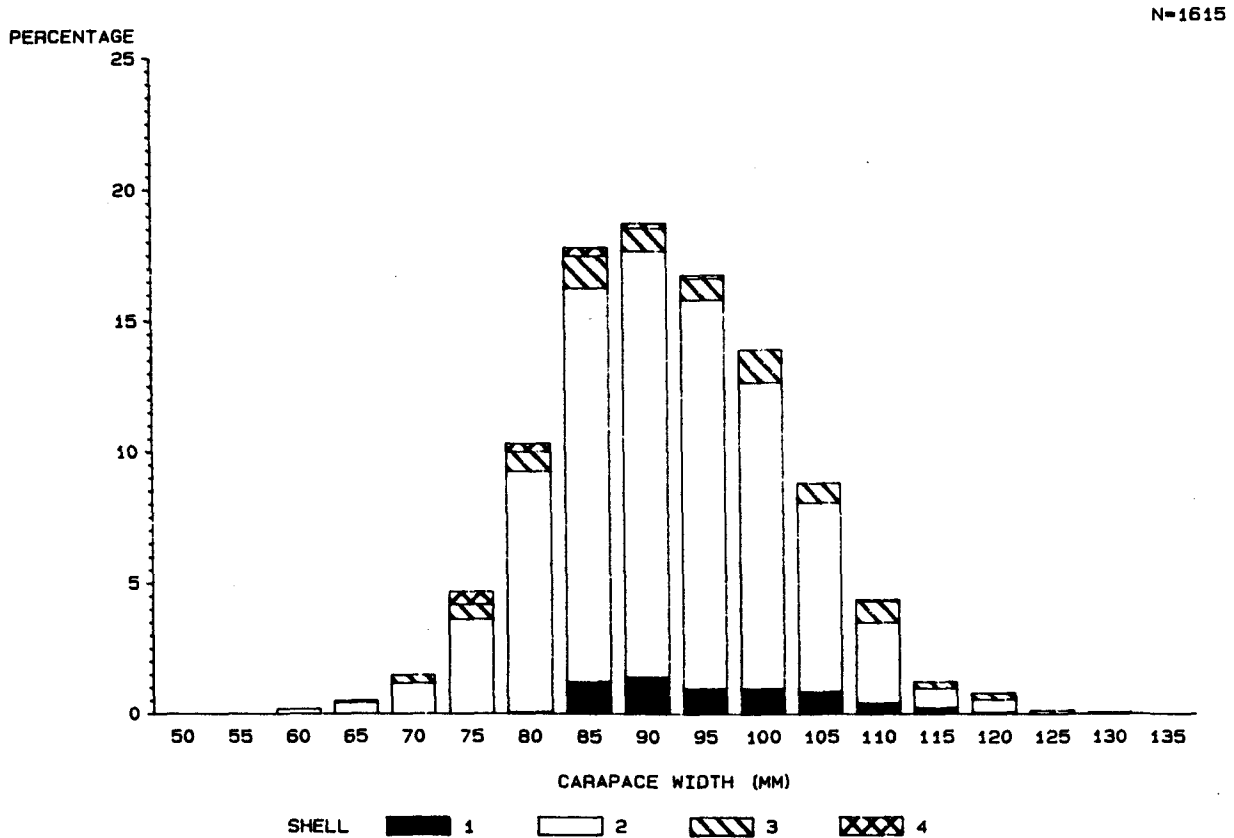
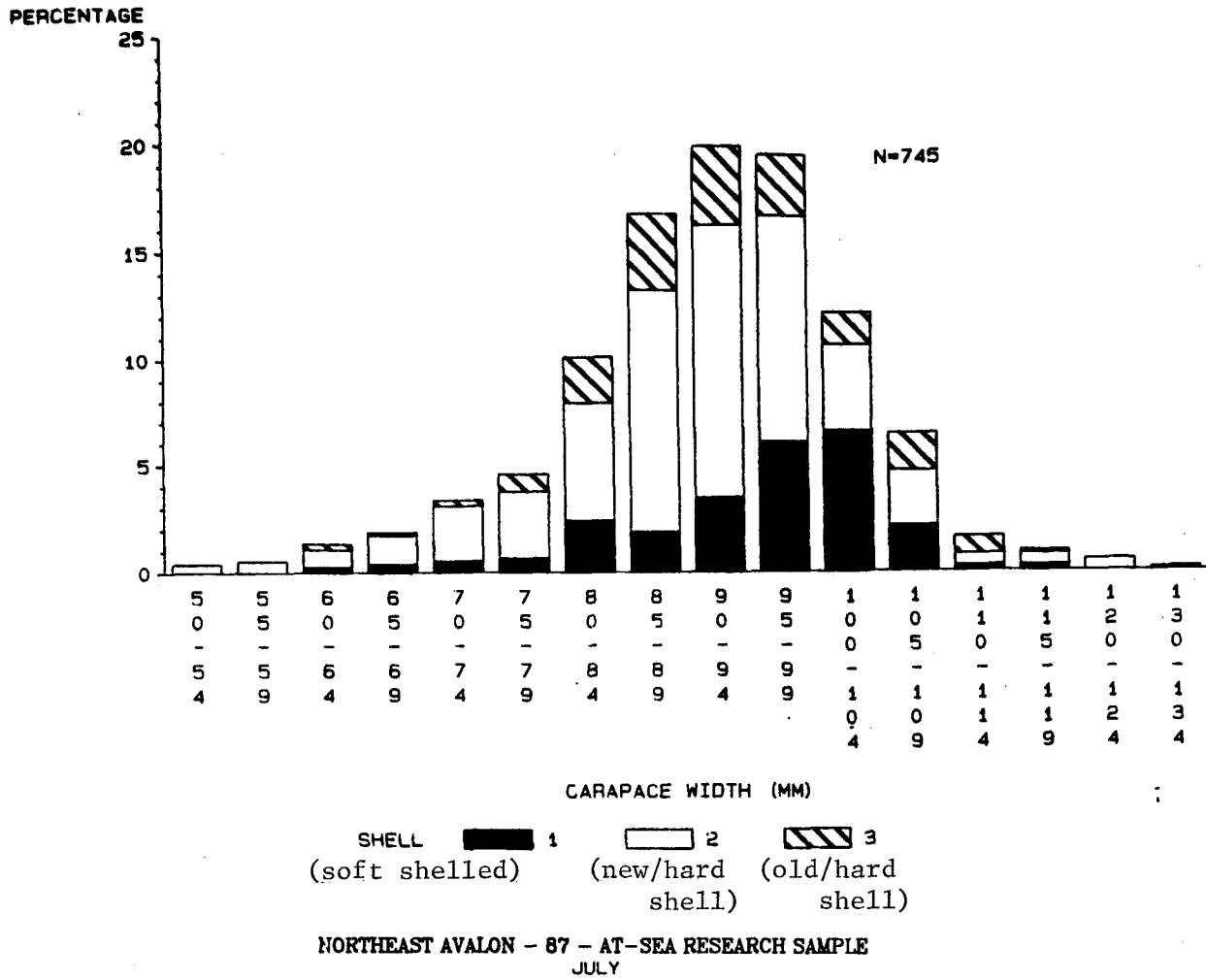


Figure 18. Snow crab size frequency distribution, northeastern Avalon, 1986-87.

