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Fishery for and stock composition of pilchard (*Sardina*
pilchardus) in the western Channel

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by
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On the basis of the surveys of 1966 and 1967 (2,3) and operative investigations at the beginning of other seasons in every spring time since 1967 our small side trawlers (250 h.p.) are fishing in the western Channel on *Sardina pilchardus* (sardine or pilchard). In some years our logger-trawlers (300 h.p.) took part too. Both types of fishing vessels used the pelagic pair trawling system. Some trials of fishing by pelagic one boat system also with bigger vessels were less effective because of the important flight reactions of sardine shoals.

The spring season biologically is characterized by prespawning/spawning and feeding concentrations. The main concentrations start in April or at the beginning of May after immigration from the places of hibernation more westerly. The concentrations finish at the close of June or in July.

The main months of fishery are May and June. In April the fluctuations of the catches are very important, especially in the last seasons. Typically were long periods without any concentrations. Therefore and because of the relative bad weather in the last seasons the fishery started only in May. The fluctuations of the catches during all past seasons were approximately in the level according to the data published for 1967 (3).

The influence of the environmental respectively endogenous factors as on the beginning of spring season as on the development during the season are yet not quite clear. We have continuously sampled only endogenous factors as length, age, maturity, relation of males and females, intestinal fat and material on feeding activity. It is necessary to use foreign data from hydrographic sections in later works. The very small average catch per unit in season 1972 (Fig. 4) in all probability is due to the low water temperature in the first part of the season.

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The total region of fishery in spring season for all years is situated between $48^{\circ}10'N$, $50^{\circ}05'N$, $02^{\circ}40'W$ and $04^{\circ}40'W$. Figure 1 demonstrates the local distribution of the fishery in the seasons 1967-1969 and 1971-1973. Figure 2a and 2 b show the actual catch positions and their distribution in the single months in selected seasons (1971 and 1972). The figures demonstrate the trend of dislocation of the catches during the season. In the first part of all seasons the fishery went on north of $49^{\circ}30'N$. In the second part the most frequent catch positions were situated south of $49^{\circ}30'N$. In the season 1968, when the fishery took place only in April, all catch positions were north of $49^{\circ}30'N$. The dislocation of fishery happened first in eastern and then in southern and south-western direction (Fig. 2a and 2b).

Because of the good organization of fish search during the season and relative small total area of maximal settlement we can assume that the distribution of catches coincides nearly with the distribution of the adult stock.

The representation of abundance and local distribution in figure 1 respectively figure 2 bases on the main positions of commercial catches, taken from the log books.

In nearly all seasons the local catch distribution shows a picture as a horseshoe with the open side in western direction. This characteristic configuration of the catch region cannot be understood as occasionally. We must assume as reason characteristic environmental factors. The works on this problem are not finished. Some results are known from soviet works about the conditions of concentrations of horse mackerel in winter period approximately in the same region (4). The soviet results show distinct temperature and salinity gradients between Atlantic and Channel water in the region of horse mackerel.

1973 we carried out an echo sounding survey before the beginning of the season. The survey was done by 4 small side trawlers in the short period from 9. - 12. April 1973. The preliminary results of abundance and distribution of the echo indications distinguished in midwater and pelagically near the bottom shows picture 3. Most of the fish indications were found in the northern part of the investigation region and those of sardine in the limited area between $49^{\circ}40'N$, $49^{\circ}50'N$, $03^{\circ}20'W$ and $04^{\circ}20'W$.

Following table contents the catch per fishing day expressed as unweighed average of all months of the seasons and the total catch.

Tab. 1

Trend of catch per fishing day of the small side trawlers and total catch of the whole fleet from 1967 - 1973

Years	1967	1968	1969	1970	1971	1972	1973
Months	IV-VI	IV	(IV), V, (VI)	IV-VI	IV-VI	IV-VII	(VI)V-VI (VII)
catch/ fishing day (in metr. tons)	4,3	5,5	4,7	4,4	5,1	2,7	4,6
n	969	267	530	478	893	350	238
total catch (in 1000 metr.tons)	8,8	3,0	4,3	2,1	3,4	1,5	2,6

According to the preliminary results the catch per fishing day amounted to 4,7 tons.

In order to demonstrate the trend of age structure the year classes are summarized in 4 groups.

