SFIA Report

FISHERIES MODELLING & ECONOMICS
PROJECT A21 TECHNO-ECONOMIC STUDIES

UK Fleet Restructuring Model Progress Report

Sea Fish Industry Authority

Technical Report No. 197 March 1983

SEA FISH INDUSTRY AUTHORITY
Industrial Development Unit

Technical Report No. 197
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U.K. FLEET RESTRUCTURING MODEL

PROGRESS REPORT

SUMMARY

This report contains the progress achieved on MAFF project A.2.1 which requires the development of systems and software to provide techno-economic analyses of policies aimed at restructuring the U.K. fishing industry.

It describes a proposed mathematical model of the fleet in terms of financial viability, the object of which is to simulate performance given specific policy scenarios, providing detail information with regard to the development of regional fleet sectors.

The three elements of the model, which consist of model structure, methodology and data analysis, are discussed.

Considerable progress has been made in the areas of model structure and methodology, where a suitable philosophy has been established. Development of algorithms for fishery resource management and fleet restructuring policy implementation is not yet concluded.

The model procedures cannot be finalised until the analysis of the data, originating from DAFS, FERU and MAFF, is advanced further. Although some progress in this area has been made, substantial effort is still required.

SEA FISH INDUSTRY AUTHORITY

Industrial Development Unit

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U.K. FLEET RESTRUCTURING MODEL

PROGRESS REPORT

1. INTRODUCTION

MAFF project A.2.1 requires the IDU to develop systems and software to provide techno-economic analyses of policies aimed at restructuring the UK fishing industry.

In order to achieve this, a mathematical model of the fleet in terms of operating expenses and earnings is being written. It should be noted that the objective of this model is to simulate fleet performance given specific policy scenarios, rather than to establish optima, as is the aim of existing fleet models. It should therefore provide detailed information regarding the development of regional fleet sectors throughout a time period.

The data to be used originate from existing databases maintained by DAFS, FERU and MAFF.

The methodology adopted is to base the predictions of fleet development on both the average and variance of financial and technical parameters.

This report discusses progress to date, therefore it consists mainly of proposals for the final model, together with parameter definition. As Technical Report No. 192 describes the model's mathematical aspects, and Technical Reports Nos. 198 and 199 cover detailed models of individual vessel performance, their contents are not repeated here.

2. STRUCTURE

2.1 General Philosophy

After internal discussion, and consultation with members of the industry and individuals from the Working Group on Bioeconomic Modelling, the following approach was formulated.

The central concept of the model is that financial performance of a vessel forms the basis by which predictions of fleet development are obtained. The factors which comprise the financial performance, expressed as profitability, are earnings and expenses, which are determined by technical, financial, and ecological components and iteractions.

In order to be effective, the model should predict the changes in fleet structure sequentially over a period of several years, to demonstrate the trends produced by specific policy scenarios.

It is desirable to assess the consequences of a strategy in detail for a specific region. Therefore the model should examine the fisheries of any particular region in depth, with the total effects of all the other regions being simulated by considering the UK as a single entity.

The average is an insufficient description of the performance of a group, because of the variance between the component vessels. The use of mean values would produce extreme changes in fleet structure, since for instance, a complete group would be interpreted as non-viable and therefore excluded. Thus the model should be statistical to allow for the dispersion between individual group members to be taken into account.

Simulation was chosen as the modelling method because it can fulfil all the requirements above, resulting in a 'what-if' model as opposed to an optimisation model.

An optimising model is designed to find the most economically efficient fleet, within constraints with regard to maintaining landings close to assumed quotas and a fleet structure near to the existing. A 'what-if' model would predict the performance, in technical and financial terms, of the existing fleet as it develops under assumed policy scenarios. This allows the user to interpret the results of the policies applied as to their acceptability and achievement of the required goals.

Three main areas of policy input to the model are proposed, which are:

a) Resource management techniques consisting of closed grounds, closed seasons, vessel quotas and licensing arrangements.
b) Price adjustments for fish and cost factors such as fuel, interest charges, etc.
c) Direct restructuring policies relating to the payment of scrapping grants, and newbuilding grant and loan schemes.

The outputs from the model, against which the user would judge the effects of the above policies applied either singly or in combination, should be:

a) The landings of each species taken, for each ground and season, to allow comparison with national or regional quotas, together with the value of these landings, for each vessel category.
b) The annual total earnings, operating profit, nett profit and average crew income, expressed in terms of the mean of each vessel category, together with the variance between individuals, which together define the proportion profitable.
c) The total capital value of, and crew employed by, each vessel category annually to assess the social effects of policy scenarios.
d) The number of vessels entering and leaving each category annually, together with the nett change in fleet structure to determine the overall success of each fleet sector.

2.2 Parameter Definition

On the basis of similarity of fisheries, thirteen regions within the UK have been identified, the boundaries of which have been chosen to coincide with the existing statistical framework whenever practicable. However, within some regions, certain major ports and subregions must be treated as individual entities, as they do not conform to the overall pattern of fisheries within the region. A detailed definition, together with a sketch, of the regions, subregions and major ports chosen is given in Appendix I.

The existing British fisheries databases use varying definitions of fishing methods ranging from very detailed to very broad. For this model eight methods have been identified, which is believed to represent a good compromise, giving sufficient detail whilst avoiding over-complication. The definition of these methods, in terms of existing descriptions, is given in Appendix II. Whilst it is appreciated that incorporation of multi-purpose vessels would be desirable, as it is not possible to identify these in the historical data, this has not yet been accomplished. It may however be possible to consider these categories in the future, if suitable analyses and algorithms can be devised.

As one of the prime objectives of the model is to establish the technical parameters of vessels likely to be successful, a fine graduation of registered length categories was felt to be necessary. Therefore nineteen groups have been chosen being; less than 30 ft., 30 to 80 ft. in 5 ft. divisions, 80 to 140 ft. in 10 ft. divisions, greater than 140 ft., and freezers. It would be desirable for group boundaries to have included 12.0m, 16.5m and 24.4m registered length, and 33.0m length between perpendiculars, as these now form regulatory divisions, but existing databases render this impractical.

Since the age of a vessel determines its technical parameters and financial performance, the date of construction must form part of the definition of a vessel category. The divisions have been chosen in such a manner as to produce a fairly even distribution

for each of nine age groups which are: vessels built pre-1940, 1940-49, 1950-59, 1960-64, 1965-69, 1970-73, 1974-77, 1978 -81, and post 1981.

The fishing grounds considered are the twenty International Council for the Exploration of the Sea (ICES) statistical areas of most interest to UK fisheries. The use of the finer ICES statistical rectangles is impractical, as the amount of data to be extracted would be enormous, yet probably would not materially improve accuracy. A chart showing these areas is reproduced as Appendix III.

As fishing activity varies widely throughout the year, a subdivision into four seasons is required. A natural division is possibly December-February, March-May, June-August, September-November reflecting weather conditions; but January-March, April-June, July-September, October-December is probably more convenient.

Based on Modelling Group experience a categorisation of species has been produced, covering all main and potential commercial species, a copy of which is included as Appendix IV. The use of different grades for several species was seriously considered for the model, but had to be rejected because of different grading practices at each port, and the lack of information required to predict potential catches of each grade individually.

2.3 Logical Structure

The structure of the proposed model is described in the form of a flow chart which is attached as Appendix V, which consists of Figures 1 to 4, Figure 1 showing the overall structure, and Figures 2 to 4 particular segments in detail. It will be noted that each cell is identified by a number, used in the description below, e.g. Figure 1 - 6 refers to the cell "Age Group", item 6 on Figure 1.

In Section 2.3.1 the system proposed to calculate the technical and financial performance of a vessel category is discussed in detail. However the influence of external controls on the model is considered in Section 2.3.2 and biological feedback in Section 2.3.3.

2.3.1 Performance Prediction

As the model is required to forecast the structure of the fleet and to examine the trends therein produced by various development strategies, it is proposed to simulate seven years results (Figure 1-1). This number has been chosen as great enough to illustrate trends and overcome any problems associated with ecological and environmental fluctuations, yet avoid excessive computation. The calculations of performance and structure are to be performed sequentially for each year.

