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An estimation of cod discards on the basis of youngfish investigations by a herring bottom trawl in the western and southern Baltic

by

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Abstract

In the 4th quarter of the year the estimated discards of cod in a herring fishery with bottom trawl varied with year (1977-79), area (Subdivision 22, 24, 25) and fishing depth (13.6-73.5 m). Between trawling depth and discards per hour fishing respectively percentages of discards by weight in relation to theoretical landings a positive correlation from 10 to 40 m depth and a negative correlation from 40 m downwards was stated.

In all areas discards were built up by 2 age groups. Values of 45 % discards by weight in relation to landings and 60 kg discards per fishing hour of cutters with about 235 h.p. were common in nearly all Subdivisions. The largest amounts of possible discards were found in Subdivion 24. These results support the urgent need for better protection of young cod in this area, especially because of the critical spawning stock-recruit relations.

Résumé

Les rejets estimés de morue pendant la pêche en chalut de fond de hareng variaient dans les années differentes (1977-1979), les regions (subdivisions 22, 24, 25) et les profondeurs (13.6-73.5 m). Entre les rejets par heure de pêche, resp. les pourcentages des rejets par poids en relation aux debarquements théoretiques et la profondeur de pêche une correlation positive jusque 40 m et une

correlation negative au dessous de 40 m a été trouvé.
Dans tous le regions les rejets ont été composés de deux groupes de l'age. Des valeurs des rejets de 45 %.par poids en relation aux debarquements et 60 kg des rejets par heure de pêche des petits chalutiers de 235 c.v. ont été constatés presque dans tous les subdivisions. Les plus hautes valeurs des possibles rejets ont été trouvés dans la subdivision 24. Les resultats confirment la necessité urgente pour la meilleure protection de morue juvenile de cette region specialement à cause des relations critiques des recrues du stock adult.

Introduction

The discards of cod in the herring fishery may influence the recruitment of the commercial stock to a high degree. As stated by Bagge (1979) the percentage of discards in relation to landings varries within the year according to month and depth and also between different years according to strength of recruiting year classes in relation to commercial stock. The discards per u.e. change with the same factors. Therefore it is necessary to obtain data from different months at different depths in different years. Moreover discards are dependent on the type of fishing gear and its selectivity and also on the minimum landing size.

Material and Methods

The basic data for estimation of possible cod discards in the Baltic herring fishery were obtained during the youngfish surveys in October and November 1977, November 1978, and January and November 1979. Investigations were carried out in the Mecklenburg Bay (Subdivision 22), Arkona Basin (Subdivision 24), and Bornholm Basin (Subdivision 25) in different depth zones. All surveys were done by the R/V "Eisbär" (1200 h.p.) by means of the Polish herring bottom trawl HG 20/25, but with a mesh opening of 20 mm in the cod end. The vertical net opening was about 4 m. Primarily

these trawls were designed for a cutter with 225-245 h.p. and a length of about 25 m o.a. Each haul took 30 minutes at a trawling speed of about 3.0-3.9 knots. The trawl stations in each 10 m depth zone were determined by means of random numbers of sections 2 n.m. in square. Their different quantity is given in table 1.

The table gives also the mean fishing depth of each depth zone and calculated landings and discards by application of a 50 % retention length of 30 and 33 cm to the catch. For this end a theoretical mesh selection curve of cod in a cod trawl with a 50 % retention length of 30 and 33 cm and also of cod in a herring trawl(Trešščev and Ševcov 1975) with a 50 % retention length of 15 cm, fitting to a mesh opening of 40 mm when the selection factor is 3.74 (Olofson and Otterlind 1978), were applied to the numbers in catch. Next the weight was calculated for each cm of length by the length/weight relationships of cod in the Subdivisions 22, 24 and 25 (Berner 1978).

Altogehter table 1 provides possible discards of cod in a herring fishery by bottom trawl in the 4th quarter of the year which could be avoided by application of the cod trawl.

Results

The results are shown in table 1 and figure 1-9. All figures as well as the subsequent discussed results relate to a 50 % retention length of 30 cm corresponding to the legal minimum landing size.

The length distribution of discards includes always 2 age groups, 0 and 1 in the Mecklenburg Bay and in the Arkona Basin 1 and 2 in the Bornholm Basin (fig. 1-2). By numbers, the first age group can be fished in the same strength as the following age group according to the different year class strength and to month in coincidence with growth and change to bottom life. By weight, the upper age group (1 or 2) give the greatest amount of discards by reason of higher mean weights.

The weight of discards as percentage of landings differ from year to year according to commercial stock and recruitment (fig. 4), the catch per u.e. of discards however differ from year to year only with different strength of recruitment(fig.5), In Subdivision 22 and especially in Subdivision 24 the strong year class 1976 is evident in 1977. In 1978 this year class increased the catch per hour also in Subdivision 25.

In the investigation period the discards of cod by weight in relation to landings have varied from 16.3-48.4 % in Subdivision 22, from 0.4-134.0 % in Subdivision 24, and from 1.6-139.2 % in Subdivision 25 (table 1). In the main catch depth 45 % of discards in relation to landings in all investigated areas and about 60 kg of discards per hour in Subdivisions 24 and 25 are not uncommon.

In fig. 6 the weight of discards as percentage of landings and in fig. 7 the catch per hour of undersized cod is plotted against depth for Subdivisions 24. Both figures show a positive correlation between depth and the amount of discards with a high correlation coefficient. The correlation is current between 17.0 and 42.6 m trawling depth and in conformity with the formation of wintering concentrations of cod in these areas at this time. In fig. 8 and 9 the same was done as in fig. 6 and 7 however for Subdivision 25 and in a range from 44.3-73.1 m. trawling depth. Thes two figures show a negative correlation between depth and amount of discards, also with a high correlation coefficient.

