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Scotia-Fundy Shrimp Stock Status - 1986

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, as in 1986 only 126 t (3.3%) of the total quota of 3800 t (8.6% of the Louisbourg quota of 1460 t) were taken. This represents an exploitation rate of 1.8% based on the total biomass estimate. Two research cruises were done in 1986 (May and October) resulting in decreased catch rates in Canso but slightly increased rates in Louisbourg and Misaine compared to last year's values. The proposed total catch level for 1987 for all three areas is 2450 t.

Résumé

La zone de pêche de la crevette rose (Pandalus borealis) de la région Scotia-Fundy englobe trois cuvettes d'une profondeur supérieure à 100 brasses : cuvettes de Canso, de Louisbourg et de Misaine. Au cours des dernières années, ces divers endroits ont été continuellement sous-exploités; en 1986, seulement 3,3 % (126 t) du contingent total de 3 800 t ont été récoltés (8,6 % du contingent de 1 460 t dans le cas de la cuvette de Louisbourg). Selon l'estimation de la biomasse totale, il s'agit d'un taux d'exploitation de 1,8 %. Deux campagnes de recherche ont été entreprises en 1986 (mai et octobre); on a observé des taux de capture plus faibles dans le cas de la cuvette de Canso, mais légèrement plus élevés dans le cas des 2 autres cuvettes, par rapport aux données de l'année précédente. Le niveau de prise total proposé en 1987 pour les trois cuvettes est de 2 450 t.

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 shrimp catches from research cruises are corrected taking tow length into account. 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 have not been changed from year to year to save searching time for fishable bottom.

The shrimp fraction by weight, approximately 12% of the total catch (Table 2), is a slightly lower value than determined from previous 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 (Table 2). Table 3 showed an increase in by-catch in the spring of 1986 specifically silver hake and cod. In Canso, the spring cruise had a high catch rate of silver hake and the lowest catch rate of shrimp ever seen in research cruises. The silver hake (never present in a spring cruise before) were all approximately the same size at 25 cm.

The length-frequency distribution figures are based on measurement of carapace length, to 0.1 mm, and then grouped into 0.5 mm groupings. Figure 3 separates the data by area showing similar distributions for the three holes. Grouping the data by sex we get Figure 4, with the number at the top of each figure being the number of individuals in the total sample. In comparing the graphs from 1982-1986 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. When we follow the very high peak of males in the spring of 1984 through the fall of 1985 (where it is mature females) to the spring of 1986, we see that this strong year class apparently disappears.

Figures 5a and 6a show normalized catches for Louisbourg and Canso holes. We can from these maps pick out some 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 reported by some fishermen.

When we consider biomass estimates we see an all-time low value in April 1985 (Figure 7) with a very slight increase since that time. As an index of stock health, the number of ovigerous females was compared to those non-ovigerous (Table 6). In the fall virtually all females are ovigerous as in our fall sampling from 1982-1986, approximately 139 out of 28,600 females were not.

Bottom temperatures collected for approximately 40% of the research tows revealed a slightly increasing trend from 1982-1986 (Figure 10). When grouped by area in Figure 11, Canso stands out as being very warm this spring

and corresponds with the lowest shrimp catch rates ever recorded for this area.

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 34% coverage with the official statistics for these areas. Effort was low again this year with only four boats (all from New Brunswick) reporting catches. There was no fishing reported in the Canso and Misaine areas at all this year. The average yearly commercial catch rate (corrected values to Yankee 36 trawl) for Louisbourg was 58.1 kg/h (table 4), an increase from last year's value of 41.1 kg/h but still less than previous years. Table 3 shows the usual pattern seen in most years, of higher catch rates at the start of the season dropping off somewhat as the months progress. The total landings this year of 126 t are the lowest of the past 10 years and reflect a substantial decrease in effort since 1983's peak year (Table 5). Table 7 shows commercial catch rates according to gear type. After correction factors have been applied there appears to be a substantial difference between gear types, indicating perhaps overcorrecting and a need for research on trawl efficiency.

Figure 9 shows monthly catch rates from the commercial fishery and research cruises starting in 1977. The commercial catch rates show a falling trend through the years, although 1982 and 1985 are slightly different in that they don't really reflect a general decrease in catch rates during the season.

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. Tow lengths as seen in Figure 8, ranged from 1.2 to 1.9 km and show no relationship between longer tows and higher catches. The tows were however corrected for length as defined by the start and end positions. The catch rates (kg/tow) for all research cruises have been recalculated taking tow distance into account, resulting in generally lower average catch rates than previously stated. 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 (t) from survey data, 1986.

Area	Cruise			Recommended catch levels*
	May	October	Average	
Canso	341±162	585±226	457	160
Louisbourg	5561±1325	1953±290	3757	1320
Misaine	3938±1098	1700±347	2760	970

* Rounded to the nearest tens.

Average catch (kg/tow) from research cruises.

Year	Area		
	Canso	Louisbourg	Misaine
1982	56.8	41.4	34.2
1983	114.5	62.3	117.4
1984	45.6	44.5	57.0
1985	13.6	24.3	24.1
1986	8.2	39.3	30.7

The average catches starting from high values in 1983 have declined significantly each subsequent year until 1986, where they have still decreased in Canso but increased in Louisbourg and Misaine.

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	740	1460	1600	3800
*1987	160	1320	970	2450
**1987	1020	1500	1910	4430

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

The proposed quota of 2450 t (determined from the 1986 biomass estimate) is down substantially from previous years. However when you use the average biomass estimate for the last 9 years (table 8) you get a higher proposed quota of 4430 t which is closer to previous figures. Last year's quotas were determined on the average biomass of 1984 and 1985.

Discussion

The biomass estimates are very close to last year's values which are a considerable decrease from previous years. The fact that the last two years show a greatly decreased biomass from previous years suggests that in using a long-term average to determine recommended catch levels, one is ignoring a strong indication of a change in biomass. Even so, exploitation rates have never reached their quota levels. The abundance of shrimp in Canso seems to have fallen even more so in 1986 while Louisbourg and Misaine have regained some of their strength. The almost complete lack of shrimp seen in Canso in the spring of 1986 may be related to a high bottom temperature (Figure 11) and the sudden appearance of silver hake (Table 3), which are known to prey upon shrimp. This suggests an oscillatory biomass driven more so by biotic and/or enviornmental factors, than by fishing as the past two years saw virtually no commercial exploitation and very low research catch rates.

