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Scotia-Fundy Shrimp Stock Status - 1985

by

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Abstract

The Scotia-Fundy shrimp (*Pandalus borealis*) fishery covers three areas with depths > 100 fm, referred to as Canso, Louisbourg, and Misaine holes. These areas have been continuously underexploited over the past years, and even more so in 1985, as only 133 t (2%) of the total quota of 5560 t were taken. This represents an exploitation rate of 1% based on the biomass estimates. Two research cruises were done in 1985 (April, October) resulting in decreased catch rates from 1984 values. Therefore the proposed catch level for 1986 (for all three areas) is 2420 t, a substantial decrease from previous years.

Résumé

La pêche des crevettes (*Pandalus borealis*) dans la région de Scotia-Fundy regroupe trois secteurs ayant plus de 100 brasses de fond, à savoir les fosses de Canso, de Louisbourg et de Misaine. Ces endroits ont été continuellement sous-exploités au cours des années et plus particulièrement en 1985, alors qu'on n'a pêché que 133 tonnes (2 %) du contingent global de 5 560 tonnes. D'après nos prévisions sur la biomasse, cela donne un taux d'exploitation de 1 %. Deux excursions de recherche effectuées en 1985 (avril et octobre) ont donné des taux de capture inférieurs à ceux de 1984. En conséquence, le taux de capture proposé pour 1986 (les trois secteurs ensemble) s'établit à 2 420 t, soit une diminution appréciable par rapport aux années antérieures.

Methods and Results

Research Data

Research tows were carried out for half hour durations at a nominal speed of 2.5 knots using a Yankee 36 trawl with a 32 mm mesh size. The results of these surveys are displayed in Table 1 and graphically in Figures 1 and 2. The holes are defined by the 100 fm depth contour, where stations were allocated randomly inside the single stratum for Canso and Louisbourg holes. The Misaine stations were random stations from previous cruises, which were revised to save searching time for fishable bottom.

The shrimp fraction by weight, approximately 19% of the total catch (Table 2), is basically the same value as determined from last year's cruises. As before, the commercial logs show a higher catch percentage of shrimp than the research cruises, presumably because the fishing captains are directing for clean catches. A potential problem exists with the redfish by-catch as it is frequently above the 10% by-catch limit in commercial as well as research tows. The length-frequency distribution figures are based on measurement of carapace length, to 0.1 mm, and then grouped into 0.5 mm groupings. The number at the top of each figure is the number of individuals in the total sample. Figure 3 separates the data by area showing similar distributions for the three holes. Grouping the data by sex we get Figure 4. In comparing the graphs from 1982-1985 spring/fall research cruises we can see the large portion of transitionals that are present in the spring disappear from the population in the fall. We also detect two peaks of males supposedly representing two year classes which can be followed from spring to fall where they peak at a slightly higher length. There does not appear to be as high a preponderance of males in the population in 1985 as we saw in 1983-1984. Figures 5a and 6a show normalized catches for Louisbourg and Canso holes. We can from these maps pick out patches of high concentrations of shrimp. These concentrations do not appear to be correlated with depth (Figures 5b and 6b) and do not seem to follow close to the 100 fm contour as believed by most fishermen.

When we consider biomass estimates we see an all-time low value in April 1985 (Figure 7). This may be the reason that fishing dropped off so drastically in the spring of this year. There is also a definite increase each year from spring to fall in the numbers of larger shrimp (fishable biomass) in the stock.

As an index of stock health, the number of ovigerous females was compared to those non-ovigerous (Table 5). In the fall virtually all females are ovigerous; in our sampling approximately 99 out of 22,000 were not.

Midway through the fall cruise of 1984 the trawl doors used on research surveys were changed from the older type of wooden construction to the newer steel doors. The size remained exactly the same and the weight very similar, but it appeared that the steel doors may have been fishing more off the bottom than the older wooden ones. Catches had less mud and brittlestars in them; and (Table 6) catch rates apparently increased for silver hake and miscellaneous species (mostly dogfish) and decreased for shrimp, redfish, and flatfish (these being the animals found more closely inhabiting the ocean bottom). This may indicate that the catch rates for shrimp in 1985 are a slight underestimate compared to years before. However, looking at Table 7 there seems to be no marked difference between the research catch percentages over the past 4 yrs.

Larval tows done in the spring (Figure 8) revealed *P. borealis* present both in the shallower waters (60-70 fm) of Chedabucto Bay and in Canso Hole (80-110 fm). *P. montagui*, although found in both areas, was in much higher concentrations in the Bay. It is interesting to note that *P. montagui* tends to live in shallower waters than *P. borealis* and this is where the majority of its larvae were found.

Commercial Data

Commercial data for this report came from the logbooks and the Foreign and Domestic Quota Monitoring Unit, Fisheries Operations Branch. The logs were at about 30% coverage with the official statistics for these areas. Effort was down considerably this year with only four boats (all from N. B.) reporting catches, when last year 16 boats fished the Cape Breton area. The average yearly commercial catch rate (corrected values for Yankee 36 trawl) for Canso was 21.1 kg/h, quite a bit less than last year's value of 92.2 kg/h (Table 3). For Louisbourg it was 41.1 kg/h, also down from last year's value of 72.1 kg/h (one should note that this information was taken strictly from log information received and that log coverage was down 40% this year along with the decreased effort). Misaine did not report any catches at all this year. The overall average catch rate was 40.7 kg/h, down from last year's value of 78.0 kg/h (Table 4). This is the lowest CPUE ever recorded, approximately half the value of other years. Table 8 shows commercial catch rates according to gear type. There appears to be a substantial difference between the two types in use in 1985, indicating a need for the correction factors used. In past years this gear difference has not been evident.

Anecdotal information suggests that because of good catches in the Gulf of St. Lawrence this year most of the N. B. vessels did not venture to the Cape Breton area. The smaller inshore vessels from N. S. which exploited only Canso hole last year found catches so poor at the end of the season that they did not attempt to fish there again this year. Indeed the research catch per tow for Canso this year was 18.5 kg/h (see table in "Biomass Estimates" section). Louisbourg was the area of almost all of the fishing activity, presumably because of its tradition of larger animals.

Table 3 does not show the usual pattern seen in past years, of higher catch rates in the first few months dropping rapidly as the season goes on, but rather a fairly steady rate throughout the season, approximating 40 kg/h (except for one exceptional trip in July).

Figure 9 shows monthly catch rates from the commercial fishery and research cruises starting in 1977. The commercial catch rates show a general falling trend through the years, although 1982 and 1985 are slightly different. In these two years the research catch rates are similarly very low. It is interesting to note that after 1982's low values, 1983 was a peak year.

Biomass Estimates

For each hole the biomass was estimated by areal expansion, where the horizontal opening of the research gear was assumed to be 36 ft. The standard tow was 1/2 h at 2.5 knots giving a length of 1.25 nautical miles and a swept area of approximately 1/135 of a square nautical mile. The areas of the three holes measured by polar planimeter (using the 100 fm contour) were 276.4, 472.2, and 442.2 square nautical miles for Canso, Louisbourg, and Misaine respectively. The tows were not corrected for length as defined by the start and end positions. Tow lengths as seen in Figure 10, ranged from 1.37 to 2.07 km. Since longer tows show no relation to higher catches there seems to be no need to correct for tow length (although greater precision during the tows would be advantageous). The average catch rates from the research cruises were standardized to Western 2A catch rates by multiplying by 1.5 to account for the vertical distribution above the Yankee 36 (Labonte 1980).

Biomass, standard error, and proposed catch levels from survey data, 1985 (t).