Tab. 2

The trend of the age structure of the sardine stock in western Channel by average of all samples from 1967 to 1973 (2)

Years	Months	1 year	2and3 years	4and 5 years	6years and more	n	
					age	length	
1967	III-IV, II, XI	0	4	6	90	180	5725
1968	II-IV XI-XII	0	10	7	83	950	7343
1969	V-VI	0	2	4	94	446	1497
1970	III-IV, XI	0	6	17	77	1357	3646
1971	IV	0	2	41	57	312	400
1972	IV-V	0	8	41	51	620	3046
1973	IV-V	2	9	35	54	674	4883

In connection with the age structure it is interesting to divide the stock into males and females:

Tab. 3: Relation between males and females of the sardine stock in western Channel by all samples from 1967 to 1974

Years	1967	1968	1969	1970	1971	1972	1973	1974 ¹⁾
Months	III, IV	II-IV, XI-XII	II, V-VI	III-IV, XI	IV	IV-V	IV-V	IV
males (%)	52	41	39	36	23	34	27	34
females (%)	48	59	61	64	77	66	73	66
n	573	1229	498	4654	400	770	806	600

1) preliminary results from spring samples

In order to demonstrate the trend of data and possible inter-relations between age structure, proportion of males to females and the catch per day we have designed picture 4.

The development of age structure from 1967 to 1973 shows picture 4a. From 1967 to 1969 about 90 % of the catch stock consisted of very old year classes (6 and older). From 1969 to 1971 we remark a distinct reduction of these very old year classes on to 57 %, while the younger part of the adults (4 and 5 years) increased obviously from 4 % to 41 %. Since 1971 up to 1973 the stock situation shows no remarkable changes concerning the relation between the named two groups. The recruits (2 and 3 years) appeared in a minimum portion of 2 % and in a maximum one of 10 % in the seasons 1968, 1972 and 1973 appeared the highest quantities with 8 to 10 %. The young sardine (0 and 1 years) usually doesn't settle the catch region, they likely only live in coastal water of France respectively England.

From 1967 up to 1971 is to remark a striking trend of a decrease of the males and of an increase of females, what approximately coincides with the trend of decreasing of the very old portion of the stock (Fig. 4 b). In the last years from 1971 the proportion of the males to the females was approximately uniform like the age structure. The average portion of males enclosed 30 % in the period 1971 - 1974.

It is very difficult to point out the reasons for the trend of catches per unit (Fig. 4c), because stock, environmental, technical and economical factors may be expressed in the data.

The average catch per unit shows an increase from the first fishery season (1967) to the second one (1968) from 4,4 to 5,5 tons. This increase is probably to explain by the adaption of

the ship's crews to the new fishery. From 1968 to 1972 with the exception of 1971 we see a decreasing trend showing some parallels with the reduction of the very old part of the stock (1969-1972) and with the decrease of males (1967-1971). The exception of 1971 in this trend is likely caused by the improvement of the pelagic two boat trawl before the fishing season. The comparatively high catches in last years (1973 and 1974) are most probable partly caused by a new effective improvement in construction of the pelagic two boat trawl. The very small catches per unit in 1972 are not explainable by the stock reduction. We assume in the first part of the season an unusual strong influence of the environmental factors, because the small average of the catches is caused only by the bad catches in the first part of the season. There are some indications of a deficit in the development of water temperature and in the maturation of the gonads.

The whole problem of influences of environmental factors on the fish concentrations and partly on the catches per unit in all past seasons is intended to be treated later. For this purpose are necessary all foreign hydrographic data for the western Channel especially from February to July, but also for other months in all available years and to relate them to our data about maturity, intensity of feeding and to the results of stock composition.

Besides the solution of the problem of the causes for the beginning of the season hydrographic data may be usefully in order to find out the reasons for the fluctuations of fish concentrations during the seasons and last not least for the fluctuations of the long term conditions for the reproduction of the stock. We ask hydrographers having published or unpublished data to come in contact with the author.

