5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.1. Behaviour and strategies in the fishing sector

FAIR-CT96-1454

**Measurement of economic impacts of fishery management decisions — Model-based approaches in specific fleet sectors**

**INTRODUCTION**

The importance of fishing has to be seen not merely in terms of its contribution to the gross domestic product (GDP), but above all in terms of its geographical concentration and the importance of the activities linked to it. In coastal regions and at local economy level, the socioeconomic importance of fishing increases substantially, even if there is a restriction on essential activities. Other induced activities (product processing and connected activities), multiplier effects and spin-off activities, such as tourism, are also of great importance.

A key hypothesis to be considered is that proper fishery management methods which put greater emphasis on economic efficiency become more attractive with economic development resulting in improvement of the efficiency of public administration and in more economic and social security for the working population.

In this context it is necessary to evaluate the effects of decreasing quotas, remote fishing grounds, varying catch rates, modification of days at sea, changing cost structures, sales prices, etc., on the gross margins. This kind of information should be of great interest for the policy formation process within the European common fisheries policy (CFP) context.

**OBJECTIVES**

The overall objective of this study is to identify the likely consequences of different management decisions within the scope of the European common fisheries policy by developing a computer-based simulation model for the measurement of the economic impacts in specific fleet sectors from the North Sea, Baltic Sea and Mediterranean Sea.

Such a sectoral fleet model for the analysis of management decisions will enable political institutions and fishing industries to assess the economic effects of individual and political decisions concerning quotas, fishing grounds, catch rates and prices on the costs and gross margin of particular fleet segments.

Based on detailed cost accounts in the Netherlands, Germany and Spain and on other technical and statistical data about catch effort, by means of this model it is possible to identify the consequences of policy instruments under various conditions, especially on effort and overcapacity, in economic terms.
In particular, the basic issues that are covered in this study are:

- the analysis and evaluation of existing calculations of costs and earnings and technical and statistical data in the Netherlands, Germany and Spain as a basis for the development of planning models;
- the generation of better knowledge of fleet activities and management strategies for a better understanding of changes in fishing capacity and fishing effort;
- the development of an appropriate computer-based economic simulation model placing particular emphasis on the economic effects of alternative management options;
- the quantitative assessment and measurement of impacts of operational behaviour, public policies, including allocation of fishing quotas, etc., on the profitability (gross margin) in different fleet segments.

The study can be classified as an empirical investigation, which analyses the effects of specific instruments in specific fleet sectors (regions), and is formulated in concrete rather than abstract terms. Apart from the evaluation of existing policies, emphasis is on the likely effects of changes in policy. The participants will attempt to identify the effects implied by the choice of different management systems. These effects will be calculated in quantitative terms.

**WORK CONTENT**

The overall research objective covers a number of tasks in order to include all the relevant aspects and objectives of the project.

*Analysis of databases in selected fleet segments*

Selection of specific fleet segments (‘standard vessels’) and evaluation of existing databases, collecting and/or updating of operational, financial and technical data and data comparison, harmonisation and preparation for model use.

*Building of an economic computer-based simulation model (CBS model)*

Analysis of economic and operational mechanisms, testing data framework by using table calculations, designing a computer-based simulation model and experimental calculations and feasibility tests with the designed CBS model configuration.

*Application of the CBS model to a variety of management decisions conceivable within the framework of the common fisheries policy*

Model calculations of different scenarios by using different variables in selected segments and assessment of impacts of various management measures including decisions on dissemination.

**METHODOLOGY AND RESEARCH TASKS**

The methods applied for the three areas of investigation are a combination of desk and field research, planning cost accounting (‘standard costing’) table calculations organised in Excel or Lotus workbooks’ construction of a comparative static economic model.

*Application of a simulation model approach*

The methodology is well proven by the four participants as far as desk and field research and Excel or Lotus workbooks are concerned. Standard costing as a basis for planning purposes in the management theory is also well known but is only
applied in few cases in fisheries economics. The comparative static models, including simulation approaches, have been used in agricultural research and were found to be very useful in the assessment of impacts of political decisions.

**PROJECT MANAGEMENT AND COORDINATION**

The proposed project is a concerted investigation involving four research institutions from three different EU Member States in the course of which the data collection will mostly be organised on a national level. The relationship between the four teams is that of equal partners carrying out each complementary part of the work in order to meet the objectives of the project. However, the Institute für Landwirtschaftliche Marktforschung (IFLM) acts as coordinator and team leader. Furthermore, scientific coordination is the responsibility of the coordinator, but each participant is responsible for collecting and updating of the particular databases in the request form.

Whereas the German and Dutch participants have extensive data sources at their disposal, it has to be noted that the Spanish partner has to collect the required financial data on the spot as well as operational and catch data of representative vessels of the fleet segments chosen. For this task, the Spanish participant has engaged two subcontractors, the Instituto de Estudios Oceanográficos (IEO) and the Instituto de Ciencias del Mar (ICM).

In order to guarantee that the different experiences of the partners from the three involved countries can be taken into consideration, the harmonisation and preparation of data as well as the development, examination and application of the developed model configuration (including the table calculations) were designed as a joint research action with the participants operating very closely.

**INTERMEDIATE RESULTS**

During the first of the two years research period, the bulk of the preparatory work necessary for the application of the simulation model has been executed. Firstly, all teams of the participating countries selected the following fleet segments, which are investigated in the project:

- German North Sea cutters (located in Cuxhaven) and Baltic vessels (located in Sassnitz/Ruegen),
- Dutch beamers of different size (300 hp ‘Eurocutters’ and 2 000 hp beam trawlers), and
- Spanish Mediterranean vessels (located in Barcelona) and purse seiners (located in Castelló).

Secondly, data requirements have been determined and data collection has nearly been finished. This task included, on the one hand, collecting of activity (operational) data from the logbooks, such as fishing areas, catch species and quantities and, especially, fishing periods (active and inactive time) and, on the other hand, cost and price data. The harmonisation of these data between the participating countries is still in progress. In this context, it is evident that realistic assessments of alternatives need monthly or at least quarterly data instead of annual figures in order to reproduce the varying seasonal catchability at different fishing grounds and fluctuating fish prices.

Thirdly, the preparation of these largely uniform data for model use comprised a splitting of costs into variable and fixed shares and their allocation to the different fishing activities. With regard to this task, information was collected through
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY
5.4.1. Behaviour and strategies in the fishing sector

FAIR-CT96-1454

Interviews with fishermen and their cooperatives. Additionally, former corresponding investigations which were made in the Netherlands have been evaluated.

Besides data collection, harmonisation and allocation, the first approaches to constructing an appropriate model configuration have been made. The model under development — using the GAMS modelling language — compares various fishing strategies which are related to different fishing grounds, distances to ports, catch rates, etc., and the ensuing impacts of the gross margin of a ‘standard vessel’. As a preliminary result, it has to be realised that there are significant differences between the fleet segments involved in the project. Nevertheless, the first approaches of model application demonstrated the suitability of the selected model configuration for different purposes.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.1. Behaviour and strategies in the fishing sector

FAIR-CT97-3541

Concerted action: Promotion of common methods for the economic assessment of EU fisheries

OBJECTIVES

The general objective is to promote and strengthen research into fishery economics in the EU and to provide economic information required for effective fisheries management.

Specific objectives

1. An annual economic report (AER) on selected fleet segments will be prepared for review by the STECF
   1.1. Continue report format established by the first concerted action
   1.2. Expand to new national fleet segments and include all EU Member States
   1.3. Develop and apply methods to allow analysis of EU-wide fisheries.

2. An annual economic interpretation of the ACFM advice will be prepared and submitted for review by the STECF
   2.1. Continue report format established by the first concerted action
   2.2. Expand to new fleet segments
   2.3. Improve method for short-term forecasting.

METHODOLOGY

An annual economic report will be prepared using data collected in the various participating countries and put into the format developed in the document Economic performance of selected fleet segments in the EU (Working Documents Nos 6 and 10 of the project ‘Coordination of fisheries economics research’). The reliability of data and validity of estimates will be cross-checked with independent information from other sources, by consultations with experts or by other techniques (e.g. sensitivity analysis).

The procedure for the preparation of the AER is as follows:

- data to be compiled from existing sources;
- estimates or proxies to be drawn from existing cross-sections or time series, justifiable assumptions and/or expert judgments;
- estimates to be cross-checked with independent sources;
- intensive communication by fax or e-mail;
- report to be completed during a workshop.

Contract No: FAIR-CT97-3541
Total cost: EUR 1 100 000
EC contribution: EUR 1 100 000
Starting date: 1.2.1998
Duration: 36 months

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An economic interpretation of the ACFM advice (EIAA) will be based on the method developed in the abovementioned project. The method will be gradually improved.

