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REPORT OF WORKING GROUP ON INTERNATIONAL YOUNG FISH SURVEYS IN THE NORTH SEA, SKAGERRAK AND KATTEGAT

Copenhagen, 9 - 15 January 1985

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1. TERMS OF REFERENCE AND PARTICIPATION

At the 1984 ICES Statutory Meeting, both the Pelagic Fish Committee and the Demersal Fish Committee adopted the following resolution (C.Res. 1984/2:8):

"(i) The present Working Groups on "North Sea Young Herring Surveys" and the "International Gadoid Survey Working Group" be combined into one Working Group with the overall task of coordinating the international young fish surveys, will be called "Working Group on International Young Fish Surveys in the North Sea, Skagerrak and Kattegat" (Chairman: Mr. A Corten) and will meet at ICES headquarters from 9-15 January 1985 to consider the following items:

- standardisation of fishing and sampling methods, including fishing gear,
- evaluate the usefulness of survey indices as recruitment estimates for various species,
- area coverage and sampling intensity for various species,
- the need for additional autumn surveys for gadoid species,
- data exchange, analysis and reporting,
- evaluate the progress made in establishing a central Young Fish Survey Data Base at ICES headquarters,
- collection of environmental data in conjunction with the survey.

(ii) The Working Group will report to the 1985 Statutory Meeting;

(iii) All participating countries are urgently requested to make available (if they have not done so already) data on tape for the 1983 and 1984 surveys to ICES before 1st December 1984."

The meeting was attended by the following:

T W Boon	United Kingdom
A C Burd	United Kingdom
A Corten (Chairman)	Netherlands
N Daan	Netherlands
O Hagström	Sweden
H J L Heessen	Netherlands
J Lahn-Johannessen	Norway
N A Nielsen	Denmark
A Saville	United Kingdom
A Souplet	France
H Sparholt	Denmark
G Wagner	Federal Republic of Germany

Mr. K Hoydal, ICES Statistician, also attended the meeting.

Mr. P Munk, Denmark, Mr. W Panhorst, ICES, and Dr. H Dooley, ICES, participated partly in the meeting.

2. INTRODUCTION

The present Working Group combines the tasks of the two earlier Working Groups mentioned above, and also the task of the Study Group on Computerisation of IYFS Data. The subjects to be addressed by the present Working Group, therefore, were very diverse, ranging from an evaluation of survey results for the various fish species, methodology used in the various kinds of sampling, to the analysis of data and reporting of results. Because of the limited amount of time and specialists' knowledge available to the Group, it was obvious that not all subjects could be treated in the same depth. The evaluation of survey results for particular species will also be considered by the relevant Assessment Working Groups. Technical problems concerning fishing gear may need further attention by the Fish Capture Committee or national laboratories, and a detailed statistical analysis of data available at the ICES data base is a specialists' job, to be done outside the scope of this meeting.

The primary task of the present Working Group is to make sure that the effort provided by all participating countries is coordinated in an optimum way; that fishing and sampling methods are standardised as much as possible, and that a proper order of priorities is set in distributing sampling effort over various programmes, species and areas. In order to decide on a proper order of priorities, some evaluation must be made of the results and prospects that the survey offers for various fish species. This evaluation of survey results is presented in Section 3.

Section 4 presents a brief review of other groundfish surveys that are regularly conducted in the North Sea. The purpose of this review is to see whether there is a duplication of effort between the IYFS and these other surveys, and whether other surveys for some species provide better recruitment forecasts than the IYFS. It is important to note that the IYFS is primarily a young fish survey, whereas some of the other surveys are aimed at estimating overall biomass. The fact that the IYFS is aimed primarily at forecasting recruitment has a distinct bearing on methods used, priorities set in sampling, and in the reporting of results.

In reporting survey results the timely availability of data has been a major bottleneck for the last two years. In 1982, the Study Group on Computerisation of IYFS Data recommended that in 1983 countries should try and send their results on exchange file tapes to the IJmuiden Institute as an alternative to the usual hand-written forms. However, the exchange of data by magnetic tape turned out to cause more problems than had been envisaged, and the preparation of error-free tapes was in some cases seriously delayed. Moreover, when countries had chosen for exchange by magnetic tape, in most cases they stopped sending hard copies in the traditional format to IJmuiden.

During the Council Meeting in 1983 ICES decided that a data base for the entire IYFS data set should be set up at headquarters and that the Secretariat should take over the responsibility from the IJmuiden Laboratory, for checking tapes and in the end also for the primary analysis. However, during a transition period the latter institute should be provided with the necessary

data to carry out fall-back analyses. The split responsibilites resulted in some confusion and further delays originated due to changes in the species codes to be used on the tapes. The ultimate effect of all this was that both in 1983 and 1984 insufficient data collections were available in IJmuiden to prepare the annual reports to the ICES Statutory Meeting.

The present meeting of the Working Group was convened in Copenhagen in view of the facilities that were expected to be available from the ICES data base at the time of the meeting. As it turned out, only a limited amount of data from the 1983 and 1984 surveys had actually been loaded into the data base (Table 6.2), and also the data base itself was inaccessible during the meeting because of technical problems. Therefore, it unfortunately limited the possibility to demonstrate the use of the present ICES data base.

3. EVALUATION SURVEY RESULTS

3.1 General Problems concerning Calculation of Survey Indices and the Use of these Indices in Predicting Recruitment

In using abundance indices of juvenile fish for predicting recruitment, two general problems are encountered. The first question concerns the calculation of an overall abundance index for the total survey area (or part of it) for each species: are the hauls grouped by rectangle or larger sub-area? are numbers per haul transformed in logarithms, and at what stage in the calculation? how is the variance of index estimated? what standard area is used to calculate the survey index?

The second question concerns the relationship between the survey index and the population parameter one tries to predict; this normally is the VPA-estimate of recruitment at a certain age, but it may also be the total annual or seasonal catch. The choice here is between predictive regression, functional regression, regressions through the origin, curvi-linear regression, etc.

Various Stock Assessment Working Groups in the past have already given considerable thought to both types of questions. In addition, the ICES Working Group on Methods of Fish Stock Assessment has studied these problems during its recent meeting (Anon., 1984a). The conclusion of the above Working Group was that the choice of a method for either calculating survey indices, or for regressing the survey indices against other estimates of recruitment, depended very much on the statistical properties of the different indices for each individual species.

For a thorough examination of the statistical properties of the survey indices for various species, one should have access to a complete set of historical data in the data base. Because of the limited use that could be made of the data base during the present meeting, it was clearly impossible to do such an analysis. The Working Group, therefore, decided to postpone the relevant statistical studies until the time when sufficient data have been assembled in the data base. Such studies can then be conducted by individual scientists that have access to the data base, and who should report to future meetings of this Group.

At the present meeting, the effect of a log-transformation of survey indices was tested for some of the species investigated. The results (Sections 3.2.2 - 3.2.4) show that this sort of transformation may improve the

relationship between survey index and VPA-recruitment for some species, whereas it spoils the existing relationship for others. These results confirm that in the end different methods for calculation of survey indices and regressing these against VPA-estimates may be advisable for different species.

3.2 Results by Species

The purpose of this section is to illustrate the present significance of the survey for the assessment and management of various species, and to indicate prospects for increased application of survey results in future. For each commercial species sampled during the survey, an updated series of one or more survey indices is presented, together with a time series of population parameters to which the survey indices can be related. For each species, the most promising set of survey indices and stock parameters is used to calculate a regression equation that may be used for prediction purposes.

3.2.1 Herring

A. Herring in the North Sea

In the report of the Herring Assessment Working Group for the Area South of 62°N in 1984 (Anon., 1984b), it was remarked that the regression equation used in estimating the strength of recruiting year classes from the indices of abundance of 1-ringed fish derived from the IYFS, was based on the 1958, 1959 and 1968-1974 year classes and that it might be advisable to update it by including some of the more recent year classes. The opportunity to do so was taken during the current meeting of the Working Group on International Young Fish Surveys. The basic data are given in Table 3.2.1. The abundance indices from the IYFS are identical to those given in Anon., 1984b. It should be noted that the indices for the 1981 and 1982 year classes are both still preliminary, due to delays in obtaining outputs from the ICES data base, which is currently being set up to access these data. Any resulting changes in these indices, however, are likely to be minor. The estimated sizes of the corresponding year classes as 1-group, from VPA are also given in Table 3.2.1.1. Those for the year classes 1972-1980 are taken from Anon., 1984b and for earlier year classes from Anon., 1982a. It would have been preferable to have taken all values from a single VPA extending backwards to 1960. But any error arising from the procedure adopted will be minor, as in the 1982 VPA the estimates for the 1972 and 1973 year classes are only 4% and 11%, respectively, higher than those given here from the 1984 VPA.

The data are plotted in Figure 3.2.1.1 for the year classes 1958-1980. In Anon.,1984b it was suggested that in updating the previous regression equation it might be advisable to reject some of the earlier year classes and incorporate some of the more recent ones. This was because it was thought that increases in the efficiency of sampling might have affected the comparability of earlier indices with those from more recent years. Figure 3.2.1.1, however, does not suggest that any changes in gear, ships, etc. have had this effect. Moreover, although the VPA estimates of year class strengths of the 1980 and 1979 year classes are highly dependent on the input F to the 1984 VPA, their relationship to their IYFS index is obviously very similar to those of earlier year classes. Accordingly, a regression equation was estimated for all of the year classes 1958-1980. This is shown in Figure

3.2.1.1; it is significant at the 0.1% level. This new regression equation, $\hat{Y} = 0.0029X - 0.12$, is not appreciably different from the one $\hat{Y} = 0.0031X - 0.21$, previously used by the Herring Assessment Working Group in the functional form, or from the predictive form $\hat{Y} = 0.0028X - 0.16$ based on the same data set.

As the intercept of the new equation given above is not significant, it has been forced through the origin, as recommended in the Report of the Methods Working Group (Anon., 1984a), with the amended slope, estimated by $\Sigma xy/\Sigma x^2$, of 0.0028.

The outputs from the IYFS have played a major part in the assessment of the North Sea herring Stock, and in producing advice on its management, for many years. In particular in the years immediately prior to the closure of the fishery in 1977, when the catches were very dependent on the recruiting year class, and during the period of the closure when recovery of the stock was conditional on recruitment of stronger year classes, the ability to provide sound, real-time, management advice was very dependent on the outputs provided by IYFS. Undoubtedly, the advice on re-opening the fisheries would have had to be delayed for at least one further year in the absence of these data.

Since 1977, sampling of late herring larvae has also been carried out in the North Sea, using an Isaac-Kidd mid-water trawl, in the hope that these data may provide an even earlier indication of the strength of a year class. Sampling coverage and intensity have progressively increased over the period 1977-84, so the data series currently available is probably not strictly comparable over the entire period. Moreover, since the 1980 year class is the last one whose strength can be measured at all precisely from VPA, the data series is, as yet, too short to evaluate these data precisely. The indications are, however, that they are likely to be of considerable value in providing an estimate of year class strength one year earlier than is currently possible, to the northern and central North Sea stocks. Of the seven year classes sampled to date using this technique, those of 1976-1978 were very scarce in the IKMT samples and recruited in very low numbers to the northern and central North Sea stocks. The year classes 1979, 1980 and 1981 were abundant in the IKMT catches and recruited more strongly than preceding year classes to the northern and central North Sea stocks. The preliminary results suggest the technique has considerable potential in providing management advice and accordingly in Sections 5.2 and 5.3 of this report further advice is given on improving the sampling coverage and techniques using this gear. Consideration will also be given to deriving appropriate annual abundance indices from these data.

B. Herring in Division IIIa

The use of indices and validity

The indices of 1-group herring in Division IIIa are given in Table 3.2.1.2.

The indices have not been used for predicting the recruitment to the herring stocks in this area, the main reason being that the indices reflect the abundance of both indigenous spring spawners and autumn spawners from the North Sea. It is for the same reason not possible to compare the indices with the VPA.

However, the indices could be regressed against the catch of the same year classes as 0-group and 1-group in the area.

The catch data are shown in Table 3.2.1.2, and the regressions are given in Figures 3.2.1.2 and 3.2.1.3. Both regressions have a very high correlation coefficient of 0.93 and 0.94 respectively, and the intercepts are not significantly different from zero and the regressions have been forced through zero. The regression equations are given in the table.

How to improve the use of the indices

To be able to use the indices for assessment purpose, separate indices for spring spawners and autumn spawners are needed.

It has been show by Hagström (1984) that it is possible to use differences in the length frequency distribution to split the 1-group herring into components which will have mean vertebral counts within the observed ranges for spring spawners and autumn spawners respectively. The new indices are given in Table 3.2.1.3.

The new indices are not directly comparable with the combined indices as the former includes all rectangles sampled and are calculated as arithmetic means and weighted by areas.

The VPA and prognosis carried out hitherto have only included 2-group and older herring which are exclusively spring spawners.

The IYFS spring-spawner index will provide a possibility to tune the VPA. A further improvement in the assessment of the herring stocks could be achieved if the commercial catches of spring spawning 0- and 1-groups were included in the VPA. The same method used to split the 1-group herring index could be applied.

3.2.2 Cod

In 1969 and 1970, 1 989 and 1 986 rectangles were fished respectively in the IYFS which was then basically directed at herring studies. Coverage increased in 1971 and 1972 from 105 to 122. Subsequently, the annual sampling has varied between a minimum of 121 in 1973 to 163 in 1977. The average over the period 1974-83 was 153.

