

Fol. 41 #

This Report not to be cited without prior reference to the Council^{x)}

International Council for the
Exploration of the Sea

C.M.1977/H:2

Pelagic Fish (Northern) Committee
Ref. Pelagic Fish (S) Cttee

*Fiskeridirektoratet
Biblioteket*

REPORT OF THE MACKEREL WORKING GROUP

Charlottenlund, 27 February - 3 March 1977

This Report has not yet been approved by the International Council for the Exploration of the Sea; it has therefore at present the status of an internal document and does not represent advice given on behalf of the Council. The proviso that it shall not be cited without the consent of the Council should be strictly observed.

x) General Secretary,
ICES,
Charlottenlund Slot,
DK-2920 Charlottenlund,
Denmark.

REPORT OF THE MACKEREL WORKING GROUP

24 February - 3 March 1977, Charlottenlund, Denmark

1. INTRODUCTION

A report from the 1976 meeting of the Mackerel Working Group (Anon., 1976a) was presented at the 64th Statutory Meeting of ICES together with an Addendum (Anon., 1976b). The Addendum to the report contained a revised assessment of the Western mackerel stock based on changes in the catch data reported after the meeting of the Working Group.

At the Statutory Meeting it was decided that the Mackerel Working Group should meet

"... to re-assess the mackerel stocks in Sub-areas III, IV, VI, VII and VIII and to assess the state of the horse mackerel stocks in NEAFC regions 2 and 3".
(C.Res. 1976/2: 33).

The Group was also requested by the Chairman of the Liaison Committee, to prepare a review of mackerel, horse mackerel and pilchard resources within the Convention Area by

"... providing a brief description of each species' life history, fishery and extent between both the 200-mile fisheries zones of the two or more countries, and beyond such limits into international waters"

The Group met at Charlottenlund, 24 February - 3 March 1977, with the following participating members:

E Bakken, Chairman	Norway
H B Becker	Netherlands
A C Burd	U.K. (England)
J Guéguen	France
M Liwoch	Poland
J A Moores	Canada
A Saville	U.K. (Scotland)
Ø Ulltang	Norway

V Nikolaev attended the meeting as ICES statistician.

Two stocks of mackerel were considered: the North Sea stock and the Western stock. The stocks have spawning and overwintering areas in the North Sea and Celtic Sea respectively, but parts of the stocks are found mixed in the northern North Sea in summer. For this reason, catches from the two main fishing areas, Sub-areas IIIa+IV (North Sea area) and Sub-areas VI+VII+VIII (Western area) cannot directly be referred to one or the other of the stocks.

Assessments, therefore, relate to the two separate stocks, while catches are reported by ICES areas. Extensive revisions have been made as a result of the availability of improved data.

For horse mackerel (Trachurus trachurus (L.)) no data for analyses of stock separation are available, and all horse mackerel within the total distribution area have been considered a unit.

2. THE FISHERIES

2.1 The North Sea

Table 2.1.1 gives the quantities of mackerel landed by countries. The provisional data for 1975 have been revised and those for 1976 are added. The total catch has decreased by about 20 000 tons.

Landings by Norway and USSR decreased considerably, but this was partially compensated by an increase of about three times in the Faroe catch. A more detailed breakdown by ICES Divisions is shown in Table. 2.1.2.

As in previous years the bulk of the catch was taken in Division IVa (86%), whereas landings from Divisions IIIa and IIa are a third of those in 1975.

The catch in numbers of mackerel by year-classes are given in Table 2.1.3. Age compositions were only available for Norway and the Netherlands. The Norwegian data covered the purse seine, gill net and hook and line fisheries. All other purse seine catches from the area were raised to the Norwegian data. The Netherlands trawl data referred to all Divisions in the North Sea and other catches for which no age data were available were raised by the relevant Dutch catches in numbers.

The data again show the dependence of the North Sea fisheries on the dominant 1969 year-class which still, as 7 year olds in 1976, comprises 46% of the catch in number. Two other factors of note are the 1968 and 1971 year-classes. Both these year-classes are dominant in the Western stock (Table 2.2.3) and from their abundance in the North Sea fisheries it could be implied that there have been important influxes of fish from the Western area.

2.2 The Western area

The data for the Western area (Table 2.2.1) have been completely revised from those presented in the previous report. It is now seen that the 1975 catch was of the order to 500 000 tons, compared with the provisional total of 430 000 tons. The 1976 provisional catch is of the order of 470 000 tons, so it may be supposed that the total annual catch for 1976 may be equal or exceed that of 1975. USSR alone accounts for about half the total international catch from the area.

A breakdown of catches by Sub-areas is given in Table 2.2.2. Sub-areas VII and VIII together contribute 88% of the landings from the Western area. This is about the same proportion as last year, but Soviet catches originating from Sub-area VIII have nearly doubled in one year to 21 700 tons. Total landings from Sub-area VII have decreased by about 10%.

Considerable difficulties have arisen in attempting to compile catch in number per age group. This has been engendered by the absence of USSR scientists from the meeting and the very small quantity of USSR data made available.

In this report, in an attempt to utilise the information to further advantage, the catches in number for Sub-area VI are shown separately (Table 2.2.3). For this Sub-area age data are available for the Netherlands, Poland and Scotland. These data have been used to raise the international catches.

For 1976 in Sub-areas VII and VIII, age data were available for a number of national fisheries within the area. Data from France referred to catches in winter in Division VIIa and in the spring and summer in Division VIIg-k. Netherlands data referred to the summer fishery in the Celtic Sea. English data came from the winter fishery in the western English Channel. Polish catches were converted to catch in number using an age length key from Polish sources from the southeast of Ireland in summer.

USSR supplied some percentage age distributions referred to SW Ireland for the months February to August and percentage length compositions for most months up to December.

Catch information was available to allow distribution of the USSR total catch to Divisions of Sub-area VII. The catches from February to August were raised by the USSR age data using numbers per kilo. for the first quarter of the year in Sub-area VII as given in the Working Group report for 1976 (Anon. 1976a).

For the fishery from August to December, which is mainly distributed in the Western Channel and southern Celtic Sea the percentage length distributions were converted to weight by means of a weight/length conversion derived from English sampling in the same period and same area. These data were used to convert the USSR catch in weight to catch in number, via an age/length key derived from the English fishery in the last quarters of the year.

In addition, the data for 1972-75 were revised by the inclusion of English data previously not available and corrections made to the tabulations previously reported.

In this Western area it can be seen that the 1968 and 1969 year-classes appear to be of similar strength. This contrasts with the North Sea situation. The year-classes 1971, 1973, 1974 and 1975 all contributed heavily to the catches. The 1972 year-class appears to be weak.

3. STOCK SEPARATION AND DISTRIBUTION

Hamre (1975) and previous reports of the Mackerel Working Group, have commented on the fact that the North Sea and Western stocks of mackerel both contribute to the catches taken in the Shetland area in summer. The evidence in support of this has been strengthened by the recoveries in the Shetland area of mackerel which were tagged in the Celtic Sea, discussed in paragraph 3.1.2.