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)	Cor. (kg)	Total (kg)
May 1986	Canso	1	107		1	1	293
		2	100	5.2	2	1	244
		4	107	7.0	1	1	290
		5	124	7.0	2	2	494
		6	118		3	2	435
		7	106	6.2	29	26	274
		28	113	3.6	6	6	261
		29	127		28	20	141
		30	157		2	1	767
		33	118	6.3	1	1	638
	Louisbourg	8	152		80	60	170
		9	132		90	85	140
		10	150		26	22	598
		11	133	4.5	126	133	226
		12	136	4.7	28	25	115
		13	151		111	106	222
		14	160	4.7	49	43	76
		15	167		99	90	151
		16	212		4	4	66
		17	126	3.3	14	13	173
	Misaine	18	110	2.6	18	17	664
		19	137	2.1	106	99	583
		20	128	2.0	41	38	457
		21	167		27	22	162
		22	133		44	37	598
		24	125		48	45	235
		25	109	3.1	1	1	195
		26	111	3.1	118	109	217
		27	142	3.4	27	26	239
Total					1132	1036	9124

...Contd.

Table 1. Contd...

Cruise	Area	Tow #	Depth (fm)	Bottom temp.	Shrimp (kg)	Cor. (kg)	Total (kg)
Oct 1986	Canso	1	105		9	8	756
		2	106	2.6	5	4	237
		3	103	2.5	6	4	89
		4	109		13	9	129
		5	124	2.8	3	2	281
		6	118	2.7	11	8	259
		7	120		19	15	81
		29	118	3.6	4	3	689
		30	107	3.2	63	41	136
	Louisbourg	9	137		24	19	80
		10	150	4.4	32	25	110
		11	131		40	32	135
		12	149	4.6	30	24	75
		13	146	4.5	26	17	63
		14	144	4.5	48	35	124
		15	150		25	19	88
		16	140		16	11	59
		17	160	4.6	24	20	147
		18	139	3.8	3	2	386
	Misaine	19	130	2.5	45	34	163
		20	151	2.2	34	27	142
		21	100	2.2	38	28	125
		22	164		48	38	175
		23	136	3.0	6	5	743
		24	110	3.1	20	16	108
		25	128		10	7	65
		26	111	3.1	22	15	71
		27	125		22	15	175
		28	139	3.3	5	4	133
Total					651	487	5824

Table 2. Percentage catch composition of shrimp tows.

Species	May		June	Sept	Oct	
	Com*	Cru**	Com*	Com*	Com*	Cru**
Shrimp	54.8	12.4	40.8	64.5	40.6	11.9
Cod	5.5	30.3	4.3	7.5	2.1	10.9
Redfish	34.2	17.6	52.6	23.3	51.5	33.8
Flatfish	1.8	6.5	1.1	3.0	3.5	8.7
Hake	-	23.9	0.1	0.5	0.6	28.0
Halibut	-	-	0.5	-	-	0.3
Haddock	0.1	1.7	0.1	1.0	1.4	0.7
Pollock	3.6	0.3	0.6	0.1	0.2	1.2
Misc	-	7.3	-	-	-	4.5
Total shrimp catch (kg)	37554	1036	9902	7630	2354	487

* Commercial log data.
** Research cruises.

Table 3. Catch rates in kg/h (left-hand column) and percentages (right-hand column) of individual species in research cruises (1982-86).

Cruise	Shrimp		Cod		Redfish		Flatfish		Hake		Misc.		Total
Apr 82	58	20	79	27	72	24	35	12	--	--	52	17	296
Nov 82	120	21	117	21	50	9	87	15	147	26	48	8	569
May 83	212	37	100	17	160	28	47	8	--	--	58	10	577
Nov 83	169	33	83	16	16	3	58	11	122	24	62	12	510
May 84	132	24	140	25	222	40	30	5	--	--	31	6	555
Oct 84*	64	13	88	18	86	18	43	9	169	35	35	7	485
Apr 85	32	19	35	21	49	30	24	14	--	--	27	16	167
Oct 85	50	19	34	13	63	24	18	7	80	31	17	6	262
May 86	72	13	171	32	90	16	37	7	121	22	51	9	542
Oct 86	34	11	29	9	107	35	28	9	87	28	22	7	307

*Change of trawl door.

Table 4. Monthly commercial shrimp fishing information for Louisbourg area (1986).

	May	June	Sept	Oct	Yearly
Catch (kg)	37554	9902	7630	2354	57440
Effort (un)	405	87	118	48	658
Effort (cor)	660.0	113.1	153.4	62.4	988.9
CPUE	56.9	87.6	49.7	37.7	58.1

Table 5. Scotian Shelf commercial shrimp landings and standardized (Yankee 36) CPUE.

Year	Catch(t)				CPUE
	Canso	Louisbourg	Misaine	Total	(kg/h)
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
1986	--	126	--	126	58

Table 6. Numbers of ovigerous/non-ovigerous individuals in samples from research cruises.

		Non-ovigerous females	Ovigerous females
Spring	Apr 82	2638	650
	May 83	1330	2085
	May 84	2574	12
	Apr 85	3211	246
	May 86	1286	866
Fall	Nov 82	52	7016
	Nov 83	11	2917
	Oct 84	15	5716
	Oct 85	21	6551
	Oct 86	40	6396

Table 7. Catch rates (kg/h) for commercial boats off southwestern Cape Breton, 1986.

No. of boats	Gear type	Louisbourg Area	Cor. factor
1	Sput Nik	32.50	3.0
2	Yankee 41	66.41	1.3
1	Yankee 36	82.74	1.0

Table 8. Research vessel biomass estimates (t).

