Analysis of the Snow Crab, Chionoecetes opilio, Fishery in Newfoundland for 1984

by

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Abstract

Population size estimates for snow crab (Chionoecetes opilio) off the east coast of Newfoundland, based on Leslie analyses are presented for the 1984 fishing season. Within given crab management areas, estimates of population size ranged from 119 to 3092 t and exploitation rates from 42 to 93%.

Résumé

On présente des estimations de l'effectif de la population de crabes des neiges (Chionoecetes opilio) au large de la côte est de Terre-Neuve pour la saison de pêche 1984. Ces estimations sont fondées sur les analyses de Leslie. Selon la zone de gestion considérée, l'effectif de la population varie de 119 à 3092 t et le taux d'exploitation, entre 42 et 93%.

Introduction

Snow crab (Chionoecetes opilio) landings in Newfoundland continued to decline in 1984 as a result of the virtual collapse of the fishery in those areas of the Southern Zone which until 1982 had been the mainstay of the fishery. Landings for the island fell to 9606 t; 4526 t from the Southern Zone and 5080 t from the Northern Zone. With the exception of Areas 8 and 32 all management areas (Fig. 1) experienced a drop in CPUE (Tables 1 and 2).

In the Southern Zone effort and landings were reduced by 9 and 51%, respectively, due primarily to severe ice conditions during the spring and extremely low CPUE's for the entire fishing season which greatly reduced the economic incentive for fishermen to fish.

While ice conditions in the Northern Zone were also severe during the spring, satisfactory CPUE's and the initiative of four new entrants in Areas 34 and 38 caused an overall increase in effort and landings of 17 and 4% respectively.

Materials and Methods

As in previous assessments of Newfoundland snow crab stocks (Taylor and O'Keefe 1981), catch/effort data from fishermen's logbooks were analyzed and data for each management area compared to processor's sales slips in an attempt to ascertain the veracity of the fishermen's reports. From these data biweekly catch/effort tables were constructed for each management area in order to determine whether Leslie analysis was feasible.

During 1984 it became obvious that in the Southern Zone the reliability of the data used in Leslie analysis is highly questionable. Therefore, all analyses of Southern Zone management areas, particularly biomass estimates should be viewed with caution.

While the authors (Taylor and O'Keefe 1985) reported that in 1983 fishermen deliberately misreported trap hauls in order to avoid prosecution for hauling in excess of 800 traps per day, many fishermen, particularly in the Southern Zone, reported hauling more than this number in 1984, presumably confident that logbooks would not be used as a means of prosecuting breaches of fishery regulations.

Results and Discussion

Southern Zone

Examination of Tables 1 and 2 shows that in almost all areas (Area 20 excluded due to the extremely low level of effort) CPUE was reduced. This reduction in CPUE for the third consecutive year has caused many fishermen to become convinced that the snow crab fishery is not an economically viable proposition. A further indicator of the general malaise which appears to have overcome fishermen in this area is that five of the larger vessels once

considered "highliners" have switched half their effort to long-lining or otter trawling for groundfish while several others have attempted to sell their vessels.

In the eleven management areas where Leslie analyses were calculated, all show a pronounced decrease in biomass coupled with excessively high exploitation rates.

Fishermen prosecuting the offshore fishery (Areas 13 and 19) reported that there is an absence of soft-shelled crab and new/hard-shelled individuals on the fishing grounds. A research cruise conducted in Area 19 during July of 1984 corroborated their reports. Of 25 sets of experimental traps hauled in this area, only two had catches that could be considered as being at a commercial level. All animals were measured and their shell conditions determined during sampling. No soft-shelled animals were found and newly recruited hard-shelled animals were virtually absent from the catches.

Effort in Bonavista Bay has increased markedly over 1983 levels as fishermen, disappointed with low catch rates in Area 19 returned to their traditional fishing grounds inshore. Despite this increase in effort, $\bar{x}$ CPUE was relatively unchanged from 1983 levels, due to the fact that for the first time, processors in Area 25 relaxed quality control practices and began accepting soft-shelled crab near the end of the fishing season.

Low effort levels in the Southern Zone caused many management areas to experience such drastic reductions in effort that Leslie analyses must be viewed with caution. Leslie analyses were carried out for Areas 12 (Fig. 2), 13 (Fig. 3), 14 (Fig. 4), 18 (Fig. 5), 19 (Fig. 6), 22 (Fig. 7) and 25 (Fig. 8).

The biomass estimate for Area 18 is most likely an underestimate due to the fact that most fishing effort was restricted to the near shore areas.

Northern Zone

Effort in the Northern Zone increased over 1983 levels by 17%. However, with the exception of Area 32 where effort was reduced by 13% as vessels transferred effort to Area 34, CPUE was reduced in all areas. The continued dramatic rise in effort in Area 34 (64%) has resulted in a drop in CPUE of 21%. Effort in Area 34 should be reduced to 1983 levels. Catch/effort data for Area 36 were not suitable for Leslie analysis.

Biomass estimates are presented for Areas 28 and 30 for the first time (Table 2).

Although Area 28 has only been fished for two years CPUE was reduced by 26% while landings and effort increased by 15% and 55%, respectively. Logbook data for this area indicate that the area available to fishermen is quite small.

Leslie analyses were carried out for four areas in the Northern Zone - Area 28 (Fig. 9), Area 30 (Fig. 10), Area 32 (Fig. 11) and Area 34 (Fig. 12).

Conclusions

The crab fleet in the Southern Zone continued to experience disasterously low catch rates, particularly in the offshore areas where there has been an apparent recruitment failure.

The Northern Zone appears to be very productive but the continuing decline in CPUE indicates that effort should be reduced in Areas 28 and 34 and maintained at current levels in all other areas.

A summary of the overall performance of the Newfoundland snow crab fishery since 1979 divided into the Northern and Southern Zones is presented in Table 3.

References

Taylor, D. M., and P. G. O'Keefe. 1981. Assessment of snow crab (Chionoecetes opilio) stocks in Newfoundland, 1979. CAFSAC Res. Doc. 81/57.

1985. Analysis of the snow crab, (Chionoecetes opilio), fishery in Newfoundland for 1983. CAFSAC Res. Doc. 85/8.

Table 1. Summary of statistics for the Newfoundland Snow Crab fishery (Southern Zone), 1979-84.

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	-	-
10	1983	3,080	43	13.9	-	-
	1984	18,700	175	9.4	217 (201-241)	81
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	1140 (948-2343)	94
13	1982	7,295	114	15.6	-	-
	1983	61,089	733	12.0	-	-
	1984	41,080	397	9.7	592 (501-790)	67
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
15	1981	18,128	404	22.3	-	-
	1982	66,949	1056	15.8	1861 (1465-3024)	56
	1983	1,320	138	10.5	-	-
	1984	-	-	-	-	-
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	-	-
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
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

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Table 1. Continued.