3.1 Tagging returns

3.1.1 Estimates of the mixing rates of North Sea and Western stocks in the Shetland area.

In carrying out cohort analyses it is necessary to allocate the fish caught at Shetland during the summer to the two stocks in the correct proportions. This has been done by using the equation given by Hamre (1975):

$$P_j = \frac{P_{N_j}}{P_{S_j}} \cdot \frac{\sum r_{ijS}}{\sum r_{ijN}}$$

where:

P_j is the proportion of North Sea stock in the Shetland catches of the year-class under consideration in year j;

P_{N_j} is the catch of that year-class taken in the North Sea area in year j which was effectively screened for tag recoveries;

P_{S_j} is the catch of that year-class taken in the Shetland area in year j which was effectively screened for tag recoveries;

$\sum r_{ij}$ are recoveries of fish of that year-class in the year in question summed over all releases; with the subscripts S and N denoting recoveries from the Shetland and North Sea areas respectively.

The recoveries on which the proportions were calculated are given in Table 3.1.1. The calculated proportions of North Sea fish in the Shetland catches in each year for each age group are given in the text table below.

Year	Year-class 1970-72	Year-class 1969	Year-class 1968 and older
1972	-	0.92	0.08
1973	-	0.80	0.17
1974	0.22	0.41	0.22
1975	0.14	0.63	0.05
1976	0.18	0.91	0.46

In all years it was assumed that fish younger than 4 years old, taken in the Shetland fishery were derived only from the North Sea stock.

The part of the purse seine catches in the Shetland area taken from the North Sea stock has been calculated by applying mixing ratios per age group (given above) to the age distribution of the total Norwegian catch from that area (Table 2.1.3 and 2.2.3).

3.1.2 Recoveries in the North Sea of fish tagged in the Celtic Sea

Since 1970 Norwegian tagging releases have been made off the south-west of Ireland in May of each year. Tags from these releases have been recovered in the Shetland and North Sea fisheries. Hamre (1975) reported the results up to 1972, and data supplied to the Working Group have amplified and extended the series.

In the previous section the recoveries of North Sea tagged fish from the Shetland fishery have been discussed. Until recently, relatively few fish caught in the Western area went directly to fish meal plants in which there was much possibility of tags being recovered. The areas of recovery of tags from the Celtic Sea and North Sea taggings have been in the Minch, at Shetland and in the North Sea fisheries.

In order to compare the return rates, these have been expressed as returns per unit of effective production (P_j) in the Norwegian fish meal plants. The annual quantity processed from catches from Shetland and the North Sea have been reduced by the magnet efficiencies of the plants and have been presented in Hamre (1975) and by Hamre to this meeting.

Table 3.1.2 shows the returns per unit production (P_j) for the 1969 year-class released in the two areas. The upper figure for each year refers to the recoveries of North Sea tagged fish and the lower figure to Celtic Sea tagged fish.

It is seen that in most cases the rate of return of North Sea tagged fish is higher from the North Sea fishery than at Shetland. However, there are equal return rates in both areas from the Celtic Sea taggings. It may be recalled that the 1969 year-class is the dominant one in the North Sea stock while it is relatively weak in the Western stock.

Table 3.1.3 shows the data for fish older than the 1969 year-class. These fish are abundant in the Western stock, but relatively few in the North Sea stock. The most striking feature of this table is the high rate of recapture of Celtic Sea tagged fish in the North Sea.

It is not possible to calculate mixing rates from the Celtic Sea taggings as was done for the North Sea tagging, primarily because the actual stock composition of fish tagged in the Celtic Sea is unknown and partly because in the absence of tag returns from western areas the degree of migration cannot be estimated.

It is, however, clear from the Celtic Sea tagging data that a high recovery of Celtic Sea tags was made in the North Sea which would confirm the assessment based on mixing rates from North Sea tag returns.

3.2 Mean weight at age

For the Western stock a new set of values was calculated. For Sub-area VI this was made from Scottish data from the summer and autumn trawl fishery off the Butt of Lewis which were pooled with previous data from various countries. In the same way, for Sub-area VII more English data were available which were considered as being more representative of the actual fishery. Table 3.2.1 shows the results of the new calculations. The weighted means presented here are much lower than those of previous years, particularly for age group I. From these age data, the quarterly mean weights at age have been weighed by the catches within each area and quarter. From these an annual mean weight at age per age group in the catch have been derived and this is used in the TAC calculation in paragraph 5.2.

For the North Sea assessment the mean weight at age as reported previously (Anon. 1976a) was used.

4. CATCH IN NUMBER, MORTALITIES AND STOCK SIZES

4.1 The North Sea stock

As discussed in the previous report (Anon. 1976a), in carrying out a cohort analysis with only five years catch in number per age-group data, it is necessary to have some way of estimating a fishing mortality rate, or stock size, for one year during the

series from which to estimate an input F for the last year of the series. In case of the North Sea mackerel stock an estimated F value can be derived from the tagging data obtained from the long series of tagging experiments carried out by Norway in the North Sea.

Using the tag release and recovery data given in Table 3.1.1, survival rates for the 1969 year-class have been calculated in each year using the method of Robson (1963). Similar survival rates could be calculated for the 1968 and older year-classes, but it was decided that the rates calculated for the 1969 year-class were likely to be more reliable in that they are based on much larger numbers of releases and recoveries. These survival rates were then converted to the equivalent instantaneous fishing mortality rates by deducting the natural mortality rate (M) of 0.2 used in previous reports. The resulting values are given in the text table below.

	1972	1973	1974	1975
F from tag recoveries	(-0.3)	0.10	0.08	0.17
F from cohort analysis	0.04	0.09	0.11	0.12

The value of F, derived in this way for the 1969 year-class in 1973, was chosen as that likely to be the most reliable in that it was based on the largest number of recoveries. The cohort analysis was then run for that year-class using various values of assumed F in 1976 until an F value for 1973 approximating closely to 0.10 was obtained. This demanded an input F of 0.2 in 1976. The F values derived from the cohort analysis for other years using this input in 1976 are also given in the text table above. It will be seen that they are all in reasonable agreement with the values for other years derived from tagging. This engenders more confidence in the procedure used. It should be noted, however, that with the comparatively high survival rates found for North Sea mackerel in these years, the F value estimated in this way is very sensitive to the value of natural mortality used. For example, in the year 1973 actually using the total instantaneous mortality

rate of 0.3 derived from tagging would entail an F of 0.1 where M is assumed equal to 0.2, but to an F of 0.2 if M is assumed equal to 0.1. This would have a very appreciable effect on the subsequent estimates of stock sizes.

The value of 0.2 for the fishing mortality rate on the 1969 year-class obtained in this way was also assumed to apply to all other fully-recruited (4 year old and older) age groups. Input F's for younger year-classes were obtained by applying the exploitation pattern shown by the cohort analysis to this fully-recruited F.

