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DECISION-SUPPORT SYSTEMS FOR FISHERIES
THE "ITAFISH" CASE STUDY



**Istituto Centrale
per la Ricerca
Scientifica
e Tecnologica
Applicata al Mare**



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Organization
of
the
United
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GENERAL FISHERIES COMMISSION FOR THE MEDITERRANEAN

DECISION-SUPPORT SYSTEMS FOR FISHERIES
The “Itafish” case study

by

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PREPARATION OF THIS DOCUMENT

The Italian Central Institute for Marine Research (ICRAM) in its computerisation process proposed to FAO, Fisheries Department to jointly design and develop a "typical" DataBase and Information System for a fishery institution to be used by ICRAM as a prototype and by the FAO Fisheries Department as a "visible" model to be proposed to other countries in the General Fisheries Commission for the Mediterranean (GFCM) area for their national decision making needs.

The document produced by the ITAFISH team, after the completion of the work, describes the methodology developed, the solutions adopted and the elements constituting the Decision Support System. It has been prepared in Italian and English.

ITAFISH, in its regional context, has already been used by FAO-COPEMED Project as a base to develop its "Fishery Research and Development" regional DataBase, and by the FAO-ADRIAMED project as the backbone to build up the sub-regional information system ADRIAFISH, as support to Sub-regional decision making.

The decision to publish it in English, in the "GFCM Studies and Reviews" series, was taken to comply with the many requests from individuals and Institutions to use it as a reference document as well as an information guide on how a national Decision Support System could be constructed using approaches that have been successfully developed and tested.

Coppola, S.; Crosetti, D.

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ABSTRACT

The purpose of the joint ITAFISH project, between the Italian Ministry of Agricultural and Forestry Policies and FAO, was to design, develop and test a computerized system or methodology for the organisation, storage and first analysis of the mass existing data available on fisheries and aquaculture in the Mediterranean for decision making. The system is based on a network of institutions and users which exchange data and information using the applications and exchange formats developed by the project. This paper describes the ITAFISH project regarding: the context in which it was conceived and developed, its contents, the input models, the functioning and the outputs, and how it is managed. A separate manual is also available describing the installation of the system and its more technical specifications. The development model and the system architecture of ITAFISH make it possible for ITAFISH to integrate with other components, thereby constructing a made-to-measure Decision Support System as a national model. The conceptual design also envisages its integration into an eventual regional network where ITAFISH would be the national node or interface which connects with other similar systems in the network.

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INTRODUCTION

The ITAFISH Information System is the product of a joint research project between the Italian Central Institute for Marine Research (ICRAM) and the Fisheries Department of the Food and Agriculture Organization (FAO) to develop a system of data banks for fisheries and aquaculture, both as a prototype for Italian institutes/centres and as a model for decision making in the Mediterranean basin (GCP/REM/058/ITA).

The Project was financed by the Directorate-General of Fisheries and Aquaculture of the former Ministry of Agricultural, Food and Forestry Resources (now the Ministry of Agricultural and Forestry Policies: MiPAF) from funds in the third Three-year Plan for Fisheries and Aquaculture. It was included in the FAO Technical Assistance Programme and implemented under the direction of the FAO Fisheries Resources Division.

ITAFISH has been designed to incorporate already acquired knowledge, develop and integrate new applications, and establish standards for the exchange of information through a network between institutions and users:

- **it is an instrument for gathering and disseminating fishery and aquaculture information that has been collected on Italian territory;**
- **it is a virtual information site, whose institutional memory is physically located with the people working in these fields;**
- **it has been designed to expand autonomously starting from an initial nucleus;**
- **it was conceived as having a modular architecture to evolve as the users, who are also the suppliers of the information, grow in number.**

This paper describes the Project, the context in which it was conceived and developed, as well as its contents, the input models, functions, and outputs, and how it is managed. A more detailed description of the structure, functional specifications, contents, installation and use of ITAFISH is given given in Vol.2 "ITAFISH – structure and management of the System".

1. BACKGROUND

Although the availability of information, data and statistical systems for fisheries and aquaculture is generally considered fundamental for estimating production levels, as well as for providing decision makers with the most accurate, reliable and up-to-date information on which to base their strategies, it can generally be stated that the vast amount of fishery and aquaculture data at present collected in Italy is insufficiently used. This is mainly because these data are not organised in structured and coordinated systems and, therefore, are not easily accessible for sectorial analyses and comparisons with other data.

The Ministry of Agricultural and Forestry Policies therefore felt it was important to promote a research project to study and develop a prototype information system for Italian institutions and centres that operate in fisheries and aquaculture. The project was entrusted to ICRAM and, at the express indication of the Ministry, carried out in collaboration with the FAO Fisheries Department.

So as to ensure that the final product would be both effective and efficient, the System was designed taking into account the organisational and institutional conditions of Italy and its location (in the Mediterranean basin) and the necessary functional characteristics that would ensure this as well as its gradual evolution.

1.1 Fisheries and aquaculture as renewable resources

Fishery and aquaculture activities play an important role in the coastal areas because they not only provide healthy and appetising food, but they also create essential employment opportunities, thus favouring economic and social prosperity.

Marine fauna is a natural resource that is part of our common heritage. It is both a renewable and mobile resource, whose reproduction and dynamics escape control. For fishery activities to be maintained at a satisfactory level healthy stocks are necessary, and this presupposes a healthy marine environment. In order to safeguard the marine ecosystems and permit restocking through a correct management of the sea that is sustainable over time, fishery and aquaculture activities must be regulated by international cooperation. This cooperation should aim at resolving the common problems which, within the

present context of fisheries and aquaculture, are the risks of overexploitation and pollution of the marine ecosystems.

Over the last few years the Italian fishery and aquaculture sector as a whole (management, enterprises, fishery associations, public and private research) have also become conscious of the importance of environmental policies in fisheries and aquaculture because of the industry's close relationship with the environment. The "Code of Conduct for Responsible Fisheries" (FAO, 1995), contributed to this awareness. Among the Code's principal objectives is the commitment to protect the aquatic ecosystem by undertaking fishery and aquaculture activities in a responsible manner in order to guarantee the correct management of aquatic resources and their conservation.

The Italian Government, through the adoption of multi-year programming of political and administrative action in the sectors (Three-year Plans for Fisheries and Aquaculture) therefore established measures to control fishery activities in order to maintain the catch at a sustainable level, i.e., by regulating fishing effort and the technical characteristics of the boats.

It should be noted that, within the framework of the Three-year Plans, scientific research is engaged in projects aimed at assessing fishery resources and identifying production technology that both respects the ecosystem and is economically valid. In this connection, the use and improvement of economic and social analysis tools to plan the management and development policies for the sectors are underlined. In this context the need to collect and disseminate the information mainly, but not only, through the latest communication means (Internet, CD rom, data banks, etc.) was emphasised.