Area	Cruise			Recommended catch levels*
	April	October	Average	
Canso	1138±199	940±288	1035	360
Louisbourg	1244±262	4595±772	3101	1090
Misaine	2384±406	3157±907	2770	970

* Rounded to the nearest tens

Average catch (kg) per tow from research cruises.

Year	Area		
	Canso	Louisbourg	Misaine
1982	52.8	42.2	32.6
1983	126.3	77.1	119.4
1984	57.0	55.0	71.3
1985	18.5	32.4	30.8

The catches starting from high values in 1983 have declined significantly each subsequent year.

Recommended Catch Levels

The recommended catch levels were derived from the biomass estimates using an exploitation rate of 35% as was used in previous analysis and recommended by CAFSAC.

Quotas (t).

Year	Canso	Louisbourg	Misaine	Total
1980	1086	1553	2382	5021
1981	--	--	--	--
1982	1000	1400	1800	4200
1983	1400	2000	2400	5800
1984	1400	1800	2500	5700
1985	1350	1790	2420	5560
*1986	360	1090	970	2420
**1986	1210	1690	2180	5080

* Proposed values.

** Values based on the average of biomass estimates from 1978-86.

The proposed quotas for 1986 are down from 1985, approximately half of any previous values seen. When we determine the average biomass estimate for the last 8 yrs (Table 9) we have quota values very close to previous years.

Discussion

Biomass estimates are down considerably this year, due mostly to very low catch rates in the spring research survey. Even so, these values are still below any level of exploitation seen in this fishery in past years. The large preponderance of males seen in 1984 did not appear as transitionals or females in 1985. Instead we see a distribution very similar to 1982. In Canso Hole, abundance fell more than the other areas suggesting some independence between the three areas. 1982 and 1985 seem very similar in their patterns as far as research information is concerned. We see an increase in research catch rates as the season wears on for both of these years, compared to a decrease in catch rates in other years. Commercial data basically go along with this trend. This may indicate an oscillatory biomass, driven probably by biotic and/or environmental factors, as exploitation would appear to be too small to affect this resource.

In the crab fishery in recent years, the proportion of ovigerous females in the population has fallen. In order to establish a similar measure we have initiated reporting of ovigerous females. In the larval work done it is interesting to note that *P. montagui* larvae were seen in surprising numbers in the deeper waters where adults of this species are not commonly found. Instead, in these areas 99% of the adults caught in research tows would be *P. borealis*.

References

- Labonté, S. S. M. 1980. An assessment of shrimp stocks off southeast Cape Breton, South Esquiman and North Anticosti. Can. Atl. Fish. Adv. Comm. Res. Doc. 80/67.

Table 1. Tow information from scientific research cruises.

Cruise	Area	Tow #	Depth (fm)	Bottom temp.	Shrimp (kg)	Total (kg)	
April 1985	Canso	1	104	3.4	17	35	
		2	106	3.3	9	34	
		4	110		3	21	
		5	119	4.6	23	74	
		6	100	2.8	23	49	
		7	112	3.5	17	51	
		8	127	2.6	22	54	
		9	119	3.7	39	68	
		10	110		30	97	
		Louisbourg	14	155		6	67
	15		151		17	89	
	16		131		7	201	
	17		150		21	88	
	18		155		16	99	
	19		141		23	79	
	20		137		13	102	
	21		144		1	159	
	Misaine		11	141		1	644
			12	112		33	76
			13	101		21	54
		22	126	3.8	25	79	
		23	140		26	118	
		24	125	1.2	13	59	
		25	147		46	157	
		26	138		21	88	
		27	109		49	152	
		28	111		30	55	
	October 1985	Canso	1	105	2.8	5	249
2			105	2.8	7	455	
3			105	2.8	12	159	
4			110	3.2	51	201	
5			107	3.0	5	16	
7			120	3.2	10	85	
8			116	3.2	4	77	
9			131	3.7	10	187	
10			150		25	121	
11			130	3.4	39	78	

...Contd.

Table 1. Contd...

Cruise	Area	Tow #	Depth (fm)	Bottom temp.	Shrimp (kg)	Total (kg)
	Louisbourg	20	142		77	135
		21	134	5.3	55	156
		22	130		63	626
		23	110		71	183
		24	132	4.5	67	258
		25	152		30	79
		26	152	4.9	10	65
		27	157		36	120
		28	177	4.1	7	190
		29	125	3.7	64	373
	Misaine	12	112		19	110
		13	140		19	135
		14	110		25	153
		15	127		15	138
		16	136	3.2	8	135
		17	116	3.6	8	64
		18	164	2.0	35	66
		19	135		61	114
		30	124	2.5	111	344
		31	143		50	165

Table 2. Percentage catch composition of shrimp tows.

Species	April		May	June	July	October	
	Com*	Cru**	Com*	Com*	Com*	Com*	Cru**
Shrimp	55.1	19.4	64.8	32.6	24.6	55.3	19.1
Cod	23.3	21.1	10.6	3.2	2.4	5.5	12.9
Redfish	0.7	28.9	21.3	56.9	70.9	34.5	24.1
Flatfish	19.6	14.4	2.4	0.8	1.2	3.2	6.7
Hake			0.2	0.1	0.1	0.9	31.0
Halibut	1.0	0.2		4.7	0.2		
Haddock	0.3	0.1	0.5		0.5	0.6	0.3
Pollock			0.2	1.7	0.1		0.6
Misc	15.9						5.3
Total shrimp catch (kg)	756	552	17903	10593	2455	8429	999

* Commercial log data.

** Research cruises.

Table 3. Monthly commercial information for Canso and Louisbourg areas (1985).

	April	May	June	July	October	Yearly
Canso:						
Catch (kg)	216			223		439
Effort (un)	12			4		16
Effort (cor)	15.6			5.2		20.8
CPUE	13.8			42.9		21.1
Louisbourg:						
Catch (kg)	540	17182	10593	2232	8429	38976
Effort (un)	23	274	90	15	105	507
Effort (cor)	29.9	508.8	180.0	19.5	210.0	948.2
CPUE	18.1	33.8	58.9	114.5	40.1	41.1
Both areas:						
Catch (kg)						39415
Effort (un)						523
Effort (cor)						969.0
CPUE						40.7

Table 4. Scotian Shelf commercial shrimp landings and standardized (Yankee 36) CPUE.

Year	Catch(t)				CPUE (kg/h)
	Canso	Louisbourg	Misaine	Total	
1977				269	105
1978				306	97
1979	534	295	8	838	128
1980	360	491	133	984	97
1981	10	418	26	454	93
1982	201	316	52	569	80
1983	512	483	15	1010	81
1984	318	600	10	928	78
1985	15	118	--	133	41

Table 5. Numbers of ovigerous/non-ovigerous individuals in samples from research cruises.

	Spring				Fall			
	Apr82	May83	May84	Apr85	Nov82	Nov83	Oct84	Oct85
Non-ovigerous females	2638	1330	2574	3211	52	11	15	21
Ovigerous females	650	2085	12	246	7016	2917	5716	6551

Table 6. Catch rates (kg/h) by species comparing wooden and steel trawl doors in the October 1984 research cruise (Canso and Misaine stations only).

Species	Wooden	Steel
Shrimp	123.6	64.6
Cod	77.6	78.2
Redfish	56.7	29.1
Flatfish	114.9	29.3
Hake	281.6	374.0
Halibut	--	4.0
Haddock	1.3	2.2
Miscellaneous	22.0	49.3
Total catch (kg)	677.8	631.1

Table 7. Catch rates in kg/h (left-hand column) and percentages (right-hand column) of individual species in research cruises (1982-85).

