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AN ANALYSIS OF LOGS FROM THE 1986 4X SUMMER PURSE SEINE FISHERY

by

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ABSTRACT

Analysis of data from the second year of use of the revised 4WX purse seine logbook is presented. The overall coverage was again excellent with all active boats represented and the logbooks accounting for 91% of the landings recorded by Statistics Branch. Despite a 40% reduction in catches in comparison with 1985, overall effort (days fished and sets made) was reduced by only 20% and hours searched by 10%. This overall trend of reduced catch and increased relative effort resulted in generally lower CPUE for all areas. This has been attributed to the very specific roe market which dominated the fishery. The set rate per hour was higher or the same for all areas except Trinity Ledge, suggesting a problem or weakness in this important stock component.

RESUME

On présente l'analyse des données provenant de la deuxième année d'utilisation de la version révisée du journal de bord pour la pêche à la senne coulissante dans la zone 4WX. Encore une fois, la couverture globale était excellente : tous les navires actifs étant représentés et la correspondance entre les journaux de bord et les débarquements enregistrés par la Direction des statistiques était de 91 %. Malgré une réduction des prises de 40 % comparativement à 1985, l'effort global (jours de pêche et mouillages réalisés) n'a été réduit que de 20 % et les heures de recherche, de 10 %. La tendance globale vers une réduction des prises et un accroissement de l'effort relatif s'est traduite par une diminution générale des PUE dans toutes les régions. Cette situation est attribuée au marché très spécifique de la roque qui a dominé cette pêche. Le taux de mouillage par heure a été plus élevé ou le même dans toutes les régions, sauf à Trinity Ledge, ce qui indiquerait un problème ou une faiblesse dans cette composante importante du stock.

INTRODUCTION

In 1985, a special effort was made to improve the quantity and quality of information from the purse seine fleet which dominates the 4WX herring fishery. A new logbook format containing several improvements including fields for search time, markets and set specifics, was introduced to the 4X summer purse seine fishery. Log collection was improved in part by making log submission part of a fragmented license system. Logbooks were received from all vessels and accounted for 96% of the landed weight of fish in that fishery. Details of the log format and analysis of its first year of use, including a range of CPUE indices, were presented and discussed by Power and Stephenson (1986).

This logbook format is now used by all purse seine fishery components in NAFO areas 4W and 4X. In this paper we summarize the 1986 4X summer logbook data and make initial comparisons with the previous year.

METHODS

In 1986, as in 1985, log submission was linked to the fragmented license scheme, and this resulted in a near complete set of records. Again, all logs were coded by Marine Fish Division personnel familiar with the herring fishery. During coding, an additional field for the commercial length frequency sample number was included where available. This allows matching to the length frequencies and biological detail samples by vessel, set and date. The computer records were edited and verified against original logs.

USE OF LOGS IN PREPARATION OF THE CATCH-AT-AGE MATRIX

Spatial information from logs was used in matching catch in the 4X summer fishery with appropriate biological samples. "Total kept catch" (mt) from logs (partitioned by month and 10 minute square) was adjusted proportionately to the reported statistics catches for that month (Table 1). Catches without associated locations were not included in the calculations. Adjusted catch values were then matched to length frequency samples for each 10 minute square. In the case of squares without length frequencies and the occasional length frequency sample without associated catches, data from adjacent squares were 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. 1987).

CPUE ANALYSIS

Log information was used to derive several indices of CPUE for each vessel. These include catch per night, catch per hour searched, catch per set and sets per hour searched. All calculations are the same as those presented for the 1985 fishery (Power and Stephenson 1986).

RESULTS

LOG COVERAGE

Log coverage was high. Logs were received from all vessels (n=42) and accounted for 91% of the landed weight of fish (Table 2). Interestingly, total logged catch exceeded recorded catch during early months of the fishery (June, July in Table 1). This supports anecdotal information that monitoring was lower and misreporting higher during the early months of the fishery. Table 1 also indicates that the Statistics Branch 'over-the-side' records of 398 t are indeed low. Logs were again generally complete and decipherable (Table 3). Ninety-eight percent provided location information attributable to a 10' square; 49% specified point set location (usually Loran C). Catch information was provided in 84% of the records.

TEMPORAL AND SPATIAL DISTRIBUTIONS OF THE FISHERY

A plot of the distribution of catch and effort by 10' squares (Fig. 1) shows the focus of fishing activity on major grounds, especially Trinity Ledge, German Bank and the Seal Island area. Although the overall pattern was very similar to that in 1985, there was relatively less effort in the Trinity Ledge, Seal Island and Southwest Ground areas and more in Grand Manan, Long Island and German Bank areas (Table 4).

Monthly plots of catches (Fig. 2) show the concentration of the summer fishery in August and September in Trinity Ledge, German Bank and Seal Island areas. Figure 3 shows the correspondence with spawning (roe) fish and the occurrence of spawning (stage 6) fish only in localized areas on Trinity Ledge and German Bank primarily in August and September.

CATCH AND EFFORT

The total catch in 1986 was approximately 40% lower than in 1985 (Table 4). Effort was lower but not in the same proportion as total catch, with approximately 80% of the total days fished and number of sets and almost 90% of the hours searched (Table 4). Table 5 compares several CPUE indices for 1985 and 1986. Average trip time (12.7 h was 0.5 h longer than in 1985). Search hours per trip (4.5) and sets per hour (0.6) were similar for the two years. Catch kept per hour (18 t) and per set (31 t) were both lower in 1986 than in 1985 (26 and 41 t, respectively). Release values, on the other hand, were higher: 24.4 t per hour in 1986 in comparison with 13 t per hour in 1985.