The procedure for the preparation of the EIAA is as follows:

- data to be drawn from the AER;
- estimates to be made and cross checked;
- report to be completed through e-mail;
- improvement of short-term model;
- workshops to serve for evaluation of and improvements to future issues.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.1. Behaviour and strategies in the fishing sector

**FAIR-CT97-3936**

*The significance of economic incentives in fisheries management under the common fisheries policy*

**OBJECTIVES**

The project commenced on 1 January 1998 and has a duration of 27 months. The project will examine the implementation at the national level of those key policy components of the common fisheries policy (CFP) which are intended to control fishing effort and fishing mortality. The focus of the project will therefore be on the measures adopted by different Member States in order to fulfil their obligations under the basic conservation and management regulation relating to the observance of national catch quotas and to achieve the reductions in fleet capacity agreed under the MAGPs.

The focus is put on the subsequent types of management:

- quota management systems (output regulation);
- effort management systems (input regulation);
- fleet capacity adjustment.

**Economic incentives (definition)**

Economic incentives can be used by managing authorities (principals) to induce particular responses or behaviours from investors or actors (agents) in the fishing industry, either by reducing profits (in the case of negative incentives) or by increasing profits (in the case of positive incentives). When trying to determine the minimum value of the premium which should be paid from the principal (managers) to the agent (fisherman) to switch from one target species to another, for example, fisheries managers are faced with an optimisation problem with a number of economic constraints. Problems like this can be handled using available software (such as GAMS which is used by several project partners).

**Quantification**

Economic incentives materialised in the shadow value of circumventing or violating specific management stipulations will be quantified wherever possible. This will happen along the lines explained in the above optimisation problem, once we have identified where, when and how economic incentives are implemented through existing management schemes. Hereafter, quantification could take various forms which will have to be determined after the objectives of the CFP on Member State level and the economic incentive types have been identified. Without laying down any precise approach and methodology, a number of aims are listed:

**Effort management:** In the investigation of effort regulation, the limitation of number of vessels and fishing days with respect to certain quota limitations.
would lead to a larger profit of a given species. This profit will be calculated in an optimisation model used in the sub-project. The profit will lead to a reallocation of effort by the fisherman towards this species. Should managers want to prevent fishermen from targeting this species, the necessary compensatory payment would be calculated as equal to the profit (marginal) from fishing this species. The method used is to construct a model that optimises the profit of a vessel/or group of vessels subject to a number of constraints (linear/non-linear programming). The optimisation produces marginal profits which are the shadow value of having the constraints relaxed, e.g. have an extra fishing day or an extra tonne of fish.

Capacity adjustment: A different type of quantification is the premium that is paid for decommissioning (capacity adjustment). Here the economic incentive is laid down in advance by the managers, and the sub-project would investigate the premium structure and the size of payment and relate this to the numbers of vessels, gross registered tonnage (grt) and horsepower withdrawn. The premium is the economic incentive to persuade fishermen to choose decommissioning rather than to keep on fishing.

Quota management: A third type of quantification is associated with individual transferable quotas. The price of the quota is an estimate of the premium that has to be paid to fishermen to, say, reduce the catches of a particular species. If a quota market exists, managers could use the price of a quota as an indication of the magnitude of the economic incentive a fisherman needs to go on fishing, and, consequently, what is needed to prevent him from fishing. Where no legal quota trading exists, quantification may be difficult. Nevertheless, the capital that is accrued in these rights is an estimate of the magnitude of an economic incentive and it would be important to identify where and how the capital is accrued in the absence of a market. In principle, the same method as the one used in effort regulation could be applied in an attempt to estimate the value of quota rights.

GENERAL OBJECTIVE

The objective of the project is to investigate the role and significance of economic incentives in the management of European fisheries within the framework of the common fisheries policy.

Specific objectives

1. To identify the role and significance of economic incentives in the management of European fisheries in the context of the CFP; in particular, to examine how the behaviour of fishing firms in response to national policy measures have aided or hindered the achievement of management objectives.
2. To produce a set of guidelines for policy-makers suggesting how the design of fishery management measures could be improved by taking economic incentives into account.

The study approach

Case studies have been selected in the five Member States participating in the project: Denmark, France, Italy, the Netherlands and the United Kingdom.

The configuration of the case studies will be as follows:

- quota management systems will be studied in Denmark, the Netherlands and the United Kingdom;
- effort management systems will be studied in Denmark, Italy and the Netherlands;
- capacity adjustment programmes will be studied in France, Italy and the United Kingdom.
At the start of the project a general methodological framework will be developed by the coordinator in order to provide the conceptual foundation for the study.

The overall analysis of the role and significance of economic incentives in fisheries management will be approached from the perspective of the economic theory of agency. This characterises the contractual relationships between individuals in the economy in terms of a principal and one or more agents. The principal (in this case the fishery management authority) seeks to ensure that the aggregate of the choices of all the individual decision-making agents (fishing firms) is in the interest of the principal. However, the (private) interests of the individual agents may not be the same as the (public) interests of the principal. If perfect enforcement of desired behaviour on the part of all agents is not feasible, the principal must try to establish an incentive scheme that will align the interests of the agents with those of the principal. Where this is not achieved, there is an incentive alignment problem that will tend to produce a suboptimal outcome (at least from the principal’s point of view). This conceptual approach has been applied to a variety of situations, including problems of environmental quality and the modelling of international fisheries relations.

The methodological framework will also outline the context for the study through a summary of the relevant areas of the CFP and an identification of the policy limits within which national management measures have been implemented.

Against the background of this conceptual and contextual framework, the specific methodology for each of the case studies will then be developed jointly by the relevant groups of participants. Each specific case study methodology will be adapted to the particular type of management measure under consideration, the precise details of national policies in this area and the nature of the requisite data sets identified.

However, the basic questions that each of the case studies will seek to answer at the national level may be summarised as follows:

- How was the national management system designed and implemented?
- What were the general and detailed objectives in terms of Community obligations and national priorities?
- What were the results in terms of the stated objectives, and what other results were apparent that might be of interest to policy-makers?
- What were the economic incentives, affecting the behaviour of fishing firms in response to the management measures, that impacted on the results observed?

In order to identify the appearance, operation and consequences of economic incentives in each of the national studies, both quantitative and qualitative analyses will be employed, depending on the particular management objectives involved and the extent of data availability at the national level.

A comparative analysis of the results of the national studies will be undertaken within the appropriate groups of participants in order to produce the results of the case studies on different types of management measures.

During the final phase of the project, a synthetic treatment of the results of the case studies will be undertaken by the coordinator. A key issue to be explored here will be the interaction between different types of management measures and the overall objectives of the CFP. The overall results will be interpreted and discussed against the background of the literature on the economics of fisheries management. Finally, the conclusions of the project will be presented in the form of a set of clear guidelines on how the design of fishery management measures could be improved by taking economic incentives fully into account.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.1. Behaviour and strategies in the fishing sector

FAIR-CT98-4409

A legal and economic analysis of foreign ownership of the production in the Atlantic fisheries

OBJECTIVES

Foreign ownership of fisheries production (FOFIP) rights, commonly called ‘quota hopping’, mainly occurs in Atlantic and North Sea fisheries. Fisheries management in Europe has led to numerous forms of input- or output-based rights designed to limit access to fisheries resources: quotas, licences, kilowatt and grt limitations. Most of these are defined in national terms: national quotas, national objectives for total kilowatts or grt in the MAGPs. But the free movement of capital, goods and labour in Europe allows for foreign investors to gain access to these rights by investing in the harvesting sector or in the distribution/processing sector when the industry is vertically integrated. This includes the purchase of 100% of a vessel or the purchase of shares in companies. Under various and contradictory arguments, national industries and governments resist or promote such purchases.

The general objective of this programme is to assess the legal and economic aspects of foreign ownership phenomena, based on a European review of the practices and the analysis of national or local situations. These case studies are conducted in four Member States: the United Kingdom, Ireland, France and Spain. The legal analysis will assess the formal and informal barriers to foreign ownership of fish production that already exist. The economic analysis will cover the identification of the economic incentives and the direct social and economic consequences for the catching sector and for the immediate onshore economies. The legal and economic dimensions of these practices will be discussed in regard to the general objectives and principles of European integration and of the common fisheries policy.

TASKS

Task 1 is a review as to what extent and under which legal framework foreign investment takes place in the fisheries of the European Union States located along the Atlantic and the North Sea (i.e. Portugal, Spain, France, Ireland, United Kingdom, Belgium, Netherlands, Germany and Denmark). This assessment is descriptive and limited to the information that can be obtained from public sources. It has a twofold objective: the review of the principles founding policy/legal choices regarding foreign ownership and the identification of the fisheries concerned with this phenomenon.

Based on four national case studies, in countries representing the diversity of approaches in Europe, task 2 will document in a more analytical manner the
formal and informal rules for guaranteeing access to national catch quotas in the United Kingdom, Ireland, France and Spain. The core objective of this task is to explain the evolution of the strategies and policy, as perceived by stakeholders, as transcribed in law and as implemented through legal cases. Regional differences within countries will also be discussed. The historical background will be searched as far as the foreign ownership issue has been raised in the four countries.