Each subregion or major port (Figure 1-2) is to be treated individually to show variation within the specific region under consideration. The effects of fleet activities in other regions, e.g. on landing rates and fish prices, are to be incorporated annually by simulating the UK fleet as a single entity, using the same algorithms for development as the regional calculations.

Fishing method (Figure 1-3) and length group (Figure 1-4) define the vessel group, which for the prediction of performance is to be subdivided by age (Figure 1-6) to form vessel categories. To minimise the number of calculations required, only length groups applicable to a specific method (Figure 1-5) are to be analysed.

The mean days at sea (Figure 2-9) spent on each fishing ground (Figure 2-8) in a specific season (Figure 2-7) are to be estimated for each vessel category using historical data and by reference to resource management policies (Figure 2-10, see Section 2.3.2). If a ground is worked (Figure 2-11) then it is recorded as a valid ground (Figure 2-12), to be used in subsequent calculations, otherwise it will not be considered further for this season.

For each fishing method (Figure 2-14) a valid species list can be derived from historical data, which (Figure 2-13) is to be used to establish corresponding prices and contributions to seasonal landings and earnings.

The mean seasonal average fish price (Figure 2-15) is to be obtained by reference to the price array (Figure 2-16) which is updated annually as a result of fish price elasticity (Figure 2-17, see Section 2.3.2) and marketing strategy (Figure 2-18, see Section 2.3.2).

The valid ground array (Figure 2-20), established previously, is to be used as a basis (Figure 2-19) to obtain mean landing rates, landings and earnings.

Landing rate (Figure 2-21) is defined as the catch per day at sea for a specific species, ground and season, and since it includes steaming time it also applies to a specific region. Landing rates are to be used in preference to catch rates in order to simplify calculation and abstraction of data.

The mean landing rate array (Figure 2-22) is to be established by reference to historical data, the previous total UK landings, and resource management policies (Figure 2-23, see Section 2.3.2). From both the landing rate and days at sea established previously the mean landings (Figure 2-21) are to be calculated.

The contribution of the specific season, species and ground under consideration to the mean earnings (Figure 2-24) is to be obtained from the landings and fish prices.

Once the mean annual earnings for an individual vessel within a category have been established (Figures 2-7 to 2-24), the variance of earnings between vessels is to be obtained by reference to historical data (Figure 2-26).

At this stage the model will have predicted the activity, landings and earnings for the age category under consideration.

Operating profit (Figure 1-27), which for the present purpose is defined as earnings less variable and fixed operating costs, but excluding depreciation and capital and interest payments, will be obtained from a formula in which the costs are related to activity, landings and earnings.

Nett profit, defined as operating profit minus capital and interest payments, which are a function of age, is then to be calculated (Figure 1-27).

Average crew income, defined as crew share, which may be wages plus poundage, divided by number of crew, including skippers, is then to be estimated (Figure 1-27).

The constants in the formulae for operating profit, nett profit and average crew income, can be modified as required by changes in cost factors (Figure 1-28, see Section 2.3.2). Each of these three formulae essentially comprises two parts, the first estimating mean values for the vessel category, and the second obtaining the variance between individuals.

The final parameters to be calculated for each vessel category defined by age are the capital value (Figure 1-29), defined as the total insured value, and the total number of sea-going personnel (Figure 1-29).

2.3.2 External Control

Three areas of model control are proposed, firstly through use of resource management techniques, secondly through modification of prices used for both fish and cost factors, and thirdly through the application of restructuring policies.

Resource management could be introduced by controlling the fishing activity (Figure 2-10), by modifying the days at sea, or by controlling the fish landed (Figure 2-23) by alteration of

landing rates. These are intended to simulate resource management policies such as closed seasons, closed grounds, quota restrictions and licensing arrangements, for which the exact algorithms have yet to be determined.

Control over fish prices is to be divided into two separate segments. It should be possible to introduce price elasticity factors (Figure 2-17) as defined in usual economic supply and demand terms. The effects upon the fleet of marketing strategies (Figure 2-18), such as a fish promotional campaign, could be simulated by changing prices by a simple factor.

Expected or artificially introduced alterations in cost factors (Figure 1-28), such as direct operating subsidies or fuel price and interest rate modifications, could be taken into account by adjusting the coefficients used within the formulations for operating profit, nett profit and average crew income.

Changes in group structure, i.e. number of vessels in each age category (Figure 3-30), based on financial performance, are believed to operate in three ways: scrapping, bankruptcy and new building. For the model bankruptcy is defined as permanent withdrawal from fishing for financial reasons, e.g. permanent lay-up, un-assisted scrapping or sale for other duties. The algorithms are still to be finalised, but must take into account the following factors.

Scrapping of vessels (Figure 3-33) depends upon the availability of a scrapping grant (Figure 3-31), the nett profitability and value of the existing vessel (Figure 3-34), and the actual level of grant available (Figure 3-32).

The number of vessels becoming bankrupt is determined by the proportion of non-profitable vessels (Figures 3-36) within the category, and the fraction of those vessels which actually cease fishing (Figure 3-37). In the absence of a direct scrapping

policy elderly vessels will leave the fleet if they become unprofitable as their activity declines and costs increase, which would appear to mirror reality.

New-buildings (Figure 3-38) depend upon expected operating profitability and construction costs (Figure 3-39), together with the level of grant aid and financing schemes (Figures 3-40).

Within this section of the model it should be possible to link the number of vessels built to the number scrapped as a specific restructuring policy.

2.3.3 Biological Feedback

In order to account for the effects of fleet development and alterations in fishing activity a simple biological model must be incorporated, as assuming constant stock size and landing rates would not show any operational advantage to reducing fleet size, nor penalty for increasing effort.

Once the simulation of the total UK fleet is completed (Figure 1-42) the biomass (Figure 4-45) of each stock (Figure 4-44) of each species (Figure 4-43) should be estimated. The result depends upon the stock's previous biomass, its production function and the total landings (Figure 4-46).

The production function, which must be established for each stock, relates the change in biomass due to natural behaviour to the stock size some years previously. The estimated biomass, used as the basis for the next year's prediction, is the existing biomass plus production less total catches (including any by-catches landed).

As each stock may be dispersed over several grounds (Figure 4-48), for each of which (Figure 4-47) the landing rates will have to be adjusted in proportion to the expected change in available stock biomass (Figure 4-49).

3. METHODOLOGY

It is proposed that the model be developed using the Apple II Pascal language and operating system. This has been chosen in preference to Basic on the basis of operating speed and inter-machine portability, Apple II Pascal being an implementation of the standard U.S.C.D. Pascal. It may be necessary to code certain time-critical portions of the model, e.g. Figure 2, in Assembly language, but this will be avoided if possible in the interests of inter-machine portability.

A search for methods to handle statistical variates has been undertaken, and the results discussed in Technical Report No. 192, the main conclusions of which are summarised below.

Three possible methods of estimating the parameters of financial performance statistical variables for the purposes of this model were discovered, as follows.

a) Monte Carlo Simulation is accurate and also desirable as it is the only method found which gives a complete description of the behaviour of statistical variables. However it cannot be applied to this model as computer run times would be excessive.

b) Taylor Series Approximation is an accurate method for predictions of the mean results but underestimates the variance between individual outcomes. It may however find application if the formulae derived to express model variables are too complex for single combined function estimation.

c) Single Combined Function Estimation is an exceptionally accurate method for derivation of mean and variance of financial performance variables but is restricted to formulae of relative simplicity.

It is proposed that the model is based on the use of single combined function estimation whenever practicable, but use can be made of Taylor Series approximations if necessary.

Both these methods require the terms in any formula to be independent of each other. A recent problem has been to find a suitable description of activity, as it is obvious that days fishing a specific ground will depend on days spent at alternative grounds. Furthermore order of magnitude estimates of computer run time using statistical activity, landing rates and prices suggest the need for simplification.

A proposed solution to these problems, which is incorporated in the flow chart (Appendix V), is to restrict the calculation of days at sea (Figure 2-9), fish prices (Figure 2-15), landing rates (Figure 2-21) and earnings (Figure 2-24) to mean values only. However an estimate of the variance of the annual total earnings (Figure 2-25) may be obtained by assuming that the coefficient of variation (Figure 2-26) is constant for each vessel category. This assumption may not be too drastic, as alteration of two of the components of earnings, viz fish price and landing rate, implies multiplication by simple factors, which leads to constant coefficient of variation for these components.