If we compare the two correlations probably there is a positive correlation between depth and amount of discards in Subdivision 25 in shallower waters too and the direction of regression in a period will be determined more by depth than by areas (Subdivisions). In this way the result cannot be a straight correlation from 0-90 m but a straight positive correlation from 10 to about 40 m and a straight negative correlation from about 40 m downwards.

Discussion

In order to increase young cod protection it is not favourable to use herring bottom trawls in the 4th and at the beginning of the 1st quarter of the year in trawling depths from 25 to70 m in the investigated areas. Such gears should be substitued by pelagic herring trawls or cod trawls with an increased mesh size in cod adequate to an increased minimum landing size (> 30 cm) of commercial cod.

Especially important is an increased young cod protection in Subdivision 24. Here a flat topped spawning stock-recruit curve and an insufficient spawning stock of cod (Bormann and Berner 1979) come together with very good catch chances for young cod and very high values of estimated cod discards. In GDR zone an injunction of herring fishery in large parts of coastal waters of Subdision 24 in the 3rd quarter of the year has been effective since 1980.

Data on discards in the 2nd and 3rd quarter of the year in all areas and especially in Subdivision 24 would complete the hitherto existing results and are therefore most necessary.

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Table 1: Cod discards in herring trawl

Sub-division	Date	Mean depth m	Number of hauls	Sum of fishing hours	50%-length 30 cm					- 50%-length 33 cm				
					Landings	Discards				Landings	Discards			
					kg/hour	kg/hour	%	Øweight g	Ølength cm	kg/hour	kg/hour	%	Øweight g	Ølength cm
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
22	12.10.-13.10.77	21.1	11	5.5	17.2	8.3	48.4	190	26.7	14.5	11.1	77.0	201	27.1
22	18.11.-19.11. 77	22.3	7	3.5	99.5	44.3	44.5	210	27.2	79.0	64.7	81.9	229	28.1
22	29.11.-02.12.78	21.5	19	9.5	49.3	8.5	17.2	270	29.9	43.9	13.9	31.6	290	30.7
22	14.11.-16.11.79	21.2	19	9.5	114.7	18.7	16.3	126	22.2	109.1	24.3	22.3	142	23.1
24	08.10.-15.10.77	22.3	9	4.5	141.1	46.8	33.2	162	24.5	124.2	63.8	51.4	183	25.4
		35.8	4	2.0	743.5	330.1	44.4	189	26.2	629.5	444.2	70.6	204	26.8
		41.4	7	3.5	159.9	198.2	124.0	135	23.3	115.9	242.1	208.9	146	23.8
24	21.11.-25.11.77	17.0	2	1.0	144.3	15.6	10.8	354	32.2	126.6	33.2	26.2	396	33.5
		22.6	5	2.5	90.6	26.2	28.9	160	23.3	75.9	38.9	51.2	189	25.1
		36.0	3	1.5	361.3	254.8	70.5	83	19.2	305.0	311.2	102.0	95	19.9
		44.0	6	3.0	223.2	299.0	134.0	140	23.3	148.0	374.2	252.9	152	23.9
24	18.11.-28.11.78	16.1	4	2.0	19.1	1.2	6.2	296	29.6	18.4	1.8	9.9	330	31.0
		22.3	4	2.0	155.1	30.9	19.9	297	30.5	133.5	52.5	39.3	318	31.2
		37.3	5	2.5	140.0	81.0	57.8	165	24.2	109.2	111.8	102.4	186	25.3
		42.3	11	5.5	210.1	94.4	45.0	192	26.3	174.5	130.0	74.5	209	27.0
24	17.01.-21.01.79	13.6	4	2.0	18.4	0.1	0.4	49	17.2	18.4	0.1	0.4	49	17.2
		22.4	5	2.5	127.8	4.2	3.3	272	28.1	122.4	9.7	7.9	357	31.3
		36.4	5	2.5	237.6	36.8	15.5	209	25.7	209.6	64.8	30.9	261	27.9
		43.0	10	5.0	294.1	60.9	20.7	235	27.2	250.4	104.6	41.8	278	29.0
24	01.11.-05.11.79	16.3	4	2.0	58.5	1.8	3.0	317	30.9	56.3	4.0	7.0	395	33.2
		22.7	5	2.5	157.4	2.0	1.3	270	29.0	155.1	4.4	2.8	351	31.7
		35.0	5	2.5	343.0	71.7	20.9	185	25.8	314.2	100.4	32.0	206	26.6
		42.8	10	5.0	292.8	32.4	11.1	162	24.6	278.4	46.8	16.8	192	25.7