Area	Year	Effort (trap hauls)	Landings (mt)	CPUE (kg/trap haul)	Estimated biomass (mt) (confidence limits)	Exploitation rate (%)
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	-	-
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
24 & 26	1979	173,305	1586	9.2	-	-
	1980	191,754	1905	9.9	-	-
	1981	171,685	1376	8.0	-	-
25	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

Table 2. Summary of statistics for the Newfoundland Snow Crab fishery (Northern Zone), 1979-84.

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
30	1983	163,138	1470	9.0	-	-
	1984	120,628	1019	8.4	2426 (1876-3765)	42
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
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
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	-	-
38	1983	66,123	681	10.3	-	-
	1984	102,102	948	9.3	-	-
40	1984	11,035	67	6.1	-	-

Table 3. Summary of performance of Newfoundland snow crab fishery, 1979-84.

Year	Southern Zone Catch (t)	Southern Zone Effort ('000 trap hauls)	Northern Zone Catch (t)	Northern Zone Effort ('000 trap hauls)	Total Newfoundland Catch (t)	Total Newfoundland 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

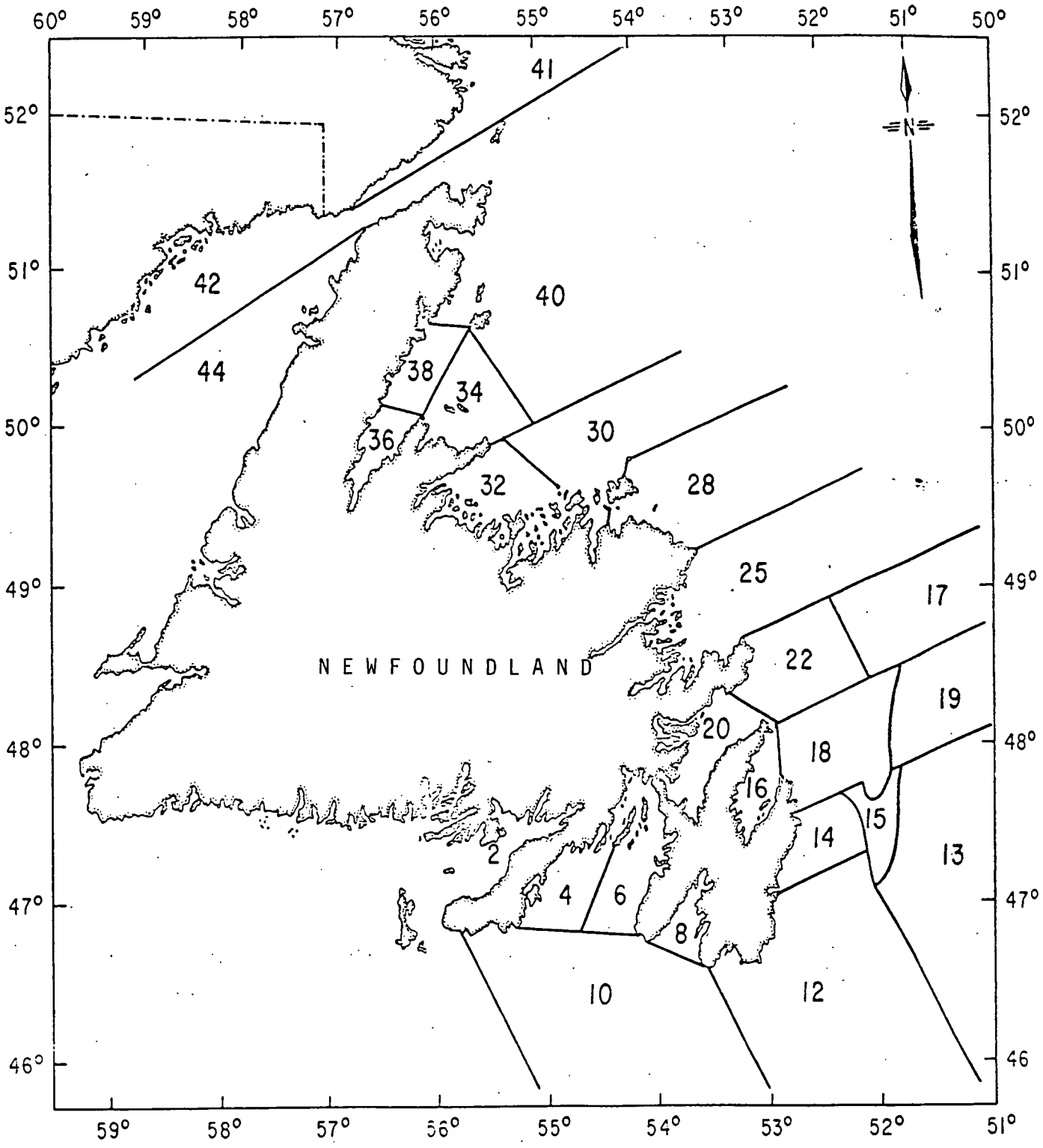

Fig. 1. Snow crab management areas.

