COOPERATIVE RESEARCH REPORTS

No. 36

REPORT OF THE LIAISON COMMITTEE OF ICES TO THE NORTH-EAST ATLANTIC FISHERIES COMMISSION 1973

Members of the Liaison Committee 1972/73

Mr A J Lee	Chairman
Mr J G de Wit	Chairman, Gear and Behaviour Committee
Mr J A Pope	Chairman, Statististics Committee
Mr A Hylen	Chairman, Demersal Fish (Northern) Committee
Dr R Monteiro	Chairman, Demersal Fish (Southern) Committee
Mr K Popp Madsen	Chairman, Pelagic Fish (Northern) Committee
Prof K Tiews	Chairman, Pelagic Fish (Southern) Committee
Dr H J Thomas	Chairman, Shellfish and Benthos Committee
Mr K A Pyefinch	Anadromous and Catadromous Fish Committee
Mr A C Burd	Coopted Member
Mr J Hamre	Coopted Member
Mr Sv Aa Horsted	Coopted Member
Dr A Schumacher	Coopted Member
Dr A I Treschev	Coopted Member
Mr J Møller Christensen	Secretary to the Liaison Committee

ISBN 978-87-7482-522-7
ISSN 2707-7144

https://doi.org/10.17895/ices.pub.5512

International Council for the Exploration of the Sea
Charlottenlund Slot, DK-2920 Charlottenlund
Denmark

July, 1973

CONTENTS

CONTENTS (ctd) Page

-o-o-o-

PREPARATION OF THE LIAISON COMMITTEE's REPORT

The Committee informed the Commission at its last meeting that in order to achieve improvements in stock assessment it is essential to greatly improve the coverage, accuracy and speed of reporting national statistics, to extend substantially the biological sampling programmes, and to monitor recruitment by means of larval, 0-group and groundfish surveys. In preparing its present Report, the Committee has noted that the work of various ICES Working Groups is being seriously hindered by lack of the most recent statistical data.

The groups require the data from the most recent calendar year and some countries cannot provide these before the end of February. Thus, if meaningful assessments are to be provided, the groups and the Liaison Committee should meet in March, not in February as at present. This would entail the Liaison Committee's Report's reaching the Secretary of the Commission less than than 60 days before the Commission's annual meeting.

It is also becoming more and more difficult to find time for Working Group meetings in the first two months of the year. As many as 7-10 meetings are involved at a time when a number of scientists are also engaged in the mid-term meetings of ICNAF.

It would seem, therefore, that some re-adjustment of the Commission's and the Council's timetables is called for, and the Council would welcome the early opportunity to discuss this matter with representatives of the Commission.

-o-o-o-

A. REVIEW OF NOMINAL CATCHES IN NEAFC AREA 1964 - 1971

1. A general review of the fish production in the Convention Area from 1964 - 1971 is given in Tables 1-3. The tables, which are based on statistics published in ICES "Bulletin Statistique", show for each NEAFC region (i) the nominal catch of all species combined, (ii) the catch in the main fishing areas of (a) demersal species (comprising Pleuronectiformes - flatfishes; Gadiformes - codfishes; demersal Percomorphs - redfishes, gurnards, sandeels etc.); (b) pelagic species (all marine fish species not included in the demersal fish group); (c) each of the main species within the demersal and pelagic fish groups. Freshwater and anadromous species, shellfish and the catches by ICES non-member countries are not included in the tables.

2. The main changes in the fish production in each region are summarised below.*) A map showing the Regions, Sub-areas and Divisions referred to is given at the end of the Report. It should be noted that the grouping of catches in Regions, Sub-areas and Divisions does not necessarily accord with the patterns of distribution of individual stocks.

Region 1 (Table 1)

3. The total production of all species combined was 4 200 000 tons in 1971, which was at about the same level as in 1970.

4. In Sub-areas I and II the catch of capelin in 1971 remained at the high level of about 1 400 000 tons to which it rose between 1969 and 1970. Herring catches are still negligible. Catches of cod, which fell by about 300 000 tons from 1969 to 1970, decreased by a further 200 000 tons in 1971 to 724 000 tons. The catches of Polar cod again showed a substantial increase from 243 000 tons in 1970 to 348 000 tons in 1971. Saithe catches were also high in 1971 - above 200 000 tons - even if there was a slight decrease from last year's figure.

5. There were no substantial changes in the catch of any of the species from Sub-area V, and the total catch was the same as in 1970.

---

*) Catch data for Finland and Spain were not available when the Report was presented to NEAFC. They have later been submitted, and Tables 1-3 are revised accordingly in this published version of the Report.

Region 2 (Table 2)

6. The total catch in Region 2 was about the same as in 1970, showing only a slight decrease to just under 4 000 000 tons.

7. In Sub-area IV and Division IIIa both herring and mackerel catches decreased by about 100 000 tons from the 1970 level to 735 000 tons of herring and 243 000 tons of mackerel. The reported catches of sprat, however, rose from 58 000 tons to 100 000 tons and the catch of cod went up by 100 000 tons. There were also large increases in the catches of both Norway pout and sandeels. The former rose from 290 000 tons to 385 000 tons, and the latter from 195 000 tons to 404 000 tons. The catch of haddock, on the other hand, decreased substantially from a level of 650 000 tons in 1969 and 1970 to only 260 000 tons in 1971.

8. In Sub-areas VI and VII the total catch increased by 100 000 tons to 709 000 tons, herring and mackerel forming the main component of this increase.

9. The catches in Region 2, which were not specified in the corresponding table in last year's Report, contained 147 000 tons of unsorted and unidentified species caught mainly in Sub-area IV and Division IIIa. The corresponding figure for 1971 is 137 000 tons.

Region 3 (Table 3)

10. The total catch in Region 3 shows a slight increase in 1971. The catch of pilchard increased by about 50 000 tons from 1970 to 1971, but catches of other specified species declined. This is probably because Spain in its report of catches for 1971 may have included catches of these species in "unsorted and unidentified species".*)

B. REGION 1 FISHERIES

B.1 North-East Arctic Fisheries

B.1.1 Arcto-Norwegian Cod

11. In order to do its work properly the Council's North-East Arctic Fisheries Working Group needs much more reliable data for the most recent calendar year, in time for its meeting, than has been the case over the last few years. Final data for the 1971 landings showed considerable differences from the provisional data on which the last Report

*) See footnote on p.2

had to be based. These differences led to errors in the stock assessment. A similar position may occur again this year, since the figures for the 1972 catch are preliminary and perhaps even more uncertain than last year.

12. The estimate of the 1971 catch has been revised to 705 000 tons, an increase of over 88 000 tons from that given in the previous Report. According to the very preliminary figures for 1972 the nominal catch has decreased to 643 000 tons. The revised estimate of fishing mortality for 1971 is F = 0.63. This fishing mortality is too high to give the maximum sustainable yield. If the fishing mortality on the fully recruited age groups remains at the 1971-72 level in 1973-74, the total catches in these years are estimated to be 500 000 and 650 000 tons, respectively.

13. In earlier years the fishing mortalities have been overestimated. This bias has given estimates of the stock size which were too small, with a consequent underestimate of the predicted catches. At least some of the earlier discrepancies between the predicted catch and that subsequently recorded can be explained on this basis.