The input data for the cohort analysis and the outputs of F and stock sizes are given in Table 4.1.1. As in earlier years, the 1969 year-class continued to dominate the mackerel catch taken from the North Sea stock. There is no evidence, at present, of the advent of a new strong year-class to this stocks.

The fishing mortality rates derived from the cohort analysis would suggest that after a period of rather low exploitation rates in 1972-74, the fishing mortality has increased progressively in 1975 and 1976, and in the latter year was very close to the value advocated by the Working Group in previous reports (Anon.1975, 1976a). In this stock there is no evidence of any significant change in the exploitation pattern over the period covered by this series of data; a year-class does not appear to be fully recruited to the exploited stock until age 4.

The data given in Table 4.1.1 show a progressive decline both in stock number and stock biomass over the period 1972-76. This decline in stock is almost entirely due to the low level of recruitment subsequent to the 1969 year-class. The 1974 year-class would appear to be somewhat stronger than any of the others which have joined the stock since the 1969 year-class, but on present evidence would appear to be only about 14% of the strength of the latter.

The stock biomasses given in Table 4.1.1 are very similar to those given in the previous report (Anon.1976a) for 1972 and 1973. Both

were based on mean weights at age on 1 Jan of:

Age	3	4	5	6	7	8	8+
Weight, g	206	268	336	396	400	404	440

(Hamre & Castello 1969)

The stock biomasses given in this report, however, for 1974 and 1975 are about 20% higher than those in the previous report for these years. This is accounted for by the slight overestimate of the 1975 fishing mortality rate used in that report.

4.2 The Western stock

The Western stock is defined as the one which contributes the catches in Sub-areas VI, VII and VIII, to which is added a component of the Shetland catch. This component is shown in Table 2.2.3 and the total catches in number of the Western stock are given in Table 4.2.1.

A cohort analysis was made on the basis of these catch data. In selection of the input F values on adult mackerel the estimates of the relative stock sizes of the 1969 year-class of Western and North Sea stocks in the Shetland area have been considered. That level of input F which corresponded with the component of the calculated stock size at Shetland of the 1969 year-class of Western stock was computed. This calculation suggested a level of 0.4 with a natural mortality of 0.2.

From Lockwood & Dawson (1976) the total mortality rate on the old fish in the fishery to the south-west of England indicated a value of the order of 0.30 over 1975. Comparing the effort in terms of numbers of vessels engaged in the fishery there has been a major increase during the 1976 and 1977 season. The major increase has been in purse seiners which increased by three times and by mid-water trawlers which increased by nearly 30%. The increase in fishing mortality used in the cohort analysis is consistent with the increased effort.

With the continued decline in the numbers of older fish, which can be seen in the catches, the effort has been directed on to the younger, recruiting age groups. For this reason the fishing mortality distribution in 1976 was increased on the 0, 1 and 2 groups, as compared to that shown by the cohort analysis in previous years.

The 1971, 1974 and 1975 year-classes appear to be strong, nevertheless the stock adult biomass indicates a continued decline from 2.7 million tons in 1972 to just over 1 million ton in 1977.

5. TOTAL ALLOWABLE CATCH (TAC)

5.1 North Sea TAC for 1977 and 1978

In calculating the TAC for the North Sea stock in 1977 and 1978 the basic input data are the estimates of stock in number per age at 1 January 1976 and the estimated F's on each age group given in Table 4.1.1. From these the stock surviving to 1 January 1977 was calculated. The TAC for 1977 was calculated using the value of 0.2 on fully-recruited age groups, which was recommended in previous reports. The fishing mortality rate on younger age groups was estimated from the exploitation pattern shown in Table 4.1.1. The mean weights at age used in calculating the TAC for this stock are the same as in the previous report. These are given in the text table below, together with the stock in numbers per age group at 1 January of each year.

Age	1	2	3	4	5	6	7	>7
Stock in number (x10 ⁻⁶) at 1 Jan 1977	589.2	168.3	606.9	343.0	104.0	192.6	74.1	1179.3
Fishing mortality rates	.014	.100	.120	.200	.200	.200	.200	.200
Stock in number (x10 ⁻⁶) at 1 Jan 1978	589	475.7	124.6	440.7	229.9	69.7	129.1	840.2
Mean weight at age (g) in catch	139	262	354	430	428	464	527	527

The recruitment values for 1-year-old fish at 1 January 1977 and 1 January 1978 are estimated from the mean recruitment level at this age in the years 1972-76 inclusive.

On these bases the TAC for the North Sea stock in 1977 is estimated as 182 000 tons. On the assumption that this TAC is adhered to in 1977, the estimated TAC for 1978 is 153 000 tons.

This estimated TAC for the North Sea stock in 1977 is considerably higher than that estimated last year. This has largely resulted from the over-estimation of the 1975 fishing mortality rate in the previous report, but also owes something to revision of the catch in number per age group data.

As pointed out in previous reports, and in earlier sections of this report, there is considerable mixing of the North Sea and Western stocks in the Shetland area in summer. It is therefore necessary to allocate part of the Western stock TAC to the North Sea area to take account of the catches taken from that stock in the Shetland area. Past estimates of the proportion of western fish taken in the Shetland area suggests that that fishery generates a fishing mortality rate of 0.04 on the age-groups which migrate to that area. This would entail a catch from the Western stock of 40 000 tons in 1977 and 37 000 tons in 1978.

Adding these quantities to the TACs given above for the North Sea stock, one gets TACs for the North Sea area (Sub-area IV and Division IIIa):

222 000 tons in 1977

190 000 tons in 1978

5.2 Western area TAC for 1977 and 1978

The basic data used for calculating the TACs for the Western stock in 1977 and 1978 are similar to those described in paragraph 5.1 in relation to the North Sea stock. The parameters used are given in the text table below.

Age	0	1	2	3	4	5	6	7	8+
Stock in number (x10 ⁻⁶) at 1 Jan 1977	2 760	869	3 008	1 209	841	342	593	261	937
Fishing mortality rates	.03	.06	.12	.20	.20	.20	.20	.20	.20
Stock in number (x10 ⁻⁶) at 1 Jan 1978	2 760	2 192	670	2 184	810	564	229	397	803
Mean weight at age (g) in catch	64.5	112	169	207	269	318	362	398	505

As pointed out above, there is evidence in 1976 of a shift in the exploitation pattern to the younger age groups. This has been taken into account in estimating the fishing mortality rates given above for the younger age groups. The fishing mortality rate on the fully recruited age groups is 0.20 as for the North Sea stock. The recruitment of 0-group fish in 1977 and 1978 has been set at the mean of these age groups in the years 1972-1976 inclusive obtained from cohort analysis.

The TACs calculated for the Western stock in 1977 and 1978 are 289 000 tons and 276 000 tons respectively. It should be noted that this estimate of the TAC for 1978 is valid only on the assumption that the TAC for 1977, quoted above, is adhered to.