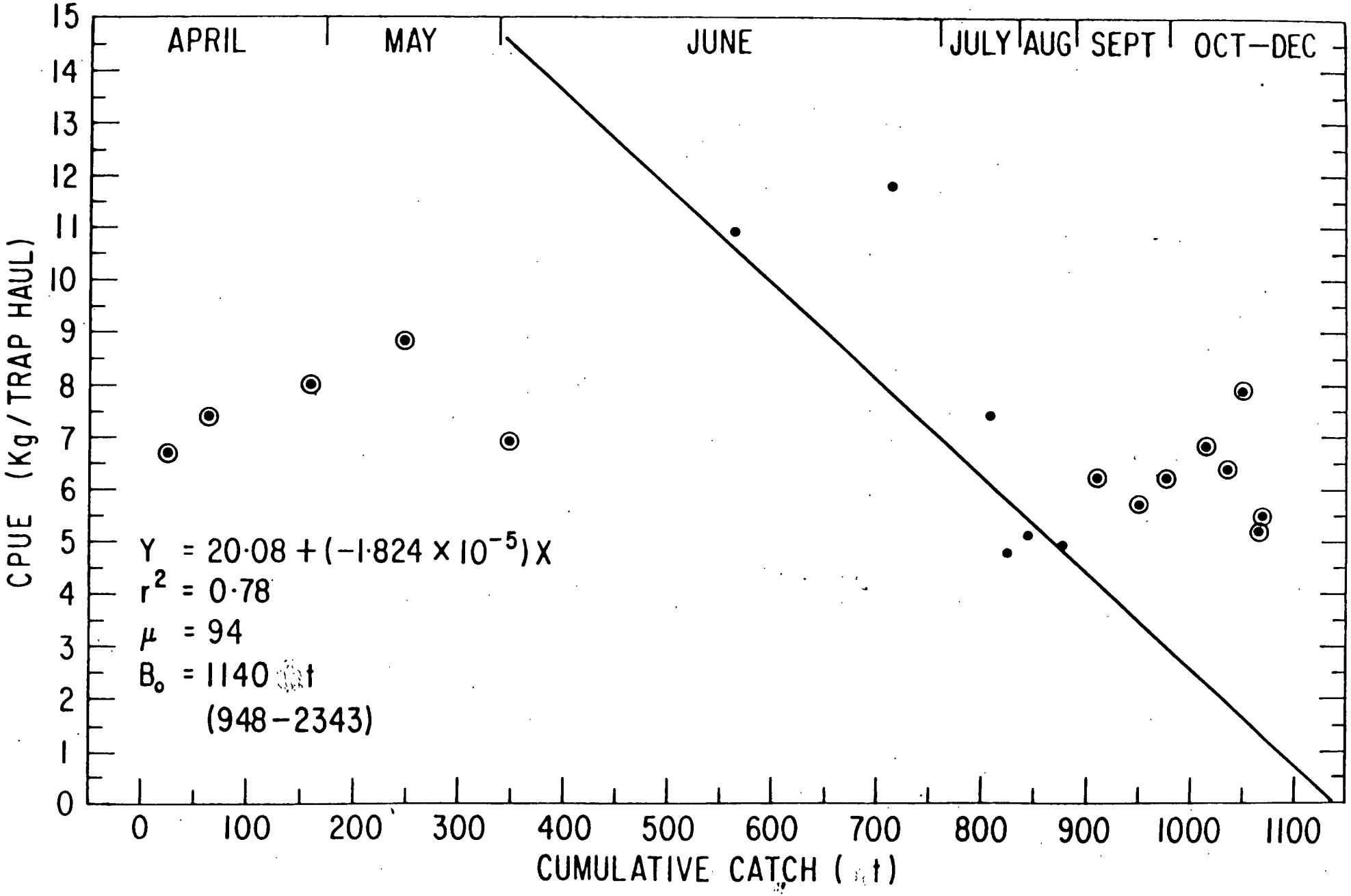

Fig. 2. Leslie graph of biweekly catches of snow crab from Southeastern Avalon (Area 12) 1984.

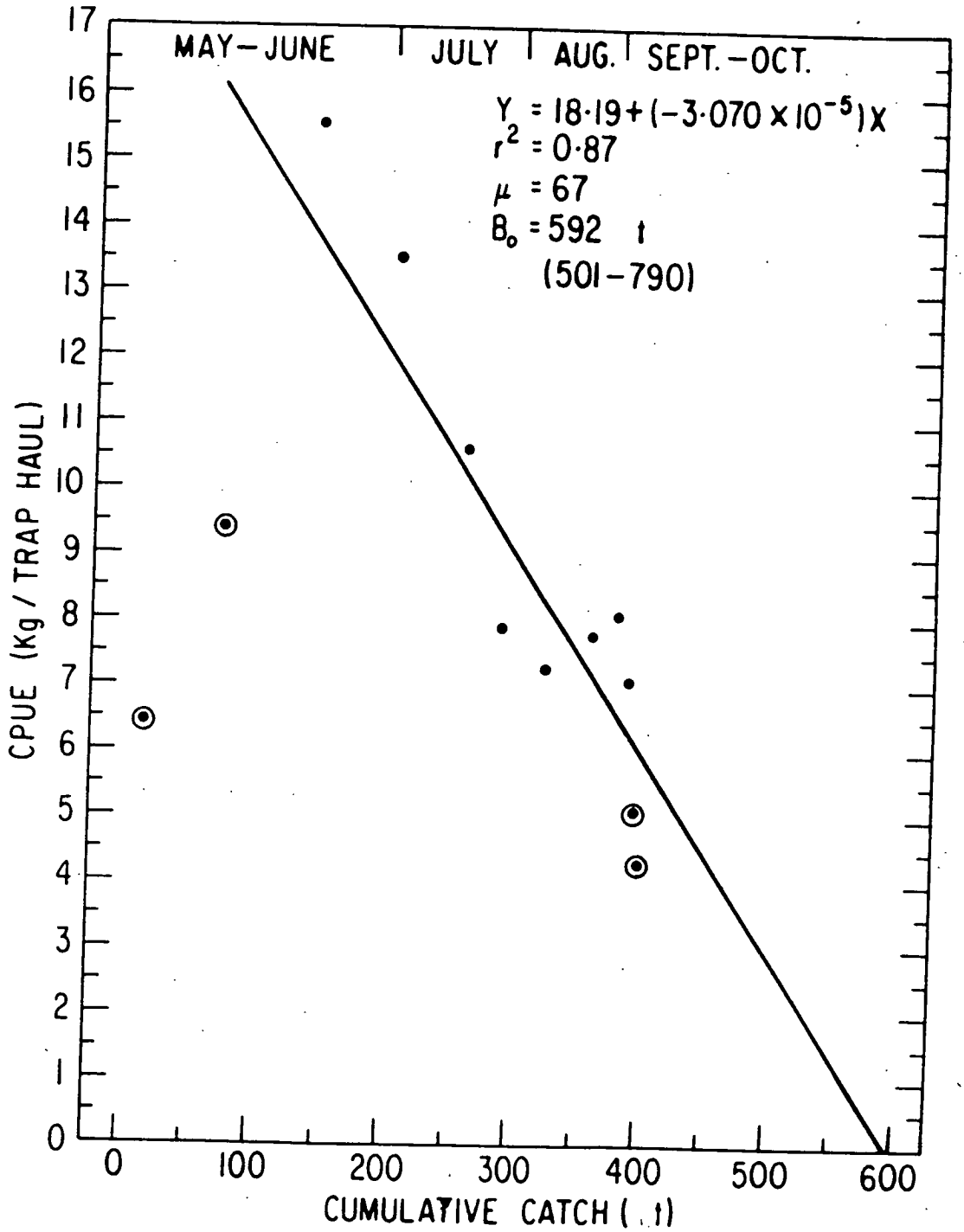

Fig. 3. Leslie graph of biweekly catches of snow crab from Downing Basin (Area 13) 1984.