14. The strong recruiting year classes of 1963 and 1964 provided high catches in 1972 in the Division IIa fisheries, while the Sub-area I and Division IIb fisheries were relatively poor owing to the weak 1965-68 year classes. New information on the 1969 year class suggests that this was underestimated in the previous Report. The 1970 year class is still expected to be rich and information on the 1971 and 1972 year classes from the 0-group survey suggests them to be of above average strength.

15. The spawning stock will decrease year by year to a very low level in the mid-1970's. In 1976 it is expected to be about 1/40 of the stock size in the mid-1940's. Last year it was pointed out that the immediate and perhaps long-term future of the cod resource depends critically on the level of exploitation of the recruiting 1969-71 year classes. At low spawning-stock levels there are increased risks of poor recruitment. A sacrifice in the coming years, by reducing the amount of fishing on these recruiting year classes at the youngest ages, could make a significant contribution to the future size of the spawning stock and would also increase the overall yield from these year classes.

16. It appears that an average recruitment of 1200 million 3-year old might be produced by an optimum level of spawning stock such as that existing in the early 1950's. If the spawning stock is allowed to build up to this optimum size an annual yield from the fishery of more than 800 000 tons might be expected. With the same selection pattern as in 1971 this stock size could only be maintained with a much lower fishing mortality rate on the fully recruited age groups than the present ($F = 0.26$ against $F = 0.63$). However, the present selection pattern might not be the optimum one for the fishery. Even higher yields and a more rapid rate of recovery of the fishery might be obtained with either a lower fishing mortality rate on the younger fish and/or variation of fishing mortality according to year class strength.

B.1.2 Arcto-Norwegian Haddock

17. The provisional figures for nominal catches in 1971 given in the last Report were overestimated by 35 000 tons. The final figure for 1971 was 73 000 tons. According to the very preliminary figures for 1972 the total catch increased to 166 000 tons. The overall fishing effort deployed on haddock in 1972 was much the same as in 1971 and the fishery on the fully recruited age groups was as expected, but catches of 3-year old haddock (1969 year class) were greater than predicted. This year class appears to be stronger than expected, but this finding depends very much on the reliability of the age composition data for the 1972 catches. The 1970 and 1971 year classes are thought to be above average and the 1972 year class appears to be less abundant than the 1969-71 year classes.

18. On the assumption that the fishing mortality remains at the 1971-72 level, the nominal catches in 1973 and 1974 are expected to be 125 000 and 150 000 tons respectively.

B.2 Effect of Increase in Mesh Size

19. At its 1972 Meeting the Commission requested ICES to consider the effects on all species in Region 1 of increases in mesh size. This has now been done and the effects on cod, haddoock and redfish have been considered separately. It should be borne in mind, however, that the fisheries are not separate. In the U.S.S.R., for example, no distinction is made between cod and haddock in the catches. Moreover, the mesh size corresponding to a particular age at first capture differs between cod and haddock, being smaller for the latter.

B.2.1 Arcto-Norwegian Cod

20. Assuming the most recent pattern of fishing and fishing mortality and that the natural mortality is M = 0.3, the mesh assessments show a 30% increase in mature stock biomass per recruit for a mesh size corresponding to an age at first capture of five years (i.e. 220 mm manilla), but only a slight increase in total yield per recruit. Smaller increases in mesh size would give correspondingly smaller increases in mature stock biomass and total yield per recruit. These assessments depend, however, to a large extent on the values that are adopted for the mortality rates. Higher fishing mortalities on the younger age groups involve increased gains from an increase in mesh size. Differences between the present assessment and that made in 1969 result from the smaller fishing mortality rates used in the most recent study, and from differences in the mesh sizes corresponding to various ages at first capture caused by differing selection factors.

B.2.2 Arcto-Norwegian Haddock

21. Assuming the most recent pattern of fishing and fishing mortality and that the natural mortality is M = 0.2, the yield per recruit would increase with increasing age at first capture. An increase in mesh size to that corresponding to an age at first capture of five years (i.e. 190 mm manilla) would increase the yield per recruit by about 16%. The Division IIa fishery would benefit more than the Sub-area I and Division IIb fisheries from a mesh size increase. It is expected that a 68% increase in the mature stock biomass per recruit would be obtained by increasing the age at first capture to five years. Smaller increases in mesh size would give correspondingly smaller increases in mature stock biomass and total yield per recruit.

B.2.3 Iceland Cod

22. A mesh assessment on Iceland cod for an increase in mesh size from 130 to 140 mm (manilla) has been made on the basis of the length composition of the 1971 landings. These assessments show that the United Kingdom would have an immediate loss of 7% and a long-term loss of 2%. All other nations would have a smaller immediate loss and a long-term gain of at least 6 to 7%. It is known that mature East Greenland cod join the Icelandic spawning stock from year to year. The effect of this immigration could not be eliminated from the length composition of the total spawning stock. As a result this long-term gain in the catches of cod of Icelandic origin is underestimated. An increase in the mesh size from 130 to 140 mm in the Icelandic area would in the long term result in an increase in the total yield of this cod stock. However, the allocation of the total catch between the various fisheries would be changed.

B.2.4 Redfish

23. Because of lack of data no mesh assessment can be made. However, attention can be drawn to two factors affecting selection. Selection experiments at East Greenland have shown that the selection factor for Sebastes marinus decreases with increasing catches. In big catches there is nearly no selection. A further problem is the meshing which, according to the most recent observations, takes place during hauling. It depends on the mesh size and the length composition of the catches. The number of meshed redfish increases with increasing mesh size up to a size which corresponds to the most frequent length of the redfish. If the mesh size is then increased still further, the number of meshed fish decreases. If these findings hold true for Division IIa, where fishing for Sebastes marinus also takes place, meshing is at its greatest with the mesh size now in force and with a modal length of Sebastes marinus of 40.6 cm. An increase in mesh sizes in Division IIa would therefore decrease the rate of meshing. In other divisions an increase in mesh size would tend to increase somewhat the rate of meshing.

B.3 ICES/ICNAF Assessment of North Atlantic Cod Stocks

24. An ICES/ICNAF Working Group on Cod Stocks in the North Atlantic met in 1972 and integrated assessments for the various cod stocks with estimates of fishing effort and fleet structure through the decade 1960-70. This showed that the progressive increase in the range and mobility of the fleets, through technological improvement, has increased their overall efficiency to the level where all the available cod resources can be fully exploited by the fleet which was deployed on cod in 1970.

25. The data assembled were incorporated in a model which permits appraisal of the interaction between fisheries. Considering selected North Atlantic stocks as a single fishery unit, using the 1970 ratio of mobile to non-mobile effort, and assuming that recent recruitment levels are maintained, the Working Group concluded that:-

a. There is a probability that spawning stocks as low or lower than the present could lead to a recruitment failure and consequently to a very large drop in total catch. Taking this into account, and to some extent the economic benefits implied by an improved catch per unit effort, a desirable level of fishing mortality (effort) would be approximately half the present level. This would not affect the average long-term yield.

b. If such a reduction were achieved in a single year, then, given average recruitment, the cod catch would recover close to the current level after a transitional period of five years.

c. The same benefit could be achieved by a phased reduction involving less immediate disturbance to the catch, though it would perhaps take ten years to realise the full benefits.

d. If the displaced fishing effort remained fishing and could be redeployed on lightly exploited species, there would be an increase in the total catch of all species and a less severe immediate loss.