The International Gadoid Survey Working Group, using the year class estimates of 1-group cod from 1964-75 and the VPA based on the age compositions given in the Roundfish Working Group (Anon., 1979/G:7), showed a significant correlation between these two indices. It also defined a subset of 144 rectangles for calculation of abundance indices for cod. The International Gadoid Survey Working Group in 1981 considered the methods of calculating rectangle means and the overall abundances. They rejected log-transformation and proposed the use arithmetic means for correlation with VPA. Eleven years were considered in this analysis (surveys in 1969-80) and the indices were correlated with VPAs from a completely revised data base of catch inputs. The correlations over the 8 year classes 1969-76 were not significant for 1-group but significant for the 2-group.

In 1983, the International Gadoid Survey Working Group again met to examine the survey material to "develop methods whereby the results from these surveys and any other relevant surveys can be treated to give improved re-

cruitment indices" (C.Res. 1982/2:24). Again the problem with cod was a major task of the Group. It considered the year classes 1968-1981 and devised a number of new methods for calculation of indices and their statistical use in correlation with VPA. A new standard area was devised and gave a correlation coefficient for 1-group of 0.59 with the 13 year classes correlated with VPA values.

Since that meeting the catch data base has again been revised and the new estimates of recruitment as 1- and 2-groups from the IYFS and VPA and their regression parameters are given in Table 3.2.2. The IYFS index is poorly correlated with VPA for 1-group (Figure 3.2.2(a)), but the 2-group estimates are highly correlated (Figure 3.2.2(c)). The data series used here commences with the 1971 IYFS when 105 rectangles were worked.

Following the advice of the ICES Methods Working Group the mean logarithmic transformed rectangle abundance in the IYFS has been correlated with the log-transformed numbers in VPA (Figure 3.2.2(b)). It should be noted that the observations of the 1977 and later year classes all lie to the upper side of the regresions in both natural number and as logarithmic values. This series of recent year class VPA values have been correlated with the English Groundfish Survey indices (see Sect. 4.4.1).

2-group IYFS indices are highly correlated with VPA stock estimates of this age group (Figure 3.2.2(c)). This relation has not been used recently by the Roundfish Working Group as the data have not been available at the time of the meeting. The magnitude of recruitment indicated by the English Groundfish Survey is taken into consideration by the Roundfish Working Group when assessing the input F value derived by the Rho method.

Burd and Parnell (1982) showed that the high densities of juvenile cod were associated with low salinities. These low salinities generally occur in the coastal areas which have been poorly sampled in the IYFS. High abundances occurred offshore when the low salinity water also extended offshore. Much variability is added to the recruitment index by the annual extent of these salinity distributions. They derived an index which took into account the salinity effect. However, it was not possible to use this index for prediction as the salinity data are not available at the time of the Working Group meeting shortly after the survey is made.

Heessen (1983) has demonstrated the changes in the quarterly distribution of juvenile cod in the southern North Sea. He clearly shows the concentration of young cod in the inshore area in February and their maximum spread offshore by the third quarter with a return to coastal areas in the autumn.

ACMF (1984) commented on the high correlation between the indices of abundance of juvenile cod as by-catch in the Federal Republic of Germany cutter fishery. This additional relationship suggests that the lack of correlation between IYFS index and VPA is due to the inshore distribution of cod at the time of the survey which does not provide a reliable estimate at that season of the year. Nevertheless, the possibility that the VPA value is itself biased should not be dismissed.

3.2.3 Haddock

As with the cod, and also whiting, this data series commences with the data from the 1971 IYFS when 105 rectangles were worked. The haddock standard area comprises 115 rectangles mainly in Division IVa, which prior to 1971 were poorly covered.

The updated series of IYFS and VPA data are given in Table 3.2.3. The correlations are shown in Figures 3.2.3(a) and (b) for both the data in natural number and in log-transformed values for 1-group. The correlation for 2-group is shown in Figure 3.2.3(c). All give significant correlations.

In 1981, the International Gadoid Survey Working Group demonstrated significant correlations for both 1- and 2-group with the VPA for the year classes 1969-76 and 1968-75 respectively. Since that date the catch data base was changed and the VPA values currently used differ markedly from the earlier report.

The IYFS data are used in the assessment by the Roundfish Working Group. Their procedure was to plot all data available including the 1969 year class and year classes 1980, 1981 and 1982 for which the VPA is heavily dependent on input parameters in 1983. No regression was calculated by the Roundfish Working Group but a VPA value was chosen by inspection of the graph using the appropriate IYFS index. In the present analysis these recent year class VPA values have been eliminated from the scatter plots for haddock, cod and whiting.

As 1-group VPA numbers of North Sea and West of Scotland are correlated (C.M.1984/Assess:10), the IYFS indirectly supplies recruitment estimates for ICES Division VIa.

3.2.4 Whiting

The revised series of IYFS indices and VPA estimates are given in Table 3.2.4 and the correlations of 1-group on arithmetic and log-transformed indices are shown in Figures 3.2.4(a) and (b). There is no correlation with the log-transformed data. Both the 1- and 2-group are correlated with a $p = 0.22$ on the arithmetic data. The correlation of 2-group indices is shown in Figure 3.2.4(c).

The Roundfish Working Group (as with the haddock) inspected the scatter plots of the data without correlating the series. The value of recruitment selected was further judged in relation to the F value which would result. In the case of the 1982 and 1983 year classes the recruitments were consistent with the average F value of the last five years. The VPA 1-group estimates in Sub-area IV and Division VIa are correlated.

The IYFS indices of 2-group and corresponding VPA data are also given in Table 3.2.4 and Figure 3.2.4(c). Though the Roundfish Working Group did not use a regression, they did accept its potential. Owing to the difficulty of obtaining the IYFS 2-group estimate at the time of the Working Group, the potential of this data series has not been utilised.

3.2.5 A. Sprat in the North Sea

The relation between IYFS data and stock parameters

Two sprat IYFS-indices are given in Table 3.2.5, one giving the No./h. of 1-group sprat in Division IVb (no 1-group index for the whole North Sea was available) and one giving No./h. of all ages in the whole of the North Sea. The former has been regressed against the seasonal catch in weight of the same year class in the season following the IYFS (i.e., from 1 July in the same year to 30 June of the following year), because the data then reflect the life history of the sprat as proposed by Burd and Johnson (1983). Predictive regression has been used and gives a correlation coefficient $r = 0.73$, which is significant (Table 3.2.5.1 and Figure 3.2.5.1).

As, however, when the Industrial Fisheries Working Group meets soon after the IYFS has finished, no age-disaggregated IYFS data will be available to them. Only preliminary data (for example an index for sprat less than 10 cm as was the case in 1984) will be available. Such preliminary data have rather dubious validity as an index of 1-group because the appropriate separation length between the 1-group and the 2-group sprat changes from year to year. It would, therefore, be desirable to have a regression of an IYFS index for No./h. of all age groups of sprat against a stock parameter, so that no age data are needed. If, again, the catch of 1-/2-group sprat in the following season is used as the stock parameter, we get a correlation coefficient r = 0.39, which is less than in the former situation and not significant (Table 3.2.5.1).

The regression of IYFS 1-group against VPA 1-group at the beginning of the year is considered to be less useful because of uncertainties about the VPA outputs due to uncertainties about the natural mortality rate, and because of the short lifespan of sprat which makes the results heavily dependent on the input F. The actual correlation coefficient was not significant (r = 0.24) (Table 3.2.5.1).

The use of IYFS data by the Industrial Fisheries Working Group

No sprat IYFS index has so far been used by the Industrial Fisheries Working Group in tuning of the North Sea sprat VPA, because no IYFS index has been considered reliable (Anon., 1984d).

However, in 1984 the 1-group IYFS index (R1) for Division IVb was used in the SHOT method (Shepherd, 1984) where the relation between yields in year t, Y(t) and yield in the previous year (Y(t-1)) and the IYFS index (R1) was obtained using the equation:

$$Y(t) = 0.5\ Y(t-1) + 0.13\ R1$$

Only data from the years 1976-83 were used because a preliminary prediction based on data from 1973-83 tended to overestimate systematically the catch in the most recent years and because of a general inadequacy of survey coverage in the earliest years. Results for 1979 were also excluded due to the inadequacy of the IYFS index for that year.

Improvement in the use of the IYFS data in future

In the future preliminary tapes with IYFS length data will hopefully be available at ICES before the meeting of the Industrial Fisheries Working Group. This may give the Working Group better possibilities to make a proper choice of the separation limit between 1- and 2-group sprat each year. They will therefore be in a better position to use the regression between the IYFS 1-group index and the seasonal catch of 1-/2-group sprat.

B. Sprat in Division IIIa

The IYFS index of 1-group sprat was calculated by the Industrial Fisheries Working Group (Anon., 1984d) as the arithmetic mean of the average No./h. per rectangle. These are given in Table 3.2.5.2 together with the yield in tonnes in Division IIIa and in the fjords of Western Norway (Division IVa E), in the same year. In this area, the fishing

season is the calendar year and 1-group sprat constitutes the main part of the catch. The regression line is shown in Figure 3.2.5.2. The correlation coefficient is r = 0.68. The regression line is not forced through the origin because the intercept is significantly different from zero.

This regression of the IYFS index against yield in the same year was used by the Industrial Fisheries Working Group to predict the 1984 catch on the basis of the 1984 IYFS index value. Only the years 1978-83 were used because the GOV-trawl has been the standard gear in this period. However, the correlation using this limited number of years was not significant. No VPA was attempted because of doubts about the accuracy of data on the sprat catches.

3.2.6 Norway pout

Promising relationships between IYFS indices and stock parameters

Table 3.2.6.1 presents a series of survey indices and stock parameters available since 1975. As recommended by the Working Group for Norway Pout Sandeel and Sprat, previous IYFS indices have been omitted (Anon., 1982b).

The selection of regressions indicates the present possibilities of making use of IYFS indices so far available for the forthcoming meeting of the Industrial Fisheries Working Group (IFWG) in March this year. Due to delayed outputs from the ICES data base, IYFS indices of 1 + 2-group Norway pout are not available for 1983 and 1984. The various plots are shown in Figures 3.2.6.1-3.

Figure 3.2.6.1 shows an almost significant correlation at the 5% level between indices of the 0- and 1-group derived from the English Groundfish Survey (see Section 4.1) and the IYFS indices of the same year classes as 1- and 2-group fish in the subsequent year (r = 0.85). Unfortunately, as indicated in the Figure, the IYFS values for 1983 and 1984 are not available. At present, therefore, it is not possible to establish a more reliable relationship between these indices.

Figure 3.2.6.2, reproduced from the IFWG 1984 (Anon., 1984d), presents a just significant correlation between the IYFS 1-group index and the corresponding VPA estimated figures as 1-group (r = 0.84). The preliminary IYFS 1-group indices for 1983 and 1984 are expected to be somewhat higher than the estimated ones.

Figure 3.2.6.3 demonstrates a highly significant correlation between IYFS indices of 1- and 2-group fish and the estimated annual catch of Norway pout (r = 0.93). Due to reasons mentioned above the data sets are not comparable after 1982.

Applications of IYFS indices in Norway pout stock assessments

The IFWG attempted in 1983 to obtain an estimate of total mortality Z by using cpue data from IYFS and concluded that Z was in the ragne 1.5 - 2.5 $year^{-1}$. This was somewhat higher than shown by other methods. Indices of the 1-group, but not the 2-group, when regressed against VPA estimates showed a functional relationship (r = 0.84). The same procedure therefore

was followed in 1984. It was not, however, possible to predict the landings in 1984 by means of IYFS indices, because 2-group indices for 1983 and 1984 were not available. Catch predictions were instead made by applying the SHOT method (see Section 3.2.5.A), which yielded the equation:

$$Y(t) = 0.25\ Y(t-1) + 0.079R1$$

and a predicted catch of 390 000 tonnes in 1984.

Possible improvements for future application of IYFS (survey) indices

It seems to be imperative that available survey data are at hand for the IFWG meetings which take place shortly after the survey, at least in a preliminary form. Provisional figures for the 1-group and for the total number caught might enable the Working Group to proceed with more confidence in its assessment studies.

3.2.7 Mackerel

Abundance indices from IYFS are given in Table 3.2.7 together with the VPA recruitment estimates.

These indices have not been used by the Mackerel Working Group for many years because they seem to describe only the North Sea component of the recruitment and a large proportion of the North Sea catch may originate from outside the North Sea. So the surveys' estimates could not be expected to forecast year class strength in commercial catches (Walsh, 1977).

Inspection of the scatter plot of VPA estimates against IYFS indices (Figures 3.2.7.1 + 2) suggests that no quantitative predictions can be made from the values currently available. The fact, however, that low IYFS-values since 1971 have corresponded to weak year classes do suggest that these indices may be useful as qualitative indicators.

4. OTHER GROUNDFISH SURVEYS

In addition to the IYFS, four countries undertake annual groundfish surveys in the North Sea. Three of these surveys are conducted in summer and are depth-stratified, one is carried out in the autumn and is on a rectangle basis like the IYFS. The design and objectives of these extra groundfish surveys are reviewed and the results obtained so far are discussed.

4.1 English Groundfish Surveys

The English Groundfish Survey commenced in 1977 with the intention to continue for 10 years. The gear chosen is a Granton trawl fitted with a small-meshed liner. The objective is to study the abundance and distribution of the major commercial species and their food organisms. About 120 stations are worked in August/September, which are standardised to location and distributed according to depth strata. The annual abundance index is calculated by area weighting. 3 m-beam and 1.5 m-Agassiz trawls are used to collect epibenthos. The distribution of primary stations worked over the period 1977-81 is given in Woolner and Pope (1983).