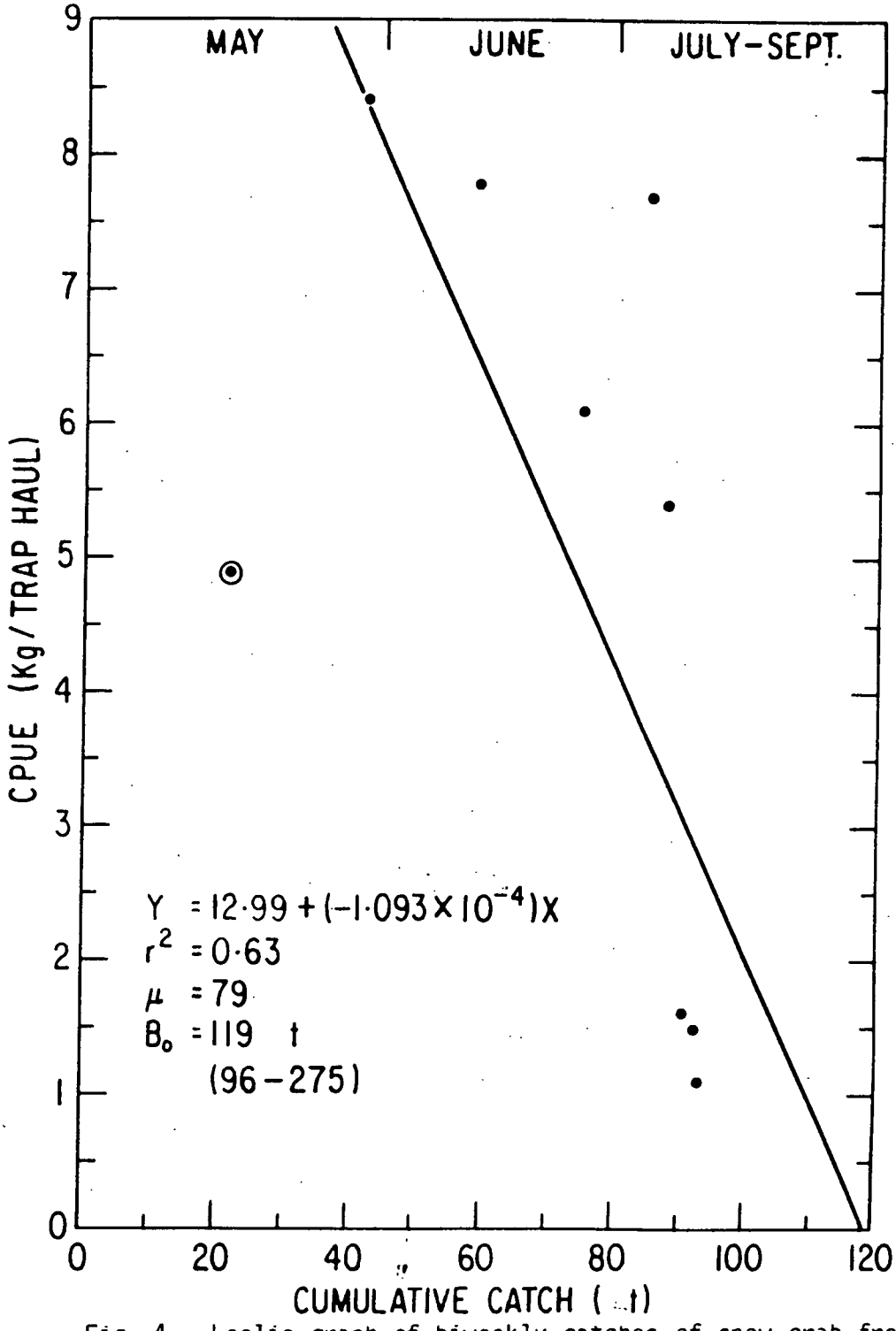

Fig. 4. Leslie graph of biweekly catches of snow crab from Eastern Avalon (Area 14) 1984.

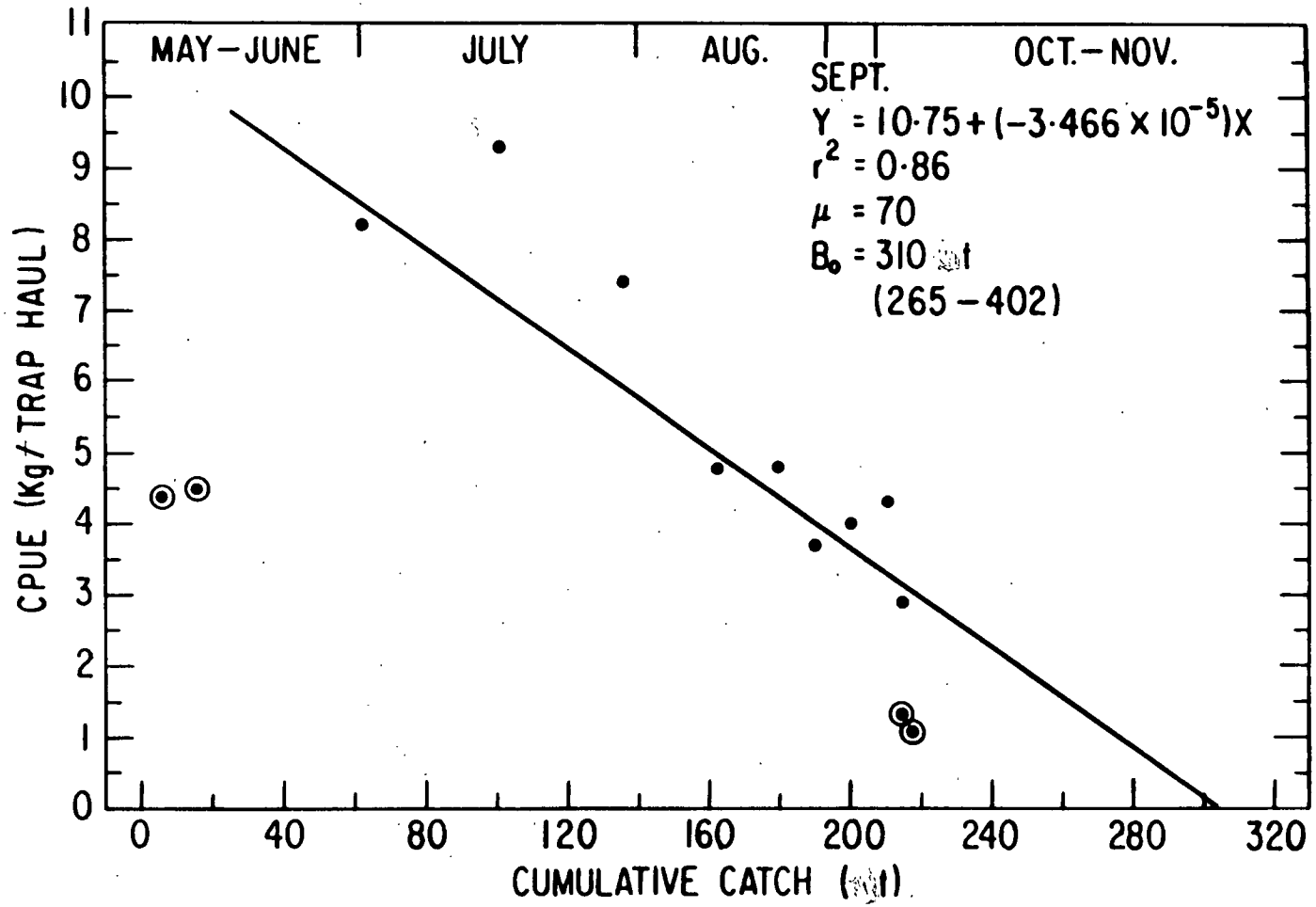

Fig. 5. Leslie graph of biweekly catches of snow crab from Northeastern Avalon (Area 18) 1984.