Release comments in 1986 (Table 6) indicate 'No fish found' as the major reason for set rejection or lack of sets made, followed by 'Condition of fish' (usually roe too hard) in, respectively, 4 and 3% of all sets or activity records. The majority of reported released tonnage was attributed 'Condition of fish' (41%) and 'Net sunk' (26%). In 1985, 'Size of fish' was the dominant reason for release with 42% of release catch, while in 1986 'Condition of fish' (i.e. roe stage) accounted for approximately the same proportion (41%) of release catch. This is consistent with the dominance of 4-yr-olds which were this year fully recruited to the roe fishery and rejected only because of hard roe.

A summary of intended market (Table 7) shows the dominance (as in 1985) of the roe market; 44% and 40% of the kept catch were attributed to roe and adult shore (which includes roe) markets, respectively. The sardine and 'Over-the-side' markets played a minor role in this year's fishery, with 5% and 1% of the kept catch, respectively. The breakdown of intended market by month (Table 8) shows the concentration of the fishery in August and September, with the roe and adult shore markets dominating.

1985 and 1986 effort and CPUE values for individual fishing grounds are compared in Table 4. The relative effort, as a percent of the total days fished among spawning grounds, changed slightly. Trinity Ledge was lower and there were small increases in all others except SW Ground. The catch rate, measured as catch per hour and per set, was lower for all important (>10% of total catch) fishing grounds. The decrease is thought to be primarily the result of the roe fishery which requires herring of a specific maturity stage. Set rate (sets per hour; Table 4) which is thought to be more representative of availability or abundance (Mace, pers. comm.) was the same or higher in all areas except Trinity Ledge. On Trinity Ledge, the set rate decreased from 1985 to 1986 by 41%. This decrease could be the result of a lack of fish or of suitable aggregations due to intense fishing pressure on that ground. This decrease in set rate, particularly in light of an increasing stock size, indicates a possible problem on Trinity Ledge.

1985 and 1986 effort and CPUE values plotted by month for the three major fishing grounds (Fig. 4) show similar seasonal trends. Effort as measured by 'Hours Searched' and 'Days Fished' was lower except for German Bank in September during the peak of the roe season. The catch and set rate data have high variances and must be interpreted with care. The catch rate as measured by 'Catch per Hour' is also down consistently for most months and all areas. The set rate in 'Sets per Hour' remained approximately the same between years for Seal Island and German Bank areas, but was relatively constant for Trinity Ledge in spite of highly variable total effort.

SUMMARY

The log information from the 1986 4X summer purse seine fishery was comparable to 1985 in scope and quality. A relatively complete set of records was received from all vessels, and accounted for 91% of the recorded catch. The log data set provided a complete and useful description of the purse seine fishery which allowed:

- 1) spatial and temporal analysis of purse seiner effort and catch;
- 2) comparison of purse seiner activity including CPUE with 1985;
- 3) validation of biological information (including relative strength of stock units) and anecdotal information (including market effects and aspects of misreporting).

Spatial information shows a very similar pattern in 1986 compared with 1985. CPUE analysis shows a major change on Trinity Ledge (decrease in catch rate and set rate) but that other areas were similar in the two years. The

decreasing set rate, despite increasing stock size, suggests a problem in the Trinity Ledge spawning stock component.

ACKNOWLEDGMENTS

We thank the captains of the 4X purse seine fleet for their efforts and cooperation in providing information, and members of Department of Fisheries and Oceans Scotia-Fundy Operations Branch for their efforts in collection of completed logs. We express our particular appreciation to C.D. Burnett who coded and edited the logbooks with great care.

REFERENCES

- Power, M. J., and R. L. Stephenson. 1986. An analysis of logs from the 1985 4X summer purse seine fishery. Can. Atl. Fish. Sci. Advis. Comm. Res. Doc. 86/44: 35 p.
- Stephenson, R. L., M. J. Power, and T. D. Iles. 1987. Assessment of the 1986 4WX herring fishery. Can. Atl. Fish. Sci. Advis. Comm. Res. Doc. 87/75: 39 p.
- Stephenson, R. L., M. J. Power, T. D. Iles, and P. M. Mace. 1985. Assessment of the 1984 4WX herring fishery. Can. Atl. Fish. Sci. Advis. Comm. Res. Doc. 85/78: 58 p.

Table 1. 4X purse seine landings by month (t) from Statistics Branch and log record data. (OTS = over-the-side).

	June	July	Aug.	Sept.	Oct.	Total
Log (kept mt)						
4Xa purse seine domestic	316*	6901*	16838	23205	2474	50378
4Xa purse seine OTS		214*	430*			644*
TOTAL Log	316	7115	17268	23205	2474	51022
Statistics Branch						
4Xa purse seine domestic	197	6871	18488	26987	3198	55741
4Xa purse seine OTS			398			398
TOTAL Stats	197	6871	18886	26987	3198	56139
Ratio (Log/Stats)	1.60	1.04	0.91	0.86	0.77	0.91

*Higher than Statistics Branch data.

Table 2. Historical logbook coverage of the 4X summer purse seine segment in 4WX herring assessments.

Year	No. of vessel	Log return (% of vessels)	Total # sets logged	Fishery catch Total(t)	(% logged)
1967	-	-	-	117382	-
1968	-	-	-	133267	-
1969	-	-	-	84525	-
1970	-	-	-	74849	-
1971	-	-	-	35071	-
1972	-	-	-	61158	-
1973	17	-	403	36618	(48)
1974	-	-	-	76859	-
1975	-	-	-	79605	-
1976	-	-	-	58395	(72)
1977	27	-	1137	68538	(47)
1978	22	-	701	57973	(36)
1979	28	-	641	25265	(28)
1980	44	-	1273	44986	(73)
1981	39	-	802	53799	(55)
1982	12	-	268	64344	(8)
1983	47	-	1406	63379	(68)
1984	26	(60)	530	58354	(43)
1985	41	(100)	2995	87167	(96)
1986	42	(100)	1850	56139	(91)

Table 3. Summary of data coverage by field for 1985 and 1986 4X herring purse seine logs.