1.2 Information requirements

The monitoring of fishery and aquaculture activities and a proper management of the marine resources would meet the growing needs of many countries, and in particular those of the Mediterranean countries. The latter, in fact, constitute a unique fishing area whose wealth must be opportunely preserved and managed by all its many users. However, effective activity monitoring and correct management cannot be undertaken without all the necessary information being made available to the individuals and organisations who operate and have decisional power in the Mediterranean area.

The existing knowledge of the Mediterranean ecosystem is considered inadequate to fulfil the need for information for various reasons. Certainly, factors such as the scarce experience of some countries in data collection and information management, or the insufficient level of technology available to them, have contributed to this lack, which could be eliminated through appropriate technical assistance projects. However, the most important and most common reason is of structural origin, i.e., regardless of how efficient the institutions are in each country, appropriate importance and adequate resources were never given to this problem. Some of these structural elements are listed below:

- a. Generally speaking, the term "information" includes only statistical data (i.e., numerical), collected and processed by the national systems. All the other information from various sources (producers' organisations, credit institutions, administrative authorities, international organisations) as well as that produced by the scientific and technical research world, which is essentially qualitative not quantitative, is not fully exploited.
- b. Monitoring and managing resources are activities that have only recently been introduced into the production and institutional contexts. Consequently, given the inevitable inertia of any organised system to adopt innovations, to date there is a gap between the quantity, quality, frequency and degree of coverage of the information collected by the existing statistical systems and that indispensable for the monitoring and management activities.
- c. National statistical systems are structured and constructed (by typology, by methodology and by information processing technology) completely in accordance with the criteria of the country concerned. In other words, they are closed systems that are incommunicable and more or less impermeable to efforts to integrate them into a regional information network. They are often simultaneously "difficult" and "inefficient" instruments - difficult because they are accessible only to users who are able to interpret and process their contents; inefficient because they are not structured to provide answers to complex problems but only to supply elementary information.

To eradicate this "cultural" delay in information management, which is the only way of effectively managing marine resources, the concept of the statistical system as the only source of information should first of all be given up. Then, information systems, i.e., instruments of knowledge that permit users to access information from different sources, sectors and disciplines (i.e., from statistical systems, government authorities, research organisations, databases, geographic information systems, telesurveys, information networks, experiments, system experts, etc.), according to different cultural levels and different operative needs, should be set up.

It should be emphasised, however, that in the Mediterranean area there is also a serious problem of lack of circulation of information between the countries concerned. It is emblematic in this context to note that of the numerous national, regional and international initiatives launched in the last decade in the fishery and aquaculture sectors by international organisations (FAO, UNDP, CE, World Bank, etc.), the information return to institutions, researchers and users in the Mediterranean area was, and still is, scarce, and often redundant or a duplication.

The reasons for this are many: reluctance of researchers to disseminate the results of their work, confusing procedures, lack of international scientific networks, badly interpreted national interests, and so on. On the whole, though, the following structural causes can be identified under national and regional responsibility:

- lack of harmonisation and control in the multi-disciplinary data collection systems
- lack of coordination in the data processing
- lack of or scarce resources to manage the information
- modest knowledge of information technology, data collection and computerised processing techniques
- inadequate administrative structure to support information systems in the long term.

To help overcome the above problems a Regional Information System for the Mediterranean, under the aegis of the GFCM, was attempted. However, for a number of different reasons (financial, organisational, and statutory) the project was not realised.

The alternative strategy, into which ITAFISH can be placed, was to construct a regional information grid system (one grid = one country). Here, national systems would constitute the single nodes based on a technological and information model that was adaptable to the requirements (standards, methodologies, and levels of accuracy of the information) and which could be implemented over the whole region.

The feasibility of this project was based on various considerations, two of which were considered fundamental for its success:

- the obvious need for a system dedicated to assisting the researcher with a continuous flow of data and information useful for the evaluation, forecasting, and study, etc., of events that are, or could in some way be, linked to fisheries and aquaculture and to their control;
- the conviction that both public and private institutions possess a large quantity of data and information that could be very useful in the management of this sector, but which remain un- or only partially utilised because they are organised, processed and disseminated in such a way that it is difficult and often impossible to integrate and associate them with information of a different nature and from different sources.

2. ORIGIN OF THE PROJECT

In 1995 ICRAM was entrusted with a research project to develop an information system for the fishery and aquaculture activities in Italy based on:

- the use of innovative technologies to organise and manage the information
- collocation in the environmental and institutional context in which Italy interacts, i.e., the Mediterranean
- effective feasibility.

The project was financed by the Directorate-General of Fishery and Aquaculture of the then Ministry of Agricultural, Food and Forestry Resources (now the Ministry of Agricultural and Forestry Policies, MiPAF) and included in the FAO technical assistance programme under the direction of its Fisheries Resources Division.

The FAO Fisheries Resources Division (FIR) is responsible for activities aimed at increasing knowledge of all the elements which affect both the dynamics in the water and its related exploitation through fishing, in order to strengthen and optimise these food resources on a world-wide scale. Moreover, FIR guarantees that such knowledge is aimed at the promotion and growth of these resources in a responsible manner. Its assistance focuses especially on developing countries. In addition to the various technical programmes, the Division offers assistance in each phase of project development, from formulation to accomplishment, and also provides specialised information to public and private institutions.

As already mentioned in the Introduction, ITAFISH is a joint ICRAM/FAO-FIR research project to develop a prototype system of fishery and aquaculture data banks for Italian institutions and centres and for use as a model for other Mediterranean countries and, as such, met the requirements of both parties:

- ICRAM needed technical assistance from FAO to develop a set of sectorial databases that would enable an information system for Italy to be set up. The decision to request assistance from the FAO Fisheries Department was dictated by two fundamental reasons: firstly, the Department's regional and international experience in the design, development and management of statistical and information systems for fisheries and aquaculture; and, secondly, its experience in designing and proposing information systems based on models used in SIPAM (Information System for the Promotion of Aquaculture in the Mediterranean) and SIPAL (Information System to support the decisions for aquaculture in Latin America), whose design is considered innovative and which take account both of the sectors' problems and of the involvement of the final users in the design and development of the system.
- FAO-FIR's interest in participating in this project had two objectives: on the one hand, in accordance with its institutional mandate, to provide technical assistance to a Member Country (Italy), for systemising and processing information; on the other, to design and participate in the implementation of an information system that could be proposed as a national information system model for other countries in the Mediterranean, within the

framework of the wider project for the establishment of a regional information system.

In this context, on completion of the project it is FAO-FIR's intention to transfer the ITAFISH technology to other countries in the Mediterranean area which request it, so as to accelerate the development and integration of the data and information not only at the national level but also at the Mediterranean regional level (MEDFISH).

3. ITALIAN INSTITUTIONAL CONTEXT

The ITAFISH project, in accordance with the decision of the Directorate-General of Fishery and Aquaculture of the then Ministry of Agricultural, Food and Forestry Resources, was entrusted to ICRAM, which carries out activities in the fishery and aquaculture sectors.