The English Groundfish Survey samples recruitment at 0- and 1-group (Table 4.1). The estimate of 0-group is probably insufficient as the gear used is not designed for capture of this age of gadoids which at

that time may be semi-pelagic in distribution. The international 0-group gadoid surveys failed to provide useful recruitment indices when sampling with pelagic gear in June-July.

The sequential correlations of the indices of year class abundance in August and February are shown in Figure 4.1.

The estimates of abundances of 0-group in August and 1-group in February give little agreement in year class strength for cod and haddock, though there is some indication for whiting. The estimate of 1-group in February (IYFS) and August (EGFS) are highly correlated for cod and haddock but not for whiting. The recruitment estimates for August 1-group (EGFS) and February 2-group (IYFS) are also highly correlated for cod and haddock but not for whiting.

The fact that the 1-group IYFS index is correlated with the August EGFS index for cod raised questions as to the cause of the lack of correlation between 1-group IYFS index and the VPA values for the 10 years of observations. When comparing the EGFS estimates with VPA, in view of the short data series, the 1980 year class has been included in the regressions (Figure 4.2), significant correlations are obtained for cod and haddock but not for whiting which contrasts with the IYFS series where a significant correlation is obtained for whiting but not for cod.

The recruitment estimates arising from the two surveys are clearly different in whiting, though in cod and haddock they are similar.

The use of a single ship on the EGFS must reduce noise in the recruitment estimate arising from between-ship differences; the choice of fixed stations should reduce some effects of between-ground differences (Hunton, 1984). The EGFS index being weighted by area and raised by depth strata must be of a different nature than the simple summarisation in the IYFS. Nevertheless, both series as 1- and 2-group give consistent estimates of year class strength. Perhaps the difference in correlation between VPA and 1-group indices lies in the nature of the VPA estimate. But, during its November meeting in 1984 a new series of data was presented to ACFM on the by-catch of cod in the Federal Republic of Germany shrimp fisheries in the German Bight, which is highly correlated with the number of 1-group cod in the VPA ($r = 0.87$, $n = 13$).

4.2 Scottish Groundfish Surveys

In 1981 Scotland began doing an annual survey, aimed primarily at the gadoid species, in the North Sea. These surveys have been carried out, each year, in August over the area north of $54^{\circ}45'N$, sampled by 80-85 stations, using an Aberdeen 48 foot trawl with a 20 mm lining in the cod-end. The stations are distributed on a combined depth/rectangle basis. Although the survey is principally directed at obtaining population indices for the gadoid species of commercial importance, all fish species are sampled for length and age in a similar way to that used during the IYFS.

The data series available from these surveys is as yet too short to evaluate their usefulness for predictive purposes. The data collected can be accessed by an Aberdeen computer program.

4.3 Groundfish Surveys by the Federal Republic of Germany

In 1983 the Institute for Sea Fisheries continued its North Sea summer surveys in July/August, which were replaced during some years by summer surveys in the North-East Atlantic. The study area is the North Sea north of 54°00' N, the 12 miles zone is excluded. The hauls are distributed over seven depth zones: (1) until 30 m, (2) 31 - 50 m, (3) 51 - 80 m, (4) 81 - 100 m, (5) 101 - 150 m, (6) 151 - 200 m, (7) 201 - 250 m.

The surface of these seven zones is calculated and taking into account (a) the extent of the different zones, (b) the distribution and abundance of cod, haddock and saithe known from former summer surveys, and (c) ship time; the position of the different fishing stations were distributed over the area. The required number of hauls was calculated to be at least 150.

The gear used is a 180 feet herring bottom trawl with a small-meshed liner (20 mm) in the codend and bobbins in the ground rope, to make the results comparable with former surveys. Haul duration is 30 minutes.

The main target of the survey is to get an overview of the density, distribution and biomass of commercially important gadoid species. The relevant biological data for the other fish species are also collected. Hydrographic observations are made at each station (water, temperature, salinity and nutrients).

In 1983 and 1984, 180 stations could be fished. All data are stored in a computer. The results of both surveys will be published in the near future. In 1985, the area will be slightly extended to cover also the area south of the Dogger Bank. For this reason, and because less ship time will be available due to a technical inspection of the vessel, the stations have to be re-arranged.

The time period of this survey is too short to draw any conclusions with regard to the abundance indices of the species studied.

4.4 Dutch Groundfish Surveys

In the years 1980/1982, a GOV-survey was conducted by the Netherlands in the southeastern North Sea (approx. roundfish area 6) in quarters 2, 3, and 4, primarily with the intention of collecting stomach samples. From the results of these surveys there appeared to be considerable changes in abundance and distribution of cod during the year (Heessen, 1983). During the first quarter of the year (data from IYFS) 1-group cod is concentrated near the coast and the estimated abundance is lower than during the preceding and following quarter.

In quarter four it is possible to get a first indication of the year class strength of 0-group, whereas the 1-group is not yet concentrated in the coastal area.

To get a series of abundance estimates for cod these surveys were continued in the fourth quarter of 1983 and 1984. The method used in these surveys is the same as applied during the IYFS, and the indices are therefore directly comparable with those obtained from the IYFS. The number of hauls and the number of rectangles fished are given in Table 4.2. Abundance indices for cod and whiting (haddock is not properly sampled because of its more northern distribution) are given in Table 4.3. In this table values for the first quarter of the year are included.

4.5 The Need for Coordinating an Autumn Survey for Gadoid Species

The four national surveys comprise a great effort and the results obtained so far are promising. The Dutch surveys in November indicate that 0- and 1-group cod and whiting have a relatively more offshore distribution at this time of the year than in February and the timing of IYFS does not appear to be ideal for these species. However, the lack of correlation between VPA and IYFS for cod might be caused by special properties of the VPA and not by inefficient sampling during the IYFS.

The decision to start an additional internationally coordinated gadoid survey in autumn should not be lightly taken. Surveys start to pay off only after they have been carried out over prolonged periods of time, because of the minimum number of approximately ten data points required for proper evaluation. It would not be advisable to start a new data series to the detriment of the February survey because of the ongoing need for recruitment indices for assessment purposes. Also, it seems unlikely that the effort presently employed by various countries in other groundfish surveys would become readily available, because they have been designed as national research programmes, which cannot easily be integrated.

It is clear that the additional surveys do provide very useful background information on the abundance of gadoids, and the continuation of these has the strong support of the Group. The problem remains that these surveys cannot actually replace the IYFS, because in planning there is no commitment to ICES and therefore any of them may be stopped at short notice.

It was decided to concentrate on improvements of the IYFS in February with reference to sampling of cod and whiting rather than to develop an additional autumn survey.

5. SURVEY METHODS

The Working Group during its present meeting prepared an updated version of the Survey Manual, copies of which will be available from the ICES Secretariat.

5.1 GOV-Trawl: Fishing Method

Since the introduction of the GOV-standard trawl in the years 1977-78, some countries have experienced problems in complying with all the technical specifications for the rigging of the trawl, given in the Survey Manual. This has resulted in certain deviations from the specifications given in the Manual by some of the participants. Although it is clear that the Working Group aims at a complete standardisation of all gears used in the survey, it is appreciated that the solution of certain technical problems in some countries requires time, money and manpower, and that not all the necessary adaptation can be achieved at once. It would be useful, therefore, to have some insight into the effect of several variations in the rigging of the trawl, in order to determine priorities in future attempts at standardisation.

In February 1984, Denmark and the Netherlands organised a series of flume-tank tests with a model of the GOV-trawl in the North Sea Centre in Hirtshals. During these tests, several of the modifications in rigging presently used were studied in the flume-tank. The observed effects on geometry of the net, and the expected effects on catching power are de-

scribed in a detailed report (Wileman, 1984). The Working Group took notice of the results of the flume-tank experiments, and drew up a list of recommendations for increased standardisation of the gear (see below).

It is expected that a much better analysis of differences in catch rates, resulting from differences in rigging, can be made in the future when sufficient survey results will have been stored in the data base. In order to do such an analysis, more details on the rigging of the trawl should be available than are currently recorded on the exchange tape. It was, therefore, decided to record in future more detailed information about gear on the exchange tapes.

In the meantime, the Working Group recommends the following steps to increase present standardisation of gear:

- All countries should use 4.5 m^2 polyvalent trawl doors.

- The double-bridle system used by one country may result in a changed fishing power. Steps should be taken to go over to the standard single-bridle system.

- The semi-pelagic rigging used in the southernmost rectangle will change the fishing properties of the net completely. Hauls made with this type of rigging should not be used for the calculation of abundance indices.

- Efforts should be made to evaluate the effect of using bobbins on the catches of small fish. The Aberdeen Laboratory will look into this matter.

- The vertical net-opening corresponding to the standard rigging of the GOV-trawl is estimated at 5.0 - 5.5 m. If a different net-opening is consistently measured with the headline transducer during the survey, this is a sign that something is wrong with the rigging of the trawl, and steps should be taken to remedy this. Also, in case some deviations from the standard rigging are unavoidable for technical reasons, one should try to obtain a vertical opening of 5.0 - 5.5 m, as this indicates that the geometry of the net is comparable to the one with standard rigging.

- Participants should always use the standard kite on the headline. The use of extra floats instead of a kite makes the vertical net-opening much more dependent upon the speed of the ship.

- Instead of specifying a certain number of floats, the manual will give the total buoyancy of the floats to be attached to the headline. This buoyancy should be 175 kg.

- The recommended duration of the hauls is maintained at 30 minutes. With this short duration, it is important that the starting time of the haul is properly defined. In addition to the old criterion, that "the trawl has settled on the bottom", it is now specified that the trawl must be judged to have stable geometry.

- An inventory of meteorological data collected on the different vessels should be made in order to decide which of these data in future

could be added to the standard haul parameters on the exchange tape. It would be very useful if a study of national data could be undertaken, to evaluate which meteorological data have an effect upon the catch rate of certain species.

5.2 GOV-Trawl: Area Coverage and Sampling Intensity

No major revision of sampling area or distribution of sampling effort within the sampling area was considered.

It was decided to exclude square 46E6 (Pentland Firth) from the gadoid sampling area. Because of its geographical position, sampling this square requires a disproportionate amount of time. It normally contributes very little to the survey index for the various roundfish species, and it has already been abandoned during several of the recent surveys.

5.3 Allocation of Sampling Areas to Countries

Some countries expressed a preference for a more compact sampling area than they have been allocated at present.

In the early days of the survey, each country worked in as many different parts of the North Sea as possible. Also, the allocation of sampling areas to countries was changed each year. All this was done to minimise the effect of possible differences in catch power between different countries.

As the gear and methods used during the survey became more standardised, the concern about differences in catching power became less, and the sampling area for each country got more concentrated in order to reduce steaming time between hauls. The present allocation of sampling areas is a compromise between the old policy of "spreading the risk", and the new tendency to save fuel and time. There has also been a preference by some of the participating countries to concentrate most of their sampling in their own economic zone.

Conditional on the results of an analysis of inter-ship variance, in the planning of future surveys, sampling areas may be further concentrated.

5.4 Collection of Biological Data

The Working Group agreed on the following amendments to the Survey Manual:

Length distributions

- Length distributions are recorded for all fish species caught.
- For species other than those listed in the Manual, sub-samples of less than 50 fish may be taken for length measurement.
- The length of all fish species other than herring and sprat is recorded with a minimum precision of cm, below.
- Certain related species that are hard to record separately (sandeels, gobii) may be grouped by genus or larger taxonomic unit.

Age distributions

- Herring otoliths should also be collected from fish less than 15.0 cm. This is in order to detect the possible occurrence among juvenile herring of spring spawners with a different otolith type.

- Sprat otoliths should also be collected from fish larger than 15.0 cm.
- Mackerel otoliths should be collected from 15.0 cm upward.

Sex and maturity

- These parameters should be recorded for cod, haddock, whiting, and Norway pout. The same numbers per length group should be sampled as for age distribution; also for the length groups below the threshold for age sampling. Data on sex and maturity, collected during the IYFS, have already been useful for the Roundfish Assessment Working Group. For Norway pout, the data may be used to detect a suggested year-to-year change in maturity ogive.

Special studies

In certain years, special requests for the collection of additional biological information may be made to the participants in the survey. For the 1985 survey, such requests have been made for the collection of VS-counts in herring, and the collection of stomach contents for a number of species. Requests for these ad hoc data collections will be specified in the survey programme for the year concerned.

5.5 IKMT: Fishing Method and Biological Sampling

The Working Group took note of a working document prepared by Mr. P Munk, which contained various proposals for increased standardisation of the sampling. This document, which was based on a preliminary analysis of data stored in the computer of the Danish Institute showed that the distribution of hauls over the survey area was very irregular. Some countries tended to concentrate their hauls in the corners of adjacent squares; obviously to save time. Another problem was that the duration of hauls made at the same depth varied considerably between countries. Until now, it was assumed that all participants strictly adhered to the standard instructions for fishing the IKMT, and that following these instructions would result in a constant duration of tow for a given depth. The results presently available suggest that either some countries deviate from the instructions given for warp speed (possibly for good technical reasons), or else that the tow profile depends also on other parameters than warp speed alone, and that the use of the specified warp speed could still result in a different duration of tow on different ships.

Now that it appears that different countries are filtering different volumes of water at a given station, it is obvious that the number per haul is no longer an adequate index of the density of larvae. In order to correct for differences in volume filtered, information on distance towed through the water will have to be measured and reported.

