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Summary of Joint Canada/Japan Research Program on Short-finned Squid (*Illex illecebrosus*), 23 October to 29 November 1979: Emigration and Biology

by

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INTRODUCTION

A joint Canada/Japan research program was undertaken between scientists of the Shellfish Section, Resource Branch, Department of Fisheries and Oceans, and Far Seas Fisheries Research Laboratory, Japan Fisheries Agency, to study emigration and biology of the short-finned squid Illex illecebrosus from October 23 to November 29, 1979. Two cruises were carried out: i) Cruise 7912, October 23 to November 10, 1979 - along the Scotian Shelf break. ii) Cruise 7913, November 11-29, 1979 - in deep water seaward of the Scotian Shelf.

The cruise programs were as follows:

Cruise 7912

The survey attempted to study the geographic and diurnal distributions of Illex illecebrosus; to collect larval, juvenile, and mature female specimens; to make morphological measurements in order to study population structure, growth rates, feeding habits, and the life cycle; and to capture live specimens for laboratory studies.

Ten transects (Figure 1) were chosen along the Scotian Shelf. Within these transects, 30-minute bottom trawls (except Sets 1 and 2 which were of 60 minutes duration) were conducted every three hours over a 24-hour period, stratified by depth and time according to the contingency table (Appendix Table 1). Transects were occupied in the following sequence: 10 → 8 → 6 → 4 → 2 → 1 → 3 → 5 → 7 → 9 (Figure 1 and Appendix Table 2).

On Transects 10 or 8 (depending on catches), 6 and 3, 24-hour Engle midwater trawl (EMT) surveys were scheduled to be carried out. EMT stations consisted of a series of 15-minute tows at 50, 100, 200, and 300 m, conducted in rapid succession and repeated every four hours over a 24-hour period.

Catch was not large in Transect 10 to justify trying a 24-hour EMT station. In Transect 8, after the bottom trawl survey, an EMT station was attempted but was terminated after two sets due to poor results. In Transect 6 the EMT was replaced by a 24-hour standard midwater trawl station at 300 m of water in an area where good squid catches were obtained during the bottom trawl survey. Thirty-minute sets were conducted every two hours, alternating between 100 and 200 m. Time permitted a 12-hour bottom trawl survey and a 12-hour night time midwater trawl station in Transect 3. The midwater trawl did 30-minute tows every two hours at 100, 200, and 300 m.

Salinity and temperature profiles were obtained at each set to a depth of 110 m, using a portable salinometer. XBT temperature profiles were also taken at the extreme ends of each transect as well as during each set of the midwater station.

A total of 99 sets were completed during the cruise: 8 EMT sets, 18 midwater trawl sets, and 73 bottom trawl tows (Appendix Table 2).

Throughout the cruise, lively specimens of I. illecebrosus were put in a tank in an attempt to bring them back to the lab for behavioral studies. The tank measured 1.5 x 1.5 x 1.2 m, had a heavy rubber cover to keep out the light, and had seawater constantly circulating through it. Various techniques were attempted to keep squid alive.

Cruise 7913

The survey attempted: to study geographic and temporal variations in the distribution of I. illecebrosus; to determine if larvae and juveniles are present outside the Scotian Shelf; to locate and study mature females; to study oceanographic conditions at sampling station; to collect data for studies on population structure, growth rate, feeding habits, and life cycle of Illex; and to collect live specimens for laboratory studies.

The cruise track suggested the following transect sequence: 1 → 3 → 5 → 7 → 9 → 8 → 6 → 4 → 2 (Figure 2). Due to the shortage of time, Transect 2 was not occupied. Proposed operations at each station included oblique bongo hauls, a series of EMT's at 50, 100, 200, 300, and 500 m conducted in rapid succession, and XBT and nansen bottles to determine temperature and salinity profiles.

Thirty stations were sequentially surveyed using standard midwater gear (Appendix Table 3). The EMT was used at Stations 1-4 where the five depths were surveyed at each station with 15-minute trawls. Due to extremely poor catches, it was decided to replace the EMT with a standard midwater trawl.

At the MWT (midwater trawl) stations, 30-minute trawls were made at depths of 100, 300, and 500 m, except Stations 12 to 15a. At these latter stations, two trawls were made at either 100 and 300 m or 200 and 500 m.

At each station, salinity and temperatures were taken at 0, 50, and 100 m depths, using a portable salinometer. In addition, three salinity samples were taken at 200, 300, and 450 m, using nansen bottles. XBT casts were also made at each station to obtain temperature profiles. A vertical bongo tow instead of an oblique tow was made from 200 m, using a 505 μ mesh because the vessel was not equipped with a proper winch to make an oblique tow.

After completion of Transect 4 and finding no mature female Illex, it was decided to conduct a series of bottom trawls on the slope where, in Cruise 7912, maturing females had been found. Seventeen stations (Figure 2) were conducted on the slope of the Shelf in Transects 5, 6, and 7. At each station, salinity and temperature profiles were obtained at 10 m intervals to a depth of 110 m, using a portable salinometer. Additional XBT temperature profiles were taken at Stations 71, 78, 79, 85, 86, and 87 and also at the extreme ends of each transect. Vertical bongo tows were done at each of these stations as well.

RESULTS AND DISCUSSION

The ten transects (Figure 1) in Cruise 7912 were distributed along the edge of the Scotian Shelf in order to maximize geographic coverage of possible emigration areas of I. illecebrosus from the Shelf. The cruise track and sampling program was made sensitive to possible southwestward migration patterns. Bottom trawl sampling was depth stratified using a contingency table (Appendix Table 1) to also determine a possible deep-water migration, while diurnal patterns were monitored. The cruise included a survey of the upper regions of the water column at strategic transects. Appendix Table 2 gives locations and set details.

The cruise track proposed for Cruise 7913 attempted to cover a larger area outward of the edge of the Scotian Shelf (Figure 2) using midwater gear. The transects extended into the Gulf Stream where larvae and juveniles from possible early spawnings may occur (Amaratunga, 1980a). However, poor catches required revisal of the program by compacting the stations and including a few bottom trawls. Appendix Table 3 gives locations and operations conducted during the cruise.

Indications of geographic distribution of I. illecebrosus obtained from the bottom trawl survey in both cruises are shown in Table 1a and b. Transects 5, 6, and 7 had the highest catch rates. Geographically, this represented an area extending from southwest of Sable Island Bank to Emerald Bank, an area traditionally known for large I. illecebrosus catches (Amaratunga et al., 1979). Cruise 7913 surveyed the same three transects because these transects produced good catches and relatively mature females were encountered. Catch rates continued to be high in Transects 5 and 7 approximately three weeks after the first survey, while Transect 6 showed considerable decreases approximately five weeks after the first survey.