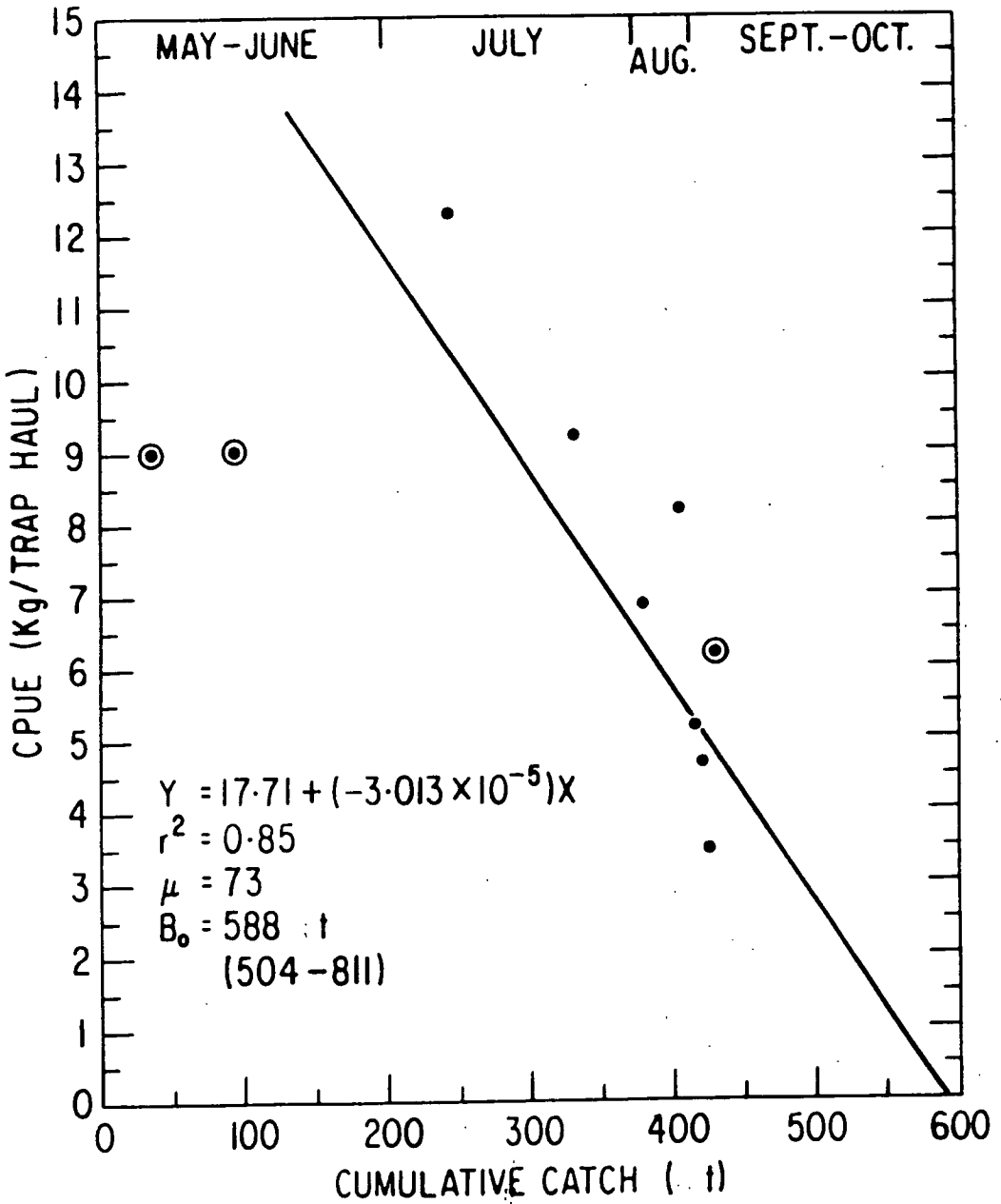

Fig. 6. Leslie graph of biweekly catches of snow crab from Northeastern Avalon (Area 19) 1984.

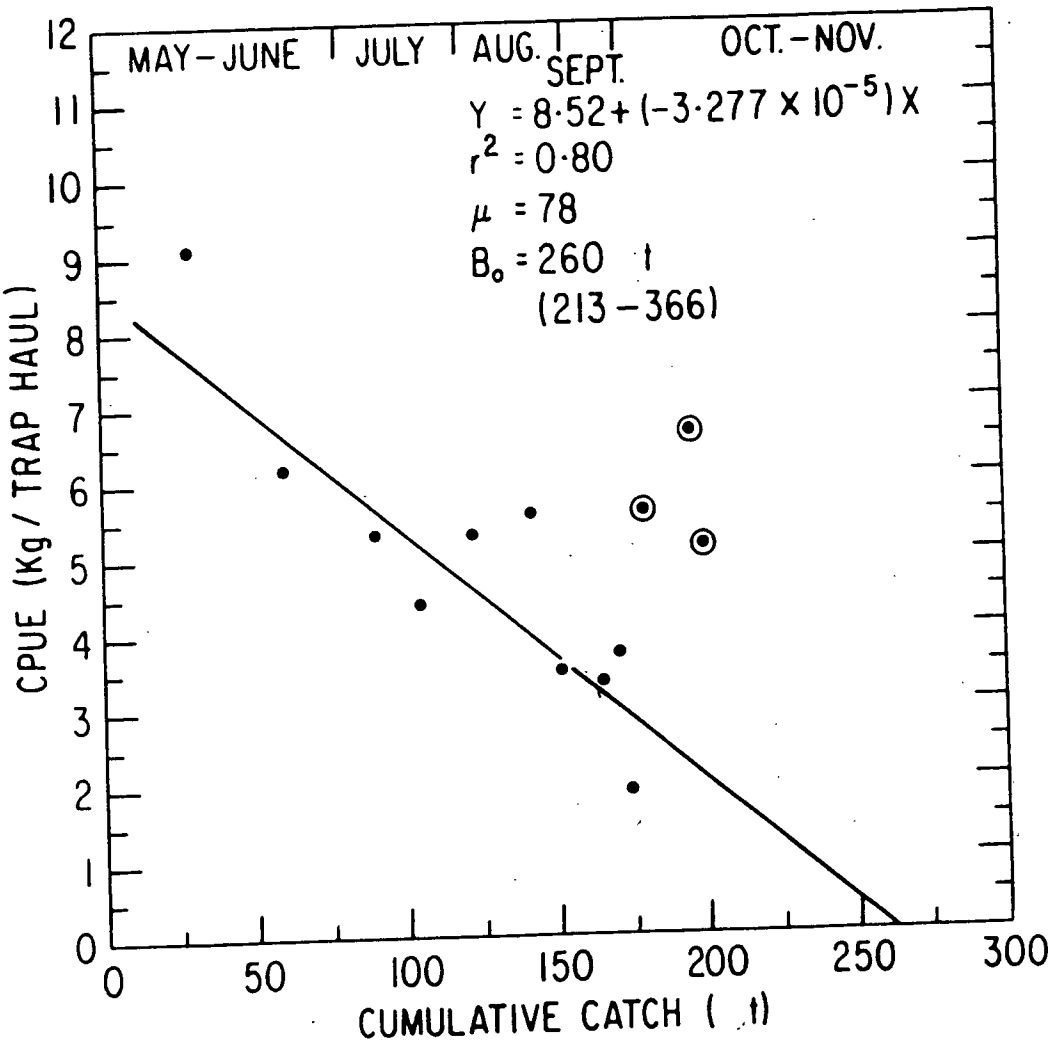

Fig. 7. Leslie graph of biweekly catches of snow crab from outer portion, Trinity Bay (Area 22) 1984.