Cruise	Shrimp	Cod	Redfish	Flatfish	Hake	Misc.	Total
Apr 82	59 20	78 26	75 25	35 12	-- --	53 17	300
Nov 82	120 21	119 21	50 9	81 15	141 25	48 9	559
May 83	230 37	111 18	173 27	50 8	-- --	63 10	627
Nov 83	185 33	94 17	19 3	68 12	132 23	67 12	565
May 84	158 22	168 24	298 42	35 5	-- --	47 7	706
Oct 84*	86 13	118 18	113 17	58 9	231 36	47 7	653
Apr 85	41 20	45 21	61 29	30 14	-- --	34 16	211
Oct 85	67 19	45 13	84 24	23 7	108 31	22 6	349

*Change of trawl door.

Table 8. Catch rates (kg/h) for commercial boats off southwestern Cape Breton, 1985.

No. of boats	Gear type	Area			Cor. factor
		Canso	Louisbourg	Both	
2	Western 3A	--	82.48	82.48	2
2	Yankee 41	27.44	52.26	48.65	1.3

Table 9. Research vessel biomass estimates (t).

Year	Area		
	Canso	Louisbourg	Misaine
1978	3900	5600	--
1979	2900	4300	9600
1980	--	--	--
1981	3000	4100	5000
1982	3000	4000	2900
1983	7100	7400	10700
1984	3190	5260	6410
1985	1040	3100	2770
Average	3450	4820	6230

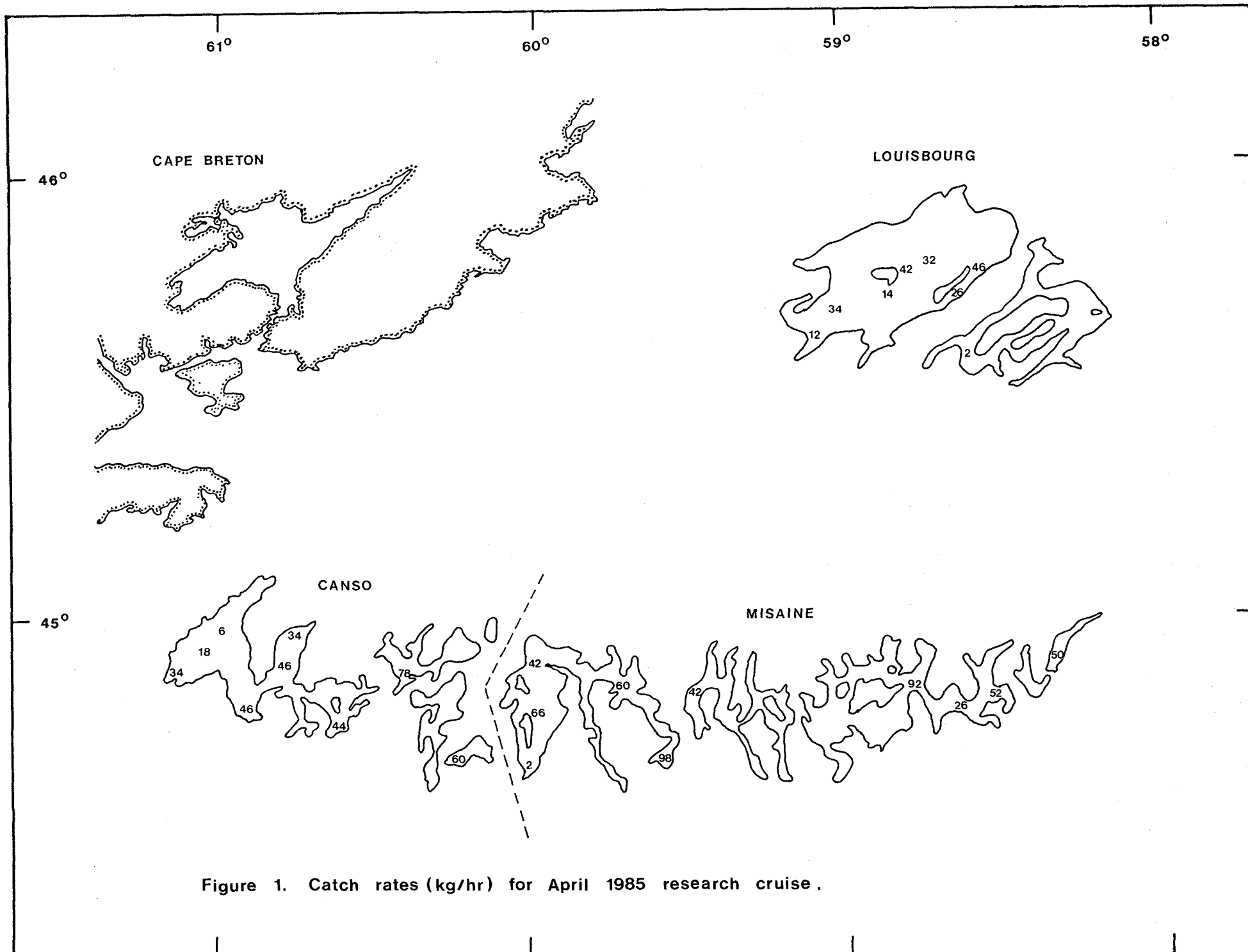


Figure 1. Catch rates (kg/hr) for April 1985 research cruise.