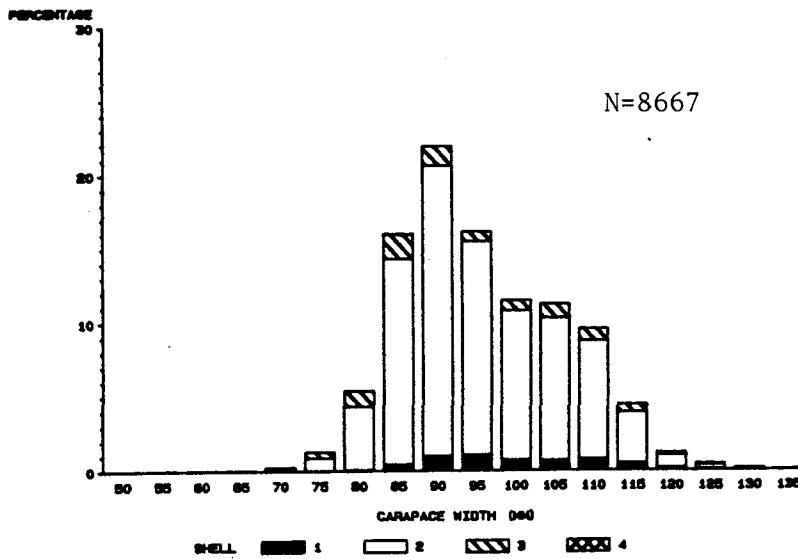
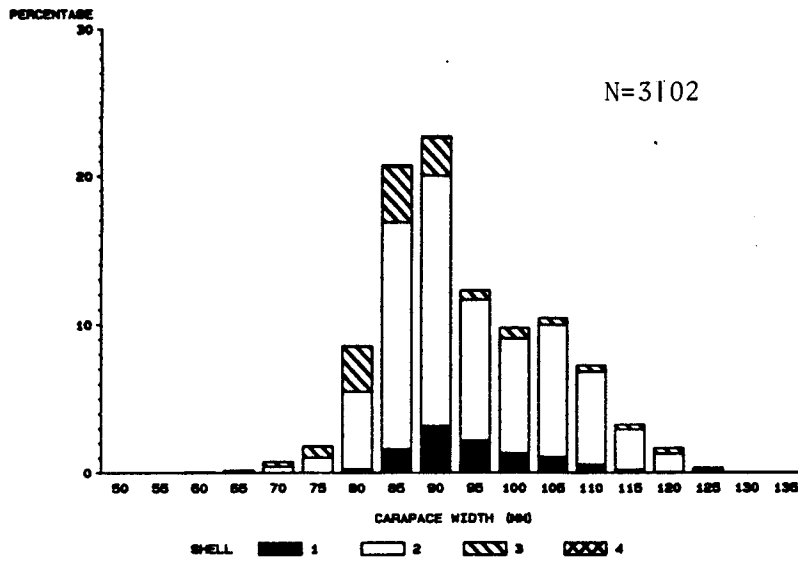
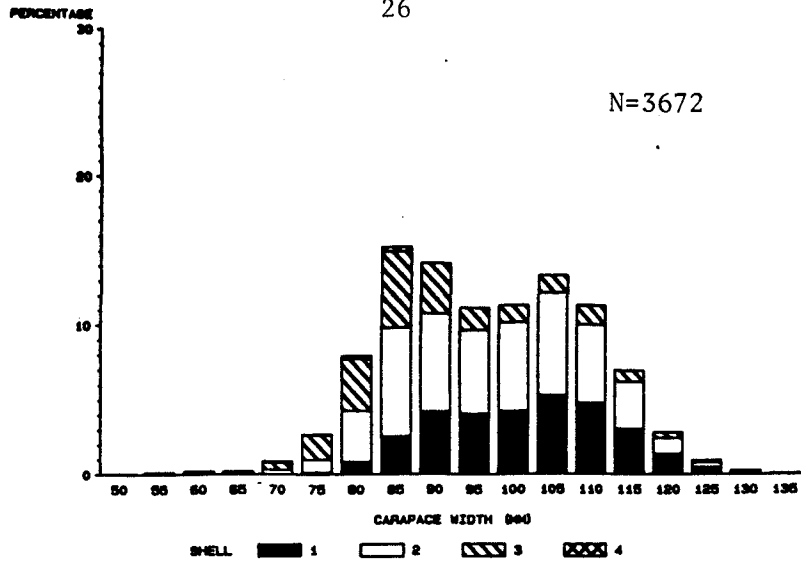


Fig. 19. Snow crab size frequency distribution, Bonavista Bay, 1985-87.