26. This conclusion applies to the North Atlantic cod resources as a whole; the effect on individual resources of a 50% reduction of fishing mortality would vary. But, if regulation of fishing mortality is applied to one or more stocks in the North Atlantic, it is now possible from the model to judge more exactly the effects that the diversion of fishing effort might have on other unregulated cod stocks.

27. The Report has been published as ICES "Cooperative Research Report", No.33.

B.4 Polar Cod

28. As shown in Table 1 the catch of Polar cod increased from 140 000 tons in 1969 to 347 000 tons in 1971. In 1972 the catches have decreased again to 147 000 tons. These large fluctuations in the catch reflect pronounced differences in the availability of the fish.

29. The Polar cod, Boreogadus saida, is a circumpolar species. It is distributed in the eastern and northern parts of the Barents Sea and around Spitsbergen. The Polar cod spawn for the first time at an age of 3-4 years. They are fished from an age of 2 years, but their highest contribution to the catches is at an age of 4-5 years. The stock is exploited by U.S.S.R. and Norway. The main part of the catches is taken by bottom trawl and only small quantities by purse seine and pelagic trawl.

B.5 Atlanto-Scandian Herring

30. The Council has not undertaken studies of the Atlanto-Scandian herring since it reported on this stock to the Commission in 1971. The stock is still in a critical state and shows no signs of improvement at all.

B.6 Capelin

31. The catches of capelin have gone up considerably during the last five years and reached a total of 1 870 000 tons in 1972. 1 600 000 tons of these were caught in the Barents Sea, mainly by Norway, while 270 000 tons were caught by Iceland in the waters around Iceland.

32. The Barents Sea capelin is subjected to a winter fishery when the mature stock approaches the coast to spawn, and to a summer fishery on the feeding grounds. Most catches are taken by purse seine, but during the spawning season the pelagic trawl is also used.

33. The Barents Sea stock of adult capelin in 1972 was estimated by acoustic surveys and observations of egg production to be about 10 million tons. Further calculations indicate that in 1973 the spawning stock will be greater than in 1972. The stock around Iceland is believed to be at a high level and the 1972 year class is estimated to be the strongest for several years.

34. To protect the capelin during its best growth period the Norwegian capelin fishery has been regulated by closing parts of the summer season in 1970-72. In 1972 the winter fishery was also closed for a short period after spawning had started. In addition, a minimum legal size of 12 cm was introduced in 1971, and this was changed to 13 cm in 1972. This measure protects the 1 and 2 year old fish. Regional and seasonal regulations are also enforced at Iceland in order to prevent fishing of immature capelin.

C. REGIONS 2 AND 3 FISHERIES

C.1 Herring Fisheries in Region 2

C.1.1 North Sea Herring

The Development of the Fishery in 1972

35. The preliminary figures for the catch show totals of 456 000 tons and 62 500 tons for the North Sea and Skagerrak respectively. As the preliminary catch figures tend to be too low, perhaps 10% should be added. This indicates a total North Sea catch of about 500 000 tons which is very close to that of 1971.

36. The main part of the catch, almost 60%, derived from the northwestern North Sea. In the northeastern North Sea the catch was negligible and, apart from the young herring fishery, the catch figures for the central and southern North Sea were about the lowest on record. 1972 is thus the third successive year in which the main part of the catch was taken in the waters north of Scotland, i.e. east and west of the Shetlands and Orkneys.

37. The catch in terms of numbers per age group for the last five years is given below.

Number of Herring (in millions) caught per Age Group (Winterrings)							
Year/Age	0	1	2	3	4	5 and older	Total
1968	839	2425	1795	1494	621	571	7746
1969	112	2503	1883	296	133	336	5264
1970	898	1196	2003	884	125	143	5249
1971	684	4378	1147	662	208	97	7177
1972x)	701	3117	1446	353	147	70	5834

x) preliminary figures

38. Despite the differences induced by varying year class strength, as shown by the case-history of the weak 1968 year class (0-group in 1969, 1-group in 1970, 2-group in 1971 and so on), the table demonstrates clearly the increasing importance of younger fish in the catch and a downward trend in the catch of the older age groups. Considering that about half the catch of the 2-group is taken before the fish has spawned for the first time, the figures indicate that about 70% of the total North Sea

catch in 1971-72 consisted of juveniles and maturing first time spawners. It should be noted that an important part of the increased catch of 1-groups in these years was apparently taken in the northwestern North Sea.

Possible Effects of Catch Limitation in 1971-72

39. In its last Report (p.26) the Liaison Committee presented a prognosis of future catch levels. The North Sea Herring Assessment Working Group has since corrected earlier data and considered new estimates of recent year class strengths. By the time of the Liaison Committee meeting the Group had yet to reach firm conclusions concerning the recent development of the fishing mortalities, but it appears that, under the previous assumption of a juvenile F = 0.5 and an adult F = 1.0, the prognoses of catch levels in 1972 underestimate the actual catch of juveniles and overestimate that of the adults.

40. Even if the 1969 year class may have been somewhat above average strength, the number of 1-group fish caught in 1971 exceeds those from the decidedly strong year classes of 1956 and 1963. This indicates that the fishing mortality of the juvenile part of the stock has increased and that the closures in 1971-72 did not affect the fishery for juveniles.

41. Subsequent to 1967 the fishing mortality of the adult part of the stock has been at F = 1.0. From the catch figures in 1972 an F of = 0.7 appears to be a more likely estimate. If this is so, the closures in force in 1972 may have resulted in some decrease in the fishing rate of the adult component. Alternatively, there may have been a reduced effort on adult herring because of low abundance and a resultant transference of effort, either to areas outside the North Sea or on to the juvenile component. Even if some reduction in the fishing rate of the adult component may have taken place in 1972 it should nevertheless be noted that F = 0.7 corresponds to the high level attained in 1965-67 when the fishery in the northern North Sea expanded.

Yields at Steady State Recruitment

42. The maximum sustainable yields of North Sea herring, with no fishery on juvenile herring, is obtained with a value of F = 0.4. Simulation under the assumption of a steady recruitment of 7.9×10^9 (being the calculated average for the 1947 to 1969 year classes) and different sets of constant mortalities shows the effects on juveniles and adults as illustrated on page 12:-

F. juv.	F. ad.	Catch	0	1	2	3	4	5	6 and older	Total
0	0.4	Nos. in millions	0	0	2036	1235	749	454	679	5153
		Weight in '000 t	0	0	254	225	155	103	170	907
0.4	0.4	Nos. in millions	295	2162	1311	795	482	293	450	5788
		Weight in '000 t	5	108	164	145	100	66	112	700
0.7	0.7	Nos. in millions	716	3117	1400	629	283	127	103	6375
		Weight in '000 t	12	156	175	115	59	29	25	571

The bottom row shows the steady state with what appears to be the more likely fishing mortalities at present, but because the fishery in this situation is heavily dependent on the youngest age groups (1 and 2), any succession of poor year classes, whether induced by natural causes or by a stock/recruitment relationship, would effectively eliminate the North Sea fisheries for adult herring.