Field	Occurrence (1986)	% occurrence		Range comments (1986)	Mean	
		1985	1986		1985	1986
1. Vessel	42 of 42 vessels; 1425 nights 1838 sets	100	100	12 to 100 nights per vessel	-	-
2. Departure date	1425 nights	100	100	June 18-Oct. 14, 1985	-	-
3. Trip time (hours)	1136 nights	83	80	1.5 to 31.0	12.2	12.7
4. Search time (hours)	1005 nights	65	71	0.1 to 16.5	4.3	4.5
5. Set date	1681 of 1964 activity records	81	86	June 18-Oct. 15, 1986	-	-
6. Set number	1838 sets	91	94	0-6 per night; 6.4 unsuccessful nights (0-6 and 9% in 1985)	1.4 per successful night	1.4
7. Start set time	1523 of 1964 activity records	75	78			
8. Position type	- unspecified	4	2	No position recorded	-	-
	- latitude/longitude	8	6	Specified on log	-	-
	- Loran C	32	30	Specified on log	-	-
	- square number	15	13	Specified on log	-	-
	- interpreted	41	38	From comments on log	-	-
9. Total catch per set	1653 of 1964 activity records	84	84	0.9 to 172.4 MT	40.1	31.2
10. Kept catch per set	1640 of 1964 activity records	82	84	0.9 to 131.5 MT	39.5	30.7
11. Release catch per set	27 of 1964 activity records	3	1	0.9 to 136.1 MT	39.6	49.7
12. Catch units	- unspecified	56	16	Short tons assumed in cal-	-	-
	- metric ton	6	3	culations unless market was	-	-
	- short ton	38	81	over-the-side, then MT	-	-
	- hogsheads	0.2	0.3		-	-
13. Release code	384 of 1964 activity records	21	20	See Table 6	-	-
14. Size of fish code	391 of 1964 activity records	19	20	-	-	-
15. Roe condition code	523 of 1964 activity records	14	27	-	-	-
16. Market code	1655 of 1964 activity records	76	84	See Table 5	-	-

Table 4. 4X purse seine effort and CPUE by fishing ground, 1986 and (1985) (1985 data from Power and Stephenson 1986).

Fishing ground	Days fished	Total mt caught	% of total days fished	Hours searched	Number of sets	Set/h searched	Catch/h searched	Catch/set
Grand Manan	104 (91)	3023 (3583)	7 (5)	284 (184)	107 (91)	.81 (.73)	22.8 (27.8)	29.8 (40.6)
Long Island	82 (30)	2739 (857)	6 (2)	266 (149)	97 (25)	.75 (.44)	21.6 (15.8)	30.1 (38.0)
Trinity	473 (808)	13419 (35721)	33 (45)	1650 (2106)	519 (1028)	.41 (.70)	11.1 (28.5)	28.6 (39.4)
Lurcher	1 (9)	0 (308.2)	0 (0)	8 (39)	0 (8)	0 (.18)	0 (10.5)	0 (46.8)
SW Ground	72 (150)	2251 (5675)	5 (8)	211 (526)	68 (199)	.84 (.46)	30.8 (16.7)	35.6 (34.2)
Seal Island	198 (236)	8420 (13142)	14 (13)	503 (671)	283 (328)	.61 (.59)	19.9 (29.1)	34.0 (44.7)
German Bank	273 (248)	13215 (15239)	19 (14)	858 (660)	467 (363)	.60 (.62)	21.0 (30.9)	34.9 (49.8)
Other	222 (230)	8501 (8790)	16 (13)	740 (823)	309 (253)	.59 (.46)	18.1 (19.7)	31.0 (39.1)
Total	1425 (1802)	51571 (83317)	100 (100)	4519 (5157)	1850 (2295)	.58 (.62)	18.0 (26.6)	31.5 (41.2)
Ratio (85/86)	.79	.62		.88	.81	.93	.68	.76

Table 5. CPUE variables for the 1985 and 1986 4X summer purse seine fishery.

Summary type	Variable name	Number of observations		Mean		Standard deviation		Minimum		Maximum	
		1985	1986	1985	1986	1985	1986	1985	1986	1985	1986
Per night	Total catch (mt)	1802	1425	46.2	36.2	38.1	28.3	0	0	562.5	200.0
	Kept catch (mt)	1802	1425	44.6	35.3	35.0	26.6	0	0	224.0	200.0
	Released catch (mt)	1802	1425	1.6	0.9	14.7	8.9	0	0	471.7	158.7
	Total trip hours	1494	1136	12.2	12.7	3.9	3.9	1.0	1.5	36.0	35.1
	Total search hours	1177	1005	4.4	4.5	2.8	2.7	0.1	0.1	14.5	16.5
Per set	Catch per set (mt)	1539	1258	41.2	31.5	25.1	18.8	0.9	0.9	187.5	172.4
	Release per set (mt)	68	25	26.3	33.8	25.6	33.0	0.6	0.5	157.2	136.1
	Kept per set (mt)	1519	1252	40.6	30.9	24.4	17.6	0.9	0.9	164.2	131.5
Per hour	Catch per hour (mt)	994	902	26.6	18.0	41.8	28.9	0.2	0.2	590.0*	363.0
	Release per hour (mt)	44	16	13.0	24.4	18.6	33.2	0.3	0.1	113.4	130.4
	Kept per hour (mt)	980	898	26.4	17.6	41.8	28.0	0.2	0.2	590.0*	363.0
	Sets per hour	1054	940	0.6	0.6	0.7	0.9	0.1	0.1	10.0	10.0

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

Table 6. Summary of release information from 1986 4X herring purse seine logs (n=1964). Comparable 1985 values in brackets.