Mean catch/tow was generally high within Transect 2, 3, and 4, producing close to 300 kg/30-minute trawl, and Transects 8 and 9 producing close to 400 and 500 kg/30-minute trawl respectively. The extreme region of the Shelf produced the lowest catch rates. Figures 1 and 2 also depict catch rates.

Catch rates summarized by depth (Tables 2a and b) show highest values at 251-350 m depths in Cruise 7912 (Table 2a), with catch/tow distribuiton being skewed toward deeper water (Figure 3). Three weeks later, the bottom trawl survey was limited to depths greater than 300 m. The catch rates were high at all these depths (Table 2b) and registered substantial increases at 651-850 m.

The catch rates of the midwater trawl survey are tabulated in Tables 3a and b. Cruise 7912 had very few tows which were mainly concentrated at depth 300 m or less.

Table 3a shows very high catch rates at 151-250 m depths. The later Cruise 7913, which covered a wide area, showed considerably lower catch rates but the best rates at 250-350 m and 450-650 m showed the presence of squid in deeper areas of the water column.

In order to determine if these results showed any geographic migration or migration to deeper water, squid mean sizes were cross tabulated (Table 4) against transects and depths. The mean lengths plotted against transects (Figure 4) showed no geographic distributional trends, although Transects 4 and 7 inclusive tended to have larger animals. The average length of males at each transect was close to 230 mm and females close to 260 mm. However, good correlations between mean mantle length and depth are seen in both sexes (Figures 5a and b). Such distributions, also observed in Cruise 7913, have been observed in late-season I. illecebrosus before (Amaratunga and McQuinn, 1979) and are presumed to relate to an ontogenic migration of mature animals (Lu, 1973; O'Dor et al., 1977).

Study of the maturation patterns were conducted in relation to possible ontogenic migrations. The general data showed that 88.5% of the males had reached maturity by Cruise 7912 and 94.7% by Cruise 7913. A majority of the females also showed the onset of maturation (Stage 3 - Amaratunga and Durward, 1979) had taken place. Similar results have been seen in the overall population for 1979 (Amaratunga, 1980a). Maturation patterns in Figures 6 and 7 show that as the maturity stages advanced, both males and females tended to be located in deeper water. Thus, an ontogenic migrating pattern (Lu, 1973; O'Dor et al., 1977) was evident in the bottom trawl survey.

Food and Feeding

Standard gut content and food type analyses (Amaratunga, 1980b) were conducted throughout the cruise. Although Cruise 7913 did not have many representative samples, Tables 5a and b summarize stomach fullness data. Criteria defined as "recently fed" animals (Amaratunga, 1980b) remained low through the season in the bottom trawl survey, similar to those observed for the 1979 population (Amaratunga, 1980b). The food type study of the bottom trawl survey also concurs with those observed for the 1979 population in that importance of crustacea in the diet decreased as cannibalism increased, and fish remained fairly low in importance (Tables 6a and b). The midwater trawl (although representative numbers were small) showed an increased importance of the fish component. The diurnal patterns of gut content (Table 7) showed crustacean component increasing between 08:00-12:00 hours similar to the total population studies. However, some interesting trends were seen in the fish and squid components. The fish remained relatively constant throughout the diurnal cycle, possibly indicating benthic fish predation and not associated with the diurnal migration as suggested for the total population (Amaratunga, 1980b). Cannibalism, on the other hand, was out-of-phase by increased percentages between 04:00-08:00 hours.

Preliminary observations on plankton samples showed no larvae or juveniles. However, the plankton samples have not been sorted and analyzed yet.

There were various attempts to retain live squid in tanks aboard. Techniques of catching them varied from bottom and midwater trwls as well as specifically attempting to catch them by short midwater trawls and jigging. In the tanks, various conditions such as changing water flow, introduction

of food, etc. were provided. All attempts proved unsuccessful. Usually the squid survived well for a day or two and gradually weakened and died after that.

In conclusion, it must be recognized that the survey produced a large amount of valuable data that has not been completely analyzed yet. While deep-water ontogenic emigration of I. illecebrosus was evident from the present biological data, much more information is likely to ensue from the physical oceanographic data and the plankton samples.

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Table 1a. Total catch and catch rate of *Illex* caught in the bottom trawl during Cruise 7912.

Transect	No. of tows	Total squid catch (kg)	Mean catch/tow (kg/tow)
1	5	614.5	122.9
2	8	2255.7	282.0
3	4	1065.5	266.4
4	8	2268.6	283.6
5	8	7851.3	981.4
6	7	13026.0	1860.9
7	8	9006.9	1125.9
8	8	3003.8	375.5
9	6	2939.0	489.6
10	5	860.1	172.0

Table 1b. Total catch and catch rate of *Illex* caught in the bottom trawl during Cruise 7913.

Transect	No. of tows	Total squid catch (kg)	Mean catch/tow (kg/tow)
5	8	6272.2	784.0
6	7	1362.2	194.6
7	2	1405.2	702.6

Table 2a. Total catch and catch rate of *Illex* caught in each depth strata using the bottom trawl during Cruise 7912.

Depth	No. of tows	Total catch (kg)	Mean catch/tow (kg/tow)
0-150	14	3087.5	220.5
151-250	16	9178.3	573.6
251-350	13	19600.4	1507.7
351-450	13	9325.4	717.3
451-650	8	4865.0	608.1
651-850	4	319.5	79.9

Table 2b. Total catch and catch rate of Illex caught in each depth strata using the bottom trawl during Cruise 7913.

Depth	No. of tows	Total catch (kg)	Mean catch/tow (kg/tow)
0-150	-	-	-
151-250	-	-	-
251-350	-	-	-
351-450	5	2205.4	441.1
451-650	6	3488.1	581.4
651-850	6	3346.1	557.7

Table 3a. Total catch and catch rate of Illex caught in each depth strata using the midwater trawl during Cruise 7912.

Depth	No. of tows	Total squid catch (kg)	Mean catch/tow (kg/tow)
0-150	12	62.6	5.2
151-250	9	493.2	54.8
251-350	3	22.5	7.5
351-450	1	17.0	17.0
451-650	1	0.4	0.4
651-850	1	0.9	0.9

Table 3b. Total catch and catch rate of Illex caught in each depth strata using the midwater trawl during Cruise 7913.

Depth	No. of tows	Total squid catch (kg)	Mean catch/tow (kg/tow)
0-150	32	15.9	0.5
151-250	6	0.9	0.2
251-350	28	112.8	4.0
351-450	-	-	-
451-650	27	264.4	9.8
651-850	-	-	-

Table 4. Mean lengths of I. illecebrosus from Cruise 7912 tabulated against transect and depth.