After discussion of the above working document, the Working Group decided to make the following amendments to the present instructions in the Manual:

- IKMT stations should be distributed as evenly as possible over the allocated sampling area. Distance between successive stations should be at least 10 miles. No fixed stations are specified in the Manual, but countries could decide on fixed positions for their own vessel if they consider this preferable in planning their survey.

- The duration of the tow should be recorded, as this information can be used to quantify the catch rate.

- The IKMT record form should contain separate entries for number per haul and numbers measured.

- Countries should comply with the instruction to measure towing distance, preferably by a flow-meter attached to the net, or else by an accurate ship's log. If a flow-meter is used, the flow-meter calibration coefficient should be entered on the record form.

- Length measurements recorded should be to the mm below.

- Fixation is recommended in 4% formaline; if larvae are measured before fixation, this should be indicated on the form.

A data file containing existing IKMT-data for the North Sea, IYFS, has been created on the Digital-VAX computer of the Danish Institute in Charlottenlund. The Working Group accepted the offer by Mr. Munk to also store data collected during future surveys in this data file. Data prints or copies of the file can be obtained by all participants.

For future surveys, a summary of the IKMT-results will be prepared for inclusion in the joint report to the ICES Statutory Meeting.

5.6 Collection of Environmental Data

The ICES Hydrographer, Dr. H Dooley, commented upon the quality of temperature and salinity data that have been collected during recent surveys. Some countries that have changed from Nansen bottles to CTD-probes have neglected to calibrate their CTD at sufficiently regular intervals. The result has been a general deterioration of the quality of CTD-data, often to the extent that data reported had to be discarded. It is therefore recommended that countries using CTD-probes should calibrate this equipment more frequently.

The Working Group also discussed the long-standing request from ACMP for the collection of nutrient samples in conjunction with the survey. Due to some communication problems, this request did not reach the participants until shortly before the 1984 survey, and there has been some confusion regarding the objectives of this programme, and the methods to be used. Dr. Dooley explained that the request was based on the assumption that all participants were taking temperature and salinity samples by using Nansen bottles, and that there would be very little additional effort required to collect nutrient samples at the same time.

In practice, some countries had difficulties in complying with the request for nutrient samples because they either did not use Nansen bottles during the survey, or they did not have manpower for analysis of the samples after the survey. At present, France, Scotland, England and the Federal Republic of Germany are collecting nutrient samples. Norway will start during the next survey whereas France will stop, due to lack of manpower.

It was decided that the coordinator of the survey should be informed well in advance which countries are going to collect nutrient samples in a particular year. If it appears that certain areas in the North Sea will not be covered, he will inform the ICES Hydrographer who will then contact hydrographers at national laboratories to try and arrange additional sampling.

The Working Group appreciates the importance of a synoptic nutrient sampling programme, but it cannot take the responsibility to make sure that the sampling is actually carried out. This responsibility remains with national hydrographers and chemists. Some countries that presently do not take nutrient samples themselves would be willing to take scientists from other laboratories on board for the collection and analysis of nutrient samples.

It is recommended that temperature, salinity, and possibly nutrient data are reported to the ICES Hydrographer, either on tape or on the old record forms. If data are reported on tape, this should be done separately from the exchange of fish data, in order to avoid delay in the reporting of fish data.

6. DATA EXCHANGE, REPORTING AND ANALYSIS

6.1 Exchange Tapes

The Working Group reviewed the exchange tape format in the light of the experience gained since the meeting of the Study Group on Computerisation (Anon., 1982c).

Changes to the format are given in Table 6.1, and it was agreed that these will take effect from 1 February 1985. A revised and updated version of the exchange format will be issued by the IJmuiden Laboratory as soon as possible, together with the updated and corrected list of species codes.

The changes in the format are kept at a minimum and are mostly clarifications and tidying up of some inconsistencies (e.g., spaces are now the general missing information code).

The following details might be noted: The recording of the net-opening is now possible. Length classes less than the ones recommended in the IYFS Manual (Anon., 1981) are now accepted. The reporting of winter-rings rather than age is demanded for herring and sprat.

Following a discussion on the environmental data, in which the Council's Hydrographer, Dr. H Dooley, took part, it was agreed to split the reporting of fish data and environmental data (temperature, salinities, nutrients) into two stages, because the time factor and the screening process are so different between these two sets of data (see Sect. 5.6). The possibility of marrying these two types of data later on and making them available on the exchange tapes that are sent back to participating laboratories was, however, maintained.

Species recording codes and validity codes

The Group discussed at length the problems of different practices of reporting species between laboratories and years. In the exchange format a system of codes has been designed to make it evident what the practice has been. This information has to be present in the data base to make sure that misinterpretations of non-occurrences are not made. The Group agreed to exclude all invertebrate species from the data base. In the exchange tape format specifications, which are available from the ICES Secretariat, the use of recorded species codes and validity codes is discussed in more detail.

One purpose of setting up an IYFS data base has been to allow a statistical analysis of the various sources of variations in catch rates with particular reference to standardisation of gear operations. The gear codes defined so far refer to very general gear specifications, but within the GOV, for instance, no identification of specific differences in rigging is allowed and thus an analysis of variance would be limited to inter-ship variation and variations due to vertical net-opening obtained in individual hauls. Although the latter can be interpreted as a useful parameter describing the geometry of the net on the bottom, it was felt that some important aspects (e.g., herding effects of differently sized bridles or of differently rigged bridles) should also be taken into account. Even though the full range of actual gear variations during past surveys could not be assessed at this stage, a preliminary proposal to be extended at a later stage was drawn up and accepted (Table 6.1). It should be stressed

that these changes must not cause further delays in submitting exchange tape data. If countries have difficulties in providing this detailed gear information, they should stick to the formerly agreed codes and can provide updates at a later stage.

6.2 The ICES Data Base. Progress Report

The Group reviewed the status of the submission of tapes to the ICES Secretariat and the processing of data (Table 6.2). All data for 1984 have now been reported and are in different stages of processing. All 1983 data with the exception of one country have likewise been submitted, and two countries have started reporting back years. The initial problems in reading tapes and floppies seem now to have been solved.

However, since new problems might be envisaged with the coding of data sets from earlier years, and because of the danger of mixing data with variable degrees of reliability, it is recommended to concentrate on data input from the survey year 1974 onwards.

The ICES Secretariat has in cooperation with the University Computer Center in Copenhagen, Recku, selected the SIR (Scientific Information Retrieval) data base system for handling the IYFS data. The reason for selecting SIR is its flexibility and its power to produce reports, tables and links with common statistical packages. It is envisaged that retrievals from the data base will generally be undertaken with programs, written by the ICES Secretariat, according to specifications. The possibilities of producing other outputs than the exchange format on tapes for the national laboratories participating in the IYFS will be investigated further.

A more detailed discussion of the ICES data base is given by Hansen, Hoydal and Panhorts (1983).

6.3 Standard Analysis

The ICES Secretariat has based the development of standard output from the data base on reports from earlier years. The following guidelines for the basis calculations were outlined by the Working Group. Note that calculations for herring are based on daylight hauls only, roundfish species on all hauls.

Total number per length group per area

The average number per hour per length group is calculated for each rectangle and these averages are combined to give an arithmetic mean by area as appropriate.

Use of age/ring length keys

Area age/length keys are produced by combining data for all countries. These are applied to the length frequencies per rectangle and subsequently the number per age/ring is summed for sub-areas and areas. These numbers are also used for the distribution charts and maturity ogives. The year class indexes are straight sums of the numbers per age group per rectangle divided by the number of rectangles in the area.

For roundfish this index is produced for each roundfish area and the total area; for herring, for the herring standard only.

How to handle length classes without age data

In situations where there is no observation on age in a given length class, the age/length key in neighbouring classes is inspected and a straight average of the age/length key in these is used. It would generally not be expected to be necessary to search more than 2-3 neighbouring classes, but the program will allow higher numbers. The number of neighbouring length classes, which it has been necessary to search, will be recorded and output, together with the results for quality control purposes.

The information to be contained in the various tables of standard output is given in Appendix I.

These standard tables will also include layouts, which make it possible for the participating laboratories to check the information that has been entered into the data base.

6.4 Standard Report

In the past, annual reports of the survey have been reported to the ICES Statutory Meeting in a number of separate documents. The purpose of these reports was to make survey results available to the participants themselves, to the various Assessment Working Groups, and to a wider audience of scientists interested in the recruitment trends in various species.

As soon as the ICES data base will be fully operational, survey results in much more detail will be available on exchange tape to all participants. Also the Assessment Working Groups, meeting in Copenhagen, will have access to survey results in the data base. Although the primary users of the survey results, therefore, no longer depend on the annual ICES reports, it was considered advisable to continue the preparation of a brief annual report for the ICES meeting in order to inform a wider audience within ICES of the main survey results.

This report should contain some general information about the survey, and a short description of the survey results for each species. It should be prepared under collective authorship, and the Working Group designated the following persons to deal with this task for the next three years:

Herring	:	A C Burd	(Lowestoft)
Sprat	:	P O Johnson	(Lowestoft)
Gadoids	:	J Hislop	(Aberdeen)
IKMT	:	P Munk	(Copenhagen)

General survey information:

and editing: A Corten (IJmuiden)

The ICES Secretariat will send a set of standard output tables to each of the designated authors of the annual ICES report. After receipt of the edited manuscript, the ICES Secretariat will take care of the production of the report for the Statutory Meeting.

The contents of the annual ICES report will also be published (if necessary in an updated version) in Annales Biologiques.

In order to make it possible to produce the annual report in time, the deadline for submitting tapes to the ICES Secretariat has to be set at 1 June. The report in 1985 will also contain information on the 1983 and 1984 surveys on which no annual report has been issued hitherto.

6.5 Special Studies

The Working Group did not attempt to outline detailed suggestions for special studies. It was stressed that the important point was to get the data base in shape and make its contents avilable to national laboratories for further analysis.

It is expected that the first step will be an analysis of variance, examining how much the different factors (vessel, area, etc.) contribute to the

variance. Major parts of this analysis (except the effects of trends in time) can be started already on two years' data.

The Working Group stresses that in ICES the production of exchange tapes with checked data from the data base, should be a top priority.

6.6 Preliminary Data for the Assessment Groups

Irrespective of the problems of getting correct and detailed data into the data base, the problems of deriving indices for the Assessment Working Groups in the very short time interval between the end of the IYFS and the first Working Group meetings are of major importance.

It was agreed to recommend that the participating countries immediately after the end of the 1985 survey produce preliminary data tapes with the length frequency data, and that the ICES Secretariat produces total length frequencies for the meetings of the Working Groups this year.

1985 will be a trial year, to explore if this is practically possible in the time given. To make sure that preliminary indexes are available, the usual procedure, collecting data for the preliminary indices by radio during the cruises, will be carried out in parallel this year.

7. RECOMMENDATIONS

For optimum utilisation of the data base at ICES, the Working Group recommends that ICES provides the necessary service to Assessment and other Working Groups if they want to access the IYFS data base. To ensure that staff is made available to support the Working Groups, the Chairmen of these Groups should inform the ICES Secretariat of their wish to access the data base.

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Table 3.2.1.1 IYFS indices for North Sea 1-group HERRING. VPA Estimates and Regression equation

Year class	IYFS index	VPA as 1-group ($\times 10^{-9}$)	
1958	2 421	6.84	
1959	648	1.58	
1968	822	3.35	*)
1969	2 647	7.36	
1970	1 629	5.82	
1971	827	3.79	
1972	1 195	1.74	
1973	1 592	3.95	
1974	452	0.40	
1975	342	0.38	
1976	575	0.59	**)
1977	139	0.60	
1978	535	1.44	
1979	551	2.03	
1980	1 293	3.73	
1981	1 910		
1982	2 473		

$b = 0.002900$

$s_b = 0.0003149$

$t = 9.2096$ (d.f. = 13) $P = <.001$

$\hat{y} = 0.0029 x - 0.120$

*)Taken from Table 2.10
Anon., 1982a

**)Taken from Table 2.31
Anon., 1984b

Table 3.2.1.2 IYFS indices of 1-group HERRING in Division IIIa and catches in No. x 10^{-6} of the same year class as 0-group and 1-group

Survey year	IYFS index Feb.	Catch of the same year class as 0-group in the year prior to the IYFS index	Catch of the same year class as 1-group in the year of the IYFS
1972	78		
1973	181		
1974	726		
1975	455		
1976	1 339		
1977	204		
1978	575	934	876
1979	3	147	168
1980	504	457	467
1981	544	682	966
1982	1 647	3 624	905
1983	3 255	3 334	2 603
1984	4 690	4 876	

Regression equations.

Index on catch of 0-group: $Y = 0.82x$, $n = 7$, $r = 0.93$

Catch as 1-group on index: $Y = 0.79x$, $n = 6$, $r = 0.94$

Table 3.2.1.3 Indices for 1-group spring-spawned and autumn-spawned HERRING in Division IIIa. Year classes given.

