Scotia-Fundy Shrimp Stock Status - 1983

by

M.L. Etter and R.K. Mohn
Invertebrates and Marine Plants Division
Fisheries Research Branch
Scotia-Fundy Region
Halifax Fisheries Research Laboratory
Department of Fisheries and Oceans
P.O. Box 550
Halifax, N.S. B3J 2S7

ABSTRACT

As in previous years, the 1983 Cape Breton shrimp stock was underexploited. Only 17% of the total quota of 5,800 t for the three fishing areas was taken. Two research cruises were done in 1983 revealing increased catch rates in the main fishing areas over former years. This resulted in higher biomass estimates and a greatly increased recommended TAC total of 8,900 t. Some plankton tows done in inshore, shallow areas revealed Pandalus borealis larvae in different stages of development, suggesting a migration from deeper offshore areas to spawn.

RESUME

Comme ce fut le cas ces dernières années, les stocks de crevettes au large du Cap-Breton ont été sous-exploités in 1983. Sur un contingent total de 5 800 t pour les trois zones, seulement 17 % ont été capturés. Les deux croisières de recherche effectuées en 1983 révèlent une augmentation du taux des prises par rapport aux années antérieures dans les principales zones de pêche. Les estimations de biomasse sont donc plus élevées et les TAC recommandés ont augmenté considérablement pour atteindre un total de 8 900 t. Quelques opérations de chalutage de plancton effectuées dans les eaux intérieures peu profondes ont révélé la présence de larves de Pandalus borealis à divers stades de développement. Ces larves sont venues vraisemblablement d'eaux plus profondes au large des côtes pour frayer.

METHODS AND RESULTS

Research Data

Research tows were carried out for one-half hour durations at speeds of 2.5 knots using a Yankee 36 trawl with 32 mm mesh size. The results of these surveys are displayed in Table 1 and graphically in Figures 1 and 2. The November survey was incomplete due to mechanical failure on board the vessel. The holes are defined by the 100 fathom depth contour, where stations were allocated randomly inside the single strata 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, of the total catch was higher this year approximating 37% (Table 2), compared to last year's value of 20%. This year is closer to historical levels of 40-50%. The species composition of the by-catch was very similar to previous years. The length frequency distribution figures are based on measurement of carapace length, to one-tenth of a millimeter and then grouped into 0.3 mm groupings. The number at the top of each figure is the number of individuals in the total sample. Figures 3 and 4 separate the data by fishing area. Figure 3 shows for the three areas, very similar distributions, as does Figure 4 for Louisbourg and Canso. When we group the length frequency data according to sex rather than area we get Figures 5 and 6. In May there are a large proportionate number of males peaking at 17 mm while in November the peak is 19 mm. A transitional peak at 22 mm is seen in May but is nearly non existent in November. The female distribution remained remarkably similar and averaged somewhere around 24 mm caparace length. However, the November sample of females existed of almost purely ovigerous individuals while the group in May had recently released their eggs. Regression analysis (Table 4a, b, c, d) was calculated from tow data from 1982-83 research cruises. It was done on individual areas and on an overall basis. The one point that remains significant when considering the importance of year, month, time of day, depth, temperature, and total catch to shrimp catch, is the year. This is in accordance with the observation that the shrimp catches on our cruises were much higher from November 1982 on, compared to previous data. Plankton tows done in Chedabucto Bay and Canso hole revealed Pandalus borealis larvae in different stages of development. Fourteen (14) larvae were identified from three tows done in the shallow inshore bay while none were found in one tow in the offshore fishing area. Since the adults are found in much greater numbers in the offshore fishing areas this suggests an annual migration inshore to release the larvae and then transport of the larvae as they mature, from shallow to deeper waters.

Commercial Data

Commercial data for this report came from the logbooks and Foreign and Domestic Quota Monitoring Unit, Fisheries Operations Branch. The logs were at about 13% variance with the official statistics for these areas. The average yearly catch rates from the logs for Canso was 88.8 kg/h per corrected Yankee 36 trawls and 129.5 kg/h for all year. For Louisbourg the catch rates were a bit lower at 73.2 kg/h for corrected trawls and 124.1 kg/h for all gear types (see Table 3) Misaine had limited fishing effort of 85 h, with a corrected catch rate of 155.3 kg/h. The average catch rate for the three areas is 81 kg/h which is very close to last year's value. Monthly values show a steady decrease in catch rate for both major fishing areas as the fishing season advances. The total shrimp catch by the commercial fishery was 1,010 t, an increase from the two previous years by almost double (see Table 5). The average catch rate remained the same while effort increased sharply in Canso hole at least threefold.

Biomass Estimates

Biomass for each hole was estimated by areal expansion. The horizontal opening of the research gear is assumed to be effectively 36 ft. The standard tow is one-half hour 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 a polar planimeter using a 100 fathom contour were 276.4, 472.7, and 444.2 square nautical miles for Canso, Louisbourg, and Misaine respectively. 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 (Labonté, 1980). The tows were not corrected for length as defined by the start and end positions. The tow lengths ranged from 1.14 to 1.66 km in length. Also, Figure 7 shows the lack of correlation between tow distance and catch per tow.