The TACs are based on weight at age data different from those used in the previous report. These new data have reduced the calculated TACs by about 7%. Despite this, the TAC for 1977 given above is considerably higher than that given in the previous report for this stock. This has arisen predominantly from the better data now available on catch in numbers per age group for national catches and a better allocation of fish caught in the Shetland summer fishery to the two stocks.

As mentioned in paragraph 5.1 it is necessary to allocate 40 000 tons and 37 000 tons respectively of the 1977 and 1978 Western stock TACs to the North Sea area to take account of the fishery on this stock in the Shetland area. As a result, the TACs estimated for the Western area (Sub-area VI, VII and VIII) are:

249 000 tons in 1977

239 000 tons in 1978

6. HORSE MACKEREL

The data on horse mackerel (Trachurus trachurus (L.)) presented for consideration to the Working Group were not comprehensive. Catch data for 1976 were only available from Norway, Poland and France. France also supplied age-length keys and length-weight relationships for Sub-areas VII and VIII for 1976. Norway and Poland presented length distribution for Division IVa in that year. There are also Polish length data for other areas around the British Isles. No time series, even of length observations, were available. The only directed fisheries for horse mackerel are those of USSR, Spain and Portugal. No biological data were available from these major fisheries.

There were therefore insufficient data to do any assessment of exploitation rate or sustainable yield of horse mackerel in the ICES area. More information is required on stock definition and increased sampling needed to generate age-length keys from sufficient areas and gears to allow for reliable calculation of numbers at age from the catch data.

Two other species occur within the ICES areas, and a minor part of the catches in Sub-areas IX and X may include Trachurus mediterraneus and T. picturatus. These are not distinguished in the catch statistics.

6.1 Catches

The total catch of horse mackerel has increased from 103 000 tons in 1966 to a peak of 353 000 tons in 1973 (Table 6.1.1). In 1974 and 1975 the catches declined, but there were insufficient data to determine if the decline continued in 1976, and if the decline was caused by a decrease in abundance or in effort. As shown in Table 6.1.2 the catches in VII, VIII and IX were of greatest importance during the last 10 year period.

Figure 1 shows the changes in annual catches of horse mackerel in these three most important fishing areas. In Sub-area VII the catches increased to about 100 000 tons in 1972 and have since remained at this level. In Sub-area VIII catches have varied greatly from year to year with a maximum of near 120 000 tons in 1973, and somewhat lower catches in the later years. In Sub-area IX the catches from year to year show small variations, but there is a clear trend of declining catches since 1968.

6.2 Exploitation and management

In view of the lack of data on horse mackerel, consideration should be given to placing a ceiling on catches. Based on data from Macer (1977) and from France, it was concluded that the horse mackerel growth pattern is similar to that of mackerel (S. scombrus) with an exponential early growth phase reaching an asymptote at about 3-4 years of age. This creates problems for calculating F_{max} , and the population biomass would not display a marked decrease until the fishery was directed towards fish of age 4 and younger. If the fishery was forced to take young fish due to low population numbers, the population would decline rapidly. A reduced population size will also affect spawning stock size. If the spawning stock is greatly reduced, and the fishery concentrates on immature fish, the ability of the stock to recover significantly, or indeed to maintain itself, will be impaired.

In the light of these considerations it would seem advisable to hold the catch in Sub-area VII at its current level of 120 000 tons until more data are available to permit an assessment. In Sub-area IX, in the light of the sharp decline of recent years, the catch should be frozen at a level not exceeding 40 000 tons. There are some evidence that the exploitation pattern in that area departs widely from the optimum. This question should be given immediate consideration.

7. SUMMARY

Mackerel

7.1 In 1976 the total catch of mackerel in the North Sea area (Sub-area IV , Divisions IIa and IIIa) was about 300 000 tons, a decrease by 20 000 tons compared to 1975. The reduced catch was mainly caused by restrictions in the Norwegian fishery which, however, was partially offset by an increase in the Faroe catch. The catches were again dominated by the 1969 year-class. The 1971 year-class and 1968 and older year-classes were also quite prominent in the landings from this area, but there is evidence which suggests that these fish were predominantly immigrants from the Western areas.

In the Western area (Sub-areas V, VI, VII and VIII) the 1976 provisional catch, is about 470 000 tons, and it may be supposed that the total annual catch may be equal to or exceed that of 1975. USSR accounts for about half the total international catch. In the catches, the 1968 and older year-classes continued to play a significant part; however, the 1971, 1973, 1974 and 1975 year-classes were also prominent in the catches.

7.2 Two stocks of mackerel were considered: the North Sea stock and the Western stock. The stocks have spawning and overwintering areas in the North Sea and the Celtic Sea respectively, but parts of the stocks are found mixed in the northern North Sea in summer. Returns of tags from mackerel tagged in the North Sea and the Celtic Sea provide data for estimates of mixing rates and information on migration of Western stock mackerel into the North Sea.

7.3 Extensive revisions of the 1976 assessments have been made as a result of the availability of improved data. It is noted, however, that there are insufficient biological data relating to the largest catch in the Western area.

- 7.4 The North Sea stock was assessed from a modified cohort analysis incorporating parameters derived from tagging data. The estimates of stock size are in substantial agreement with those estimated in the previous report in showing a decline in stock biomass and some increase in exploitation rate since 1972. The major cause of the decline in stock is the low level of recruitment to this stock since the 1969 year-class recruited in 1972; the fishing mortality rate, even in 1976, is somewhat below the optimum value.
- 7.5 The assessment of the Western stock was also based on a cohort analysis. The relative sizes of the two stocks as derived from tagging data were considered in order to select input parameters for the analysis. With the continued decline in number of older fish, the fishing effort has been directed on to younger, recruiting age groups. The estimates of stock biomass have been considerably increased from those given in the previous report by improved catch in number at age data made available to the 1977 meeting of the Working Group. In particular, the recruitment to this stock in recent years has been much better than was estimated in the previous report. Despite this, however, the stock biomass at 1 January 1977 is estimated to be only a half of that at 1 January 1974. The fishing mortality rates in 1975 and 1976 are estimated at about twice the optimum value.
- 7.6 The TAC for the North Sea stock is estimated as 182 000 tons. On the assumption that this TAC is adhered to in 1977, the estimated TAC for 1978 is 153 000 tons. The TAC for 1977 is considerably higher than that estimated last year. This has largely resulted from a more accurate estimate now available of the fishing mortality rate in 1975.
- 7.7 The TAC for the Western stock in 1977 and 1978 are 289 000 tons and 276 000 tons respectively. The TAC for 1977 is considerably higher than that given in the previous report. This has arisen predominantly from the better data now available on catch in numbers per age group.

7.8 It is necessary to allocate part of the Western stock TAC to the North Sea area to take account of the catches taken from that stock in the Shetland area. Estimates of the fishing mortality generated on the age groups which migrate to that area, correspond to a catch from the Western stock of 40 000 tons in 1977 and 37 000 tons in 1978.