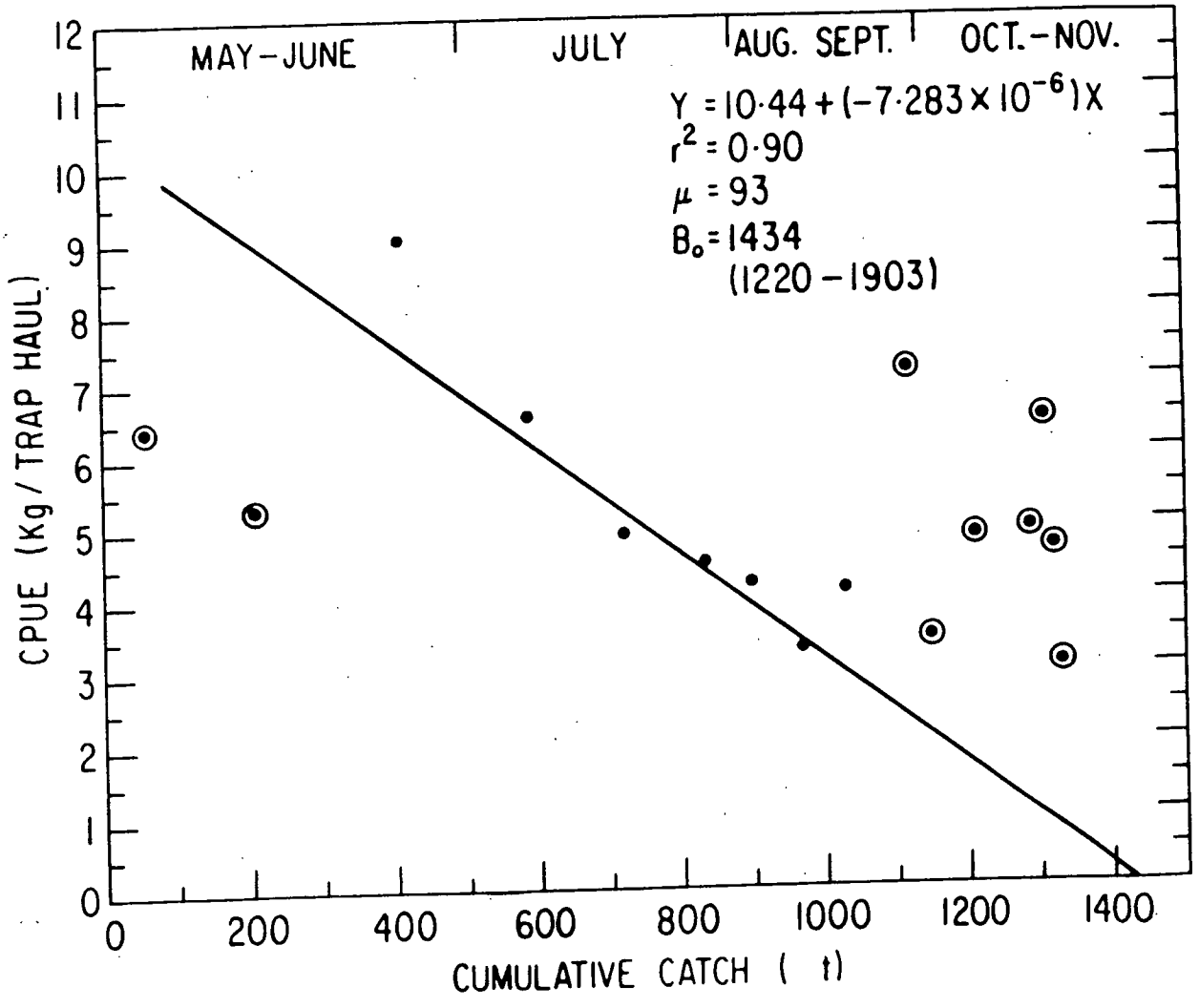

Fig. 8. Leslie graph of biweekly catches of snow crab from Bonavista Bay (Area 25) 1984.