Biomass, standard error, and proposed catch levels from survey data, 1983 (t).

Cruise	May	November	Avg.*	TAC*
Canso	8,894±2,045	5,244±835	7,100	2,500
Louisbourg	7,159±1,586	8,375±1,196	7,400**	2,600
Misaine	10,743±1,719	-	10,700	3,800

*Rounded to nearest hundreds.
**Average weighted by number of tows.

The biomass estimates are much higher than previous years as we had higher catches per tow in both surveys this year.

Average catches (kg) per tow - research cruises.

	Canso	Louisbourg	Misaine
1982	52.8	42.2	32.6
1983	126.3	77.1	119.4

The catches in the May 1983 and November 1983 cruises were similar to last November 1982 cruise but much higher than the catch rates of the April 1982 cruise. A possible explanation for this may be more effective fishing by the research vessel by the implementation of heavier doors on the boat after April 1982.

Recommended Catch Levels

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

Quotas (t).

	Canso	Louisbourg	Misaine	Total
1980	1,086	1,553	2,382	5,021
1981	-	-	-	-
1982	1,000	1,400	1,800	4,200
1983	1,400	2,000	2,400	5,800
1984* [1]	2,500	2,600	3,800	8,900

*Proposed values.

The proposed quota for 1984 is higher than in previous years due to increased biomass estimates for the three areas.

[1] In providing advice on catch levels for 1984, CAFSAC applied an exploitation rate of 35% to averaged research vessel biomass estimates for all available surveys from 1978-83. See Advisory Document 84/10 for details.

DISCUSSION

Biomass estimates are much higher this year due to increased catches in research cruises. Commercial catches have increased substantially and length frequency data show a strong new influx of small individuals into the population. These points indicate a healthy stock. This is probably partly due to the fact that to date the exploitation of the Cape Breton stocks has always been well below the TAC level. Increasing this level would seem to have little effect on the catch. On the other hand we see a definite decrease in catch rates in the commercial fishery from the beginning of the season to the end. It is not known if this is due to fishing or not. A serious consideration is that these holes are effectively at virgin biomass levels and it is not known how the biomass will respond to higher and sustained levels of exploitation; but the response so far observed seems to be a strengthening of the stock.

Nine new licenses were issued to Nova Scotia-based fishing vessels to fish for shrimp in 4VW this year. The only information obtained on their activities was anecdotal reports of a small Nova Scotia boat (190 hp - 46 ft) catching 2,000 lb of shrimp in two 2 h tows in January. These high catch rates seemingly stopped, shortly after, for no apparent reason.

REFERENCES

Labonté, S.S.M. 1980. An assessment of shrimp stocks off southeast Cape Breton, south Esquiman and north Anticosti. CAFSAC Res. Doc. 80/67.

Table 1. Research information from scientific research cruises.

Cruise	Area	Set	Depth (fm)	Bottom temp.	Shrimp (kg)	Total catch (kg)
May 1983	Canso	1	106		210	325
		2	111		128	187
		3	104		94	282
		4	124		189	344
		5	125		447	576
		6	151		89	315
		7	116		168	346
		8	122		67	186
		32	138		161	242
		33	111		36	120
	Louisbourg	9	106		22	288
		10	111		31	395
		11	150		168	248
		12	138		127	274
		13	157		115	173
		14	159		-	1665
		15	148		67	200
		16	136		50	122
		17	116		45	161
		18	129		48	177
	Misaine	19	133		259	382
		20	143		118	213
		21	119		59	168
		25	156		96	224
		27	163		93	154
		28	138		127	705
		29	120		137	352
		30	108		84	230
		31	134		102	134
November 1983	Canso	1	102	2.4	142	290
		2	109		63	308
		3	103		91	323
		4	130	2.2	127	301
		5	108		96	337
		6	159		24	104
		7	138		69	160
		8	122	2.2	164	281
		9	170		31	207
		10	111	4.5	130	379
	Louisbourg	11	130		75	288
		12	132	4.4	100	409

Table 2. Percentage catch composition of research cruises, 1983.

Species	May	November
Shrimp	36.7	32.8
Cod	17.8	16.7
Redfish	27.6	3.3
Flatfish	8.0	12.0
Hake	-	23.4
Halibut	-	0.3
Miscellaneous	9.9	12.0
Total shrimp catch (kg):	3337	1112

Table 3. Monthly commercial information for Canso and Louisbourg areas (1983).

	April	May	June	July	August	Sept.	Oct.	Nov.	Yearly
Canso:									
catch (kg)	-	-	38870.0	248692.0	104662.0	18521.0	19680.0	11741.0	442166.0
effort (un)	-	-	247.0	1591.0	976.0	235.5	209.0	155.0	3413.5
effort (cor)	-	-	282.7	2274.2	1410.5	355.8	406.0	247.5	4976.7
CPUE	-	-	137.5	109.4	74.2	52.1	48.5	47.4	88.8
Louisbourg:									
catch (kg)	26582.0	108921.0	64581.0	93496.0	60874.0	59629.0	6456.0	-	420539.0
effort (un)	131.0	815.0	426.0	667.0	666.5	623.5	60.0	-	3389.0
effort (cor)	196.5	1363.0	825.0	1037.1	1106.5	1101.0	120.0	-	5749.1
CPUE	135.3	79.9	78.3	90.2	55.0	54.2	53.8	-	73.2
All areas: *									879869.0
									6887.5
									10836.3
									81.2

*Includes Misaine.

