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Preliminary results of the occurrence of two mackerel
groups (*Scomber scombrus* L.) with different growth
pattern west of Britain

by

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SUMMARY

In ICES-area VI and VII two mackerel groups with distinct differences in their growth rates are caught.

The growth data of the slow growing group are similar to the mackerel of the North Sea.

The growth data of the fast growing group correspond to the Slope-mackerel of the Celtic Sea.

General the fast growing group in ICES-areas VI a is caught from April to June and the slow growing from July to August. Both groups were found mixed in the Bristol-Bay, south of Ireland and in the Channel in spring and autumn.

The different groups don't have no specific types of otoliths and different numbers of vertebrae.

Parts of both groups mature and spawn in ICES-area VI a in summer.

RÉSUMÉ

Dans la région ICES VI a et VII il y a deux stocks de maquereaux avec des différences distinctes de la vitesse de croissance relatif à la taille et le poids.

La croissance du stock croissant lentement ressemble au maquereau de la Mer du Nord. La croissance du stock croissant vite est analogue au maquereau du talus de la Mer Celtique.

Dans la région ICES VI a a on pêche en général le stock croissant vite d'avril à juin et le stock croissant lentement de juillet à aout.

On a trouvé les deux stocks mélangés dans la baie de Bristol, à la Manche et au Sud d'Irlande. Il n'y a aucuns types particuliers ni un nombre différent des vertèbres.

Certaines parties des deux stocks parviennent à la maturité et frayent dans la région ICES VIa en été

INTRODUCTION

The basis of the GDR-mackerel fishery in ICES-area VI and VII are mackerels of different populations. The knowledge about the mackerel stock regarding population identification and migration pattern ist still poor. The present paper gives some informations about two mackerel groups with different growth rates in ICES-areas VIa.

MATERIAL and METHOD

Samples have been collected from the catches of factory and research vessels in ICES-area VIa and VII from 1973 to 1976. The most representative material (1519 age determinations) originates from 1976. The mackerels were measured (cm lf), weighted (± 10 g), sexed and the stages of maturity determined. Countings of vertebrae (incl. urostyl) were done on 327 individuals. Otoliths were taken, dried and placed into canadabalsam.

(1961). Measurements of otoliths were done by binocular and ocularmicrometer (magnification 2.5 x 17, exactness ± 0.04 mm). For theoretical growth calculations the Bertalanffy-equation was used. The age and length analysis of the single age groups were made on basis of the natural distribution of fishes in the age groups although some mackerels of the other growth group can be among them. The length distribution in the age groups shows that only few age groups are mixed with a small number of fishes of the other mackerel group (tab. 1 and 2).

LENGTH-AGE

The GDR carried out pelagic mackerel fishery in the ICES-area VIa north of Ireland, west of the Stanton-Bank, St. Kilda and along the slope. The catch season was from April/May to the middle of August with the peak in June or July.

Generally adult mackerel is caught in ICES-area VI a from April to June with a length composition from 28-40 cm lf (Fig. 1, No 5-8). Considerable smaller mackerels are caught usually from the middle of June to the end of the season. Their length composition mainly differs between 25 and 34 cm lf (Fig. 1, No 1-4). The age analysis obviously showed that usually the smaller mackerels are also adult fishes but with a lower growth rate. Tab. 3 shows the relative age composition 1974-1976. Both growth groups show in each year a different age composition. The most representative samples of 1976 indicate greater differences in the strength of the year-classes 1967, 1969, 1970 and 1973. Both growth groups show a high abundance of the year-class 1968.

The two growth groups are only scarcely mixed in ICES-area VIa in summer. Mixing mainly occurs in the older age groups (tab. 1,2). Typically mixed age groups were caught in the Bristol-Bay, south of Ireland and in the Channel in spring and autumn (fig. 2, No 9-12, tab. 4). In ICES-area VIa in summer usually one peak of abundance per age group is developed, although some fishes of the other growth group can be among them. Tab. 4 shows

the mean length of age groups from 1973 to 1976. Fig 4 shows the age length relations of the two different growth groups calculated by representative age groups from 1973 to 1976. Theoretical growth calculations on the basis of the material from 1976 (Bertalanffy-equation) agree well with the empirical results (tab. 5). The different mackerel groups show differences of the equal year classes in mean length from 2.9 to 4.5 cm. L_{∞} of the slow growing mackerels is 37.27 cm, of the fast growing 39.96 cm, T is -4.2927 and -4.7675 respectively. T_0 was calculated without data of the age groups 0 and 1 respectively.