Year class	Index spring-spawned	Index autumn-spawned	Year class
1979	1 607	704	1978
1980	996	2 250	1979
1981	1 408	1 152	1980
1982	1 522	3 897	1981
1983	2 793	3 242	1982

Table 3.2.2 North Sea COD.
Estimates of recruitment at ages 1 and 2

Year Class	Age 1			Age 2	
	I Y F S		VPA number x 10^{-6}	IYFS	VPA number x 10^{-6}
	1	2	IV	1	IV
1969			379	25.9	263
1970	98.3	2.9382	429	34.5	312
1971	4.1	0.2850	78	10.6	60
1972	38.0	1.4697	154	9.5	104
1973	14.7	1.1199	128	6.2	92
1974	40.3	1.6205	225	19.9	157
1975	7.9	0.5400	109	3.2	84
1976	36.7	1.7754	375	29.3	252
1977	12.9	1.1118	223	9.3	157
1978	9.9	0.7855	233	14.8	158
1979	16.8	1.3651	428	25.5	300
1980	2.9	0.3091	154	6.7	106
1981	9.2	1.0719	290	16.4	(179)
1982	3.7		(131)		
1983	15.5[3]				

1) International Young Fish Survey: Arithmetic mean number per hour trawling per rectangle in the standard area (ICES, C.M. 1983/G:62)

2) Mean of ln transform of rectangle means.

3) Preliminary figure.

Results of correlation	r	p	intercept	slope
1-group				
a) VPA/arithmetic mean	.597	n.s.	-	-
b) VPA/log transform	.758	<.01	4.546	0.600
2-group				
VPA/arithmetic mean	.934	<.001	41.020	7.529

n.s = not significant

Table 3.2.3 North Sea HADDOCK.
Estimates of recruitment at ages 1 and 2.

Year Class	Age 1			Age 2	
	I Y F S		VPA number x 10^{-6}	IYFS	VPA number x 10^{-6}
	1	2	IV	1	IV
1969			470	32	148
1970	855	4.8985	3 290	299	1 083
1971	740	4.1635	2 335	971	1 306
1972	187	2.4372	756	110	294
1973	1 072	5.2544	2 603	385	1 047
1974	1 168	6.2930	4 607	670	1 898
1975	177	3.4323	387	84	167
1976	162	3.6037	554	108	230
1977	385	4.2311	925	240	348
1978	480	4.4350	1 190	402	661
1979	896	5.3230	2 174	675	1 128
1980	268	3.8836	436	252	230
1981	526	4.3476	829	386	(412)
1982	313		(743)		
1983	989[3]				

1) International Young Fish Survey: Arithmetic mean number per hour trawling per rectangle in the standard area (ICES, C.M.1983/G:62)

2) Mean of ln transform of rectangle means.

3) Preliminary figure.

Results of correlation

	1-group	r	p	intercept	slope
a)	VPA/arithmetic mean	0.925	< .001	-145.15	3.311
b)	VPA/log transform	0.829	< .01	4.542	0.618
	2-group				
	VPA/arithmetic mean	0.835	< .01	166.71	1.671

Table 3.2.4 North Sea WHITING.
Estimates of recruitment at ages 1 and 2.

Year Class	Age 1				Age 2			
	I Y F S		VPA number x 10^{-6}		IYFS		VPA number x 10^{-6}	
	1	2	IV	VIa	1		IV	VIa
1969			926	22	31		227	17
1970	274	4.4033	1 408	31	190		598	23
1971	332	3.9634	2 438	93	763		1 156	61
1972	1 156	5.3519	3 258	194	496		1 632	147
1973	322	4.0109	1 711	67	153		726	47
1974	893	5.4168	3 175	150	535		1 741	110
1975	679	4.3999	1 799	51	219		1 043	34
1976	418	4.4940	2 144	80	293		847	51
1977	513	4.7557	1 814	110	183		1 109	74
1978	457	4.6296	1 994	79	391		1 077	59
1979	692	4.9526	1 660	183	485		1 069	140
1980	227	4.3022	694	39	232		391	28
1981	161	3.7381	759	30	129		(384)	(22)
1982	129		(737)	(30)				
1983	397[3]							

1) International Young Fish Survey: Arithmetic mean number per hour trawling per rectangle in the standard area (ICES, C.M.1983/G:62)

2) Mean of ln transform of rectangle means

3) Preliminary figure

Results of correlation

1-group	r	p	intercept	slope
VPA/arithmetic mean	0.729	< .02	1.209	.0016
VPA/log transform	0.568	n.s.	-	-
2-group				
VPA/arithmetic mean	0.725	< .02	530.31	1.491

n.s. = not significant

Table 3.2.5.1 SPRAT

Survey year	A	B	D	E
	IYFS Div. IVb 1-group	IYFS North Sea All ages	Catch in Kt of 1/2-group per season	VPA-1-group at the beginning of the year No. x 10^9
1972	90	873	58	
1973	123	713	138	
1974	481	2 631	245	166
1975	-	-	251	98
1976	1 186	2 127	338	148
1977	136	3 031	94	62
1978	1 474	2 208	284	81
1979	248[a)]	569[a)]	420	116
1980	1 402	3 770	181	55
1981	886	2 107	128	41
1982	183	602	73	24
1983	399	852		24
1984	525[b)]	c)		

a) Underestimate due to abnormal conditions.

b) Preliminary - specimens less than 10 cm as reported by radio at sea.

c) No data available. Only data on sprat less than 10 cm were available because the data were obtained during the survey by intership communication.

Results of regressions (survey year 1979 excluded):

A vs E:		r = 0.24 (not significant)	n = 8
B vs D:		r = 0.39 (not significant)	n = 9
A vs D:	Y = 0.26 · X	r = 0.73 (significant)	n = 9

The regression line found has been forced through the origin because the intercept was not significantly different from zero.

Table 3.2.5.2 SPRAT in Division IIIa

Year	IYFS Index of 1-Group	Yield in Div. IIIa and the Fjords of Western Norway (Div.IVa E) ($x10^{-3}$ tonnes)
1974	2 074	70.4
1975	12 124	112.4
1976	4 222	61.9
1977	10 862	79.1
1978	6 263	78.7
1979	4 774	84.4
1980	5 307	105.3
1981	2 809	87.1
1982	1 841	45.7
1983	1 173	36.9
1984	4 141	

Regression (1974-83): $y = 0.004 \cdot x + 53\ 409$

$r = 0.68$ $p < 0.05$

$n = 10$

Intercept significantly different from 0.

Table 3.2.6.1 NORWAY POUT.
Survey indices and stock parameters

Survey year	A	B	C	D	E
	EFGS 0/1-group	IYFS 1-group	IYFS 1/2-group	VPA as 1-group x 10^{-9}	Catch in Kt
1975		4 242	6 654		560
1976		4 599	4 984		435
1977	2 162	4 813	5 147	83.71	390
1978	1 512	1 913	3 128	48.27	270
1979	2 208	2 690	2 930	87.17	320
1980	975	4 081	4 692	98.64	470
1981	2 155	1 375	1 932	27.89	235
1982	2 528	4 315	4 718	102.63	359
1983	2 016	2 612[1)]	N.A.	77.21	421
1984	979	3 587[1)]	N.A.		

[1)] Preliminary figures. Specimens less than 15 cm.

Results of regressions:

A vs C: $Y = 1.8887 \cdot X + 75.75$, $r = 0.85$, $N = 5$

B vs D: $Y = 0.0176 \cdot X + 20.34$, $r = 0.84$, $N = 7$

C vs E: $Y = 0.0661 \cdot X + 97.61$, $r = 0.93$, $N = 8$

Table 3.2.7 MACKEREL.
1-group. IYFS indices and
VPA recruitment estimates.

Year class	IYFS	VPA	Ln IYFS	Ln VPA
1969	6 536	3 334	8.785	8.112
1970	3 250	480	8.086	6.174
1971	13	479	2.565	6.172
1972	28	219	3.332	5.389
1973	14	453	2.639	6.116
1974	191	542	5.252	6.295
1975	7	295	1.946	5.687
1976	28	151	3.332	5.017
1977	31	19	3.434	2.944
1978	5	101	1.609	4.615
1979	1	148	0.000	4.997
1980	2	264	0.693	5.576
1981	2	331	0.693	5.802

Table 4.1 English Groundfish Survey: Number per 100 hrs trawling. Estimates of recruitment at age 1 and 2

Year Class	0- GROUP			AGE 1			AGE 2		
	Cod	Haddock	Whiting	Cod	Haddock	Whiting	Cod	Haddock	Whiting
1975				-	-	-	459	3 119	6 531
1976				6 818	6 634	21 969	1 249	3 105	5 482
1977	1 559	57 993	32 340	2 373	12 605	24 632	592	6 053	7 441
1978	1 679	37 240	23 271	2 265	29 691	20 019	697	15 755	15 040
1979	1 856	87 033	34 475	5 150	62 392	30 044	1 411	43 835	30 646
1980	1 006	35 099	18 490	1 232	17 036	26 603	289	7 955	7 928
1981	7 963	150 782	35 753	3 234	31 501	27 704	1 095	10 945	10 855
1982	254	28 199	6 948	1 541	21 762	11 813	n.a.	n.a.	n.a.
1983	9 595	83 061	71 659	6 122	n.a.	n.a.			
1984	45	n.a.	n.a.						

n.a. =Not available

Table 4.2 Number of hauls and number of rectangles of roundfish area 6 fished in the Dutch GOV survey in the fourth quarter of the year

Year	Hauls	Rectangles	Vessel
1980	28	28	Rose Marie
1981	26	26	Tridens
1982	31	31	Rose Marie
1983	50	27	Tridens
1984	84	33	Tridens, Isis

Table 4.3 Abundance indices in number per hour for different year classes of cod and whiting in roundfish area 6 during the Dutch GOV survey in quarter 4 and during the IYFS

Year class	0-Group Qu 4	1-Group Qu 1	1-Group Qu 4	2-Group Qu 1
COD				
1979	-	91.9	180.8	42.8
1980	45.6	55.0	65.0	11.5
1981	176.9	39.0	83.2	22.0
1982	26.8	9.6	24.8	-
1983	138.9	59.0[*]	122.4	-
1984	3.7	-	-	-
WHITING				
1979	-	425	369	395
1980	178	254	228	84
1981	1 082	222	641	63
1982	166	79	360	-
1983	2 422	698[*]	1 291	-
1984	154	-	-	-

[*] Preliminary

Table 6.1 Amendments and Clarification of Exchange Tape Specifications

RECORD TYPE 1 (Haul information)

Position	Name	Type	M/O	Range	Comments
43	Day/Night	1 A	M	D,N	Not given, space filled
69	Net opening	3 N	O	10 to 150, space	In m x 10
70-100	Paddingfield	31 A	M	Spaces	Filled up with spaces

AMENDMENT TO GEAR CODE SPECIFICATIONS

To be incorporated in the gear field:

14-16	Bridle length	3 N	O	0 to 999, space	in m. (0: semipelagic rig)
17	Exceptions	1 A	O	B,D, space	B: Bobbins; D: double sweeps)
18	Door type	1 A	O	P,V,F,K, space	P: Polyvalent; V: Vee; F: Flat; K: Karm Waco

To be incorporated in the padding field:

70-72	Distance	4 N	O	1 to 9999, space	Distance towed over ground (in m)
74-76	Warp length	3 N	O	1 to 999, space	in m
77-78	Warp diameter	2 N	O	1 to 99, space	in mm
79-81	Door surface	3 N	O	1 to 999, space	in m^2 x 10
82-85	Door weight	4 N	O	1 to 9999, space	in kg
86-89	Buoyancy	4 N	O	1 to 9999, space	in kg
89-91	Kite dimensions	2 N	O	1 to 99, space	in m^2 x 10
92-95	Ground rope	4 N	O	1 to 9999, space	in kg

NB: It is at present not possible to fully assess the range of difference that may occur in former years, but this set up should be robust enough to incorporate additional codes as required.

RECORD TYPE 2/3 (Length/frequency distribution and Age/Length frequency)

51-55	Catch weight/hour	5 N	M	0 to 99999, spaces	In 100 g; not known: spaces
56-58	No measured	3 N	M	0 to 999, spaces	Not known: spaces
59	Length code	1 N	M	.,0,1,5,9, space	Class 1 mm: .; 0,5 cm: 0; 1 cm: 1; 5 cm:5; + group: 9; space: no size class info
60-62	Length class	3 N	M	1 to 999, space	space: no info
63-68	No. at length	6 N	M	1 to 999999, space	space: no info
(RECORD TYPE 3 only					
70-71	Age/Ring	2 N	M	0 to 99, space	Unknown age/ring: space

RECORD TYPE 4 (SMALK's)

44-47	Area code	4 AN*)	M	SEE APPENDIX VIII	
59-60	Age/Ring	2 N	M	0 to 99, space	Unknown age/ring: space

*) exception: right justified, space filled.

In force from 1 February 1985.

Table 6.2 IYFS Data received at ICES Headquarters and Stage of Processing

Country	Tapes received (not processed)	Disc at RECKU (processed)	Loaded in data base
Denmark	1983 1984	-	-
France	1979 1980	1982 1983 1984	1984
Fed. Rep. of Germany	-	1983 1984	1983
Netherlands	1983 1984	-	-
Norway	1984	1983	1983
Sweden	1984	-	-
England & Wales	-	1983 1984	1983
Scotland	1981 1982	1983 1984	-

Figure 3.2.1.iv. North Sea HERRING.
Relation between IYFS recruitment indices and VPA numbers of 1-group.