Table 1:
Continued

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
25	05.10.-08.10.77	31.7	3	1.5	31.7	3.5	10.9	115	23.2	31.0	4.2	13.6	124	23.7
		43.7	6	3.0	144.9	93.1	64.3	65	19.1	139.6	98.4	70.5	67	19.2
		54.2	5	2.5	169.1	59.2	35.0	58	18.4	165.0	63.3	38.4	61	18.5
25	25.11.-26.11.77	31.0	1	0.5	74.8	104.1	139.2	119	23.3	57.2	121.8	219.9	126	23.6
		44.0	1	0.5	168.8	68.6	40.7	101	21.8	149.6	87.8	58.7	117	22.5
		56.3	2	1.0	83.4	59.4	71.2	99	21.8	74.1	68.7	92.7	106	22.2
		60.5	1	0.5	55.2	32.4	58.6	84	21.0	52.1	35.5	68.2	88	21.2
		72.0	1	0.5	14.5	16.4	113.6	89	21.1	12.2	18.7	153.0	95	21.5
25	23.11.-27.11.78	30.5	1	0.5	134.8	2.1	1.6	356	33.5	129.4	7.6	5.8	378	34.0
		40.5	1	0.5	23.6	1.2	5.0	198	27.2	21.6	3.1	14.5	262	29.8
		58.8	4	2.0	145.4	34.3	23.6	151	24.7	134.1	45.7	34.1	168	25.5
		62.5	6	3.0	166.2	99.2	59.7	173	26.0	131.2	134.2	102.3	188	26.7
		72.6	5	2.5	3.1	0.7	21.3	185	26.9	2.9	0.9	29.2	195	27.4
25	22.01.-25.01.79	48.0	1	0.5	250.0	226.8	90.7	155	25.0	175.8	301.0	171.3	171	25.7
		57.0	5	2.5	568.7	169.6	29.8	181	26.3	498.1	240.1	48.2	200	27.2
		64.6	6	3.0	231.4	46.0	19.9	175	26.5	209.5	67.9	32.4	197	27.6
		73.5	4	2.0	44.8	7.0	15.7	203	27.3	40.9	10.9	26.7	234	28.5
25	06.11.-11.11.79	48.0	1	0.5	234.8	35.8	15.3	193	26.9	214.6	56.0	26.1	229	28.2
		57.4	5	2.5	352.8	93.6	26.5	202	27.0	299.6	146.8	49.0	232	28.3
		64.1	5	2.5	242.7	32.4	13.4	157	25.1	224.6	50.5	22.5	190	26.6
		73.5	4	2.0	6.8	0.7	10.1	227	28.0	5.8	1.6	28.2	272	30.1

Fig. 1 Discards in numbers per cm per 10 hours fishing (50% length 30cm)
Subdivision 22

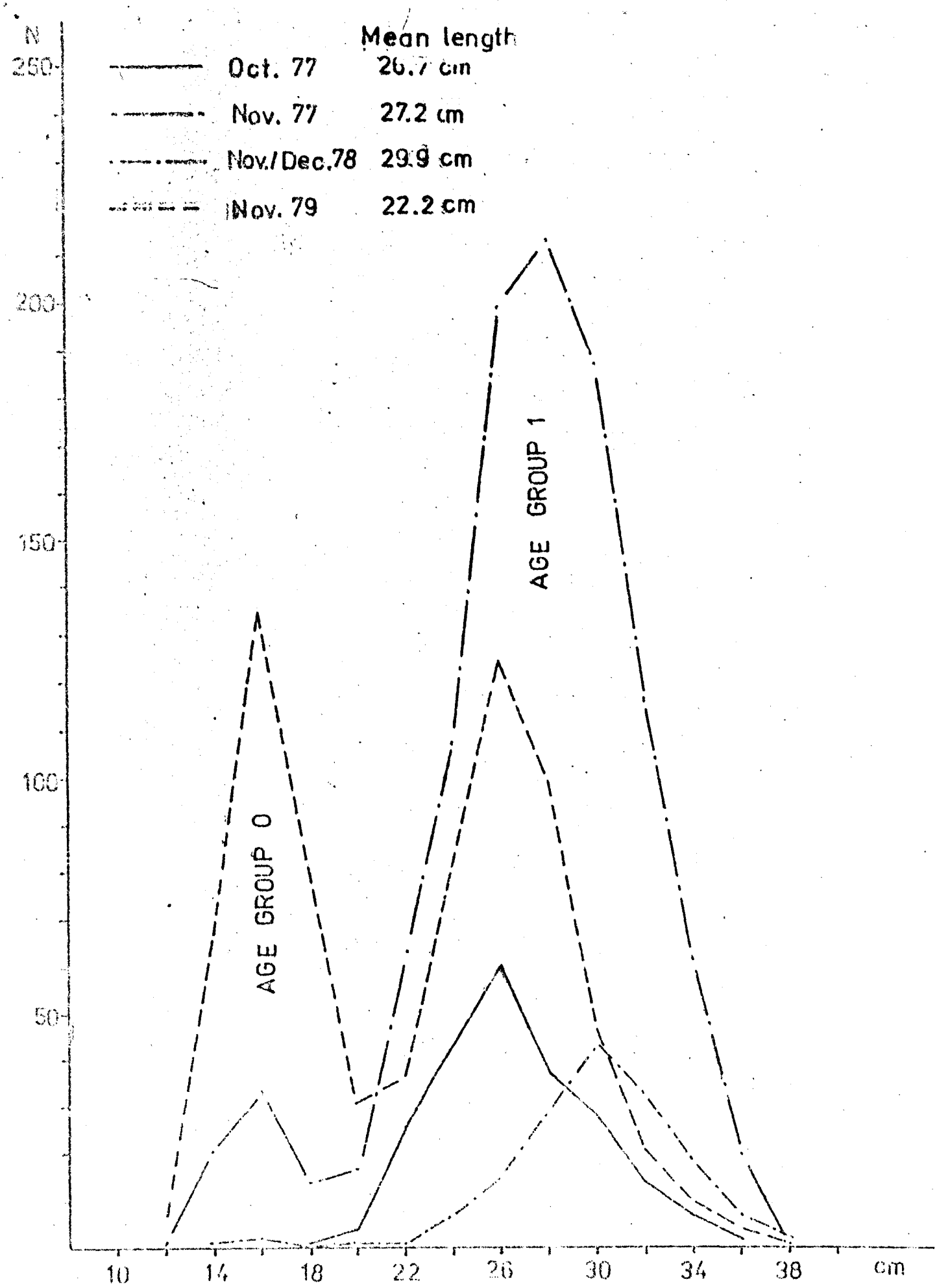

Fig.2 Discards in numbers per cm per 10 hours fishing (50% length 30cm) - Subdivision 24