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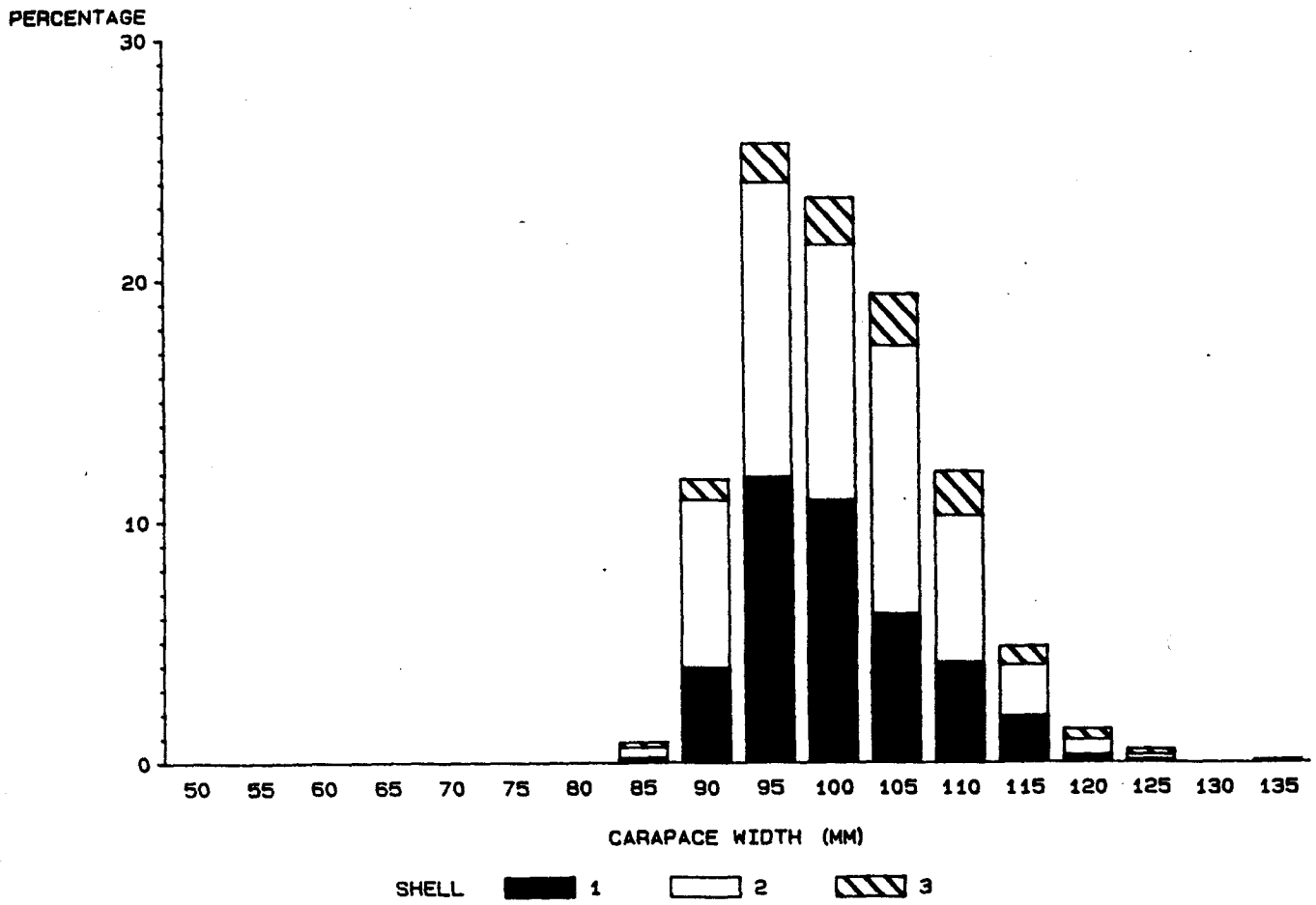


Fig. 20. Commercial plant sample, Bonavista Bay (Area 25), 1987.