The objective of task 3 is to assess the economic dimensions of the foreign ownership phenomenon through six case studies on main fisheries concerned in major fisheries-dependent localities. These include the evaluation of the extent of foreign ownership in local fleets, the understanding of the diversity of economic incentives for a private investor to buy or sell abroad resource access rights, the quantitative illustration of these incentives and the most likely social and economic consequences of doing so for the catching sector and the near-shore economies. A case study may be focused either on one harbour or one fishery. This will be done according to the results of the general review which will show to what extent foreign ownership is targeted on specific fisheries and locations. A similar methodology will be applied to each case study involving three levels of analysis. First, the extent of foreign ownership will be evaluated in terms of production means and output. Second, the incentives backing the decision by private investors to buy or sell abroad resource access rights will be investigated. This will be documented by direct interviews with all the private investors. Third, reference income distribution structures and multipliers will be used to assess the likely impact of foreign ownership on income transfer to or from the near-shore economies.

At the end of the programme a fourth task will integrate the results of legal and economic work within the framework of a discussion confronting foreign ownership practices to the principles founding European integration and those of the common fisheries policy. Policy implications will be discussed.
OBJECTIVES

The social science of fisheries management is a relatively recent, but expanding and rapidly maturing, field of research activity. However, unlike either fisheries science or fisheries economics, the activities of the social sciences remain fragmented among several cognate disciplines and dispersed among a large number of academic institutes, with no integrating organisational framework. As a consequence, the dissemination of research findings and the impact on policy debates have been weak. Accordingly, the overall aim of ESSFiN is to develop an active network of social scientists engaged in policy-relevant research in fisheries management, with the following objectives:

1. to review the current state of social science research relating to fisheries management;
2. to identify key issues for social science research particularly in areas relating to the strategic behaviour of fishermen, institutional arrangements for fisheries management and the impact of alternative regulatory systems on fishing communities and fisheries-dependent areas;
3. to develop opportunities for greater collaborative involvement in policy-relevant research in fisheries management and development;
4. to facilitate the provision of appropriate socioeconomic advice to policy-makers.

Description

In fulfilment of these objectives, ESSFiN has set itself a number of clearly defined tasks. These include the following:

• A register of research interests of social scientists engaged in work on fisheries management is the essential first step in developing the network, identifying potential participants in the activities of ESSFiN and providing a basis for future research collaboration. At present the register includes a little over 300 persons drawn principally from EU member countries and from Norway, though there is a sizeable ‘chapter’ of non-European members, particularly from North America. Of the total, almost one quarter have participated in the ESSFiN activities listed below.
• A series of five thematic and regional workshops forms a core activity with the purpose of reviewing the key issues in fisheries management from a social science perspective and facilitating the pooling, assessment and refining of the most recent research findings.
• A selected and annotated bibliography of the social science of fisheries surveys the contribution of the social sciences during the period since 1985 and thereby makes good some of the problems posed by the widely dispersed and sometimes inaccessible location of key publications in the field.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY
5.4.2. Fishery management systems

- Establishing the framework for a socioeconomic database for fisheries-dependent areas is an initial step towards creating more specific and relevant information for monitoring the impacts of fisheries policies on fishing communities and the wider regions in which they are located.
- A comparative assessment of inshore fisheries management systems attempts to fill a specific gap in our knowledge and understanding of fisheries management in an area where there are increasing demands for integration with other users of marine resources and maritime space.

The final report on ESSFiN activities will outline the main issues and areas of future research in the social science of fisheries management. Throughout all the tasks identified above, particular importance is attached to the need for effective dissemination of results and recommendations.

RESULTS

At the time of writing, the concerted action is two thirds of the way through its initial lifespan. The following comments thus apply only to those sections of the programme which have so far been completed.

Workshops

Three out of the original schedule of five workshops have been held.

- ‘Property rights, regulatory measures and the strategic response of fishermen’ (Seville, 5 to 7 September 1996). Property rights are of central concern not only to an understanding of the social ecology of fishing but also as a prerequisite for effective management. However, the current debate on use rights has become distorted by the misuse of terminology, an overemphasis on ITQs and a decontextualisation of use rights from the broader social conditions under which fishing takes place. Use rights should not be considered only in the narrow context of finding an efficient operational solution to a management problem. The embeddedness of use rights means that externally imposed regulation may act as an indirect form of social change, which may help to explain the resistance of fishermen to the introduction of new policy measures. A schema is proposed wherein ITQs and centralised regulation are preferred for certain forms of offshore fishing, open access and/or group quotas, with a combination of centralised and devolved regulation, are regarded as relevant to other forms of fishing within exclusive economic zones (EEZs), and Community use rights and local systems of regulation are adopted for inshore fisheries within the 12 nm limit.

- ‘Northern waters: management issues and practice’ (Aarhus, 29 to 31 May 1997). Three main tendencies characterised the social scientist’s concerns in the ‘northern waters’, defined as the north Atlantic and the subsystems of the Baltic and North Seas. Running throughout the region is a concern for the lack of flexibility of response generated within modern management systems by a combination of unstable management scope and institutional inertia which renders the systems unable to cope with the increasing pace of internal and external change. Of particular significance in the North Sea is the pressing need to integrate fisheries management with the wider concerns for the quality of the marine environment and the integrity of the marine ecosystem. Implementation of integrated fisheries management raises particular questions relating to institutional reform. Finally, differences in the focus of concern prompt the consideration of a centre-periphery structure to the discourse on management issues, with the periphery’s preoccupation with the basic relationship between production, employment and incomes within the fisheries sector contrasting with the centre’s tendency to shadow recent consumer trends relating to environmental and market issues.

- ‘Alternative management systems’ (Brest, 18 to 20 September 1997). Focusing on institutional restructuring of fisheries management rather than on the content of fisheries policy, three themes emerged relating to: (i) the spatial scale of management; (ii) the organisational structures conducive to good management; and (iii) how fisheries management might cope with the increasing pressure for the assimilation of ecosystem management and the precautionary approach. Two
alternative models for decentralisation and devolution of responsibility for policy formulation were outlined: the designation of regional seas and regional fisheries councils to replace the monolithic CFP, and an interlocking system of coastal State management, whereby responsibility reverts principally to the individual Member States. Caution was expressed with regard to overstating the claims of co-management, which remains a rather ill-defined concept, and overemphasising the causal links between user participation, legitimisation, compliance and the success of the management system. Meanwhile, the challenge of ecosystem management can be met in one of two ways: through the reorientation of policy objectives within a State-led integrated management system or through eco-labelling schemes promulgated by an alliance of environmental lobby groups and major players in the food industry, which bypass the formal policy process.

A socioeconomic database for fisheries-dependent areas

The task group responsible for this initiative has elaborated a framework for a database for the analysis of fisheries-dependent regions, including consideration of issues of data availability, indices (economic, socio-demographic and fisheries based) and operational aspects. The framework focuses on coastal Europe and draws upon the international nomenclature of territorial units for statistics (NUTS) system of area classification as its frame of reference; preference is given to a municipality level of analysis (NUTS 4). Attention is given to the question of utility and it is concluded that such a database would provide a valuable contribution to policy intervention and assessment for European fisheries. In particular, it would provide the means for identifying fisheries-dependent areas and highlighting those which are most economically and socially vulnerable, through an evaluation of the location, level and nature of fisheries dependence. The database could, therefore, contribute to the design of more appropriate socioeconomic measures and more effective targeting of regional development initiatives. Development of a comparative database, however, represents a formidable challenge. Improvements in the availability of data through the greater harmonisation of national statistical programmes with regard to the frequency of published data sources, the reliability of data and their temporal and spatial consistency, and the development of data sets at low spatial scales, are needed.

FUTURE PROGRAMME

In addition to the publication of the annotated bibliography covering more than 200 key references early in 1998, completion of the workshop schedule with meetings in Syros, May 1998, on ‘Southern waters: management issues and practice’ and in Lofoten, August 1998, on ‘Fisheries-dependent areas’, and the work of the task group on inshore fisheries management, it is hoped to organise a concluding workshop on the integration of fisheries management, involving participants from different disciplinary backgrounds, fisheries administrations and user-group organisations, to review the key issues for research in fisheries management at the turn of the millennium.

MAIN PUBLICATIONS

A principal undertaking for the network is the dissemination of its main findings. ESSFiN has been fortunate in securing the agreement of a major science publishing company to publish the edited proceedings of its major workshops. The first of these is already available:


The second and third volumes are either in press or at an advanced stage of preparation.

Other publications from the network will be printed in-house, including the database reports and the bibliography. ESSFiN has been keen to realise its resources in other directions. Network members have, for example, been prominent in two special issues of social science journals:


**DISSEMINATION ACTIVITIES**


Contains extended summaries of papers presented by: J. Carlos Cuerda; L. C. Hamilton, C. M. Duncan and N. E. Flanders; K. Crean; J. L. Prat; S. Collet; E. Hoefnagel; A. Begossi; M. van Vliet; W. Davidse; P. Holm, S. A. Rånes and B. Hersoug; V. Wiium; J. Bailey; S. des Cleres; O. Otterstad; J. L. Alegret; B. Marugan Pintos; J. L. Suárez de Vivero and M. Fieyro; G. Mondardini; N. Steins; D. Symes and J. Phillipson; and R. van Ginkel.