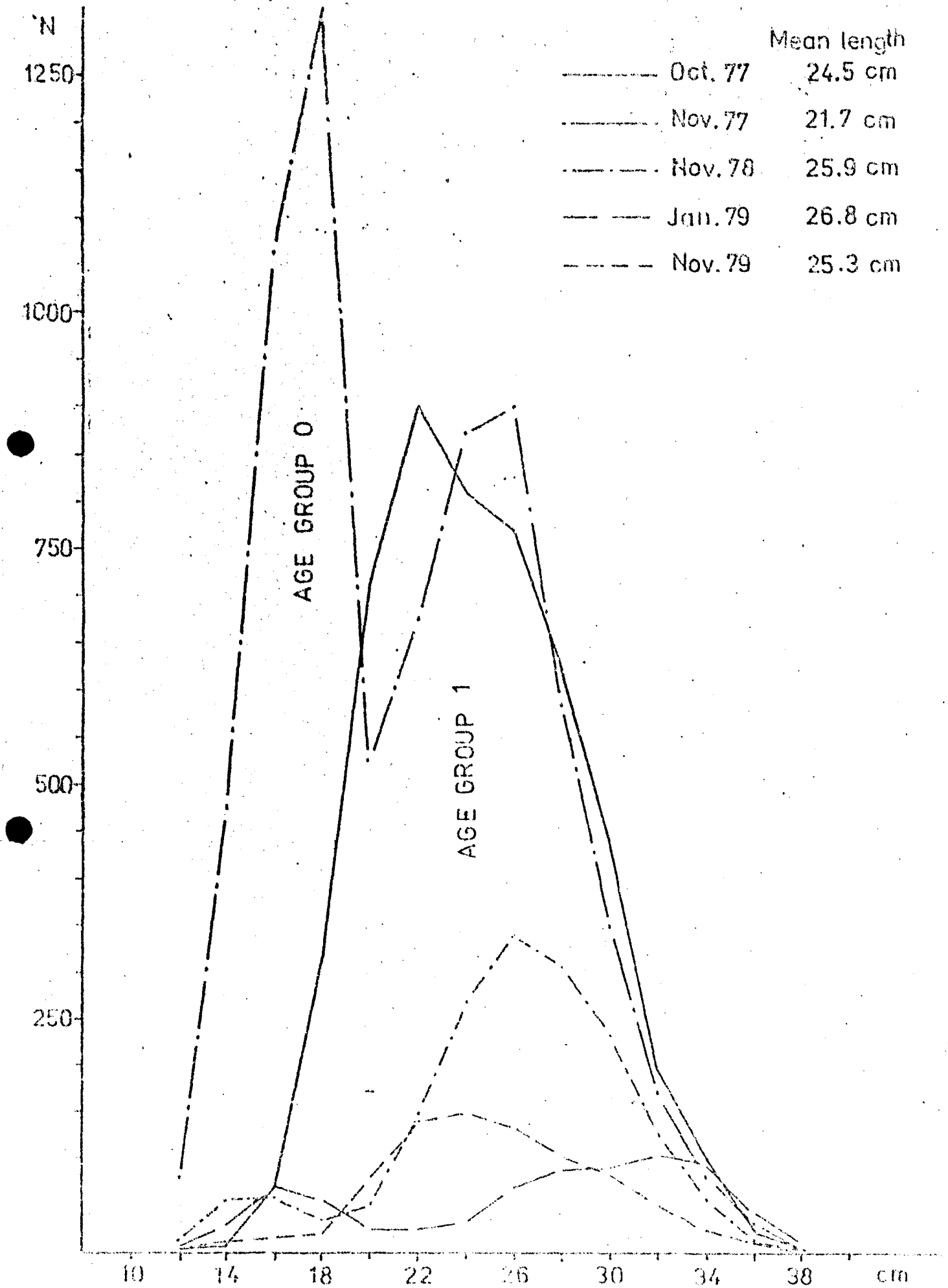

Fig.3 Discards in numbers per cm per 10 hours fishing (50% length sel.) - Subdivision 25.