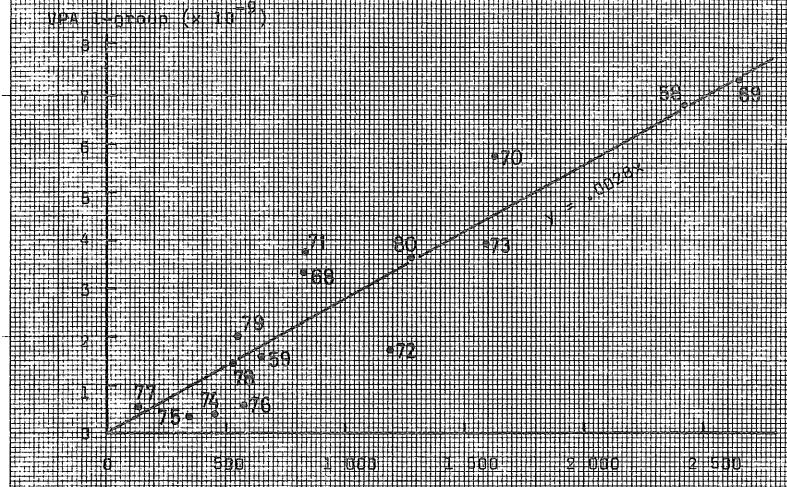


Figure 3.2.1.2. Division IIIa HERRING. Regression of IYFS recruitment indices on the catch of the same age group as 0-group (year classes indicated).

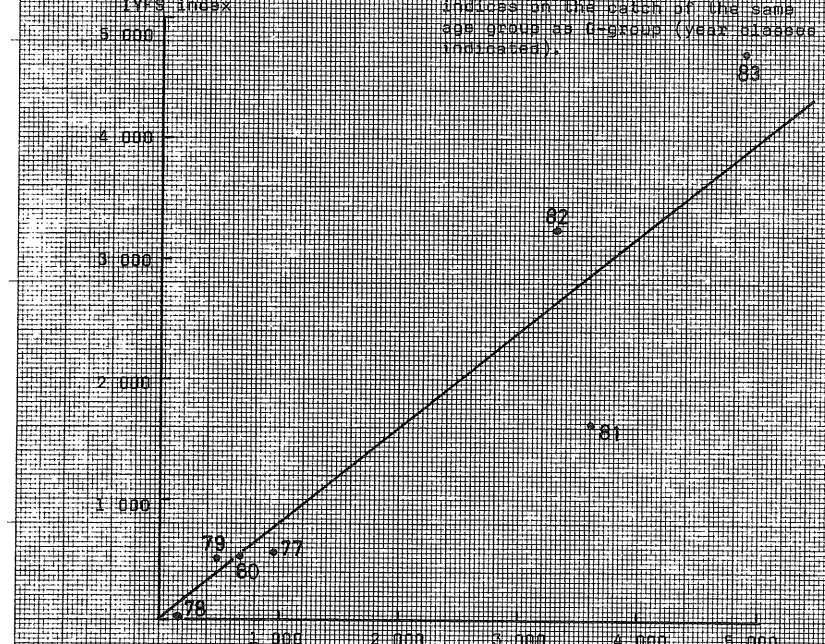
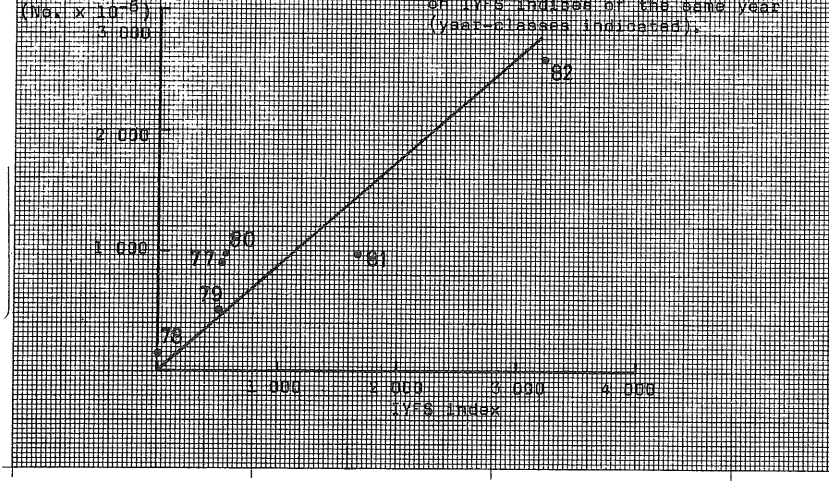


Figure 3.2.1.3. Division IIIa HERRING. Regression of catch of 1-group on IYFS indices of the same year (year-classes indicated).



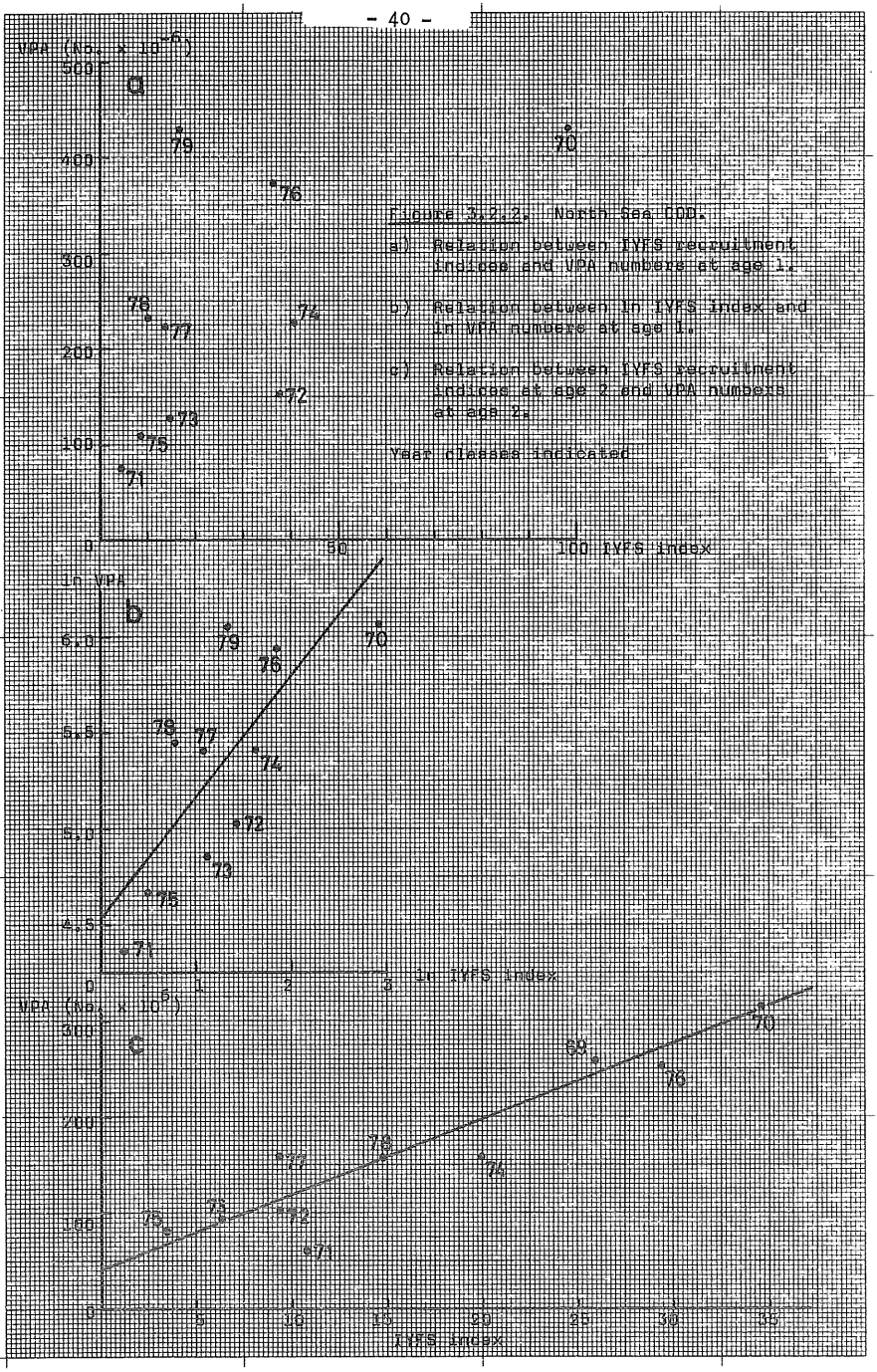


Figure 3.2.2. North Sea COD.

a) Relation between IYFS recruitment indices and VPA numbers at age 1.

b) Relation between ln IYFS index and ln VPA numbers at age 1.

c) Relation between IYFS recruitment indices at age 2 and VPA numbers at age 2.

Year classes indicated

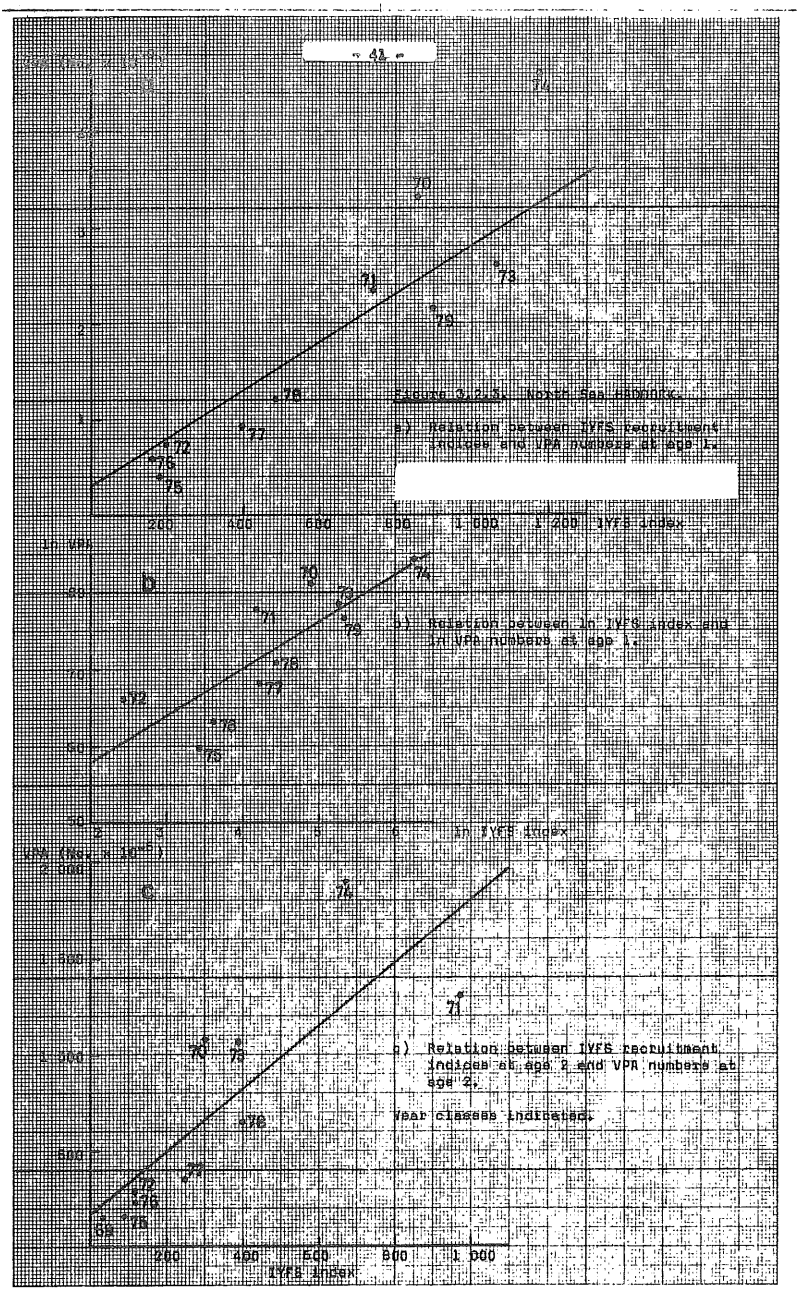


Figure 3.2.5x North Sea herring.