State of the Stock in 1972

43. The Liaison Committee has examined the data on the state of the stock size and spawning potential. It appears that in 1948-50 the total biomass of the adult stock (2-groups and older) fished in the North Sea was about 3 million tons compared with the preliminary estimate for 1972 of about 400 000 tons, i.e. there has been a reduction of about 87%.

44. The mean annual egg production calculated over the period 1947-69 (corresponding to an average recruitment of 7.9×10^9 for the 1947-69 year classes) was 444×10^{12}. A preliminary estimate of the egg production in 1972 is 90×10^{12} which indicates a decline of 80%. It should be noted that this decline has taken place since 1965. Concerning the strength of the 1971 year class, first estimates suggest it to be well below average.

C.1.2 Celtic Sea Herring

45. Since 1966 the catch from the ICES statistical Divisions VII g-k has fluctuated around 30 000 tons, reaching a maximum of 48 000 tons in 1969. These catches are greatly in excess of the earlier estimate, based on

catch data up to 1962, of a maximum sustainable yield of about 18 000 tons. The average catch for 1956-62 was 18 000 tons with an instantaneous total mortality rate of about 0.5. The fishery at this time was mainly confined to the spawning areas off Dunmore, though towards the end of this period the summer offshore fishery (at Labadie Bank) began to expand.

46. The expansion of the fishery into the offshore feeding areas has also been accompanied by an expansion of the area fished in winter near the Irish coast. Because of the changing nature of the fishery there is no comparable series of catch per effort data covering the whole period from 1951 to the present. Gear used by the Irish and Dutch vessels has changed, while the Dutch vessels have also changed their fishing season.

47. While it is not clear to what extent the increase in total catch is associated with an increasing fishing mortality, it seems obvious that it is partly due to the following two factors:-

a) an increase in the stock consequent upon an increase of 86% in recruitment;

b) an increased rate of growth resulting in an increase in the average weight of the stock of about 30%. This as well as the increase in stock size will also result in an increased spawning potential.

48. It is concluded that, with the recent higher levels of mean recruitment and growth, the stock is at present being exploited at about the maximum sustainable yield (30 000 tons at an F = 0.4).

49. Owing to a complete lack of information on larval abundance, or the abundance of 0-group or other juvenile herring, it is impossible to forecast levels of recruitment and therefore to estimate future catches and stock sizes.

50. The Liaison Committee recommends that action should be taken as soon as possible to collect information for estimation of the strengths of incoming year classes from larval and young herring surveys.

C.2 North Sea Mackerel

51. The total catch of mackerel in the ICES Division IIIa and Sub-area IV decreased from 740 000 tons in 1969 to 250 000 tons in 1971 and to less than 200 000 tons in 1972. According to Norwegian tagging experiments, the mature stock of mackerel in the northeastern North Sea declined from 3.5 million tons in 1965 to about 0.5 million tons in 1971. In 1972 the spawning stock increased to about 1.2 million tons due to the recruitment of the very strong 1969 year class. The relatively low fishing mortality in 1972 was due to the conservation measures imposed on the Norwegian purse seine fishery.

52. The 1970 and 1971 year classes are both poor in strength, and only insignificant recruitment to the spawning stock can be expected in 1973 and 1974.

53. According to recent studies, the maximum sustainable yield may be obtained at a level of 30% annual fishing mortality. It is estimated to be 350 000 tons a year, maintaining a spawning stock of about 1.2 million tons. Fishing during winter and spring may reduce the maximum sustainable yield by up to 25% in weight, and even more if recruitment is influenced by the exploitation. A minimum legal size of 30 cm is found to be justified at the level of fishing mortality giving the maximum sustainable yield.

54. Norwegian tagging experiments carried out in the North Sea and in the area southwest of Ireland since 1970 have yielded information concerning the division of the stocks in the northern part of Subarea IV. They show that the fishery around Shetland exploits both the stocks of the North Sea and that spawning to the west of the British Isles. During the last 3 years about 20% of the catch from the area around Shetland has originated from the North Sea stock.

55. Since 1970 the Norwegian purse seine fishery for mackerel has been regulated on a national basis by (i) a minimum legal size (30 cm), (ii) a closed season (January - July), and (iii) annual catch quotas in order to reduce the mortality rate. The aim of the regulations in force in 1971 and 1972 has been to rebuild the spawning stock to the level at which the maximum sustainable yield is expected (1.2 to 1.5 million tons). This goal has now been achieved, and the future aim of a regulated fishing strategy will be to con-

trol the total effort as well as the seasonal distribution of effort according to the prognosis of maximum sustainable yield.

C.3 Irish Sea Whiting

56. At its 1971 Meeting the Commission requested ICES to investigate the Irish Sea whiting stocks, taking into consideration Recommendation 2(A) of the Convention. A re-appraisal of the situation in the Irish Sea has therefore been made.

57. By the 1970's the largest part of the landings of marketable whiting from ICES Division VIIa were being made by fishermen from N.Ireland, France and Ireland. In 1971 fishermen from these countries collectively landed 85% of the total catch for the area. Lesser landings were reported by Belgian, English and Scottish fishermen. The Belgian, French and English fisheries are located in the areas to the southwest of the Isle of Man and in the northeastern Irish Sea. The Irish fisheries are located mainly in the western part of the Irish Sea.

58. There has been a drop in the catch per unit effort in Division VIIa, especially since 1968, accompanied by a general decline in the relative importance of the landings of whiting for human consumption. For example, from 1965 to 1968, 16.3% of the total value of the catch of Northern Ireland came from whiting, but by the period 1969 to 1971, this percentage had fallen to 8.6%; and in the case of Ireland the drop was from 23.8% to 9.9%. In both Ireland and Northern Ireland the drop in the catch of whiting for human consumption has been to some extent the result of changing fishing patterns. For example, in the case of Northern Ireland there has been a marked increase in fishing for Nephrops in consequence of which whiting fishing has been reduced. In the case of Ireland some of the effort has changed to industrial fishing, and though whiting have been reduced to fish meal, ever decreasing quantities have reached the market for human consumption.

59. The justification for the "box" concession under Recommendation 2(A) was based on evidence that there was a large-scale spring emigration of one and two year old whiting from the east coast of Ireland to parts of the Irish Sea where they would be beyond the the range of Irish east coast fishermen. From the late 1960's the

character of the fleets has changed and most vessels can now cover the whole of the Irish Sea. Further, there is now good evidence to suggest that a considerable percentage of the fish which emigrate in spring do, in fact, return to the Irish east coast in the following autumn.

60. The conclusions of the Working Group which studied the matter may be summarized as follows:-

(a) The abolition of the 60 mm "box" and the use of 70 mm mesh (cod ends) throughout Division VIIa would result in

(i) a long-term improvement of 8 to 20% in the yield per recruit of whiting (under conditions of constant recruitment this level would be reached in five years).

(ii) an immediate loss of 25% by weight to the Irish autumn whiting fishery. Irish fishermen would benefit less than others in the long term. Adjustment of the present minimum size would not be necessary if the mesh size for whiting were to be increased.

(b) Recruitment of whiting to the fishery for human consumption would be improved by a reduction in the numbers of undersized fish taken in the course of fisheries using small meshed nets. The two relevant fisheries are:

(i) the Irish fishery for "industrial" fish, in which at certain seasons a large percentage of the landings consists of young whiting.