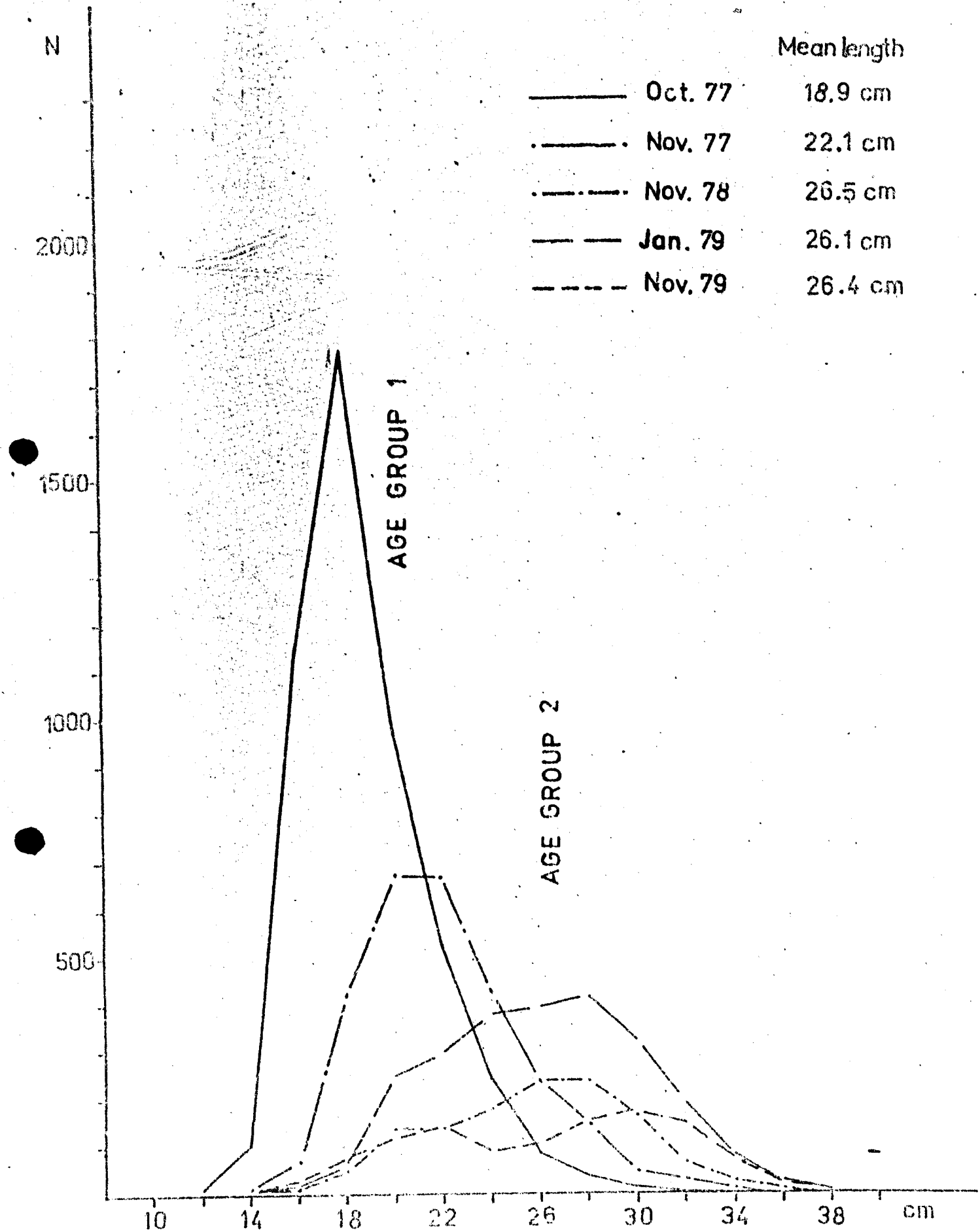

Fig.4 Discards in % by weight in relation to landings of cod (50% length 30cm) for Subdivisions (SD) and years in important fishing depths in November

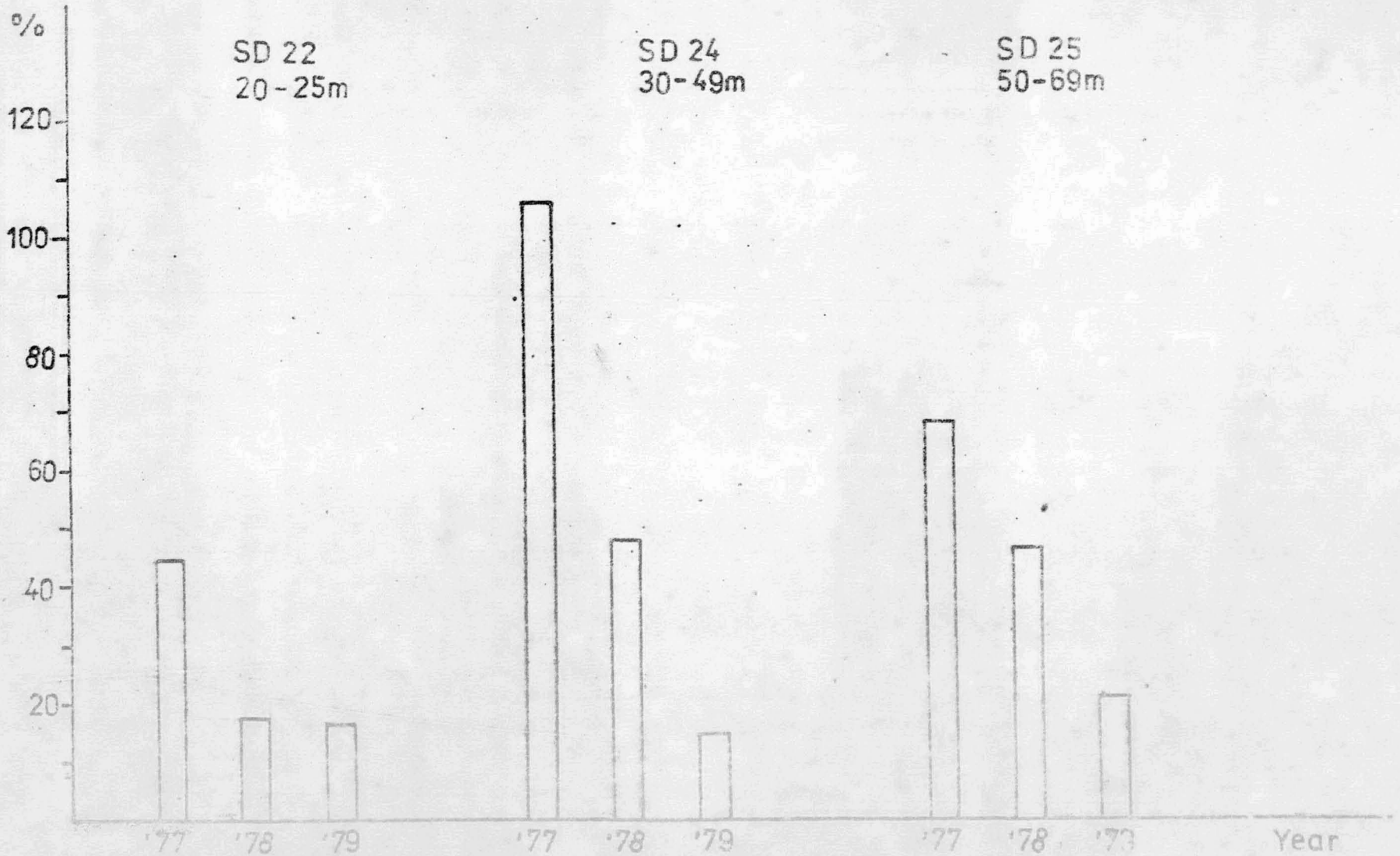

Fig.5 Discards in kg per hour fishing (50% length 30cm) for Subdivisions (SD) and years in important fishing depths in November