Depth (m) \ Transect #	1	2	3	4	5	6	7	8	9	10
0-60	- -	- -	- -	- -	- -	- -	- -	- 280.0	- -	- -
61-150	225.9 246.5	- -	224.2 252.9	- -	231.2 260.1	225.0 246.4	229.5 256.5	220.0 243.8	222.9 248.9	217.0 245.6
151-250	232.2 266.5	226.8 258.0	227.8 255.6	228.7 259.5	232.2 260.1	231.8 252.3	229.0 256.1	232.2 259.7	225.1 248.0	230.7 253.3
251-350	234.7 256.5	220.0 259.3	231.8 255.5	233.3 246.7	232.8 265.1	237.6 262.9	232.1 261.6	235.8 266.5	230.9 258.5	239.4 252.6
351-450	233.3 265.2	237.9 272.8	233.4 256.4	235.4 267.1	237.2 264.0	241.3 266.0	235.5 264.3	232.8 260.4	231.9 263.7	- -
451-650	- -	234.0 268.2	221.7 225.2	234.4 259.6	237.5 267.5	236.4 261.6	236.0 267.3	- -	- -	- -
651-850	- -	224.0 259.9	- -	235.3 269.0	236.6 267.4	228.4 259.4	- -	- -	- -	- -

Table 5a. Percent of empty and full stomachs of *Illex* caught with bottom trawl.

Week beginning	Empty		Full	
	Nos.	%	Nos.	%
Oct. 22	817	51.1	782	48.9
Oct. 29	2282	80.0	571	20.0
Nov. 5	1915	83.3	385	16.7
Nov. 19	76	76.0	24	24.0
Nov. 26	1116	68.2	521	31.8

Table 5b. Percent of empty and full stomachs of *Illex* caught with midwater trawl.

Week beginning	Empty		Full	
	Nos.	%	Nos.	%
Oct. 22	8	72.7	3	27.3
Oct. 29	367	79.1	97	20.9
Nov. 5	205	94.5	12	5.5
Nov. 12	159	43.4	207	56.6
Nov. 19	425	58.1	306	41.9

Table 6a. Percent food type found in the stomach of *Illex* caught with bottom trawl.

Week beginning	Food type					
	Crustacean		Fish		Squid	
	Nos.	%	Nos.	%	Nos.	%
Oct. 22	392	53.9	157	21.6	178	24.5
Oct. 29	341	35.6	189	19.7	428	44.7
Nov. 5	203	22.2	228	24.9	484	52.9
Nov. 19	7	31.8	10	45.5	5	22.7
Nov. 26	116	24.5	115	24.3	243	51.3
Total	1059	34.2	699	22.6	1338	43.2

Table 6b. Percent food type found in the stomach of Illex caught with midwater trawl.

Week beginning	Food type					
	Crustacean		Fish		Squid	
	Nos.	%	Nos.	%	Nos.	%
Oct. 22	0	-	0	-	3	100.0
Oct. 29	71	65.7	2	1.9	35	32.4
Nov. 5	11	27.5	8	20.0	21	52.5
Nov. 12	15	8.1	87	47.0	83	44.9
Nov. 19	24	11.2	89	41.6	101	47.2
Total	121	22.0	186	33.8	243	44.2

Table 7. Percentage of food types found in the squid stomach over a 24-hour period.

Time	Food type					
	Crustacean		Fish		Squid	
	Nos.	%	Nos.	%	Nos.	%
00:01-04:00	111	9.4	115	13.0	168	9.1
04:01-08:00	110	9.3	167	18.9	413	22.3
08:01-12:00	313	26.5	169	19.1	397	21.4
12:01-16:00	226	19.2	105	11.9	389	21.0
16:01-20:00	296	25.1	188	21.2	314	17.0
20:01-24:00	124	10.5	141	15.9	170	9.2

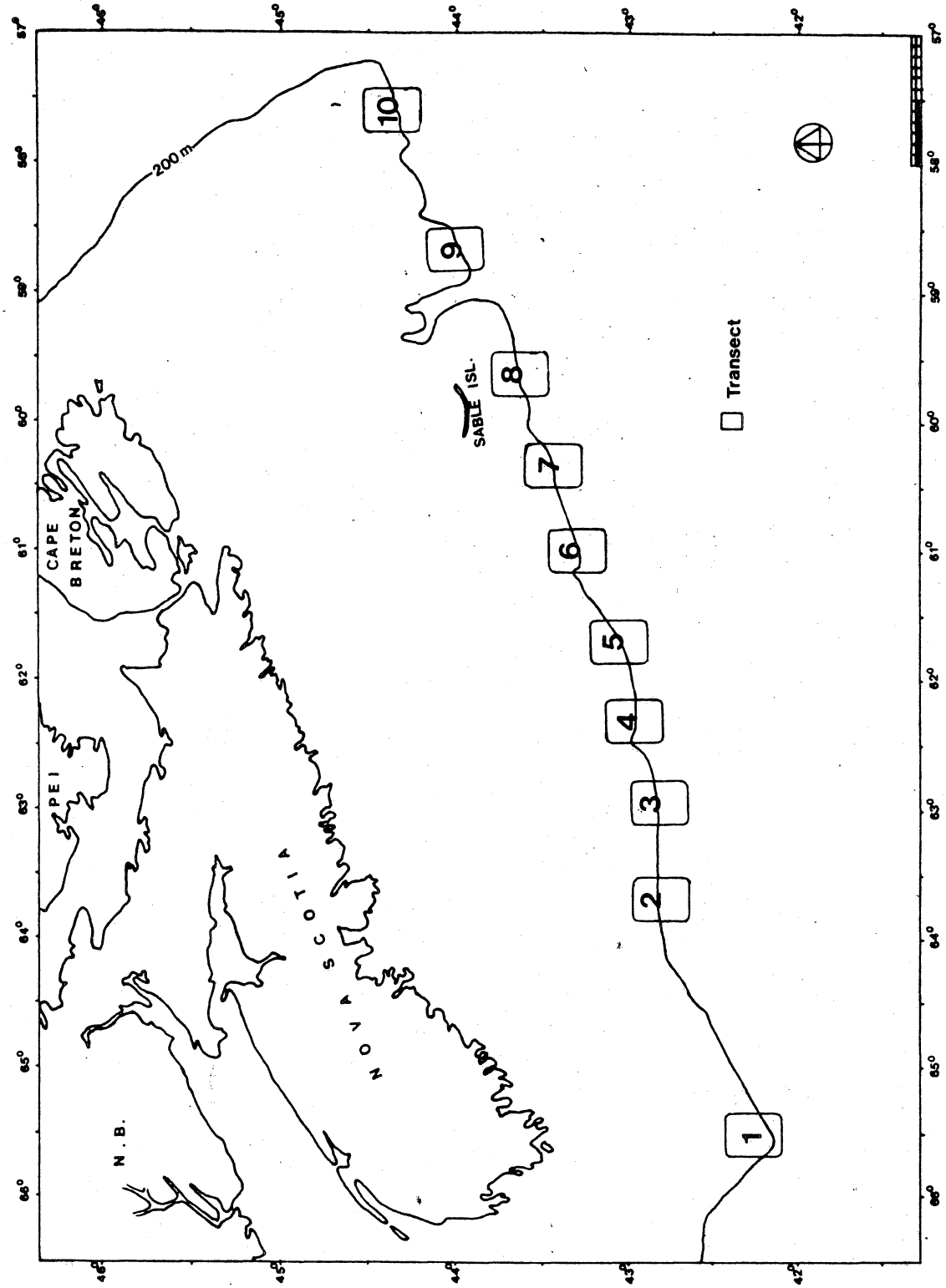

Figure 1. Transects surveyed during Cruise 7912, October 28 to November 10, 1979.