Year	Area		
	Canso	Louisbourg	Misaine
1978	3900	5600	--
1979	2900	4300	9600
1980	--	--	--
1981	3000	4100	5000
1982	3180	3970	3080
1983	6410	5970	10560
1984	2550	4250	5120
1985	760	2330	2170
1986	460	3760	2760
Average	2900	4290	5470

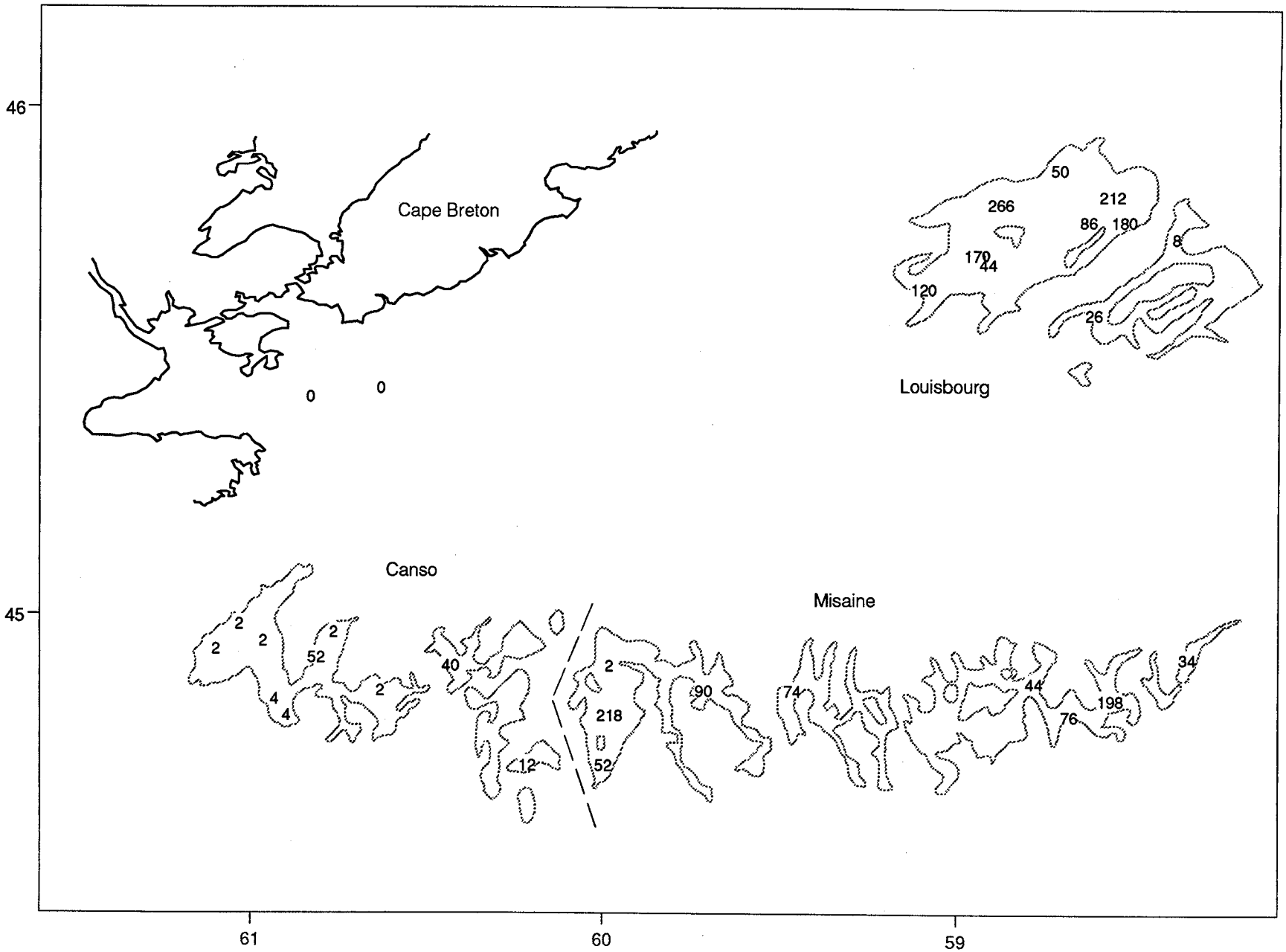

Figure 1: Shrimp catch rates (kg/hr) from research cruise, May 1986.