WEIGHT

The differences between the weights per length group (May and July 1976) of the two growth groups are not significant (fig. 5). The difference of weight per age group (fig. 3) amounts to more than 100 g. In May 1976 the weights of the age groups 8 and 10 are relative low, caused by their small mean length.

MEASUREMENTS OF OTOLITHS

Measurements of otoliths of the different growth groups (length, width, nucleus-rostrum, nucleus-pararostrum, nucleus-antirostrum) show no significant differences between the otoliths of the same cm-length group. It seemed that the otoliths of the slow growing group are somewhat longer. Significance tests (Students criterion, f-test) showed only significance in two cm-groups ($P = 0.05$). In general there are no significant differences to observe in size, shape and variability of the otolith parameters. In contrast to the relative constant morphological and morphometrical marks of mackerels (NEDELER 1960) the mackerel otoliths have high variability in size and shape. It is impossible to distinguish two specific types of otoliths for the different growth groups. The relationship between the growth of the otolith (and its parts) and the growth in length of fish is not linear. In the higher cm-groups the growth of otoliths stronger decreases than the growth of fish (fig. 6).

NUMBERS OF VERTEBRAE

Countings of 180 fast growing and 147 slow growing mackerels resulted in 31 vertebrae of every individual.

MAFURITY

In 1976 the most ovaries (63 %) of the fast growing group were filled with typical yellow yolk-vesicle-oocytes in May, 11 % reached the plum-pudding-stage (ripe oocytes are regularly scattered between the yellow yolk-vesicle-oocytes), 26 % were still in resting stage. May be that one portion of eggs and sperm was spawned in March/April. In July 62 % of the ovaries of the slow growing group contained yolk-vesicle-oocytes, 9 % were in plum-pudding-stage, 23 % in resting stage or juvenile, 6 % had spawned not long ago. By this it is supposed that one part of the mackerel stock will mature and spawn in ICES-area VI a.

DISKUSSION

The comparison of the growth data per age group with other authors shows that the slow growing group is similar in growth to the North Sea mackerel (NEDLER 1960, AKER 1961). On the other hand the growth data of the fast growing group are similar to the data by STEVEN (1952), NEDENER (1960), MOLLOY (1963) (Tab. 5) and LOCKWOOD & JOHNSON (1976) from the Celtic Sea, Donegal and the Channel.

In general the growth data of the mackerels of the area NW-Ireland-Celtic Sea - Western Channel given by different authors show greater differences which may be caused by normal growth differences of one population from year to year, but they are also explainable as data of mixed growth groups.

Tagging experiments (BOLSTER, 1965, BOLSTER & BURD 1972) show that mackerels migrate from the Celtic Sea and the Channel in northern directions. BOLSTER described migrations from the Mounts-Bay to the Shetlands and Hebrides and from Cape Clear-Island to the Hebrides. By LOCKWOOD & JOHNSON (1976) a scheme of migration in northern directions over the Irish Sea and along the west coast of Ireland is given.

Probably the fast growing mackerels are identical with the Slope-mackerel (overwintering on the slope south of Ireland). Whether the slow growing mackerel of the area north of Scotland migrates in the ICES area VI a, from the Channel or from the Irish Sea respectively is obscure. It can be supposed that the mackerel population of the northern North Sea (fished in the Shetland-area from July to September) is not identical with the slow growing mackerel population in ICES-area VI a fished from July to August. The analysis of maturity in ICES VI a showed that the slow growing mackerel spawns in July/August and represents a separate adult population.

It will be necessary to clarify the connections between the different mackerel stocks or populations in the Channel, the western areas and the North Sea by tagging experiments in ICES-area VI a in April/May and July/August.