Release code	Occurrence on logs		Reported total tonnage	Reported release		% of released tonnage
	# sets	% of total sets		Release tonnage	% of Logged total tonnage	
No release code	1580	80.4(78.8)	48450	0	0.0	0.0 (4.5)
Size of fish	20	1.0 (3.0)	39	39	0.1	2.9(41.7)
Feed	2	0.1 (1.1)	54	0	0.0	0.0 (6.2)
Condition of fish	49	2.5 (0.9)	603	553	1.1	41.2 (0.6)
Dogfish	12	0.6 (1.7)	181	27	0.1	2.0 (6.9)
Tore up net	25	1.3 (1.3)	275	36	0.1	2.7 (3.1)
Set too large	8	0.4 (0.4)	304	50	0.1	3.7(16.2)
Market filled	4	0.2 (1.3)	136	136	0.3	10.1 (6.9)
Skunk set	35	1.8 (1.8)	4	4	0.01	0.3 (0.0)
Other species	8	0.4 (0.1)	145	0	0.0	0.0 (0.8)
Set too small	2	0.1 (0.4)	1	1	0.01	0.1 (0.1)
No fish found	72	3.7 (3.3)	0	0	0.0	0.0 (0.0)
Fish too deep	36	1.8 (0.9)	49	1	0.01	0.1 (0.1)
Poor weather	16	0.8 (0.9)	0	0	0.0	0.0 (0.0)
Gear/crew problems	17	0.9 (0.6)	225	104	0.2	7.8 (0.1)
Fish too shallow	8	0.4 (1.1)	0	0	0.0	0.0 (0.0)
Fish dove	3	0.2 -	190	36	0.1	2.7 -
Net sunk	12	0.6 (0.3)	853	354	0.7	26.4(12.5)
Fish thinned out	7	0.4 -	0	0	0.0	0.0 -
Fish moving fast	12	0.6 -	138	0	0.0	0.0 -
Fish inside box/line	5	0.3 -	0	0	0.0	0.0 -
Unknown/not specif.	31	1.6 (2.2)	0	0	0.0	0.0 -
TOTAL	1964	99.9(100.1)	51647	1341	2.8	100.0(100.0)

Table 7. Summary of market breakdown of the 1986 4Xa purse seine fishery from log records.

Market	No. sets	Total tonnage	Portion (%)	
			No. Sets	Tonnage (kept)
Over-the-side	24	644	1.2	1.2
Sardine	102	2,548	5.2	4.9
Bait	44	1,472	2.2	2.9
Roe	828	22,723	42.2	44.0
Adult shore	650	20,408	33.1	39.5
Fillet	1	45	0.1	0.1
U.S. buyers	6	176	0.3	0.3
Unspecified	309	3,630	15.7	7.0
TOTAL	1964	51,646	100.0	99.9

Table 8. Summary of monthly market breakdown of the 1986 4X purse seine fishery from log records.

Market	No. sets	Total tonnage	June Total t	July Total t	Aug. Total t	Sept. Total t	Oct. Total t
Over-the-side	24	644	-	214	430	-	-
Sardine	102	2,548	31	967	90	1358	102
Bait	44	1,472	-	-	-	787	685
Roe	828	22,723	-	327	8289	13551	556
Adult shore	650	20,408	260	5358	7311	6499	981
Fillet	1	45	-	-	45	-	-
U.S. buyers	6	176	24	-	-	-	152
Unspecified	309	3,630	-	385	1710	1535	-
TOTAL	1964	51,646	316	7251	17875	23730	2475