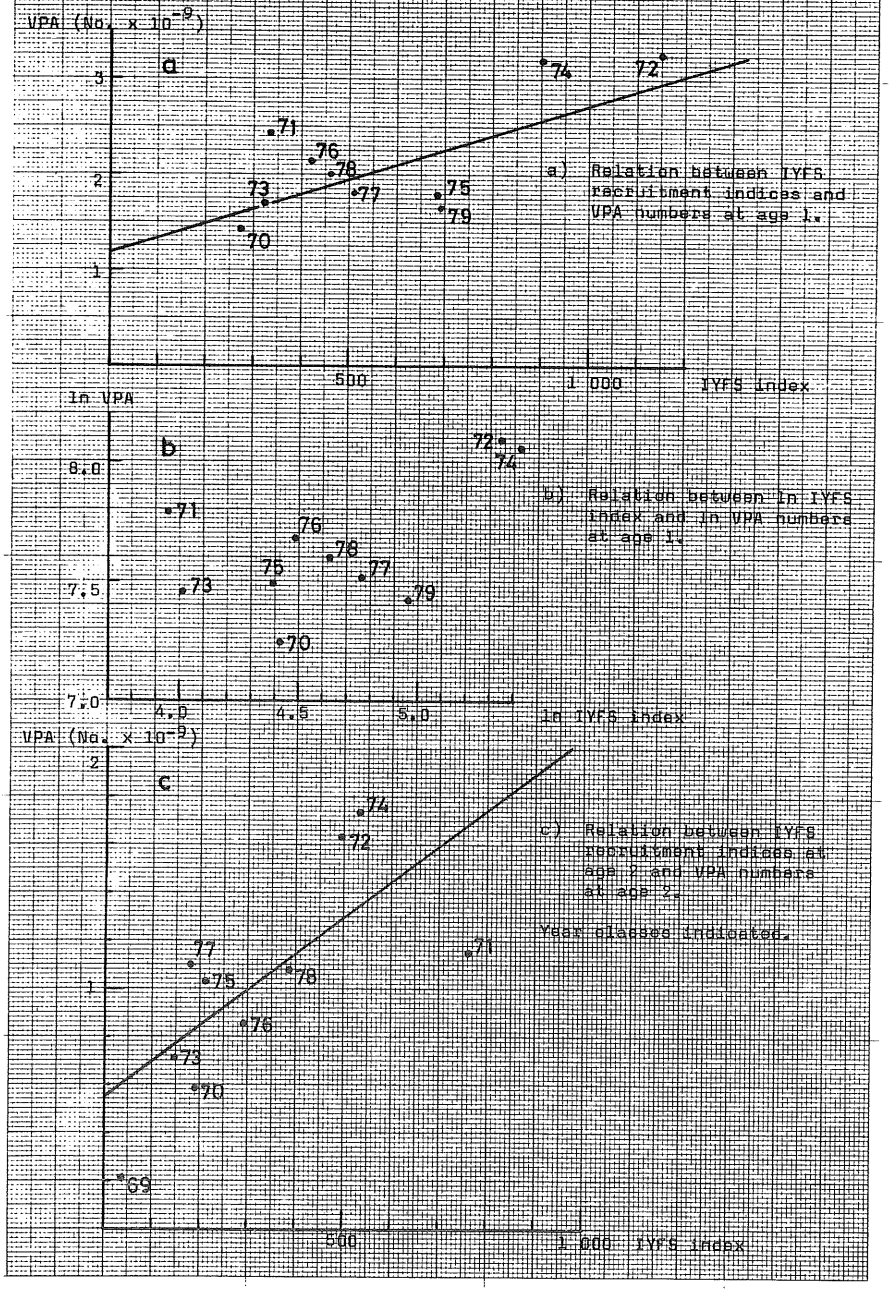
a) Relation between IYFS recruitment indices and VPA numbers at age 1.

b) Relation between ln IYFS index and ln VPA numbers at age 1.

c) Relation between IYFS recruitment indices at age 2 and VPA numbers at age 2.

Year classes indicated.

Figure 3.2.4. North Sea WHITING.



a) Relation between IYFS recruitment indices and VPA numbers at age 1.

b) Relation between ln IYFS index and ln VPA numbers at age 1.

c) Relation between IYFS recruitment indices at age 2 and VPA numbers at age 2.

Year classes indicated.

Figure 3.2.5.1. North Sea SPRAT. Relation between IYFS 1-group index (Division IVb) and catch of 1-2 group in the total North Sea (year class indicated).

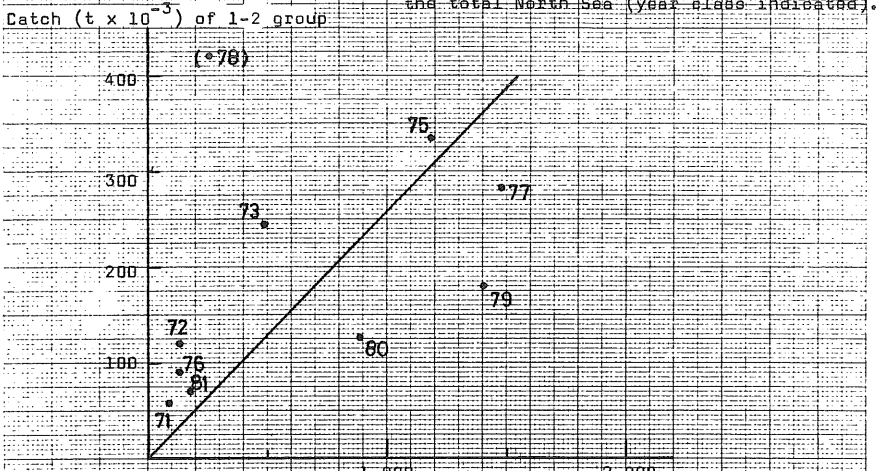


Figure 3.2.5.2. North Sea SPRAT (Division IIIa). Relation between IYFS indices for 1-group sprat and total catch in Division IIIa and the Fjords of western Norway (Division IVaE).

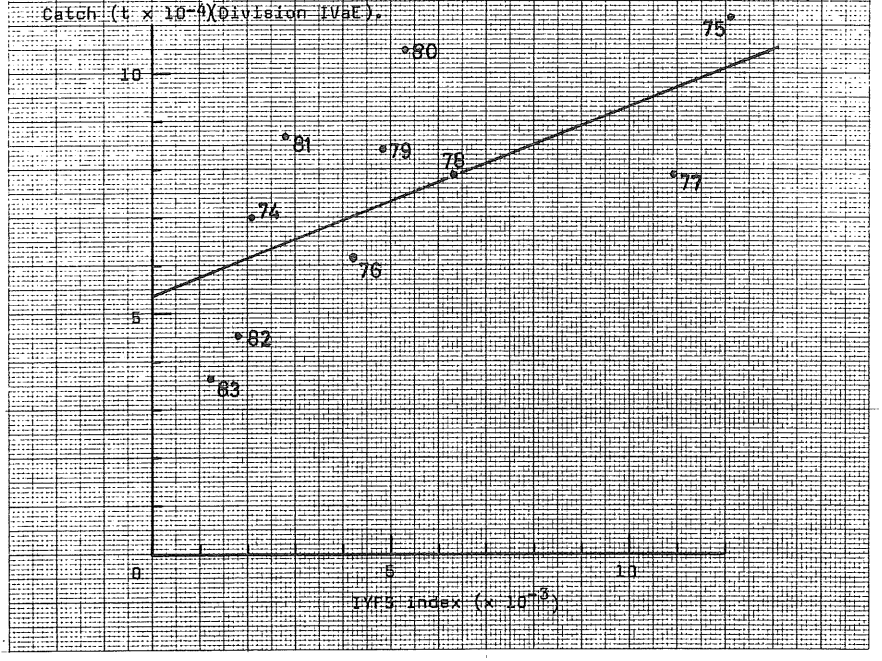


Figure 3.2.5.1. NORWAY POUT.
EGFS indices vs IYFS indices next year.

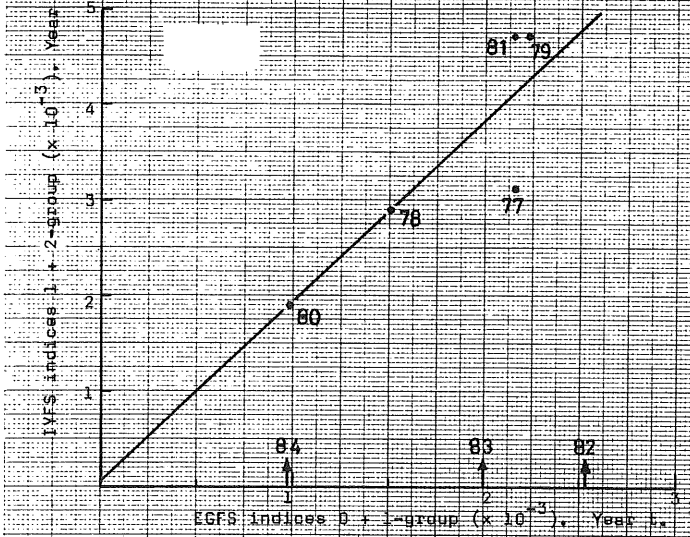


Figure 3.2.5.2. NORWAY POUT.
IYFS index 1-group vs VPA estimated 1-group.

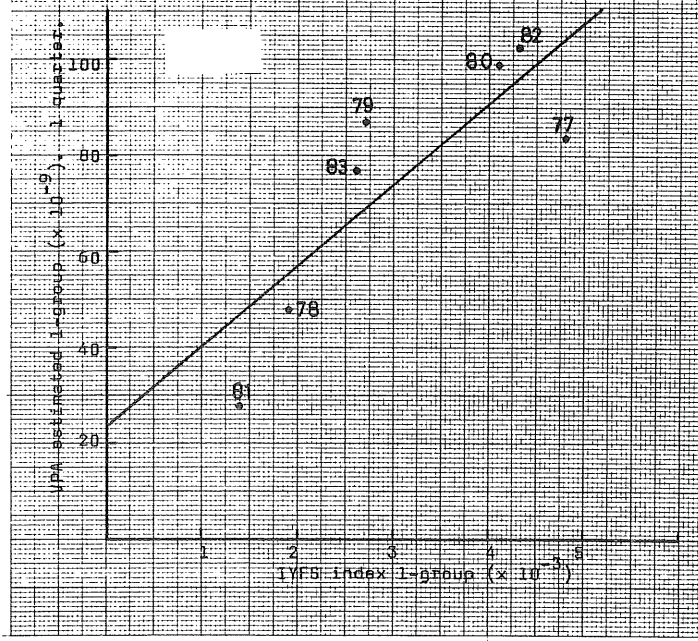


Figure 3.2.6.3. NORWAY POUT.
IYFS indices 1 + 2-group vs annual catch.

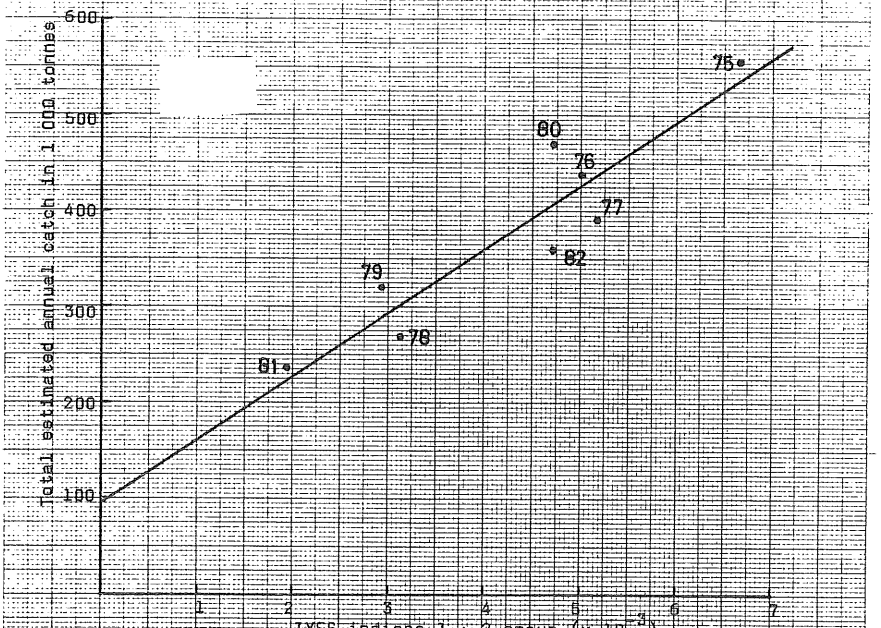


Figure 3.2.7.1. North Sea MACKEREL.
Relation between IYFS recruitment indices and VPA numbers of 1-group.

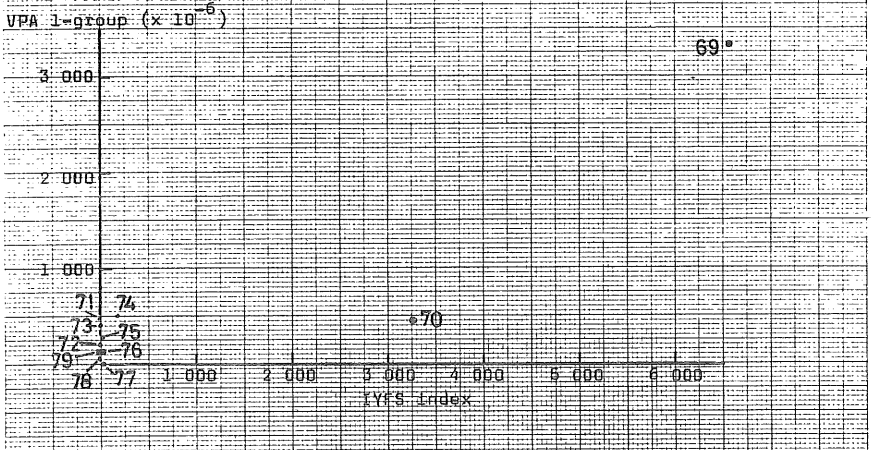
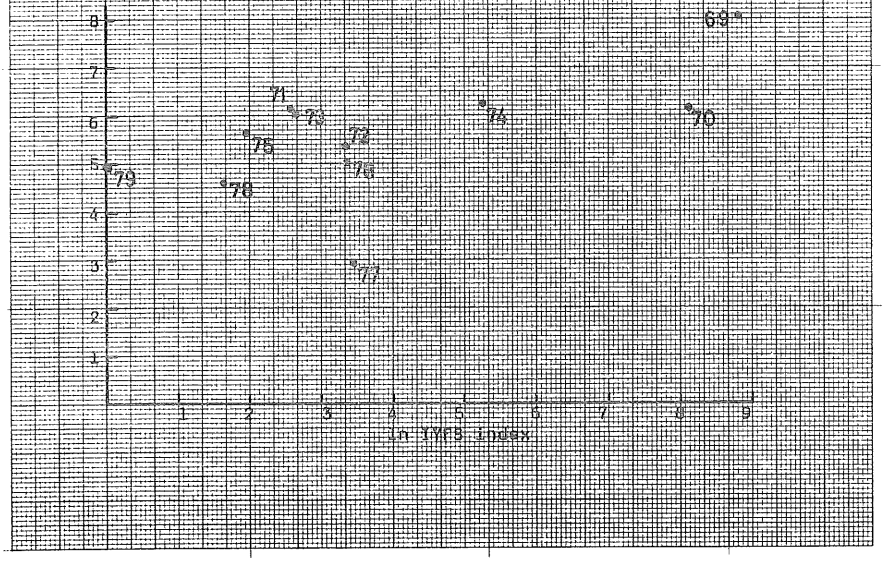


Figure 3.2.7.2. North Sea MACKEREL.
Relation between ln IYFS index and ln VPA numbers of 1-group.