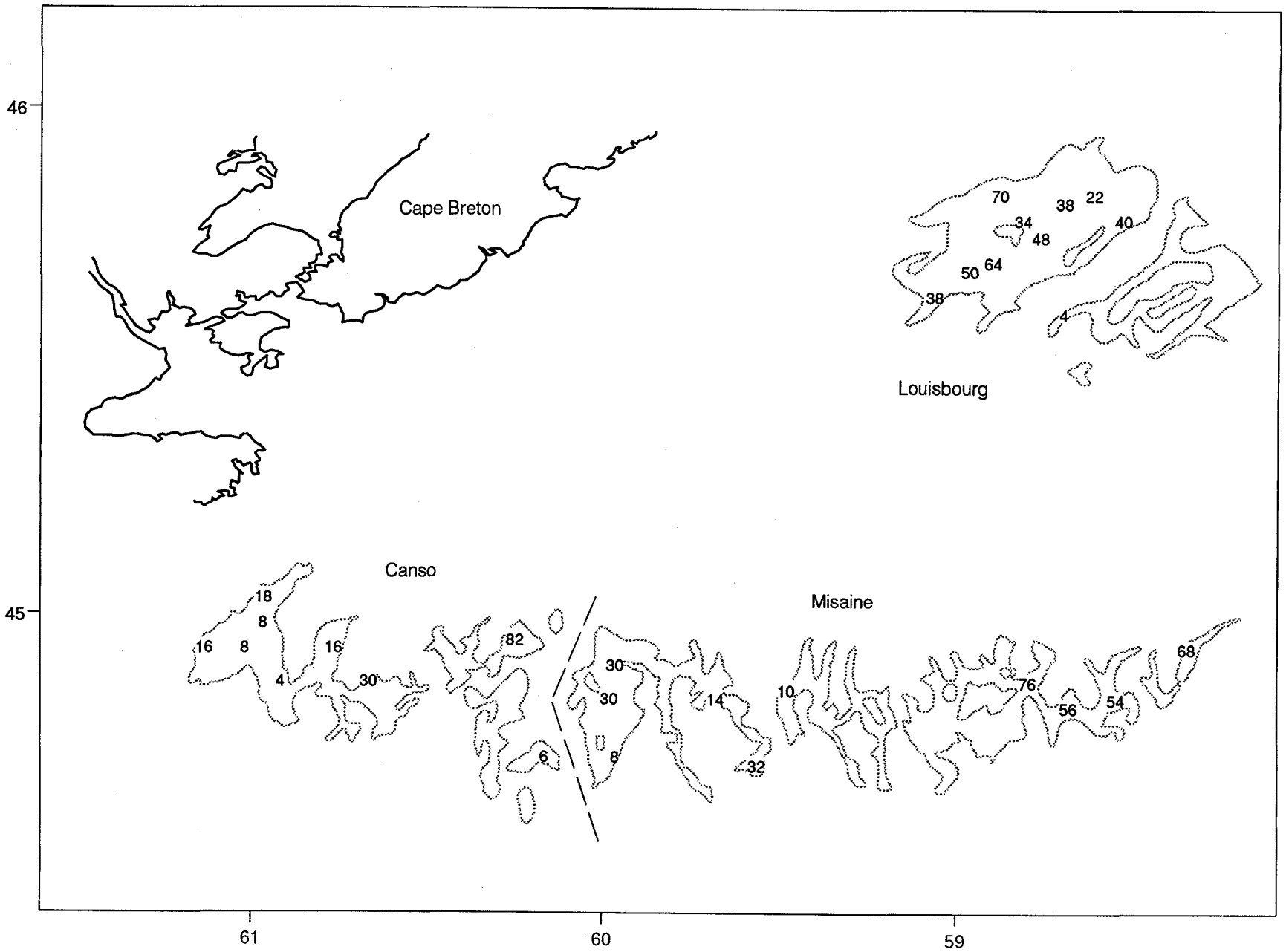

Figure 2. Shrimp catch rates (kg/hr) from research cruise, Oct 1986.

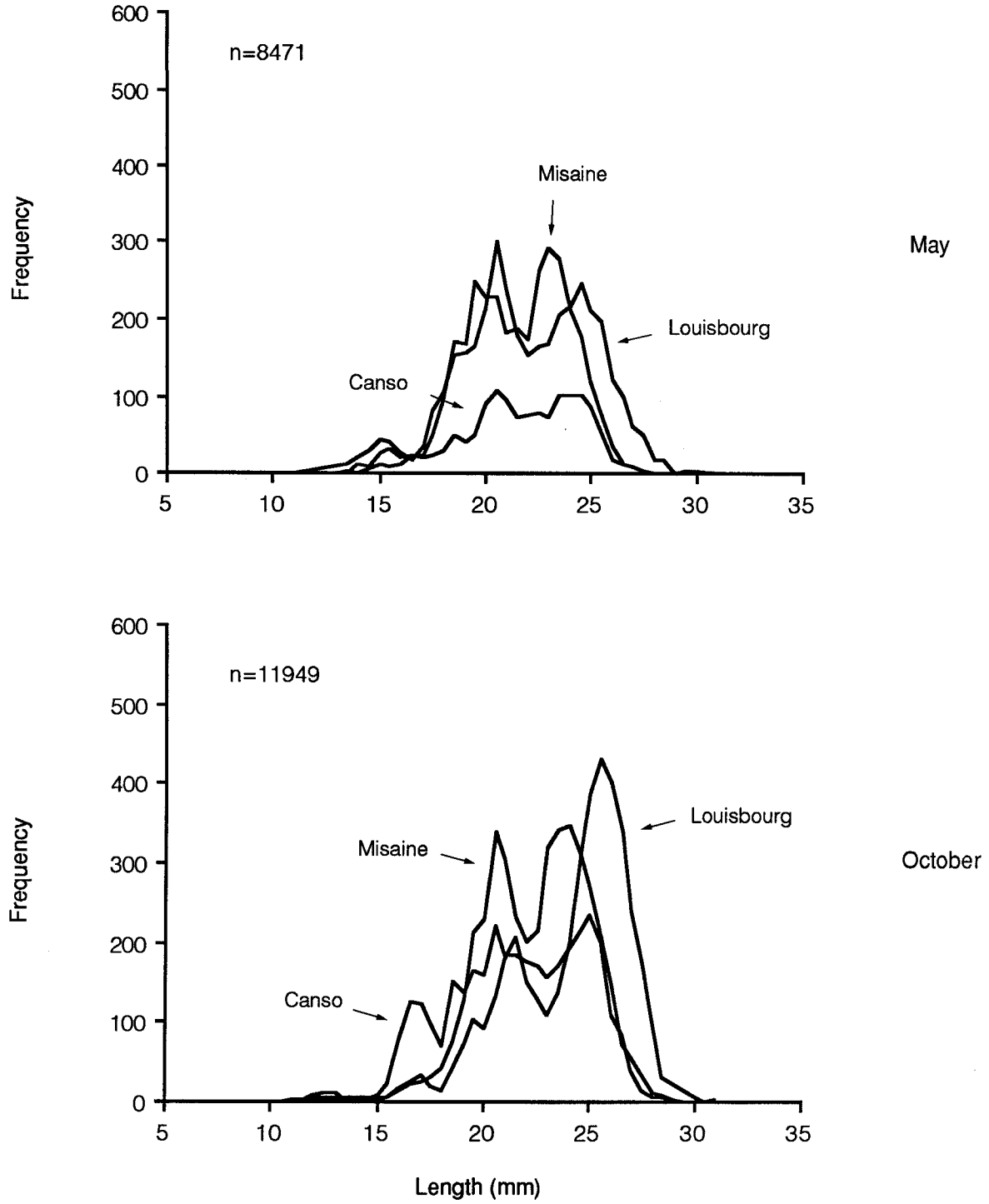

Figure 3. Shrimp length frequencies by area, 1986.