Table 4a. Regression analysis of shrimp catch - 1982-83 (all tows, n=100).

	Year	Month	Time	Depth	Total catch	$\bar{X}$	t
Year							4.75**
Month	-0.11						1.09
Time	0.05	-0.18					0.43
Depth	0.06	-0.13	0.16			129.2	-1.80
Total catch	0.24	0.14	-0.11	-0.05		253.0	1.13
Shrimp catch	0.44	0.08	0.01	-0.15	0.222	67.4	r^2=0.245

Bottom temperature vs. shrimp catch r=0.099, t=0.52, $\bar{X}$=2.9 (n=29)

**Significant at 5% level.

Table 4b. Regression analysis of shrimp catch - 1982-83 (Canso, n=39).

	Year	Month	Time	Depth	Total catch	$\bar{X}$	t
Year							3.33**
Month	0.05						-3.05**
Time	0.14	-0.21					-1.01
Depth	0.20	0.13	0.13			119.5	0.44
Total catch	0.12	0.37	-0.21	-0.20		262.4	5.83**
Shrimp catch	0.43	-0.05	-0.13	-0.08	0.631	93.3	r^2=0.632

Bottom temperature vs. shrimp catch r=0.117, t=0.44, $\bar{X}$=2.9 (n=16)

**Significant at 5% level.

Table 4c. Regression analysis of shrimp catch - 1982-83 (Louisbourg, n=33).

	Year	Month	Time	Depth	Total catch	$\bar{X}$	t
Year							2.91**
Month	-0.16						3.28**
Time	-0.10	-0.10					1.24
Depth	-0.02	-0.21	0.25			135.0	0.87
Total catch	0.38	0.10	0.05	0.06		229.0	-1.54
Shrimp catch	0.29	0.38	0.11	0.05	0.001	52.6	r^2=0.374

Bottom temperature vs. shrimp catch r=0.464, t=1.17, $\bar{X}$=3.8 (n=7)

**Significant at 5% level.

Table 4d. Regression analysis of shrimp catch - 1982-83 (Misaine, n=28).

	Year	Month	Time	Depth	Total catch	$\bar{X}$	t
Year							5.24**
Month	-0.40						0.06
Time	0.36	-0.22					-0.84
Depth	0.10	-0.11	0.36			132.6	0.32
Total catch	0.06	-0.03	-0.12	-0.17		264.5	0.08
Shrimp catch	0.77	-0.29	0.18	0.07	0.071	61.0	r^2=0.602

Bottom temperature vs. shrimp catch r=-0.09, t=-0.18, $\bar{X}$=1.8 (n=6)

**Significant at 5% level.

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

Year	Catch (t)				CPUE (kg/hr)
	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