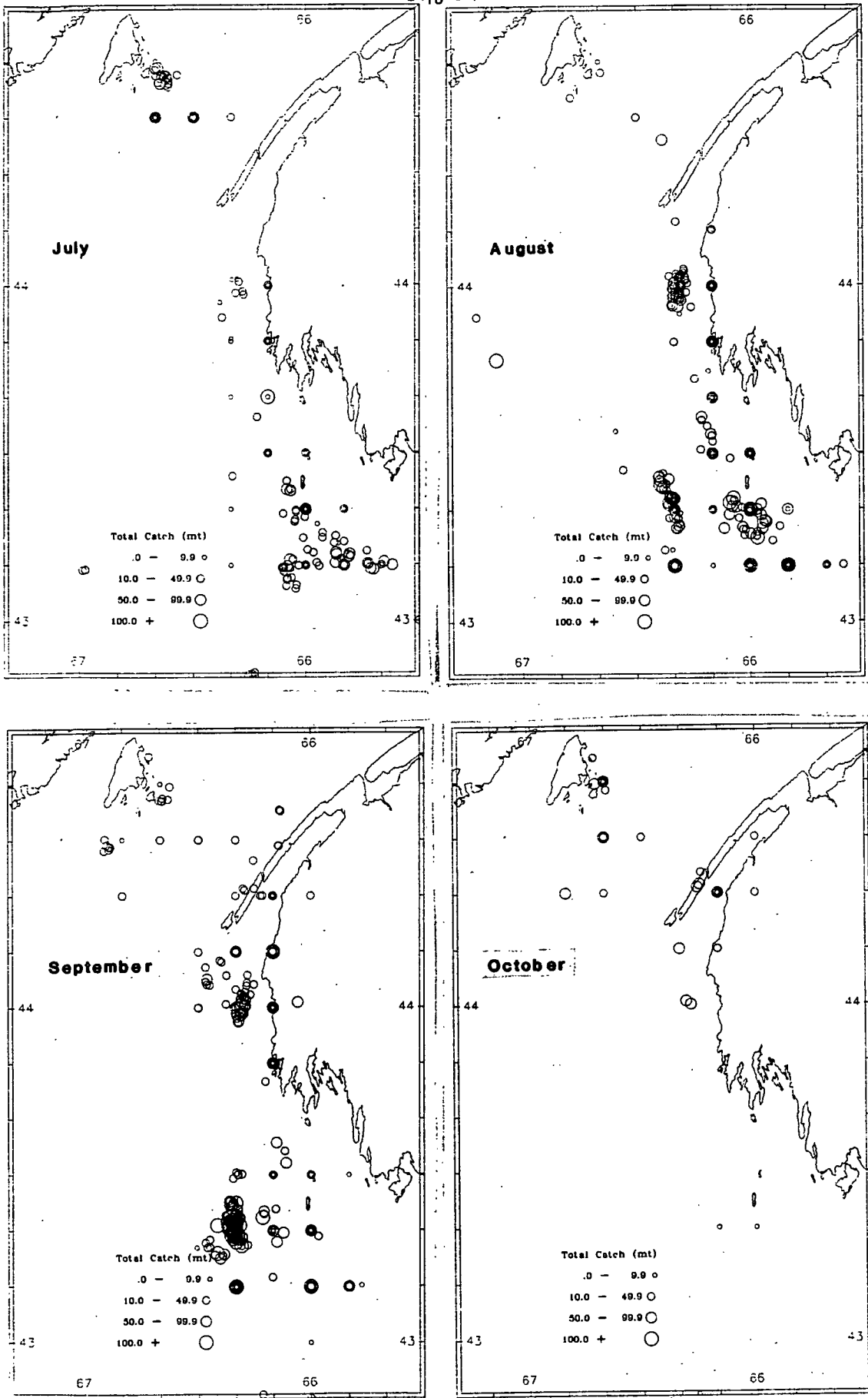


Fig. 2. Distribution of catches in the 1986 4X purse seine fishery by month.

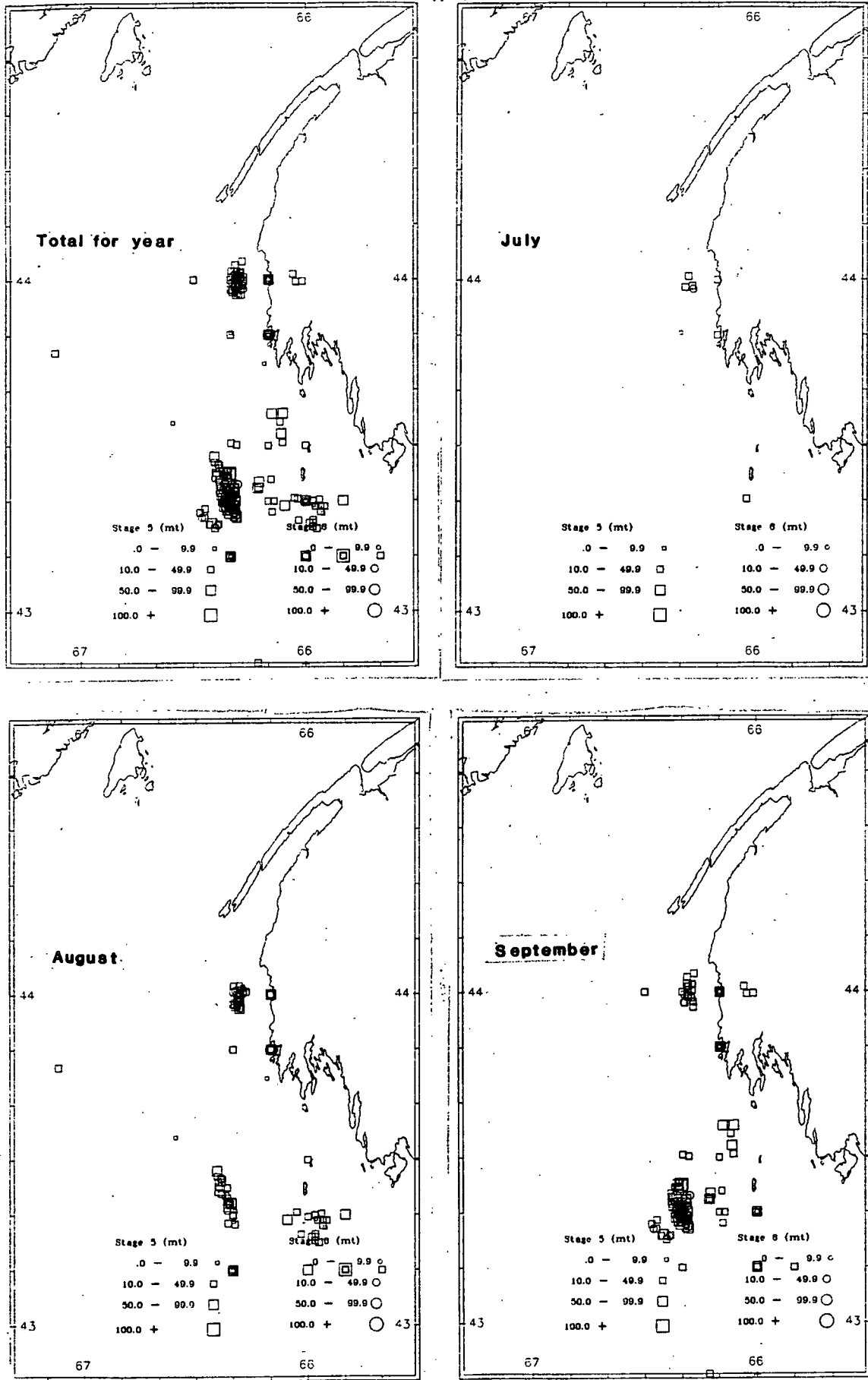


Fig. 3. Distribution of landings of roe herring (stages 5 & 6) in 4X purse seine fishery: Total and by month.

