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Finfish by-catch in the Scotian Shelf shrimp fishery

by

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SUMMARY

The shrimp fishery in the Scotian Shelf occurs mainly southeast of Cape Breton, and did not start until 1977. Few data are available concerning finfish by-catch from this shrimp fishery. However, a shrimp survey was carried out on board a commercial side trawler, the MICHEL PIERRE, southeast of Cape Breton from September 21 to October 3, 1978. Information presented in this paper was obtained from this survey and from the commercial

activities during 1977. The abundance and distribution of shrimp and finfish by-catch are presented. The proportion of by-catch to the total catch and associated CPUE are discussed.

## METHODS

### 1978 survey

Areas southeast of Cape Breton greater than 180 m were arbitrarily divided into 20 strata based on depth intervals of approximately 40 m and on geographical features of the bottom (Fig. 1).

A total of 59 station positions were generated for all the strata, using a random number table. The number of stations per stratum was made proportional to the area of the stratum. Station positions are illustrated in Fig. 1, with details given in Table 1. Thirty-nine stations were sampled; strata A04 and M01 through M05 were not sampled due to lack of time and bad weather conditions.

The gear used was a "Yankee 36" shrimp bottom trawl with 38-mm mesh size (stretched). At each station, one 30-min tow was made at a speed of 2.5-3.0 knots. We trawled only during daylight hours to avoid bias introduced by the diurnal migration of shrimp (Barr 1970; Carlsson et al. 1978) in estimating the shrimp biomass. For each station, the weights of shrimp and of each by-catch species were recorded.

Biomass estimates for shrimp and main finfish were calculated for all strata by the "swept area" method. The total biomass (B) for the area surveyed is given by  $B = \sum B_i$  and:

$$B_i = A_i \frac{\sum (Y_{ij}/b_{ij})}{n_i}$$

where:  $B_i$  = biomass (kg) in stratum  $i$ ,  
 $A_i$  = surface area (square nautical mile) in stratum  $i$ ,  
 $Y_{ij}$  = catch (kg) per tow  $j$  in stratum  $i$ ,  
 $b_{ij}$  = area swept (square nautical mile) per tow  $j$  in stratum  $i$ ,  
 $n_i$  = no. of tow in stratum  $i$ .

Standard errors were calculated in using Mackett's method (1973).

#### 1977 commercial fishery

Catch and effort data used for different calculations came from the 1977 log books.

## RESULTS

#### 1978 survey

##### Distribution and abundance of shrimp

Shrimp were taken at all stations (in the depth range of 190-335 m) except for station 15 of stratum L01 (Table 2). Shrimp represent 59.6% of total catches. The largest catches were obtained in strata L02, L04, A01 and C01, C02, C03, in each of which 50% or more of the tows yielded a catch of over 90 kg of shrimp. However, the catch distribution pattern was different in the two areas. In the Louisbourg area (L02, L04, A01) the largest concentrations of shrimp were found between 260 and 295 m, while in the Canso area (C01, C02, C03) the best concentrations were in the depth range of 200-225 m. Table 3 gives the mean biomass per square nautical mile per stratum, with the standard error and the total biomass per stratum. From these results, an estimate of the total shrimp biomass in the strata surveyed (845 nm<sup>2</sup>) is 8,212 m.t.

### Distribution and abundance of by-catch

Redfish and cod were the two main by-catch species. On a weight basis, commercial redfish represent 10.2% of the catches, non-commercial redfish ( $\leq 14.5$  cm) 11.1% and cod 8.9%. No pattern seems to appear for the distribution and abundance of cod. The largest catches were obtained in strata L01, A01 and C05 (Table 2). In contrast, redfish of commercial and non-commercial size seem to be aggregated on the east edge of the Scotian Shelf. The largest concentrations were found at a depth of 255 m. An extremely high concentration of non-commercial redfish (141 kg/30-min tow) was obtained from one tow in the stratum A03. Table 4 gives the mean biomass per square nautical mile per stratum with the standard error and the total biomass per stratum for the by-catch of redfish and cod in the SE Cape Breton area. Other by-catches (10.2%) were mainly represented by squid and plaice in the Louisbourg area and by silver hake and plaice in the Canso area.