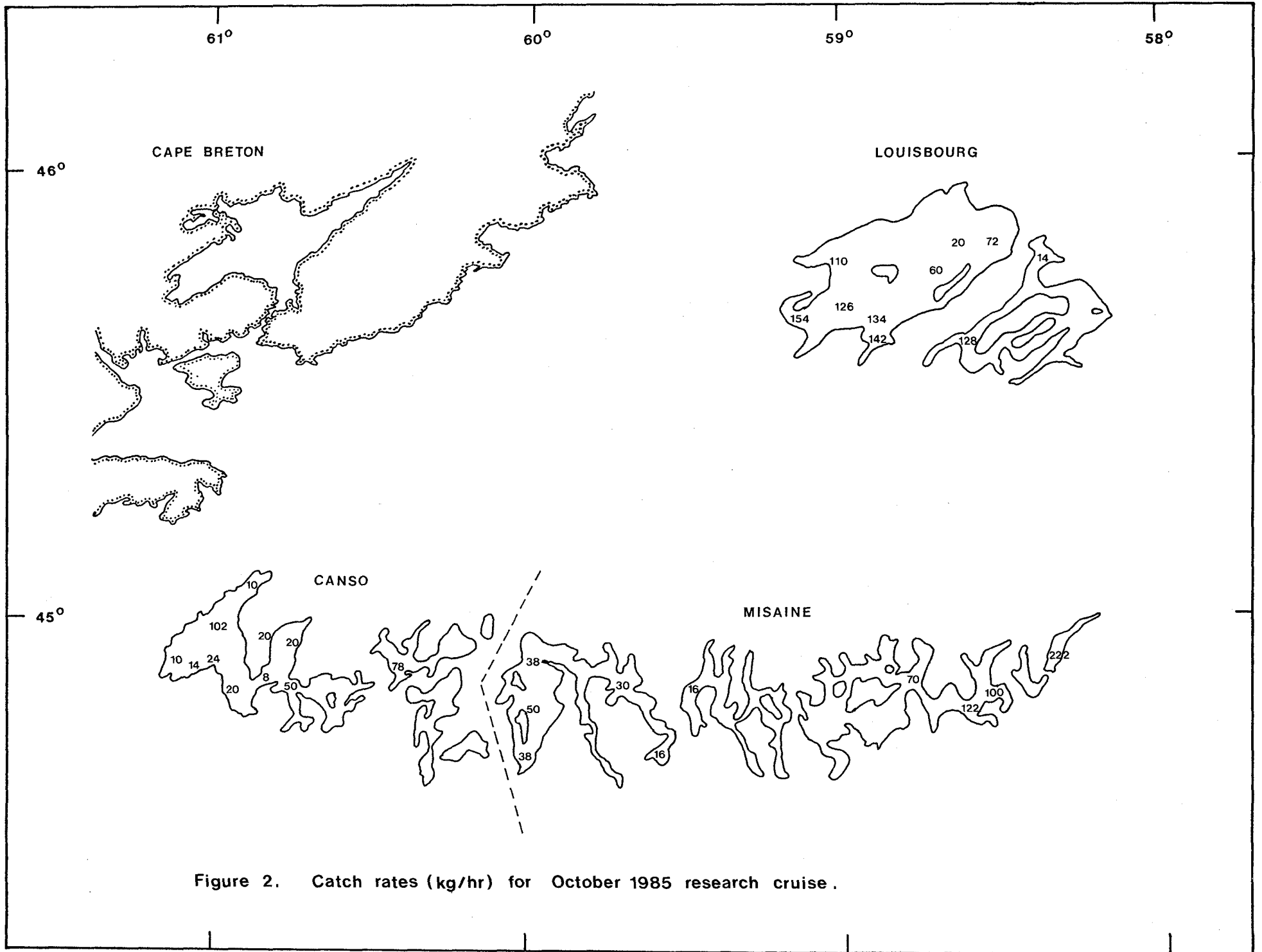
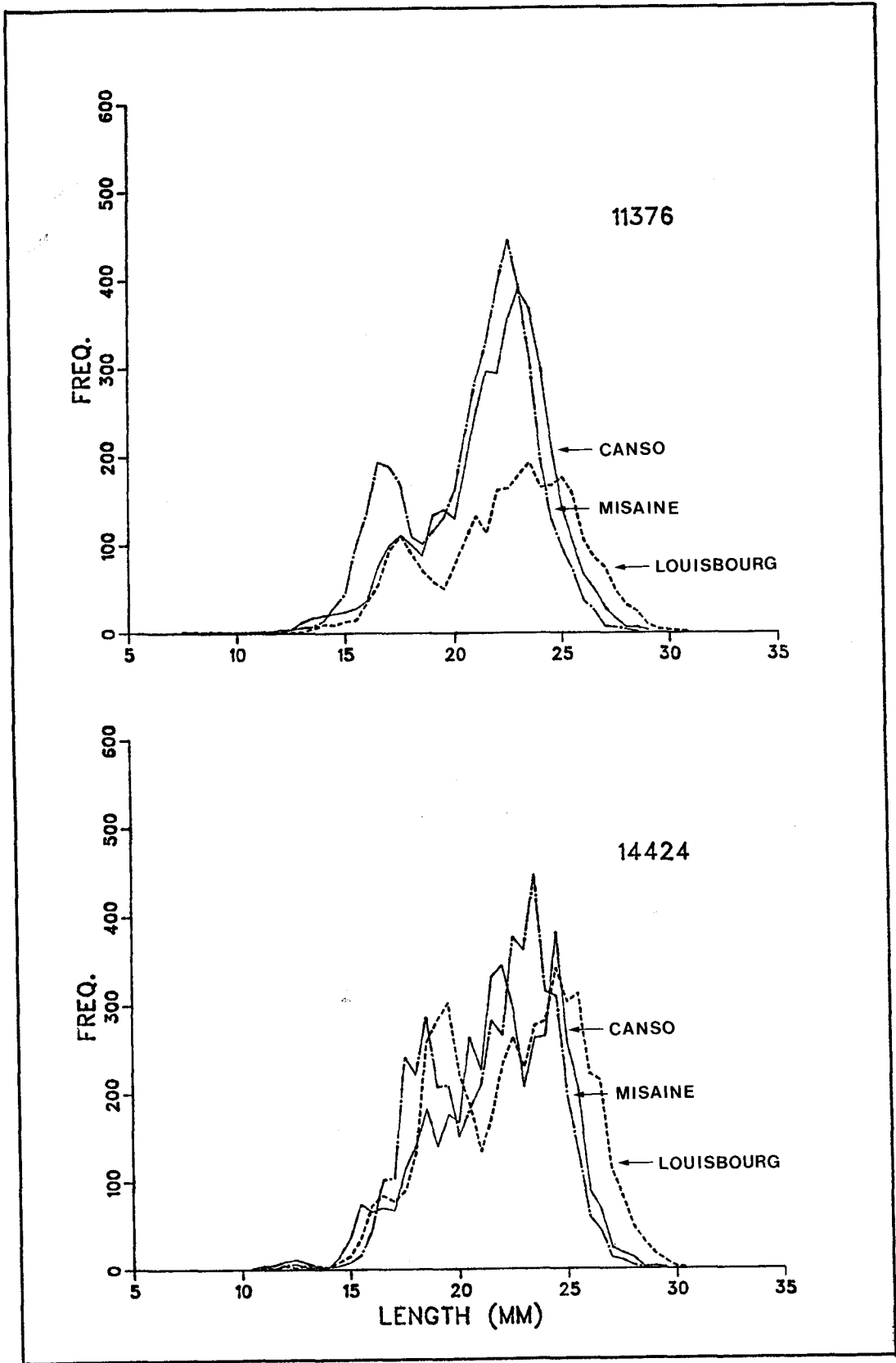


Figure 2. Catch rates (kg/hr) for October 1985 research cruise.



APRIL

OCTOBER

Figure 3. Shrimp length frequencies by area, 1985.

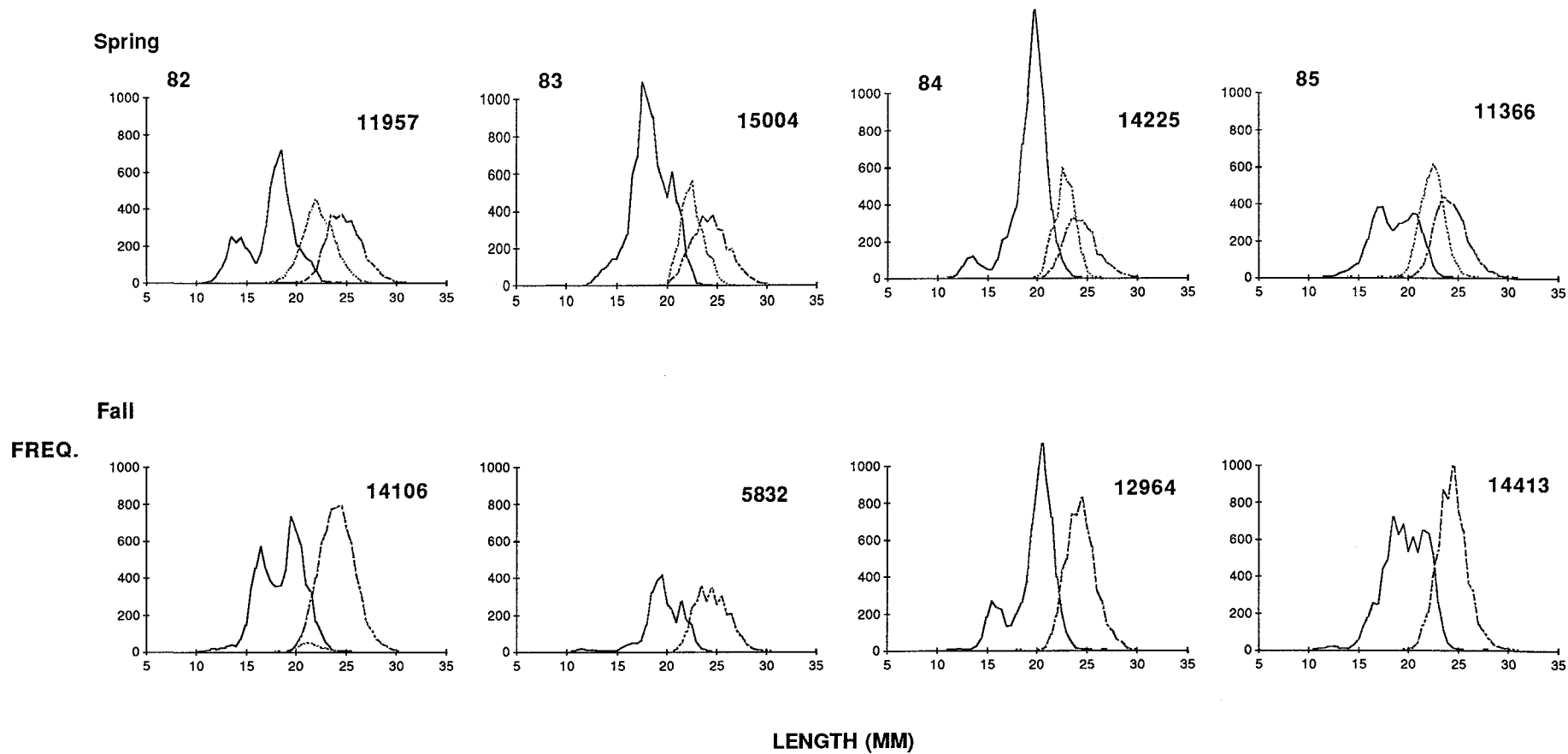
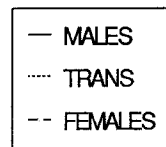


