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An Analysis of Logs from the 1985 4X Summer Purse Seine Fishery

by

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ABSTRACT

A new purse seine logbook format, introduced at the start of the 1985 4X summer purse seine fishery, is documented and the first year of use analyzed. Log coverage was excellent; 1802 logs (\approx nights fishing) were received from all 41 active vessels, representing 2395 sets and accounting for 96% of the landed weight of fish. A detailed summary of the returns by log item documents the improved quantity and quality of the 1985 data over recent years, especially in the areas of market components, reasons for release of fish and fine scale patterns of fleet activity (including effort on spawning grounds). A number of CPUE measures are presented, including catch per night, catch per set, catch per hour searching and average number of sets per hour.

RÉSUMÉ

On décrit un nouveau format de journal de bord de pêche à la senne coulissante, introduit au début de la saison estivale 1985 dans le secteur 4X où l'on pratique ce type de pêche, et l'on analyse la première année d'utilisation. Les détails ont été couverts de façon excellente dans le journal de bord; 1 802 entrées (\approx nuits d'activités de pêche) ont été fournies par 41 navires actuellement en service, représentant 2 395 coups de senne et indiquant 96 % en poids de la quantité de poisson débarqué. Dans un résumé détaillé des rentrées par élément du journal est documentée l'amélioration de la quantité et de la qualité des données obtenues en 1985 par rapport à ces dernières années, en particulier dans le domaine des composantes du marché, des raisons pour lesquelles on a laissé tomber des prises, et des modes d'activité de la flotte (y compris l'effort de pêche dans les aires de reproduction). On présente un certain nombre de mesures de PUE (Prises par unité d'effort), y compris le nombre de prises par nuit, de prises par coup de senne, de prises par heure d'activité de pêche, et le nombre moyen de coups de senne par heure.

INTRODUCTION

Purse seiners dominate the large 4WX herring fishery. For several years the fleet has been allocated 80% of the TAC and, in 1985, the 41 active vessels recorded total landings of 101,337 t ~ 90% of the 4WX stock catch (Stephenson et al. 1986). The potential of this segment of the fishery to affect the stock structure and parameters used in assessment (particularly CPUE indices) is obvious, and points to the need to document a number of aspects of fleet performance.

While a considerable amount of data has been collected routinely from the 4WX purse seine fishery, the quality and quantity of this information has not always been adequate. The previous assessment of this stock (Stephenson et al. 1985) discussed the high degree of misreporting that was occurring in the purse seine fishery at that time. Statistical information was incomplete, as was information from logbooks (Table 1). As part of an effort to improve the quality of biological information, a new purse seine logbook was designed (Fig. 1) and implemented for the 1985 4X summer fishery. At the same time, several operational initiatives were put into effect, including submission of logs on a weekly basis as a condition of licence, which reduced misreporting and improved logbook return (Table 1). The result was a significant improvement in the amount of catch information from the purse seine fishery.

In this paper we document the new log format and analysis of the first season of use. In addition, we present initial values for a new CPUE series that may be of use in future assessments.

The 4WX purse seine log format

Several logbook formats were in use in the 4WX fishery prior to 1985. These formats lacked places for information on a number of important activities for the herring purse seiners, especially searching time. The revised log (Fig. 1) has several improvements, including fields for search time, markets sought and set specifics laid out on one page for each trip or fishing night.

Preparation of logs for analysis

All logs were coded by MFD personnel familiar with the herring fishery and according to the format specified in Appendix 1. Without this aspect of quality control it would not have been possible to place much confidence in the resulting data.

Editing included keypunch verification, visual comparison with original logs and checks for specific problem fields including:

- outliers in position
- catch of 0 mt but no release code
- kept catch but no total catch.

A more complete editing program is planned for 1986 with appropriate range, inter-field and inter-record checks.

Analysis

Log coverage was excellent; 1802 logs (nights) were received from all 41 active vessels, representing 2295 sets and accounting for 96% of the landed weight of fish (Table 1). Logs were generally complete and decipherable (Table 2). The new form was completed well for location (96%) and catch (84%). Response in the new fields for search time (65%) and trip time (83%) could be improved but was adequate for this analysis.

The average trip lasted 12.2 hours, involved 4.3 hours of searching and resulted in 1.4 sets. A set location (most often a Loran C bearing) was provided for 55% of sets. An additional 41% of the sets were attributed to 10 minute squares inferred from location comments. The average total catch was 40.1 mt, and kept catch 39.5 mt per set. Table 3 lists the ranges and average values for data variables presented in this analysis.

The dominance of the roe market is shown in the summary of market codes (Table 4); 27% of all logs specified the roe market and an additional 35% indicated "adult shore" which would include roe processing.

Release comments were associated with 21% of all sets (Table 5). This compares with 23% and 17% of all sets for 1983 and 1984, respectively, reported by Mace (1985). Size of fish (usually too small) was the primary reason for release, accounting for about 3% of total sets. Less than 2% were "skunk" sets. Dogfish were cited in the comments as a reason for release in 1.7% of all sets. In addition, 3.3% of all logs which had no catch were coded as 'No fish found.'

Use of logs in preparation of the catch-at-age matrix

An important use of log data is in matching catch with biological samples. The purse seine fleet is selective for particular fishing grounds and for particular sizes of fish (e.g. roe or sardine) due to market requirements. As a result, consideration of catch and sampling data on a smaller spatial scale than that used in other gear components of the 4WX fishery has been shown to be advantageous (Stephenson et al. 1985). The 1985 log data were used to partition catches and to attribute biological length frequency samples on a 10 minute square basis by month as follows.

"Total landed catch" (mt) from logs (partitioned by month and 10 minute square) was adjusted proportionately to the reported statistics catches for that month. Adjusted catch values were then matched to length frequency samples for each 10 minute square. In cases where catches and samples did not match (often the case for squares with very low catches and infrequently for a length frequency sample without associated catches) data from adjacent squares was used. These "matched" catch and length frequency data were used to generate a catch matrix of total removals by age and length (using program HERNAG09) for each 10 minute square and month. These data were aggregated (summed) for the fishery, added to calculations for the other 4WX stock components and used as primary input to the stock assessment (Stephenson et al. 1986).

Temporal and spatial distributions of the fishery

A plot of the distribution of catch and effort by 10 minute squares (Fig. 2) shows the focus of fishing activity on major grounds; especially Trinity Ledge, German Bank and the Seal Island area. Two 10 minute squares covering the Trinity grounds, alone, account for 33,328 t, 948 hours searching and 1820 sets. This focus of activity on the one of the main spawning areas for the 4WX stock is further demonstrated by plotting catch and effort data where roe was specified as the market sought (Fig. 3). Once again, the Trinity ground dominates, followed by German Bank and Seal Island.

The spatial and temporal distribution of spawning can be estimated from comments on roe condition. Figure 4 shows the distribution by month of catches with comments on the log indicating "ripe" or "good" roe (equated with stage 5) or "spawning" (stage 6). Figure 5 shows that ripe and spawning fish are found in discrete areas between mid July and mid October, with a peak in early September.

CPUE analysis

Effort and catch-per-unit effort data are usually used to select fishing mortalities in sequential population analysis. Unfortunately, CPUE from mobile gear types in pelagic fisheries is complicated by several factors: catchability (q) of pelagic fisheries is probably not constant, and may increase as population size decreases (Saville 1980; Sinclair et al. 1985); and catch rates for mobile gear types, especially purse seiners, are affected by fleet dynamics (e.g. Powles 1981). On the other hand, a recent comprehensive study of the 4X purse seine fishery (P.M. Mace 1985 and unpubl.) indicates that a useful catch/effort series may be possible using accurately compiled data on set, search, school size and catch.

The 1985 log information has allowed the calculation of several indices of CPUE on a nightly basis for each vessel. They include catch per night, catch per hour searched, catch per set and sets per hour searched. The last measure may also be used as an indicator of availability of suitable schools of fish. These data have been summarized by month, by major fishing grounds and by square (Table 6, 7, 8, 9 and Fig. 2).

Catch per night (see Average-Total MT Caught) ranged from 28.6 T on Long Island shore to 61.4 T on German Bank (Table 8) and was highest in October (Table 7).

Total logged search time was focused on Trinity Ledge with 2106 hours (41%) of all searching and 1028 sets (45%) (Table 8). Catch per hour searching ranged from 10.5 on Lurcher to 30.9 on German Bank (Table 8) and were the highest in September (Table 7).

Catch per set ranged from 34.2 on Southwest Grounds to a high of 49.8 on German Bank (Table 8) and were the highest in September (Table 7).

The set rate (sets per hours searching) ranges from 0.18 on Lurcher to 0.73 on Grand Manan (Table 8) and were the highest in September (Table 7).

Of note is that Trinity, despite having the highest concentration of total number of sets for the months of August (46%) and September (70%) has a lower CPUE for August than most other areas. In fact, all measures of CPUE from this area are less than median for most of the entire season. German Bank and Grand Manan, on the other hand, show up consistently in the higher end for all measures of CPUE (Table 9). This difference may reflect effort saturation on Trinity Ledge; availability and CPUE may be decreasing while relatively 'less disturbed' grounds are showing higher availability and CPUE. Monthly plots of CPUE by month and fishing grounds (Fig. 6) demonstrate the relative differences for each of the CPUE measures presented.

Maps showing the distribution of CPUE for the year and each month are presented in Fig. 7 through 12 and for each of the CPUE measures. The spread of effort on pre-spawning aggregations in July which then concentrates on the spawning areas in August and to a greater degree in September is clearly shown. Differences in overall CPUE measures are not easily apparent on these distribution maps.

The variability of these data suggest the need for appropriate stratification in order to best determine an overall fishery CPUE which could be developed for the 4Xa purse seine fleet.

The next step would seem to be the development of a time series to correspond with this year's data. In 1986, we hope to maintain the excellent logbook return and completion through increased contact with the fishery, including feedback on the 1985 returns.

The incorporation of existing historical logbook data through a re-analysis and update of required fields would also be a logical step.

CONCLUSIONS

1. A dramatic improvement in log returns, 96% of total catch, together with a revised format, has resulted in improved quantity and quality of information from the 4X summer purse seine fishery.
2. Market category indicated that 30% of catches were destined specifically for roe, in addition to a proportion of the 38% described as adult shore market.
3. Releases occurred with 20% of all sets made but only accounted for 7% of the logged catch.
4. Average CPUE indices (\pm SD) were as follows: catch per night = 46.2 ± 38.1 t; catch per hour searched = 26.6 ± 41.8 t; catch per set = 41.0 ± 25.1 t; sets per hour searched = $.62 \pm .75$ h.