7.9 Taking account of this, the recommended TAC for each of the two areas are:

North Sea area (IV, IIIa)	1977	222 000 tons
	1978	190 000 "
Western area (VI, VII, VIII)	1977	249 000 tons
	1978	239 000 "

It must be stressed that these TACs for 1978 are dependent on the 1977 values not being exceeded.

Horse mackerel

7.10 The data on horse mackerel (Trachurus trachurus (L.)) available to the group were insufficient for assessment of exploitation rate or sustainable yield of this species. More information is required on stock definition, catch by area and time, age-length and other biological parameters.

7.11 The catch statistics for the preceding decade showed an increase in annual yield from the whole of the ICES area from 103 000 tons in 1966 to 353 000 tons in 1973. In 1974 and 1975 the catch declined somewhat to values of 280 000 tons and 265 000 tons respectively.

During this decade the catches from Sub-areas VII, VIII and IX were of greatest importance.

7.12 The growth pattern of horse mackerel, however, is such that no clear maximum is likely to appear in the yield per

recruit curve with increasing fishing mortality rate and no significant decline in total yield will be experienced until recruitment is affected by the reduction in stock biomass. In Sub-area VII the annual catch increased rapidly from 1967 to 1972 and then remained at an almost constant level of 120 000 tons from 1973 to 1975. It is therefore possible that this level of catch is only being maintained by a progressive increase in fishing effort from a declining stock biomass. In the light of the above considerations, it is recommended that the total annual catch from Sub-area VII should not be allowed to exceed 120 000 tons until better data are available to assess the current state of the population in the area.

7.13 In Sub-area IX the total catch of horse mackerel has shown a progressive decline from 1968 to 1975. In the light of the considerations outlined in paragraph 7.12, and the lack of evidence that there has been any reduction in fishing effort directed to this horse mackerel population, it is recommended that the annual catches from this Sub-area should not be permitted to exceed 40 000 tons until data are available to permit a more detailed assessment to be carried out. In particular data which allow a clearer examination of the current exploitation pattern of the Sub-area IX population are urgently required.

7.14 The Working Group also prepared statements on the distribution of the life-history stages and of the fisheries in relation to the new fisheries zones, on:

Mackerel
 North Sea stock
 Western stock
Horse mackerel
Pilchard

These are appended to this report.

8. REFERENCES

- Anon. 1975. Report of the Mackerel Working Group. Coun. Meet. int. Coun. Explor. Sea, 1975 (H:3): 1-15, 5 tab., 2 figs. [Mimeo.]
- Anon. 1976a. Report of the Mackerel Working Group. Coun. Meet. int. Coun. Explor. Sea, 1976 (H:3): 1-37. [Mimeo.]
- Anon. 1976b. Addendum to the Report of the Mackerel Working Group. Coun. Meet. int. Coun. Explor. Sea, 1976 (H:3): 1-5. [Mimeo.]
- Castello, J.P. and Hamre, J. 1969. Age and growth of mackerel from Skagerrak and the northern North Sea. Coun. Meet. int. Coun. Explor. Sea, 1969 (H:7): 1-6, 4 tab., 4 figs. [Mimeo.]
- Hamre, J. 1975. The effect of recent changes in the North Sea mackerel fishery on stock and yield. The changes in the North Sea fish stocks and their causes. Int. Coun. Explor. Sea, Symp., Aarhus, 1975 (22): 1-38. [Mimeo.]
- Macer, C.J. 1977. Some aspects of the biology of horse mackerel (Trachurus trachurus (L)) in waters around Britain. J. Fish. Biol., 10: 51-62.
- Lockwood, S.J. and DAWSON, W. 1976. Recent changes in the catch per unit of effort of the Cornish mackerel handline fishery. Coun. Meet. int. Coun. Explor. Sea, 1976 (H:18) 1-7. [Mimeo.]
- Robson, D.S. 1963. Maximum likelihood estimation of a sequence of annual survival rates from a capture-recapture series. Int. Comm. Northwest. Atl. Fish. Spec. Publ. 4: 330-335.

Table 2.1.1 Nominal catch (tons) of mackerel in the North Sea, Skagerrak and Kattegat
(IV and IIIa) 1965 - 1976. (Data for 1965-1975 as officially reported to ICES)

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976 ¹⁾
Belgium	67	201	77	139	19	85	129	78	145	134	281
Denmark	7 552	20 282	9 887	10 851	26 753	17 590	2 023	7 459	3 890	9 835	7 644 ²⁾
Faroe Islands	-	-	-	3 080	2 134	3 603	7 551	11 202	18 625	23 424	67 855
France	5 390	7 486	4 684	11 353	4 677	9 061	6 882	636	2 254	2 749	2 423
German Dem. Rep.	2 040	915	349	399	51	166	346	214	234	141	259
Germany Fed. Rep.	1 501	2 132	1 353	1 161	225	407	374	563	270	276	394
Iceland	-	105	352	612	1 492	649	687	3 079	4 689	198	460
Netherlands	12 247	11 964	5 986	4 928	2 956	4 945	4 436	2 339	3 259	2 390	1 955
Norway ⁴⁾	484 428	866 548	779 084	683 045	278 631	200 635	160 141	298 877	255 132	241 533	206 534
Poland	2 294	2 261	1 629	12	205	130	244	561	4 520	2 313	2 020
Sweden	13 754	15 246	11 783	10 820	4 407	3 163	4 748	2 960	3 579	4 789	4 800 ³⁾
U.K. (England & Wales)	99	46	55	35	35	23	32	31	61	109	119
U.K. (Scotland)	618	742	583	231	148	616	395	2 943	390	578	1 205
U.S.S.R.	1 778	4 098	6 094	12 516	718	2 600	611	17 150	8 161	9 330	1 201
Total	531 768	932 026	821 916	739 182	322 451	243 673	188 599	350 092	305 209	317 800	297 150

1) Preliminary

2) Jan-Nov 1976 (From NEAFC monthly returns)

3) Working Group estimate

4) Includes catches from Div. IIa (1973 - 31 573 tons,
1974 - 6 818 tons, 1975 - 34 662 tons, 1976 - 10 514 tons)

Table 2.1.2 Total catch of mackerel by Division in the North Sea, Skagerrak and Kattegat (tons).