(ii) the fishery for Nephrops, in which considerable numbers of whiting are taken as by-catch. In this fishery, a large proportion of this by-catch is made up of undersized whiting which are rejected at sea.

(c) Any regulation of the small-meshed fisheries aimed at protecting whiting stocks by reducing the number of young fish caught would be of greatest benefit if applied in the autumn, since this is the time when the young fish are most available to capture.

(d) The existence of the "box" does not appear to have had any striking adverse or beneficial effect on the stock density of whiting in Division VIIa or to have affected the age composition of the stock.

C.4 North Sea Flatfish

61. At its Meeting in 1972 the Commission requested ICES to continue studies of flatfish stocks in the North Sea, to consider in particular (a) the effects of the increase in effort exerted by beam trawlers, and (b) the effect of a possible increase in the minimum size for plaice, and also to investigate, if possible, the mortality rate of discarded fish.

C.4.1 North Sea Sole Fisheries

62. Taking into consideration the increasing effort in the sole fishery, the Council's North Sea Flatfish Working Group carried out a study of the present state of the stock and on this basis predicted the expected catches and changes in stock size over the coming five years, starting with 1971, which is the latest year for which the necessary data were available.

63. The prediction was made on the assumptions that the natural mortality coefficient is 0.15 over the entire period and that the recruitment is the average of the last five years' recruitment. This latter assumption may not be realistic because it is known that there is a great variation in the level of recruitment to the sole fishery. The effects of the following seven different strategies were examined:

run 1 effort increased gradually over 5 years to reach a level at which fishing mortality (F) is 1.3 times that for 1971 (F_{71})

run 2 effort kept constant at the 1971 level

run 3 F reduced gradually over 5 years to 0.8 times F_{71}

run 4 F reduced gradually over 5 years to 0.6 times F_{71}

run 5 F reduced gradually over 5 years to 0.4 times F_{71}

run 6 F increased in 1 year to 1.3 times F_{71} and then kept at that level

run 7 F reduced in 1 year to 0.4 times F_{71} and then kept at that level.

64. Figure 1 (page 19) shows the changes in the pattern of the fishing mortality used in the seven runs.

65. Figure 2 (p.19) gives the expected catches for the next five years as a proportion of the 1971 catch (1971 catch = 1), and the total actual catch during the years 1968 to 1971 as a proportion of the 1971 catch.

66. Figure 3 (page 19) shows the expected change in stock size relative to the stock size in 1971 and hence the expected change in catch per unit effort.

67. All predictions, including the constant effort run (run 2), show a drop in the catch and the stock size for the next years owing to the decreasing influence of the very strong 1963 year class and the good 1969 year class. The present stock size can only be maintained by an immediate decrease in the fishing mortality to a level 40% of the present value. However, if effort is reduced gradually, by 1976 the catches will still be in the immediate loss phase and the stock will be below the 1971 level. The actual 1972 catch is approximately 10% below the catch in 1971.

Fig. 1

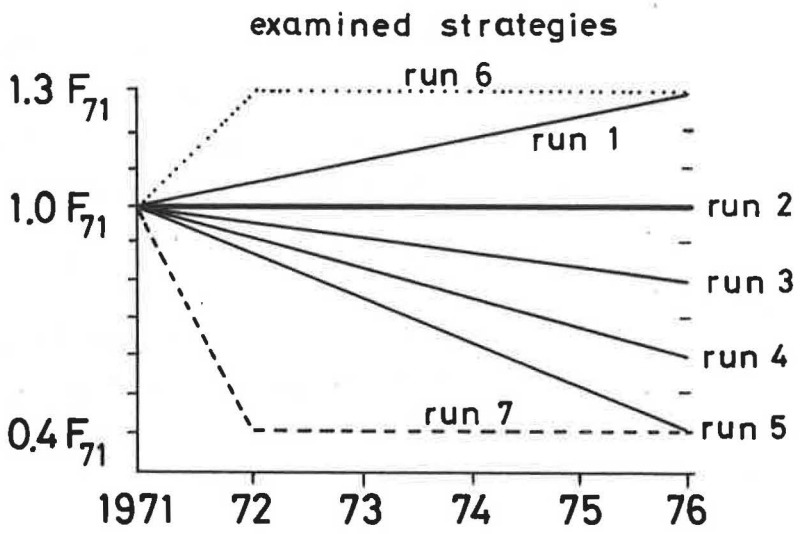


Fig. 2

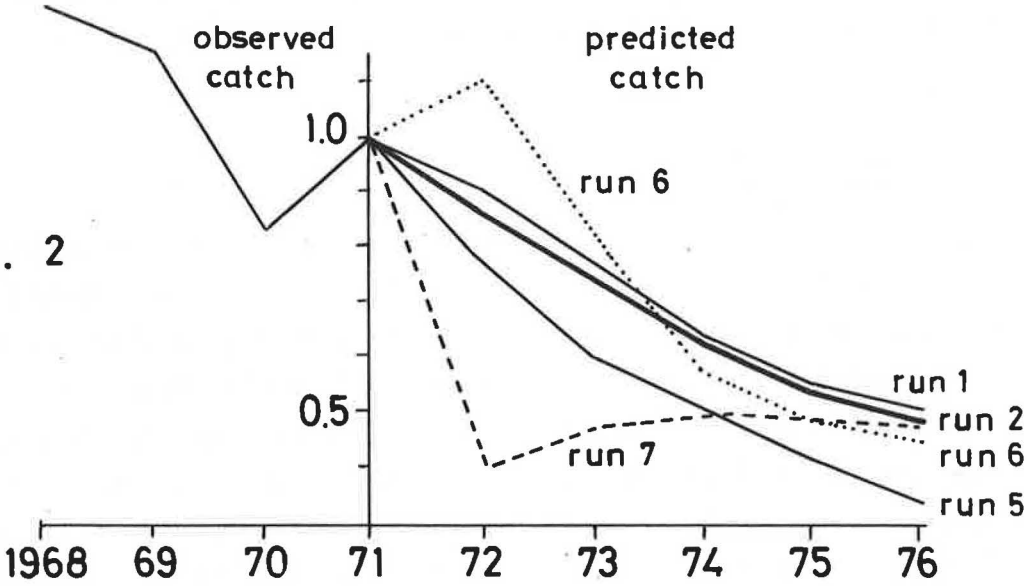
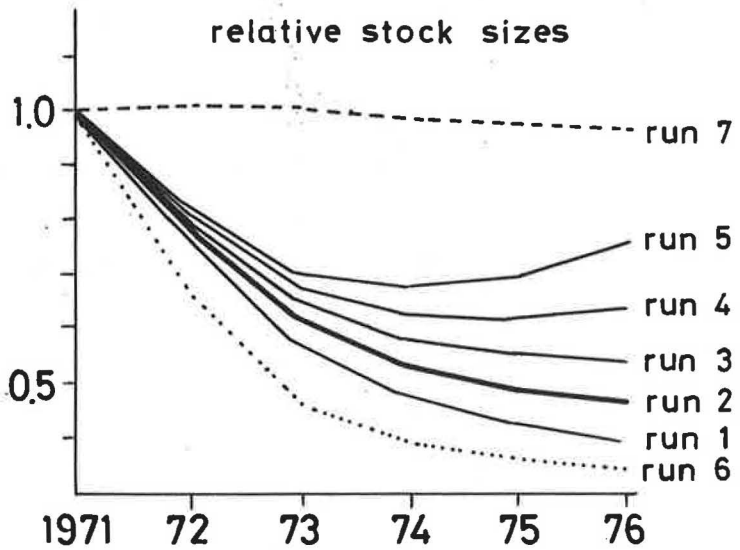


Fig. 3



C.4.2 Effect of an Increase in the Minimum Landing Size of Plaice

68. As stated by the Liaison Committee in its last report to NEAFC, landings of plaice in recent years differ substantially from the actual catch due to a very large discard, particularly in the Dutch sole fishery.