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Table 1. Historical logbook coverage of the 4X summer purse seine segment in 4WX herring assessments.

Year	Vessel #	Log return (% of vessels)	Total # sets logged	Catch per night ¹	Fishery catch Total(t) ¹	(% logged)	Source for (% logged)
1967	-	-	-	55.4	117382	-	
1968	-	-	-	52.8	133267	-	
1969	-	-	-	41.7	84525	-	
1970	-	-	-	39.0	74849	-	
1971	-	-	-	32.6	35071	-	
1972	-	-	-	45.0	61158	-	
1973	17	-	403	49.1	36618	(48) ²	This paper
1974	-	-	-	53.4	76859	-	
1975	-	-	-	57.4	79605	-	
1976	-	-	-	44.6	58395	(72)	Sinclair and Iles (1980)
1977	27	-	1137	37.4	68538	(47)	" "
1978	22	-	701	39.5	57973	(36)	" "
1979	28	-	641	31.7	25265	(28)	" "
1980	44	-	1273	28.5	44986	(73)	Stephenson et al. (1985)
1981	39	-	802	42.0	53799	(55)	" "
1982	12	-	268	40.6	64344	(8)	Iles and Simon (1983)
1983	47	-	1406	34.8	63379	(68)	Iles et al. (1984)
1984	26 ¹	(60) ¹	530	52.0	58354	(43)	Stephenson et al. (1985)
1985	41	(100)	2 295	46.2 ²	87167 ²	(96) ²	This paper

¹Catch per night, total fishery catch and % vessel returns are all from Stephenson et al. (1985).

²This paper.

Table 2. Summary of data coverage by field for 1985 4Xa herring purse seine logs.

Field	Number of logs	% occurrence	Range comments	Mean
1. Vessel	41 of 41 vessels; 1802 nights 2295 sets	100	24 to 64 nights per vessel	-
2. Departure date	1802 nights	100	June 22-Oct. 14, 1985	-
3. Trip time (hours)	1494 nights	83	1 to 30.5	12.2
4. Search time (hours)	1177 nights	65	0.1 to 14.5	4.3
5. Set date	2007 of 2471 activity records	81	June 22-Oct. 15, 1985	-
6. Set number	2295 sets	91	0-6 per night; 9% unsuccessful nights	1.4 per successful night
7. Start set time	1801 of 2471 activity records	75		
8. Position type	- unspecified	4	No position recorded	-
	- latitude/longitude	8	Specified on log	-
	- Loran C	32	Specified on log	-
	- square number	15	Specified on log	-
	- interpreted	41	From comments on log	-
9. Total catch	2077 of 2471 activity records	84	1.4 to 272.2 MT	40.1
10. Kept catch	2036 of 2471 activity records	82	1.4 to 164.2 MT	39.5
11. Release catch	75 of 2471 activity records	3	1.8 to 244.9 MT	39.6
12. Catch units	- unspecified	56	Short tons then assumed in cal-	-
	- metric ton	6	culations unless market was	-
	- short ton	38	over-the-side (then MT)	-
	- hogsheads	0.2		-
13. Release code	524 of 2471 activity records	21.2	See Table 6	-
14. Size of fish code	466 of 2471 activity records	18.9	-	-
15. Roe condition code	343 of 2471 activity records	13.9	-	-
16. Market code	1873 of 2471 activity records	75.8	See Table 5	-

Table 3. General statistics on CPUE variables for the 1985 4Xa summer purse seine fishery.

Variable name	Number of observations	Mean	Standard deviation	Minimum	Maximum
Total catch (mt)	1802	46.2	38.1	0	562.5
Kept catch (mt)	1802	44.6	35.0	0	224.0
Released catch (mt)	1802	1.6	14.7	0	471.7
Total trip hours	1494	12.2	3.9	1.0	36.0
Total search hours	1177	4.4	2.8	0.1	14.5
Catch per hour (mt)	994	26.6	41.8	0.2	590.0*
Catch per set (mt)	1539	41.2	25.1	0.9	187.5
Release per hour (mt)	44	13.0	18.6	0.3	113.4
Release per set (mt)	68	26.3	25.6	0.6	157.2
Kept per hour (mt)	980	26.4	41.8	0.2	590.0*
Kept per set (mt)	1519	40.6	24.4	0.9	164.2
Sets per hour	1054	0.6	0.7	0.1	10.0

*Result of one set with 0.1 hours searching and a catch of 59.0 mt.

Table 4. Summary of market breakdown of the 1985 4Xa purse seine fishery from log records.

Market	No. sets	Tonnage kept	Portion (%)		Portion (%)	
			all logged Sets	Wt.	market specified Sets	Wt.(kept)
Over-the-side	240	7,359	9.7	9.1	12.8	11.1
Sardine	52	1,576	2.1	2.0	2.8	2.4
Bait	35	892	1.4	1.1	1.9	1.3
Roe	662	25,320	26.8	31.5	35.3	38.2
Adult shore	869	30,867	35.2	38.4	46.4	46.5
Fillet	1	0	0.0	0.0	0.1	0.0
U.S. buyers	8	282	0.3	0.4	0.4	0.4
Bloater	6	32	0.2	0.0	0.3	0.0
Unspecified	598	14,144	24.2	17.6	-	-
TOTAL	2471	80,472	99.9	100.1	100.0	99.9

Table 5. Summary of release information from 1985 4Xa herring purse seine logs (n=2471).

Release code	Occurrence on logs		Reported total tonnage	Reported release		% of released catch
	# sets	% of total sets		Release tonnage	% of logged catch	
No release code specified	1947	78.8	77132	133	0.2	4.5
Size of fish	74	3.0	1409	1237	1.5	41.7
Feed	26	1.1	456	185	0.2	6.2
Condition of fish	21	0.9	113	18	0.0	0.6
Dogfish	42	1.7	1295	206	0.2	6.9
Tore up net	32	1.3	355	92	0.1	3.1
Set too large	9	0.4	669	482	0.6	16.2
Market filled	33	1.3	454	204	0.2	6.9
Skunk set	45	1.8	226	0	0.0	0.0
Other species	3	0.1	23	23	0.0	0.8
Set too small	10	0.4	126	2	0.0	0.1
No fish found	81	3.3	0	0	0.0	0.0
Fish too deep	21	0.9	121	3	0.0	0.1
Poor weather	22	0.9	0	0	0.0	0.0
Gear/crew problems	15	0.6	122	2	0.0	0.1
Fish too shallow	27	1.1	114	0	0.0	0.0
Overflow, corks	8	0.3	748	372	0.4	12.5
Unknown	55	2.2	32	9	0.0	0.3
TOTAL	2471	100.1	83395	2968	3.4	100.0

Table 6. 1984 4Xa purse seine fishing grounds with highest total effort by month.

Month	Area	Days fished		Total catch		Search hours		Number of sets	
		No.	%	MT	%	No.	%	No.	%
July	S.W. Grounds	99	25	3511	27	330	26	132	30
Aug	Trinity	325	47	11034	37	1047	49	406	46
Sept	Trinity	461	70	24532	69	958	62	607	70
Oct	Seal Is.	29	42	2359	55	60	43	55	56
	Grand Manan	23	33	1041	24	34	25	25	25

Table 7. 1985 4Xa purse seine CPUE by month.

Year	Month	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Srch	Catch per Set	Sets per Hrs Srch
85	June							
	Number	9						
	Total		427.7	29.1	10			
	Average		47.5			21.21 ^L	50.66	.44 ^L
	Std.Dev.		36.7			9.57	25.22	.20
	July							
	Number	381						
	Total		12925.8	1276.6	439			
	Average		33.9 ^L			21.87	35.37 ^L	.52
	Std.Dev.		30.9			32.41	24.41	.48
	August							
	Number	688						
	Total		30054.1	2157.7	882			
	Average		43.7			21.95	38.42	.55
	Std.Dev.		37.9			33.59	24.08	.69
	Sept.							
	Number	655						
	Total		35584.7	1554.7	865			
	Average		54.3			33.59 ^H	46.20 ^H	.75 ^H
	Std.Dev.		39.0			52.72	25.23	.93
	Oct.							
	Number	69						
	Total		4325.1	139.3	99			
	Average		62.7 ^H			33.13	45.86	.71
	Std.Dev.		44.9			37.35	26.08	.62
Number		1802						
Total			83317.4	5157.4	2295			
Average			46.2			26.60	41.22	.62
Std.Dev.			38.1			41.84	25.06	.75

H - Highest average value for column

H2 - 2nd highest average value for column

L - Lowest average value for column

L2 - 2nd lowest average value for column

M - single or no observation, no statistic possible

Table 8. 1985 4Xs Furse Seine CPUE by Fishing Grounds

15.

Year	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
85	Grand Manan	No.	Percent					
	Number	91	5.0					
	Total		3583.8	184.1	91			
	Average		39.4			27.83	40.64	.73 H
	Std.Dev.		24.6			26.76	21.50	.60
	Lons Island							
	Number	30	1.7					
	Total		857.4	149.2	25			
	Average		28.6 L			15.83 L2	37.99	.44 L2
	Std.Dev.		27.1			18.40	21.12	.47
	Trinity							
	Number	808	44.8					
	Total		35721.8	2106.4	1028			
	Average		44.2			28.53	39.40 L2	.70 H2
	Std.Dev.		32.0			52.94	23.52	.98
	Lurcher							
	Number	9	0.5					
	Total		308.2	38.5	8			
	Average		34.2 L2			10.46 L	46.83 H2	.18 L
	Std.Dev.		33.3			8.20	28.43	.10
	S.W. Ground							
	Number	150	8.3					
	Total		5675.0	525.9	199			
	Average		37.8			16.71	34.23 L	.46
	Std.Dev.		33.0			25.24	20.55	.49
	Seal Island							
	Number	236	13.1					
	Total		13141.7	670.6	328			
	Average		55.7 H2			29.09 H2	44.74	.59
	Std.Dev.		40.1			33.19	23.40	.54
	German Bank							
	Number	248	13.8					
	Total		15238.7	660.1	363			
	Average		81.4 H			30.90 H	49.79 H	.62
	Std.Dev.		56.9			35.44	33.23	.49
	Other areas							
	Number	230	12.8					
	Total		8790.8	822.6	253			
	Average		38.2			19.70	39.09	.46
	Std.Dev.		32.5			27.52	23.32	.41
Number		1802						
Total			83317.4	5157.4	2295			
Average			46.2			26.60	41.22	.62
Std.Dev.			38.1			41.84	25.06	.75

H - Highest average value for column
 H2 - 2nd highest average value for column
 L - Lowest average value for column
 L2 - 2nd lowest average value for column
 M - single or no observation, no statistic possible

Table 9a. 1985 4X summer purse seine CPUE by fishing ground for June.