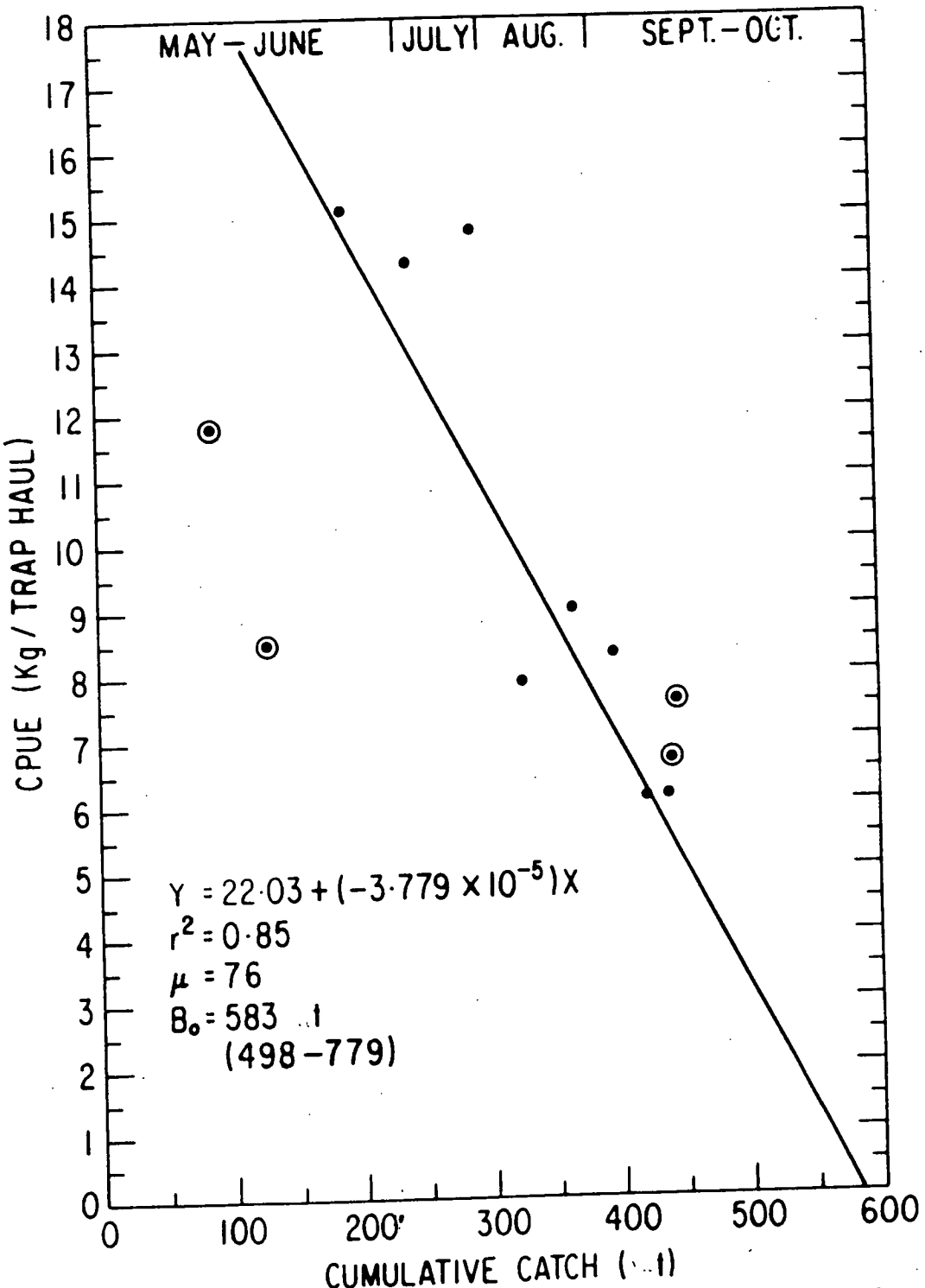

Fig. 9. Leslie graph of biweekly catches of snow crab from Fogo-Cape Freels (Area 28) 1984.

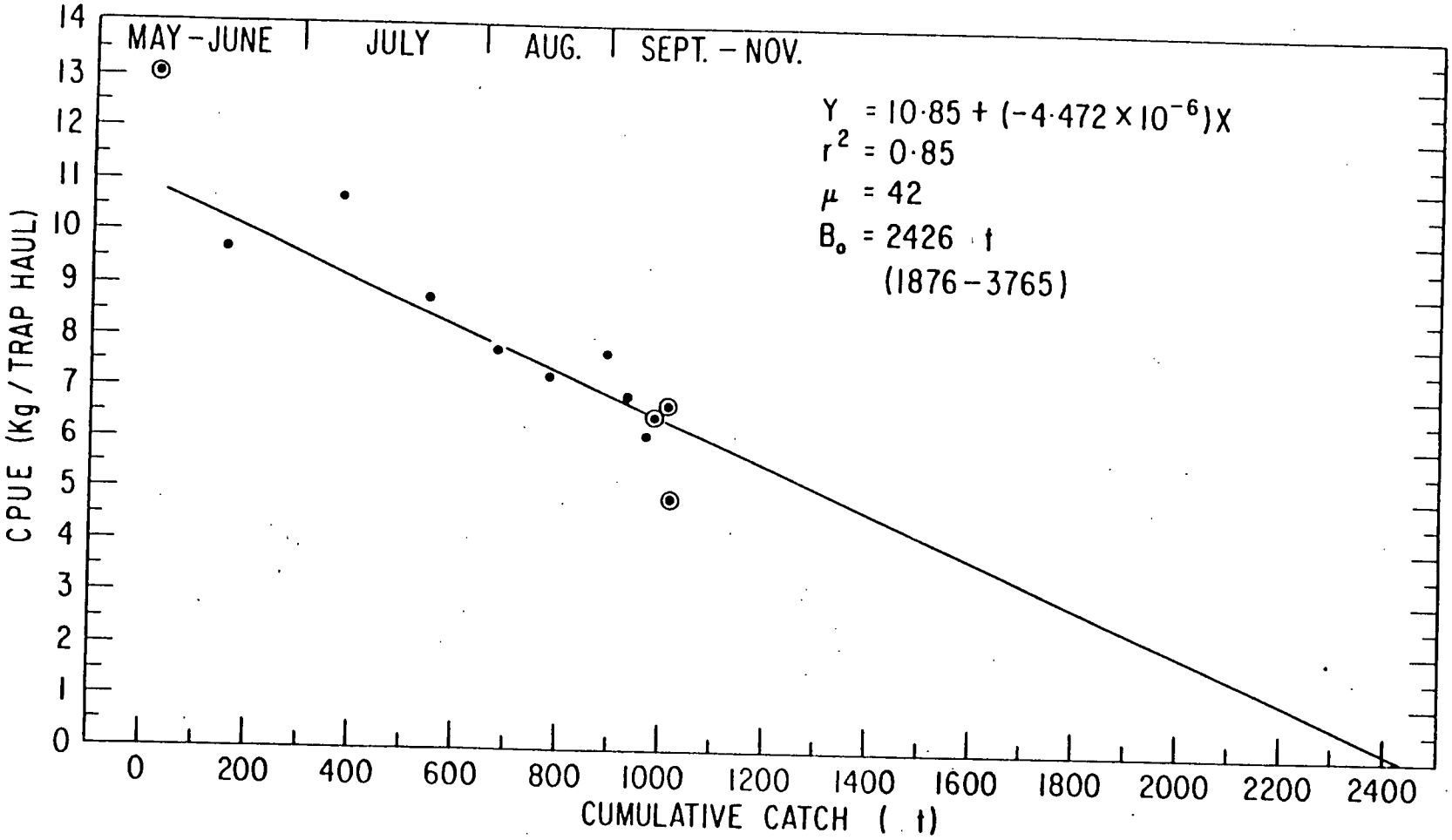

Fig. 10. Leslie graph of biweekly catches of snow crab from Twillingate (Area 30) 1984.