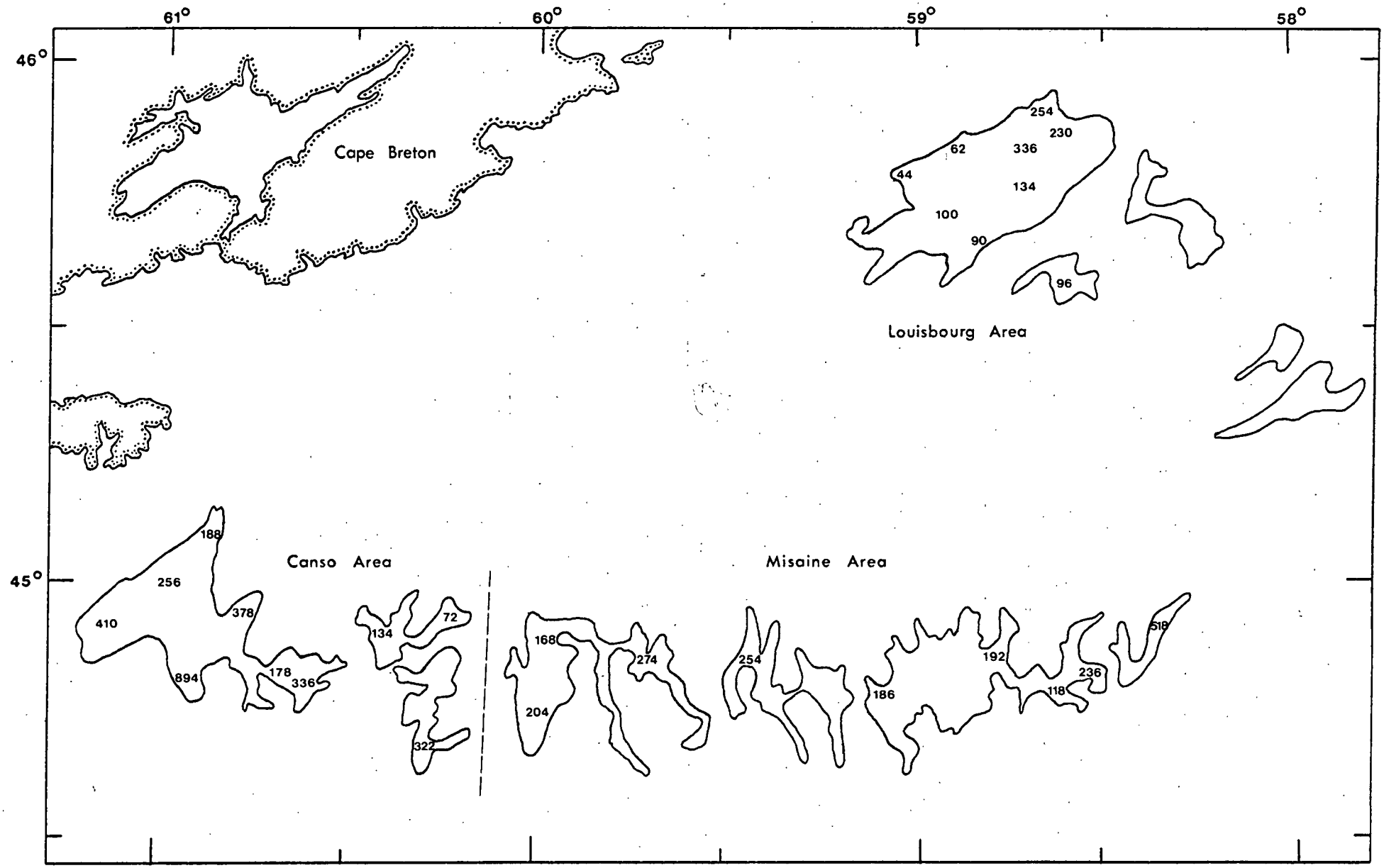

Figure 1: Catch rates (kg/hr) for May 1983 research cruise.

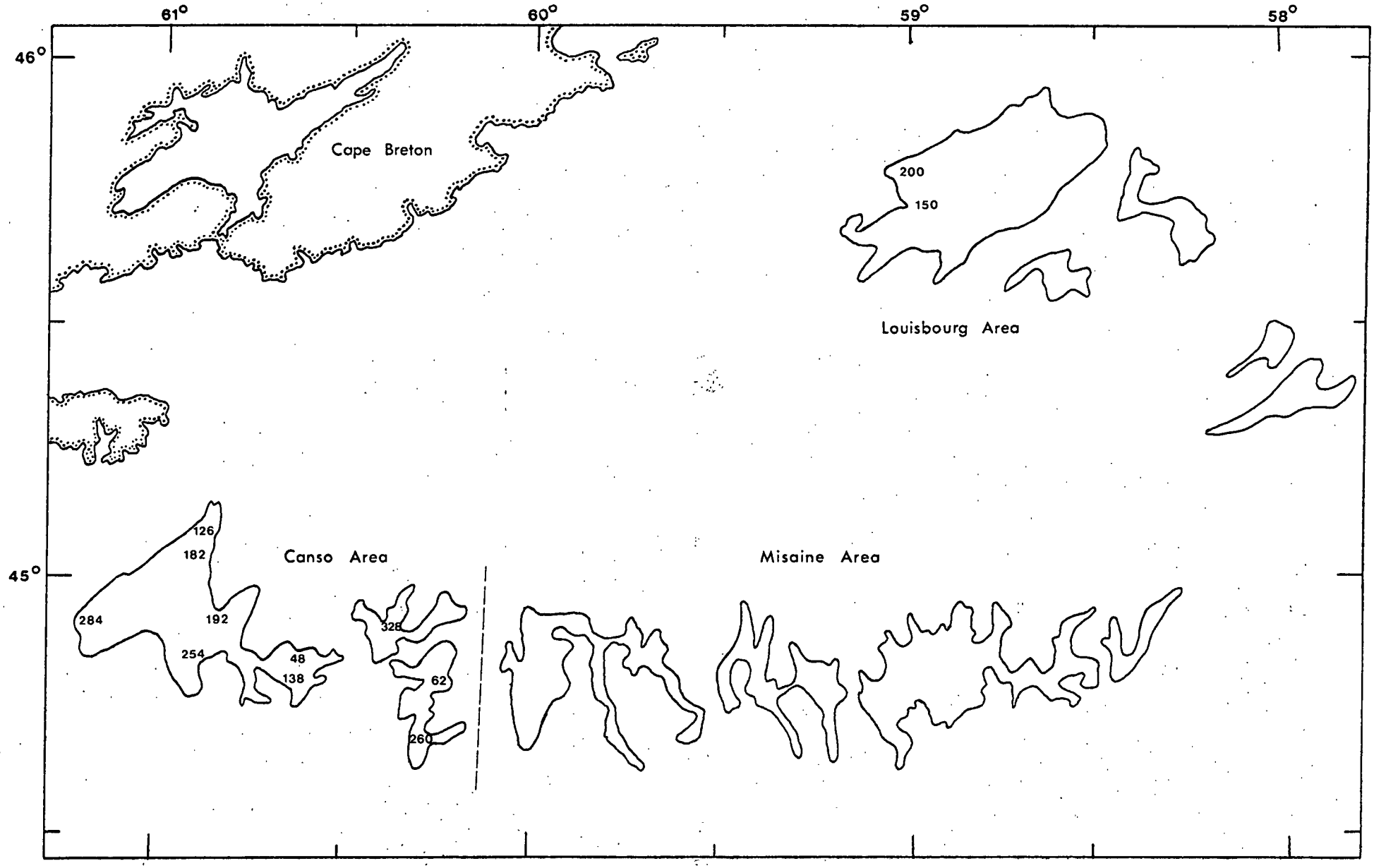

Figure 2: Catch rates (kg/hr) for November 1983 research cruise.