Figure 4. Shrimp length frequencies by sex. (1982-1985)



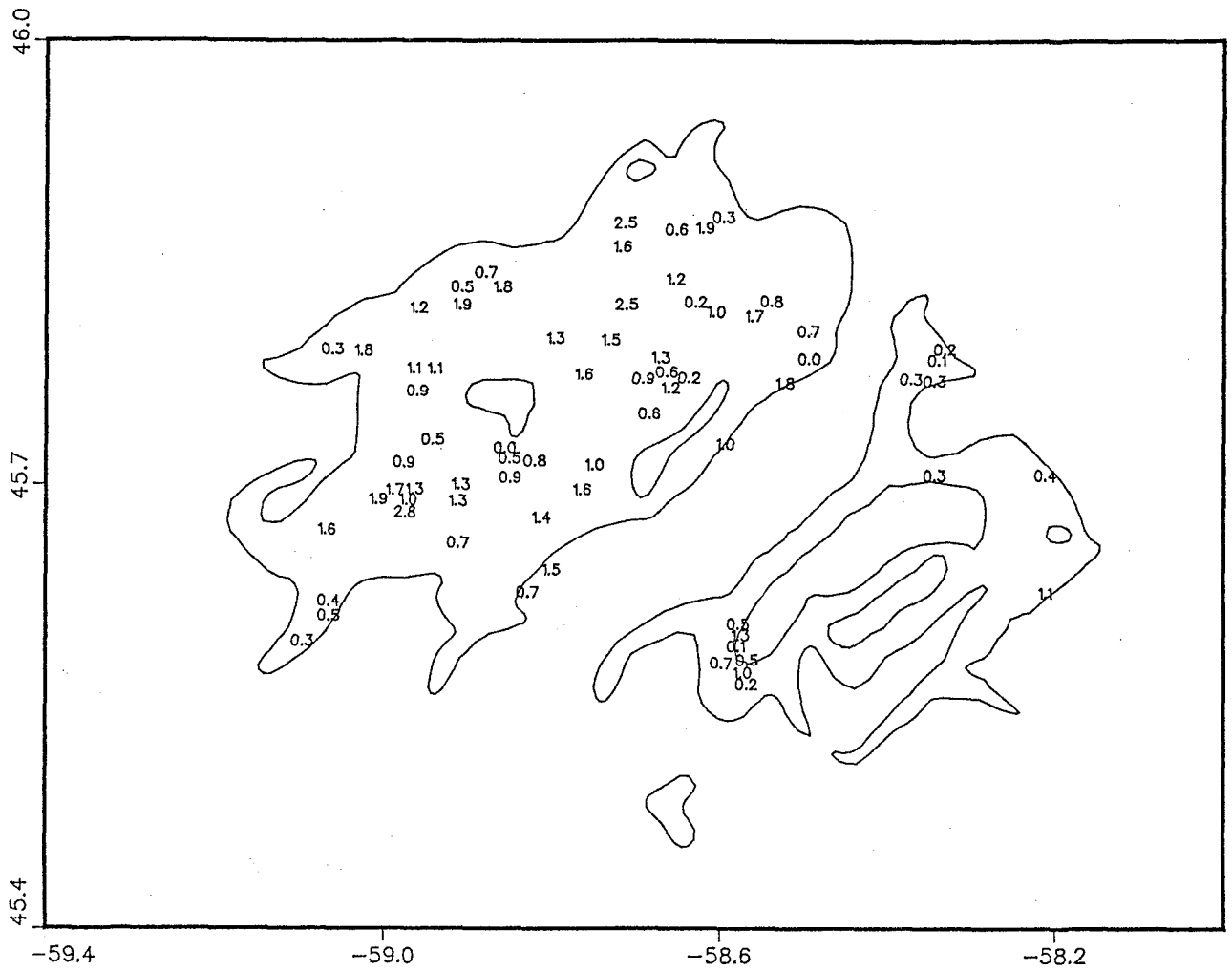
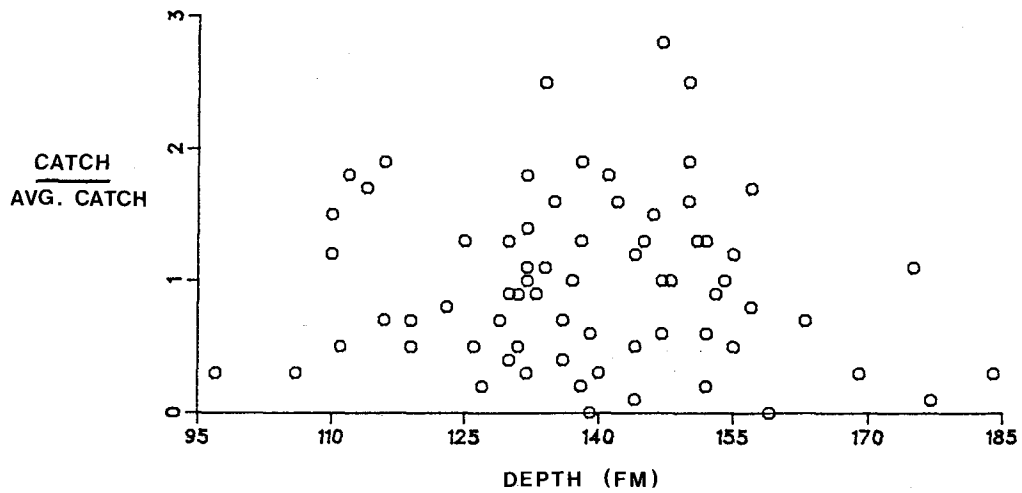


Figure 5a. Normalized catches. (Louisbourg)



5b. Normalized catches verses depth. (Louisbourg)