Year	Month	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
85	June	Trinity							
		Number	1						
		Total		0.0	7.5	M			
		Average		0.0			M	M	M
		Std.Dev.		M			M	M	M
		S.W. Ground							
		Number	3						
		Total		198.5	12.4	4			
		Average		66.2			19.16 L	49.08 L	.44
		Std.Dev.		33.3			8.90	11.16	.30
		German Bank							
		Number	3						
		Total		195.7	9.2	4			
		Average		48.2			23.25 H	57.95 H	.44
		Std.Dev.		30.4			11.71	39.41	.09
		Other areas							
		Number	2						
		Total		33.5	M	2			
		Average		16.8			M	33.50	M
		Std.Dev.		23.7			M	M	M
Number			9						
Total				427.7	29.1	10			
Average				47.5			21.21	50.66	.44
Std.Dev.				36.7			9.57	25.22	.20

H - Highest average value for column

H2 - 2nd highest average value for column

L - Lowest average value for column

L2 - 2nd lowest average value for column

M - single or no observation, no statistic possible

Table 9b. 1985 4X summer purse seine CPUE by fishing ground for July.

Year	Month	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
1985	July	Grand Manan							
		Number	37						
		Total		1075.0	74.9	32			
		Average		29.1			25.72	34.68	.72 H
		Std.Dev.		20.8			18.88	17.60	.44
		Long Island							
		Number	16						
		Total		372.9	99.2	12			
		Average		23.3 L2			16.76	36.29	.41
		Std.Dev.		28.6			24.16	19.68	.61
		Trinity							
		Number	21						
		Total		156.1	94.2	15			
		Average		7.4 L			3.00 L	15.08 L	.17 L2
		Std.Dev.		11.1			1.86	6.22	.06
		Lurcher							
		Number	7						
		Total		253.8	27.0	6			
		Average		36.3			6.62 L2	45.32 H	.13 L
		Std.Dev.		34.8			6.80	31.52	.02
		S.W. Ground							
		Number	99						
		Total		3511.0	329.8	132			
		Average		35.5			16.55	32.37	.46
		Std.Dev.		31.6			28.11	20.42	.43
		Seal Island							
		Number	53						
		Total		2458.3	166.9	62			
		Average		46.4 H			30.08 H	45.15 H2	.56
		Std.Dev.		33.1			41.38	28.06	.45
		German Bank							
		Number	73						
		Total		2691.0	213.5	90			
		Average		36.9 H2			29.01 H2	39.78	.66 H2
		Std.Dev.		33.2			35.93	30.10	.58
		Other areas							
		Number	75						
		Total		2407.7	271.1	90			
		Average		32.1			16.64	30.04 L2	.41
		Std.Dev.		29.6			34.26	21.68	.42
		Number	381						
		Total		12925.8	1276.6	439			
		Average		33.9			21.87	35.37	.52
		Std.Dev.		30.9			32.41	24.41	.48

Table 9c. 1985 4X summer purse seine CPUE by fishing ground for August.

18.

Year	Month	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
August									
		Grand Manan							
		Number	6						
		Total		297.6	10.7	9			
		Average		49.6			12.99 L2	37.60	.51
		Std.Dev.		20.1			5.72	20.38	.16
		Long Island							
		Number	5						
		Total		94.4	29.0	3			
		Average		18.9 L			8.53 L	31.47	.27 L
		Std.Dev.		17.2			6.40	.58	.20
		Trinity							
		Number	325						
		Total		11034.1	1046.8	406			
		Average		34.0 L2			16.84	30.89 L	.54
		Std.Dev.		31.0			37.82	19.53	.88
		Lurcher							
		Number	1						
		Total		54.4	3.0	1			
		Average		54.4 H2			18.13	54.40 H	.33 L2
		Std.Dev.		M			M	M	M
		S.W. Ground							
		Number	18						
		Total		688.7	83.2	29			
		Average		38.3			21.73	31.61 L2	.66 H
		Std.Dev.		34.7			24.60	19.81	.84
		Seal Island							
		Number	136						
		Total		7338.8	384.6	187			
		Average		54.0			28.43 H2	44.35	.60
		Std.Dev.		37.9			28.75	21.08	.55
		German Bank							
		Number	96						
		Total		6519.2	242.3	138			
		Average		67.9 H			31.64 H	52.35 H2	.62 H2
		Std.Dev.		51.8			39.08	33.59	.47
		Other areas							
		Number	101						
		Total		4026.9	358.1	109			
		Average		39.9			17.81	40.60	.46
		Std.Dev.		30.7			19.15	21.38	.38
		Number	688						
		Total		30054.1	2157.7	882			
		Average		43.7			21.95	38.42	.55
		Std.Dev.		37.9			33.59	24.08	.69

Table 9d. 1985 4X summer purse seine CPUE by fishing ground for September.

Year	Month	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
	Sept.	Grand Manan							
		Number	25						
		Total		1170.1	64.2	25			
		Average		46.8			28.04	48.02	.70 H2
		Std.Dev.		25.1			33.61	24.34	.79
		Long Island							
		Number	6						
		Total		208.7	17.5	7			
		Average		34.8 L2			20.23 L2	32.28 L	.59
		Std.Dev.		7.2			15.25	10.88	.35
		Trinity							
		Number	461						
		Total		24531.6	957.9	607			
		Average		53.2			36.06 H	45.18	.82 H
		Std.Dev.		29.9			59.47	24.10	1.04
		Lurcher							
		Number	1						
		Total		0.0	8.5	1			
		Average		0.0 L			M	M	.12 L
		Std.Dev.		M			M	M	M
		S.W. Ground							
		Number	27						
		Total		1220.5	93.5	30			
		Average		45.2			11.73 L	42.33 L2	.23 L2
		Std.Dev.		36.6			10.41	20.49	.15
		Seal Island							
		Number	18						
		Total		986.0	59.2	24			
		Average		54.8 H2			22.17	42.63	.43
		Std.Dev.		42.6			30.05	22.09	.53
		German Bank							
		Number	68						
		Total		5382.8	165.3	122			
		Average		79.2 H			35.93 H2	55.43 H	.65
		Std.Dev.		75.5			31.00	35.14	.44
		Other areas							
		Number	49						
		Total		2085.0	188.6	49			
		Average		42.6			25.07	49.31 H2	.55
		Std.Dev.		35.9			23.47	23.67	.46
		Number	655						
		Total		35584.7	1554.7	865			
		Average		54.3			33.59	46.20	.75
		Std.Dev.		39.0			52.72	25.23	.93

Table 9e. 1985 4X summer purse seine CPUE by fishing ground for October.

20.

Year	Month	AREA	Days Fished	Total MT Caught	Search Hours	Number of Sets	Catch per Hrs Search	Catch per Valid Set	No. Sets/ Hrs Search
	Oct.	Grand Manan							
		Number	23						
		Total		1041.1	34.3	25			
		Average		45.3 L2			33.59	41.52 L2	.82 H2
		Std.Dev.		26.0			31.21	22.12	.63
		Long Island							
		Number	3						
		Total		181.4	3.5	3			
		Average		60.5			3.89 L	60.47 H2	.29 L2
		Std.Dev.		40.7			M	40.65	M
		S.W. Ground							
		Number	3						
		Total		56.3	7.0	4			
		Average		18.8 L			M	11.52 L	M
		Std.Dev.		27.2			M	7.24	M
		Seal Island							
		Number	29						
		Total		2358.6	59.9	55			
		Average		81.3 H			35.68 H2	46.98	.78
		Std.Dev.		50.7			41.88	26.19	.68
		German Bank							
		Number	8						
		Total		450.0	29.8	9			
		Average		56.3			12.27 L2	47.74	.23 L
		Std.Dev.		40.2			10.09	25.33	.16
		Other areas							
		Number	3						
		Total		237.7	4.8	3			
		Average		79.2 H2			127.00 H	84.83 H	1.25 H
		Std.Dev.		70.8			M	23.72	M
		Number	69						
		Total		4325.1	139.3	99			
		Average		62.7			33.13	45.86	.71
		Std.Dev.		44.9			37.35	26.08	.62
		Number	1802						
		Total		83317.4	5157.4	2295			
		Average		46.2			26.60	41.22	.62
		Std.Dev.		38.1			41.84	25.06	.75

Herring Log Book 19 ____

Vessel Name _____ Captain _____ Gear Type _____ Gear Size _____

Departure _____ port _____ date _____ time _____ Landing _____ port _____ date _____ time _____

Fishing Grounds Searched _____ Sonar Time _____ on _____ off _____

S N G	Fishing or Carrying		Set Location	Total Catch	Total Kept	Buyer	Market Sought	Comments (including unsuccessful nights)
	Set Time Start Finish	Vessel that made set	Point or Square	Specify units	units			

Use 24 hr Clock

☐ Lat. + Long.
☐ or
☐ Loran C
☐ or
☐ Square (from map)

☐ tons (metric)
☐ tons (short)
☐ other _____

Specify:

- OSS
- Sardine
- Bait
- Roe
- Adult shore

e.g. - why any sets were released

- fish given away/received
- adverse conditions (such as weather)
- water depth
- other notes

00007 N° 02

EXAMPLE:

use one page per trip

In this example the vessel Clupea II made two sets of its own (fishing), then took on and carried fish caught by another vessel (carrying).

Point location in Lat. + Long. or Loran C.

Square numbers are indicated on map provided. Point location is preferred.

General fishing grounds searched. Indicate if you searched more than one, e.g., "Browns Bank, then German Bank"

Herring Log Book 19 95

Vessel Name Clupea II Captain F. R. Jones Gear Type Purse Seine Gear Size 300 to 400

Departure Yarmouth port Sept 15 date 1995 time 18 00 Landing Yarmouth port Sept 16 date 1995 time 05 00

Fishing Grounds Searched German Bank Sonar Time 22 30 on 2 15 off 2 15

S N G	Fishing or Carrying		Set Location	Total Catch	Total Kept	Buyer	Market Sought	Comments (including unsuccessful nights)
	Set Time Start Finish	Vessel that made set	Point or Square	Specify units	units			
1	23 30 00 30		45° 15', 66° 21'	20	20	Fred's Cannery	Roe	Long fish, good catch. Windy and dark so made to board.
2	1 15 15		45° 30', 66° 20'	15	15	"	Roe	
3	1 45 20	Harvey's II	45 31 - 66 1	15	15	"	Roe	Carried over from 1st set of a long set made by Harvey's II.