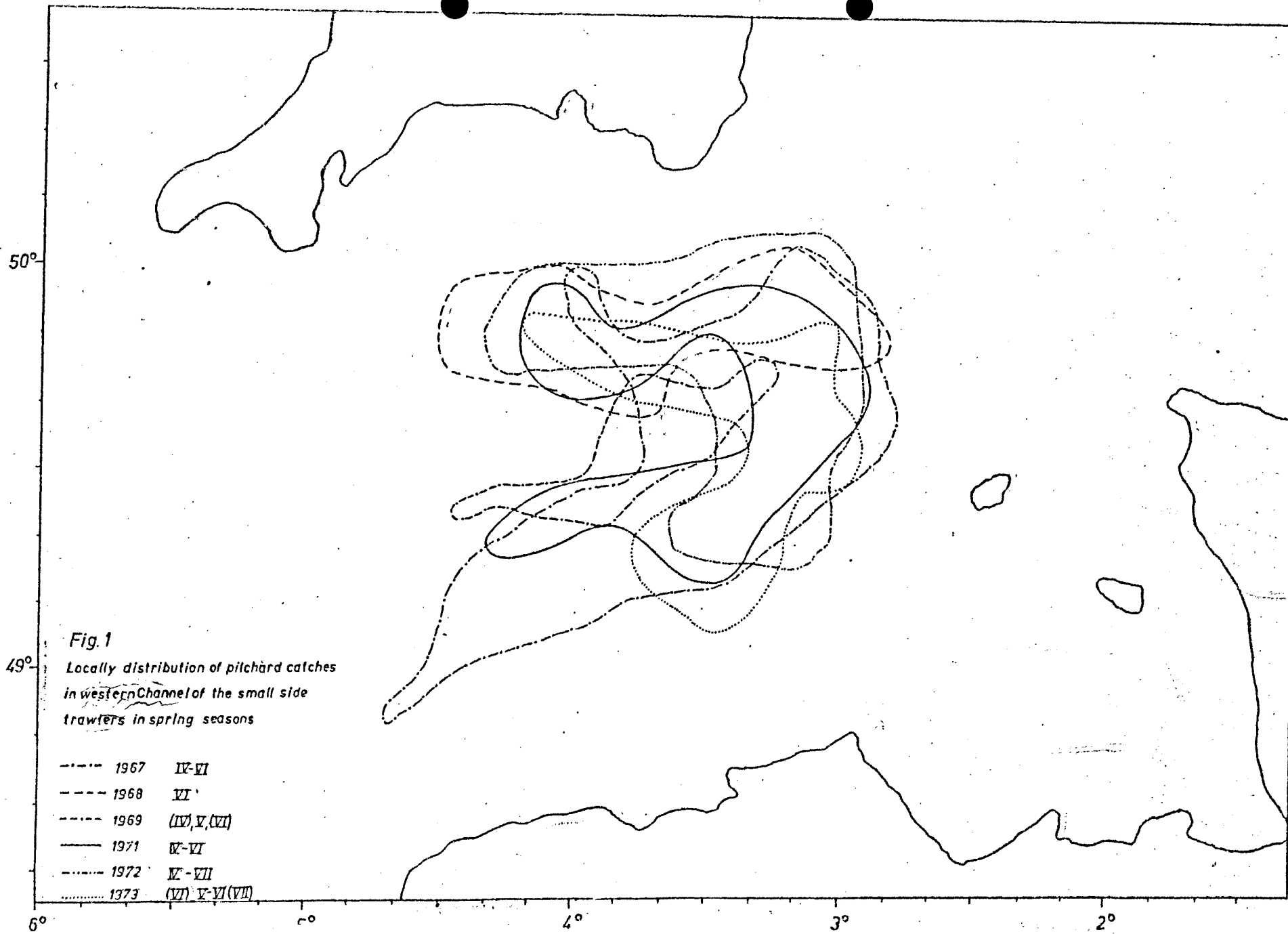
Conclusion:
(Fig. 4)