ICRAM, a public body in Category VI "Scientific research and experimental bodies" of the table attached to Law no. 70 dated 20.3.1975, was originally established by Article 8 of Law no.41/1982 (Plan for the rationalisation and development of marine fishing) with technical support functions to the Directorate-General of Marine Fishery of the former Merchant Navy Ministry to contribute scientifically to a balanced management of the marine resources. By Law no.61/1994 (regarding control of the environment and the establishment of a national agency for the protection of the environment (ANPA)), ICRAM came under the authority of the Ministry of the Environment and was restructured both organisationally and functionally.

ICRAM's mandate, at the time of its establishment in 1982, was to contribute to the protection of the sea and its resources through activities to support management, conservation and awareness based on solid scientific bases and the precautionary approach. In this context, ICRAM carries out applied research and provides technical advice in support of related policies:

- on the quality of the marine environment (coastal and lagoon), and on anti-pollution activities
- on marine biological diversity, with special attention to habitats of particular naturalistic interest and to protected marine species

- on the sustainable use of the marine environment and its resources.

ICRAM is located in Rome and has technical scientific offices in Palermo and Chioggia. It is organised as follows:

Policy

President (nominated by Presidential Decree as proposed by the Minister of the Environment)

Administrative Council (five members):

- President of ICRAM
- two representatives from the Ministry of the Environment
- one representative from the Ministry of Agricultural Policies
- one representative from the Ministry of Universities and Scientific Research

Management

Director (nominated by the Minister of the Environment as proposed by ICRAM's Administrative Council)

Auditing

Auditors (three members):

- one representative from the Ministry of the Environment
- one representative from the Ministry of Universities and Scientific Research
- one representative from the Treasury

4. REFERENCE AREA

4.1 The Mediterranean

The ITAFISH Information System was designed to be used primarily in Italy, and its reference area can only be the Mediterranean basin.

In the background paper for the FAO Council in September 1949, on the establishment of the General Fisheries Council (now Commission) for the Mediterranean, it was confirmed that "in the case of the Mediterranean basin, the borders of the geographic area concerned appear well defined and obvious". In fact, the whole Mediterranean and adjoining seas, including the Black Sea and the waters that connect it to the Mediterranean itself, constitute a unique ecological unit where some of

the edible marine species migrate across the entire basin or, at least, through its related sub-areas. This is not the case of the Red Sea which, notwithstanding its geographic proximity, has more affinity with the Indian Ocean and which, therefore, has been excluded from the "Mediterranean and adjoining waters".

4.2 The General Fisheries Commission for the Mediterranean

The General Fisheries Commission for the Mediterranean (GFCM) was established in 1947 under the auspices of FAO. In 1976 it was confirmed that its area of competence included the Mediterranean Sea in the strict sense, the Black Sea and the intermediate waters.

The general purpose of the Commission, as established in the preamble of its constitution, is to operate in the mutual interests of the participating countries "for the development and balanced use of the marine resources" through "international cooperation". It was authorised to formulate and recommend appropriate measures to manage the area concerned, including the regulation of fishing methods and fishing gear, setting a minimum catch size for each catchable species, establishing a calendar of fishing seasons, and defining the total catch and effort permitted and each member country's quota.

The GFCM is essentially an advisory body without the authority to emanate laws or rules or to give instructions that are binding to its member countries. In essence, its interventions are in the form of reports and recommendations to member countries issued at its periodic general meetings. Its functions are very wide, and cover all the biological, environmental, scientific and technical aspects of problems connected with the development and rational utilisation of living aquatic species. In particular, the Commission:

- identifies the problems
- promotes coordinated research
- publishes the results of its work
- defines research and development projects
- undertakes research and development projects
- promotes reference standards
- effects comparative studies on legislation
- encourages research on working conditions

The GFCM has contacts and collaborates with many international organisations. Of relevance, in order to examine fisheries and aquaculture problems in the Mediterranean and in the coastal countries, are its contacts with the International Commission for the Scientific Exploration of the Mediterranean (ICSEM), the European Inland Fisheries Advisory Commission (EIFAC), the Joint Commission for Black Sea Fisheries, UNESCO with its Inter-Governmental Oceanographic Commission (IOC), and the Mediterranean Association for Marine Biology and Oceanology (MAMBO).

4.3 Regional projects that can be associated with ITAFISH

4.3.1 MEDFISH

MEDFISH is a conceptual model, accepted by the GFCM within the framework of the development of an information system on fishery and aquaculture activities in the Mediterranean area. It represents the structural link between peripheral systems (national, regional and/or sectorial (fisheries, aquaculture)), (Medfish, 1997). The model was conceived to contribute towards closing some of the information gaps common in Mediterranean countries, where, for various reasons (scarce human, economic, and/or technological resources) the following scenarios exist:

- Management information systems are available to support decisional processes
- Limited or sectorial management information systems without any integration or coordination structural links have been established.
- Efficient management information systems are in place but they cannot keep pace with the increasing demand.

The basic objectives on which MEDFISH was designed are as follows:

- In the short term, to produce an instrument that enables existing or developing national applications to be incorporated into a single network, as sub-systems of a single Mediterranean information system.
- In the long term, to produce an instrument to support decision making for interested end-users, programmers and planners (DSS).

From the information technology point of view, MEDFISH is a model for the linking and centralised management of existing data bases (national, regional, FAO, EC, or of other organizations).

With regard to the architecture, MEDFISH is a specialised node of an information network, where purely technical support functions are carried out: i.e., defining work protocols and standards; elaborating a single system for coding the information; guaranteeing minimum levels of information quality and consistency; promoting the development of new applications; providing various communication interfaces between institutions, information suppliers and users. In other words, it is a computerised work environment whose specialised information systems will be accessible to all users of the network.

Functionally speaking, MEDFISH is an interface that permits rapid and easy access to information from various sectors, countries, and disciplines according to formats differentiated by use category.

The overall structure of MEDFISH can be illustrated as a pyramid with a square base, the four faces representing respectively the national component, the regional component (figs. 1-2), the visibility of the FAO information component, and the communication system. The progressive narrowing of the pyramid from the base upwards reflects the process of aggregation of the elementary components (e.g., the databases available in a given country) in more and more complex structures (e.g., national information systems) to the decision making support tool.

As already mentioned, MEDFISH is a conceptual model NOT a computerised system. It is a structural link between information systems and does not (and should not) have its own database. Consequently, its implementation will not be possible until at least the principal components have been completed, tested and activated (SIPAM and COPEMED for aquaculture and fisheries in the Western Mediterranean; ITAFISH as the national component; POPDYN for marine population dynamics; SPECIESDAB for the taxonomical and biological aspects of the species, etc.).

4.3.2 SIPAM

The SIPAM project (System for the Promotion of Aquaculture in the Mediterranean) is pending the

implementation of an information system network, established under the auspices of the GFCM (SIPAM, 1992).