☐ Lat. + Long.
☐ Loran C
☐ Square (from map)

☐ tons (metric)
☐ tons (short)
☐ other _____

Specify:

- OSS
- Sardine
- Bait
- Roe
- Adult shore

e.g. - why any sets were released

- fish given away/received
- adverse conditions (such as weather)
- water depth
- other notes

Indicate what market you were fishing for even if you did not catch any fish or if the fish you caught went to another market.

Fig. 1. Revised 4WX logbook as introduced for the 1985 4Xa summer purse seine fishery.

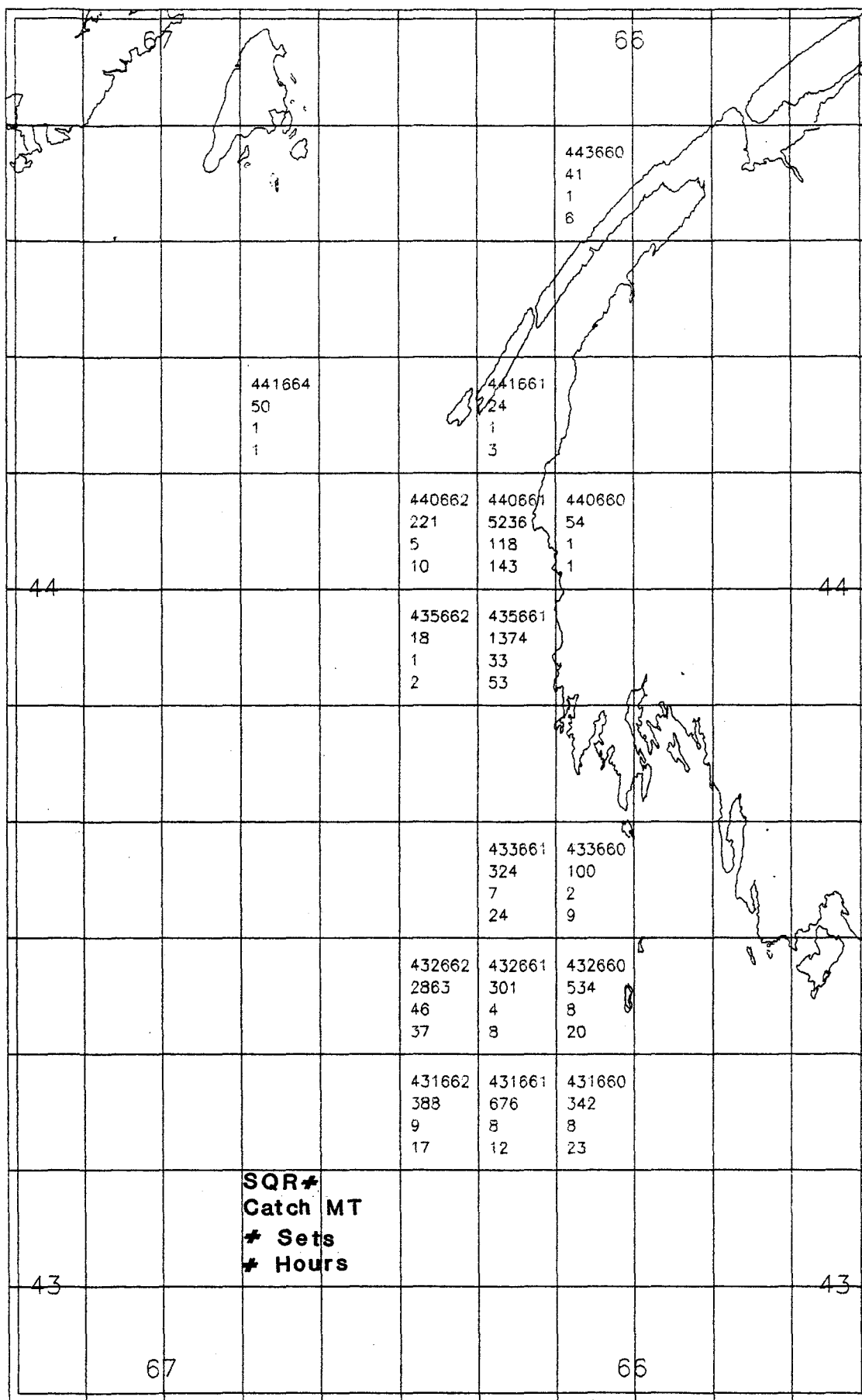


Fig. 3. Distribution of catches of stage 5 and stage 6 roe fish for the 1985 4Xa purse seine fishery.

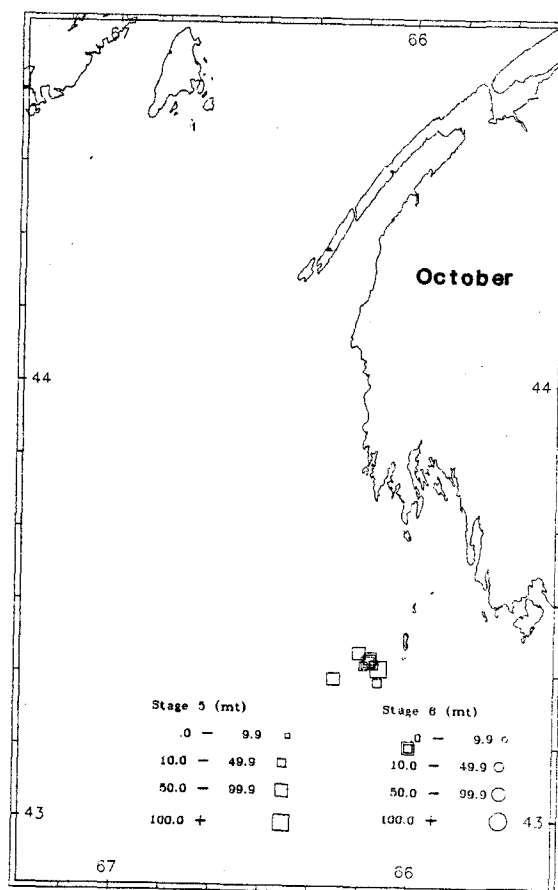
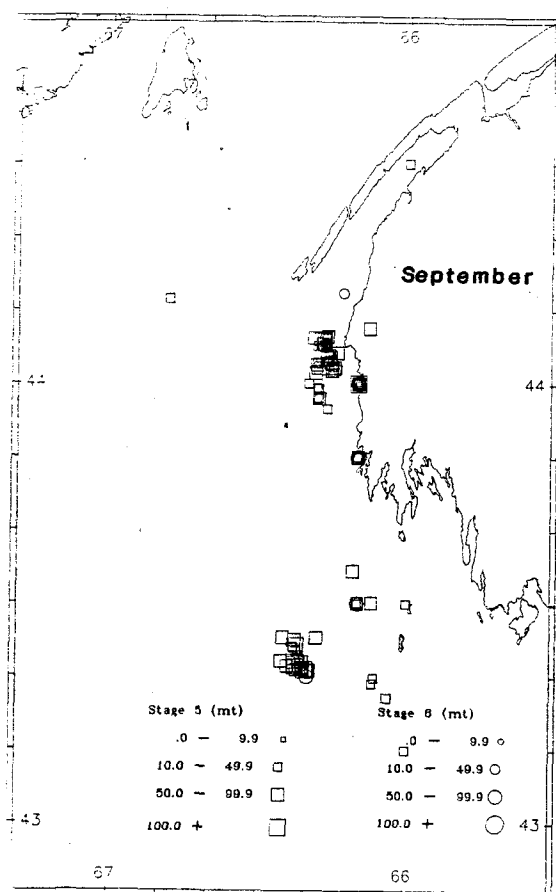
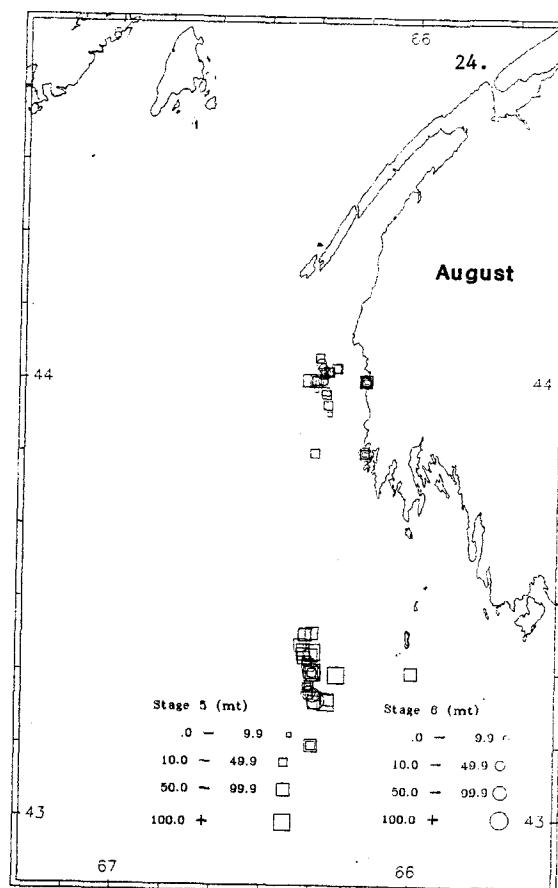
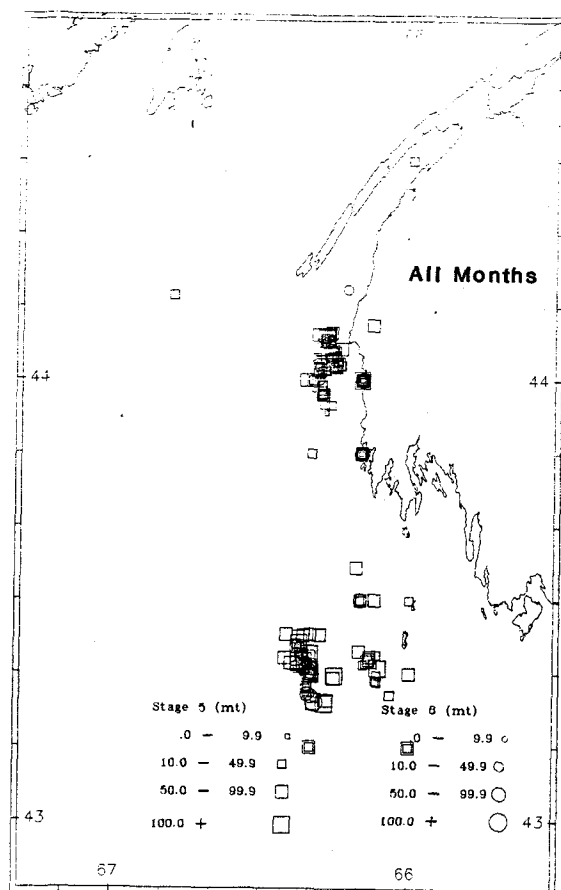


Fig. 4. 1985 4Xa purse seine roe effort distribution for stage 5 and 6 for the entire year and for months 8 to 10.