### 1977 commercial fishery

The commercial fishery in 1977 took place mainly in the Louisbourg area. Two part-time fishing units landed 144 m.t. of shrimp during the season. Corresponding by-catches of finfish were low (22.7 m.t.). Table 5 shows landings, their relative proportion to the total catch, and associated CPUE corresponding to each of them.

## DISCUSSION

Results from the shrimp survey in 1978 show that the by-catch accounts for about 40% of the total catch in weight, consisting mainly of redfish, cod and flatfishes. The major point of interest seems to be the small

redfishes, these being discarded.

For 1979 the shrimp quota for the area southeast of Cape Breton is 2,000 m.t. (Canadian Atlantic Quota Report). At the by-catch rates observed during the survey, an annual catch of 2,000 m.t. should produce a by-catch of 322 m.t. of non-commercial redfish. However, commercial activities in 1977 show less by-catch than obtained during the survey in 1978 (Tables 5 and 6). This difference can be explained by the fact that by-catch is often underestimated by commercial vessels and that fishermen generally tend to fish in areas where the ratio of shrimp to by-catch is highest. Furthermore, investigations with a Yankee 36 shrimp trawl in the area north of Anticosti (Tobey and Rycroft, 1977) revealed that small redfish account for approximately 20% of the total catch, which is twice as high as the SE Cape Breton area.

At present, interactions between shrimp and small redfish seem a minor problem and there is probably no need to introduce a sorting trawl. Few data being available concerning the non-commercial by-catch discarded, it is desirable to improve reporting of by-catch in log books.

#### REFERENCES

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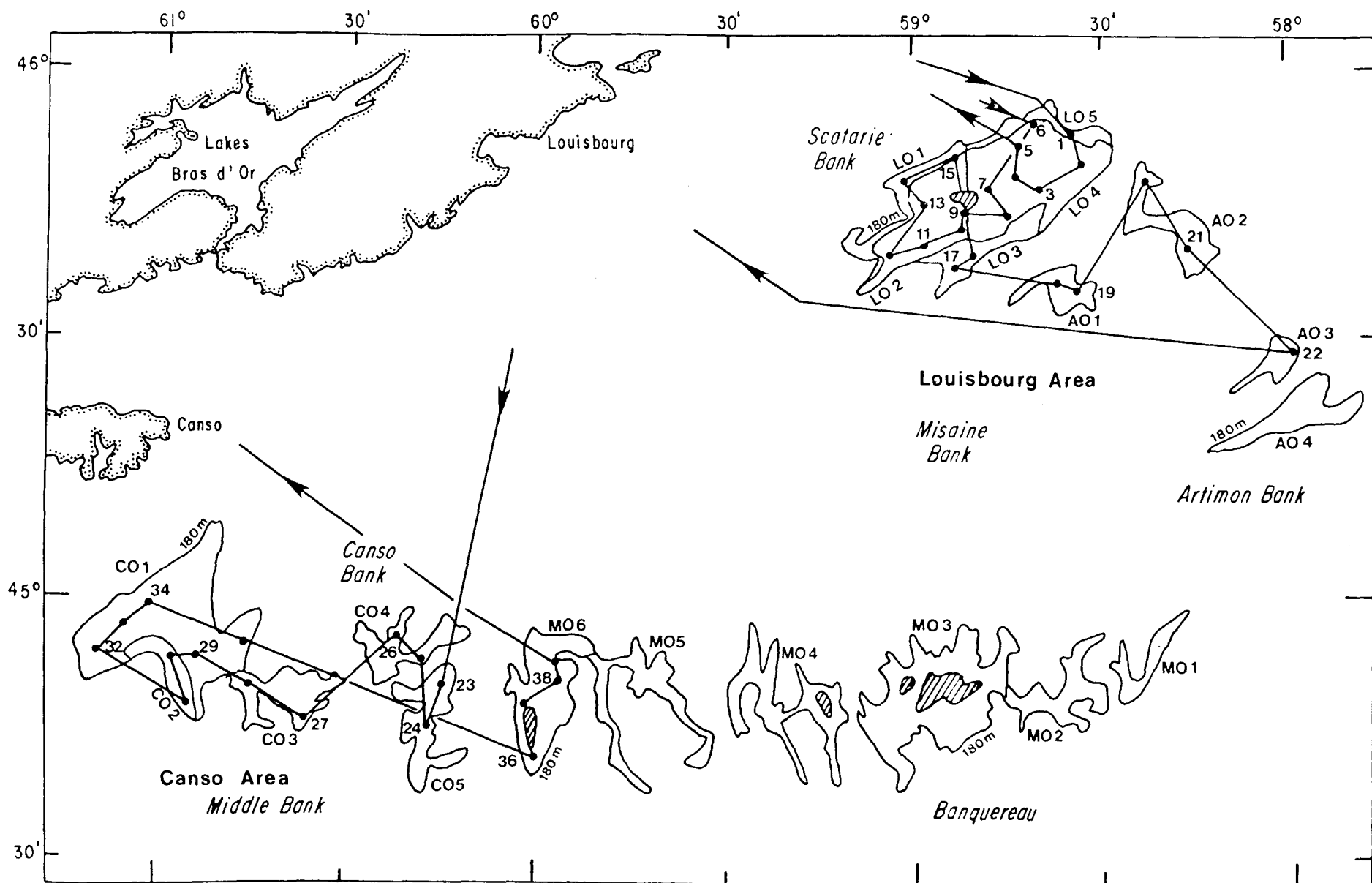