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Table 1: Length-age key of mackerel in ICES-Subdivision VI a in May 1976

year-class	74	73	72	71	70	69	68	67	66	65	Aged	Length	composition
om Age	2	3	4	5	6	7	8	9	10	10		n	%
25	1										1	1	+
6	1										1	1	+
7												5	1
8	4	5									9	28	3
9	2	7	1	6							16	96	12
30	2	12	10	13	3		4		1	1	46	347	43
1	3	9	10	31	9	8	9	1	2	1	83	662	81
2		7	7	23	24	6	20	1	2	1	91	931	114
3		1	5	28	23	16	35	1	4	2	115	1091	134
4			4	12	31	33	36	21	9	9	155	1188	146
5			1	2	9	27	37	21	16	22	135	1463	179
6					3	18	19	30	15	30	115	1230	151
7				1		6	5	12	9	28	61	702	86
8				1			2	4	1	22	30	185	35
9										10	10	91	11
40										2	2	28	3
1												5	1
n	13	41	38	117	102	114	167	91	59	128	870	8154	
% ¹⁾	8	38	39	123	114	135	195	105	89	154			1000

Number of age samples: 11

Number of length samples: 22

1) corrected by length samples

Table 2: Length-age key of mackerel in ICES-Subdivision VI a in July 1976

year-class cm	Age	75	74	73	72	71	70	69	68	67	66	Aged	Length composition	
		1	2	3	4	5	6	7	8	9	10		>10	n
21		1										1		1
2		2	1									3		5
3		12	4									16		25
4			5									5		8
5		1	9	5			1					16		25
6		1	15	64	1	1						82		126
7		1	7	55	8	14						85		131
8			3	16	21	49	3	3	3			98		151
9			2	12	14	62	6	2	20		1	119		183
30				5	5	24	3	3	31	2	3	76		117
1				3		6	4	3	23	4	5	49	1	75
2				1	1	6	1	3	8	7	10	38	1	58
3					1				4	6	2	14	1	22
4								2	2	1	2	12	5	18
5									3	3	7	16	3	25
6							1		1		1	9	6	14
7											3	5	2	8
8										1		3	2	5
9											1	2	1	3
n		18	46	161	51	162	19	16	95	24	35	22	649	
%		28	71	247	79	250	29	25	146	37	54	34		1000

Number of age samples: 10

Table 3: Age composition of mackerel in ICES-area VIa
1974-1976 (o/oo)

Year Month	1974 July	1975 May	1975 June	1976 May	1976 July
1975					28
1974				8	71
1973			126	38	248
1972	11	32	107	39	79
1971	181	58	388	123	250
1970	160	134	128	114	29
1969	124	88	50	135	25
1968	388	264	134	195	146
1967	40	86	15	105	37
1966	56	76	9	89	54
1965	(40)	144	11	(154)	(34)
1964		(118)	20		
1963			(12)		
Total	1000	1000	1000	1000	1001
n aged	81	227	251	870	649
n measured	443	2841	5141	8154	649

() =older than the year ago

Tabl. 4: Mean length of mackerel in ICES VIa and VII (cm lf)

	<u>Slow growing group</u>			<u>Fast growing group</u>			<u>Mixed groups</u>		
Year	1973	1975	1976	1974	1975	1976	1974	1974	1975
Month	July/Aug.	June	July	July	May	May	April	April	October
Area	VIa	VIa	VIa	VIa	VIa	VIa	VIIIf	VIIde	VIIg-k
<u>Age group</u>									
0									19.8
1			23.8				19.1		24.8
2	28.8	27.4	26.1	31.1		30.1	28.0		26.6
3	28.8	28.9	27.5	32.2	30.3	31.0	29.1	32.0	28.9
4	29.8	29.2	28.9	32.1	32.8	32.2	32.0	32.6	30.2
5	29.5	30.0	29.4	33.5	33.3	32.0	32.9	34.1	33.0
6	30.5	30.9	29.8	33.6	34.3	33.6	32.4	33.7	34.0
7	32.5	31.1	31.0	32.8	35.2	34.9	33.7	34.2	33.4
8		33.3	31.3	36.0	35.0	34.5	34.6		35.1
9		34.3	33.1		36.1	36.0			35.8
10		33.4	33.1		36.3	35.6			
11		35.4							
n aged	88	250	649	80	116	870	321	143	657
n measured	2182	5141	649	443	2841	8154	1038	607	2329