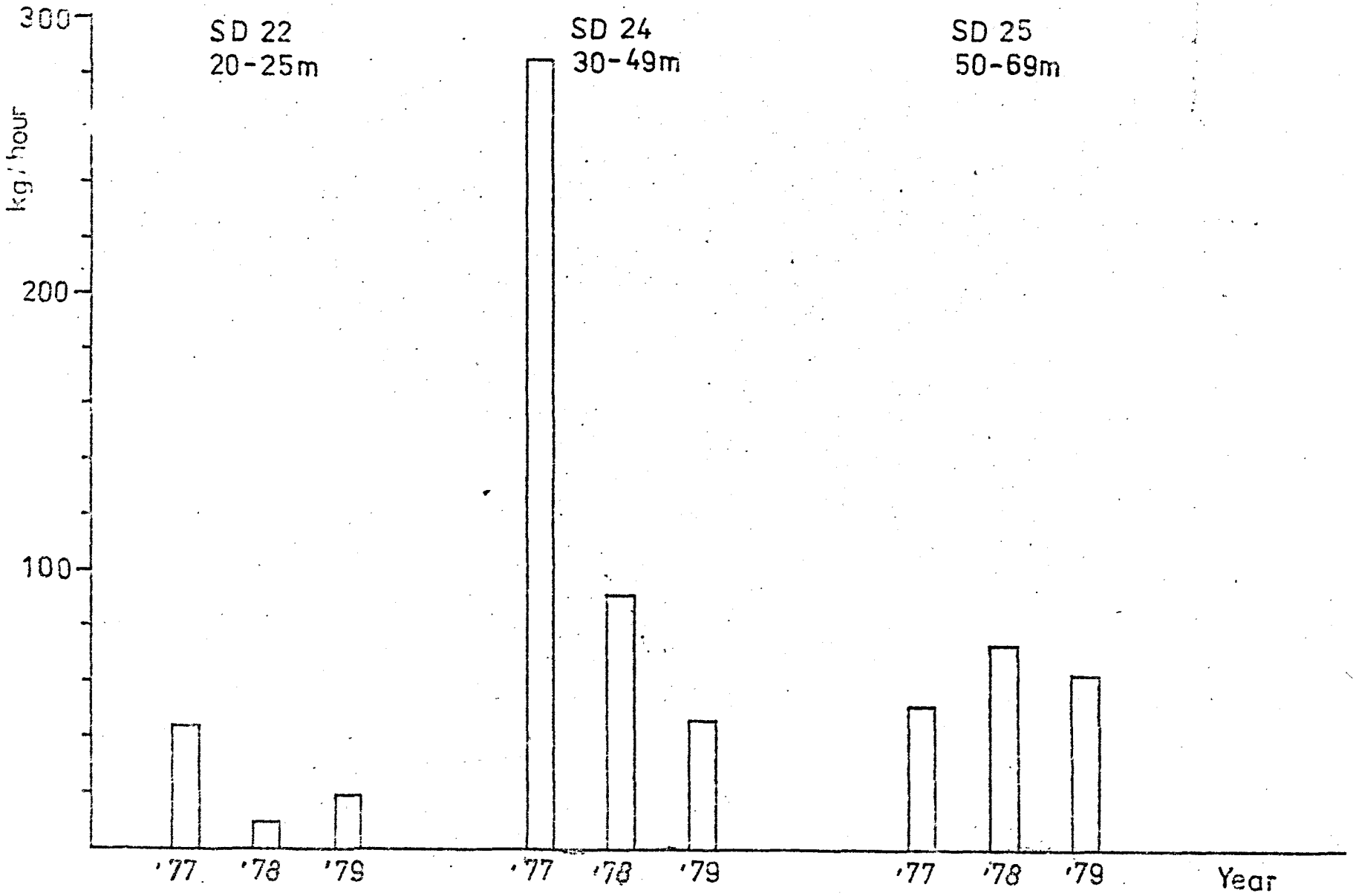

Fig.6 Correlations between discards in % by weight in relation to landings of cod (50% length 30cm) and depth in years with good and bad recruitment - Subdivision 24