69. A moderate increase in the minimum landing size of the plaice could discourage future concentration of effort on small plaice, but would not change the present plaice discarding pattern in the Dutch sole fishery.

70. An increase of the mesh size would, if sufficiently large, eliminate the discarding altogether, but would affect the level of catch of several demersal species. This question has previously been analysed by the Council and will be taken up again.

C.4.3 The Mortality Rate of Discarded Fish

71. Discarded fish may die either as a result of damage caused by their being dragged over the sea bed in the net during fishing, or from the effects of exposure on deck or during sorting and handling of the catch. Two cruises in November 1972 by the Dutch research vessel "Tridens" showed that damage to plaice, sole and dab is related to the duration of the haul, the filling of the net and the weather conditions. Survival experiments in tanks revealed that increased damage led to increased mortality. Under the conditions prevailing, rather cold weather and rough seas, 40% of the plaice from hauls of 20 minutes' duration and 60% and 74% from hauls of one and two hours' duration respectively, would have died later if they had been discarded immediately. Analysis of the mortality data for sole and dab is proceeding.

C.5 Irish Sea and Bristol Channel Sole Fisheries

72. While it is not possible to make precise assessments of the state of these stocks because the necessary mortality rate data are lacking, there are strong indications that further increases in fishing effort are unlikely to result in markedly higher yields, if any, and that these would be accompanied by large falls in catches per unit effort. Increased exploitation would also reduce the number of year classes present and make the fishery dependent on the incoming recruit year classes.

73. The sole fishery in the Irish Sea and the Bristol Channel is to some extent affected by the North Sea sole fishery. Any surplus effort from the latter is likely to be deployed in the former. In view of the limited size of the Irish Sea and Bristol Channel stocks, this surplus effort will have a marked effect and thus any regulation of the North Sea sole fishery should not be undertaken without consideration being given to similar regulation of the Irish Sea and Bristol Channel fisheries.

C.6 Hake Fisheries in Regions 2 and 3

74. In 1969 the Council reported to the Commission on assessments of the effects of increases in mesh size to 60, 70 and 80 mm for the various categories of hake fisheries in ICES Sub-areas VI, VII, VIII and IX as a unity. All these assessments were made on the assumption that any fish released by an increase in mesh size would ultimately become equally available to all vessels. The Liaison Committee stressed that this assumption was unlikely to hold, and that background information (sampling) was highly inadequate.

75. The Council's Hake Working Group reconvened in February 1973 to bring up to date its previous assessments, to study the effects of the closed areas in the Bay of Biscay, and to formulate a joint programme of research on the hake.

76. As at the 1969 Meeting, the Working Group was again unable to treat the fishing areas separately due to lack of detailed statistics; consequently Sub-areas VI, VII, VIII and IX were treated as a single entity. Assessments have, however, been made both on the previous assumption that all fish released were equally available to all vessels, and also on the assumption that the fish are stationary so that any benefit from a release of fish will accrue to the vessels that have spared them.

Review of Landings and Effort

77. Total landings of hake have remained rather stable at around 70 000 tons over the last 6-7 years. French effort more than doubled in the 1955-71 period, while English effort has remained low. No estimates of recent trends in Spanish effort are available. Catch per unit effort for France and England has been rather steady since 1966 but at a level approximately 1/3 of the 1961 level.

Assessment

78. New estimates of mortalities and updated figures for length composition, discards and mesh sizes in use have been taken into account in the new assessments. It should be noted that, although the results appear to be given by very exact figures, the basic information for the assessments, especially information on length and age distributions, is highly inadequate.

79. The following values for mesh sizes in use in 1970-72 were adopted:

French "artisans"	40 mm
French "hauturiers" and semi-industrial	63 mm
Portugal	43 mm
Spain	55 mm
U.K.	80 mm

Assessments were then made for an increase of mesh size to 50 mm for "artisans" (the legal mesh size for Nephrops fishery), and to 65 mm for other vessels (the legal mesh size in Region 3).

80. The immediate loss by weight for an increase in mesh size to 50 mm for French "artisans" would appear to be about 6%, while an increase to 65 mm (from 63 mm) for French "hauturiers" would result in a negligible immediate loss to these vessels. For Portugal an increase to 65 mm would mean an immediate loss of about 23%. U.K. already uses mesh sizes bigger than 65 mm and it is not relevant to speak about an immediate loss in this case.

81. The long-term effect depends heavily on the assumptions mentioned above.

82. Assuming that fish released spread uniformly over Sub-areas VI-IX to benefit all gears, the benefit to U.K. vessels and to French "hauturiers" would be about 16% each, to French "artisans" about 10% and to Spanish vessels about 7%, whereas Portugal would have a loss of about 11%.

83. Assuming that the fish are stationary and after release only benefit the gear that released them, for U.K. vessels, and for French "hauturiers" there would be neither long-term gain nor loss, whereas Spain would gain about 7%. For French "artisans" and for Portugal the effect would be a small (1%) loss and a small (1%) gain respectively.

84. For both assumptions the overall effect would be a long-term gain of about 7%. However, it should be noted that basic data have been chosen so that all gains mentioned are likely to be underestimates. It is highly important to obtain knowledge about the degree of interchange between the hakes in the various fisheries. This would indicate whether one or the other or neither of the basic assumptions for the present assessments is valid. The Council will initiate further research.

The Effects of the Closed Areas in the Bay of Biscay

85. Since January 1, 1970, two areas in the Bay of Biscay have been closed to fishing as a measure for protecting hake nursery grounds.

86. Analyses of commercial catch per unit effort figures and especially of the results of French research vessel surveys of the distribution of young hake led the Working Group to draw the following conclusions:-

a) the closed areas are too small to be effective;

b) the northern area, at least, is situated some distance to the west of the area of the greatest concentration of young hake and is therefore less effective than it might have been;

c) any benefit that might accrue from the adoption of closed areas could be more effectively achieved by an increase in mesh size.

C. 7 Pandalus Fisheries

87. In 1972 the Council set up a Working Group to attempt to assess the Pandalus stocks in the ICES area. This met in May 1972 and a new meeting is scheduled to take place in March 1973.

88. At its first meeting the Working Group did not succeed in assessing the effect of the fisheries on the Pandalus stocks, due to lack of sufficient data and knowledge about the biology of the Pandalus. It agreed on a sampling scheme and on programmes for further studies which may lead to an improvement of the basis for future assessments.