Table 5: Mean length of mackerels by different authors in cm lt

	<u>NEDELER</u> N-Sea, Dogger May/June	<u>NEDELER</u> N-Sea, Utara Feb./March	<u>AKER</u> N-Sea Feb./March	<u>KÄSTNER</u> ICES Via, ¹⁾ May/July	<u>KÄSTNER</u> ICES Via July 76 (theor.)	
Age group						
1	21.2	22.0	25.1	26.0	26.9	
2	27.2	26.6	30.2	29.9	28.9	
3	32.3	29.5	33.9	30.8	30.6	
4	32.8	32.5	35.1	31.9	31.8	
5	32.8	34.2	35.9	32.3	32.9	
6	33.1	35.7	36.8	33.1	33.8	
7			38.5	34.0	34.5	
8			40.8	34.3	35.1	L = 37.27 cm lt
9				36.4	35.5	K = 0.2213
10				36.2	35.8	to = -4.7675 lf

1) slow growing mackerels, \bar{x} calculated by selected representative age groups 1973-1976

	<u>STEVEN</u> Celtic May	<u>MOLLOY</u> Donegal July/October	<u>NEDELER</u> Celtic March/April	<u>KÄSTNER</u> ICES Via, ²⁾ May/July	<u>KÄSTNER</u> ICES Via May 76 (theor.)	
Age group						
1	23.8	23.7	22.7		30.4 ²⁾	
2	30.6	26.2	27.4	32.9	32.7	
3	33.0	31.6	32.5	34.3	34.5	
4	34.1	33.4	33.7	35.3	35.8	
5	35.5	34.5	34.4	35.3	36.8	
6	36.2	35.2	36.3	36.8	37.5	
7	37.1	36.0		38.2	38.1	
8	37.8	36.0		37.8	38.5	L = 39.96 cm lt
9	38.5	36.5		39.4	38.9	K = 0.2718
10	39.1	37.2		39.1	39.1	to = -4.2927 lf

2) fast growing mackerels \bar{x} calculated by representative selected age groups 1974-1976