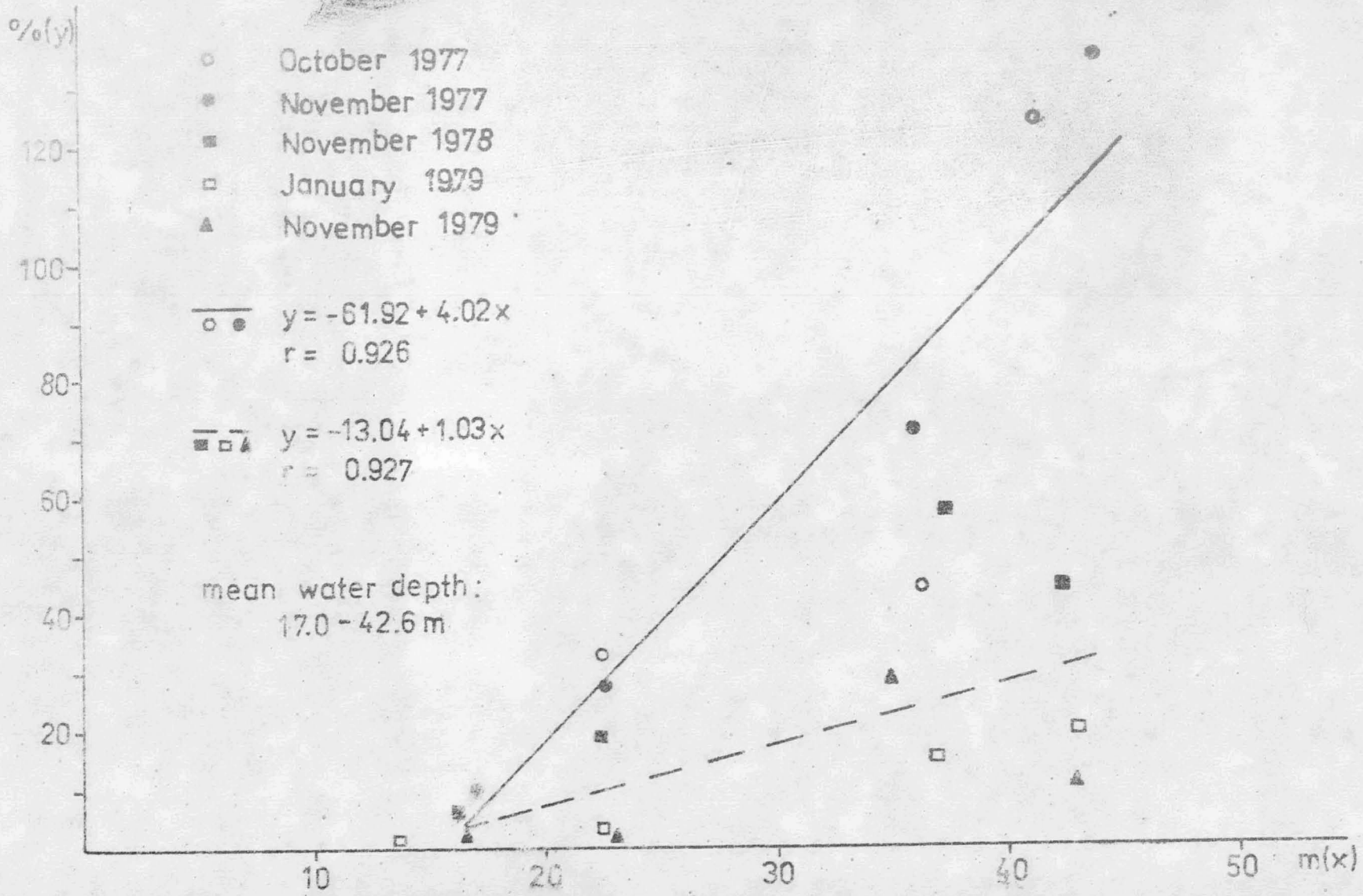

Fig.7 Correlations between discards in kg per hour fishing (50% length 30cm) and depth in years with good and bad recruitment - Subdivision 24