Its general objective is to promote the development of aquaculture in countries of the Mediterranean area. Specifically it will:

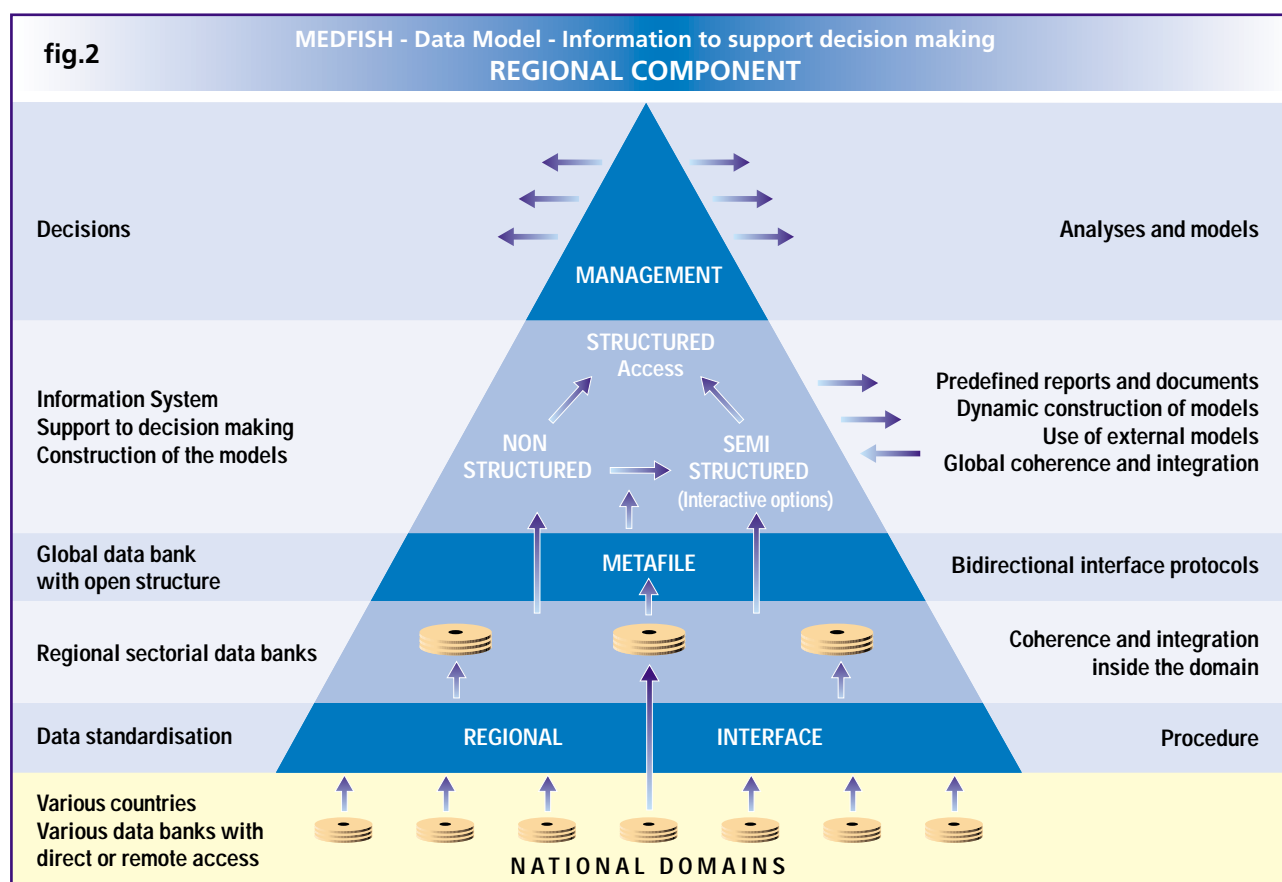
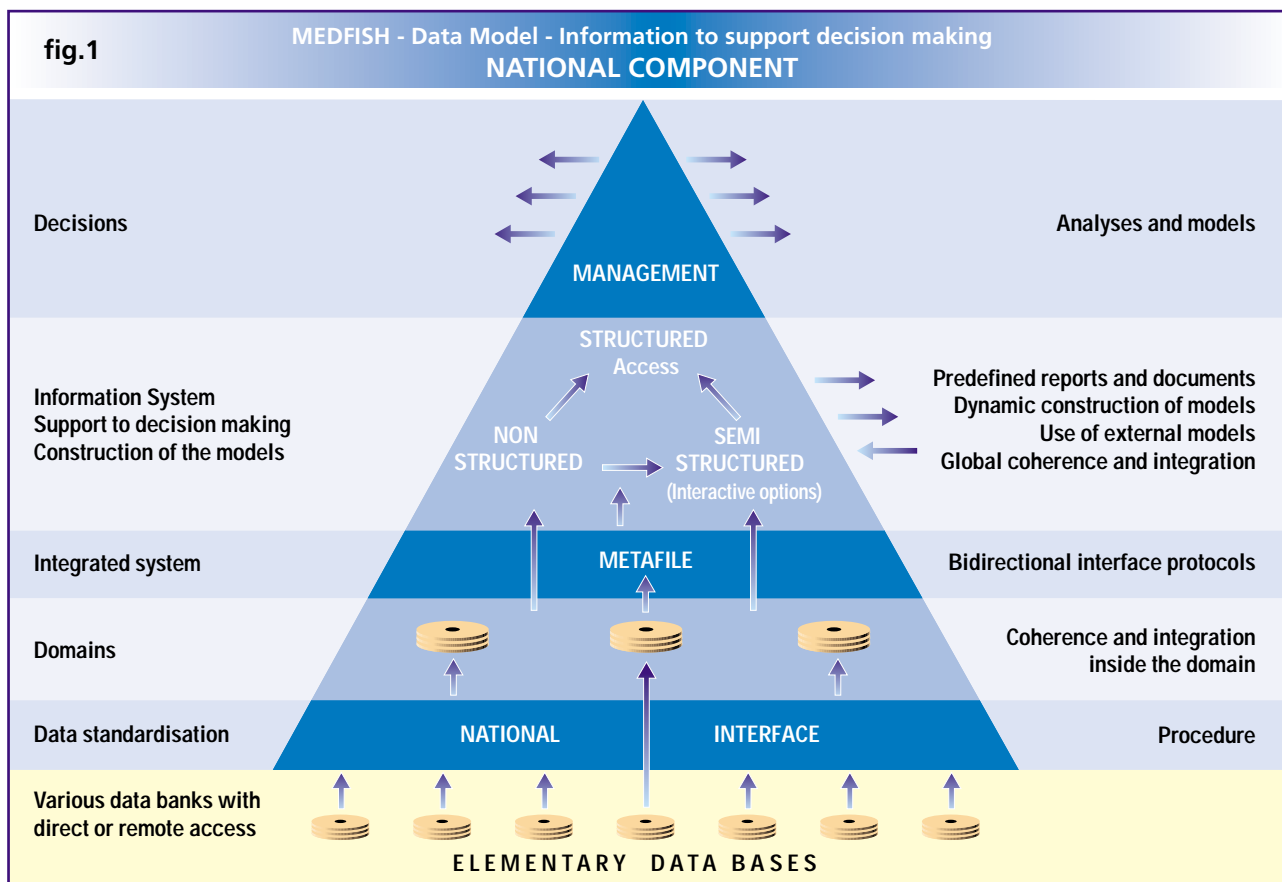
- Assist people working in the public and private sectors to rapidly and easily access the information necessary for various levels of decision making in aquaculture.
- Provide cognitive support to the aquaculture research network through the reciprocal exchange of information.
- Provide support to research planners by making available a global and up-to-date picture of the state of the art of aquaculture.