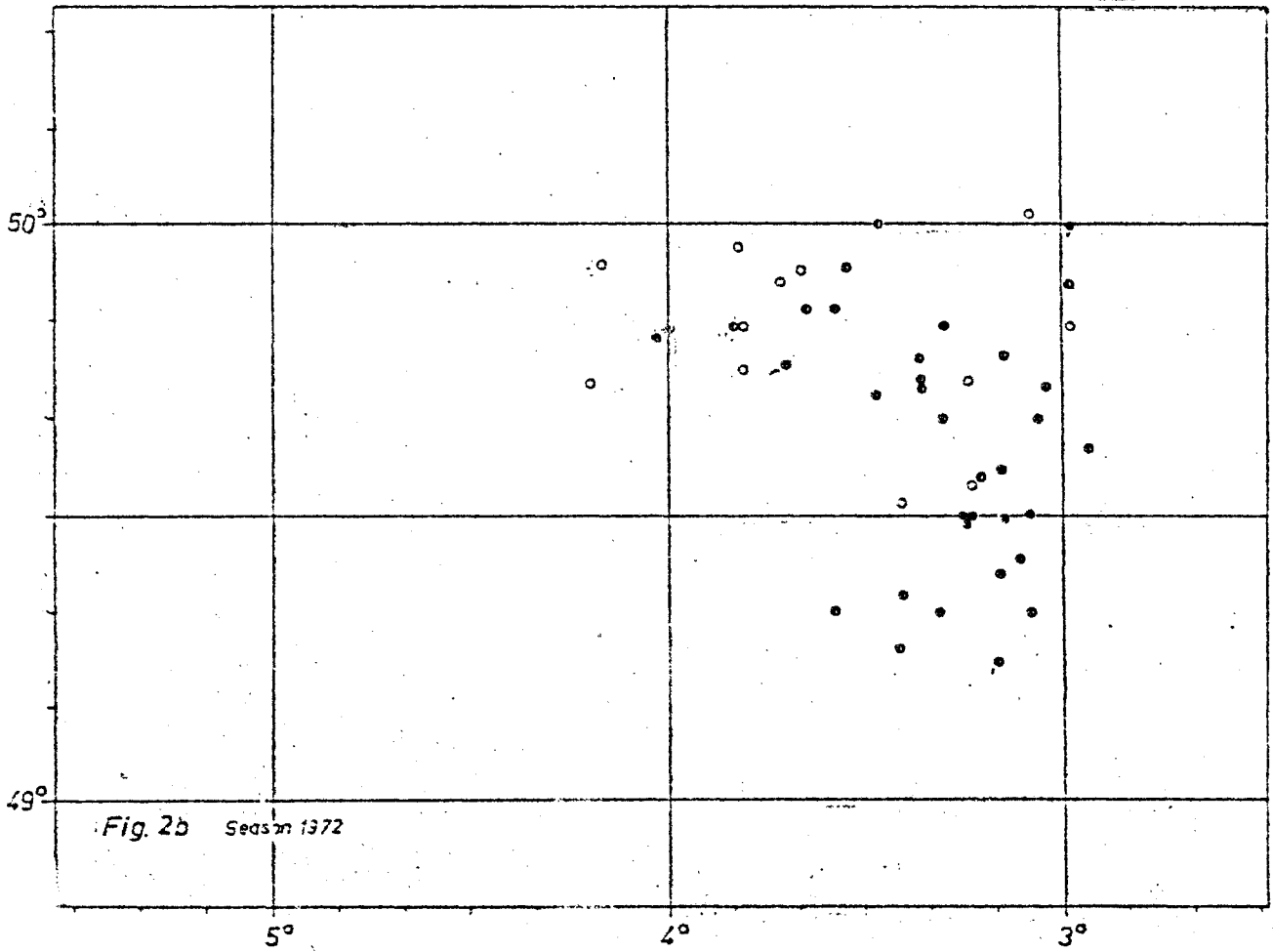
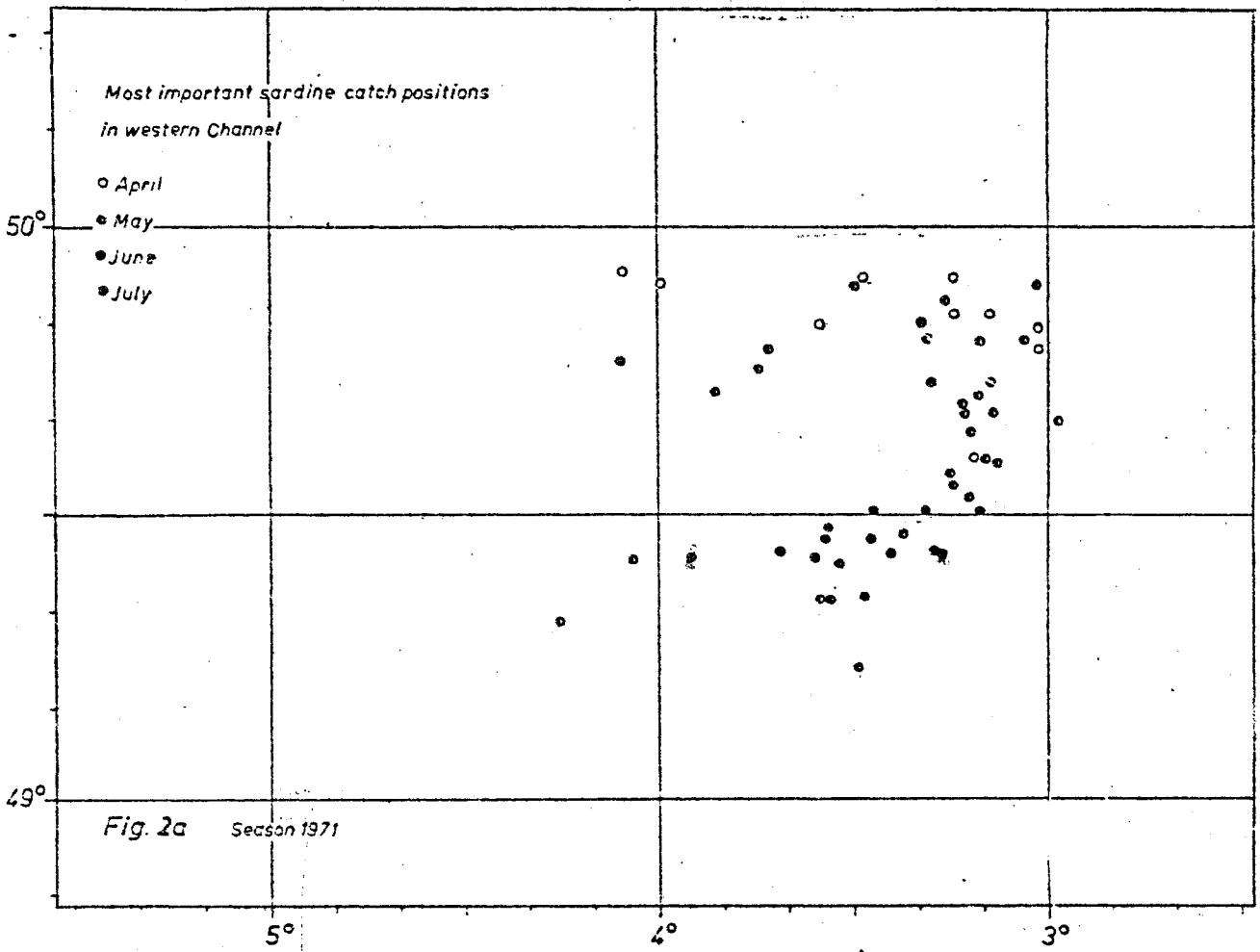
1. The stock of pilchard (sardine) in the western Channel at the beginning of our fishery in the years 1967-1969 was very superannuated.
2. From 1969 to 1971 took place a remarkable reduction of the very old part of the stock, especially of the males. The reduction of males went on in all years of our fishery up to 1971. The mortality is caused mostly by natural factors (superannuation).
3. From 1971 up to the present time the stock situation is nearly on an uniform small level.
4. The recruits were in all years (1967-1973) at the level of 2-10 %.