D. NORTH ATLANTIC SALMON

89. At its meeting in March 1972 the Joint ICES/ICNAF Working Party on North Atlantic Salmon reviewed the latest information available about the long-line fishery for salmon in the Norwegian Sea and made further assessments of its effects. They also discussed and approved the final plans for the International Salmon Tagging Experiment to be conducted by member countries of ICES and ICNAF at West Greenland in 1972.

90. The regulatory measures which were adopted by NEAFC at its Annual Meeting in 1970, and which came into force on 1 January 1971, affected the catches in 1971 in several respects. These measures included a closed season, closed areas, a minimum size for salmon caught and a minimum hook size.

91. The catch in the Norwegian Sea in 1971 (estimated at 488 metric tons) was about half that in 1970 (estimated at 958 metric tons) and the fishing effort was lower in 1971. On the basis of Danish catch data, the proportion of one-sea-winter fish (15-20% of the catch, 15% of the landings) was found to be higher in 1971 than in 1970, when they formed 10% of the catch. The application of a closed season and, probably, closed areas, were factors affecting this change. No commercial salmon fishing was conducted near the Faroes in 1971.

92. The records for 1971 indicate that, as in previous years, most of the salmon fished in the Norwegian Sea originated from and returned to Norwegian rivers, though some recaptures were recorded from rivers in the U.S.S.R. During the spring of 1969, 1970 and 1971 a total of 666 salmon were tagged near the Faroes. 29 recaptures have been reported; 15 in Scotland, 5 in Norway, 5 in Ireland, 2 at West Greenland and 1 each in England and Wales and the U.S.S.R. Most of the recaptures were made in the year of tagging.

93. Assessments were again made of the effect of the Norwegian Sea fishery on the total yield (Norwegian Sea plus home waters) and on home water stocks and catches. The former indicated that in 1971, as in 1970, the Norwegian Sea fishery resulted in a larger catch of two-sea-winter salmon than would have been taken in its absence. As the long-line catch in 1971 was substantially less than that in 1970 and 1969, the estimated losses to home-water stocks and catches were correspondingly smaller.

It was estimated that, in 1971, the loss to home-water stocks was about 400 metric tons, and the loss to the home-water catch between about 200 and about 300 metric tons.

94. In the course of the International Salmon Tagging Experiment at West Greenland, carried out during August, September and October 1972, 2 364 salmon were tagged and up to 10 January 1973 124 recaptures had been recorded, all in Greenland waters.

E. EFFECTS OF TRAWLS AND DREDGES ON THE SEA-BED

95. Following a request from the Commission the Council has invited its member countries to carry out investigations of the effect of trawl and dredges on the sea-bed. A number of papers on this item were submitted to the ICES Statutory Meeting in 1972 and were considered by the Council's Gear and Behaviour Committee. The Chairman of this Committee has prepared a summary of these documents, which is appended to the present Report (see Annex 5). It is recognized that the mechanical effects of a fishing gear bear on those biological resources of the sea-bed which are disturbed, particularly the benthos. It has therefore been decided that the Shellfish and Benthos Committee should consider this summary in collaboration with the Gear and Behaviour Committee at the Council's Statutory Meeting in 1973.

F. OTHER ITEMS

F.1 Danish Whiting Fishery in Skagerrak and Kattegat

96. The following data on whiting caught by Danish vessels in the Skagerrak and Kattegat comprise catches from all Danish Recommendation 2 (mixed) fisheries, as well as from the Recommendation 6 fishery.

Landings (in metric tons) of whiting for industrial purposes

Year	Skagerrak	Kattegat	Total
1966	13 561	5 755	19 316
1967	13 643	15 719	29 362
1968	19 155	9 863	29 018
1969	11 335	4 247	15 528
1970	6 545	6 315	12 860
1971	4 390	8 989	13 379
1972	5 712	8 153	13 865

97. The percentage composition of species in samples taken from landings in Skagen throughout 1972 is shown for the industrial fisheries and for the industrial by-catch in the fisheries for deep-sea prawns and Norway lobster:-

Species	Industrial Fisheries	By-Catch in Prawn and Lobster Fisheries
Herring	61.7	2.0
Other Rec. 2 Species	16.3	54.5
Whiting	11.7	4.5
Rec. 4 Species	4.5	5.5
Other Species	5.8	33.5
Catch in Tons	112 040	17 180

F.2 Planned Studies of Coalfish Fisheries (in relation to Protection by Minimum Size Measures)

98. At its meeting in 1972 the Commission requested ICES to review the regulation of minimum sizes for fish in order to facilitate considerations of the need to bring further species under the protection of minimum size measures.

99. This question has been specifically related to the increasing catches of coalfish (saithe) during the recent years. Thus the Council has reconvened its Working Group on Coalfish (Saithe) in order to assess the present state of the stocks within the NEAFC area and to evaluate the desirability of including saithe in the Recommendation 4 fisheries.

100. The Working Group will hold its first meeting on 9 - 14 April 1973.

F.3 Publication of the 1972 Report

101. The Report of the Liaison Committee for 1972 has been published as ICES "Cooperative Research Report", No.31.

Table 1. Nominal catch (in 000's metric tons) by Sub-areas and main species in NEAFC Region 1.

	1964	1965	1966	1967	1968	1969	1970	1971
Total Nominal Catch in Region 1[x]	3 429	3 900	4 386	4 125	3 679	3 677	4 245	4 193
Sub-areas I and II (North-East Arctic)								
Pelagic Fish								
Herring	870	1 169	1 520	1 627	700	62	62	22
Capelin	20	222	389	408	538	680	1 314	1 392
Others	4	9	7	6	8	4	4	3
Total Pelagic Fish	894	1 400	1 916	2 041	1 246	746	1 380	1 417
Demersal Fish								
Cod	468	480	557	619	1 102	1 224	944	724
Haddock	87	106	130	95	156	146	85	80
Polar Cod	...	...	...	...	...	140	243	348
Saithe	198	186	203	181	110	133	236	224
Redfish	66	40	35	24	18	30	29	44
Flatfish	53	43	37	33	32	52	83	108
Others	64	59	56	52	56	60	74	80
Total Demersal Fish	936	914	1 018	1 004	1 474	1 785	1 694	1 608
Total Catch of all Species	1 830	2 314	2 934	3 045	2 720	2 531	3 074	3 025
Sub-area V (Iceland and Faroes)								
Pelagic Fish								
Herring	640	628	492	145	37	30	19	14
Capelin	9	50	125	97	78	171	192	183
Others	1	-	1	1	1	-	-	1
Total Pelagic Fish	650	678	618	243	116	201	211	198
Demersal Fish								
Cod	460	421	381	371	414	443	503	481
Haddock	118	117	79	73	69	70	66	66
Saithe	82	82	78	97	98	144	142	165
Redfish	103	120	110	100	103	88	80	84
Flatfish	23	28	26	41	33	38	33	29
Others	55	58	47	53	61	69	53	64
Total Demersal Fish	841	826	721	735	778	852	877	889
Total Catch of all Species	1 491	1 504	1 339	978	894	1 053	1 088	1 087
Sub-area XIV (East Greenland)								
Total Catch of all Species	81	58	80	60	40	50	40	63

x) Including non-teleost fish, unsorted and unidentified species

Table 2. Nominal catch (in 000's metric tons) by Sub-areas and main species in NEAFC Region 2