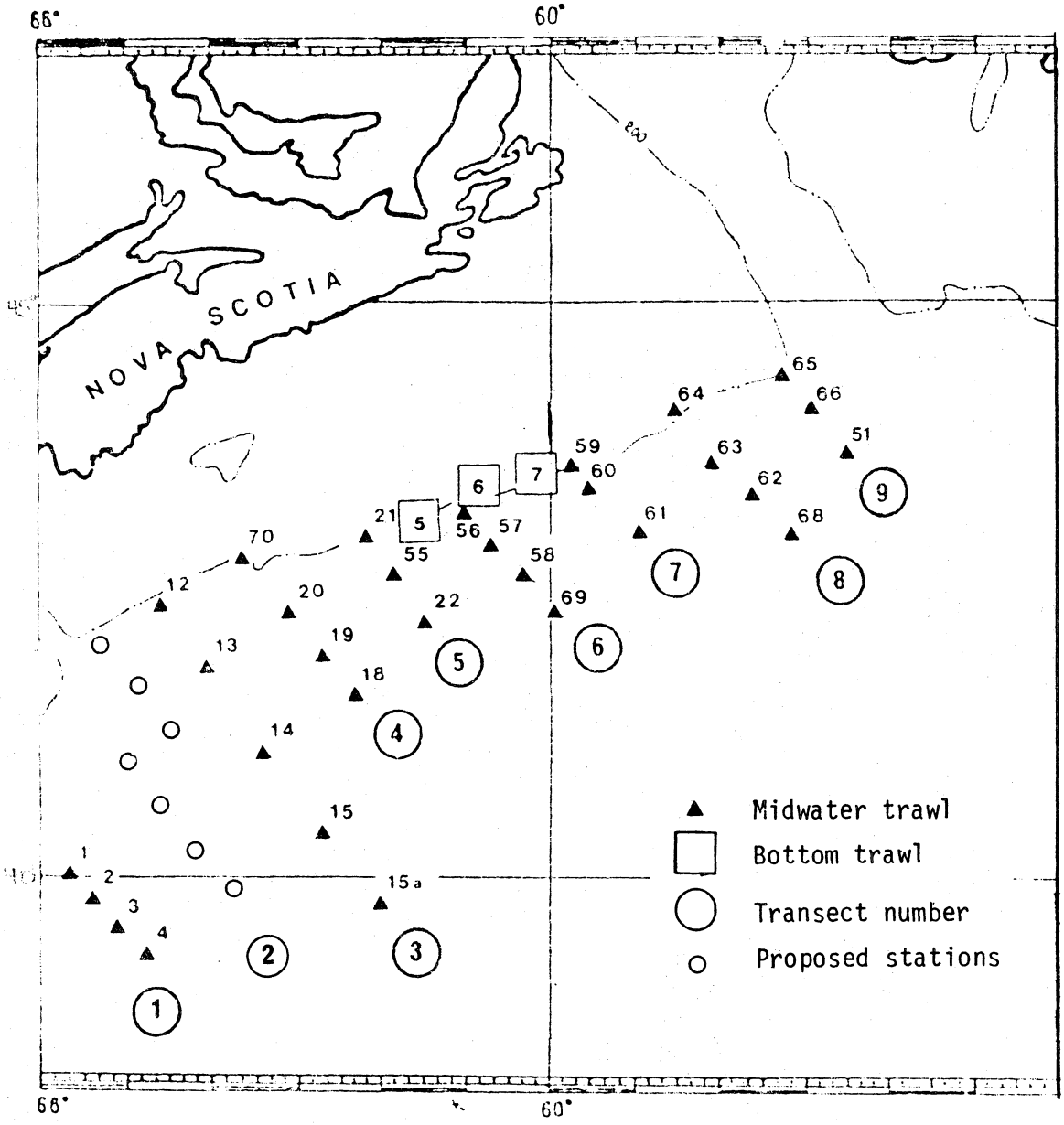

Figure 2. Transects and stations surveyed during Cruise 7913, November 11-29, 1979.