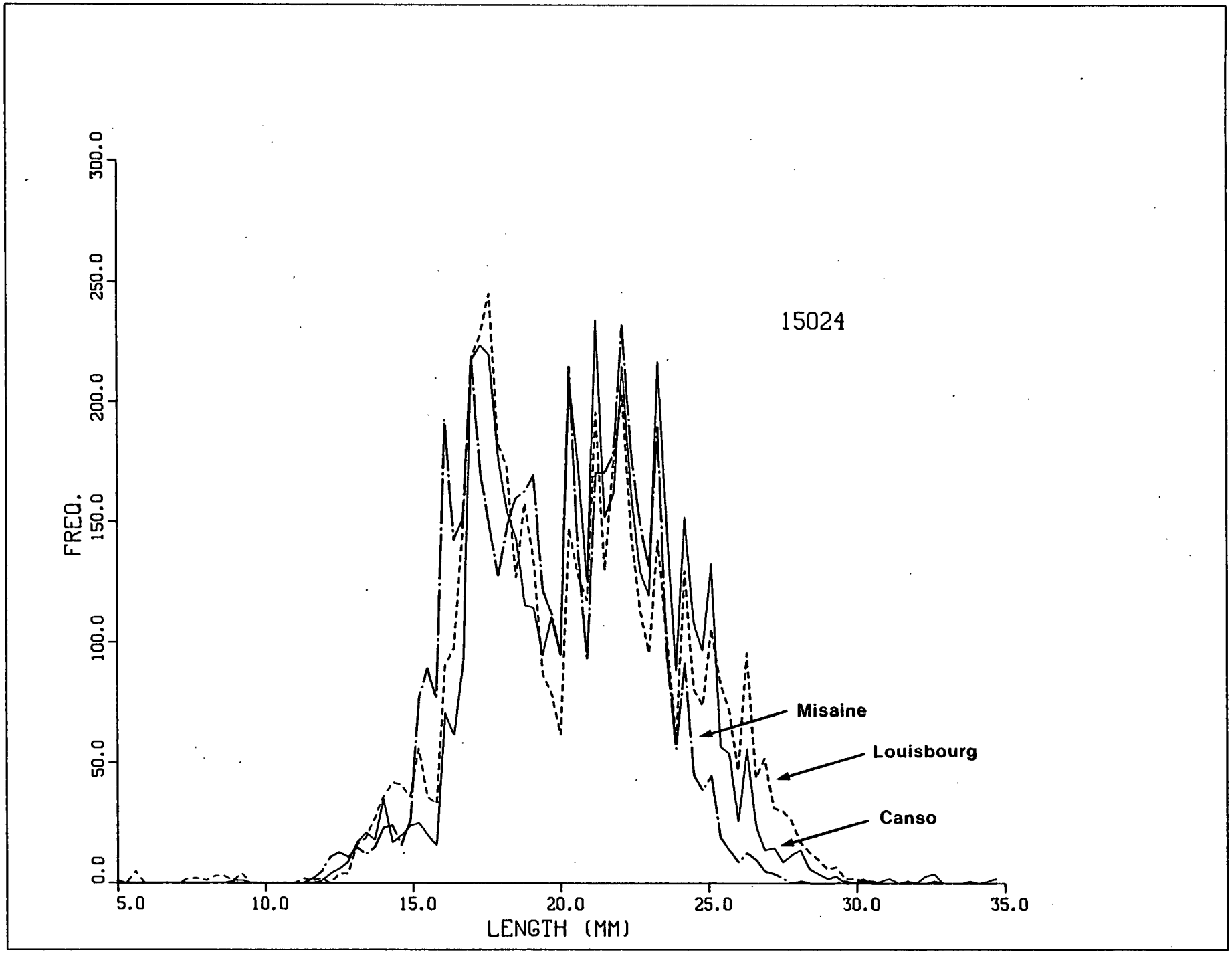

Figure 3. Shrimp length frequencies - May 1983 research cruise.