Fig. 1. Stratification scheme and stations occupied during the survey.

Table 1. Details on strata and sampling for the shrimp survey SE Cape Breton Sept.-Oct. 1978.

Stratum	Surface of stratum (mm <sup>2</sup> )	Station #	Starting position lat - long	Date	Starting time	Duration (min)	Depth (m)	Cloud coverage 0-1.0	Sea Beaufort 0-9
L01	50.5	12	45°38' -59°04'	26/09	11:17	31	285-276	1.0	3
		14	45 46 -59 00	26/09	15:06	31	216	0	4
		15	45 50 -58 56	27/09	08:07	29	201-210	0	2
L02	84.2	9	45 42 -58 50	25/09	15:43	32	247	0.7	3
		10	45 41 -58 52	26/09	08:10	30	249-245	0.2	3
		11	45 40 -58 57	26/09	09:32	32	260-271	1.0	3
		13	45 44 -58 58	26/09	13:23	31	254-242	0.1	3
L03	45.7	16	45 42 -58 52	27/09	10:18	30	245-231	0	2
		17	45 38 -58 53	27/09	11:37	32	229-207	0	2
L04	137.2	2	45 49 -58 34	23/09	09:30	31	296-300	1.0	4
		3	45 47 -58 36	22/09	11:04	31	300-286	1.0	4
		4	45 48 -58 40	22/09	13:43	37	282-275	0.3	4
		5	45 51 -58 41	22/09	15:32	35	275	0.2	4
		7	45 47 -58 17	25/09	10:32	30	278	0.5	3
		8	45 45 -58 43	25/09	13:08	31	280-262	0	3
		L05	28.9	1	45 53 -58 36	22/09	07:55	30	240-256
6	45 54 -58 39			25/09	08:00	29	245-275	0.3	3
A01	24.1	18	45 35 -58 35	27/09	15:03	31	245-280	0	2
		19	45 34 -58 33	27/09	16:24	30	275-271	0	2
A02	38.5	20	45 46 -58 22	28/09	08:01	31	335-245	1.0	3
		21	45 41 -58 14	28/09	10:00	30	260-174	1.0	4
A03	21.7	22	45 28 -57 59	28/09	13:38	30	231-282	1.0	5
C01	154.4	29	44 53 -60 53	01/10	10:10	32	190-194	0.1	3
		32	44 57 -61 05	02/10	08:39	31	198	1.0	4
		33	44 58 -61 02	02/10	10:04	32	198	1.0	4
		34	44 59 -60 58	02/10	11:19	31	198	1.0	4
		35	44 57 -60 46	02/10	13:23	32	223	1.0	4
C02	19.7	30	44 56 -60 59	01/10	13:07	31	198-209	0	4
		31	44 50 -60 56	01/10	15:10	30	249-269	0.1	4
C03	49.3	27	44 48 -60 36	30/09	16:36	31	275-260	0.1	2
		28	44 51 -60 46	01/10	08:15	30	296-264	0.1	3
C04	42.7	25	44 54 -60 18	30/09	13:01	30	271-201	0	2
		26	44 55 -60 22	30/09	14:21	30	220-207	0	2
C05	49.3	23	44 51 -60 15	30/09	08:56	30	227-307	0	3
		24	44 45 -60 18	30/09	10:41	31	333-307	0	3
M06	98.7	36	44 45 -60 00	03/10	07:43	35	243-249	1.0	5
		37	44 45 -59 59	03/10	08:47	30	231-238	1.0	5
		38	44 50 -59 56	03/10	11:40	31	216-231	1.0	5
		39	44 53 -59 56	03/10	14:56	31	238-253	1.0	5