SIPAM's strategy is based on the implementation of a single regional information system as the sum of similar parts (fig.3); in other words, SIPAM attempts to promote the development of national information systems with similar structures, linked by a communication network:

- The end users (governments, institutions, workers, researchers) access the Mediterranean network through their own national system,
- Each national system is fed by sources already existing in the country through transfer interfaces pre-set for loading the information,
- The national systems communicate with each other through the Regional Centre, which acts as the hub station,
- The Regional Centre also connects the national systems with remote systems, such as the FAO-FIR system.

4.3.3 COPEMED

COPEMED is a five-year project under the FAO-SPAIN Cooperation Programme. It was established in 1996 to provide advice and technical assistance in the central and western Mediterranean, as well as to form a collaboration network to support the coordination of fishery management activities. Eight countries in the region are involved: Algeria, France, Italy, Libya, Malta, Morocco, Spain and Tunisia. One of the activities of COPEMED's programme of work is explicitly dedicated to information systems and



internet connections. Its Executive Committee has therefore decided to incorporate the MEDFISH model into COPEMED.

The geographical coverage will be limited to the project area, i.e., to the central and western Mediterranean.

Various sub-systems will be developed during the course of the project, such as: Research and development, Statistics, Documentation and electronic library, Species biology and population dynamics, Infrastructures, Regional activities, and Legislation.

The first sub-system 'Research and Development' has already been completed and delivered to the countries participating in the project for the data input and revision operations. The sub-system comprises seven databases: Institutions, Priorities of the institutions, Experts, Projects, Documentation, Results and Networks operating in the area.

The second sub-system, which will contain the Register of the fishing fleet and fishery operations, is under preparation. It has been created to provide cognitive instruments to monitor, control, and supervise fishery and other related activities in external waters under national jurisdiction as well as to define realistic measures of control.

In the planning of further project activities, priority will be given to:

- involvement and participation of the national users (administrations)
- identification of national priority needs with respect to the regional picture
- training of users, at all operative and decisional levels
- integration or interfacing of other projects or information systems.

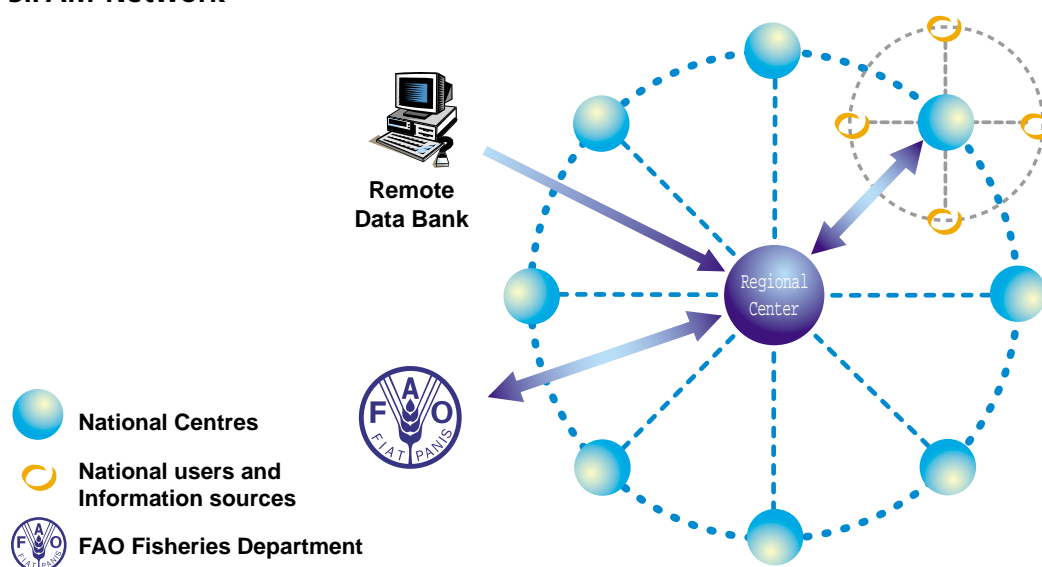
5. OBJECTIVES

5.1 Background

The broad strategy of the ITAFISH project is to design, develop and test a computerised system for organising, storing and eventually undertaking a first analysis of the mass of data available on fisheries and aquaculture in a Mediterranean context. This strategy aims at achieving two objectives.

The first, in the short term, is the design and development of an integrated data base (management) system for Italy, based on the "open architecture" technology, where various fishery and aquaculture sectors converge. The architecture should enable ITAFISH to work on two operating levels: the decision-making level, where the support of structured information is needed, and the data collection and processing level where an instrument is needed to manage the

fig.3 SIPAM Network



information. At the same time, the data management system must allow for both centralised and peripheral management of the information.

The second, a long-term objective, is to contribute to rationalising the means, methodologies and results of most of the data collection and dissemination activities in the Mediterranean. Ideally, ITAFISH will constitute the national component of the wider regional project, MEDFISH, at present still in the initial phase.

The two objectives will have to be undertaken sequentially, over time. In fact, it is widely felt that no progress can be made in implementing a regional information network unless national information systems have previously been designed, implemented and adequately tested.

ITAFISH was conceived as a system which, through the creation of a data and information network between institutions and users, incorporates already-acquired knowledge, develops and integrates new applications, and establishes standards for the exchange of information:

- it is an instrument which assembles and disseminates Italian fishery and aquaculture information,
- it is a virtual information site, whose wealth of knowledge is physically located with the people working in the two sectors,
- it is a system designed to expand autonomously, from an initial nucleus,
- it is designed so that it is the users, who are at the same time exploiters and suppliers of the information, who diffuse and enlarge the system.

5.2 Specific objectives

The above outline of ITAFISH's objectives summarises the innovative information system policy of the Italian Government and FAO to jointly support the development of the fishery and aquaculture sectors.

Nevertheless, it is obvious that the ITAFISH project will not be able to undertake all the related activities, but can only constitute the initial nucleus around which successive action and cultural, technological and economic resources converge.

Whatever the nature of a project, however, its specific objectives must first be defined in order to draw up the plan of work. These objectives should of course be in accordance with allotted resources, and their achievement should be feasible within the time scheduled, and be measurable at the end of the project.