Year	Division				
	IIa	IIIa	IVa	IVb	IVc
1966	950	24 594	496 873	8 014	247
1967	897	20 069	895 163	14 973	906
1968	42	12 867	796 538	10 605	1 557
1969	1	24 917	700 816	11 529	1 521
1970	200	32 410	257 328	26 674	5 988
1971	358	15 462	199 172	17 217	11 548
1972	88	5 961	174 335	5 596	2 309
1973	21 573	8 220	297 445	19 433	1 407
1974	6 829	6 218	275 463	12 163	4 511
1975	35 272	10 994	231 536	16 691	3 841
1976 ¹⁾	10 523	3 081	276 448	20 474	8 999

1) Preliminary

Note:

Denmark	IVb includes	IVa	1966 to 1973
Norway	IVa	" IVb	1966 to 1972
Sweden	IVa	" IVb and IIIa	1966 to 1974
Sweden	IVb	" IVa, c	1975
U. S. S. R.	IVa	" IVb, c	1966 to 1973
France	IVa	" IVb, c	1966
Netherlands	catches not allocated by area. Mainly IVb, rest IVc 1967-		

Table 2.1.3 Catch in number ($\times 10^{-6}$) of the North Sea mackerel stock by year-classes (See paragraph 3.1 in text)

Year-class	1972		1973		1974		1975		1976		
	IVa	IVb, c Shetland	IVa	IVb, c Shetland	IVa	IVb, c Shetland	IVa	IVb, c Shetland	IVa	IVb, c Shetland	
older	44.8	16.2	63.3	5.7	29.5	1.3	46.4	7.2	32.7	13.2	15.4
1968	17.8	15.0	46.0	4.3	23.6	1.2	17.9	10.7	110.7	5.4	112.7
1969	110.6	13.5	202.3	18.2	186.3	2.5	171.7	4.0	12.2	4.1	1.9
1970	3.1	30.8	19.0	4.0	32.8	1.1	20.9	4.1	20.5	14.2	12.6
1971	0.1	2.5	8.0	3.8	18.8	1.5	29.6	10.1	14.9	5.3	5.4
1972	-	-	1.7	2.8	16.3	1.2	12.4	1.9	14.2	15.5	18.7
1973	-	-	-	-	-	0.4	5.5	3.8	41.8	9.0	19.9
1974	-	-	-	-	-	-	7.6	4.3	-	1.9	-
1975	-	-	-	-	-	-	-	-	-	-	-
1976	-	-	-	-	-	-	-	-	-	-	-

Table 2.2.3 Catch in number ($\times 10^{-6}$) of the Western mackerel stock by year-classes

Year-class	1972		1973		1974		1975		1976		
	VI	VII+VIII Shetland	VI	VII+VIII Shetland	VI	VII+VIII Shetland	VI	VII+VIII Shetland	VI	VII+VIII Shetland	
older	22.8	319.1	24.0	219.2	32.8	277.7	586.4	494.1	28.8	197.6	32.0
1968	2.0	28.2	17.3	77.9	11.8	82.0	10.9	116.6	21.8	169.0	19.8
1969	4.9	21.1	5.7	94.9	10.7	68.5	10.0	155.4	13.9	179.2	11.1
1970	0.1	12.0	9.5	54.5	6.0	73.7	29.5	247.6	13.1	121.3	8.9
1971	-	12.4	0.8	48.7	10.0	98.7	6.1	84.7	22.6	244.8	57.4
1972	-	1.7	-	33.8	0.6	23.7	10.8	92.4	7.0	175.9	4.5
1973	-	-	-	74.3	0.9	86.1	0.9	51.5	15.3	430.4	15.4
1974	-	-	-	-	-	1.3	-	-	6.4	358.1	-
1975	-	-	-	-	-	-	-	-	0.1	425.4	-
1976	-	-	-	-	-	-	-	-	-	59.5	-

Table 2.2.1 Nominal catch (tons) of mackerel in the Western area (V, VI, VII and VIII) 1966 - 1976. (Data for 1966 - 1975 as officially reported to ICES).

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976 ¹⁾
Belgium	5	7	2	11	8	2	1	3	7	17	9
Faroe Islands	-	-	-	-	-	-	-	635	8 659	1 760	907
France	42 625	34 753	34 896	31 605	42 019	33 228	35 368	41 667	37 826	25 818	30 390
German Dem. Rep.	-	949	95	9	130	93	214	1 733	2 885	9 693	4 509
Germany Fed. Rep.	302	333	613	431	783	258	98	559	993	1 941	268
Iceland	-	-	-	-	90	86	74	52	-	21	-
Ireland	1 507	2 245	2 164	1 615	1 055	3 107	4 592	8 314	8 526	11 567	21 549
Netherlands	2 831	3 859	2 597	4 441	3 828	3 837	6 166	7 785	7 315	13 274	14 998
Norway	-	-	-	-	-	1 611	-	38 728	32 672	1 907	4 131
Poland	3	520	1 518	2 149	6 054	10 832	13 219	10 626	22 405	21 573	21 407
Spain	21 802	27 863	20 753	21 571	31 368	37 506	31 416	25 677	30 177	23 408	30 000 ¹⁾
U.K. (England & Wales)	1 887	2 635	2 586	2 692	3 374	4 791	6 924	13 084	21 135	32 524	55 556
U.K. (N. Ireland)	97	158	151	279	243	315	57	93	75	30	106
U.K. (Scotland)	679	496	542	410	814	806	1 416	5 217	8 470	16 178	28 251
U.S.S.R.	-	-	-	6 147	13 555	36 390	71 249	65 211	103 435	309 666	230 283
Total	71 738	73 818	65 917	71 360	103 321	132 862	170 794	219 384	284 580	469 377	442 364
Bulgaria	-	-	-	-	-	-	-	4 341	13 558	20 830	21 000 ²⁾
Romania	-	-	-	-	-	-	-	-	-	2 166	2 000 ²⁾
Grand total	71 738	73 818	65 917	71 360	103 321	132 862	170 794	223 725	298 138	492 373	465 364

1) Preliminary

2) Working Group estimate

Table 2.2.2 Total catch of mackerel by
Sub-areas in the Western area (tons).

Year	Sub-area	
	VI	VII+VIII
1966	4 403	67 086
1967	5 413	68 138
1968	5 064	60 847
1969	4 760	66 340
1970	3 854	100 340
1971	10 213	122 561
1972	13 013	157 762
1973	52 166	167 279
1974	64 136	234 018
1975	64 849	427 511
1976 ¹⁾	51 985	405 133

1) Preliminary

Table 3.1.1 Tag recoveries from the Shetland area (Sh) and the eastern part of the northern North Sea, IVa E₁(NS) in Norwegian catches as number $\times 10^6$ effectively screened for tags (P_j). Tagged in the North Sea.