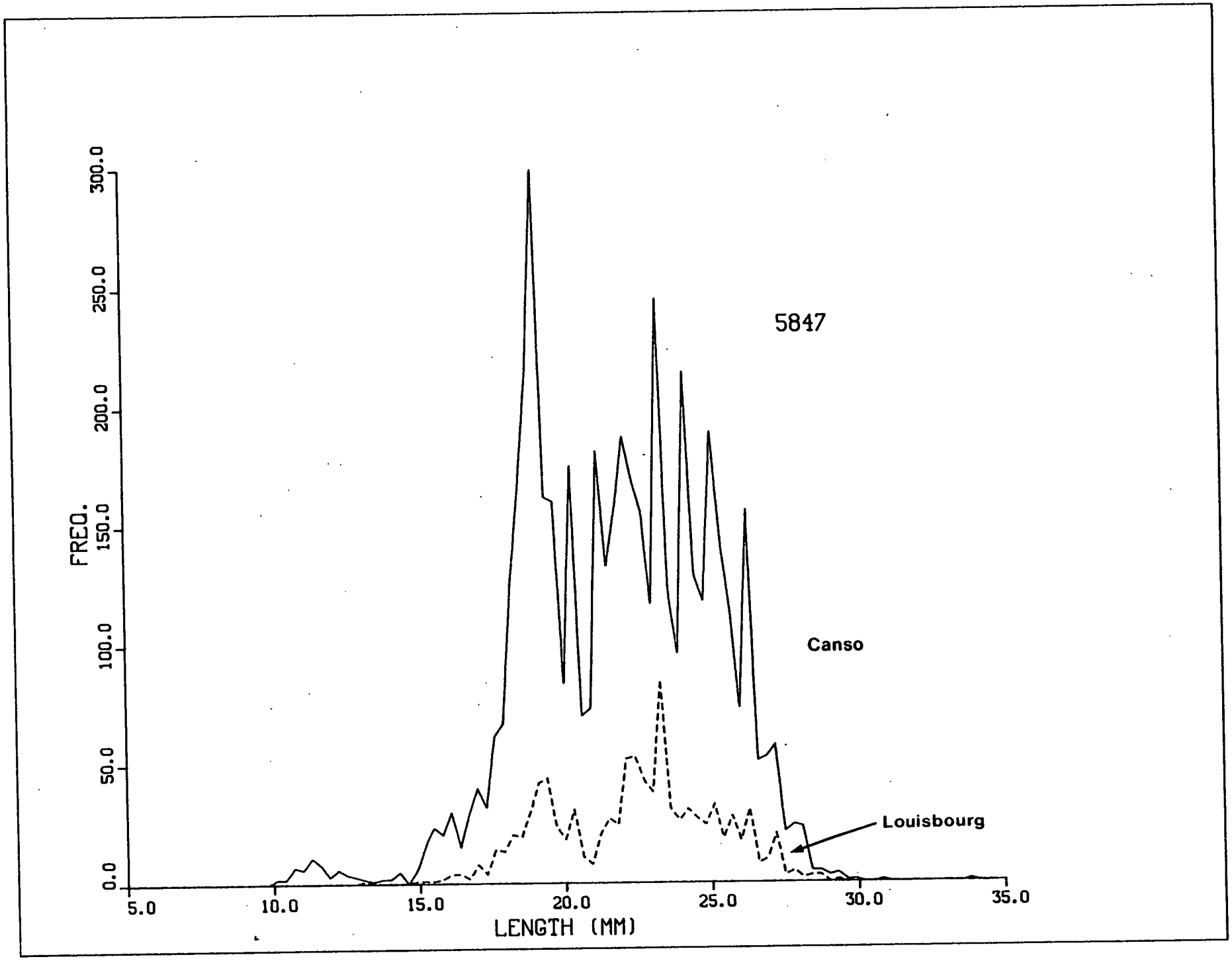

Figure 4. Shrimp length frequencies - November 1983 research cruise.