Fig.1 Length composition (in%) of GDR Mackerel catches

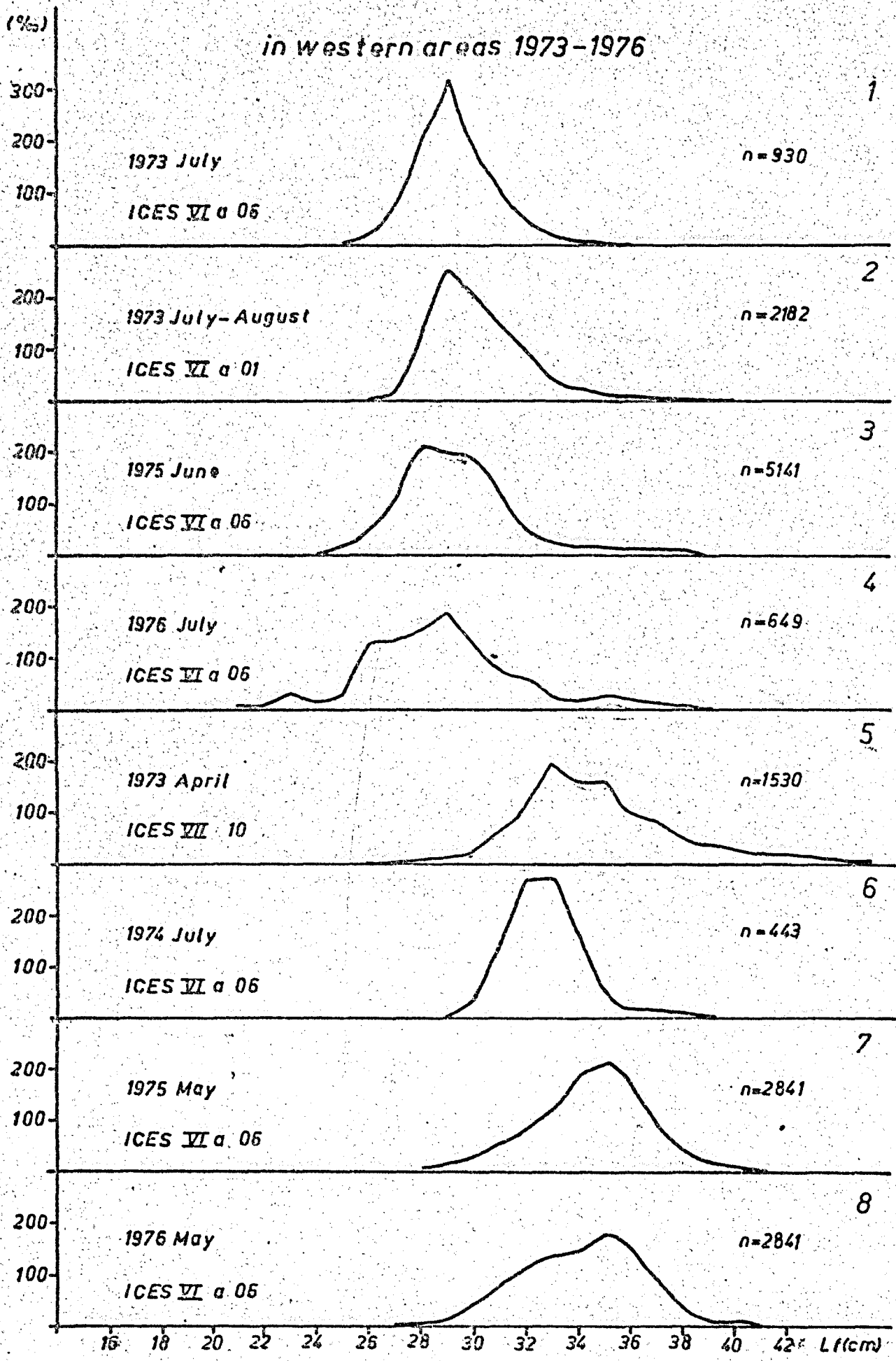


Fig. 2

Length composition (in%) of GDR Mackerel

catches in western areas 1973 - 1975

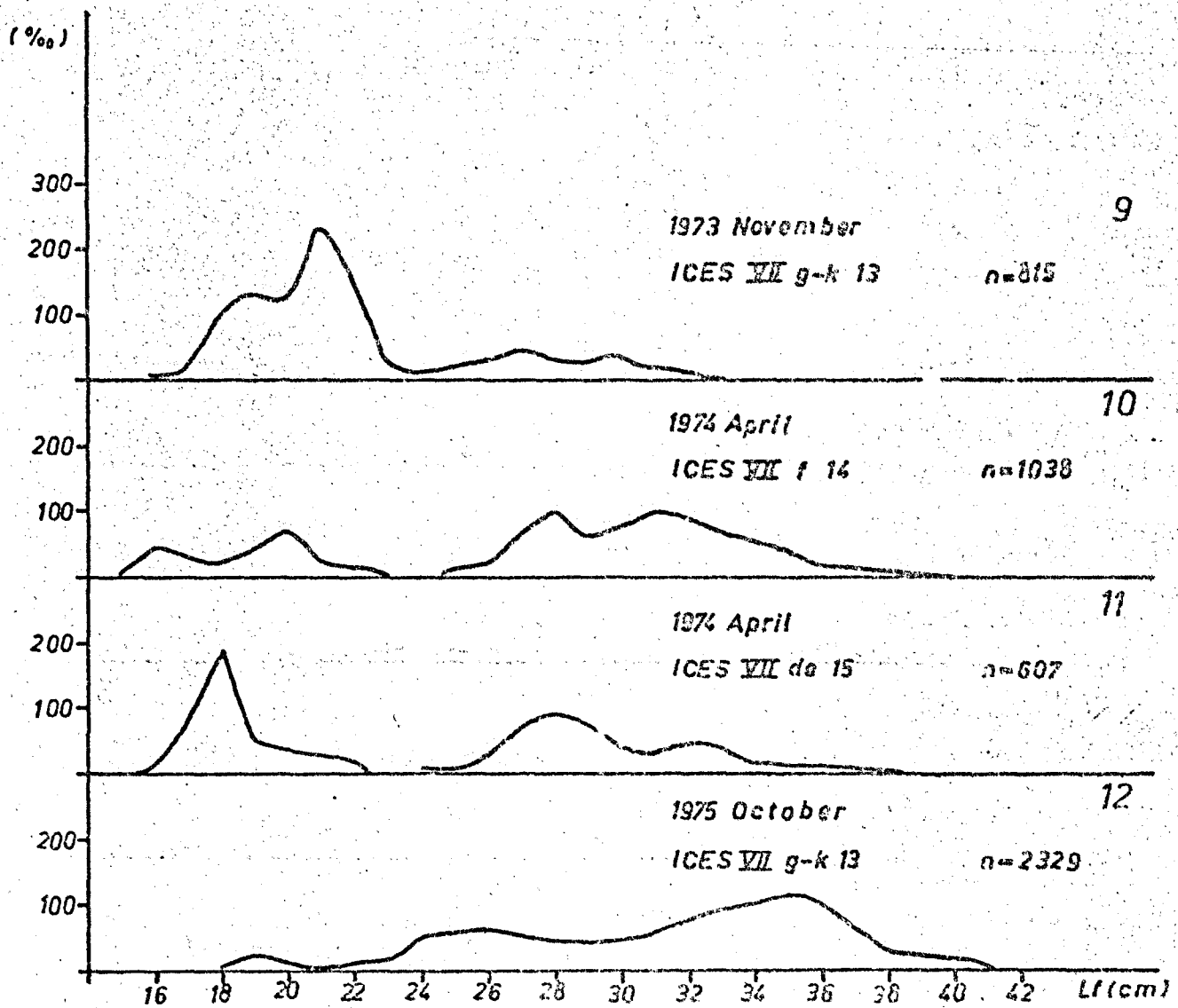