	Release		Recapture													
	Year	No	1970		1971		1972		1973		1974		1975		1976	
			Sh	NS	Sh	NS	Sh	NS	Sh	NS	Sh	NS	Sh	NS		
1969 year-class	1970	1085			4	9	3	11	9	21	4	22	2	15	5	2
	1971	6900					36	113	109	232	64	170	16	137	56	23
	1972	9447							108	401	92	382	29	282	85	55
	1973	4642									33	270	22	214	54	27
	1974	2740											7	131	42	12
	1975	4716													60	45
	P_j			7.5	24.3	17.8	70.1	51.9	120.3	75.2	111.5	16.9	100.0	54.5	26.4	
older than 1969 year-class	1969	4187	15	195	47	6	4	5	22	2	8	9	2	5	1	0
	1970	2420			30	10	6	19	23	26	13	15	3	15	4	6
	1971	2450					21	36	35	52	23	48	6	36	20	4
	1972	2126							32	80	21	68	5	44	19	10
	1973	1518									17	79	8	62	23	6
	1974	1344											4	47	15	4
1975	1048													12	8	
	P_j		41.5	212.7	170.5	8.6	60.2	32.3	204.6	62.9	114.7	30.3	75.0	36.8	42.3	7.1
younger than 1969 year-class (1970-1973)	1972	245							2	8	1	13	1	6	1	1
	1973	1117									9	52	5	44	12	3
	1974	409											2	14	7	2
	1975	2619													23	26
	P_j								0.5	15.5	25.2	26.8	43.1	39.4	52.8	19.4

Table 3.1.2 Tag recoveries per unit production from the Shetland area (Sh) and the eastern part of the northern North Sea, IVaE, (NS):
1969 year-class (P_j = number $\times 10^6$ effectively screened for tags).
 Tagged in the North Sea (NS) and the Celtic Sea (CS)

Recapture Release	1973		1974		1975		1976	
	Sh	NS	Sh	NS	Sh	NS	Sh	NS
1973 No								
NS 4642		2.49	0.43	2.40	1.30	2.14	0.82	1.02
CS 3232	0.06	0.02	0.16	0.07	0.30	0.11	0.11	0.11
1974								
NS 2740				2.34	0.41	1.31	0.64	0.45
CS 2246			0.26	0.11	0.89	0.24	0.14	0.15
1975								
NS 4716						4.46	0.91	1.70
CS 528					0.18	0.03	0.06	0.04
1976								
NS 996							0.05	0.95
CS 861							0.05	0.04
P_j	51.9	120.3	76.5	112.6	16.9	100.0	66.1	26.4

Table 3.1.3 Tag recoveries per unit production from the Shetland area (Sh) and the eastern part of the northern North Sea, IVaE, (NS): older than 1969 year-class (P_j = number x10⁻⁶ effectively screened for tags). Tagged in the North Sea (NS) and the Celtic Sea (CS)

Recapture Release	1970		1971		1972		1973		1974		1975		1976	
	Sh	NS	Sh	NS	Sh	NS	Sh	NS	Sh	NS	Sh	NS	Sh	NS
1970 No														
NS 2420	2.03		0.18	1.16	0.10	0.59	0.11	0.41	0.11	0.48	0.04	0.41	0.08	0.28
CS 4540	-		-	-	0.03	0.03	0.07	0.21	0.15	0.32	0.09	0.46	0.29	0.14
1971														
NS 2450	-			4.77	0.35	1.11	0.17	0.83	0.20	1.55	0.08	0.98	0.39	0.56
CS 5000			0.29	0.58	0.23	0.25	0.01	0.35	0.27	0.42	0.07	0.30	0.16	0.42
1972														
NS 2126						1.36	1.27	1.16	1.27	2.19	0.07	1.20	0.37	1.41
CS 5086					0.32	0.28	0.23	0.51	0.34	0.77	0.20	0.38	0.23	0.70
1973														
NS 1518								1.69	0.15	2.55	0.11	1.68	0.45	0.85
CS 3979							0.05	0.14	0.22	0.48	0.12	0.35	0.19	0.42
1974														
NS 1344										3.90	0.05	1.28	0.29	0.56
CS 6990									0.63	1.35	0.65	1.66	0.45	0.99
1975														
NS 1048												2.69	0.23	1.13
CS 6938											0.56	1.09	0.58	0.85
1976														
NS 304													0.31	1.27
CS 5652														0.99
P _j	212.7		170.5	8.6	60.2	32.3	204.6	62.9	116.2	31.0	75.1	36.8	51.3	7.1

Table 3.2.1 Mean weights (g) at age of mackerel by quarters in Sub-areas VI and VII. \bar{w} is the overall annual mean, weighted by catches in recent years.

	Age								
	0	1	2	3	4	5	6	7	8+
Jan-Mar	no data available								
Apr-Jun	-	-	232	281	309	345	357	422	462
Jul-Sep	-	203	275	284	343	432	431	483	617
Oct-Dec	-	180	286	314	327	463	415	475	625
Jan-Mar	-	58	125	177	233	246	309	356	378
Apr-Jun	-	107	147	186	257	277	285	336	356
Jul-Sep	61	112	183	223	256	277	317	321	392
Oct-Dec	65	125	181	209	275	327	373	411	509
\bar{w}	64	112	169	207	269	318	362	398	505

Table 4.1.1 North Sea stock. Catch in number with fishing mortality rates and stock sizes as derived from a cohort analysis

		Year	1972	1973	1974	1975	1976	1977
		Year-class						
Catch in number (x10 ⁻⁶)	>1968		105.55	169.28	98.02	89.71	61.24	
	1969		162.57	280.15	240.77	193.16	228.80	
	1970		35.63	37.56	39.92	27.83	18.22	
	1971		2.61	12.10	23.62	42.38	47.37	
	1972			4.54	18.73	16.23	25.57	
	1973				2.93	10.06	48.50	
	1974					11.94	70.78	
	1975						1.90	
TOTAL			306.36	503.63	423.99	391.31	502.38	
Fishing mortality (F)	>1968		.080	.179	.149	.198	.200	
	1969		.041	.093	.108	.119	.200	
	1970		.090	.129	.197	.205	.200	
	1971		.004	.021	.052	.125	.200	
	1972			.015	.079	.091	.200	
	1973				.005	.019	.120	
	1974					.013	.100	
$\bar{F} \geq 3$ years			.051	.115	.114	.135	.186	
Stock size at 1 Jan (x10 ⁻⁶)	>1968		1513.69	1143.80	783.29	552.61	371.27	248.87
	1969		4432.85	3482.21	2597.50	1908.80	1388.01	930.41
	1970		457.93	342.68	246.58	165.76	110.53	74.09
	1971		783.06	638.75	512.02	397.83	287.37	192.63
	1972			339.71	274.02	207.40	155.12	103.98
	1973				721.37	587.96	472.28	342.95
	1974					1013.86	819.27	606.93
	1975						(208.40)	168.25
1976							(589.20)	
TOTAL			7187.53	5947.15	5134.78	4834.22	3812.25	3257.31
Adult (≥ 3 years) stock biomass in tons (x10 ⁻³)			1422	1416	1355	1184	984	840

Table 4.2.1 Western stock. Catch in number with fishing mortality rates and stock sizes as derived from a cohort analysis