In considering the changes to vessel group structure (Figure 3) based on mean and variance of financial performance variables, two approaches may be followed.

By assuming distribution shapes, i.e. normal or lognormal as appropriate, the proportion of vessels which fall within financial boundaries may be obtained, e.g. loss-making vessels. These proportions would form the basis for calculating the number of vessels entering or leaving the group, under the control of the model user.

An alternative approach could be based on mathematical decision theory, but this is yet to be investigated.

4. DATA

4.1 Grampian Field Visit

A field visit to the Grampian region was undertaken in June 1982, and vessel owners, agents, co-operatives, harbourmasters and boatbuilders in the smaller ports interviewed. This region was selected because the IDU was already undertaking a study of the major ports there (Technical Report No. 194) which, when combined with the results from this visit, allowed a detailed picture of a major fishing region to be formed.

The objectives were to obtain both general information with regard to the industry's views of desirable restructuring policies, and to identify data sources for the model. The opportunity was taken to collect sample data, which was found to be in the format of the DAFS cost and earnings survey returns (see Section 4.2).

A sample of 53 returns, which represents a seventh of the total survey results, was collected, and these are being analysed using proprietary Apple II software, viz Visicalc and Inter-Stat, to test a variety of statistical assumptions.

4.2 Department of Agriculture and Fisheries for Scotland (DAFS)

Two databases are maintained by DAFS, the first containing daily fish landings data collected by fisheries officers, and the second combining the results of the Scottish cost and earnings voluntary survey with the total UK vessel list. Both databases are held by the Scottish Office Computing Service using the Statistical Package for Social Sciences (S.P.S.S.) system.

All the analysis to date has been of the cost and earning survey database, which holds technical details of 3670 vessels, together with the 373 survey returns for 1981. A Scottish cost and earnings return form is attached as Appendix VI. The analysis has been performed using standard S.P.S.S. procedures on a copy file created especially for this study, and has so far concentrated on variable transformation in line with the

definitions of Section 2.2, discovering the present fleet structure, and analysis of technical relationships.

4.3 Fisheries Economics Research Unit (FERU)

The only source so far discovered for the cost and earnings of the English and Welsh fleets is a survey conducted by FERU of vessels in which the Authority has a financial interest. For 1981 they have obtained 226 returns, the format of which is illustrated by Appendix VII, which have been made available to this project.

It is intended that these will be analysed at the IDU using an Apple II microcomputer, but as yet no suitable proprietary software has been discovered, so an analysis program may have to be especially written.

4.4 Ministry of Agriculture, Fisheries and Food (MAFF)

It is understood that MAFF maintain a landings database derived from daily returns by fisheries officers, using a special Cobol program on their Guildford computer.

The intention is to make specific requests for data on English and Welsh activity, landing rates and fish prices when this data is required for the model.

The offer to provide data for the operation of the biological feedback segment of the model (see Section 2.3.3) has been made by the Lowestoft Laboratory.

5. CONCLUSIONS

Development of the fleet restructuring model contains the three elements of model structure, methodology and data analysis. These cannot be treated in isolation as the development of each aspect determines the others' progress.

Most of the work to date has been in the areas of model structure and methodology, where considerable progress has been made.

A suitable philosophy has been developed and all the variables required have been defined. However, determination of algorithms for the exact implementation of fishery resource management and fleet restructuring policies is yet to be performed.

The model structure and methodology cannot be finalised until the data analysis is more advanced. Although some progress has been made, substantial effort in this area is still required.

Future effort will therefore be mainly devoted to both data analysis and algorithm determination. As it is likely that the model structure and methodology will be finalised before data analysis is completed, it is proposed that the model be coded and then tested using assumed data. This is likely to occur during Autumn 1983, with the final model available in Spring 1984.