Accordingly, and starting from the consideration that ITAFISH is made up of essentially two components: the Italian component and the international component, a set of specific objectives were identified:

The Italian component

- construct a tool to manage the information from the public and private sectors, which can answer scientific, technical, administrative and routine questions and which is no longer reserved only to support research and administrative activities
- aggregate numerical data (statistical data), alphanumerical data (qualitative data), cartographic data (description) into a single information system based on computer technology
- join fisheries and aquaculture into a single sector of marine resources production.
- assign the same importance to data and information from generators of information (fishery/fishermens' associations, government authorities, sovranational organisations, and above all, research institutes, etc.) as that given to data from the statistical system, citing the results produced in the course of the activities (which is often available only internally).

The International component

- participate, through the Italian component, in the development or expansion of the SIPAM and COPEMED projects and, therefore, in the implementation of the MEDFISH information model
- contribute to reducing the organisational and technological gap between the more and less advanced countries in the Mediterranean area in the information field by making available to the latter countries the information technology for immediate application; to act as a catalyser for establishing a policy of complete cooperation in the fishery and aquaculture sectors.

6. PROJECT CRITERIA

6.1 Grid type model

One of the factors which most affects centralised information systems is the extreme difficulty of keeping up with the growing amount of information let alone with updating the information they contain.

In the medium term this problem inevitably causes a non alignment of the mass of information; in other words, the information no longer represents the reality, and the system becomes inefficient and a burden with respect to the scope for which it was created. In order to avoid this information trap, the ITAFISH design favoured the grid type system where the institutional memory is broken up into several information areas, each inherent to a specific problem and updated directly by the suppliers of the information, as opposed to the centralised model.

Cohesion over the network is guaranteed by the telecommunications system. Coherence between the nodes is ensured by the unified information coding system whose consistency is safeguarded by the ITAFISH management node, which fixes quality standards, sets procedures, levels and access interfaces, promotes the development of the information system, and designs new applications.

6.2 Users and suppliers of information

The ITAFISH user is a body, organisation, institution, worker, or researcher involved in research, conservation, exploitation, transformation, and management of the marine resource. As such, in their daily activities the users certainly need to integrate, but also and perhaps most of all, to compare their own information with that available elsewhere.

This need arises from the general awareness that the world of information lives in synergy: knowledge made up of more elements is certainly more effective than a mere summation because the combination creates value added information. It follows that the users are naturally interested in participating actively in the lifecycle and development of the ITAFISH information system by:

- being alternatively a user of the information in the system, a supplier of his/her own information, a sharer of the resulting value added information (information exchange)

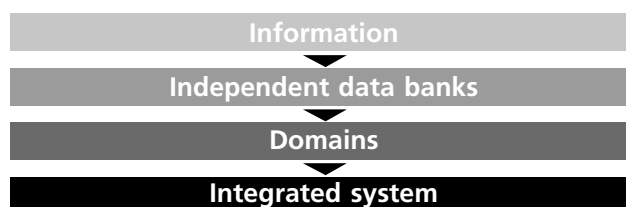
- urging, proposing and sharing new instruments for using the system (applied exchange)

In such a context it is obvious how ITAFISH takes the form of a mainly virtual information site: the bulk of basic data input during the course of the project, will function as the catalyser for integrating information residing elsewhere, i.e., with the users.

Development of the system will therefore be guaranteed not so much by the progressive expansion of the initial information nucleus (which would tend to re-invent the centralisation of the system itself) but by the capacity of the management node to attract new users, that is to give ITAFISH the autonomy for growth.

6.3 Organisation of the information

The ITAFISH model envisages an hierarchical organisational structure of the mass of information, proceeding from the simple to the complex through successive aggregations:



The independent data banks are specialised databases by type of information; they are internally coherent but do not have transversal links.

The domains are groupings of independent data bases with the same subject or theme. Operationally, they are logical connections between data banks.

The integrated system comprises the independent data banks, the linking structures (domains), and the access and updating procedures (management system).

6.4 Codification system

The method adopted for coding the information in ITAFISH comes from that previously used in the SIPAM project, and therefore from FAO's method. The same participatory approach as that already

adopted in SIPAM was followed. In other words, ICRAM and other research institutes of recognised importance were constructively involved in formulating a codification system based on international standards and at the same time suited to the national situation and characteristics.

The ITAFISH coding comprises four components:

The global component

The global component codes are taken from the FAO databases and other universally accepted information systems and can only be changed if modified at the origin.

The regional component

The regional coding subsystem has been applied to all information of a regional nature (the Mediterranean basin). To define each code reference was made to SIPAM, GFCM, and EC documentation. This type of coding can be modified only in agreement with the system managers of the original databases.

The national component

The national component adheres strictly to the codes defined by the National Statistical Office which must be applied wherever possible. National information that is not coded according to the National Office's standards cannot be input into the information system. It follows that a single datum can have three different codes (global, regional, and national). In order to avoid any non alignment of the information in the system, ITAFISH contains a complete Data Dictionary (agreed to by all the project participants) that acts as an interface between the national, regional and global components.

The sectorial component

The sectorial component is reserved for coding all the information internal to the system, for which there is no corresponding code at the national, regional or global level. This component's codes do not reflect any scientific specificity with respect to the contents of the information system, but are dictated solely by the logic of the computer world in general and by the specific system software in particular. They are dynamic and can be modified by the system manager as necessitated by the technical development of the project.

6.5 Modular structure

The modular structure is the element which guarantees the future expandability of the institutional memory of ITAFISH without having to completely, or even partially, restructure the organization of the contents, the structural links, or the system management.

The modular components are as follows:

- each independent data base can be enlarged by inserting new elementary information structures (tables), whether they are related or not to the information already in the data base
- an independent data base can be linked to each domain thereby updating the logical linking structure
- the overall network can be enlarged by inserting new nodes, or by creating new links with external information structures
- the integrated system's operations can be incremented by adding new applied modules which improve the inquiry and processing functions.

6.6 Expandability

From the practical point of view, expandability is guaranteed by the modular structure of each component of the System, as indicated in the preceding paragraph. It is important to note that the System's nodes can also be expanded. In other words, all the network nodes can modify the structure of their own institutional memory without having to go through the management node.

This characteristic is the result of the computer technology adopted at the start of the project when it was decided to construct the System according to the principle of subject matter programming.

Accordingly, the elements comprising the System were grouped into subject matter classes (information, databases, domains, nodes, and applications). While the user (end user, programmer, and system designer) does not know the internal structure of the classes, they can be accessed through the their properties and the methods employed.

In other words, the System comprises a series of black boxes, reciprocally linked by entrance and exit doors. To insert any new subject, or module, into the System it is sufficient to follow the enter and exit features (this is facilitated by a pre-set interface which, in turn, is facilitated by the management node) established in the initial System; linkage to the elements already existing is automatically guaranteed. Each new subject, in fact, is seen as a sub-system, and as such can be linked to the network structure.

The above refers to the horizontal expandability of the System, i.e., the possibility of incorporating new network models, such as nodes, new information and new applications.

In the conceptual design, however, vertical expandability was also envisaged, that is the possibility of supplementing ITAFISH with a higher technological level module, i.e., a Decision Support System (DSS).