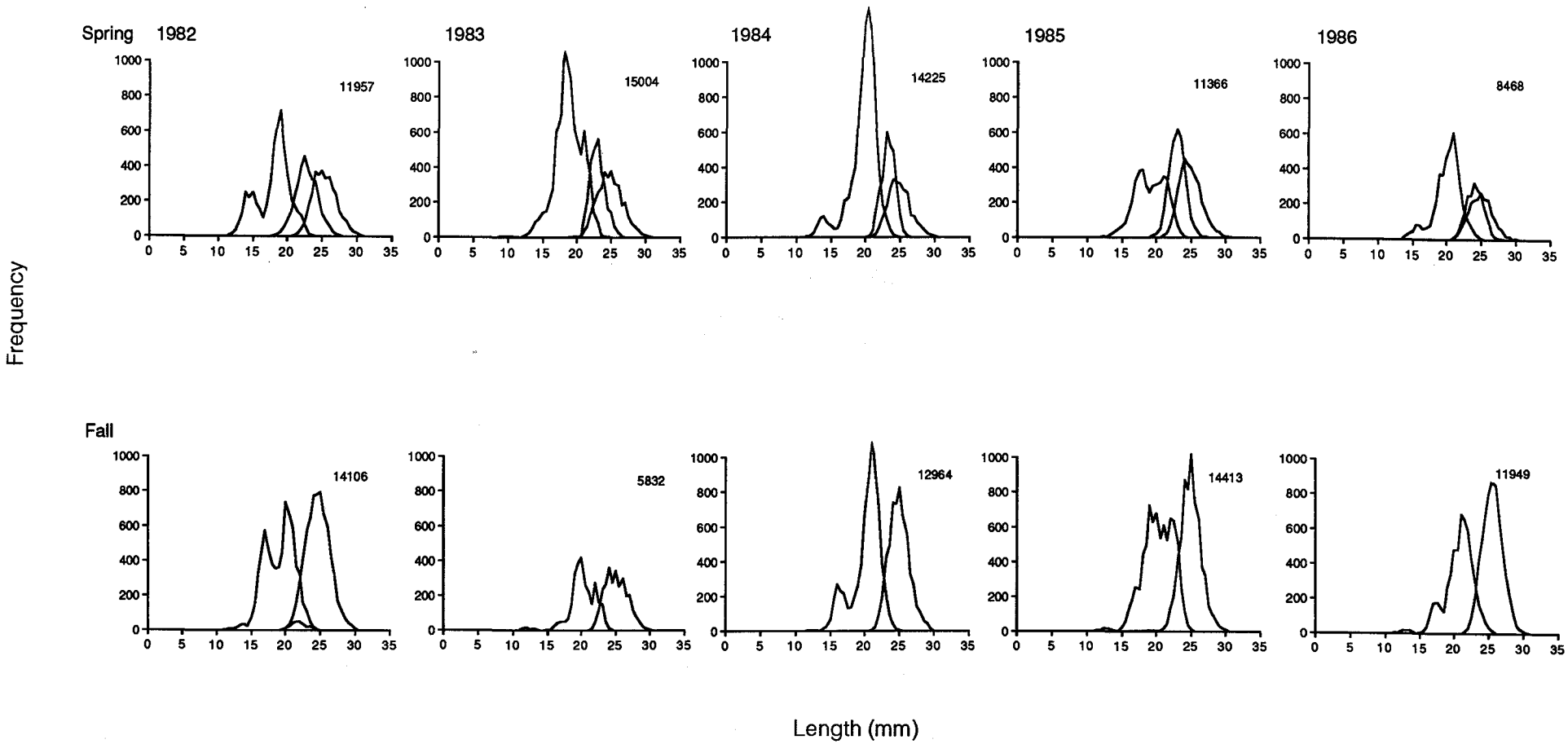

Figure 4. Shrimp length frequencies by sex (1982-1986).

Key

Left most peak - males
Center peak (where evident) - transitionals
Right most peak - females

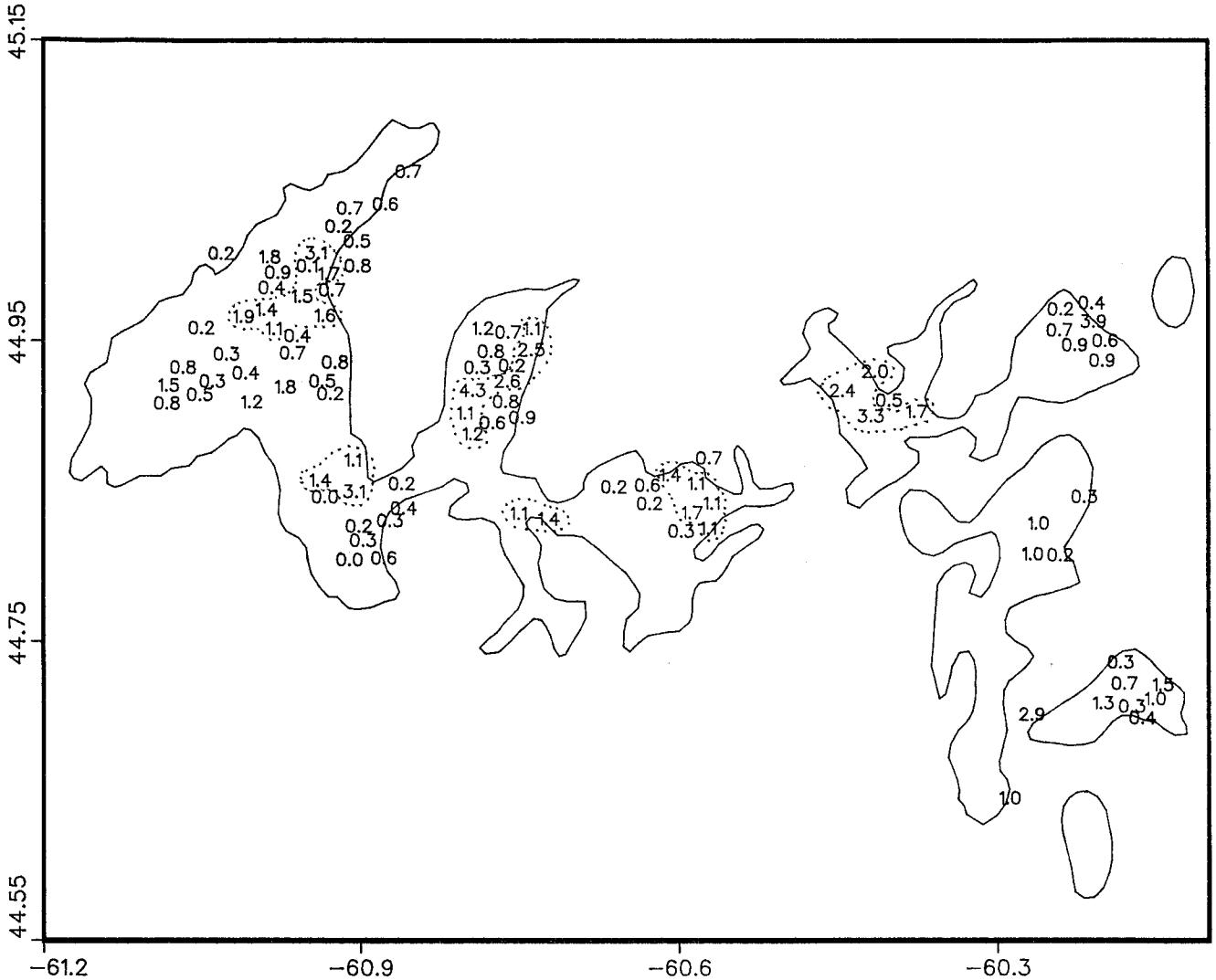

Figure 5a. Normalized catches for Canso area (1982-86).