U.K. FLEET RESTRUCTURING MODEL REGIONS

Showing Sub-Regions and Major Ports

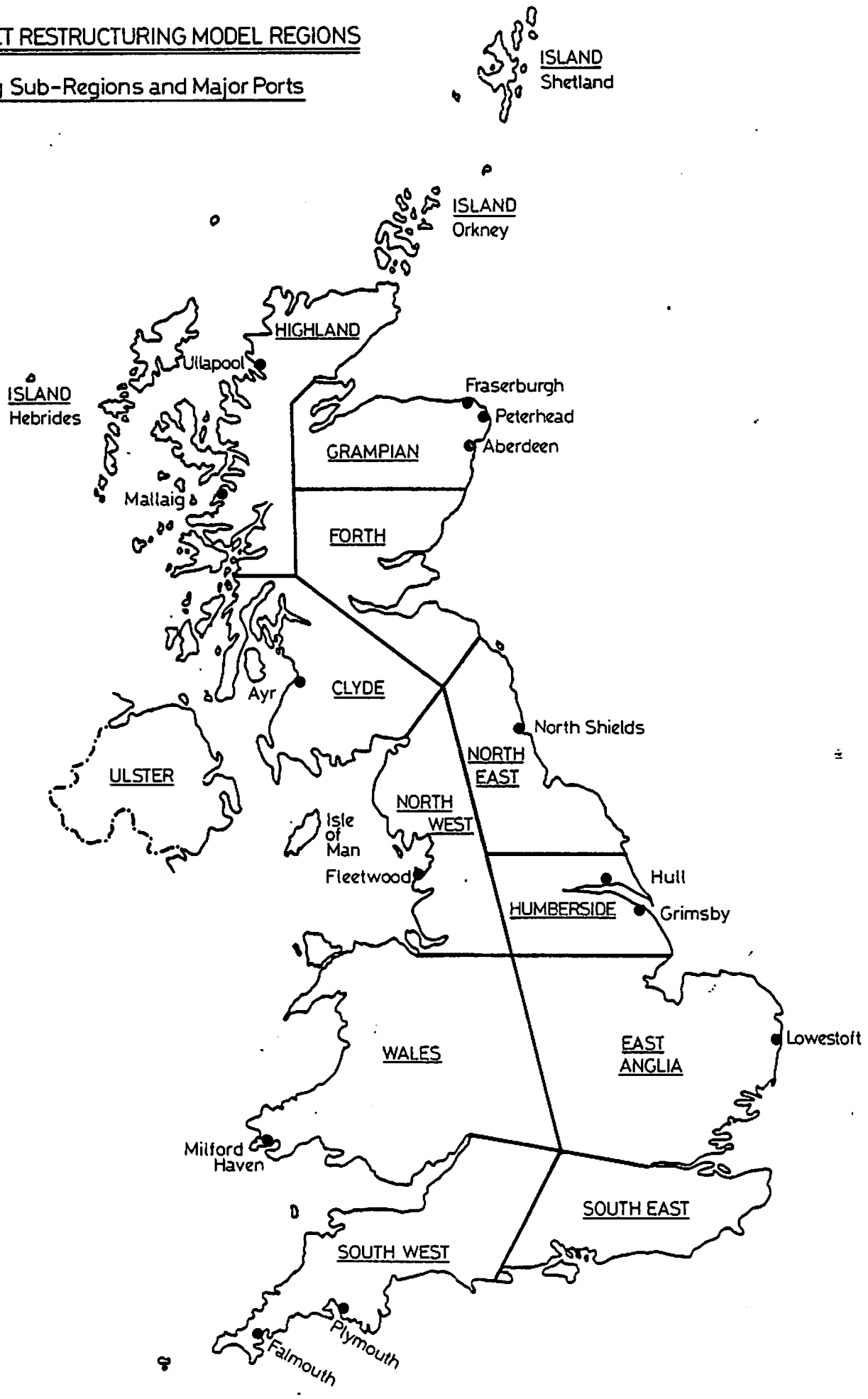


Fig.2 U.K. FLEET RESTRUCTURING MODEL ACTIVITY LANDINGS AND EARNINGS FLOW CHART

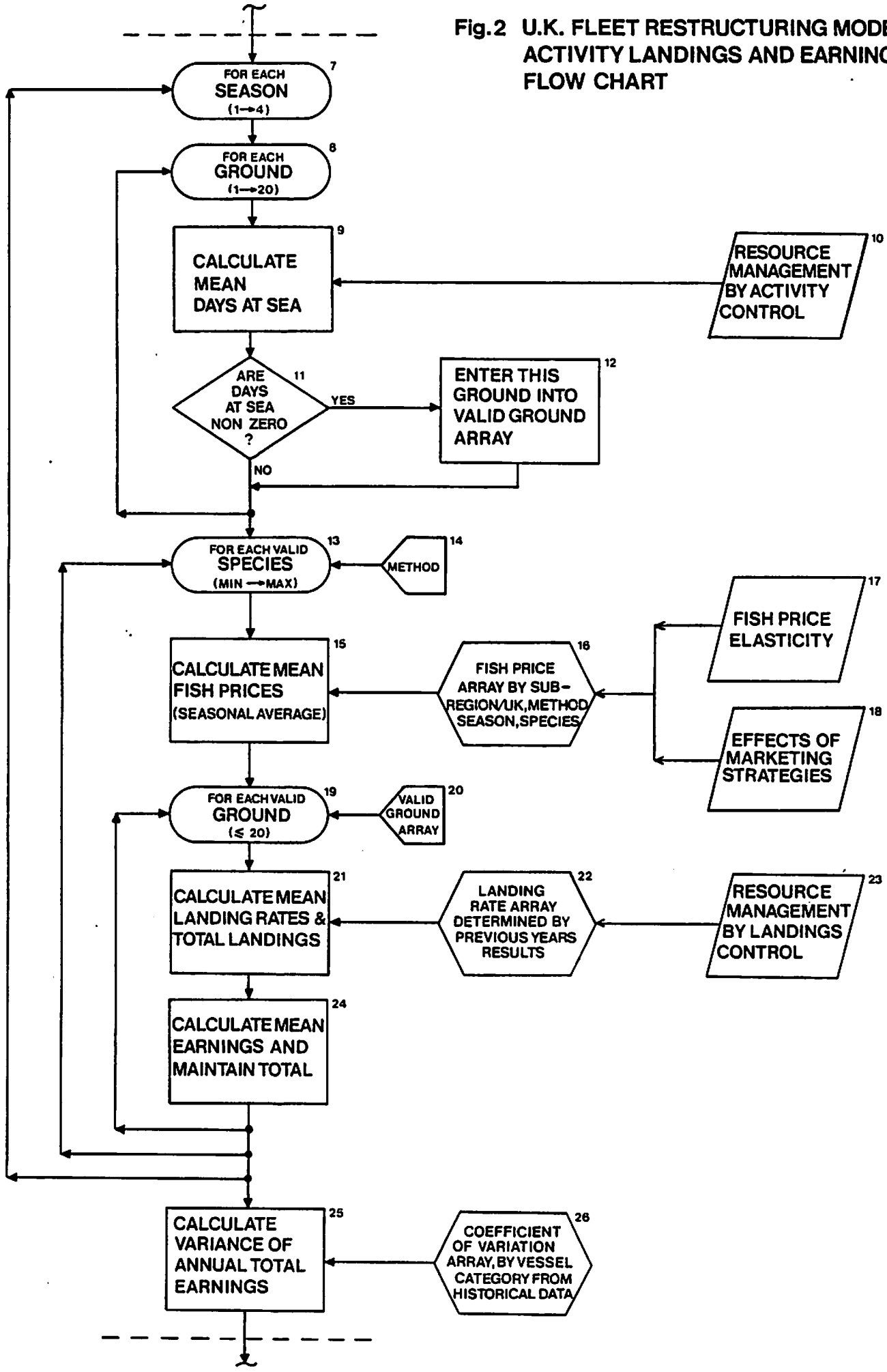


Fig.3 U.K. FLEET RESTRUCTURING MODEL
VESSEL GROUP STRUCTURE
FLOW CHART

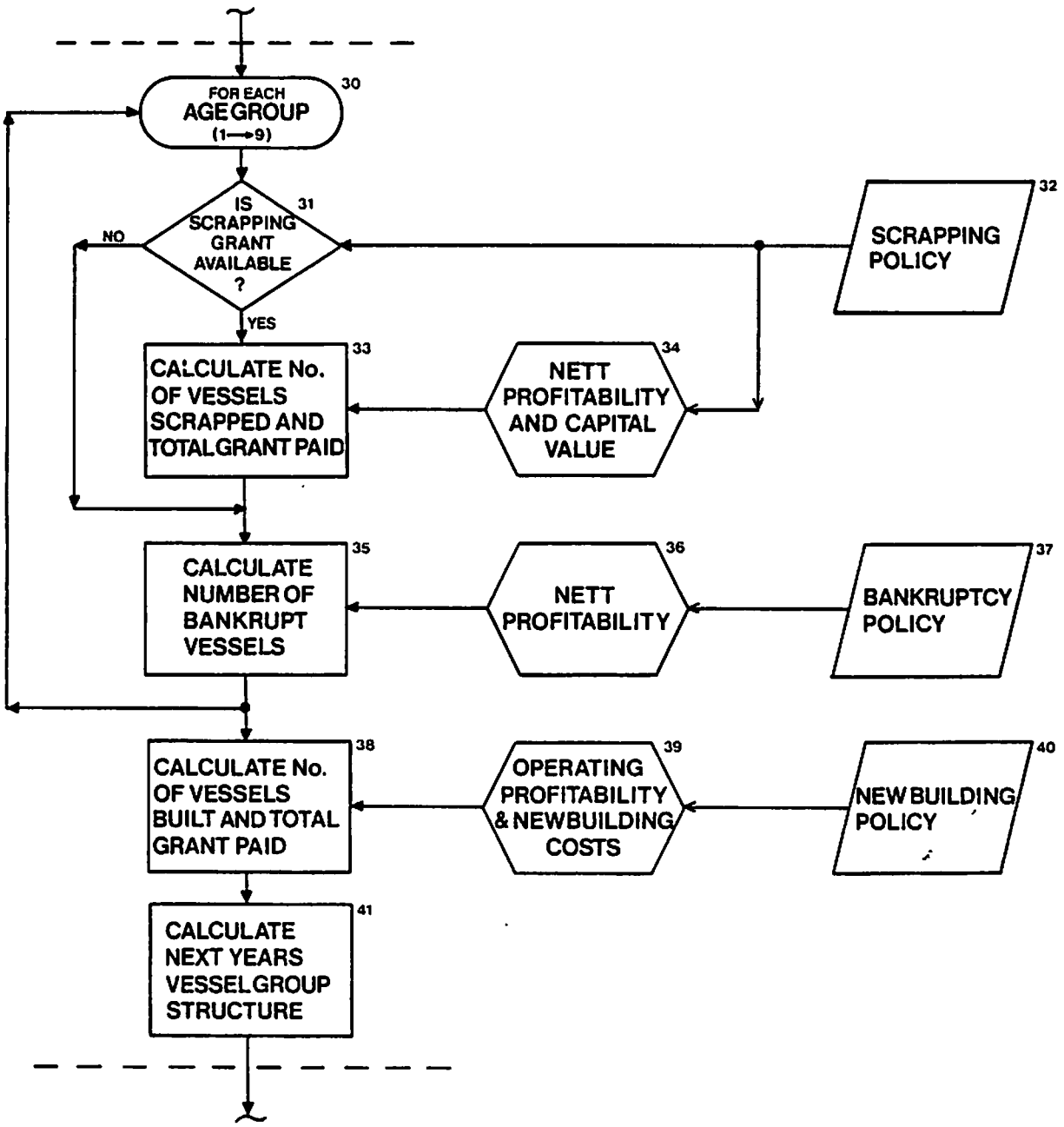
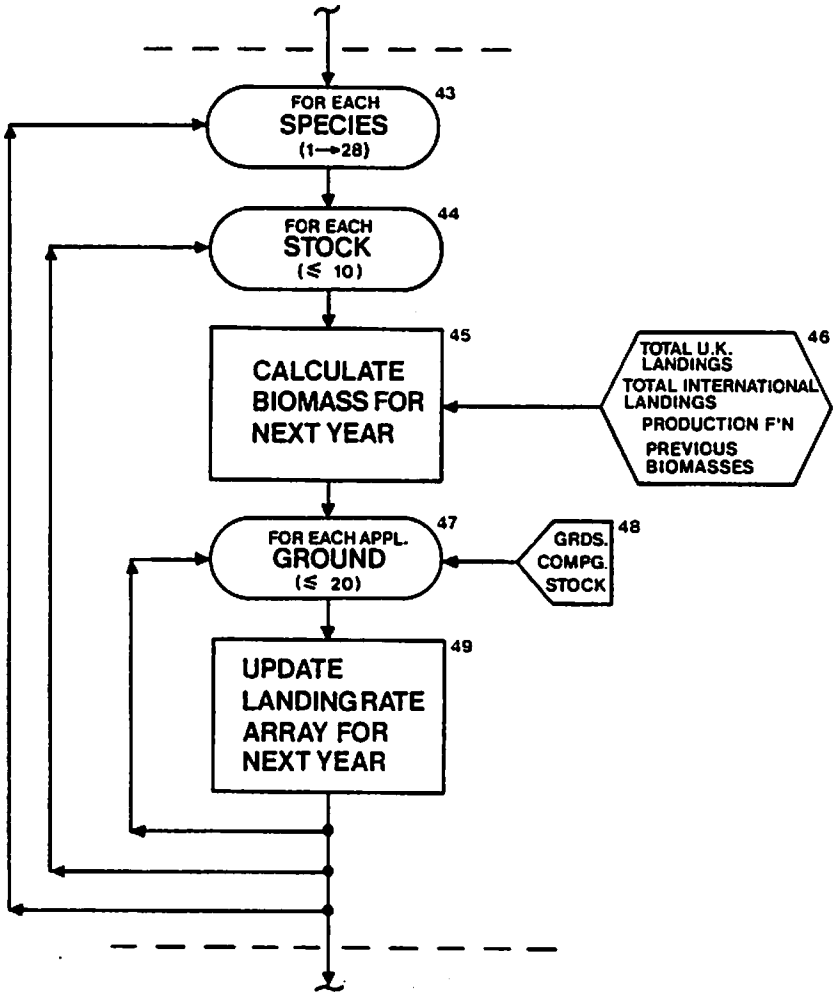