Contains extended summaries of papers presented by: T. K. Hassager; S. Hanna; M. van Vliet; S. Eikeland; E. Eythorsson; T. Matthiasson; B. Rasmussen; J. Salmi and P. Salmi; M. Alatalo and H. Appleblad; A.-L. Toivonen; T.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

Vedsmand, P. Friis and J. Raakjaer Nielsen; J. L. Suárez de Vivero and M. Frieyro; S. Sen; J. Bailey; E. Kirkegaard; E. Dunn; P. Holm, S. A. Ránes and B. Hersoug; G. Hønneland; K. Hansen; K. Awebro; M. Nuttall and K. Burnett; V. Wiium; R. van Ginkel; and N. Steins.


Contains extended summaries of papers presented by: S. Collet; F. Gonzalez-Laxe; P. Salz; D. Symes; K. Crean; M. Sipponen; D. Bailly; M. Morin; M. Tasker; N. Steins; P. Holm, B. Hersoug and S. A. Ránes; S. Jentoft; J. Phillipson; D. Langstraat; J. L. Alegret; A. Dreano; R. Varjopuro and P. Salmi; K. Frangoudes; and M. Thom.


- Des Clers, S., ‘Structural adjustments of the distant fleet of European factory trawlers fishing for Loligo squid in Falkland Islands waters’, pp. 143–152.
- Steins, N. A., ‘We have to keep the foreigners out of our bay: top-down regulations and the strategic response of Irish fishermen’, pp. 216–229.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT95-0561**

**Innovative integrated bioeconomic models for the management of multispecies and multigear fisheries**

**OBJECTIVES**

The objective of this project is to substantially improve and enrich existing bioeconomic models for the management of multispecies, multifleet and multigear fisheries that have been developed in Iceland and Italy in the past few years as well as to contribute to the development of an overall methodology for constructing and applying such models to the practical management of European fisheries. The methodology combines bioeconomic modelling, classical and Bayesian statistical estimation techniques, extensive computer programming, numerical calculation and maximisation techniques.

An appropriate biological model incorporating substock structures (e.g. cohorts), spatial movements (migrations), species interaction and environmental impacts specifying stock dynamics will be developed.

A corresponding economic model of the harvesting sector, including the harvesting sector itself, will also be developed. This model, incorporating several vessel types, will describe the selection of fishing grounds, fisheries, fishing time, fishing gear, and investment in vessels and gear and the marketing of catches. Because of investment (disinvestment) in vessels and fishing gear and the deterioration of these assets over time, the economic model contains its own dynamics.

Some versions of the models will also include the modelling of individual decision-makers (fishing firms), maximising their objectives and interacting with each other through markets for fish, vessels and possibly catch quotas. Superimposed on this complex may also be different fisheries management regimes constraining the opportunity set of the fishing firms.

The biological and economic models are connected through the fishing mortality that the harvesting activity imposes on the biology and the corresponding harvest extracted from it. The project will naturally pay special attention to this crucial link.

**INTRODUCTION**

Being designed to deal with broadly similar fishery situations, namely multispecies, multifleet, multigear and multiregion fisheries, the Italian and the Icelandic models are similar in many respects however, there are also some important differences in design. Thus, the Istituto di Ricerche Economiche per
The UI model is not an optimisation model, and cannot calculate optimal fishing patterns. However, given fishing effort, it is able to calculate the outcome in terms of biomass, harvest and economic variables. In this way, it can also provide assistance to the practical fisheries manager. The main strength of the model, however, lies in its ability to investigate the impact and economic efficiency of fisheries management regimes. Under new fisheries management directives, the firms solve their new profit maximisation problems and consequently alter their behaviour, possibly in quite unpredictable ways. Thus, the UI model is particularly well suited as an analytical and practical tool for designing efficient fisheries management systems. A fairly complete discussion on the Italian and Icelandic models is reported in [1], while a wide review on existing bioeconomic fisheries computer models is provided in [15].

RESULTS AND DISCUSSION

Significant research activity has been devoted initially to the study and improvement of the catch-effort models. The features and the results for the biological model developed for Italian fisheries have been analysed, and a statistical technique to assess the prediction reliability of logistic and biological models in fisheries management applications have been developed [8]. The technique, based on the moving blocks approach, has been tested over a set of Italian catch and effort data. The results confirm that the biological model exhibits lower prediction reliability with respect to logistic models, due to a higher number of estimated parameters, but the differences between the prediction reliability of the two kinds of models are smaller than expected.

Relevant work on the use of a Bayesian approach for fisheries management has been carried out and extensively documented. Since policy decision-making in fisheries management is often complicated by large uncertainties in scientific estimates related to fish populations and potential biological and economic responses to alternative policy options, Bayesian estimation methods have recently been developed and applied. They are able to provide a flexible framework for estimating parameters in fisheries models and giving policy advice to fisheries managers. Despite growing interest, Bayesian methods remain accessible to relatively few. This research has tried to provide some applications of these techniques using Italian fisheries data. It has considered several aspects of the Bayesian approach, such as a review of some recent applications in fisheries and the calculation of Bayesian posterior probabilities by fitting a logistic model to relative abundance indices [2], the evolution of Bayesian methodology and its application in the provision of fisheries policy advice [6], a general discussion about usefulness and weakness of Bayesian decision theory in fisheries policy.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

The case of parameter estimation for Italian fisheries has been specifically analysed [4, 11]. In the first paper, a Bayesian statistical approach that uses prior information is adopted to fit a biomass dynamic model to catch data for two species (ray and cuttlefish). An informative ‘prior’ for the intrinsic rate of increase, \( r \), is required in order to obtain reasonable parameter estimates. The estimates of \( r \) are very similar for each species across areas, and therefore estimation performance can be improved because there are fewer parameters to estimate. In the second paper, the main evidence is that, because of anomalies in the catch and effort data (due to the fact that the Italian Statistical Institute changed its method of classifying bottom-trawl gear in 1983), only the application of models assuming that catchability has increased over time, together with informative priors, provides sensible parameter estimates. Different computational techniques have also been presented, with mathematical details. A computer program in Visual Basic for the application of the Bayesian technique has also been produced.

An analysis of the results of the Italian biological model via classical statistical techniques has also been performed in order to estimate the possible effects of area and species on model parameters and to derive consistent parameter estimates in those cases where time series catch and effort data are not informative enough. Firstly, a linear regression approach has been used. Although consistent outcomes can be found in a number of cases, many results are unsatisfactory in terms of statistical significance. Some results have also been obtained by applying multivariate techniques [9]. The biological parameters refer to the physical characteristics of the fish dynamic population as performed by the Deriso-Schnute model and reflect the mathematical constraints of the model equations. Results obtained by hierarchical tree clustering algorithms and k-means clustering (applied to the 3,290 biological parameters considered, i.e. seven parameters for each of the 470 equations), show that local stocks have their own level of specificity. Results for the big pelagic species and, to some extent, for the small pelagic species follow a better dynamic behaviour considering a national aggregation level. The best findings were obtained by considering aggregation of the results by the Iscaat national groups–species stocks. Fishing mortality was found as the main rule of the dynamic behaviour. Catchability and pre-recruitment were the starting points of the whole process.

Notable research activity has concerned the analysis and improvement of the economic part of the models, also in order to test different management regimes.

For the Italian model, a significant advance in the specification of reconversion costs has been achieved in order to overcome some limits due to the use of the inertia constraint. The original formulation of this constraint should have been able to take account of the costs linked to the production reconversion, assumed as proportional to the differences between the starting and proposed fishing effort distributions, and to select optimal solutions corresponding to realistic redistributions, thus considering the labour market and the sectoral constraints. Even though powerful, this way of modelling the inertia constraint has two main limitations: (i) positive and negative changes in fishing effort produce the same value of the inertia term, although on the basis of an economic and social perspective they cannot be considered as equivalent; (ii) this approach does not consider the cost transfers of fishing effort between different area/system combinations. A more precise specification of the cost of effort reconversion, connected to the reallocation of the fleet among areas and systems, has therefore been developed [7, 28]. An LP problem has been formulated to minimise the total reconversion cost (connected to the transfers of fishing effort among areas and/or systems, as well as those effort units coming from or sent to the unemployment status). This method has been tested over a set of data obtained with the fishing effort optimisation model. Different cases have been analysed, considering several hypotheses on the unit costs of effort transfer between area/gear combinations and on the costs related to the dismissal of effort (which have been linked to the impor-
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

The integration of the revised economic model within the whole bioeconomic optimisation has also required substantial work on mathematical and computational procedures. In fact, within the previous approach, there is no direct link between the variables referring to different areas. Therefore, the optimisation problem can be solved separately for each area, and a substantial reduction in the dimension of the mathematical problem results. Within the new approach, the optimal reconversion cost depends on the whole distribution of fishing effort over areas and systems. The resulting non-linear optimisation problem must be solved simultaneously over all areas, but this implies a significant increase in the number of iterations. Moreover, computationally efficient methods for the solution of the LP problem must be adopted to keep the whole computational time within reasonable limits. With reference to numerical techniques and software implementation, for the IREPA model a new numerical algorithm for non-linear optimisation has been integrated within the catch-effort identification procedure, to improve the robustness of the identification process. A more powerful software platform has been adopted in order to overcome some memory limitations and to allow the solution of larger optimisation problems. A reconversion of the user interface, from menu-driven to Windows-style programs, has also been undertaken in order to allow an easier use of the code and promote a wider diffusion.