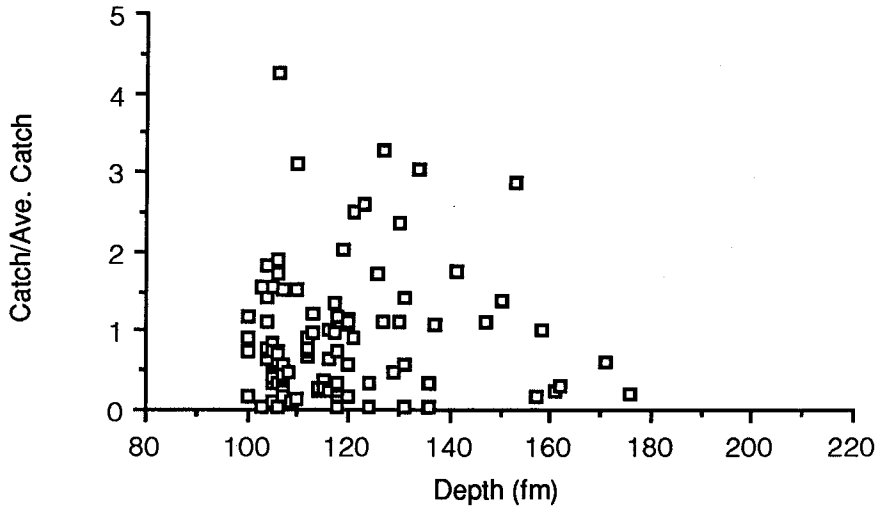

Figure 5b. Normalized catches verses depth (Canso).

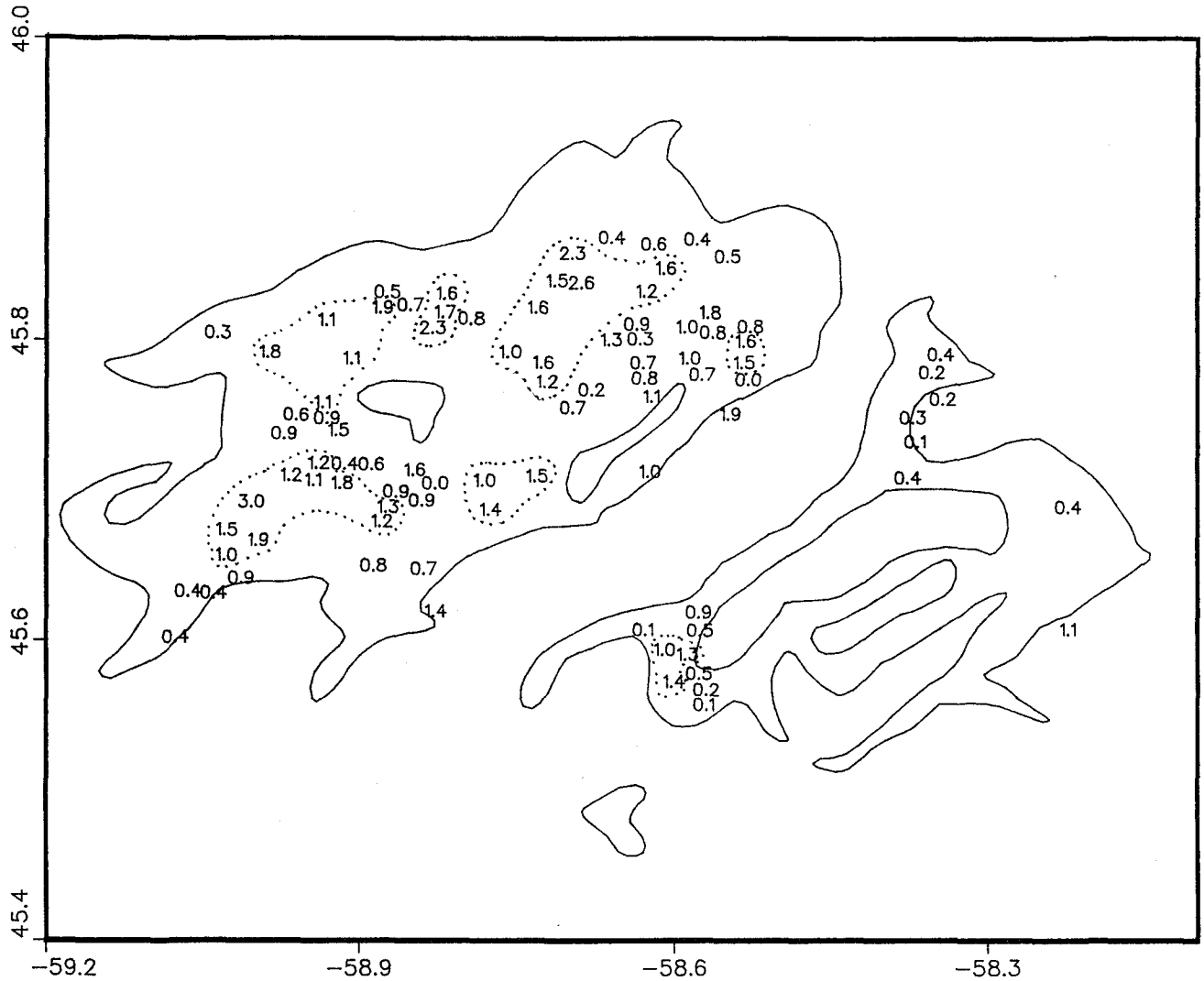

Figure 6a. Normalized catches for Louisbourg area (1982-86).