Fig. 3 Weight per age group of Mackerel with different growth rates

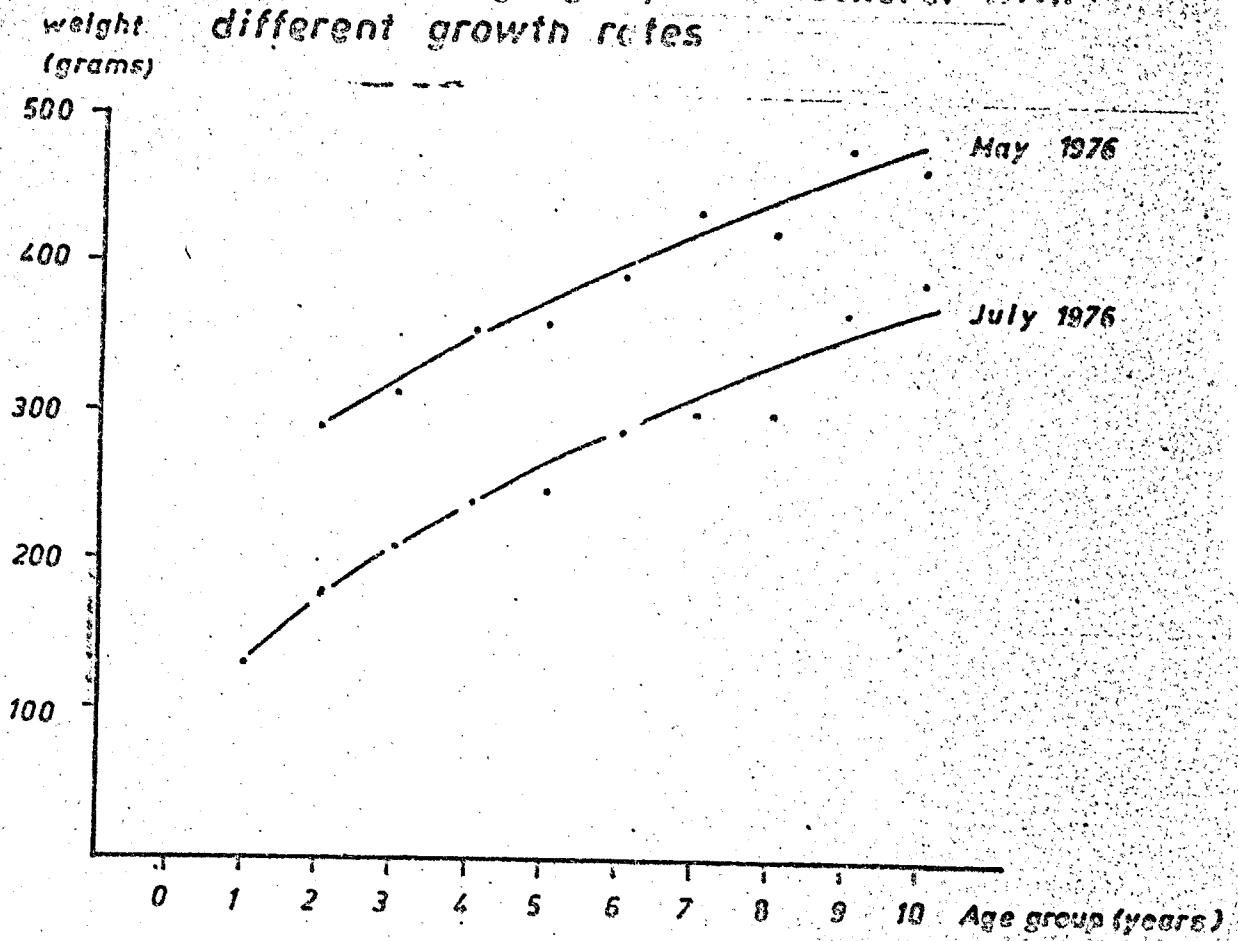


Fig. 4 Length-age relation of Mackerel with different growth rates in ICES area VIa