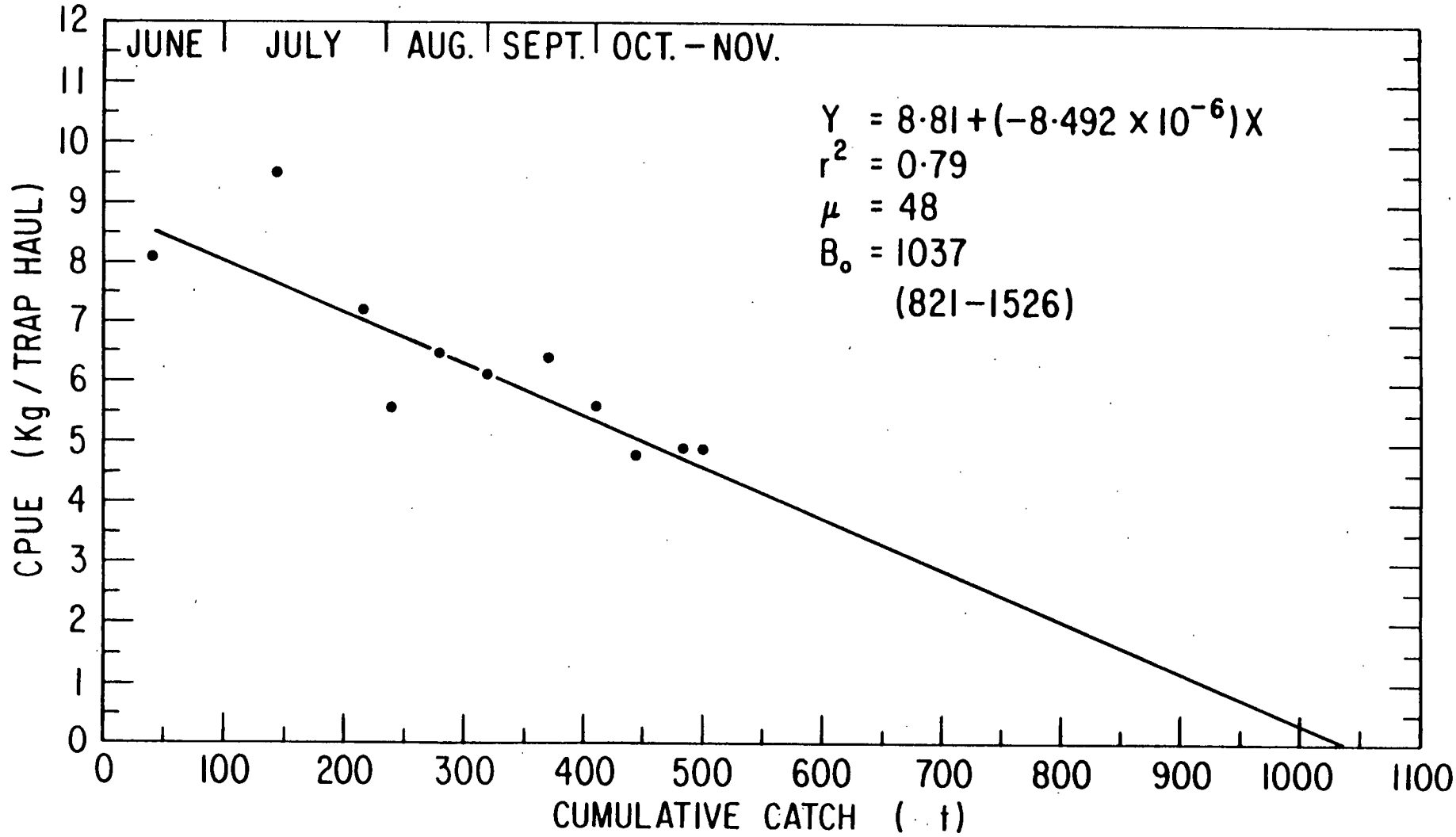

Fig. 11. Leslie graph of biweekly catches of snow crab from Notre Dame Bay (Area 32) 1984.

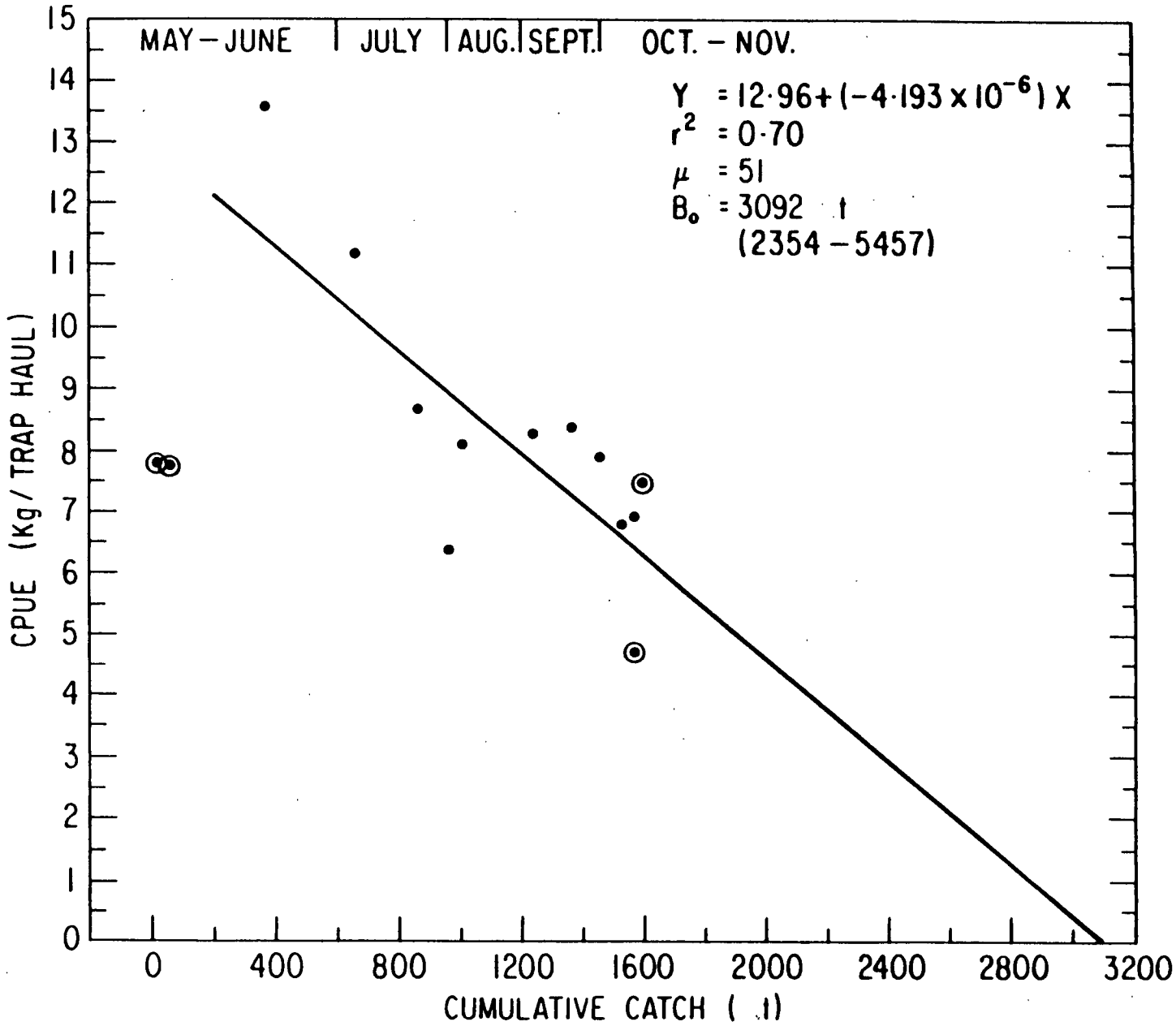

Fig. 12. Leslie graph of biweekly catches of snow crab from Horse Islands (Area 34) 1984.