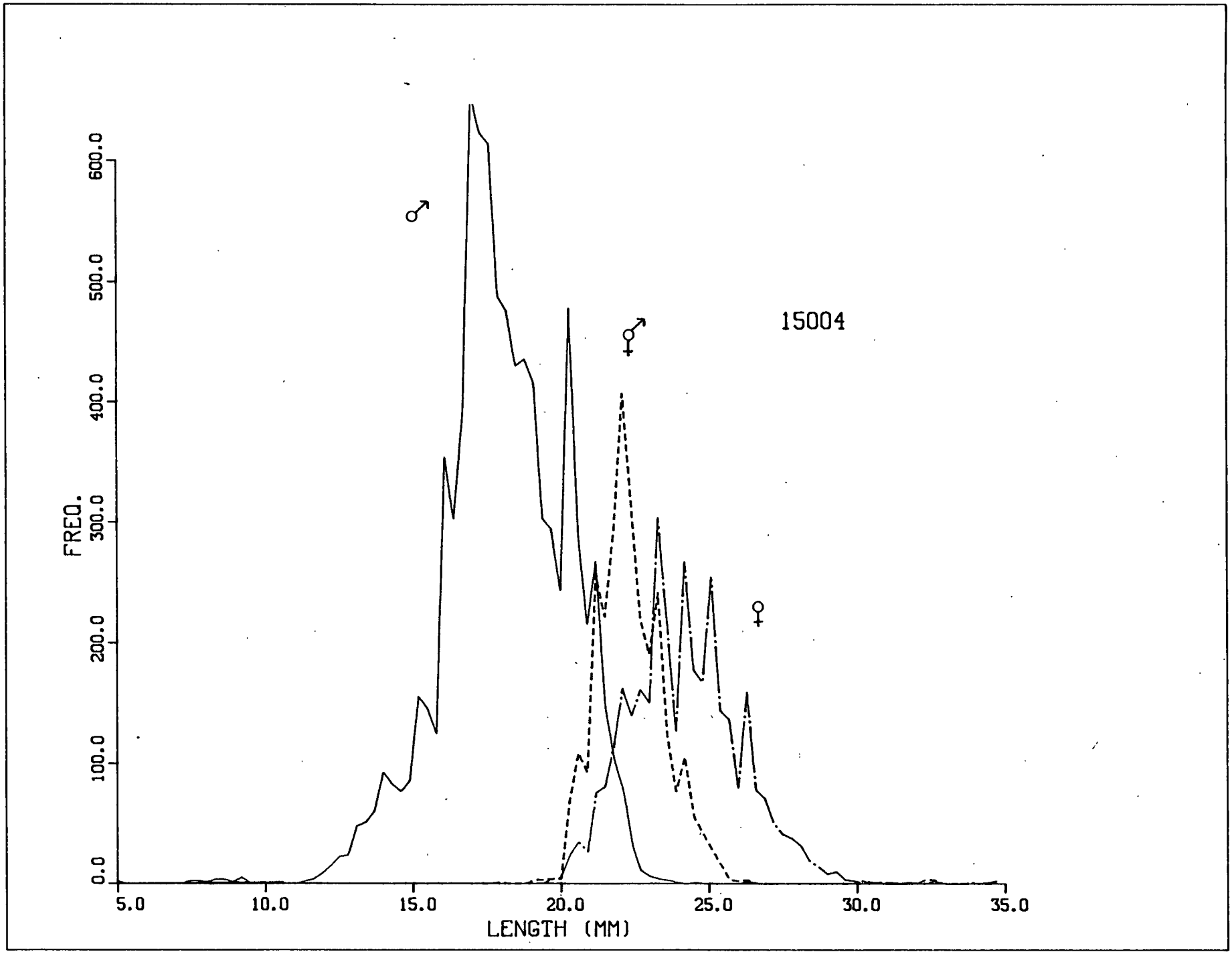

Figure 5. Shrimp length frequencies by sex - May 1983.