1985 Purse Seine Weekly Roe Observations

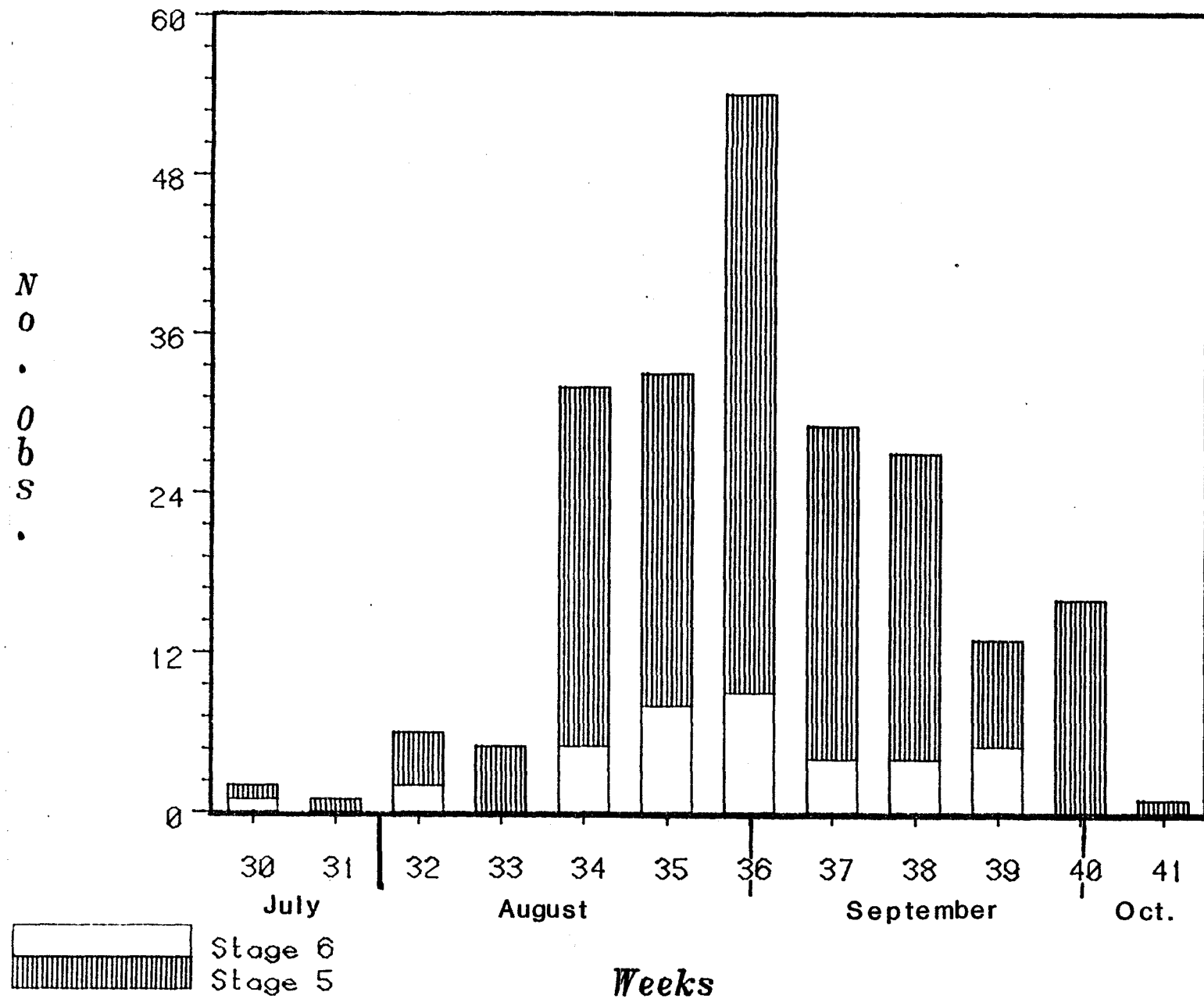
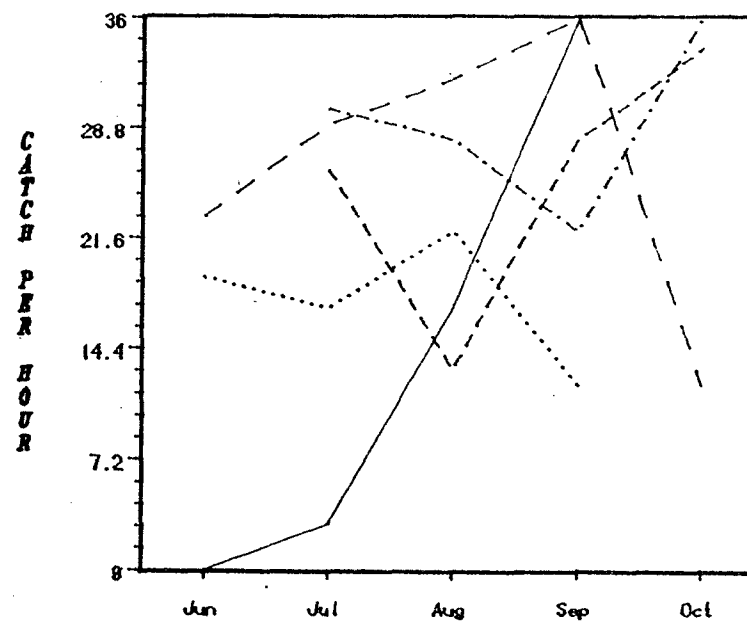
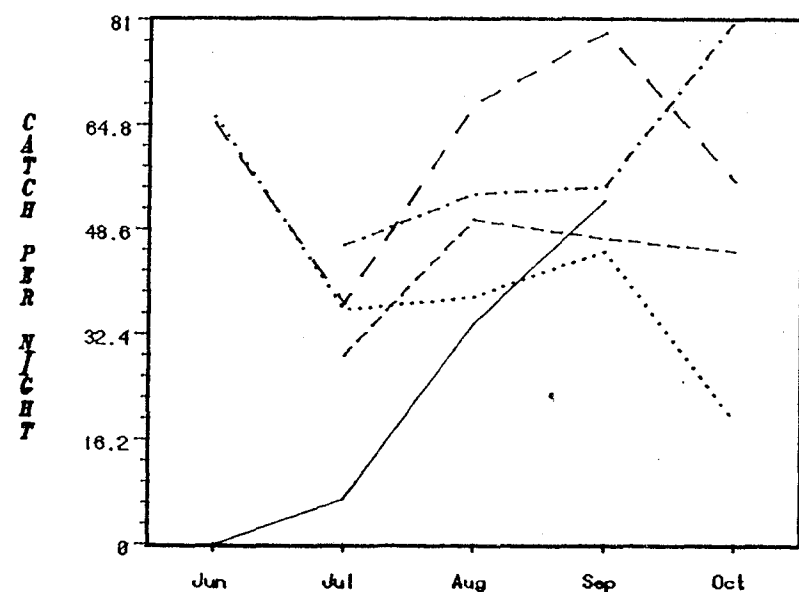
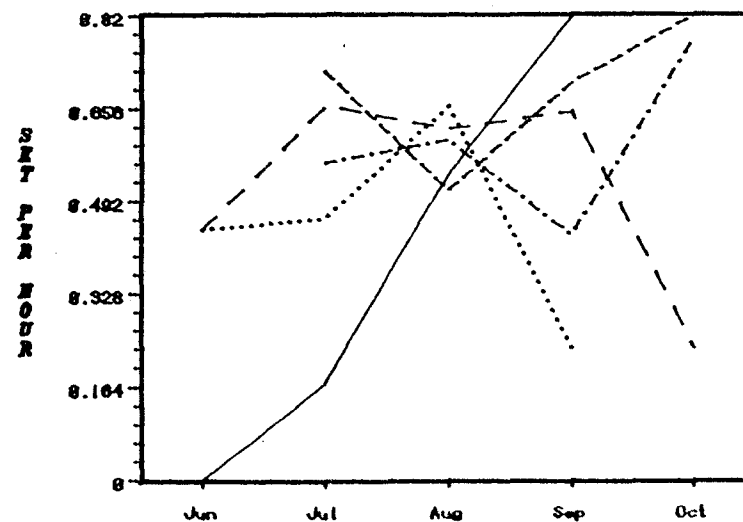
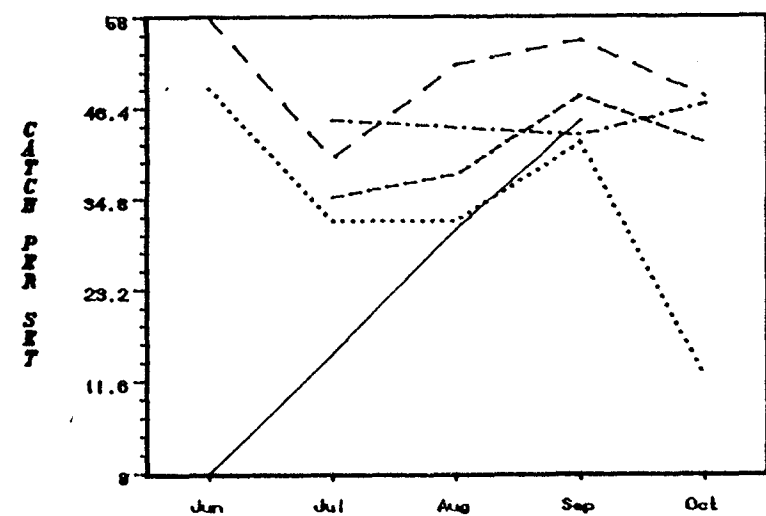


Fig. 5. Reported observations of stage 5 and stage 6 roe fish by week for the 1985 4Xa purse seine fishery.



--- GRAND MANAN
 — TRINITY
 SW GROUND
 --- SEAL ISLAND
 --- GERMAN BANK

Fig. 6. CPUE monthly trends by fishing ground for the 1985 4Xa purse seine fishery.