DSS's are computer instruments designed to assist in the decision-making process. They are particularly useful in the case of unstructured or semi-structured problems that can only be solved through a user/System dialogue. These kinds of problems are typical among analysts, planners, programmers, and decision makers. During a DSS working session, the user can insert a data management formula, carry out statistical analysis, evaluate trends with respect to a prefixed parameter, and simulate the System's behaviour. These tools are easy to use in the case of simple and small information models, but difficult for highly integrated models such as ITAFISH.

For this reason, although envisaged in the conceptual design, the DSS module has not been included in the present version of ITAFISH but will be implemented in an eventual second version.

The vertical development model of ITAFISH, from the initial data banks to the decision making support instruments, can be represented by a triangle subdivided into five "complex strata" (fig.1):

- the first stratum is made up of the various elementary databases which are managed autonomously by the institutions which hold the information. The stratum is capped by a single interface, i.e., a software procedures filter (communication standards, consistency and coherency controls) that guarantees transition to the stratum immediately above.

- The second stratum is where the elementary databases are grouped into domains of common interest. Management of this stratum is entrusted to ITAFISH's main node.
- The third stratum corresponds to the aggregation of the domains into a more complex organisational structure, i.e., the METAFILE. In the transition from the domains to the METAFILE all the information is standardised, thereby guaranteeing its coherence and consistency at the national level. For the final users, the METAFILE constitutes the "national site".
- The fourth stratum does not contain any information. It holds the information access structures (to the METAFILE). In other words, this is where the users formulate, with different access methods, their inquiries to the System.
- The final stratum, which as mentioned above will constitute the objective of a successive expansion of the project, corresponds to the decision-making support instrument.

7. CONTENTS

ITAFISH is an information system that was designed not only to contain, but also to link, existing information at the point from where it is generated. The information in the management module (subject of the project) has, in fact, been intentionally limited to basic fishery and aquaculture information. In a future development of ITAFISH, it is foreseeable that data banks or sub-systems of a different nature and technology will be linked to the System.

ITAFISH's information contents are organised on three access levels:

- **Independent data banks**
are bases containing specialised data by type of information and characterised by internal coherence; there are no transversal links
- **Domains**
are groupings of independent data bases with the same subject matter. Operationally speaking, the domains are logical structures which link internally coherent data banks with transversal links

- **Integrated system**

is the ITAFISH general information system comprising the information (independent data banks), linking structures (domains), access and updating methods (management system).

The present version of ITAFISH comprises 31 data bases grouped into ten domains (fig.4). The various data bases are integrated between each other within the domain, and linked together in a complex system architecture (fig.5). Some examples of the user interfaces are given in annex.

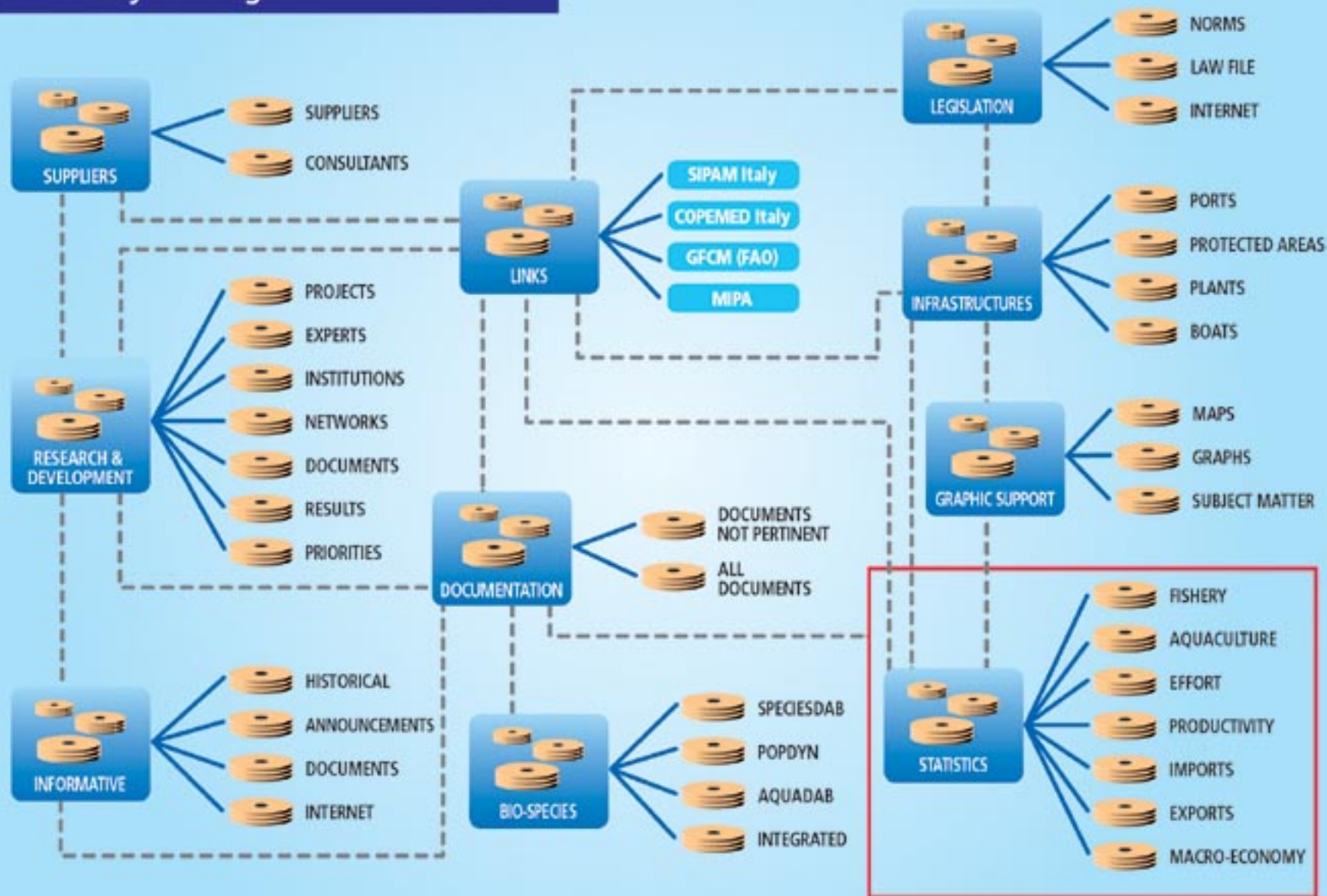
Subsequent contributions to the institutional memory can be included in the present structure or can be represented by additional modules (database, domain). This would widen the boundaries of the present system, both in terms of knowledge as well as of a new user field.