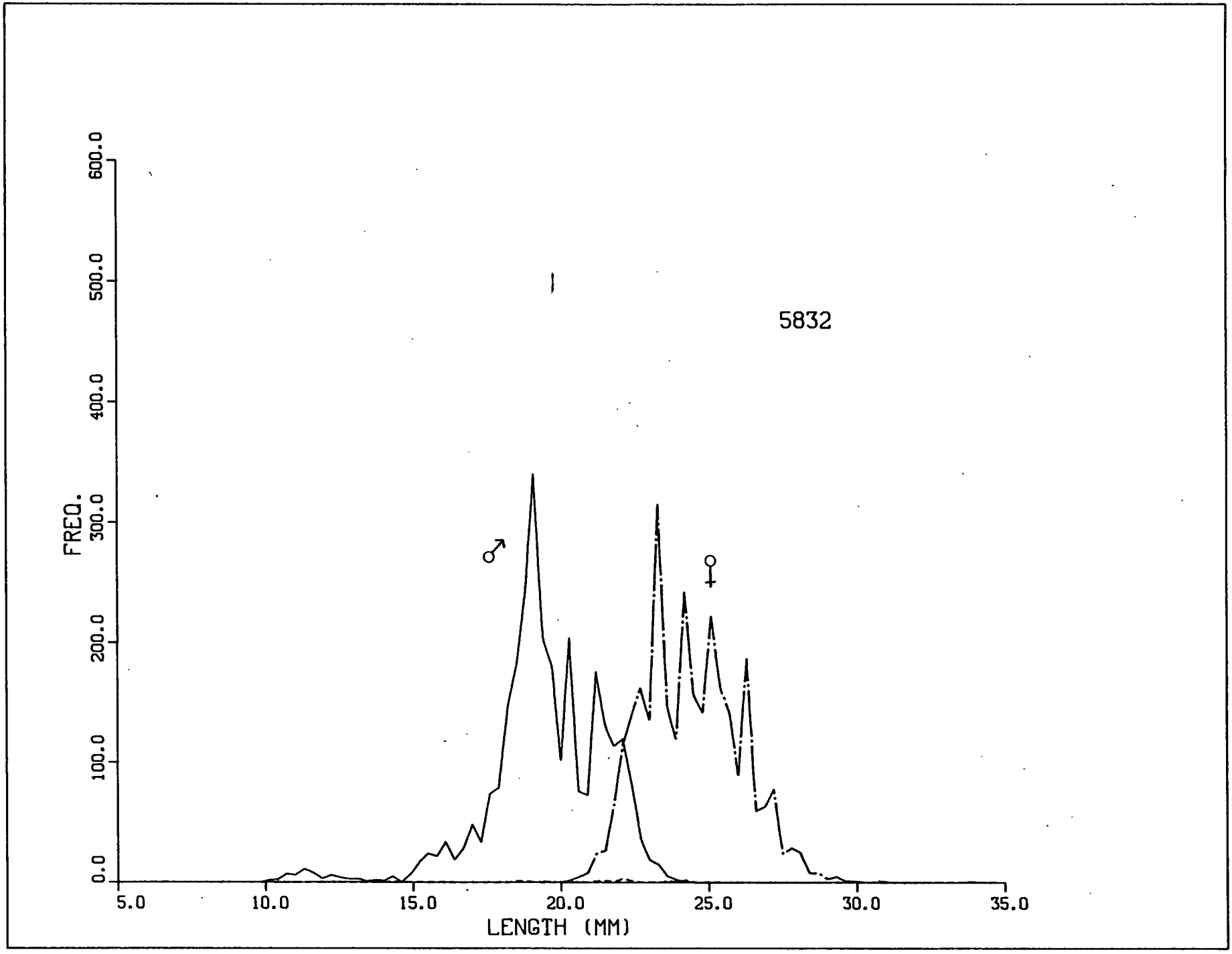

Figure 6. Shrimp length frequencies by sex - November 1983.

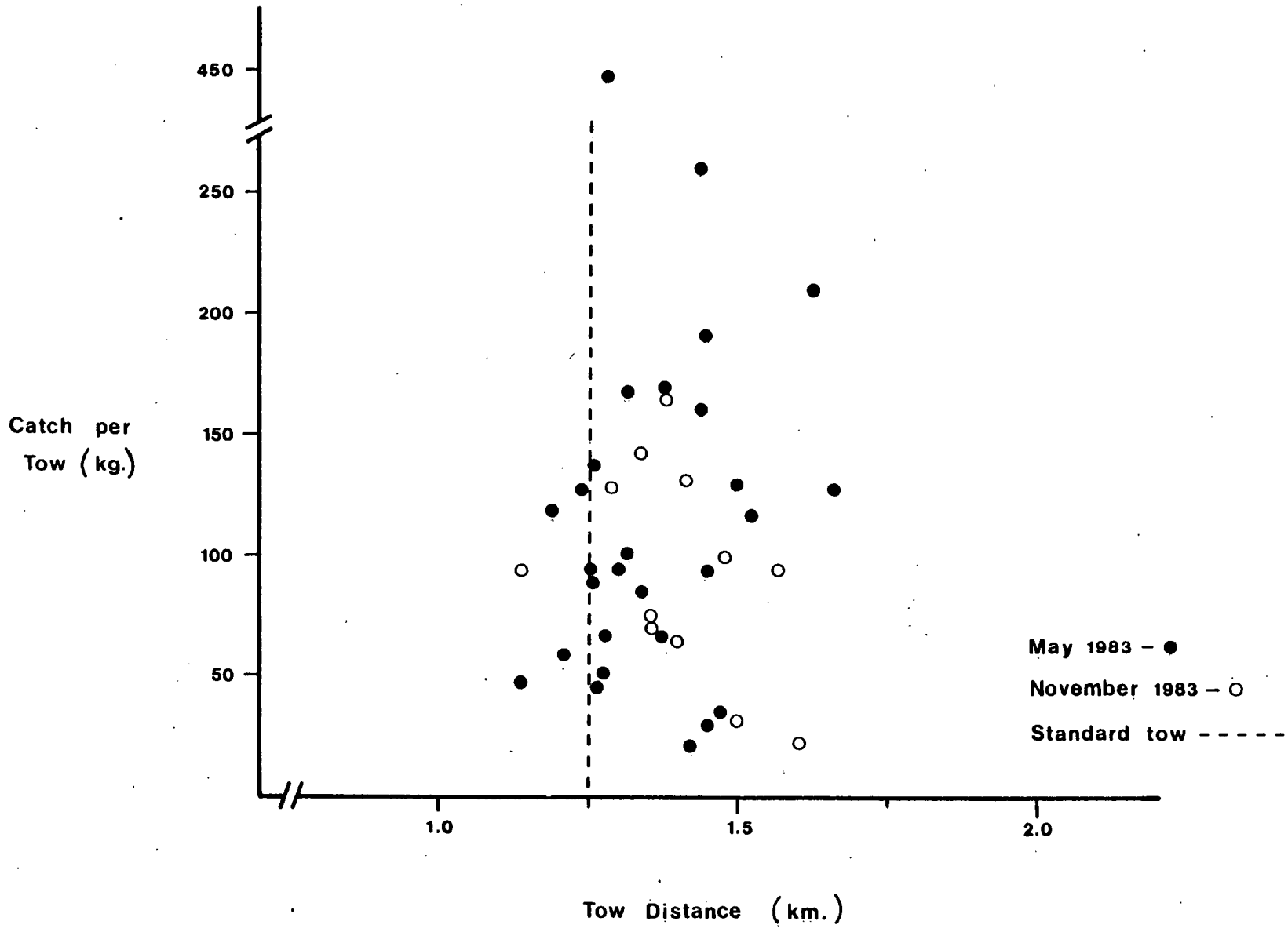

Figure 7. Correlation between tow distance and catch of shrimp in research cruises.