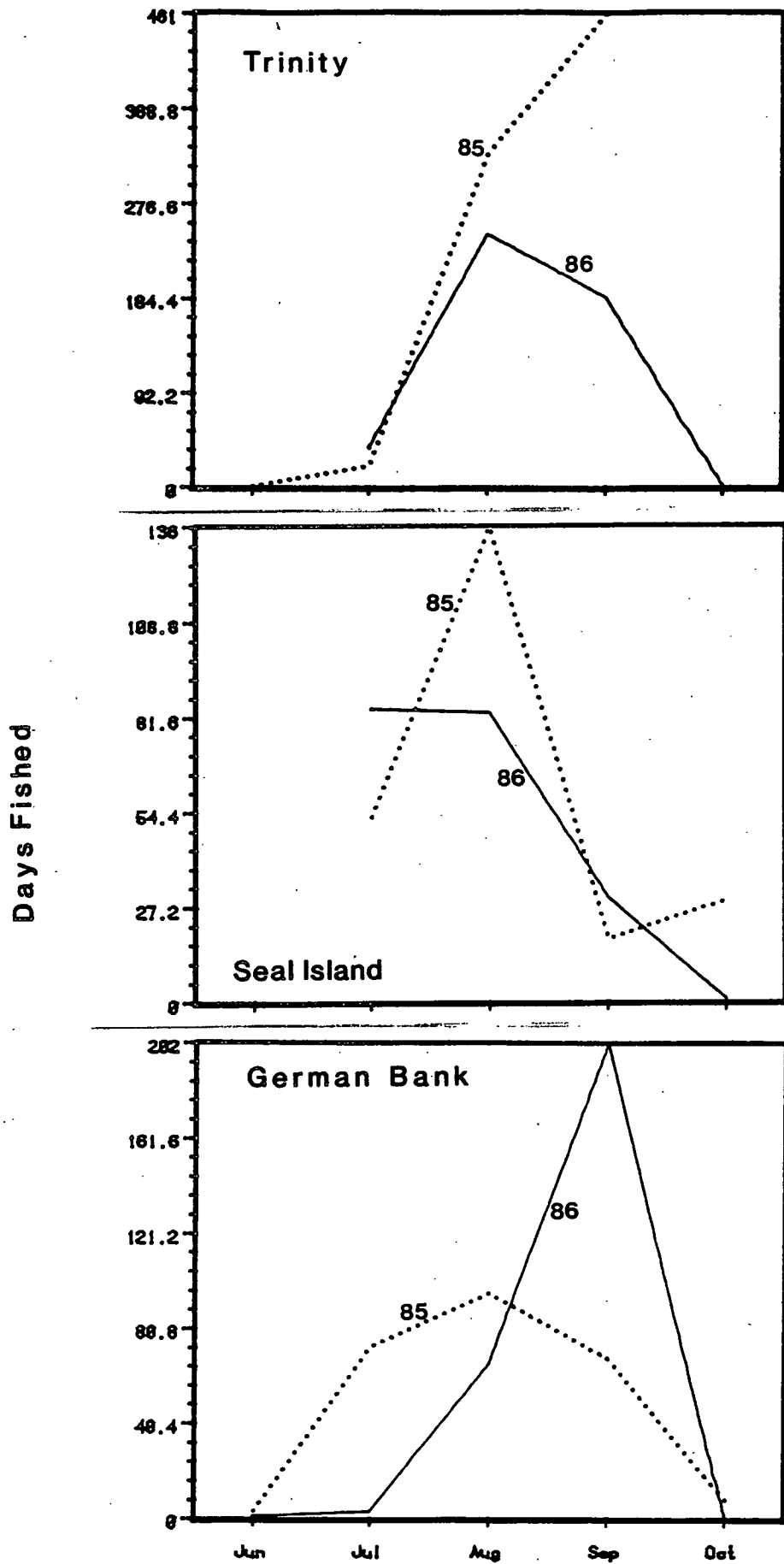


Fig. 4a. Total effort (Days Fished) by month for 1985 and 1986 for the major fishing grounds in the 4X summer purse seine fishery.