Fig.4 U.K. FLEET RESTRUCTURING MODEL
LANDING RATE FLOW CHART



APPENDIX 1

DEFINITION OF REGIONAL STRUCTURE

REGION	SUB REGIONS AND MAJOR PORTS	PORTS INCLUDED
1. FORTH	All Ports	Burnmouth, Eyemouth, St. Abbs, Cove, Dunbar, North Berwick, Port Seton, Fisherow, Newhaven, Granton, Alloa, Kincardine, Burntisland, Kirkcaldy, Methil, Leven, St. Monans, Pittenweem, Anstruther, Crail, St. Andrews, Newburgh, Arbroath, Montrose, Johnshaven, Gourdon.
2. GRAMPIAN	Aberdeen	Aberdeen
	Peterhead	Peterhead
	Fraserburgh	Fraserburgh
	Small Ports	Catterline, Stonehaven, Port Errol, Boddam, St. Combs, Inverallochy, Cairnbulg, Sandhaven, Pitullie, Rosehearty, Pennan, Gardenstown, Macduff, Whitehills, Portsoy, Portknockie, Findochty, Buckie, Lossiemouth, Hopeman, Burghead, Nairn, Inverness, Avoch, Portmahomack.
3. HIGHLAND	Ullapool	Ullapool
	Mallaig	Mallaig
	Small Ports	Golspie, Brora, Helmsdale, Dunbeath, Latheronwheel, Lybster, Wick, Staxigoe, Keiss, Auchengill, John O'Groats, Scarfskerry, Brough, Castlehill, Thurso, Scrabster, Crosskirk, Portskerra, Kirtomy, Skerray, Talmine, Eriboll, Kinlochbervie, Foindlemore, Loch Glendhu, Loch Glencoul, Culkein, Loch Inver, Gruinard, Aultbea, Poolewe, Cove, Gairloch, Torridon, Applecross, Carron, Kyle, Sleat, Broadford, Portree, Uig, Snizort, Dunvegan, Bracadale, Strathaird, Arisaig, Ardnamurchan, Fort William, Oban, Luing, Tobermory, Loch Scridain, Loch Buie, Coll, Tiree.

APPENDIX I

DEFINITION OF REGIONAL STRUCTURE

REGION	SUB REGIONS AND MAJOR PORTS	PORTS INCLUDED
1. FORTH	All Ports	Burnmouth, Eyemouth, St. Abbs, Cove, Dunbar, North Berwick, Port Seton, Fisherrow, Newhaven, Granton, Alloa, Kincardine, Burntisland, Kirkcaldy, Methil, Leven, St. Monans, Pittenweem, Anstruther, Crail, St. Andrews, Newburgh, Arbroath, Montrose, Johnshaven, Gourdon.
2. GRAMPIAN	Aberdeen	Aberdeen
	Peterhead	Peterhead
	Fraserburgh	Fraserburgh
	Small Ports	Catterline, Stonehaven, Port Errol, Boddam, St. Combs, Inverallochy, Cairnbulg, Sandhaven, Pitullie, Rosehearty, Pennan, Gardenstown, Macduff, Whitehills, Portsoy, Portknockie, Findochty, Buckie, Lossiemouth, Hopeman, Burghead, Nairn, Inverness, Avoch, Portmahomack.
3. HIGHLAND	Ullapool	Ullapool
	Mallaig	Mallaig
	Small Ports	Golspie, Brora, Helmsdale, Dunbeath, Latheronwheel, Lybster, Wick, Staxigoe, Keiss, Auckengill, John O'Groats, Scarfskerry, Brough, Castlehill, Thurso, Scrabster, Crosskirk, Portskerra, Kirtomy, Skerray, Talmine, Eriboll, Kinlochbervie, Pointmore, Loch Glendhu, Loch Glencoul, Culkein, Loch Inver, Gruinard, Aultbea, Poolewe, Cove, Gairloch, Torridon, Applecross, Carron, Kyle, Sleat, Broadford, Portree, Uig, Snizort, Dunvegan, Bracadale, Strathaird, Arisaig, Ardnamurchan, Fort William, Oban, Luing, Tobermory, Loch Scridain, Loch Buie, Coll, Tiree.

APPENDIX 1 CONT°D.

REGION	SUB REGIONS AND MAJOR PORTS	PORTS INCLUDED
4. ISLAND	Shetland	Fair Isle, Dunrossness, Levenwick, Bressay, Lerwick, Whalsay,Skerries, Yell, Fetlar, Uyeasound, Baltasound, North Roe, Hillswick, Walls, Scalloway and Isles.
	Orkney	Sanday, Westray, Eday, Stronsay, Rousay, Shapinsay, Birsay, Kirkwall, Deerness, Holm, Burray, Stromness, Hoy, Walls, South Ronaldsay.
	Hebrides	South Lochs, North Lochs, Stornoway, Portnaguran, Back, Ness, Bernera, North Harris, Scalpay, South Harris, Berneray, Houghgarry, Loch Eport, Grimsay, Loch Carnan, Lochboisdale, Castlebay.
5. CLYDE	Ayr	Ayr
	Small Ports	West Loch Tarbert, Gigha, Port Ellen, Port Askaig, Bruichladdich, Jura, Colonsay, Muasdale, Campbeltown, Carradale, Tarbert, Ardrishaig, Dunoon, Bute, Arran, Greenock, Largs, Cumbraes, Saltcoats, Troon, Dunure, Maidens, Girvan, Ballantrae, Stranraer, Portpatrick, Drummore, Port William, Isle of Whithorn, Garlieston, Kirkcudbright, Annan.
6. NORTH EAST	North Shields	North Shields
	SmallPorts	Berwick, HolyIsland, Seahouses, North Sunderland, Beadnell, Craster, Boulmer, Amble, Newbiggin, Blyth, South Shields, Sunderland, Seaham, Hartlepool, Middlesborough, Redcar, Staithes, Whitby, Scarborough, Filey, Flamborough, Bridlington.
7. HUMBERSIDE	Hull	Hull
	Grimsby	Grimsby, Immingham.