Much time has also been spent on the improvement of the Icelandic model. The fundamental economic agents in the Nordic fisheries management model (NFMM) are firms engaged in fishing and/or processing. The objective of the firms is to maximise total net profits subject to existing constraints. In the current version of the model, this task is specified as an LP problem. It is of considerable importance to investigate and formally test whether the linear specification adequately describes the true situation. An approach to test the linearity hypothesis and other important hypotheses about the economics of the fishing industry has been developed. Among other things, this methodology permits the testing of hypotheses concerning economics of scale and scope in production, the degree of factor substitution possibilities, geographical differences in cost and the possibility of technical change.

A great deal of work has therefore been allocated to improving the parameter estimates of the economic part of the model and the relative functional structure and specifications. Particularly, some studies focused on the estimation of the production technology of the Icelandic fish-processing industry by means of the hybrid translog cost functions. The estimation was carried out for the processing sectors separately (freezing industry, saltfish production industry, and fishmeal industry), and it was found that the hypothesis of constant returns to scale in these industries cannot be rejected with reasonable statistical confidence [12]. It also emerges that the technology exhibits substantial non-linearities and substitutabilities, so that the need for a more complicated representation of the production side of bioeconomic models becomes apparent.

The meaning of "endogenous optimisation" has also been clarified (by which the fishing firms maximise profits or more generally their objective functions within the confines of the model; i.e. by modelling the operating conditions of the fishing firms allows the model to generate the relationship by allowing the firms to carry out their own maximisation within the model), and numerical experiments to determine the feasibility of actually computing endogenous optimisation fisheries models involving endogenous optimisation have been performed [14]. It seems that the previous approach is perfectly feasible and extremely useful within the fisheries model (not only as a scientific tool but also for practical fisheries management), except that the extra maximisation loops add greatly to its computational requirements. The adaptation of the IFMM computer code (originally written in C++ for the UNIX Sun-ATS platform) to the PC Windows NT operating system is currently under development [13]. Even if this conversion has encountered significant difficulties, the numerical analysis on the dynamic properties of the IFMM (together with the study of the related theoretical aspects) is well advanced. The results to date do not provide much evidence of the empirical relevance of complicated dynamics.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

REFERENCES

The following documents and papers have been produced during this project (the discussion papers are available from
the authors, from DG XIV/C.2 and from the website — http://www.irepa.org/fair561):

[1] DP-01: Arnason, R., Coccorese, P., Olafsson, S., Placenti, V. and Rizzo, G., ‘Comparison of the Icelandic (UI) and
Italian (IREPA) fisheries management models’.

logistic model’.

model to catch biomass and effort data: a Bayesian approach’.

multigear bioeconomic model to catch biomass and effort data: an Italian example’.


ment of fishing effort: some results’.

fisheries: preliminary results on parameter estimation and model prediction’.

in the MOSES model’.

constraints’.

and applications to Italian multispecies, multigear fisheries’.


system platform’.


capelin’.

some harvest rules’.

addendum to Discussion Paper No 12.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

FAIR-CT95-0561


[29] Arnason, R. and Davidsson, T. B. (eds), Essays on statistical and modelling methodology for fishery management, the Fishery Research Institute, University of Iceland.

5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

FAIR-CT95-0892

Foreign trade and seafood prices: implications for the common fisheries policy

OBJECTIVES

The overall research started with a question addressed by the French fishermen during the market crisis of 1993 and 1994: are the imports of fish products responsible for the falling prices in the domestic fish auction markets? Behind this simple issue lies a request for a better understanding of the level of integration between domestic and foreign fish markets due to international trade in seafood products.

Various aspects of the problem were envisaged in order to highlight the main features of trade patterns within the European Union. Since the issue had been poorly addressed at the European level, we had firstly to characterise the determinants of seafood trade, secondly to estimate the reciprocal relationship between prices and foreign trade, and, finally, to simulate the impact of several expected scenarios of economic policy on the level of trade in Europe.

DESCRIPTION OF WORK

The description follows the three objectives mentioned above.

1. To analyse the main features of trade patterns

This first part of the work aimed at providing better empirical knowledge of trade patterns in Europe. Although fairly descriptive, this phase also had a strong analytical content due to the selected indicators used for a quantitative analysis of foreign trade in seafood products. Different dimensions of trade have been highlighted: sectoral and regional patterns of trade, internationalisation, specialisation and competitiveness. Some very recent indicators have been used together with original indicators taken from the literature in industrial economics (concentration of regional partnership and stability of market shares).

In addition, some industrial determinants of trade have been found through the main features of domestic market structures in each participating country (the United Kingdom, Spain, Norway and France). Indeed, the harvesting capacity, the development of aquaculture, the processing industry, the retailing and catering sectors, and the size and features of consumption markets have undoubtedly affected the levels and evolution of seafood trade in Europe. These aspects were dealt with both in quantitative and qualitative terms.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

2. To model the relationship between foreign trade and market prices

More conventional economics was used for this second phase. Basically, two different econometric models were developed in order to assess both the impact of relative prices on seafood trade and the integration between European and worldwide fish markets.

The first issue was answered by a panel data model combining for each country at the bilateral level a great deal of products and many trading partner countries within several years (1988–94). Amongst various determinants of seafood trade, particular attention was paid to the role of prices (foreign and domestic prices), exchange rates, tariff and non-tariff barriers, the distance between countries, etc.

The second issue on price formation referred to very recent econometric techniques on time series processing (cointegration approach), and to market models. The emphasis was put on white fish markets in Europe in relation to international markets. Basically, fish markets are likely to be integrated both across national boundaries and across fish species or product types. Looking at time series of prices gave some insight into the question of market integration.

3. To simulate the impact of various policy decisions on seafood trade levels

From the results obtained in the first two phases, some implications of several policy decisions were simulated by the models. For example, the trend of decreasing tariff and non-tariff barriers (GATT, WTO) was taken into consideration so as to forecast the levels of the European seafood imports. In the same way, the implementation of the single currency on 1 January 1999, by eliminating the changes in nominal exchange rates within the European Union, will affect the levels of fish imports for some countries whose trade is particularly sensitive to price competitiveness.

ACHIEVEMENTS AND RESULTS

A common methodological framework was designed for all country case studies (France, Spain, the United Kingdom, Norway, and Europe as a whole), resulting in five country reports. Two econometric reports were also achieved on both issues of trade determinants and market integration, as well as another report on legislative aspects of the EU trade policy for fishery products, covering the period 1988–94. In addition, a market model was designed to simulate some effects of changes in production, prices, tariffs, etc.

All reports represent significant inputs to the research in seafood international economics, both from a theoretical and an empirical point of view. Besides the political or industrial aspects of the research (impact of trade policy, role of prices), this work should contribute to the improvement of theoretical findings on the international integration of markets. An original approach (panel data, cointegration) was developed in connection with this.

Basically, the results show that the European trade faces a structural deficit for seafood products, accounting for some ECU 6 billion. This deficit is differentiated among the Member States: the northern countries are rather producers–exporters, whereas the southern countries are consumers–importers. Sectorally, the European trade is more and more designed by imports of fish fillets. Regionally, the traffic coming into Europe is diverted from the North American or African countries to new partners such as South America, Asia or eastern Europe.

Relative prices and nominal exchange rates appeared to be the key determinants of seafood imports in Europe. For instance, a 10% decrease in price competitiveness (i.e. international over domestic prices converted into the same currency) since 1991–92 has pushed up imports in all observed countries, and particularly in France, with an increase of
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

25 %, amplified by the 6.5 % appreciation of the French franc vis-à-vis the ecu between 1988 and 1994. Since the domestic markets have proved to be interrelated with international markets, we can answer the initial question addressed by this research: the imports may be somewhat responsible for the decline in French prices, but only because of the combination with other price effects due to the changes in nominal exchange rates.

Other variables have been identified as influential on the European imports, but to a lesser degree (e.g. consumption expenditure, distance, trade barriers). Looking at trade barriers was of particular interest and showed a rather limited impact on trade: a complete removal would increase imports by only 2 or 3 %. However, the traffic creation would be much bigger for some specific flows, such as prepared fish from Norway (+66 % in the long run), other things being equal and provided that the Norwegian production capacity can positively respond to such an increase in demand.