Table 2. Catches in shrimp survey SE Cape Breton, Sept.-Oct. 1978

Stratum	Station #	Shrimp (kg)	Small red (kg)	Redfish (kg)	Cod (kg)	Other (kg)	Total (kg)
L01	12	150	16	-	-	-	166
	14	21	21	102	91	9	244
	15	1	36	-	30	46	113
L02	9	70	3	31	-	-	104
	10	52	5	-	-	-	57
	11	150	11	-	-	-	161
	13	34	11	114	68	7	234
L03	16	46	3	-	-	12	61
	17	10	14	-	-	34	58
L04	2	70	4	-	-	-	74
	3	115	4	-	-	-	119
	4	138	9	-	-	-	147
	5	72	4	-	-	-	76
	7	112	2	-	-	-	114
	8	108	7	2	-	-	117
L05	1	32	28	-	-	8	68
	6	21	60	52	-	-	133
A01	18	115	21	-	-	6	141
	19	93	54	-	-	3	150
A02	20	46	19	4	-	-	69
	21	58	10	27	-	16	111
A03	22	50	141	12	46	53	302
C01	29	74	-	16	-	16	106
	32	82	-	5	-	18	105
	33	79	-	-	-	25	104
	34	98	-	-	32	30	160
	35	112	-	-	-	21	133
C02	30	119	-	5	-	39	163
	31	46	-	-	-	52	98
C03	27	120	-	2	-	7	129
	28	66	-	-	23	50	139
C04	25	85	-	2	-	20	107
	26	41	-	9	-	2	52
C05	23	48	21	83	115	2	269
	24	43	-	-	-	-	43
M06	36	21	-	-	-	-	21
	37	30	-	-	-	-	30
	38	62	-	-	-	-	62
	39	27	-	-	-	-	27

Table 3. Mean biomass estimate for shrimp SE Cape Breton,  
Sept.-Oct. 1978.