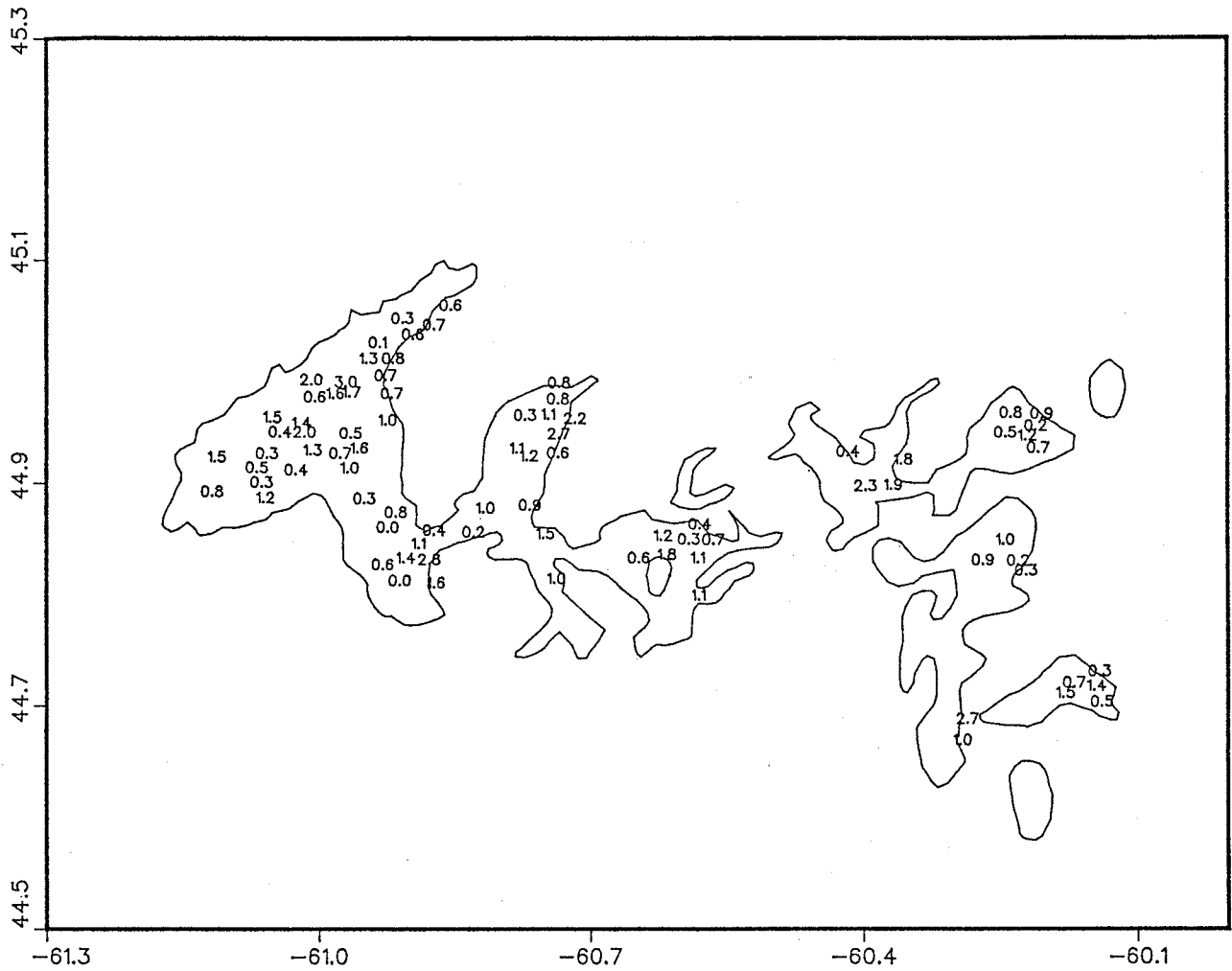
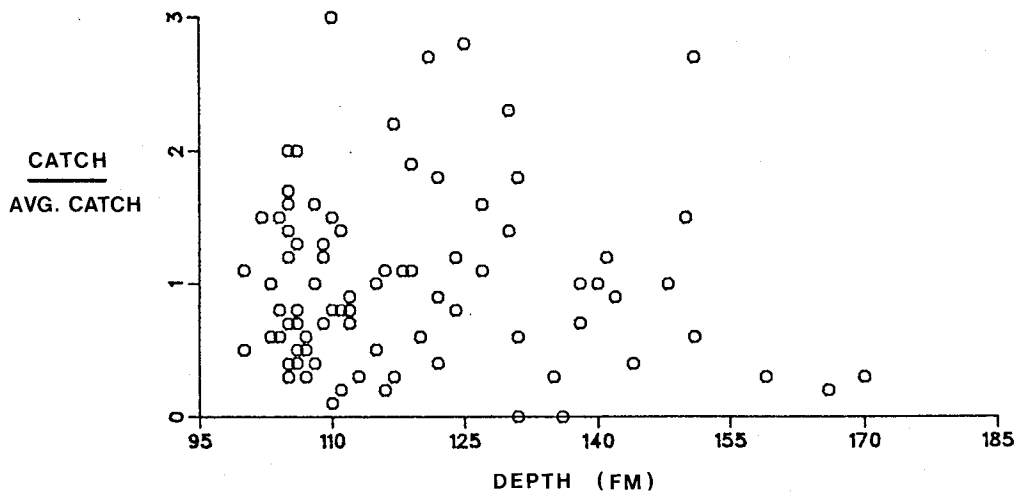


Figure 6a. Normalized catches . (Canso)



6b. Normalized catches verses depth. (Canso)

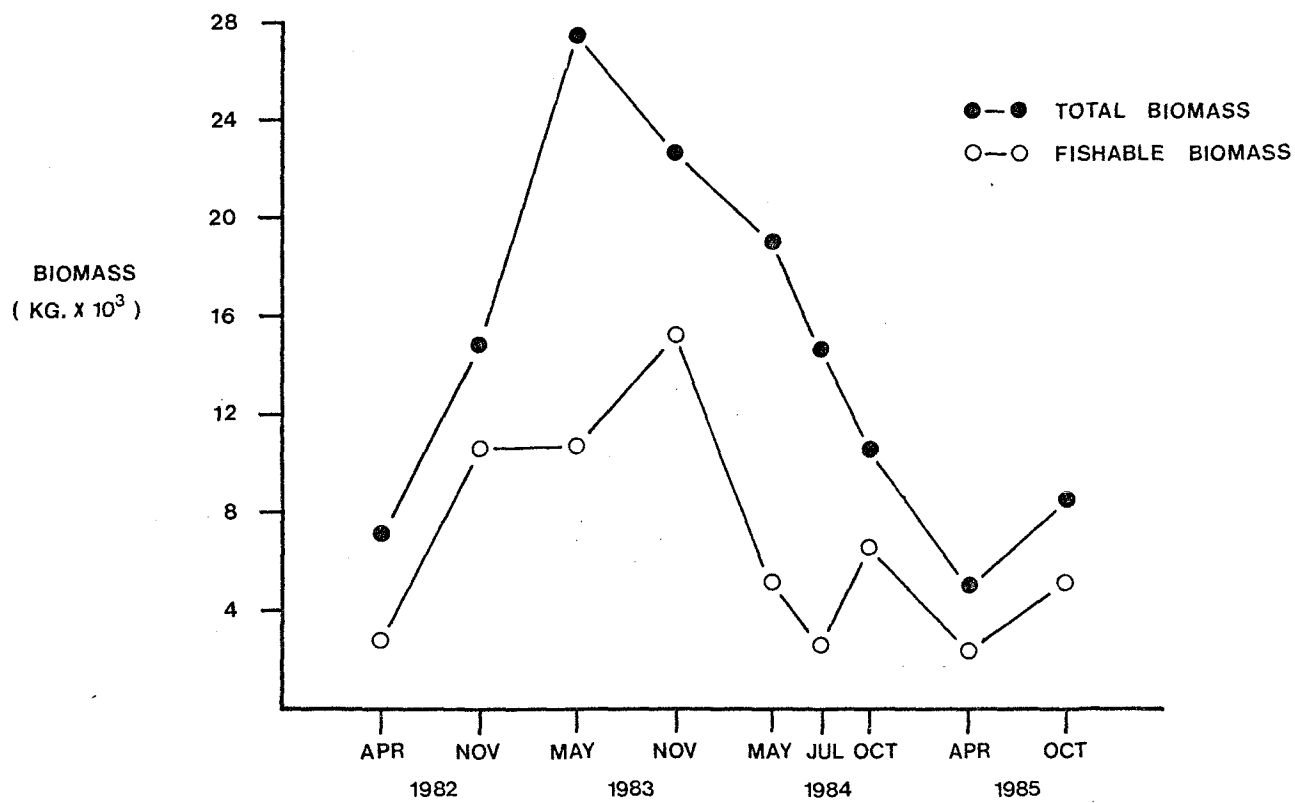


Figure 7. Biomass estimates from research cruises .