These results and a few others were extended by the cointegration analysis of price time series. Some evidence of integration was found between several European markets (UK, France, Germany, Belgium and Denmark) for fresh cod, although the price levels are fairly different between the cited countries. Overall, markets for white fish are globally integrated, as if foreign trade of seafood commodities had turned the national markets for fish into one single worldwide market, proving the reciprocal influence between trade and prices. Interestingly, domestic prices of cod and saithe appeared to be correlated with international prices on the French market. However, no relationship could be discovered between the white fish market and meat markets.

Because of this single global market for white fish, some elements of price formation could be further analysed through a market model. The demand-oriented model gave very consistent results with respect to theoretical expectations, and to the results of the panel model. The aggregate demand of France, Germany, the United Kingdom and the United States seemed to explain price formation fairly well, when seasonality was taken out of the data series. Such a result brings further evidence of the great reciprocal sensitiveness of demand to changes in price. All these results have several implications with regard to the common fisheries policy:

- The introduction of the euro on 1 January 1999 will prevent unexpected shocks on seafood imports in the EU caused by moves in exchange rates. This should benefit EU fishermen, and particularly the French market which has been undermined by the dramatic consequences of the appreciation of the French franc vis-à-vis other EU currencies.
- Some comparative advantages may be found in the development of the processing industry. Indeed, the increase of product differentiation in processed goods may initiate the development of intra-industry trade in the seafood industry.
- In the context of globalisation, import protection is no longer efficient to protect fish imports in most of the product categories. The full liberalisation of EU fish imports should not have tremendous effects overall. However, for some very sensitive categories such as processed fish from Norway, it may increase imports substantially.
- The potential of trade with Asia and South America, though limited by the great distance from Europe, may increase because of joint ventures with European firms. On the other hand, the reduction of EU import barriers may also encourage EU producers to specialise in some market segments (with a high level of processing), and help intra-industry trade to develop.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT96-1778**

Management of high-seas fisheries

**OBJECTIVES**

The intergovernmental UN Conference on Straddling Fish Stocks and Highly Migratory Fish Stocks (1993–95) addressed the management of fishery resources found both within the coastal-State 200 mile exclusive economic zone (EEZ) and the adjacent high seas. During the negotiation process, a number of suggestions were designed to solve the contradiction between the rights and duties of the coastal States and the distant maritime nations and to improve cooperation between fishing nations. A consensus was reached that the management of straddling and highly migratory fish stocks is to be carried out through regional fisheries management organisations.

Our research consists of two parts:

1. Theoretical analyses of the UN negotiation process, the implication of the negotiation text produced for the international exploitation of marine resources, and the possible regional arrangement on the management of straddling and highly migratory fish stocks. The prevailing methodologies applied are economic analysis, game theory and decision analysis.

2. Detailed economic analyses of two case studies that are important to the European Union. One of the cases is the Norwegian spring-spawning (Atlanto-Scandian) herring, exploited by Norway, Russia, Iceland, the Faeroe Islands and several EU countries. The other case is Atlantic bluefin tuna, exploited by a number of EU countries.

Research has been undertaken with regard to both parts. As regards Part 1, management issues regarding straddling and highly migratory fish stocks have been reviewed. Preliminary analysis of some alternative cooperative management regimes has been undertaken. As regards Part 2, models of population dynamics have been developed for both Norwegian spring-spawning herring and Atlantic bluefin tuna. Furthermore, available cost, effort, harvest and revenue data have been collected, and preliminary estimates of cost and harvest functions have been undertaken.

**PUBLICATIONS**

5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems


An abstract of the papers ‘Northern Atlantic and Mediterranean bluefin tuna: biological and economic issues ‘ and ‘Bioeconomic model of bluefin tuna’ was submitted to the third European Marine Science and Technology Conference to be held in Lisbon in May 1998.

DISSEMINATION ACTIVITIES

5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

FAIR-CT96-1778


Planned dissemination activities


5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT96-1814**

The implications for fisheries management systems of interactions between farmed and wild caught species

**OBJECTIVES**

The project (Demint) focuses on the demand for fish and its implications for fishery management. Factors being determinants in the price formation process and the market structure (e.g. own-price and expenditure elasticities) are analysed. Focus will be on multispecies demand interdependencies between farmed and wild caught species. In addition to the key markets of France, Spain and the UK, the aggregated EU market will be analysed. Several North Sea species are analysed. The supply side of both the farming industry and the marine wild fisheries will be explicitly modelled, and also accounted for in the demand analyses. Furthermore, price simulations and marine policy modelling analysis will be undertaken.

**DESCRIPTION OF WORK**

The project is roughly divided into six main parts, which will be dealt with in chronological order. These are described in Table 1.

<table>
<thead>
<tr>
<th>Demand or supply side</th>
<th>Part</th>
<th>Description</th>
<th>Tasks involved</th>
<th>Status by 31 December 1997</th>
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<tbody>
<tr>
<td>Demand side</td>
<td>Part 1</td>
<td>Data-collection and descriptive analyses</td>
<td>Tasks 1.1–3.5</td>
<td>Nearly completed</td>
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<tr>
<td>Supply side</td>
<td>Part 2</td>
<td>Supply-side analyses</td>
<td>Tasks 2.1–3</td>
<td>Started</td>
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<tr>
<td>Demand side</td>
<td>Part 3</td>
<td>Market delineation analyses</td>
<td>Tasks 3.1–3.5</td>
<td>Started</td>
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<tr>
<td>Demand side</td>
<td>Part 4</td>
<td>Dynamic demand modelling</td>
<td>Tasks 4.1–3.5</td>
<td>Not started</td>
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<tr>
<td>Demand and supply combined</td>
<td>Part 5</td>
<td>Price and quantity simulations/predictions</td>
<td>Task 6</td>
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<td>Part 6</td>
<td>Marine policy implications analysis</td>
<td>Task 7</td>
<td>Not started</td>
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In Part 1, we analyse the three key markets, their industrial structure, market characteristics, etc. A review of the relevant literature that is available on these markets is undertaken. Necessary time series data (e.g. quantity and price) for the individual key species from each market are collected from local domestic statistics as well as from secondary sources (e.g. FAO, OECD and Eurostat statistics). The information collected at this stage is being used to produce three key-market reports, one for each country, and the first part of the aggregated EU market report. The species to be analysed are shown in Table 2.

<table>
<thead>
<tr>
<th>Species</th>
<th>Table 2: Species analysed</th>
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<td>Salmon</td>
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<td>Octopus</td>
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<td>Prawns</td>
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<td>Trout</td>
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<td>Saithe (coal fish, pollack)</td>
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<td>Crustaceans (prawns/shrimps and Nephrops)</td>
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<td>Sole</td>
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<td>Lobster (prices)</td>
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<td>Sardines</td>
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<td>Sea bass</td>
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In Part 2, we concentrate on the supply side. We estimate aggregated supply models for the Norwegian and the Scottish farmed salmon industries (sub-tasks 2.1 and 2.2). Furthermore, we undertake productivity studies where we try to uncover which factors that have been important in determining the apparently large technological progress within these industries. Finally, we develop a bioeconomic model of the North Sea fishery that will be used to determine the management implications of the interactions between the farmed and wild caught species later in the project.

In Part 3, the objective is to analyse the demand interdependencies between wild caught and cultured species. The result from these analyses will be used to determine which species to consider in the dynamic demand systems (task 4). More specifically, these analyses will use multivariate cointegration techniques to test for price interdependencies between price series for wild caught and cultured species. This also involves the modelling of particular market characteristics such as seasonal variation in prices, structural shifts, etc.

In Part 4, the objective is to estimate dynamic demand models to analyse the demand interdependencies between wild caught and cultured species. These analyses will use dynamic versions of almost ideal demand systems (AIDS) and single equation dynamic demand models, which estimate own-price, cross-price, and expenditure elasticities. The supply side will be incorporated either in the form of instrumental techniques or explicitly modelled using supply equations from Part 2.
In Part 5, we will use the estimated supply equations for the main cultured and wild caught species in the EU together with the dynamic demand models to simulate potential short- and long-run developments of production, prices and off-take in the fish markets. Specific scenarios will be explored relating to the impact on interdependent wild and aquaculture species markets of sustained growth in aquaculture production, changes in total allowable catches (TACs) with respect to selected marine fish species, and variation in imported supplies of wild salmon and other fish.

Finally, we will develop and assess alternative management strategies for both aquaculture and the traditional harvest sector taking into consideration the interactions at the demand level (Part 6).

STATE OF PROGRESS

As can be seen from Table 1, in 1997 we have the work in Parts 1, 2 and 3. Most of the data collection is finished, and the market structure of the key markets is mapped. The results will be available by the end of February 1998 in the form of three key market reports (Part 1).

Furthermore, the supply-side analyses have resulted in two scientific reports, one where we estimate an aggregated Norwegian supply curve (Steen et al., 1997), and one productivity study of the Norwegian salmon industry by Tveterås and Heshmati (1997). The data set for the Scottish salmon farming industry has been collected, and will be analysed in 1998. Work has begun on the development of a bioeconomic model of the North Sea fishery that will be used to determine the management implications of the interactions between the farmed and wild caught species.