	Year Year- class	1972	1973	1974	1975	1976	1977
Catch in number (x10 ⁶)	1968	507.728	582.324	566.996	1196.902	469.190	
	1969	29.392	115.488	191.825	137.762	44.202	
	1970	12.117	64.035	108.519	183.209	143.283	
	1971	12.372	49.415	123.542	293.291	324.843	
	1972	1.646	33.784	24.312	90.809	187.353	
	1973			86.989	103.214	461.052	
	1974			1.315	52.436	364.439	
	1975				.988	425.501	
	1976					59.525	
TOTAL		563.255	845.046	1103.498	2058.611	2479.388	
Fishing mortality (F)	1968	.071	.109	.148	.524	.400	
	1969	.030	.156	.421	.614	.400	
	1970	.008	.052	.118	.299	.400	
	1971	.004	.021	.066	.220	.400	
	1972	.001	.028	.025	.124	.400	
	1973		.000	.039	.059	.400	
	1974			.0005	.025	.240	
	1975				.0002	.120	
	1976					.060	
$\bar{F} \geq 3$ years		0.067	0.105	0.143	0.379	0.400	
Stock size at 1 Jan (x10 ⁻⁶)	1968	8163.779	6224.520	4569.290	3227.980	1559.850	856.0
	1969	1109.108	881.466	617.185	331.738	146.952	81.0
	1970	1707.826	1387.286	1077.872	784.295	476.352	261.0
	1971	3278.170	2672.740	2143.540	1643.200	1079.960	593.0
	1972	1656.585	1354.808	1078.654	861.129	622.865	342.0
	1973		3080.523	2522.119	1986.226	1532.792	841.0
	1974			2872.367	2350.505	1876.985	1209.0
	1975				5061.831	4143.383	3008.0
	1976					1126.637	869.0
						(2760.0)	
TOTAL		15915.459	15601.343	14881.027	16246.904	12565.776	10820.0
Adult (≥ 3 years) stock biomass in tons (x10 ⁻³)		2694	2667	2290	1993	1233	1125

Table 6.1.1 Catch of horse mackerel by countries 1966-1978 (tons). ICES Sub-areas and Divisions IIa, IIIa, IV, VI, VII, VIII, IX and X. (Data as officially reported to ICES).

Country	1966	1967	1968	1969	1970	1971	1972	1973	1974	1974	1974	1976 ¹⁾
Belgium	4	10	36	37	33	41	75	72	37	27		
Denmark	-	-	4	-	-	-	-	-	-	-	-	
Faroe Islands	-	-	-	-	-	-	-	5 370	1 114	158		
France	-	-	1 830	2 479	2 768	3 039	3 603	6 549	5 525	4 969	8 000	
German Dem.Rep.	-	-	-	-	-	-	-	-	49	107		
Germany Fed.Rep.	1 532	96	1 238	1 096	966	395	175	2 891	1 720	1 480		
Iceland	-	-	-	-	-	-	-	379	203	-		
Netherlands	7	7	37	24	190	186	175	149	576	320		
Norway	-	-	-	-	7 404	23 173	6 381	20 760	21 393	3 194	5 300	
Poland	164	73	2 330	420	1 192	627	2 081	3 921	5 772	2 348		
Portugal	53 453	62 998	74 894	48 677	62 767	57 414	63 054	45 192	50 634	45 972		
Spain	47 000	53 352	62 326	85 781	98 418	26 167	82 247	113 361	70 733	83 849		
Sweden	-	-	-	-	-	-	-	2	2	1		
U.K.	214	107	104	111	121	146	221	265	1 957	636		
U. S. S. R.	279	-	-	13 320	74 952	57 049	107 753	154 254	120 264	122 014		
Total	102 653	116 643	142 799	151 945	248 811	168 237	265 765	353 165	279 979	265 075		

1) Provisional

Table 6.1.2 Catch of horse mackerel by Sub-areas and Divisions 1966-1976 (tons).
(Data as officially reported to ICES).

Year	IIa	IIIa	IVa	IVb	IVc	VIa	VIIb	VIIa	VIIb, c	VIIId, e	VIIIf	VIIg-k	VIII	IX	X
1966	-	-	430	1 620	45	69	-	7	7	17	-	4	43 035	53 475	3 943
1967	-	-	16	117	10	38	-	7	1	39	-	64	48 439	63 851	4 060
1968	-	4	33	1 367	131	88	-	64	-	570	-	2 209	56 393	78 502	3 434
1969	-	-	18	1 063	137	111	-	136	34	1 399	-	13 290	80 565	51 685	3 504
1970	76	-	10 705	1 079	202	100	1	310	1 478	554	-	70 712	95 169	64 714	2 710
1971	-	-	31 395	414	241	2 532	1	18	765	610	-	46 901	26 390	55 203	3 767
1972	1	-	7 590	22	543	1 680	196	4 012	2 104	33 844	4 000	56 276	80 507	63 811	11 187
1973	86	40	39 839	1 720	426	6 497	-	6	205	62 159	6 129	46 108	116 519	43 712	29 708
1974	-	4	25 411	1 790	3 550	3 351	170	16 555	3 875	32 842	3	62 101	59 985	50 771	19 538
1975	141	11	2 408	4 018	3 505	3 332	47	348	635	35 002	22 674	58 687	85 046	45 734	3 485

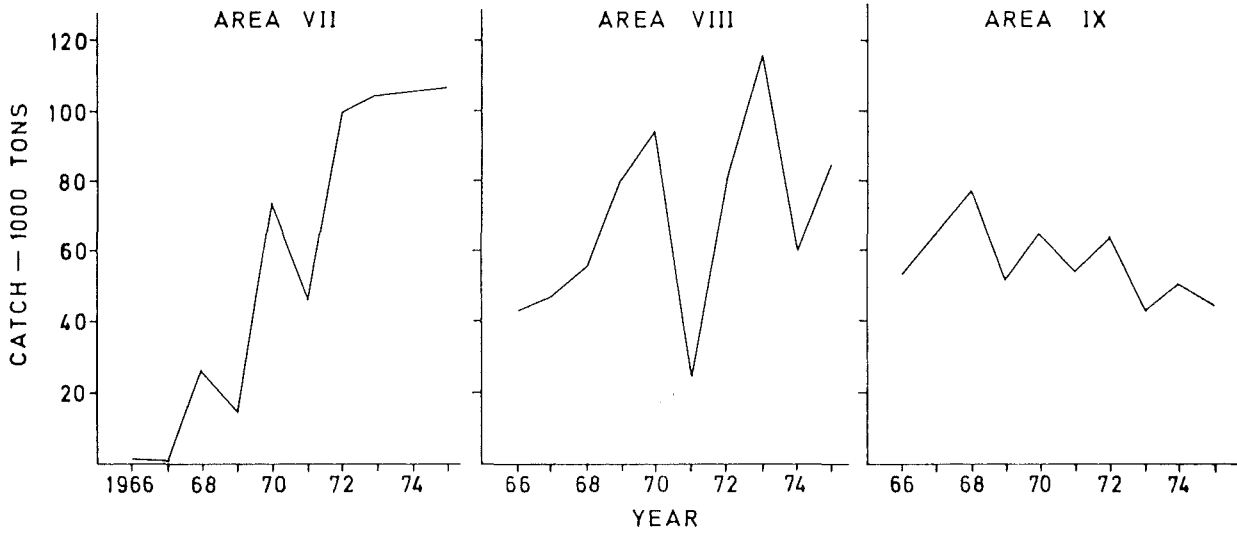


Fig.1 Total catch (all countries combined) of horse mackerel 1966-1975 in the Sub-areas of greatest importance.