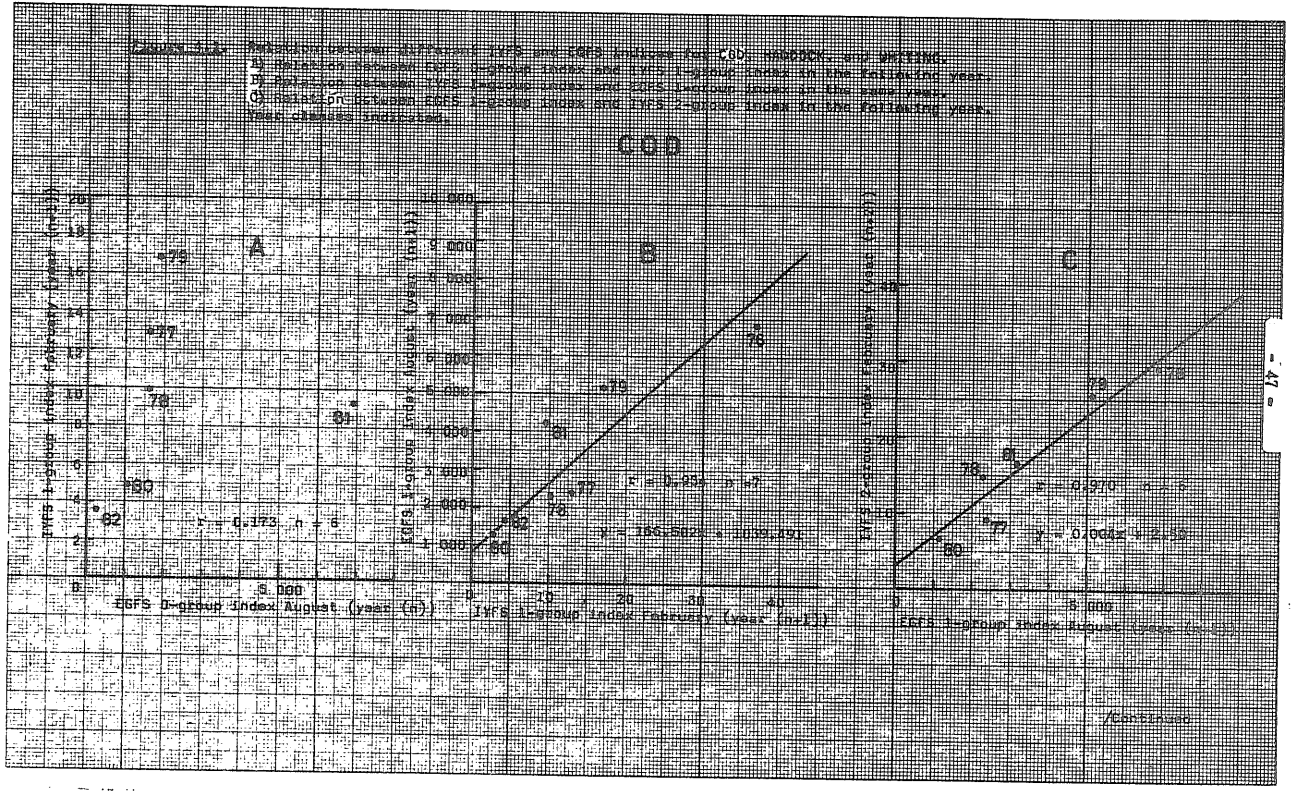
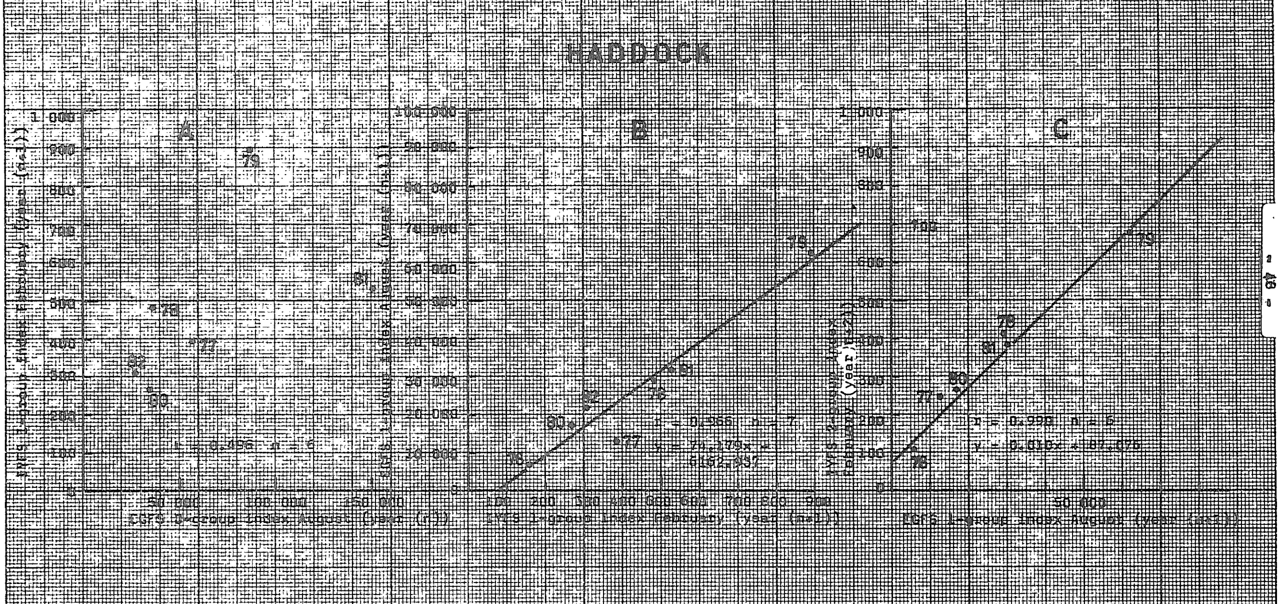


Figure 5.6: Relationship between different Tyrs and EGFS indices for COD, haddock and whiting.
A) Relation between Tyrs 0-group index and Tyrs 1-group index in the following year.
B) Relation between Tyrs 1-group index and EGFS 1-group index in the same year.
C) Relation between EGFS 1-group index and Tyrs 2-group index in the following year.
Year classes indicated.

/Co-ordinated

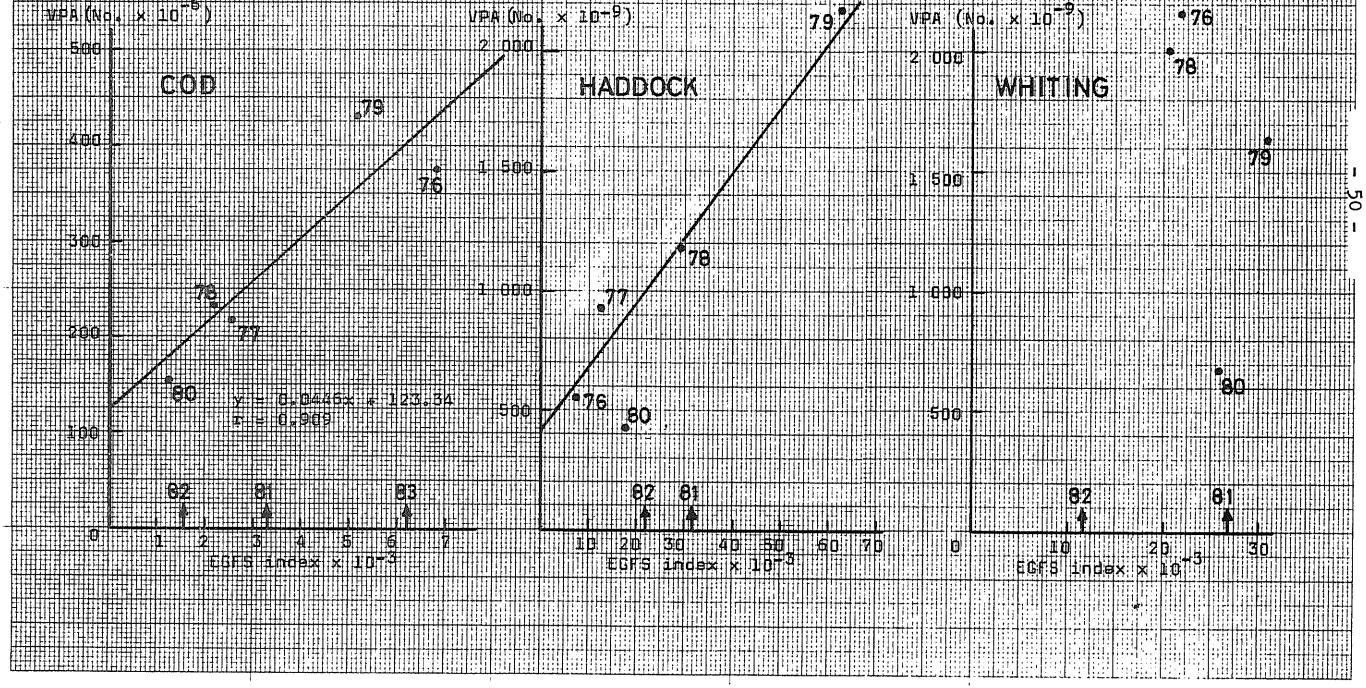
Figure [illegible].1 (Continued)



/Continued

Figure 4.1 (Continued)
WHITING
A
B
C
Type 1 Group Index Frequency (Year (n+1))
Type 2 Group Index Frequency (Year (n+1))
Type 3 Group Index Frequency (Year (n+1))
Type 1 Group Index Frequency (Year (n+1))
Type 2 Group Index Frequency (Year (n+2))
Type 3 Group Index Frequency (Year (n+1))
Type 1 Group Index Frequency (Year (n+1))
Type 2 Group Index Frequency (Year (n+1))
Type 3 Group Index Frequency (Year (n+1))

Figure 4.2. Correlation of VPA 1-group and EGFS index.
Indices for 1981, 1982, 1983 year classes indicated on x-axis. VPA figures as 1-year-olds.



APPENDIX I

Standard Output Tables

1. TRAWL STATION LIST BY COUNTRY

Young Fish Survey:
Year:
Country:
Ship:
No. of hauls: Valid:

Haul No.:
Haul validity:
Station :
Gear:
Day:
Month:
Time:
Duration:
Day/Night:
Position:
Stat. rectangle:
Depth:
Net opening:
Bottom temperature:
Bottom salinity:
Sp. recording code:

2. SPECIES LIST BY HAUL

Young Fish Survey:
Year:
Country:
Ship:

Haul No.:
Stat. rectangle:
Sp. rec. code:
No. of species:

Species Validity Code:
No. per hour: ┐
Catch weight: │
No. measured: │
Min. size class code: ├ Length
Minimum length: │
Maximum length: ┘

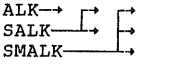
Age/Ring: ┐ Age
Plus Group: ┘

No. of otoliths:
Size class code:
Minimum length:
Maximum length:
No. of fish sexed:
No. of fish staged:

} Smalk

3. SMALK'S BY AREA
(Absolute number of otoliths sampled)

Young Fish Survey:
Year:
Country:
Ship:
Area:



Age/Ring: 0 1 2 3 4 5 6+ Total
Sex: (Males/Females)
Maturity: (Immature/Mature; 1-8)

Size class (cm):

4. LENGTH DISTRIBUTION (o/oo) BY AREA
(Averages per statistical rectangle summed over areas)

Young Fish Survey:
Year:
Species:
Area:

No. of valid hauls:
No. of rectangles sampled:
No. of fish in length distribution:

Size class (cm) N (o/oo)

5. SEX/MATURITY/AGE/LENGTH DISTRIBUTION (o/oo) BY AREA
(Depending on which output is required the appropriate ALK, SALK or SMALK must be used. These keys do not necessarily contain the same number of otoliths!! They are applied to the summed averages per statistical rectangle.)

Young Fish Survey:
Year:
Species:
Sex:
Maturity:
Area:

No. of valid hauls:
No. of rectangles sampled:
No. of fish in length distributions:

Age/Ring:	0	1	2	3	4	5	6+	Total	No.of otoliths in Key
Size class (cm):									
Total:									

Mean Length
Variance:

6. AVERAGE N/hr/PER AGE/SIZE GROUP PER STATISTICAL RECTANGLE

Young Fish Survey:
Year:
Species:

Rectangle	N valid hauls	Age Group	0	1	2	3	4	5	6+	Unknown
Total										

7. MEAN LENGTH PER AGE/SIZE GROUP PER STATISTICAL RECTANGLE

Young Fish Survey:
Year:
Species:

Rectangle	N valid hauls	Age Group	0	1	2	3	4	5	6+	Unknown
Total										

8. AVERAGE N/hr PER AGE/SIZE GROUP BY AREA

Young Fish Survey:
Year:
Species:

Area: 1 2 3 Standard

n hauls:
n rectangles:

Age Group
0
1
2
3
4
5
6+

CHARTS:

1. N/hr per statistical rectangle by age/size group (intege
2. Mean length per stat.rectangle by age/size group (1 decimal)