APPENDIX 1 CONT°D.

REGION	SUB REGIONS AND MAJOR PORTS	PORTS INCLUDED
8. EAST ANGLIA	Lowestoft	Lowestoft
	Small Ports	Boston, Fosdyke, Kings Lynn, Brancaster, Wells, Blakeney, Sheringham, Cromer, Winterton, Great Yarmouth, Southwold, Dunwich, Aldeburgh, Felixstowe, Ipswich, Harwich, Walton on the Naze, Clacton, Brightlingsea, Wivenhoe, Colchester, West Mersea, Tollesbury, Maldon, Burnham on Crouch, Great Wakering, Southend, Leigh on Sea, Canvey Island.
9. SOUTH EAST	All Ports	Gravesend, Rochester, Sheerness, Queenborough, Faversham, Whitstable, Margate, Broadstairs, Ramsgate, Dover, Folkestone, Hythe, Dungeness, Camber, Rye, Hastings, Eastbourne, Seaford, Newhaven, Brighton, Shoreham, Worthing, Littlehampton, Bognor Regis, Selsey, Prinsted, Emsworth, Hayling Island, Langstone, Portsmouth, Bursledon, Hamble, Southampton, Cowes, Isle of Wight, Lymington, Barton, Christchurch, Poole, Wareham, Swanage.
10. SOUTH WEST	Plymouth	Plymouth
	Falmouth	Falmouth
	Small Ports	Weymouth, Wyke Regis, Portland, Fleet, Abbotsbury, West Bay, Lyme Regis, Beer, Exmouth, Teignmouth, Torquay, Paignton, Brixham, Kingwear, Dartmouth, Salcombe, Millbrook, Cawsand, Looe, Polperro, Fowey, Mevagissey, PortLoe, St. Mawes, Malpas, Mylor, Flushing, Port Nevas, Helford, Porthoustock, Coverack, Cadgwith, Mullion, Porthleven, Penzance, Newlyn, Penberth, Scilly, Sennen, St. Ives, Hayle, Newquay, Padstow, Rock,

APPENDIX 1 CONT°D.

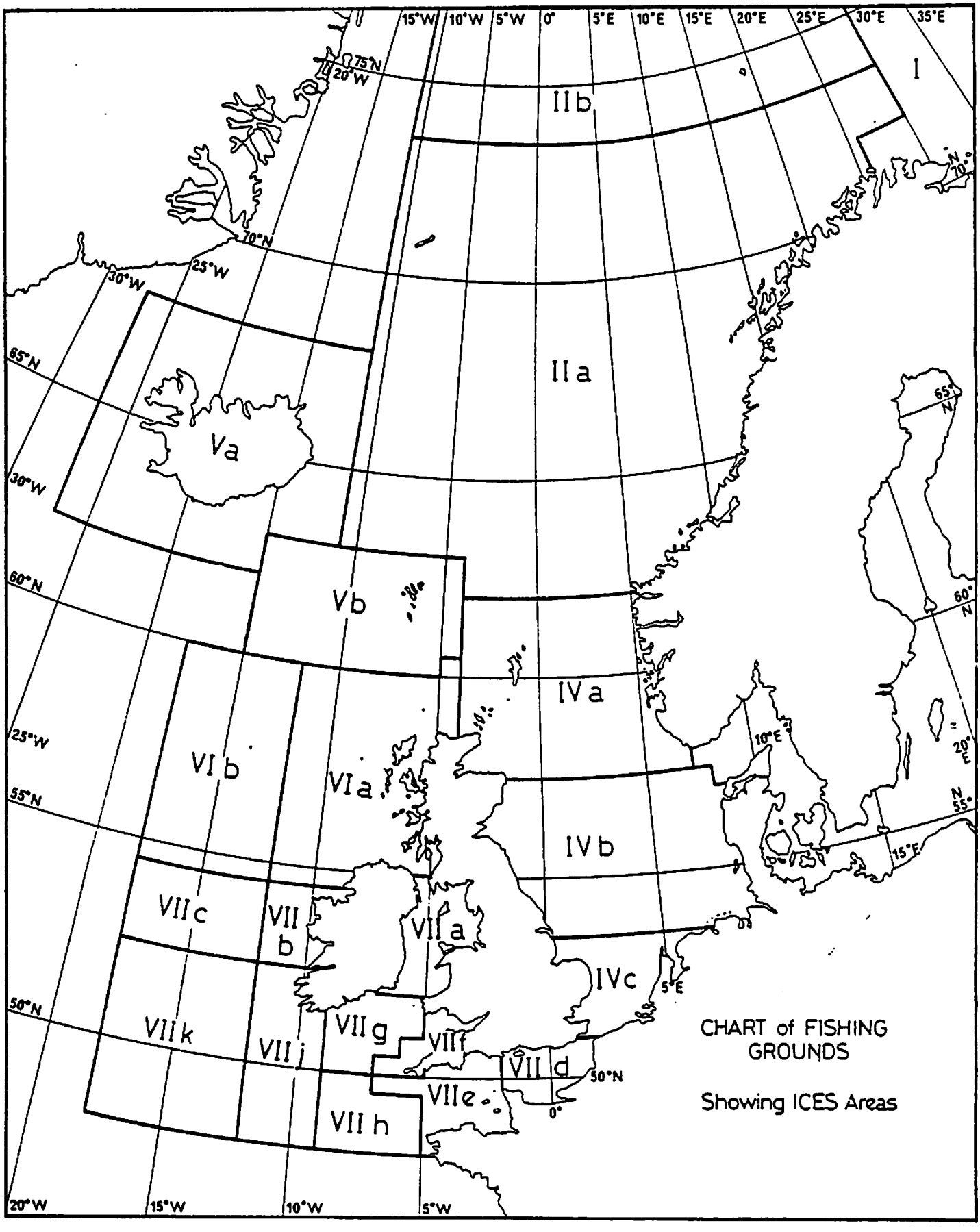
REGION	SUB REGIONS AND MAJOR PORTS	PORTS INCLUDED
10. SOUTH WEST Cont'd.	Small Ports Cont'd.	Port Isaac, Appledore, Bideford, Ilfracombe, Watermouth, Gloucester.
11. WALES	Milford Haven	Milford Haven
	Small Ports	Swansea, Penclawdd, Llanelli, Three Rivers, Saundersfoot, Solva, St. Davids, Fishguard, New Quay, Aberaeron, Aberystwyth, Aberdyfi, Barmouth, Porthmadog, Pwllheli, Aberdaron, Caernarfon, Holyhead, Penrhyn, Beaumaris, Menai Bridge, Bangor, Conwy, Rhyl, Mostyn, Connah's Quay.
12. NORTH WEST	Fleetwood	Fleetwood
	Isle of Man	Douglas, Ramsey, Peel, Port Erin, Port St. Mary, Castletown.
	Other Ports	Hoylake, Mersey, Liverpool, Southport, Preston, Lytham, Blackpool, Knott End, Glasson, Lune Estuary, Morecambe, Hest Bank, Kent Estuary, Flookborough, Coast Road, Barrow, Dudden Estuary, Whitehaven, Workington, Maryport, Silloth.
12. ULSTER	All Ports	Portstewart, Portrush, Dunseverick, Ballycastle, Cushendun, Carnlough, Larne, Carrickfergus, Bangor, Groomsport, Donaghadee, Ballywalter, Portavogie, Portaferry, Ardlgass, Killough, Minerstown, Annalong, Kilkeel.