	1964	1965	1966	1967	1968	1969	1970	1971
Total Nominal Catch in Region 2[x]	3 005	3 471	3 638	3 912	4 262	4 043	4 071	3 960
Sub-area IV and Div. IIIa (North Sea and Skagerrak)								
Pelagic Fish								
Herring	1 206	1 469	1 191	1 069	1 139	838	834	735
Mackerel	115	208	530	931	821	739	322	243
Sprat	76	79	111	76	70	69	58	100
Others	7	14	9	10	7	9	19	38
Total Pelagic Fish	1 404	1 770	1 841	2 086	2 037	1 655	1 233	1 116
Demersal Fish								
Cod	136	194	235	270	303	212	239	339
Haddock	199	223	270	169	140	640	673	260
Whiting	113	125	175	122	174	216	195	126
Norway Pout	97	68	65	194	486	151	290	385
Saithe	58	73	90	76	102	109	172	213
Sandeel	132	141	180	209	201	115	195	404
Plaice	133	110	109	115	126	135	145	133
Sole	12	17	32	34	29	28	20	24
Other Flatfish	24	26	26	32	32	21	18	22
Others	46	53	42	39	33	35	27	32
Total Demersal Fish	950	1 030	1 224	1 260	1 626	1 662	1 974	2 038
Total Catch of all Species	2 354	2 800	3 065	3 346	3 663	3 317	3 207	3 154
Sub-areas VI and VII (west and south of British Isles)								
Pelagic Fish								
Herring	90	90	131	143	142	192	230	295
Mackerel	27	22	46	39	40	45	65	87
Sprat	7	8	5	4	8	8	14	9
Others	14	7	6	6	5	21	80	58
Total Pelagic Fish	138	127	188	192	195	266	389	449
Demersal Fish								
Cod	35	41	41	48	45	46	29	32
Haddock	44	43	41	29	25	33	41	54
Whiting	39	47	45	53	44	39	28	32
Hake[xx]	20	42	15	17	18	13	14	21
Flatfish	29	32	37	33	30	32	31	32
Others	48	74	40	50	60	86	77	98
Total Demersal Fish	215	279	219	230	222	249	220	269
Total Catch of all Species	353	406	407	422	417	515	609	718

x) Including non-teleost fish, unsorted and unidentified species.

xx) The hake statistics are unreliable. Part of the catch is reported by landing port and not by fishing area.

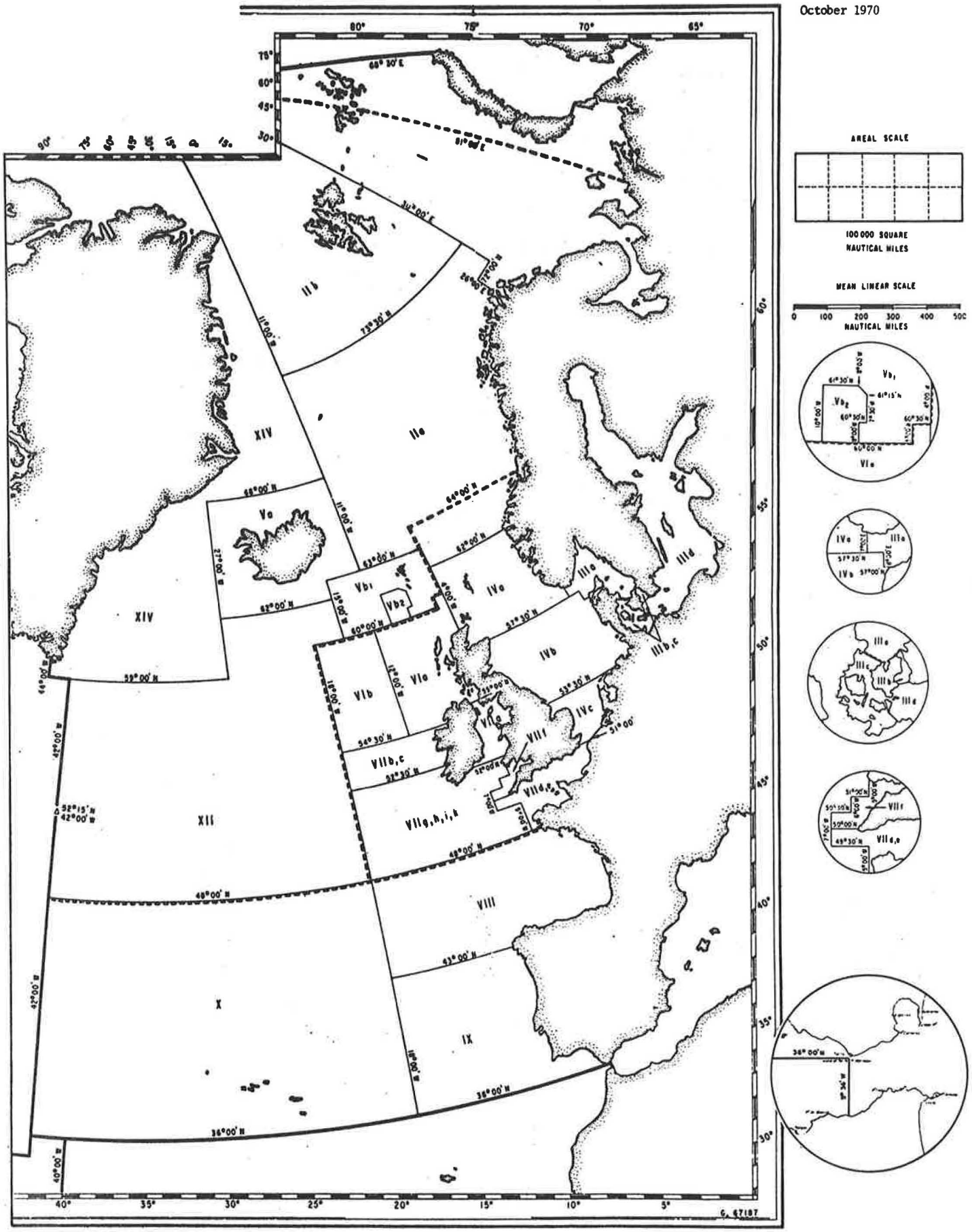
Table 3. Nominal catch (in 000's metric tons) by main species in NEAFC Region 3.

	1964	1965	1966	1967	1968	1969	1970	1971
Total Nominal Catch in Region 3[x)]	890	899	811	824	780	766	785	842[x)]
Pelagic Fish								
Pilchard	252	225	215	199	164	151	136	184
Mackerel	29	56	44	56	43	49	82	46
Horse-mackerel	125	116	100	116	138	136	163	85
Others	181	226	162	162	126	117	107	79
Total Pelagic Fish	587	623	521	533	471	453	488	394
Demersal Fish								
Hake [xx)]	105	75	89	98	89	83	100	37
Others	98	108	108	111	118	111	108	83
Total Demersal Fish	203	183	197	209	207	194	208	120
Grand Total	790	806	718	742	678	647	696	514

x) Including non-teleost, unsorted and unidentified species.

xx) The hake statistics are unreliable; part of the catch is reported by landing port and not by fishing area.

October 1970



ICES and NEAFC Fishing Areas