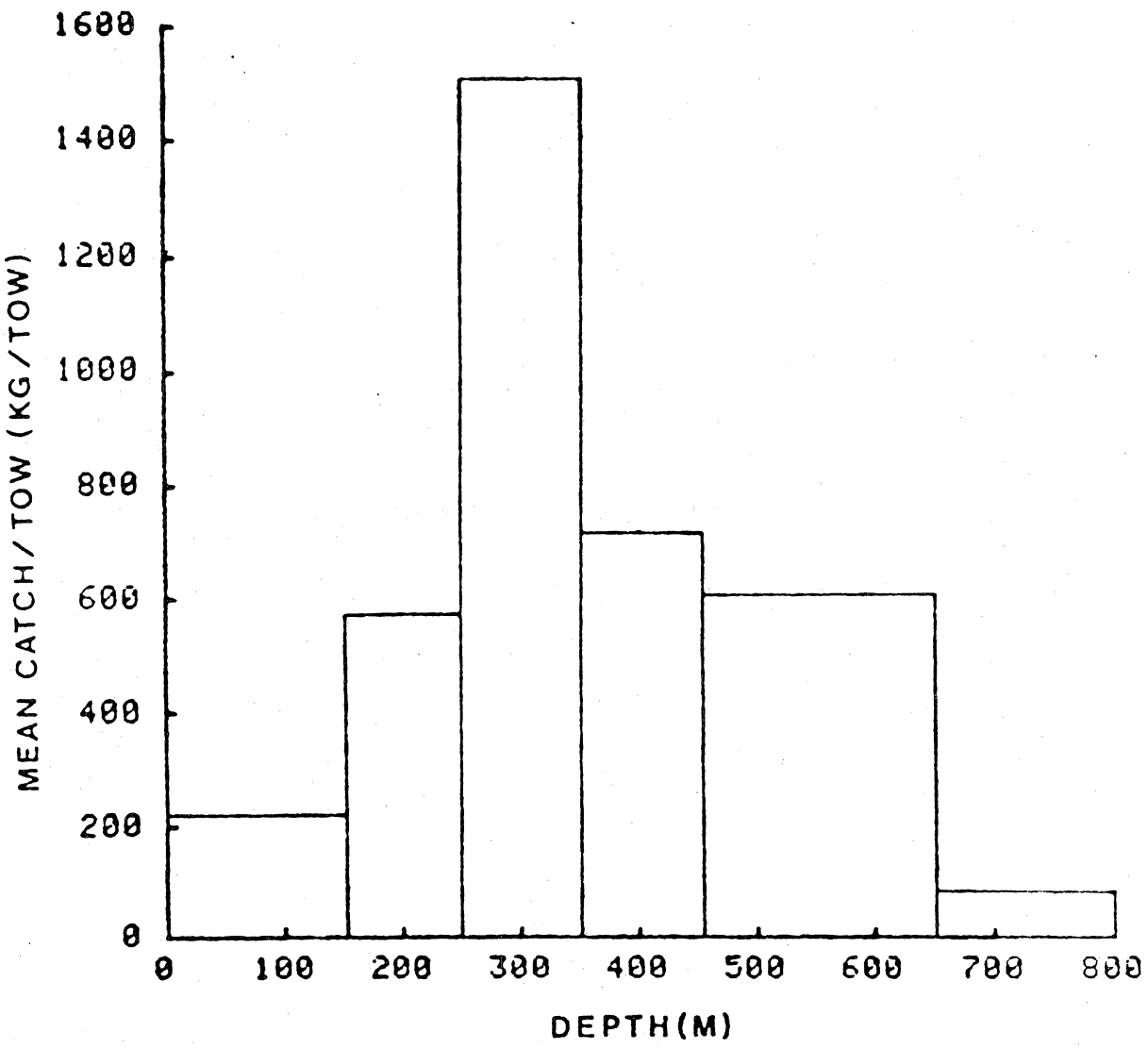

FIGURE 3 . Histogram showing mean catch per tow stratified by depth for bottom trawl survey in Cruise 7912

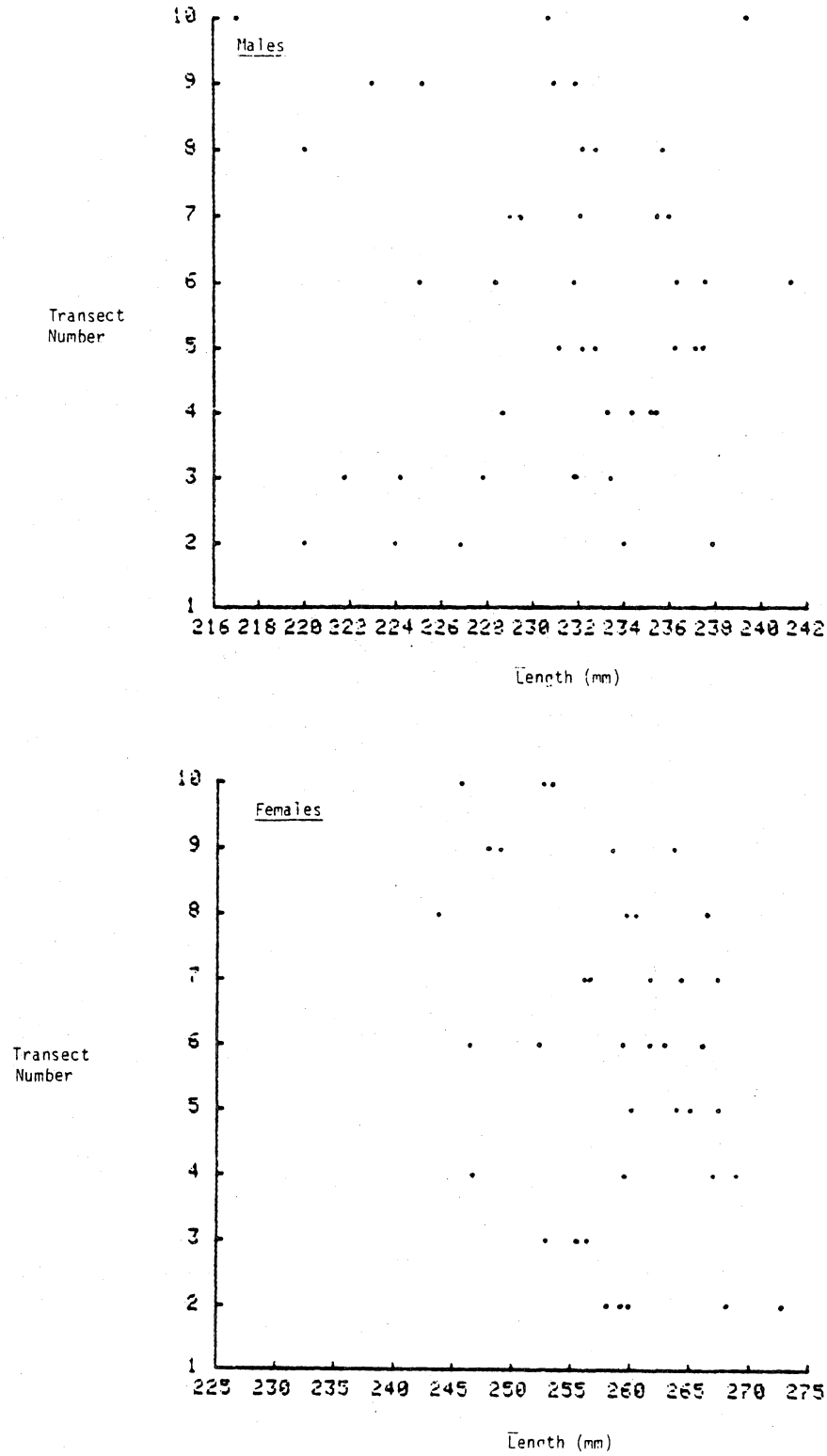

Fig. 4. Mean mantle lengths of male and female *I. illecebrosus* of Cruise 7912 plotted against transect number.