APPENDIX II

DEFINITION OF FISHING METHODS

FISHING METHOD	CORRESPONDING D.A.F.S. METHOD OF FISHING (As shown in vessel list)	CORRESPONDING M.A.F.F. METHOD OF FISHING (As shown in vessel list)
1. DEMERSAL TRAWLING	01 Single Boat Trawl (over 80 ft). 03 Single Boat Trawl (under 80 ft). 04 Two Boat Trawl (under 80 ft). 09 Industrial Trawl 10 Light Trawl 11 Two Boat Trawl (over 80 ft).	Trawl, Stern Trawler, Freezer
2. SEINE NETTING	05 Nets, Seine	Seine
3. LINE FISHING	07 Lines, Great 08 Lines, Small and Hand	Line
4. PURSE SEINING	22 Purse Seine	Purse Seine Vessel
5. PELAGIC TRAWLING	23 Single Boat Pelagic Trawl 24 Two Boat Pelagic Trawl	Trawl, Stern Trawler, Freezer
6. POTTING	32 Creel Fishing	Creel
7. SHELLFISH TRAWLING	30 Nephrop Trawl 31 Scallop Dredging 34 Shrimp Trawl 35 Queen Scallop Trawl	Shell
8. OTHERS	06 Nets, Other 20 Nets, Drift 21 Nets, Ring 33 Shellfishing by Hand	Gillnets, Ring, Drift

APPENDIX III



I	Barents Sea	VII a	Irish Sea
II a	Norway Coast	VII b	West of Ireland
II b	Spitzbergen	VII c	Porcupine Bank
IV a	Northern North Sea	VII d	English Channel East
IV b	Middle North Sea	VII e	English Channel West
IV c	South North Sea	VII f	British Channel
V a	Iceland	VII g	South East of Ireland
V b	Faröe	VII h	Little Sole Bank
VI a	West of Scotland	VII j	Great Sole Bank
VI b	Rockall	VII k	West of Great Sole Bank

APPENDIX IV

DEFINITION OF FISH SPECIES

DEMERSAL

NAME	ALTERNATIVE NAMES	DESCRIPTIONS
1. Cod	Sprag, Codling	Gadus morhua
2. Haddock	Chat, Pingers, Gibbers, Jumbo	Melanogrammus aeglefinus
3. Saithe	Coley, (Rock Salmon), (Pollack)	Pollachius virens
4. Whiting	Marlings	Merlangius merlangius
5. Hake		Merluccius merluccius
6. Blue Whiting	Poutassou	Micromesistius poutassou
7. Norway Pout		Trisopterus esmarkii
8. Sand Eels	Lance, Smelt, Launce	Ammodytes spp.
9. Monkfish	Monk, Angler Fish	Lophius piscatorius
10. Plaice		Pleuronectes platessa
11. Lemon Sole	Merry Sole, Lemon Dab	Microstomus bitt
12. Dover Sole	Common Sole, Sole	Solea solea
13. Dogfish	Flake, Huss, Rigg, (Rock Salmon), Spur Dog, Picked Dogfish	Squalus acanthias
14. ~~Sakes~~ Skates & Rays	Roker	Raja spp.

APPENDIX IV CONT°D

DEMERSAL

NAME	ALTERNATIVE NAME	DESCRIPTION
15. Other Demersal	Including:	Including:
	Ling	Molva sp.,
	Pollack	Pollachius pollachius,
	Pout	Trisopterus luscus,
	Tusk	Brosme sp.,
	Bass	Marone sp.,
	Catfish	Anarhichas sp.,
	Conger Eeel	Conger sp.,
	Dory	Zeus sp.,
	Gurnard	Trigla sp.,
	Redfish	Sebastes sp.,
	Red Mullet	Mullus sp.,
	Sea Bream	Pagellus sp.,
	Brill	Scophthalmus sp.,
	Dab	Limanda sp.,
	Flounder	Platichthys sp.,
	Halibut	Hippoglossus sp.,
	Megrim	Lepidorhombus sp.,
	Turbot	Psetta sp.,
	Witch	Glyptocephalus sp.,
	Smooth Hound, Etc.	Mustelus sp., Etc.
PELAGIC		
20. Herring	Sild	Clupea harengus
21. Sprat	Brisling, Garvock, Stuifin	Spratus spratus
22. Mackerel		Scomber scombrus
23. Skad	Horse Mackerel, Jack Mackerel	Trachurus trachurus

APPENDIX IV CONT°D

NAME	ALTERNATIVE NAMES	DESCRIPTION
24. Other Pelagic	Including:	Including:
	Anchovy	Engraulis sp.,
	Pilchard (Sardine)	Sardina pilchardus,
	Grey Mullet	Mugil sp.,
	Smelt	Osmerus sp.,
	Chub	Scomber sp.,
	(Spanish) Mackerel	
	Garfish	Belone sp.,
	Tunny (Tuna), Etc.	Thunnidae, etc.
SHELLFISH		
30. Shrimp	Prawn, Pink Shrimp, Grey Shrimp	Crangon crangon, Pandalus borealis
31. Nephrops	Norway Lobster, Scampi, Dublin Bay Prawn, Langustine	Nephrops norvegicus
32. Lobster		Homarus gammarus
33. Crab		Cancer pagurus
34. Scallop	Escallop, (Clam)	Pecten maximus
35. Queen	Queen Scallop, Queenie	Chlamys opercularis
36. Squid		Loligo vulgaris
37. Other Shellfish	Including:	
	Crawfish (Spiny/Rock Lobster)	Palinurus vulgaris
	Spider Crab	Maia squinado,
	Mussel	Mytilus sp.,
	Oyster	Ostrea sp.,
	Japanese Oyster	Crasostrea sp.,
	Cockles	Cardium sp.,
	Clam	Mercenaria sp.,
	Whelk	Buccinum sp.,
	Winkle	Littorina sp.,
	Cuttlefish	Sepia sp.,
	Octopus, Etc.	Octopus sp., Etc.