We also started the work in Part 3 in 1997. In the second Demint workshop in June 1997, market delineation was one of the main topics discussed. So far, the work has been concentrated on methodology, which recently has resulted in a scientific paper on cointegration and product aggregation methodology written by Asche et al. (1997).

The paper ‘Market delineation and demand structure’ was submitted to and published in the American Journal of Agricultural Economics, 1997, 79, pp. 139–150. Cointegration tests for market delineation and estimation of a dynamic system of demand equations are undertaken for three high-quality products in the EU: fresh and frozen salmon and crustaceans. The ideas and methodology in this paper form the basic framework for the Demint project, but in this project we undertake analyses of a much broader product group.

Finally, the Centre for the Economics and Management of Aquatic Resources (Cemare) team’s work has resulted in an article where they implement a so-called ‘goal-programming’ approach to fishery management on resource allocation in the North Sea fisheries (Mardle et al., 1997).

REFERENCES


**Workshops arranged**

Demint workshop W1, Portsmouth, January 1997.


**Presentations**

Presentations have been given on several occasions at the market research fishery programme’s symposium, Norwegian Research Council, Tromsø, the annual Aquanor Symposium, Trondheim, and lately also at the annual Norwegian salmon production meeting, Trondheim.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT96-1993**

**Bioeconomic modelling of the fisheries of the English Channel**

**OBJECTIVES**

The English Channel/La Manche contains a number of multispecies and multigear fisheries. These fisheries are exploited by UK, French and Belgian fishermen. The objective of this project is to develop a bioeconomic model of the fishery that encapsulates the key economic, biological and technical interactions in it. This model, when finalised, may be used to examine the potential effects of fisheries management policies on both the financial and economic status of the fishermen as well as the biological status of the resource.

**INTRODUCTION**

The English Channel (ICES areas VIIId and VIIe) contains a number of multispecies and multigear fisheries. These fisheries are dominated by sole, plaice and high-value shellfish species such as lobster and scallops. Commercial activity in the fisheries is predominantly undertaken by fishermen from the UK and France, although vessels from other EU countries (such as Belgium) and the Channel Islands are also active in the fisheries. In total, some 4,000 boats operate within the English Channel, over half of which are UK boats. About 90% of these operate within 10 km of the coast (Tetard et al., 1995).

The overall objective of the project is to develop a bioeconomic model of the English Channel/La Manche fisheries that can be used as an input into management decision-making. The model will be used to estimate how changes in management will affect the economic status of fishermen and also to estimate how management policies will affect exploitation rates on resource populations, the effect on stock biomass and the resultant short- and long-term yields in the fishery. In this paper, the work to date on the project will be briefly reviewed.

**PREVIOUS STUDIES**

Pascoe (1995) developed a preliminary bioeconomic model of the trawl component of the fishery. This model encompassed five métiers — two otter trawl métiers and three beam trawl métiers. This model was further expanded to include static gear métiers (pots, lines and nets) as well as dredging métiers (Pascoe, 1997). However, no stock dynamics were included in the model so its usefulness was limited to short-term analyses.

A number of bioeconomic studies have also been conducted on the French side of the fishery. Santarelli and Gros (1984) developed a bioeconomic model of
the whelk fishery in the western Channel. The model was used to estimate the fleet size and number of pots per boat that maximised profits in the fishery. Meuriot et al. (1987) developed a bioeconomic model to examine the scallop fishery in the bay of Saint-Brieuc.

RESULTS

Biological component

The key species in the Channel were classified into three main categories (Table 1). The first category comprises species for which data are considered adequate to develop age-structured dynamic models. The second group of species are those where the data are adequate for the development of dynamic models, but these are likely to be simpler models (e.g. surplus yield models). The third category includes those species where there is insufficient data to develop dynamic models, but which are sufficiently important (economically) to keep in the model as separate species. All other species will be aggregated into general categories (e.g. other crustaceans etc.).

<table>
<thead>
<tr>
<th>Dynamic modelling</th>
<th>Modelling possible</th>
<th>Simple stochastic model</th>
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</thead>
<tbody>
<tr>
<td>ICES-assessed species</td>
<td>(data rich)</td>
<td>(ad hoc)</td>
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<tr>
<td>Cod</td>
<td>Edible</td>
<td>Conger eel</td>
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<tr>
<td>Hake</td>
<td>Crab</td>
<td>Crawfish</td>
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<tr>
<td>Mackerel</td>
<td>Pollack</td>
<td>John Dory</td>
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<td>Herring</td>
<td>Scallops</td>
<td>Lobster</td>
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<td>Monkfish</td>
<td>Spider</td>
<td>Lemon</td>
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<tr>
<td>Plaice</td>
<td>Crab</td>
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<td>Sole</td>
<td>Turbot</td>
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<td>Whiting</td>
<td>Brill</td>
<td>Megrims</td>
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<td>Bass</td>
<td>Pout</td>
<td>Cuttlefish</td>
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</table>

To date, only limited analyses have been undertaken. Initial use of length- and age-based assessment techniques on UK data for turbot, brill and black bream (data-rich/ad hoc species), John Dory and red mullet (ad hoc species) produced varying results. Age-based equilibrium cohort analysis models for turbot and brill (mean data 1994–95) showed F increasing with age and reaching a maximum of 0.55 at age seven, and 1.2 at age nine respectively (with M at 0.2 and starting F at 0.8).

For black bream maximum F was 0.87 at age seven, with M at 0.2 and starting F at 0.8. Length-based methods calculated from aggregated length data for John Dory gave a consistently high estimate of Z (around 1.5: with M at 0.2, F is
therefore 1.3), but this may be biased by a migration out of the Channel by older fish. Similar methods applied to red mullet also gave relatively high Z and F, but in this case the Channel is supposed to support a coherent stock, and the methods would therefore suggest a high exploitation rate on this species. Attempts at estimating the stock dynamics of cuttlefish have also been undertaken (Dunn, no date).

Initial trials with production models (Fox and Schaefer fitted using log-normal or gamma error models) on the turbot, brill and black bream stocks using data for 1986–96 all give relatively poor fit ($r^2 < 0.5$). Similar trials on the western Channel sole stock have given a better fit ($r^2 > 0.9$) and show that, with an initial stock level of 0.2–0.4, the fitted model estimates a current biomass that approximates well with the ICES assessment (data used were for 1972–95). The failure of the production models with turbot, brill and black bream may be largely due to the short time series of data used, with less variation in total catch and effort levels, or because of the less reliable recording of landings and effort of these non-quota species (i.e. poorer data quality), or because of a general failure of the model.

These initial assessments were carried out using UK data, and may be improved when the international data are available. The suitability of techniques for particular species is the subject of further discussion and study, but the current work would tend to suggest that as many methods as possible should be used on non-ICES-assessed species to obtain the best assessment.

**Economic components**

An economic survey of UK fishermen (Pascoe et al., 1997) suggested that the fishery was not earning economic profits in 1994–95. Small boat owners, however, appeared to be performing relatively better than the larger boat owners. Further analysis of the survey data suggested that much of the economic profits that were being generated were intra-marginal rents, and that the level of resource rent in the fishery was most likely negative (Coglan and Pascoe, no date).

A survey of French fishermen produced similar results (Boncoeur et al., 1996). Economic surveys of fishermen in both countries are being undertaken as part of the bioeconomic modelling project. The data from these surveys will be used in the model.

An analysis of price–quantity relationships is also being undertaken. Analyses of the key high-valued species in the UK suggest that prices are generally inflexible with respect to the quantity landed (Jaffry et al., 1997). This analysis was limited to the four highest priced species landed in the Channel on the UK market (lobster, turbot, bass and sole). Similar analyses are being undertaken for the other key species, both in the UK and France. These relationships will be incorporated directly into the model when finalised.

The factors affecting the allocation of effort by fishermen are also an important consideration. A study of fisherman motivation suggested that those in the Channel operated in a manner consistent with profit maximisation (Robinson and Pascoe, 1997).

**DISCUSSION**

The project is still in a fairly early stage. However, the project team has managed to develop a comprehensive information base on the fishery. This information base will prove invaluable when developing and validating the model. It is expected that a number of models will be developed during the course of the study. These models will focus on particular aspects of the fishery. For example, it is expected that the project team will develop a short-run model, a dynamic model and long-run equilibrium model. These models will be able to address different sets of management questions. The development of such a comprehensive set of models will allow more effective management of the fishery in the future. This will be of benefit to the industry as well as to the fish stocks.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

REFERENCES


FAIR-CT97-3841

The socioeconomic impact of regional management of the Irish Sea Nephrops and white fish fisheries on profitability and employment in coastal communities

OBJECTIVES

The purpose of this study is to examine the effects of a common regional management regime in the Irish Sea on the *Nephrops* and white fish fisheries and the coastal communities, which derive part of their income from these fisheries.