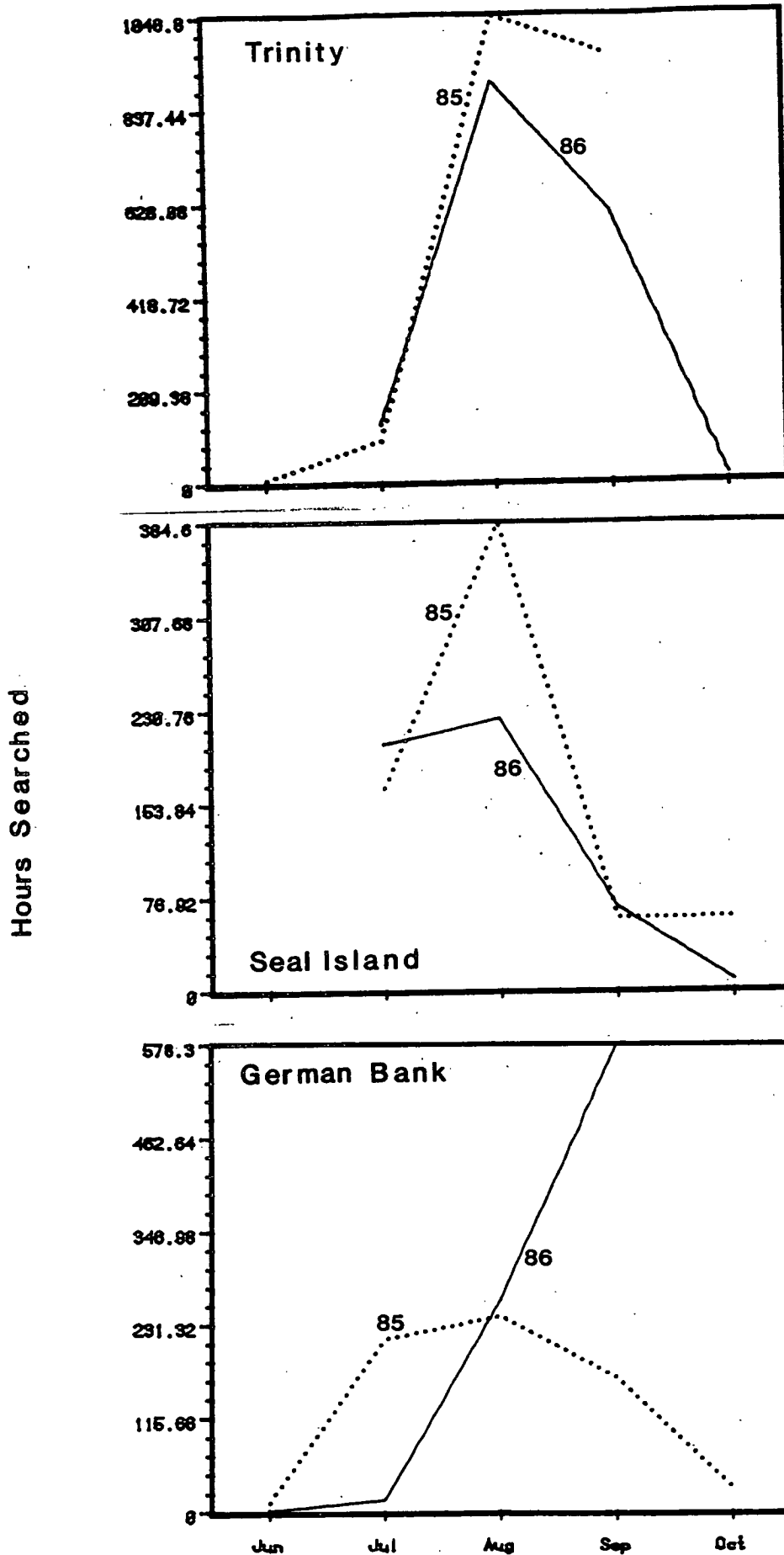


Fig. 4b. Total effort (Hours Searched) by month for 1985 and 1986 for the major fishing grounds in the 4X summer purse seine fishery.