APPENDIX V

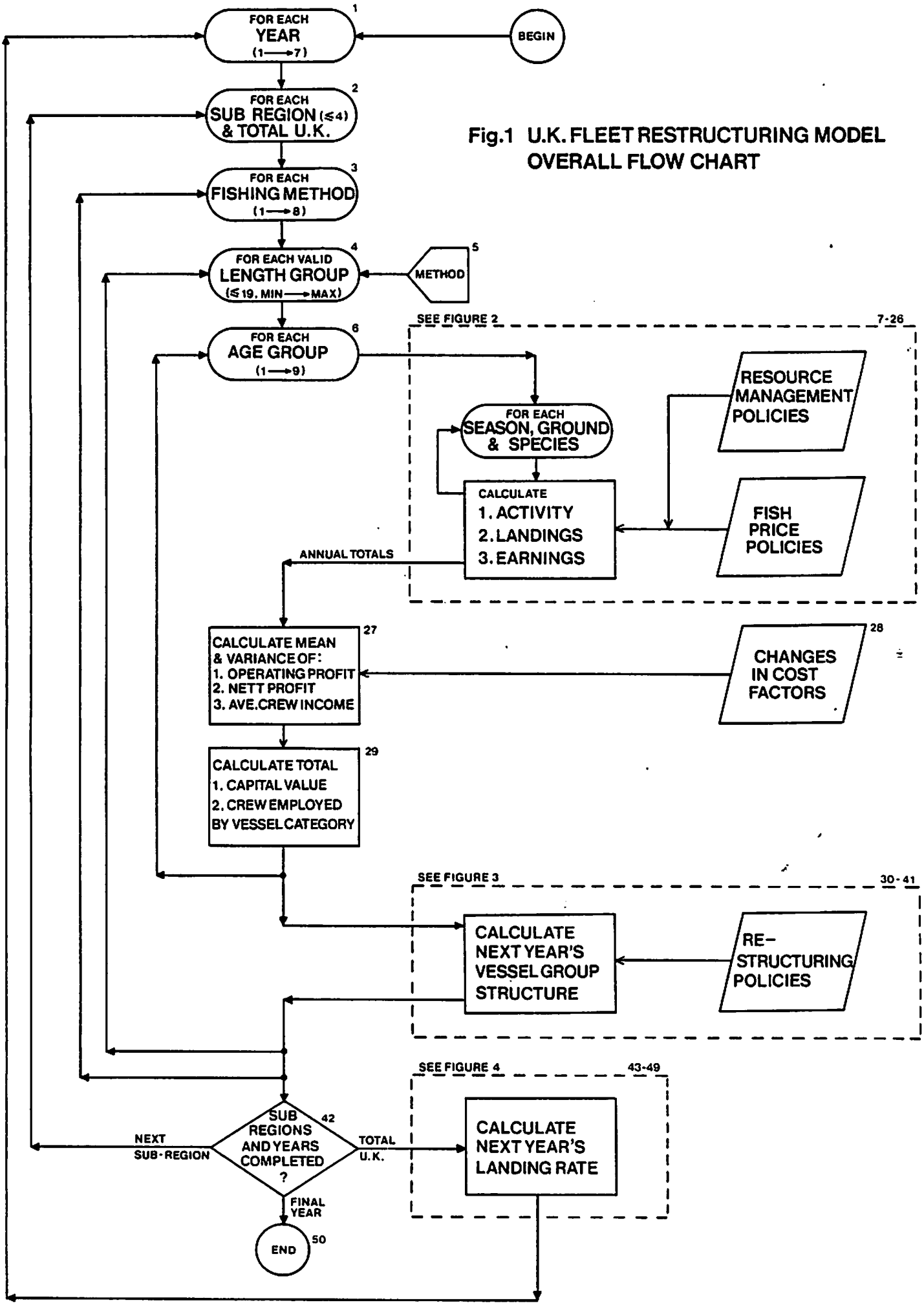


Fig.1 U.K. FLEET RESTRUCTURING MODEL
OVERALL FLOW CHART

APPENDIX VI

CONFIDENTIAL — DEPARTMENT OF AGRICULTURE AND FISHERIES FOR SCOTLAND — CONFIDENTIAL

YOUR CO-OPERATION IS REQUESTED IN PROVIDING THE INFORMATION INDICATED ON THIS FORM SO THAT THE DEPARTMENT MAY ASSESS THE ECONOMIC STATE OF THE INDUSTRY AS A BASIS FOR FUTURE PLANNING. THE INFORMATION GIVEN ON THIS FORM WILL BE TREATED AS CONFIDENTIAL FOR USE ONLY BY THE DEPARTMENT AND THE SEA FISH INDUSTRY AUTHORITY. NO INDIVIDUAL FIGURES WILL BE RELEASED TO ANY OTHER PERSON, BODY OR GOVERNMENT DEPARTMENT.

FOR OFFICIAL USE

Received

Checked

Code

INSHORE FLEET

PROFIT AND LOSS STATEMENT FOR 1981

VESSEL DETAILS

1. Vessel Name
2. Registration Letters and number
3. Base district
4. Usual number of crew
5. Registered Length (feet)
6. Days at Sea
7. Method of Fishing, number of weeks each method

Trawl (Demersal)		Shellfish Trawl	
Pair Trawl (Demersal)		Ring Net	
Seine Net		Drift Net	
Purse Seine		Dredge	
Pair Trawl (Pelagic)		Creel	
Lines		Other	

EARNINGS

8. Total Earnings	of which 9. Demersal	10. Pelagic	11. Shell

RUNNING EXPENSES

12.	Commission		
13.	Harbour Dues		
14.	Boxes		
15.	Ice		
16.	Fuel and Lubricating Oil		
17.	Food		
18.	Travelling Expenses		
19.	Other Expenses		
20.	Labour Share		
21.	Boat and Gear Share (item 8 less items 12 to 20)		

OWNER'S ACCOUNT

22.	Boat Insurance				
	Vessel repairs				
23.	Gross Costs				
24.	Receipts from Insurance		25.	Net Costs	
26.	Hire and maintenance of equipment				
27.	Expenses against gear				
28.	Other expenses				
29.	Total expenses on Owner's Account (sum of items 22, 25 to 28)				
30.	Net profit/loss on Owner's Account (item 21 less 29)				

NOTES

1. The form should be completed for the calendar year 1981. If this information is not available, estimates can be made.
2. RUNNING EXPENSES: Expenses should be listed under the appropriate sub-headings - miscellaneous costs for such items as bait, salt and stores shou be entered under 19. (Sums deducted at weekly settlements for charges against boat insurance, radio rentals, navigational and fishing aids should not included under this head. These expenses should be shown against items 22 and 26). Where boxes are charged against boat expenses these costs shou entered at 28. No expenditure on Value Added Tax should be included where this is recoverable under existing legislation.
3. LABOUR SHARE (*item 20*): This should include crew's wages, poundage, share money, bonuses, national insurance and stocker.
4. BOAT SHARE (*item 21*): This should include any allowances made at weekly settlements for charges in respect of boat insurance, radio telephone, navigational and fishing aids.
5. EXPENSES AGAINST BOAT (*Items 22 - 29*): Principal repayments, interest on boats, Engine and Gear Loans and all Capital Expenditure (ie expen on purchases which add to the boat's stock of equipment or gear) should not be included.
6. EXPENSES AGAINST GEAR (*Item 27*): This should include repairs and renewals of gear, charged against owner's share. Any expenditure regarded Inland Revenue as being of a capital nature should be entered under 33 overleaf.

CAPITAL INFORMATION

31. Year vessel purchased

32. Purchase price of vessel

33. Cost of major capital additions during year

34. Capital Grants towards capital additions during year
(eg SFIA (WFA/HIB), FEOGA)

35. Present insured value

OUTSTANDING LOANS OTHER THAN SFIA (WFA/HIB) and HIDB

36. Amount due to be paid during 1981 — Capital and interest

37. Amount paid during 1981 — Capital and interest

38. Outstanding at ~~31/1/81~~ — Capital and interest

NOTES

1. Capital additions (Item 33). All major capital expenditures on vessel and gear for which improvement grants are normally available, should be included; eg improvements to vessel storage and deck equipment, re-engining etc.

2. Foreign currency loans should be expressed in £ sterling equivalent.

Signed _____ * Owner/Partner/Director/Authorised Agent

_____

_____

_____ * delete as appropriate

_____

Date _____

Completed forms for the calendar year should be returned to the local Fishery Officer or to Room 421, Chesser House, Gorgie Road, Edinburgh, by February 28. Any forms which can only be completed for the financial year should be returned by April 30.

RE 85968 2m 1/82 TBL

APPENDIX VII
CONFIDENTIAL

SEA FISH INDUSTRY AUTHORITY

COSTS AND EARNINGS STATEMENT FOR INSHORE VESSELS (UNDER 80FT. IN LENGTH) IN ENGLAND AND WALES

TWELVE MONTHS ENDING .....

Owner's Name and Address:- _____

_____

_____

_____

_____

1. Vessel Name: _____
2. Vessel's port letters: _____ and number: _____
3. Base port: _____
4. Insured value: _____
5. Registered length: _____
6. Year built: _____
7. Usual number of crew: _____
8. Days at sea: _____
9. Fuel used: _____ gallons
10. Total earnings (less subsidy): _____
11. Subsidy: _____

RUNNING EXPENSES £		OWNER'S EXPENSES £	
12.	Commission:	22.	Boat insurance:
13.	Harbour dues:	23.	Gear:
14.	Fuel:	24.	Repair (less insurance receipts):
15.	Ice:	25.	Hire of electronic equipment:
16.	Bait:	26.	Other expenses:
17.	Boxes:	27.	Total of owner's expenses: (Items 22 to 26)
18.	Food:		
19.	Travelling expenses:		
20.	Other expenses:		
21.	Labour share:	28.	Boat share:

This information is required by the Sea Fish Industry Authority under the conditions of the Grant or Grant and Loan Agreement entered into by you with the Authority. No information obtained on this form will be made available to any person, body or Government department without the prior consent of the owner of the vessel.

This form should, on completion, be sent direct to the following address:-

Fishery Economics Research Unit,
Sea Fish Industry Authority,
Sea Fisheries House,
10 Young Street,
Edinburgh,
EH2 4JQ.

Any queries regarding this request should be addressed to R.S. MOUNCE at the above address.

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Notes for the Guidance of Owners

Item 21. Labour Share should include crew's wages, poundage, share money, bonuses, national insurance and stocker.

Item 27. Total of Owner's Expenses should exclude principal repayments, interest on engine and gear loans and all capital expenditure (i.e. expenditure on purchases which add to the vessel's stock of equipment or gear).

Item 23. Gear should exclude any expenditure regarded by the Inland Revenue as being of a capital nature. As such any expenditure which qualified for S.F.I.A. improvement grant should be excluded.

General Expenditure on Value Added Tax that is recoverable should not be included.

PLEASE NOTE: If you wish to receive a copy of the results of this survey please place a tick in the box provided.

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