From an effective management regime, the rejuvenation of these two fisheries may be envisaged. Such a regime will necessarily impose costs and benefits, which it is the purpose of the study to identify from the application of models developed in an earlier study and their synthesis into a single entity.

It will be understood that a common management regime for the region may also result in a redistribution of costs and benefits and that this redistribution may or may not be desirable. Another objective of the study will be to identify and if possible quantify these effects. From this, it may be possible to encourage those seen as desirable and to provide countermeasures to those that are not.

The objectives are therefore:

1. to identify a management regime likely to be effective as a means of regional management of the Irish Sea;
2. to synthesise the existing, bioeconomic models of the Irish Sea and to apply them in restricted form to the *Nephrops* and white fish fisheries;
3. to quantify the distribution and redistribution of costs and benefits;
4. using the Irish Sea *Nephrops* and white fish fisheries as an example, to show the benefits which can be obtained by restoring the rate of fishing from its present excessive level to as nearly as possible an optimal level.

The study will cover the area of the Irish Sea, ICES area VIIa north of latitude 53 degrees north. The part of the Irish Sea ICES area VIIa south of this line is relatively barren except the extreme south, which in most respects is part of the Celtic Sea fishery.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT97-3900**

**Economics and the common fisheries policy: perspectives for the future economic management of Europe’s fisheries**

**OBJECTIVES**

The objective of the concerted action is to promote an active exchange of experiences, analyses and ideas between European economists on the present and future management of Europe’s marine capture fisheries.

Although the central aim is to bring together economists working in fisheries, the participation of economists working in related areas (including other natural resources, agriculture and the environment) will be encouraged. Moreover, in order to maintain a practical management perspective, participation and input on key questions will also be sought from policy-makers, biologists and representatives of the fishing industry.

The focus of the concerted action is the European Community’s common fisheries policy (CFP) and the national fishery management systems that have been adopted by Member States under the CFP, but there will also be an interest in the management regimes of other members of the European Economic Area, notably Norway and Iceland. The primary concern will be the management of fishing effort in the north-east Atlantic and adjacent waters, the North Sea, and the Mediterranean.

The detailed objectives of the concerted action may be summarised as follows:

1. to identify the key problems and priorities (objectives and constraints) in the management of Europe’s marine fisheries;
2. to consider from an economic perspective the apparent successes and failures of existing national and international fisheries management policies, management instruments and institutional arrangements;
3. to consider the lessons that can be learned from European fisheries management experiences in the wider international context;
4. to explore the practical potential for new approaches to the management of fisheries in Europe, including the use of economic management instruments and the introduction of alternative systems of fisheries governance;
5. to consider the implications of these experiences and ideas for the possible future shape of the common fisheries policy.

**Contract No:** FAIR-CT97-3900
**Total cost:** EUR 450 000
**EC contribution:** EUR 450 000
**Starting date:** 1.1.1998
**Duration:** 30 months

**COORDINATOR**

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5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.2. Fishery management systems

**FAIR-CT98-4255**

*Market-driven incentive structures for sustainable fisheries management*

**OBJECTIVES**

The central objective of this project is to test and compare consumer responsiveness to ‘management regime’ (sustainable/responsible fisheries management) and ‘quality’ differentiated seafood products, to predict/simulate any derived short- and long-term changes in market demand, to assess the potential implications of a demand-positive response on fisheries management policy and to assess the applicability and validity of the methodologies utilised.

This central objective will be achieved by the following:

Sub-objectives (a)

1. To ascertain the revealed preference of consumers to environmental or management regime associated attributes of certain existing food products.
2. To ascertain the nature and extent of changes in the market place derived from the introduction of environmentally or management regime differentiated food products.
3. To ascertain, where data availability allows, the revealed preference of consumers to existing quality or otherwise differentiated seafood products.
4. To ascertain how and to what extent these may be indicative of the extent of market-based changes in consumer seafood choices with the introduction of ‘management regime’ differentiated seafood products.

Sub-objectives (b)

5. To develop and apply appropriate survey methods and analytical techniques to ascertain the expressed preferences of consumers for management regime differentiated seafood products, utilising contingent valuation (CVM) and conjoint analysis (CAM).
6. To compare the expressed preferences of consumers for management regime differentiated seafood products with those similarly derived for quality differentiated seafood products.
7. To test and evaluate the applicability (including any biases) of contingent valuation (CVM) and conjoint analysis (CAM) in the context of eliciting consumer responsiveness to attribute differentiated seafood products.

Sub-objectives (c)

Prediction/simulation of the derived short- and long-term market-based changes in consumer seafood choices in respect of management regime and quality differentiated seafood products utilising the findings of the two methodological approaches adopted (revealed and expressed preference), making appropriate statistical comparisons.
Sub-objectives (d)
Forecasting the potential implications of any demand-positive response (or otherwise) identified on fisheries management policy.

RESEARCH TASKS
The research will focus on eliciting consumer responsiveness to management regime differentiated seafood products by developing, applying and evaluating: (i) revealed preference approaches to ascertain consumer responsiveness to existing management regime differentiated food products and to existing quality or otherwise differentiated seafood products; and (ii) expressed preference methods (CVM and CAM) to ascertain consumer responsiveness to the future introduction of management regime differentiated seafood products, with comparison made to consumer responsiveness to quality differentiated seafood products. The utilisation of the two approaches will facilitate validity testing of the results of the project and correspondingly qualify the applicability of one or both of the expressed preference methods in this context.
5.4. SOCIOECONOMIC ASPECTS OF THE FISHING INDUSTRY

5.4.3. Integrated coastal area management

FAIR-CT98-4399

A European database of indicator coastal communities

OBJECTIVES

The main objective of this project is to bring together experts from different countries, academic disciplines and industry sectors, and all persons who have been engaged in former projects with the aim of creating better and more policy-relevant planning instruments for European coastal areas.

The sub-objectives are:

1. to identify fisheries-dependent areas in Europe and highlight those which are most economically and socially vulnera ble;
2. to diagnose the most important macro-processes (from fisheries policy, environmental change, technological change, etc.) expected to influence these areas in the next decade;
3. to select a number of indicator coastal communities with fisheries dependence for comparative in-depth studies;
4. in this process, to use some of the harmonised indicators that have been developed for European rural areas with fisheries dependence;
5. to assist those responsible for the management of the CFP by providing them with tools that will enable them more easily to assess the social and economic consequences of alternative management options

METHODOLOGY AND RESEARCH TASKS

The main outcome of this project will be a database with special emphasis on the socioeconomic conditions in European coastal areas with fisheries dependence. The structure of the database will consist of three elements: macro-material with aggregated numerical information, micro-material with both statistics and other types of information, and the ‘front page’, i.e. an Internet presentation.

The Internet presentation will be developed in both volume and complexity throughout the project. At the start of the project, the Internet presentation will appear more as a framework with maps and national statistics. At the time of completion, users from all over Europe will have access to substantial material comprising both quantitative and qualitative information about the selected indicator coastal communities and the counties, regions and countries to which they belong. The intention is that the database will involve users in the collection of information and that this work shall continue even when this particular project has ended.
There will be two main processes following each other hand in hand throughout the three-year project period: a ‘top-down’ process developing the aggregated data, and a ‘bottom-up’ process preparing in-depth materials for the selected indicator coastal communities. Within each of these activities, there will be groups of researchers preparing the materials about fisheries-dependent coastal areas from the macro- and micro-perspective respectively.

A third process is hardly distinguishable from the two first processes, since it integrates the two other activities by specific measures. In terms of the number of users, this third process will be the most important part of the database. Here selected information will be made available for large groups of users.

The goal of this third process is continuously to improve the public utilisation of the database material in order to help managers and others to assess more easily the social and economic consequences of alternative management options. The core element in this strategy is the Internet presentation.

The Internet presentation will give users limited access to the aggregated statistical files and full access to the historic specific information on each indicator community. ‘Feedback’ from qualified users will be used to improve the design of the Internet presentation and to decide which new information will be made available to the public. Therefore, one of the most important issues related to dissemination is to establish a network of professionals who are using the database and can suggest improvements.

In practice, the database files will be stored in three different sources, each with their own particular user interfaces. One source of the database information is the basic macro statistical files, the complex materials of (more or less comparative) aggregated data for fisheries activity and socioeconomic data. These materials are the products of the top-down process and the macro-perspective working group. The other source of information is the diversified (often more qualitative) information about the selected indicator communities. This is the result of the bottom-up process and the micro-perspective working group. The third source of information is the Internet presentation. This source will be the front page of the entire database. The information presented here shall be carefully selected from the two other sources.

By means of the two suggested main activities, the top-down and the bottom-up processes, and the integration of these activities through specific measures (a third activity), researchers, administrators and interest groups will be involved in a three year consensus process. This process has the aim of improving practical knowledge about the sustainability and diversity of coastal communities in Europe, and, in particular, about the strategic situation in fisheries-dependent communities, which means ‘the potential of intervention and change’.