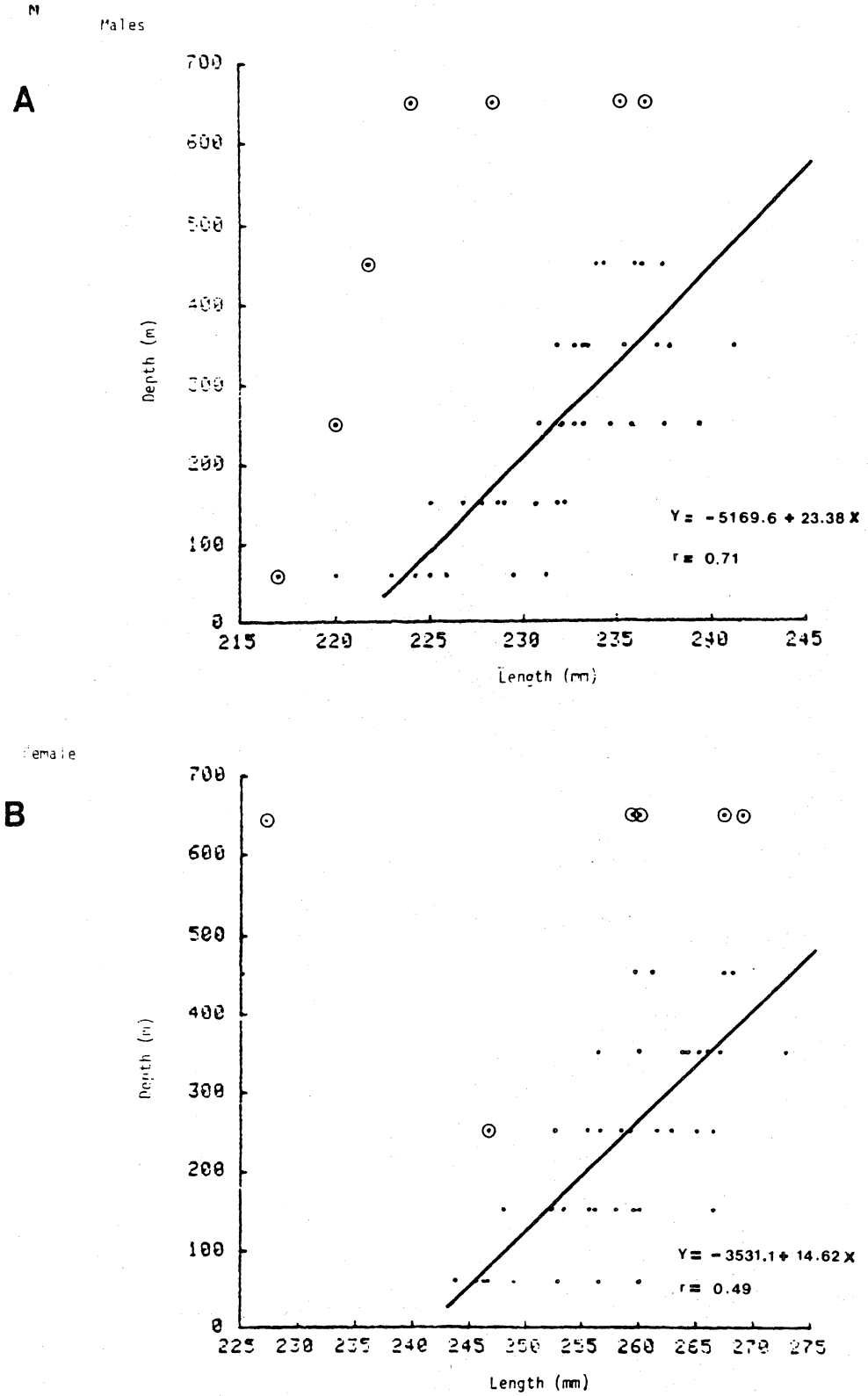

Fig. 5. Regression of mean lengths of male (A) and female (B) *I. illecebrosus* from Cruise 7912 against depth.

⊙ Excluded from regression analysis.

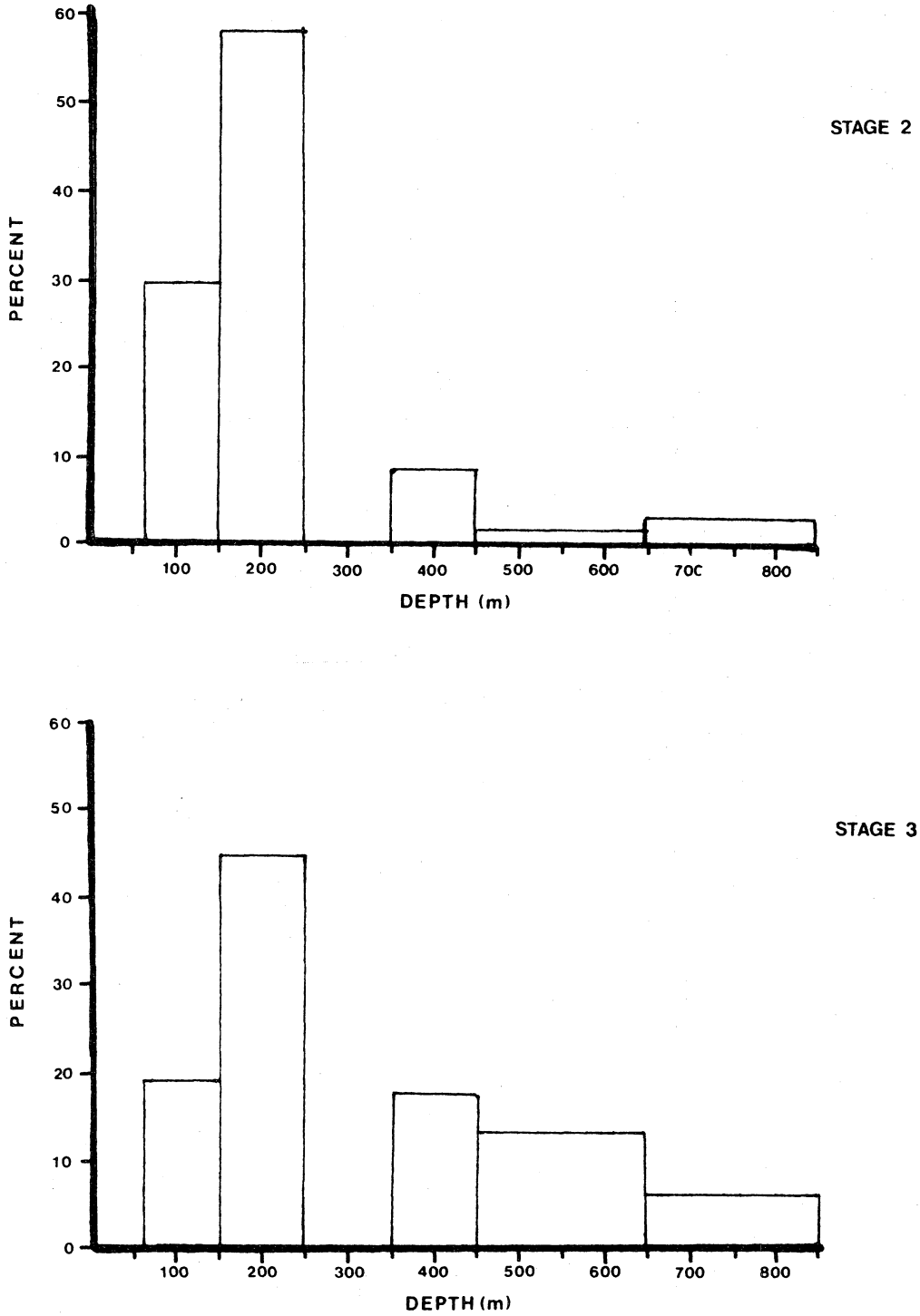

Figure 6. Histogram showing male maturity stages 2 and 3 at each depth regime.