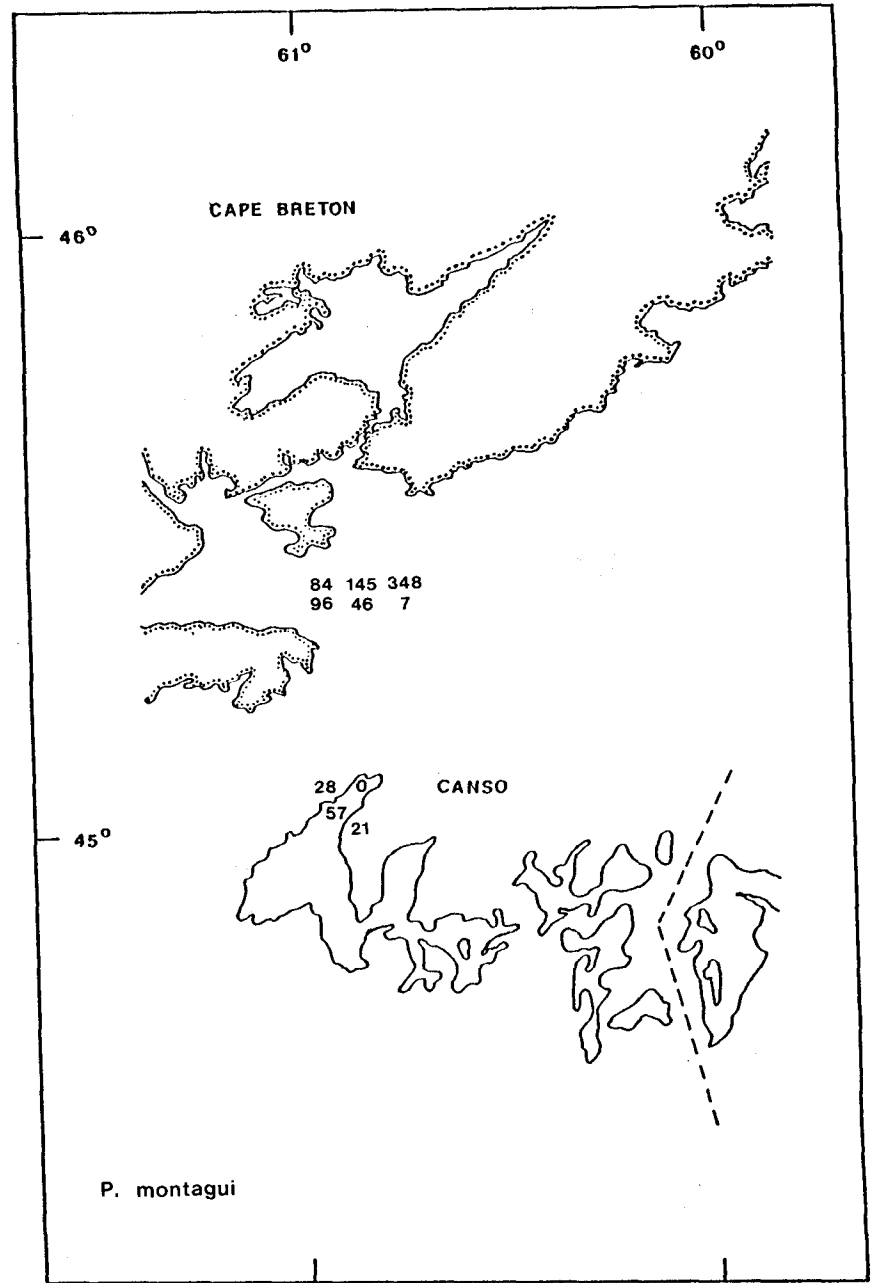
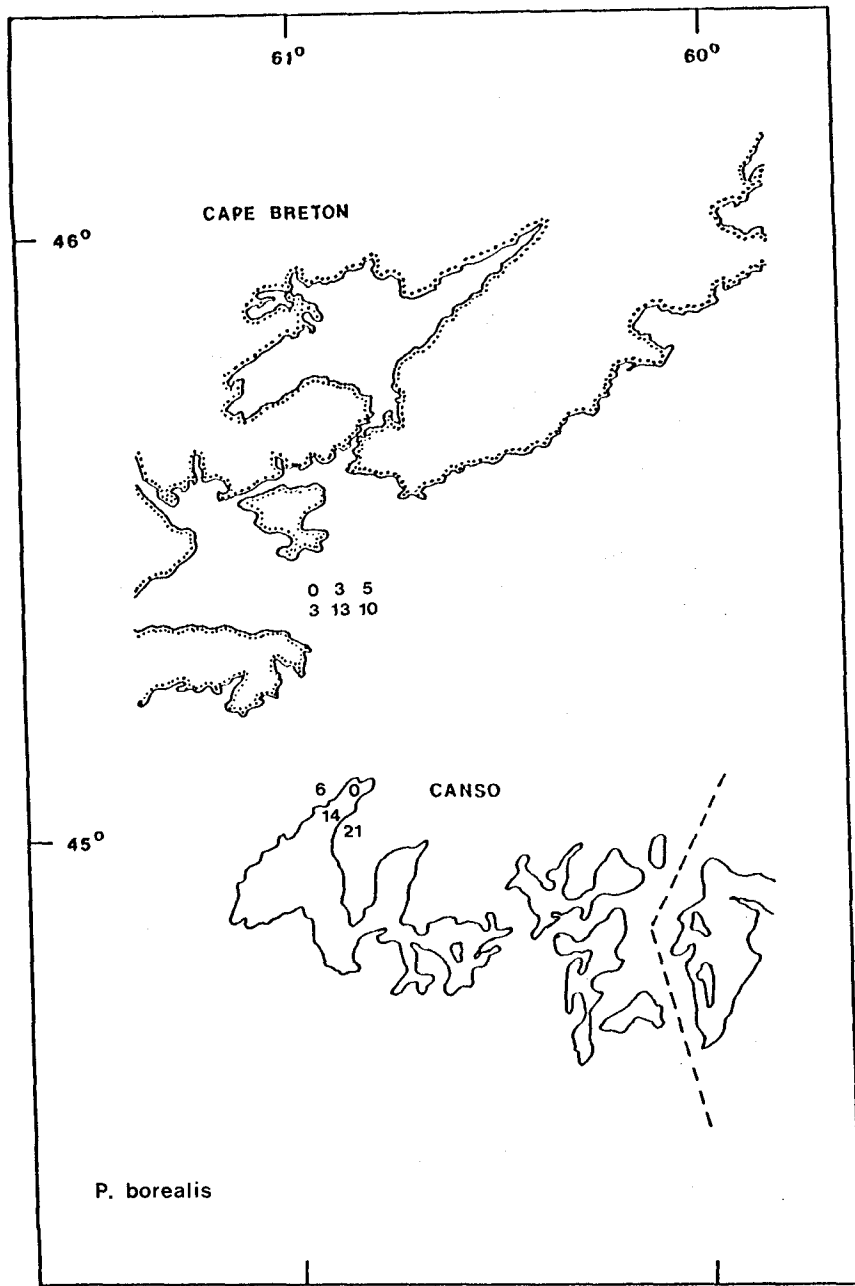