Stratum no.	Mean biomass (m.t.) per square nautical mile		Total biomass (m.t.)	
	$\bar{x}$	$s_{\bar{x}}$		
L01	8.47	6.58	427.9	
L02	10.83	3.04	911.6	
L03	3.68	2.32	168.1	
L04	15.28	1.46	2096.1	
L05	3.54	1.25	102.3	
A01	12.65	0.64	304.8	
A02	7.21	1.37	277.5	
A03	*8.08	-	*175.2	
C01	11.52	0.88	1778.5	
C02	11.28	4.93	223.3	
C03	12.28	3.89	605.6	
C04	8.59	2.85	366.9	
C05	7.11	0.95	350.4	
M06	4.31	0.86	425.0	
Total	∠	9.72 <sup>1</sup>	0.68 <sup>1</sup>	8212.2 <sup>1</sup>
		9.64 <sup>2</sup>	0.87 <sup>2</sup>	8143.9 <sup>2</sup>

\*One point estimate

<sup>1</sup>Based on stratified random

<sup>2</sup>Based on simple random

Table 4. Mean biomass estimate for by-catch SE Cape Breton area, Sept.-Oct. 1978.

Stratum no.	Redfish			Small redfish			Cod		
	Mean biomass (m.t.) per sq. naut. mile $\bar{x}$	$s_{\bar{x}}$	Total biomass (m.t.)	Mean biomass (m.t.) per sq. naut. mile $\bar{x}$	$s_{\bar{x}}$	Total biomass (m.t.)	Mean biomass (m.t.) per sq. naut. mile $\bar{x}$	$s_{\bar{x}}$	Total biomass (m.t.)
L01	5.76	5.13	291.1	3.55	0.74	179.2	6.23	4.21	314.6
L02	5.30	3.87	446.6	1.08	0.28	90.6	2.50	2.44	210.8
L03	-	-	-	1.11	0.70	50.8	-	-	-
L04	0.05	0.05	6.7	0.73	0.13	100.3	-	-	-
L05	2.78	2.69	80.4	5.32	1.06	153.9	-	-	-
A01	-	-	-	4.69	2.16	113.1	-	-	-
A02	2.26	1.71	86.9	1.94	0.44	74.7	-	-	-
A03	*1.94	-	*42.1	*22.77	-	*494.2	*7.43	-	*161.2
C01	0.51	0.36	79.1	-	-	-	0.84	0.83	130.0
C02	0.35	0.33	6.8	-	-	-	-	-	-
C03	0.14	0.13	6.7	-	-	-	1.45	1.42	71.5
C04	0.76	0.48	32.4	-	-	-	-	-	-
C05	5.31	5.20	261.6	1.34	1.31	66.2	7.35	7.20	362.5
M06	0.06	0.06	6.2	-	-	-	-	-	-
Total	1.59 <sup>1</sup>	-	1346.6 <sup>1</sup>	1.57 <sup>1</sup>	-	1323.0 <sup>1</sup>	1.48 <sup>1</sup>	-	1250.5 <sup>1</sup>
	1.71 <sup>2</sup>	0.63 <sup>2</sup>	1445.4 <sup>2</sup>	1.82 <sup>2</sup>	0.61 <sup>2</sup>	1536.5 <sup>2</sup>	1.49 <sup>2</sup>	0.59 <sup>2</sup>	1255.3 <sup>2</sup>

\*One point estimate

<sup>1</sup>Based on stratified random

<sup>2</sup>Based on simple random

Table 5. Shrimp catches and finfish by-catches in the Scotian Shelf shrimp fishery in 1977.

	Shrimp	Cod	Redfish	Plaice	Turbot	Other	Total
Catches (MT)	144.0	5.5	5.4	4.8	4.7	2.3	166.7
Catches (%)	86.4	3.3	3.2	2.9	2.8	1.4	100.0
C.p.u.e. (kg/h)	147.5	5.6	5.5	4.9	4.8	2.3	170.8

Table 6. Shrimp catches and finfish by-catches during a shrimp survey southeast of Cape Breton in September 1978.

	Shrimp	Cod	Commercial redfish	Non-comm. redfish	Other	Total
Catches (kg)	2,717	405	466	504	468	4,560
Catches (%)	59.6	8.9	10.2	11.1	10.2	100
C.p.u.e. (kg/h)	134.5	20.0	23.1	25.0	23.2	225.8