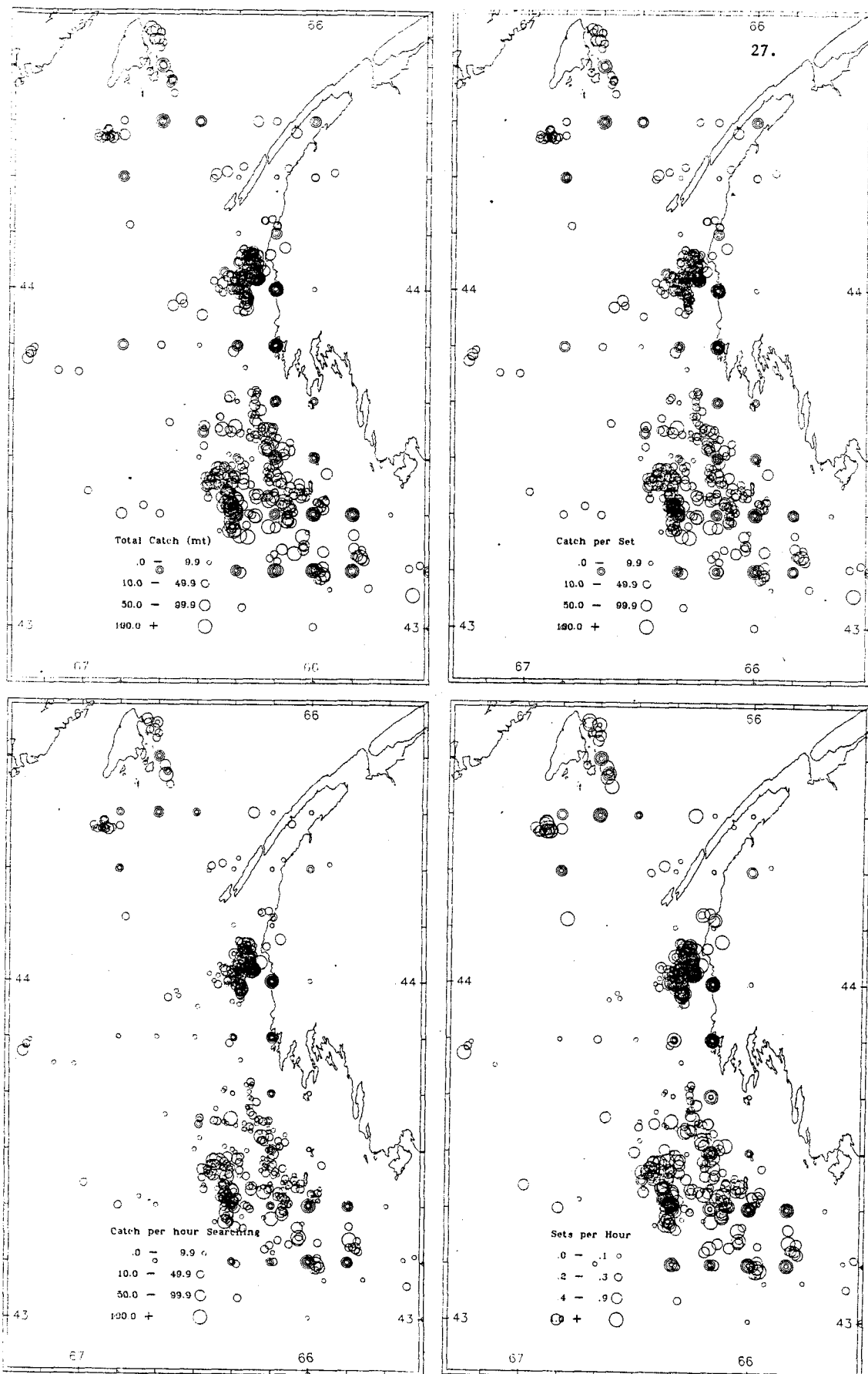


Fig. 7. 1985 4Xa purse seine log catches and catch per unit effort for the entire year.

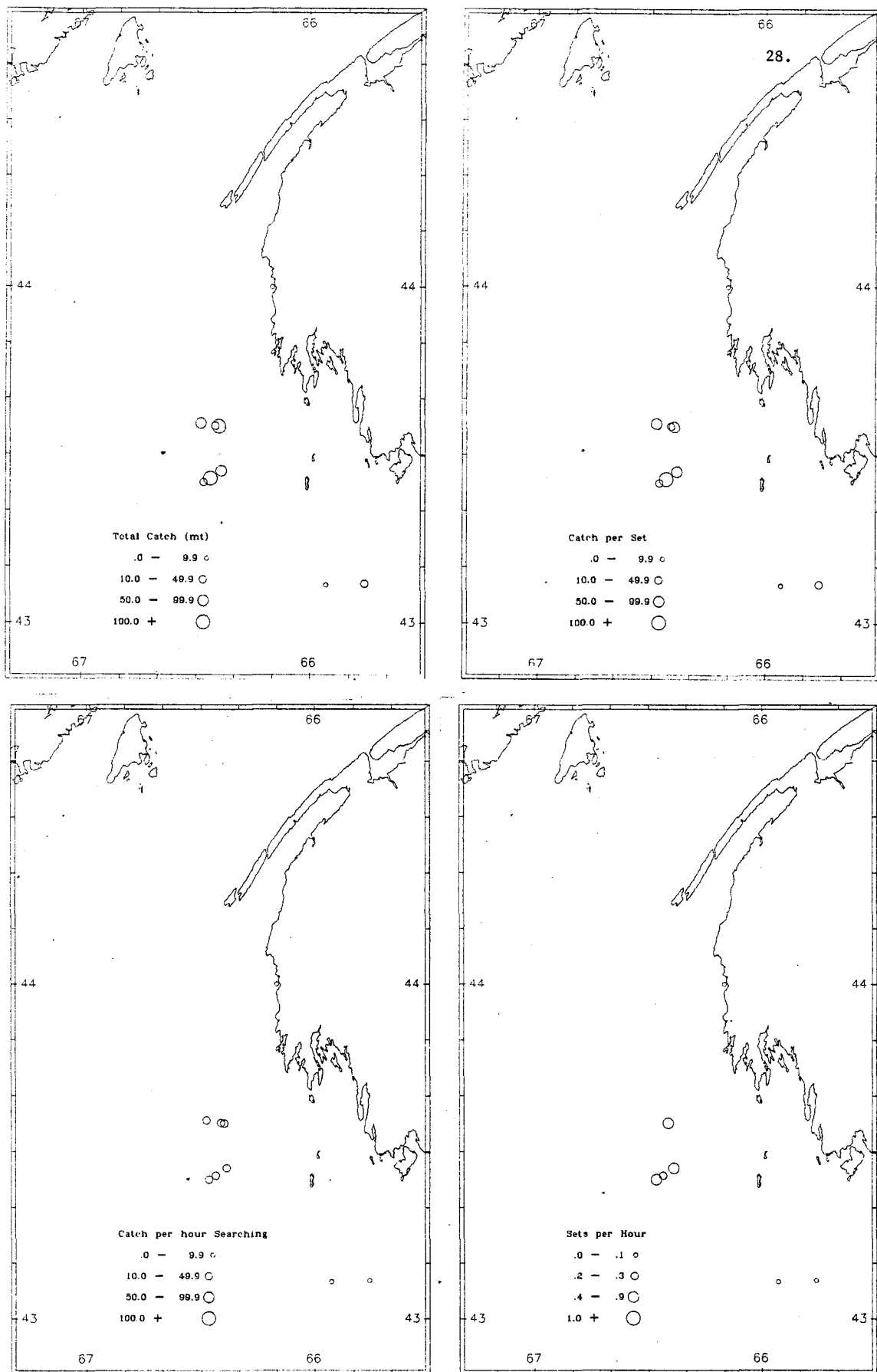


Fig. 8. 1985 4Xa purse seine log catches and catch per unit effort for the month of June.

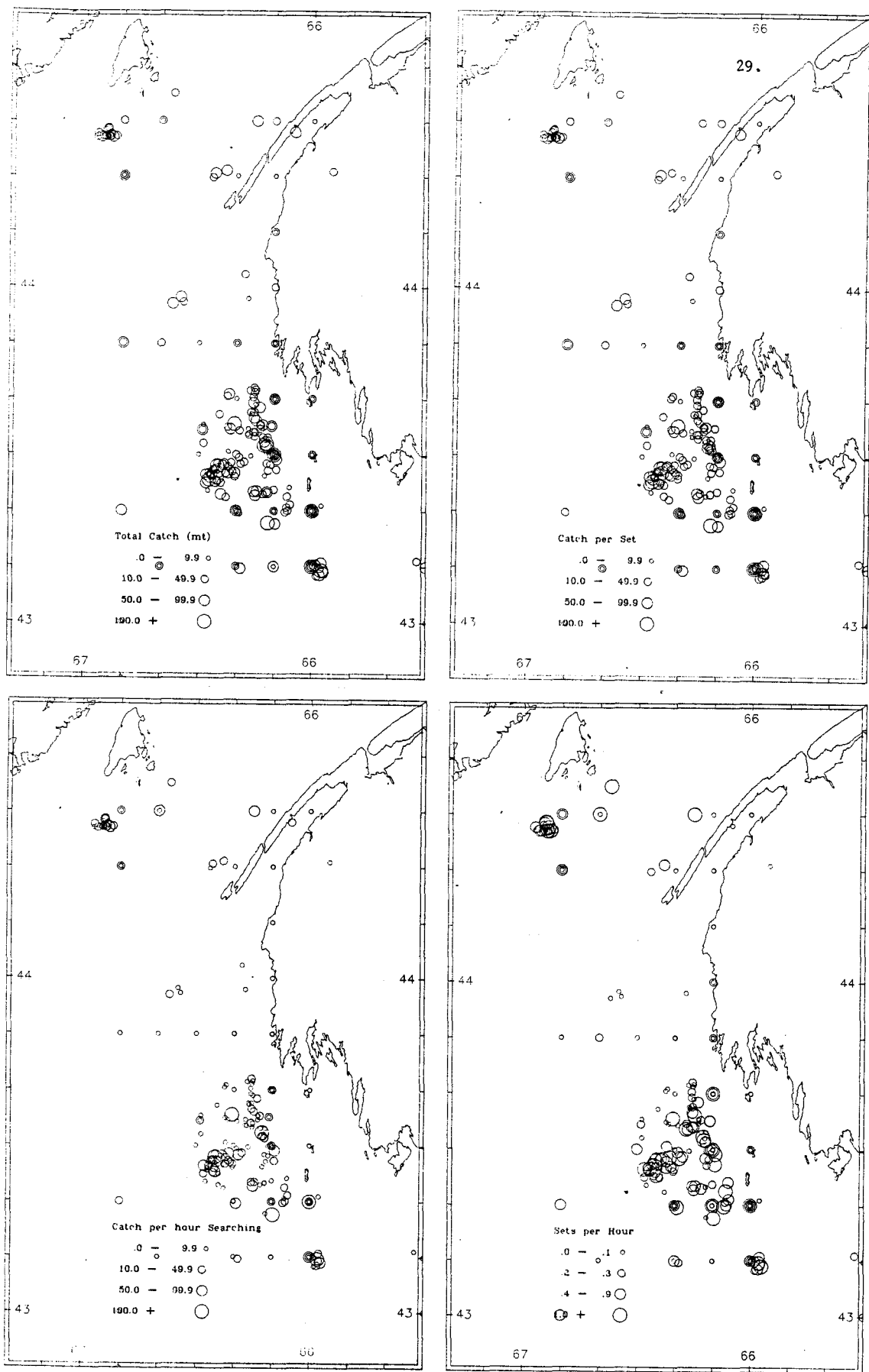


Fig. 9. 1985 4Xa purse seine log catches and catch per unit effort for the month of July.