Figure 8. Numbers of larvae present in plankton tows. (Spring 1983, 1985)

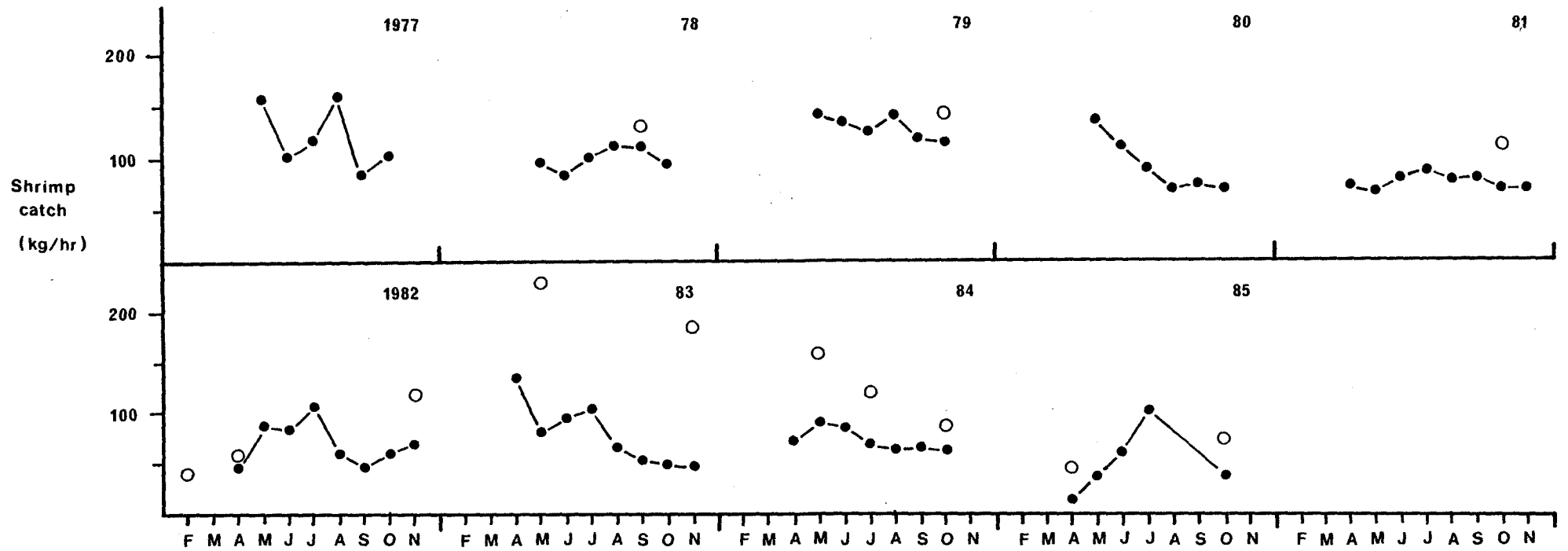


Figure 9. Shrimp catch rates by month from 1977-85.

○ research cruises
 ●— commercial boats (standardized)

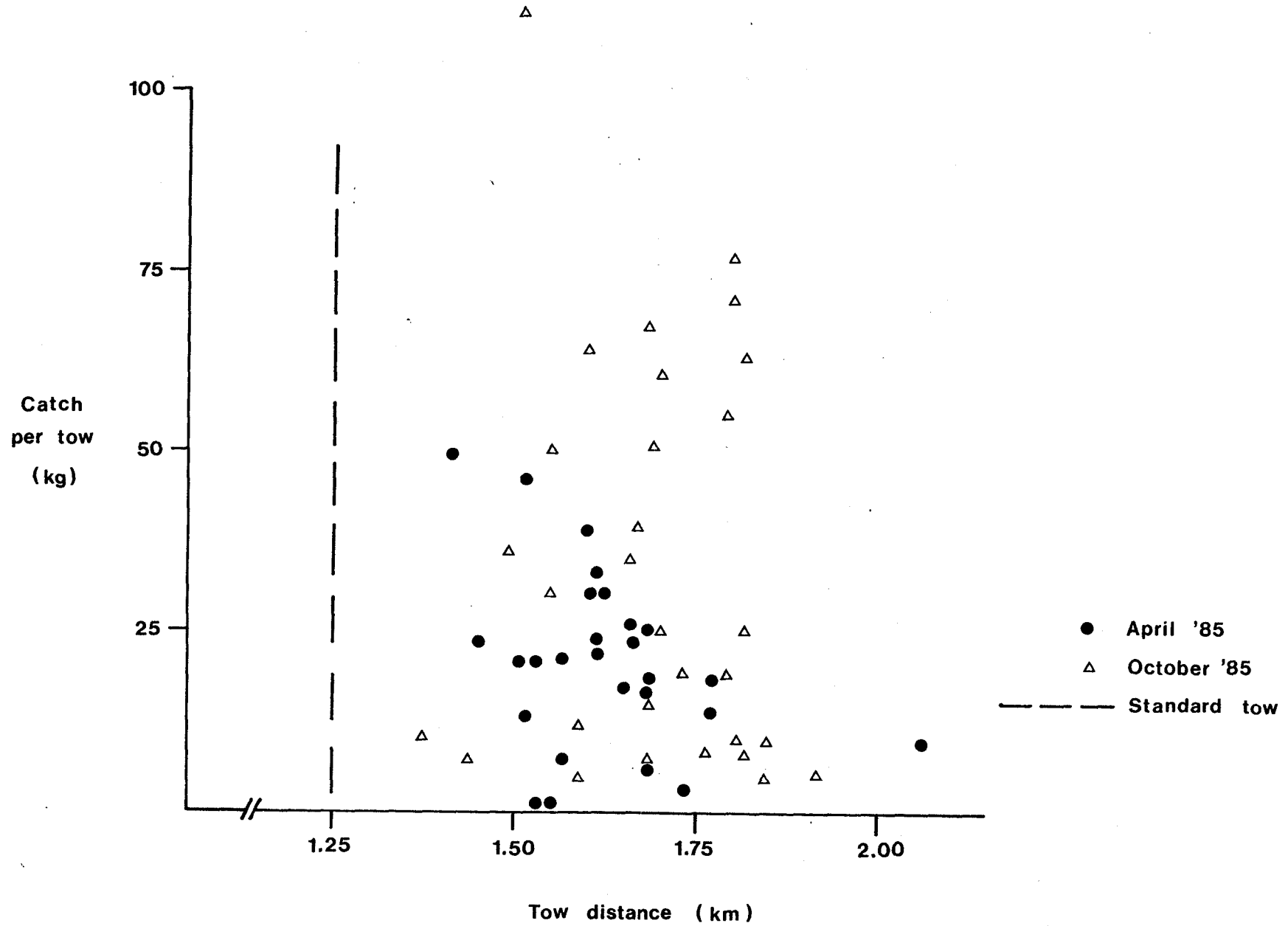


Figure 10. Shrimp catch per tow verses tow distance from research cruises.