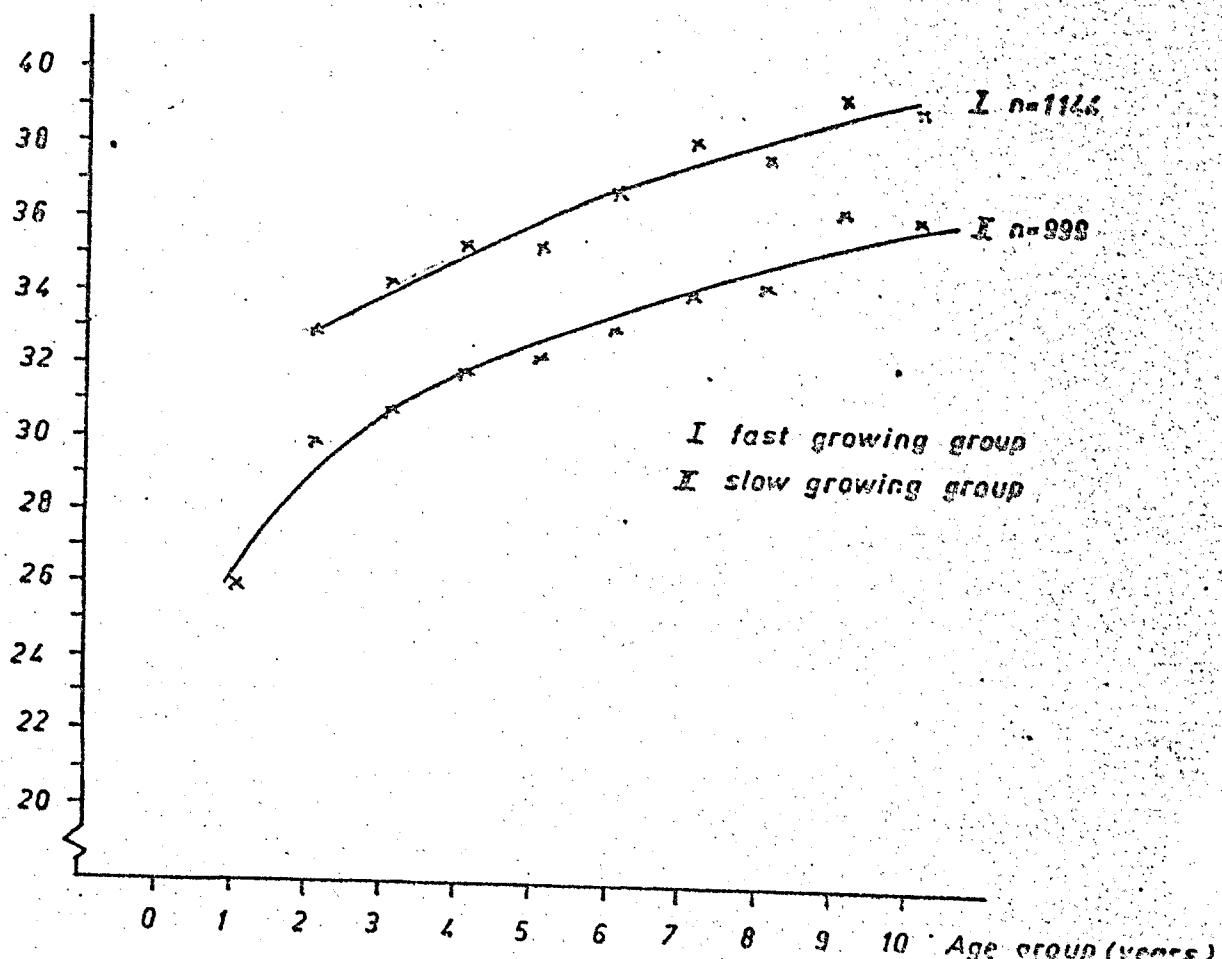


Fig.5

Weight-length relation of Mackerel (ICES VIa) 1975

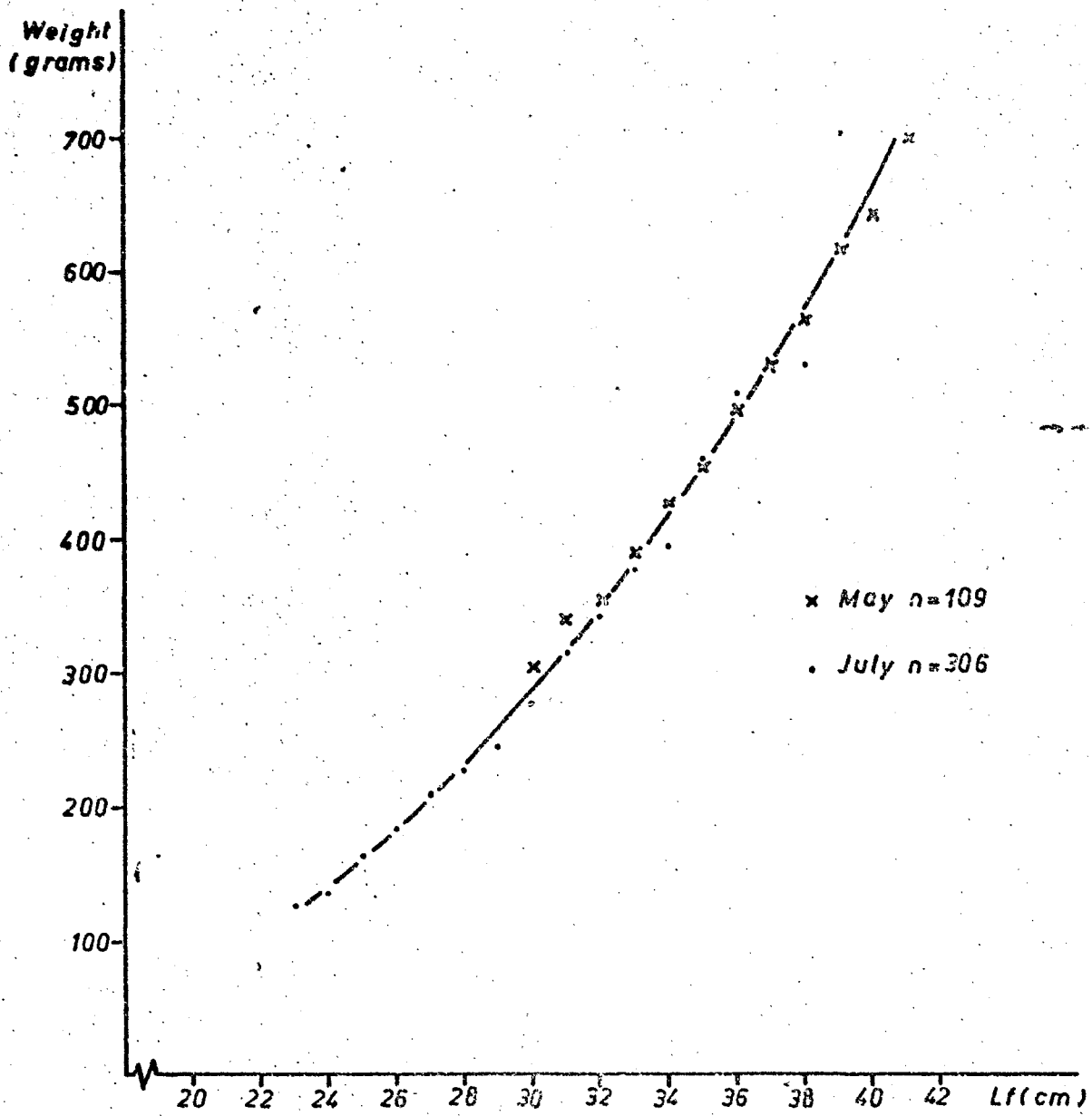


Fig. 6

Relationship otolith size - fish length

• Slow growing mackerels May 1976

× Fast growing mackerels July 1976

Size of otolith (mm)