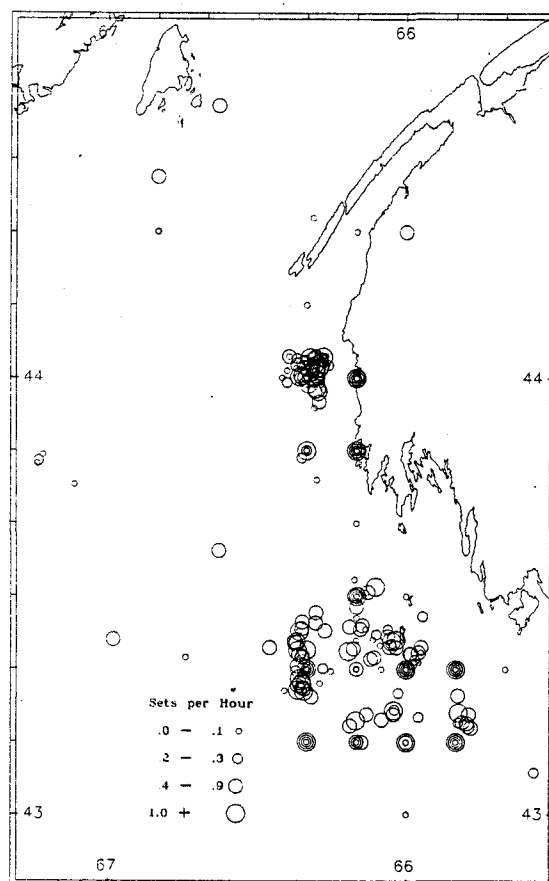
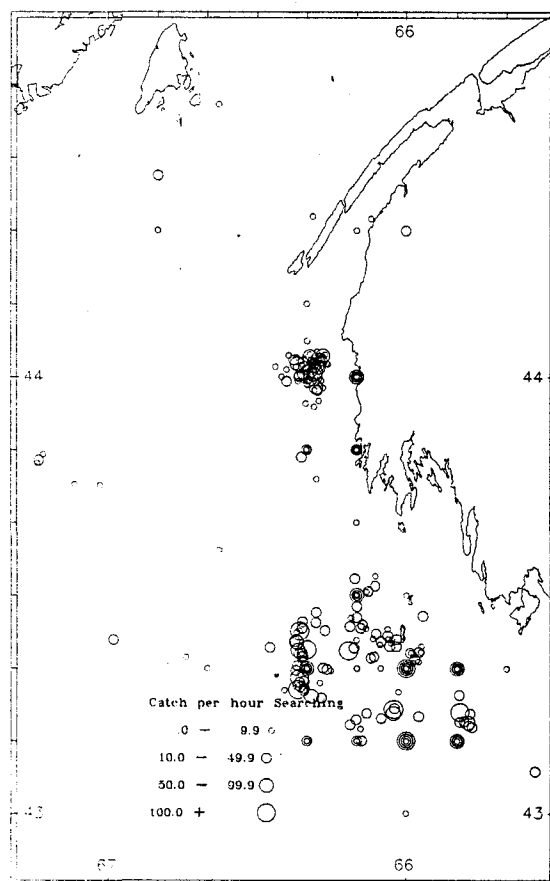
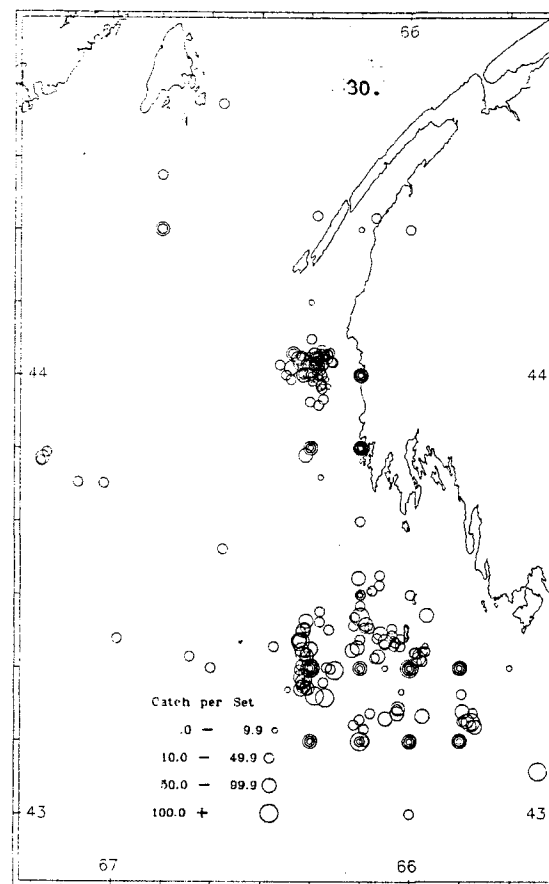
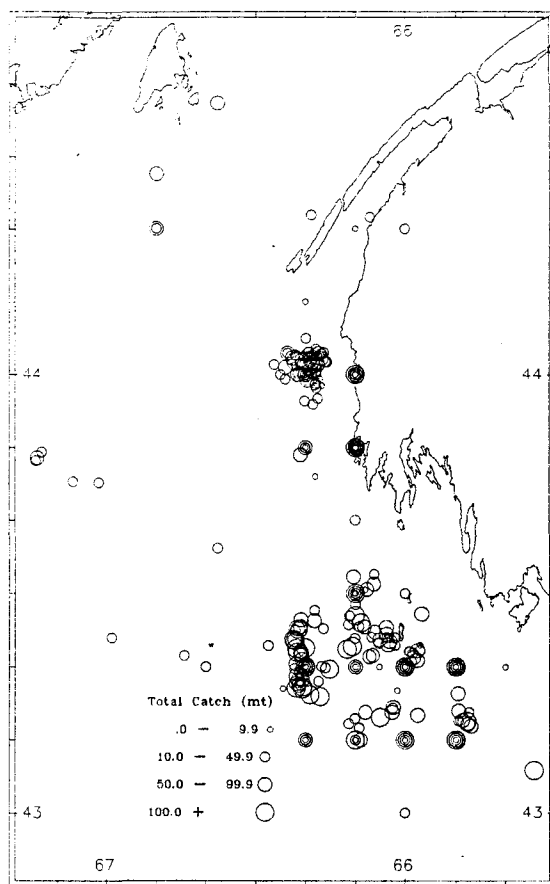


Fig. 10. 1985 4Xa purse seine log catches and catch per unit effort for the month of August.

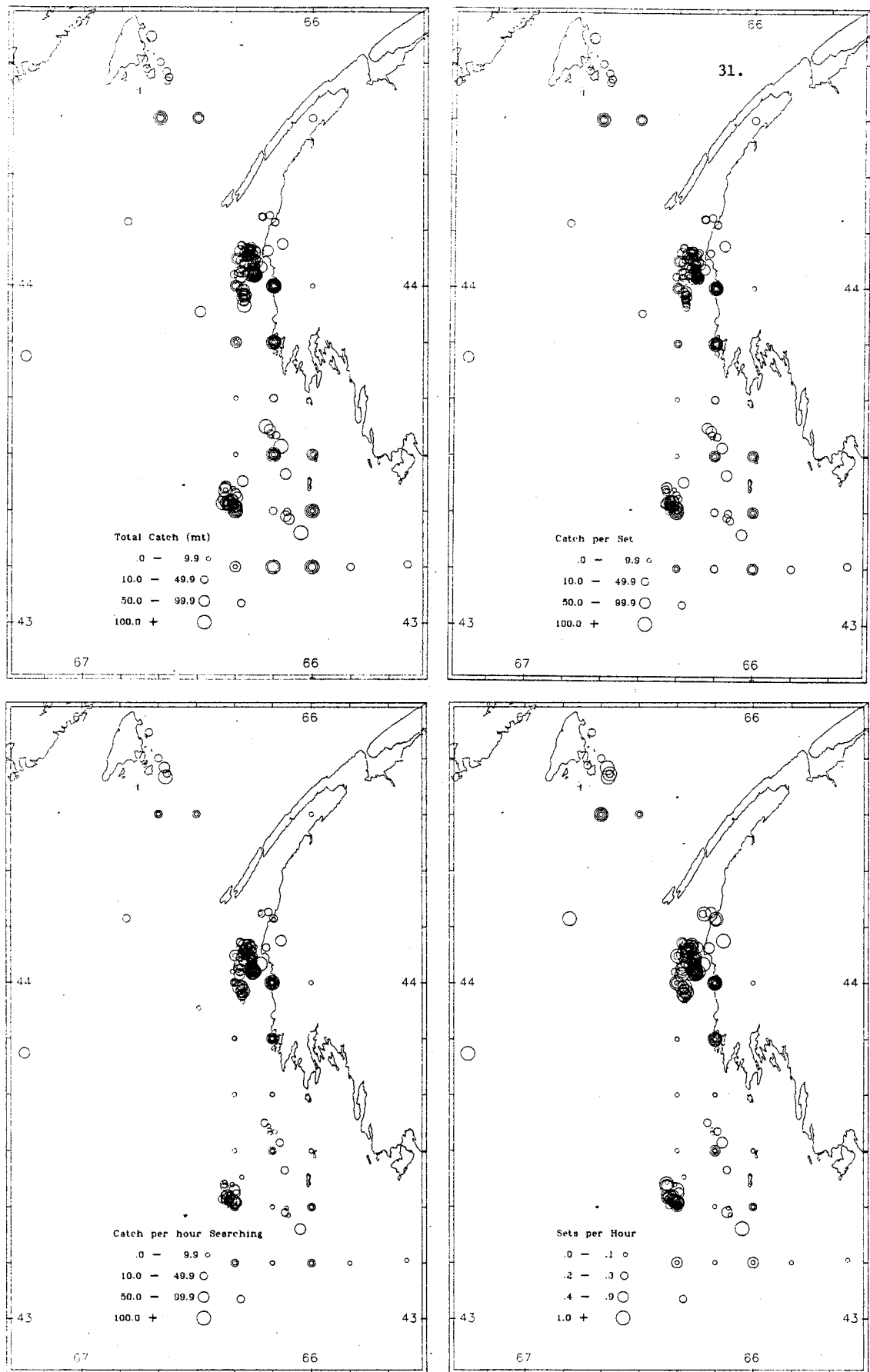


Fig. 11. 1985 4Xa purse seine log catches and catch per unit effort for the month of September.