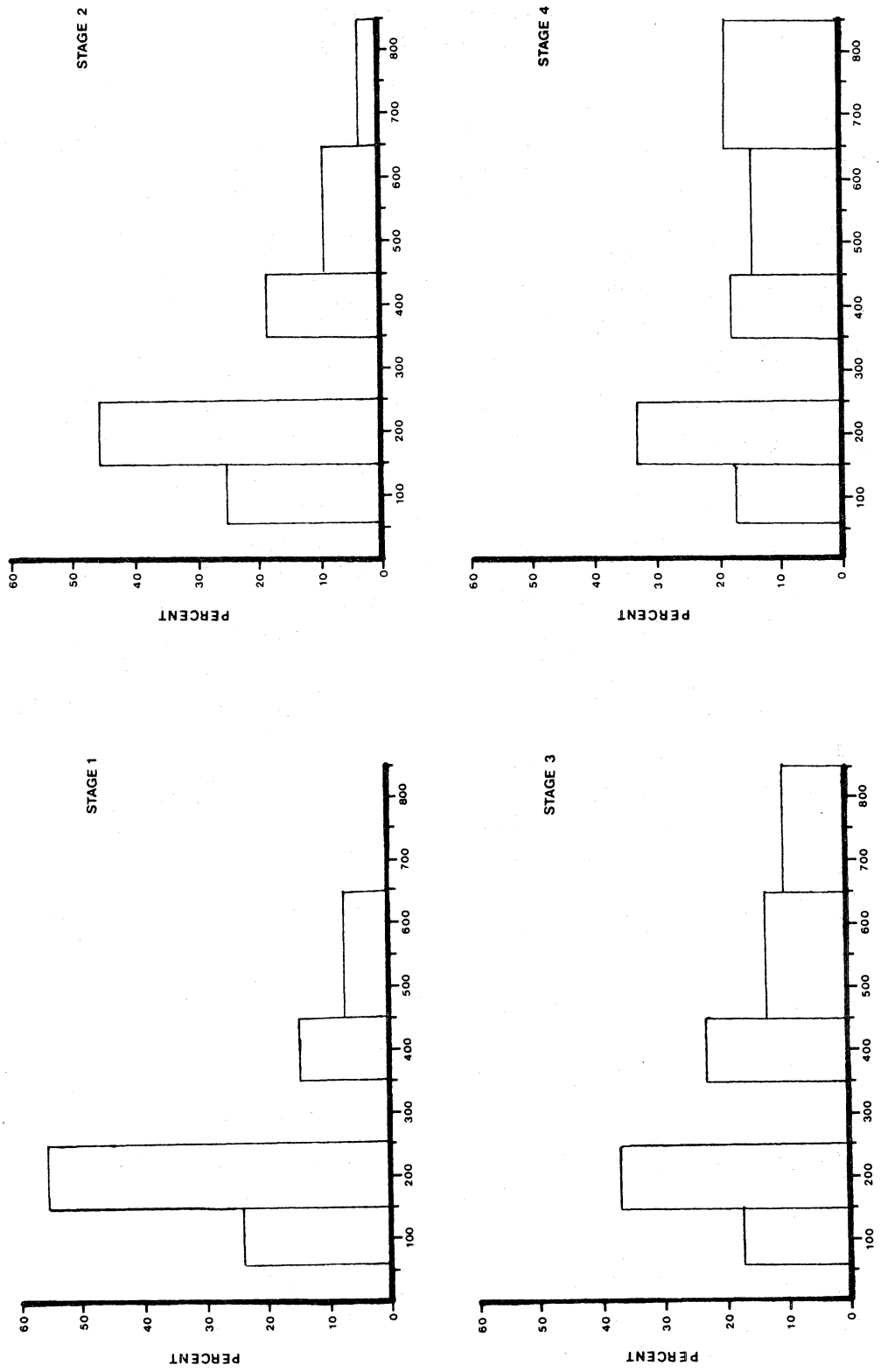

Figure 7. Histogram showing female maturity Stages 1 to 4 at each depth regime.

APPENDIX

App. Table 1. Contingincy table showing the time and depth at which each bottom trawl set was made. (NOTE: No set was made below 750 m as this was the limit of the trawl gear.)

Time / Depth (m)	00:01 06:00	06:01 12:00	12:01 18:00	18:01 24:00
100 0 - 150	6, 45, 86	1, 13, 63, 82	24, 25, 65, 70	27, 67, 91 97
200 151 - 250	28, 46, 61, 99	11, 48, 68	2, 53, 64, 90, 94	5, 55, 78 96
300 251 - 350	7, 9, 80, 98 98	30, 47, 77	3, 4, 15, 54 89	26, 66, 92
400 351 - 450	10, 29, 62, 93	12, 59, 87	14, 49, 69 95	8, 56, 85
500 451 - 650	57, 79	31, 60, 88	50, 83	52
750 651 - 850	58	81	32, 84	51

App. Table 2. Hauling depth, time, net temperature and coordinates of bottom trawl, midwater trawl and EMT stations.

STATION #	DEPTH (M)	TIME (GMT)	NET TEMPERATURE (°C)	LATITUDE	LONGITUDE
1	89	1220	5.5	44° 26'	57° 37'
2	204	1540	7.0	44° 21'	57° 39'
3	270	1754	7.0	44° 20'	57° 43'
4	295	2055	7.0	44° 19'	57° 36'
5	224	0040	7.0	44° 21'	57° 35'
6	108	0325	8.0	44° 23'	57° 40'
7	312	0635	7.0	44° 19'	57° 37'
8	365	2400	8.0	43° 37'	59° 37'
9	268	0250	8.0	43° 37'	59° 43'
10	450	0550	7.0	43° 36'	59° 42'
11	180	0840	8.0	43° 40'	59° 36'
12	420	1210	7.5	43° 37'	59° 41'
13	120	1435	3.5	43° 41'	59° 40'
14	362	1735	7.5	43° 36'	59° 44'
15	282	2020	8.0	43° 38'	59° 40'

App. Table 1. (Cont'd)