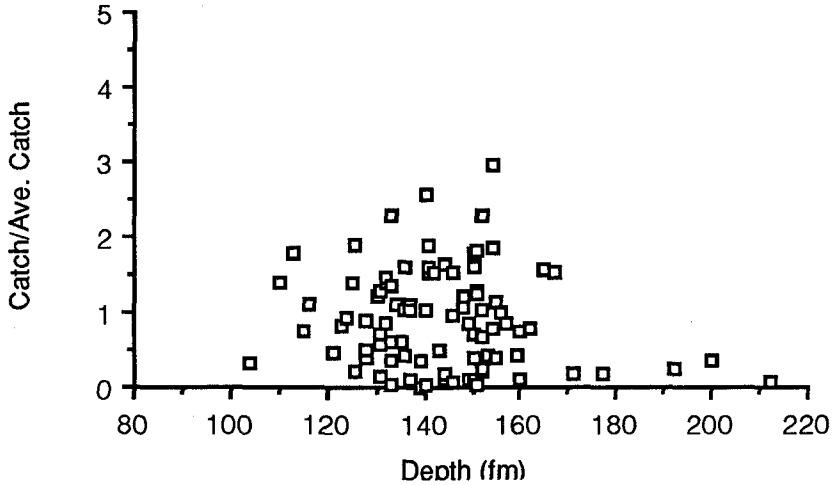

Figure 6b. Normalized catches verses depth (Louisbourg).

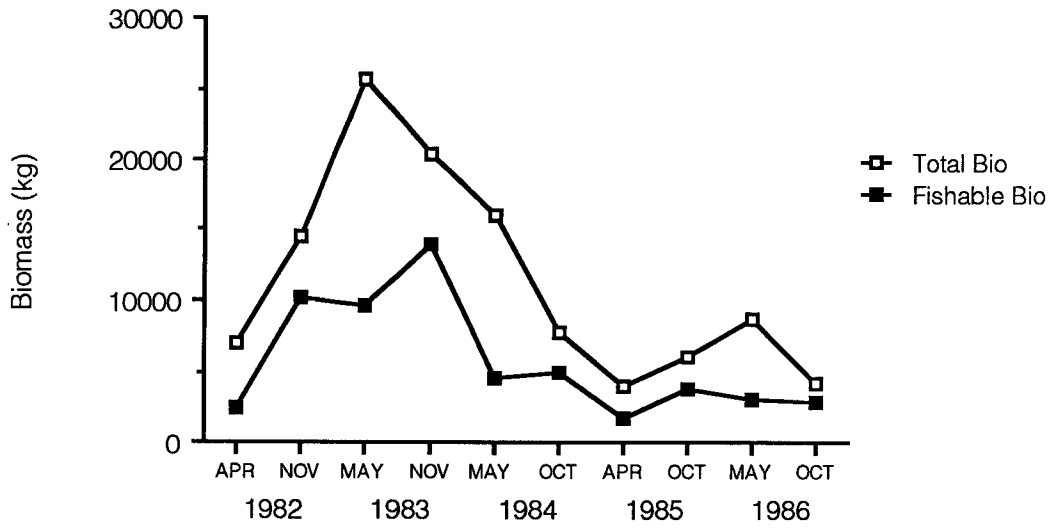

Figure 7. Biomass estimates from research cruises.

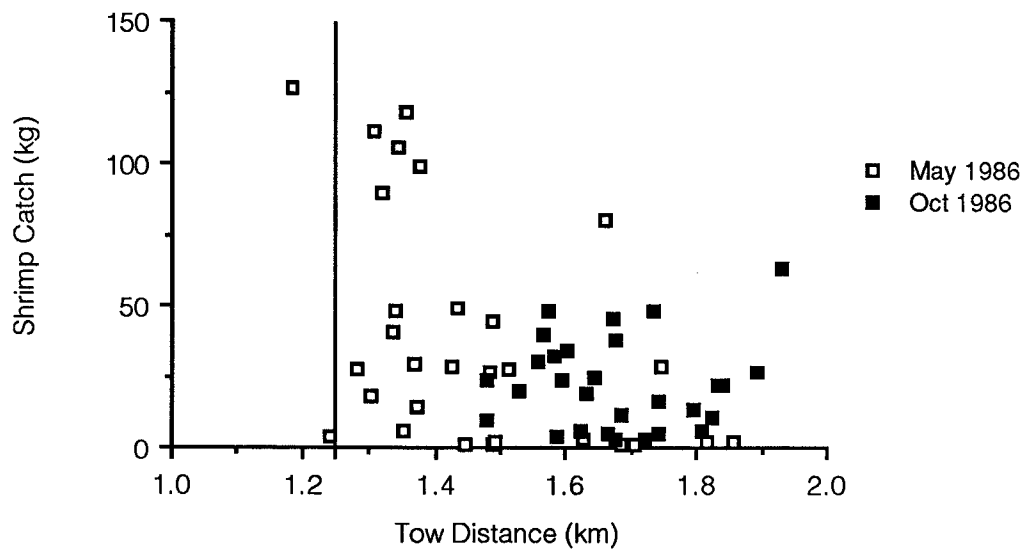

Figure 8. Shrimp catch/tow verses tow distance from research cruises.