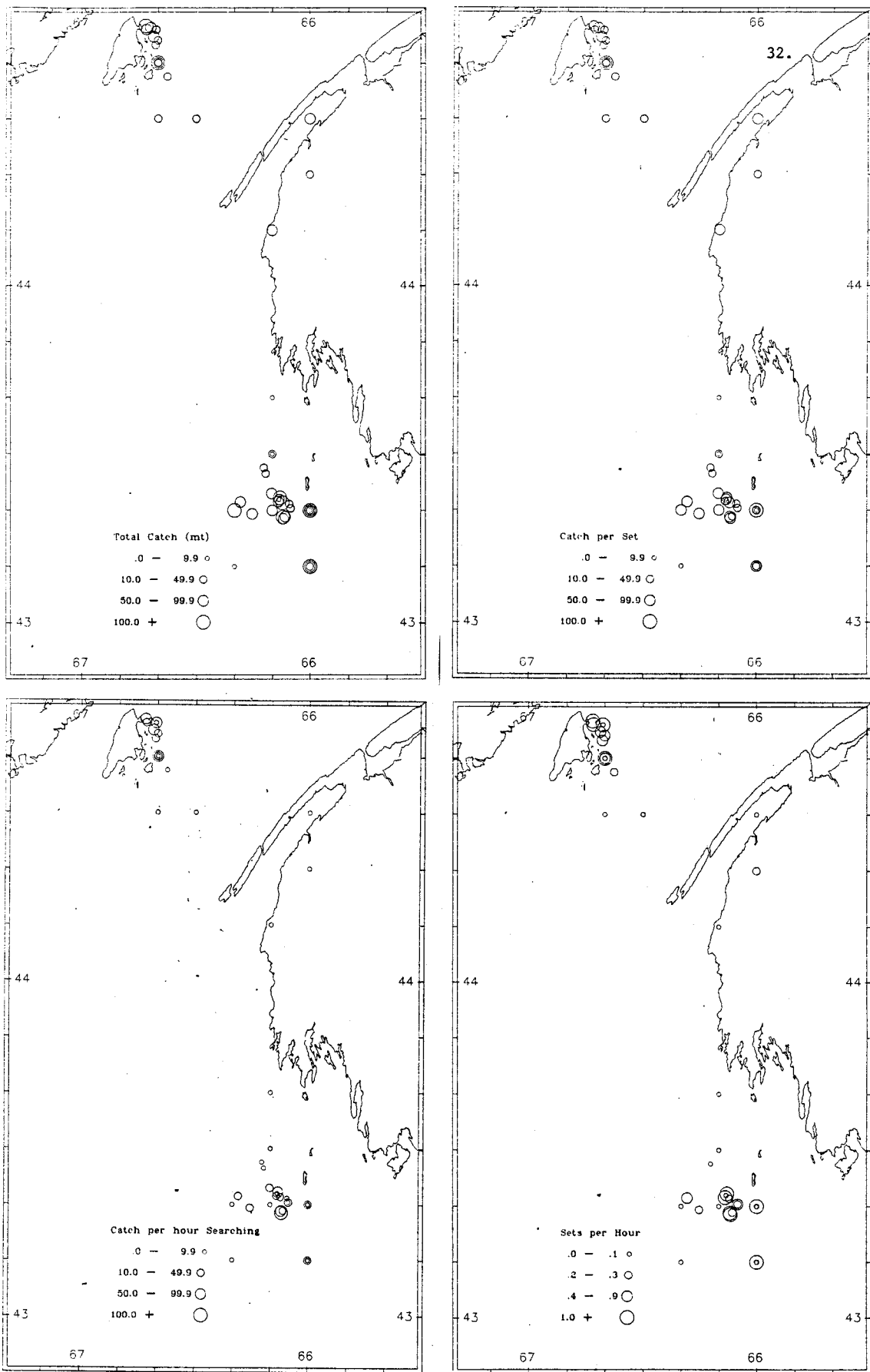


Fig. 12. 1985 4Xa purse seine log catches and catch per unit effort for the month of October.

Appendix 1. Herring Purse Seine Log Record Format and Coding Instructions

Data specifications for new coding format of 1985 herring purse seine log records. This format is especially for the newly designed log record which was introduced in May 1985 previous to the start of the 4Xa summer purse seine fishery off southwest Nova Scotia.

Field No.	Start Col.	No. Col.	Data Format	Value Ranges	Description
1	1	3	I3	1 - 999	Boat Code Number - from MFD alfa - sorted file BOATCODE.CODE.PELAGIC
2	4	6	3I2	YY-MM-DD	Date of Departure for fishing night
3	10	3	F3.1	0 - 99	Total Trip Time (1/10 hours) from the Departure Time to the Time of Landing (usually less than 24 hours). Code for first set only. Calculate with HP41C program PSTIME.
4	13	3	F3.1	0 - 99	Total Searching Time which is equal to the Total Sonar Time less overlapping Set Times which occurred. Code for first set only.
5	16	4	2I2	MM-DD	Set Date corresponding to the Start Time of this set.
6	20	1	I1	0 - 9	Set Number : a sequential series for each trip (night fishing usually). If no sets made it is left blank or as 0.
7	21	4	2I2	hh-mm	Start Set Time using 24 hour clock from 0000 to 2359.
8	25	1	I1	0 - 9	Position Type for interpretation of location information where: 1 - latitude / longitude 2 - Loran C (assuming 5930 bearing) 3 - 10 min. Square number specified. 4 - Determined from comments.
9	26	6	A6	-	Y - position (left justified) of latitude, Loran C or 10 min. square number from map (ie. 440)
10	32	6	A6	-	X - position (left justified) for longitude, Loran C or 10 min. square number from map (ie. 660)

Appendix 1. Herring Purse Seine Log Record Format and Coding Instructions

Field No.	Start Col.	No. Col.	Data Format	Value Ranges	Description
11	38	4	A4	-	Fishery Unit Area - as defined in Figure 1 for herring assessment purposes where: 4Vn - Nov 7 to Mar 1 or until quota caught 4Wa - Nov 7 to Mar 1 or until quota caught 4Xa - June to Oct 14 NB/NS summer 4Xb - Oct 15 to Mar 1 or until quota caught
12	42	4	F4.1	0-999.9	Total Amount Caught by this vessel in Units of Catch specified (FIELD 13). This is the 'total' amount captured for this particular set by this boat. Disregard vessel transfers and pooling
13	46	1	I1	0 - 9	Units of Catch Code for FIELD 12 where 0 - Unspecified 1 - Metric tons 2 - Short tons 3 - Hogsheads (HHDS) 4 - 'Russian' ton
14	47	4	F4.1	0-999.9	Total Catch Kept where only the amount of fish 'released' is subtracted. Ignore all 'pooling' and transfers. Units are in FIELD 15.
15	51	1	I1	0 - 9	Units of Catch Code for Total Kept See codes for FIELD 13.
16	52	2	I2	0 - 99	Reason for Release or lack of catch as interpreted from comments with codes: 0 - <0 or blank> no release 1 - size of fish 2 - feeding 3 - poor fish cond. 4 - dogfish 5 - tore up net 6 - set too big 7 - market filled 8 - skunk set 9 - other species 10 - set too small 11 - no fish found 12 - fish deep 13 - poor weather 14 - gear/crew 15 - fish too shallow 99 - unknown If total catch is 0 a release code should be determined.
17	54	2	I2	0 - 99	Fish Size Code as interpreted from comments where : 0 or blank - unspecified 1 - small (<9 in.) 2 - medium (9 - 11 in.) 3 - large (>11 in.) 4 - mixed sizes

Appendix 1. Herring Purse Seine Log Record Format and Coding Instructions

Field No.	Start Col.	No. Col.	Data Format	Value Ranges	Description
18	56	2	I2	0 - 9	Fish Roe Condition code from comments: 0 or blank is unspecified 4 - Ripening 2 (hard) 5 - Ripe (soft) (good) 6 - Spawning (ripe/running, excellent) 7 - bloaters 8 - US buyers
19	58	2	I2	0 - 9	Market Sought Code from buyer name or from Market field if noted where : 1 - OSS or Russian 2 - sardine 3 - bait 4 - roe 5 - Adult shore 6 - fillet
20	60	21	A21	-	Comments for the record. Use keywords for items not included in the format which are of general interest to the fishery ie. school sitings, size and behaviour fish spawning (water full of milt) - no comments on the weather or little 'green' men though.

New fields created by PSLOGFIX.PROGRAM

21	81	6	I6		Square Number - as converted from Field 8, 9, 10. - range check for valid data, else 999999
22	88	6	3I2		Latitude - degrees, minutes, seconds as converted - with range check for valid data, else 99999
23	95	6	3I2		Longitude - degrees, minutes, seconds as converted - with range check for valid data, else 999999
24	101	5	F5.1		Total Catch (metric tons) - converted Field 12 based on units specified in Field 13. If units are not specified then assume Short tons unless market is over-the-side, then assume metric.
25	106	5	F5.1		Kept Catch (metric tons) - converted Field 14 based on units specified in Field 15. If units are not specified then assume Short tons unless market is over-the-side, then assume metric.
26	111	5	F5.1		Release Catch (metric tons) - Total Catch (Field 24) - Kept Catch (Field 25)