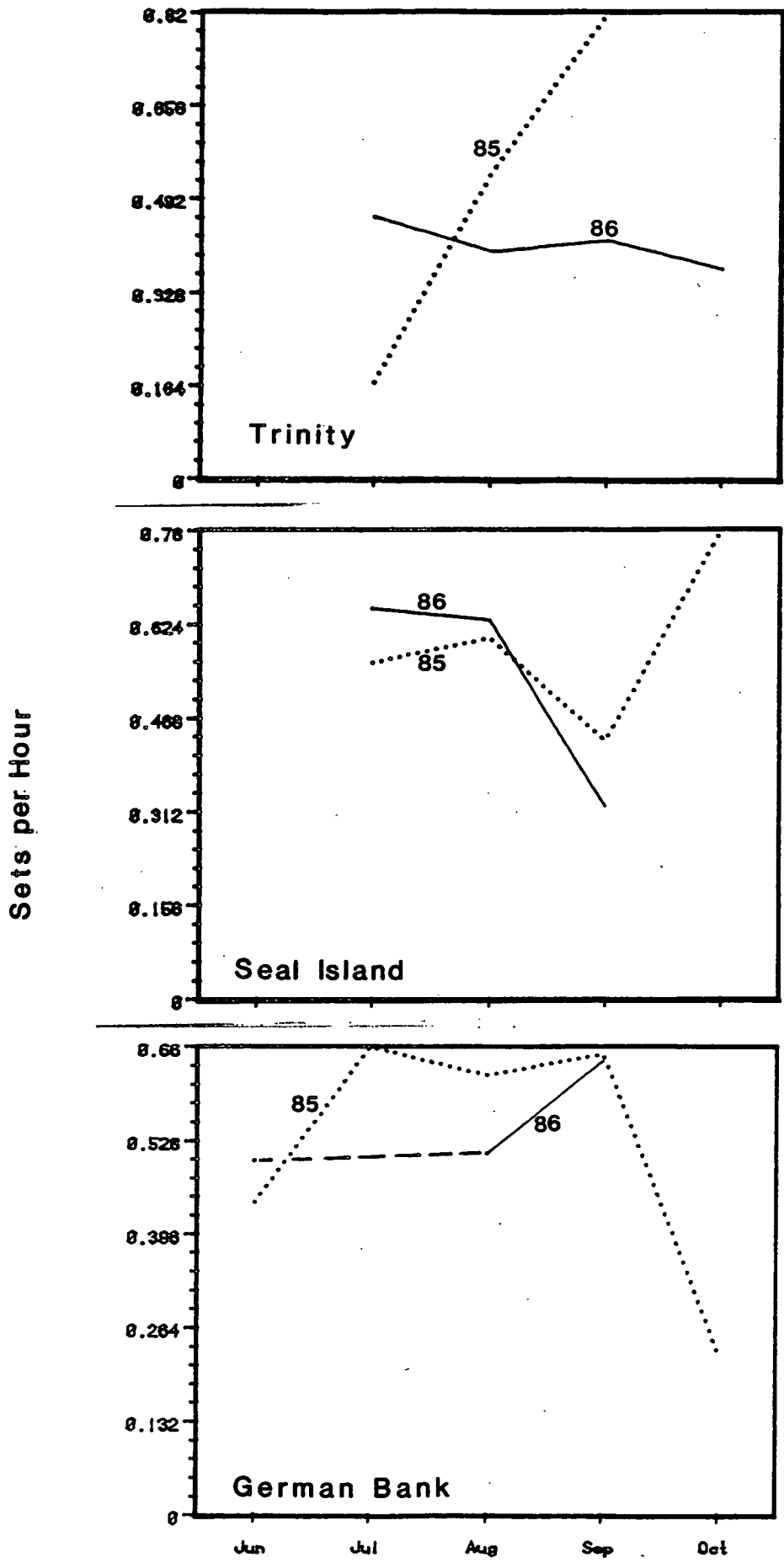


Fig. 4c. Set rate (Sets per Hour) by month for 1985 and 1986 for the major fishing grounds in the 4X summer purse seine fishery.

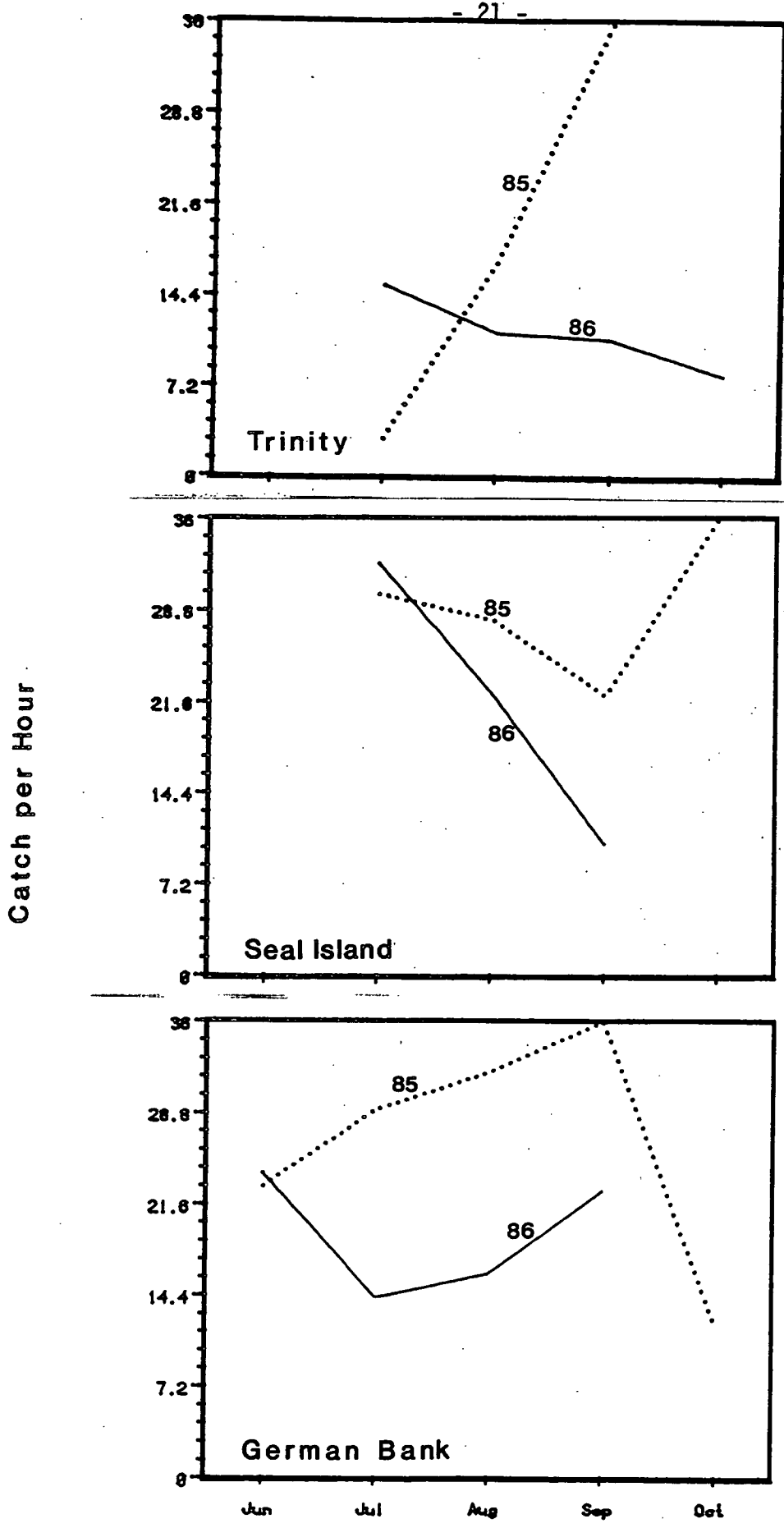


Fig. 4d. Catch rate (Catch per Hour) by month for 1985 and 1986 for the major fishing grounds in the 4X summer purse seine fishery.