STATION #	DEPTH (M)	TIME (GMT)	NET TEMPERATURE (°C)	LATITUDE	LONGITUDE
16-23 *				43° 36'	59°42'
24	102	1800	4.5	43° 23'	60°54'
25	114	1915	7.0	43° 20'	60°53'
26	260	2215	8.0	43° 17'	61°00'
27	134	0110	8.5	43° 19'	60°57'
28	170	0410	10.0	43° 19'	60°53'
29	405	0720	7.0	43° 17'	60°51'
30	286	1020	7.0	43° 16'	60°58'
31	470	1425	8.0	43° 14'	61°01'
32	700	1740	5.0	43° 13'	61°03'
33-44 **				43° 16'	61°58'
45	110	0415	7.0	43° 07'	62°14'
46	156	0720	9.0	42° 58'	62°23'
47	314	1025	8.5	42° 55'	62°19'
48	208	1335	10.0	42° 57'	62°18'
49	440	1620	6.5	42° 54'	62°19'
50	550	1925	6.0	42°55'	62°16'
51	710	2230	6.5	42°52'	62°19'
52	535	0230	5.5	42°55'	62°25'
53	222	1625	10.0	42°49'	63°45'
54	295	1920	8.0	42°48'	63°37'
55	176	2215	10.0	42°52'	63°38'
56	396	0115	7.8	42°47'	63°38'
57	570	0425	6.0	42°46'	63°34'
58	720	0730	4.8	42°44'	63°31'
60	480	1325	6.7	42°47'	63°43'
61	203	0420	11.5	42° 08'	65° 37'
62	355	0730	9.0	42° 08'	65° 37'
63	124	1035	11.0	42° 11'	65° 37'
64	190	1455	14.0	42° 11'	65° 24'
65	128	1750	15.0	42° 16'	65° 21'
66	290	2100	9.0	42° 11'	65° 22'
67	108	0035	13.5	42° 28'	65° 21'
68	151	1330	10.5	42° 51'	62° 51'
69	400	1635	7.5	42° 48'	62° 57'
70	144	1930	10.5	42° 50'	62° 55'
71-76 **				42° 48'	62° 51'
77	260	1035	7.3	42° 49'	62° 52'
78	216	0010	9.0	43° 01'	61° 43'
79	480	0330	6.0	42° 57'	61° 43'
80	292	0615	8.8	43° 00'	61° 43'
81	700	0925	5.5	42° 55'	61° 44'
82	118	1205	9.0	43° 06'	61° 37'
83	495	1520	6.5	42° 57'	61° 44'
84	720	1835	5.0	42° 54'	61° 47'
85	425	2120	6.0	42° 58'	61° 43'
86	148	0715	4.0	43° 28'	60° 20'
87	370	1040	6.5	43° 25'	60° 20'
88	452	1340	6.0	43° 24'	60° 16'
89	304	1625	9.0	43° 26'	60° 17'
90	192	1925	10.0	43° 27'	60° 22'
91	120	2225	4.0	43° 30'	60° 21'
92	288	0125	6.5	43° 26'	60° 14'
93	410	0410	7.5	43° 58'	58° 19'
94	232	1450	8.0	43° 58'	58° 41'
95	400	2100	6.5	43° 58'	58° 36'
96	231	2400	7.5	44° 00'	58° 36'
97	105	0245	3.0	43° 04'	58° 38'
98	296	0545	7.2	43° 59'	58° 36'
99	220	0835	7.0	43° 59'	58° 38'

* EMT STATIONS
** MIDWATER TRAWLS STATIONS

App. Table 3. Operations and coordinates of the stations surveyed in Cruise 7913.

Transect	Station number	Date	Location		Operations*
			Latitude	Longitude	
1	1	13/11	39°58'	65°38'	EMT, B, XBT, S
	2	13/11	39°47'	65°27'	EMT, B, XBT, S
	3	14/11	39°30'	65°03'	EMT, B, XBT, S
	4	14/11	39°13'	64°45'	EMT
3	12	16/11	42°22'	64°42'	MWT, B, XBT, S
	13	16/11	41°42'	64°00'	MWT, B, XBT, S
	14	16/11	41°02'	63°20'	MWT, B, XBT, S
	15	15/11	40°22'	62°38'	MWT, B, XBT, S
	15a	14/11	39°41'	61°57'	MWT, B, XBT, S
4	18	24/11	41°30'	62°20'	MWT, B, XBT, S
	19	24/11	41°53'	62°43'	MWT, B, XBT, S
	20	25/11	42°16'	63°06'	MWT, B, XBT, S
	70	25/11	42°46'	63°35'	MWT, B, XBT, S
5	21	17/11	42°55'	62°11'	MWT, B, XBT, S
	55	17/11	42°34'	61°48'	MWT, B, XBT, S
	22	18/11	42°16'	61°28'	MWT, B, XBT, S
6	56	23/11	42°37'	60°20'	MWT, B, XBT, S
	57	23/11	42°55'	60°41'	MWT, B, XBT, S
	58	23/11	43°11'	60°58'	MWT, B, XBT, S
	69	23/11	42°14'	59°58'	MWT, B, XBT, S
7	59	19/11	43°32'	59°43'	MWT, B, XBT, S
	60	19/11	43°19'	59°26'	MWT, B, XBT, S
	61	18/11	42°59'	59°03'	MWT, B, XBT, S
8	62	21/11	43°21'	57°43'	MWT, B, XBT, S
	63	21/11	43°41'	58°07'	MWT, B, XBT, S
	64	22/11	44°00'	58°29'	MWT, B, XBT, S
	68	21/11	42°55'	57°13'	MWT, B, XBT, S
9	51	20/11	43°40'	56°30'	MWT, B, XBT, S
	65	20/11	44°23'	57°17'	MWT, B, XBT, S
	66	20/11	44°00'	56°55'	MWT, B, XBT, S
5	71	25/11	42°59'	61°37'	BT, B, XBT, S
	72	26/11	42°59'	61°40'	BT, S
	73	26/11	42°55'	61°44'	BT, S
	74	26/11	42°57'	61°41'	BT, S
	75	26/11	43°00'	61°39'	BT, S
	76	26/11	42°56'	61°41'	BT, S
	77	26/11	42°58'	61°43'	BT, S
	78	26/11	42°55'	61°42'	BT, S
6	79	27/11	43°14'	61°03'	BT, B, XBT, S
	80	27/11	43°16'	60°51'	BT, S
	81	27/11	43°12'	61°03'	BT, S
	82	27/11	43°16'	60°51'	BT, S
	83	27/11	43°17'	60°50'	BT, S
	84	28/11	43°13'	60°55'	BT, S
	85	28/11	43°14'	60°59'	BT, B, XBT, S
7	86	28/11	43°25'	60°16'	BT, B, XBT, S
	87	28/11	43°25'	60°10'	BT, XBT, S

*EMT = Engle Midwater Trawl
BT = Bottom Trawl
MWT = Midwater Trawl
B = Vertical Bongo
S = Salinity
XBT = XBT Cast