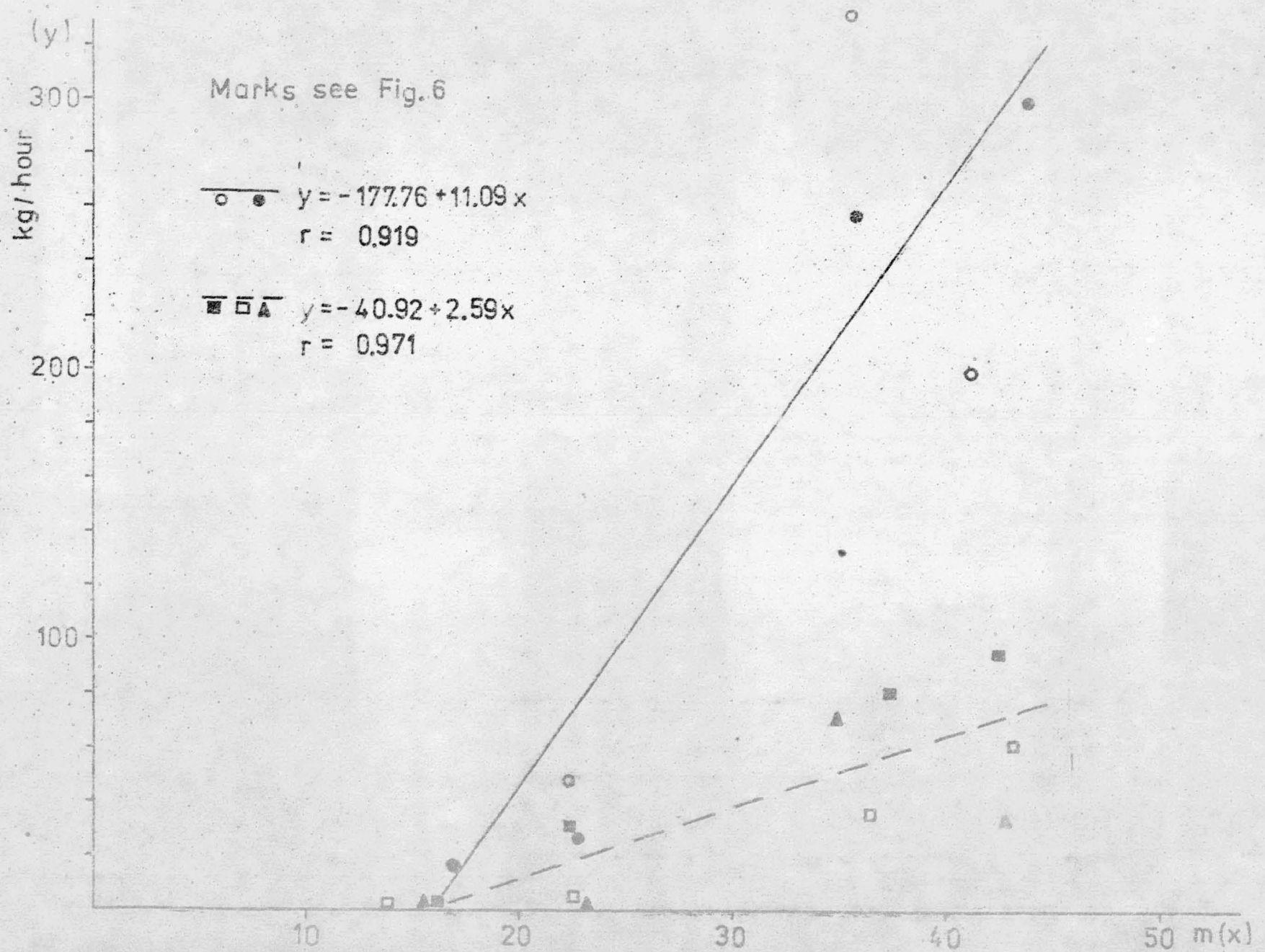

Fig.8 Correlations between discards in % by weight in relation to landings of cod (50% length 30cm) and depth - Subdivision 25

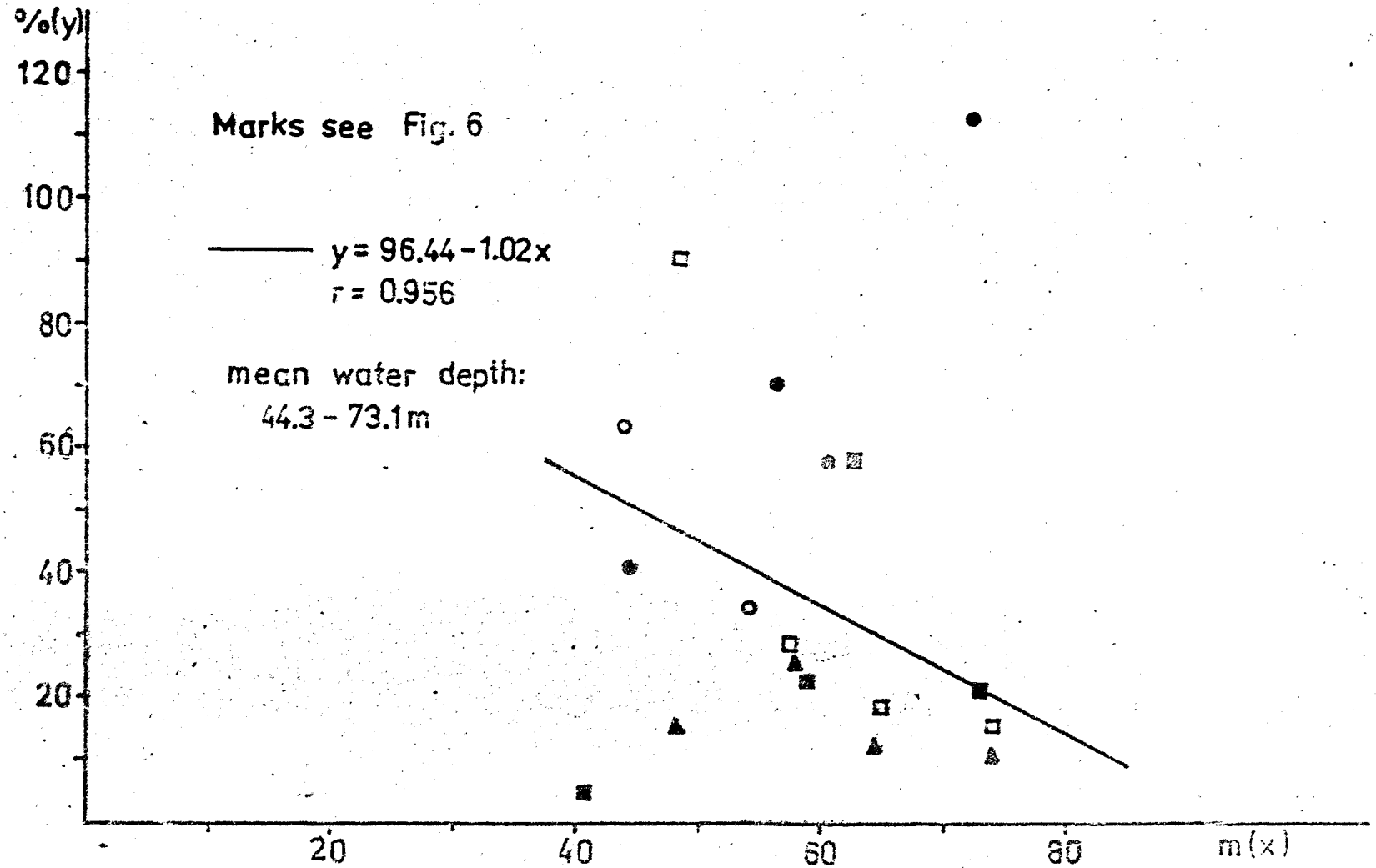

Fig.9 Correlations between discards in kg per hour fishing (50% length 30cm) and depth - Subdivision 25