5. The decrease of catches per unit from 1968 up to 1972 is partly explainable by the high mortality of the old adults. The very low catch per unit in 1972 is probably caused by environmental factors. The increase of catches in 1971 and in the last years (1973-1974) is in all probability in connection to effective improvements in the construction of the pelagic two boat trawl.
6. According to the present small stock today we cannot recommend an increasing of fishery activity.

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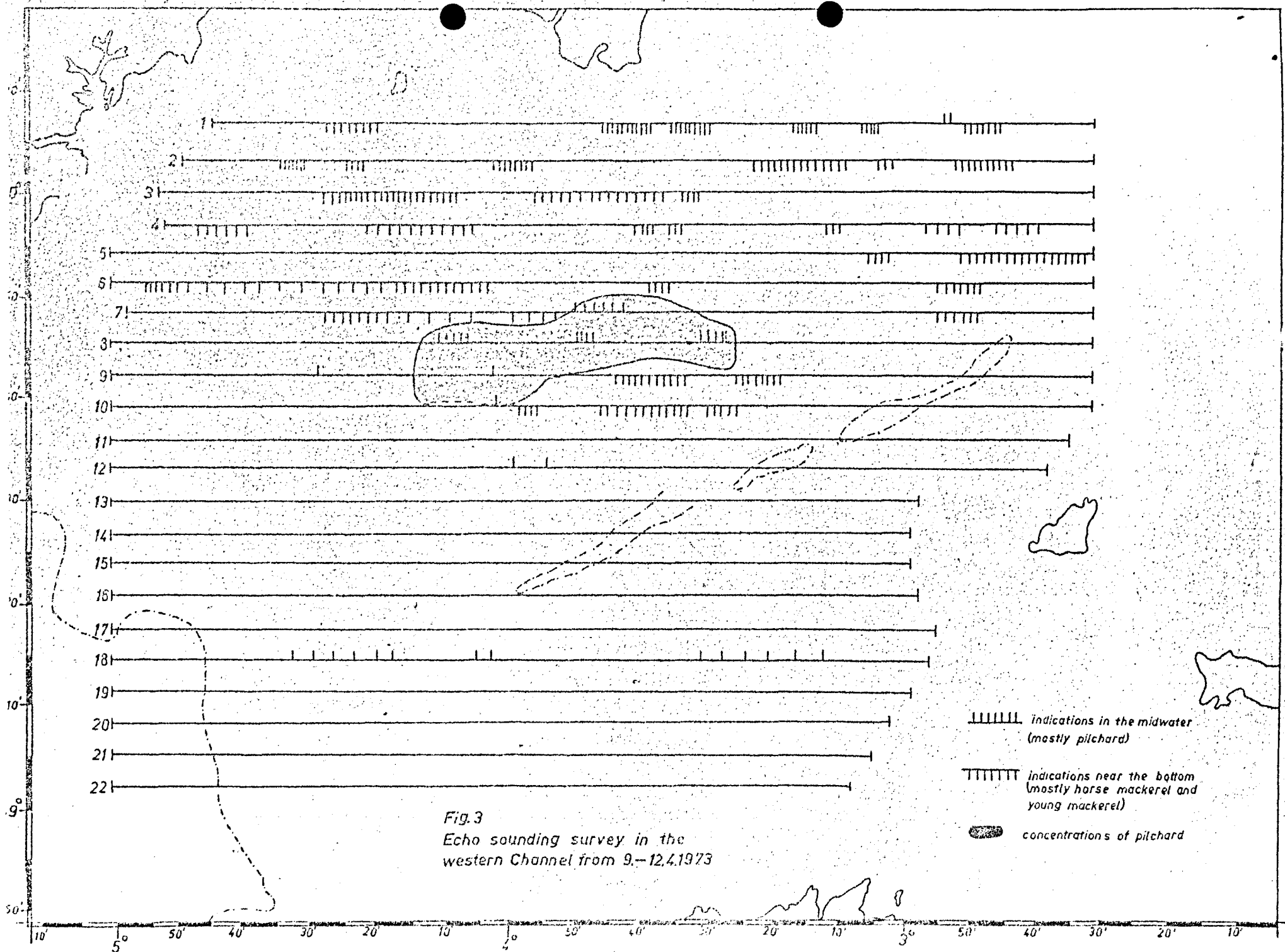
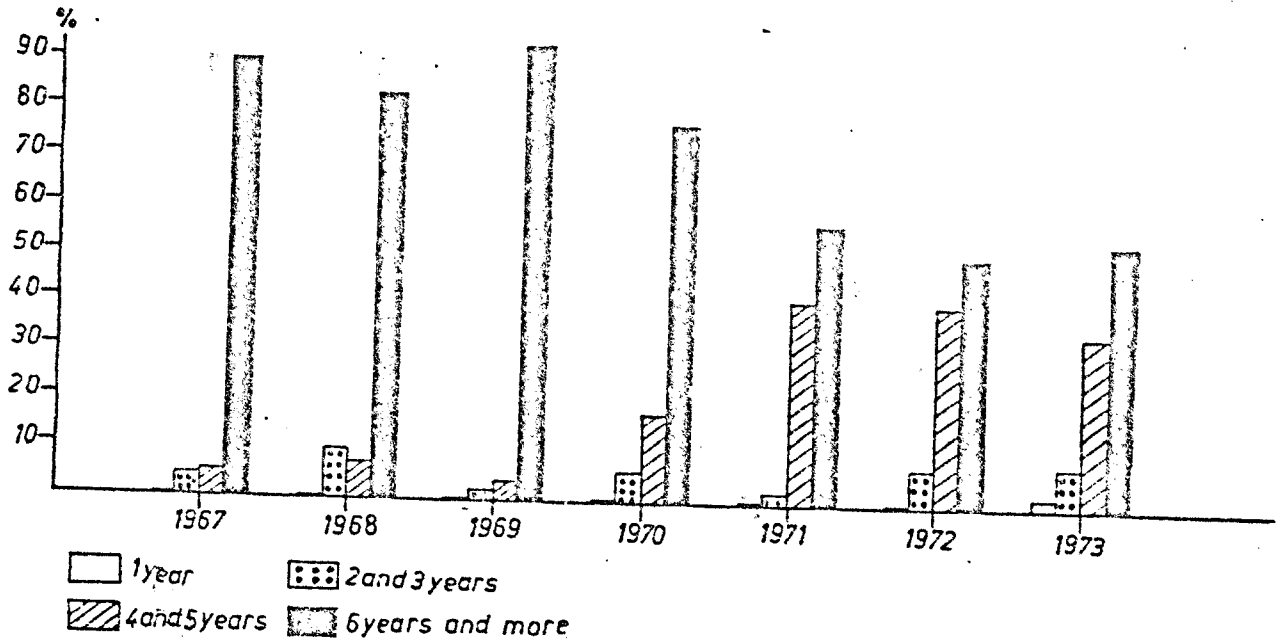
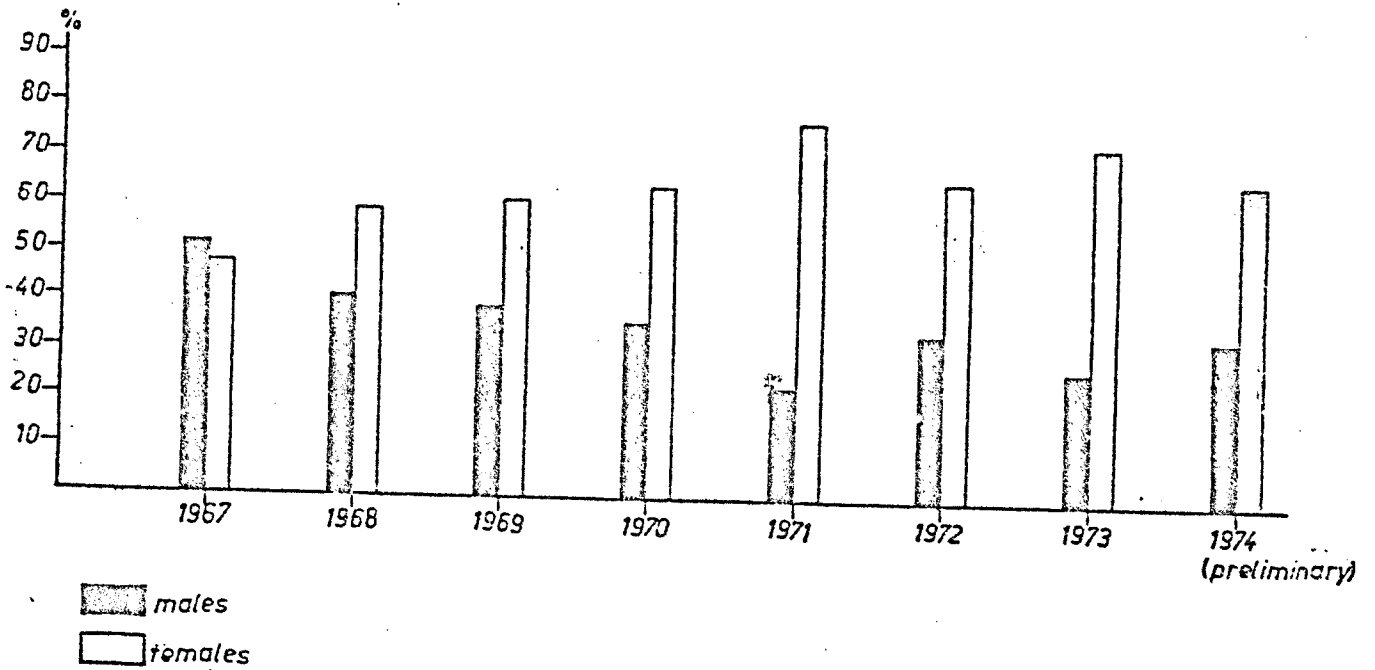


Fig4 Age composition, male and female relation and catch/fishing day of the sardine in western Channel

a Age composition



b relation males / females



c Catch/fishing day in the spring season