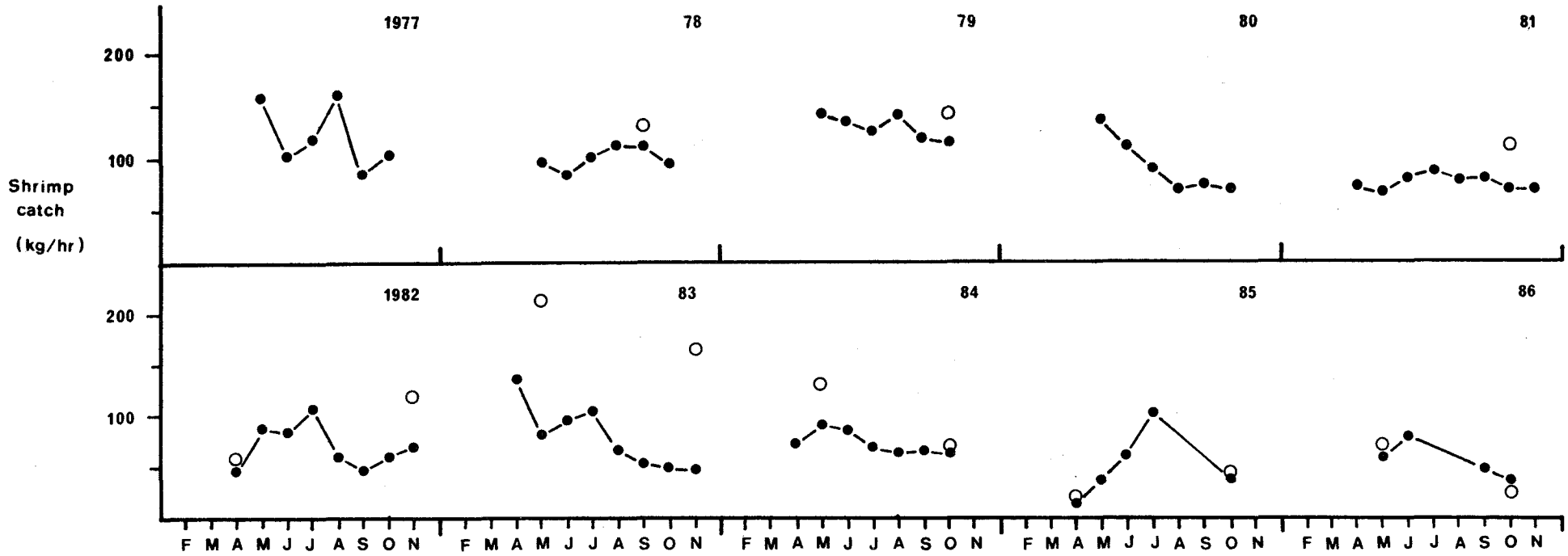

Figure 9. Shrimp catch rates by month from 1977-86.

○ research cruises

●—● commercial boats (standardized)

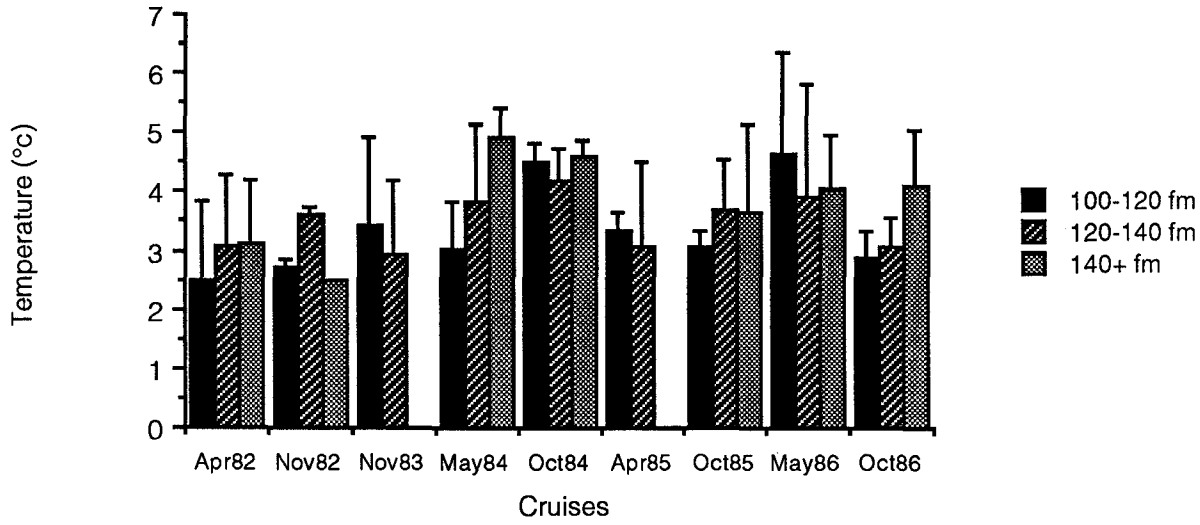

Figure 10. Average temperature by depth from research cruises.

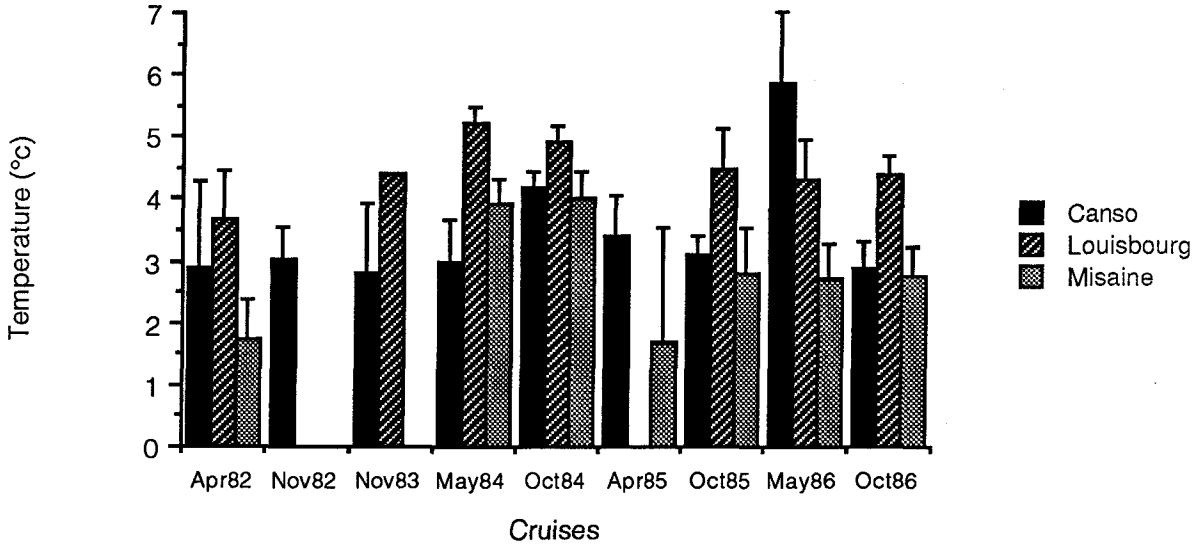

Figure 11. Average temperature by area from research cruises.