A description of the domains and of each database is given below.

fig. 4 - ITAFISH domains and data banks

1. RESEARCH AND DEVELOPMENT
Institutions
Experts
Research Projects
Priorities
Results
Documents
Network
2. DOCUMENTATION
Documents not linked to the data banks
All documents
3. INFORMATION
Historical
Announcements
Documents
Internet addresses
4. STATISTICS
Fishery
Aquaculture
Production Plants
Fishing effort
Imports
Exports
Macro-economy
Sources
5. BIOSPECIES
SpeciesDab-Ita
WinPopDyn-Ita
AcquaDab-ITA
Integrated
6. INFRASTRUTURES
Ports
Boat registers
Plant registers
Protected marine areas
7. LEGISLATION
Legal norms
Law file
Internet addresses
8. SUPPLIERS
Suppliers of goods
Suppliers of services
9. GRAPHIC SUPPORT
Maps
Graphs
Subject matter
10. LINKS

fig. 5 The System's general architecture



7.1 RESEARCH AND DEVELOPMENT

Data banks containing information on experts, institutions, basic and applied research carried out in Italy and abroad, and innovations and technological developments in the fishery and aquaculture sectors are grouped in this domain.

Institutions

This data bank contains a list of public bodies, institutes, research laboratories, cooperatives and private companies that undertake research in fisheries and aquaculture. It gives the anagraphic data, institutional and operational references, available telecommunications, equipment possessed, and services offered for each institution.

- anagraphic data: name and address of institution
- institutional references: year of foundation, affiliation
- operational references: sector and subsector concerned (up to a maximum of 10), to which network it is associated (up to a maximum of 10), species group studied (up to a maximum of 8 groups)
- telecommunication numbers: telephone, fax, Web site, e-mail
- equipment: equipped laboratory, field laboratory, research vessel, hatchery basins
- services: library, computer centre, multimedia equipment, simultaneous translation, conference room, visitors' guest house

The other data banks in this domain (Experts, Network, Documents, Results, Priorities, Projects) provide auxiliary information on the activities of every institution.

Experts

This data bank gathers information on experts who undertake research in the fishery and aquaculture sectors, including persons in public and private institutions and freelance professionals. The following information is given for each expert:

- personal information: name and surname, address, telecommunication numbers
- academic qualifications: degree, year attained, institute or university, languages spoken, computer knowledge
- employment record: name of employers, positions occupied, etc.

- professional expertise: sectors and subsectors of expertise (up to 9), species group studied (up to a maximum of 8 groups).

The other data banks (Network, Institutions, Documents, Results, Priorities, Projects) in this domain complete the professional profile of the expert.

Projects

Information on projects financed by governmental and other bodies for both applied and other research in fisheries and aquaculture, as well as on the technological developments in the sector, is contained in this data bank. The following information is available for each research project:

- description: title of project, duration, subject matter
- budget: cost of the project by object of expenditure, financing bodies, etc.
- operational: number of graduates, technicians and experts working on the project
- scientific: line of research, species groups studied (up to a maximum of 8 groups).

The other data banks in the domain (Institutions, Experts, Network, Documents, Results, Priorities,) provide additional information on the activities of the institutions.

Priorities

This data bank contains information on the types of research that institutes, cooperatives and private companies intend to undertake in the future. For each type of research information is given on the institution concerned, the line of research, sector and sub-sector of expertise, duration of the research, field of application. As already mentioned, this data bank is automatically linked to the Institutions data bank which contains information regarding the institution concerned.

Results

This data bank holds information available on the results of research projects or achieved in the institutions' regular activities. The project reference and name of the institution concerned are given for each result, as well as the title, type (information, study, graph, maps, management tools, other), support and format.

Documents

This data bank contains information on the publications issued by the institutions on their research and technological developments, as follows:

- title
- author(s)
- year of publication
- classification: ISBN code, key words
- research project and concerned institution references
- sources quoted in the document

The Institutions, Projects and Experts data banks in this domain provide additional information on the authors and research concerned.

Network

This data bank contains the list of associations and network connections of the fishery and aquaculture sectors. In addition to the description, of each association/ network, the following information is given:

- patronage
- institution concerned
- location of head office, etc.

Table 1 Domain 1 – Research and development: operators and activities in basic and applied research and technological development in the fishery and aquaculture sectors

Database	Description	Contents
Institutions	Research institutes and laboratories	Location, specialisation, equipment, sectors of research
Experts	Scientific and technical researchers	Name, location, sectors of research
Projects	basic research projects and technological development	Title, sectors of research, cost, financing
Priorities	Institutions	Description
Results	Results of the research projects	Type, subject matter, presentation
Documents	General documentation related to the subject matter of this domain	Title, location, accessibility
Networks	Association and networks linking <i>Institutions, Experts, Projects</i>	Name, location, sectors of research

7.2 DOCUMENTATION

This domain is the general archive of all documentation relating to the fishery and aquaculture sectors.

Documents not related to the data banks

This data bank contains information on fishery and aquaculture documents in addition to that already in the "Documents" data bank in the Research and Development and Information domains, as follows:

- title
- author(s)
- editorial reference: editor, series, year of publication
- classification: ISBN code, key words

All documents

Information regarding all the documents obtained during implementation of the ITAFISH project are included in this data bank: i.e., those already included in the Documents data bank of the Research and Development domain (publications produced by research institutions); those included in the Documents data bank of the Information domain (acts and communications of conferences); and, finally, publications in the data bank Documents not related to the data banks of the present domain. The following information is available for each document:

- title
- authors
- editorial reference: editor, series, year of publication
- classification: ISBN code, key words
- domain of origin.

Table 2 Domain 2 – Documentation: general archive of documents relating to fisheries and aquaculture

Database	Description	Contents
Documents not pertinents to the data banks	Documentation not available in the ITAFISH data banks	Title, location, origin, accessibility, sector concerned
Documents pertinents to the data banks	All bibliographic citations contained in ITAFISH	Title, location, origin, accessibility, sector concerned, domain of origin

7.3 INFORMATION

This domain is an inventory of meetings, conventions, congresses and information exchanges concerned with the fishery and aquaculture sectors.

Historical

This data bank contains information on congresses, seminars, meetings, etc., on fisheries and aquaculture that were held to date and gives the date, place, category, title, number of participants, host institution, and network to which they belong (up to 3). The sectors and sub-sectors dealt with (up to 12 subject matters) can also be consulted through the appropriate menus.

The link with the Documents data bank in the same domain enables the user to consult on the screen entire texts of meeting papers through the text catalogue process, while the link with the Network and Institutions data banks in the Research and development domain allows reference to information on the network of the host institutions.

Announcements

This data bank acts as a diary of meetings scheduled in the fishery and aquaculture sectors, giving dates, venue, category, title, host institution, and networks (up to 3). The topics (sectors and sub sectors) that will be dealt with (up to 12 subject matters) can also be consulted through the appropriate menus.

Documents

This data bank contains a list of the official papers and communications presented by the participants at congresses, seminars, meetings, etc., held to date. The main source of this information is the publication that contains the meeting documents. For each document or communication the following data are given:

- type of event (congress, seminar, round table, etc.)
- title
- editorial parameters (editor, series, year of publication)
- original language
- key words

For each meeting there is only one document which lists the papers of the meeting; instead, the communications may be many. As mentioned above, the complete documents are available in this data bank through the text catalogue process.

Internet

The Internet data bank is the inventory of the WEB sites that normally and systematically supply information on meetings in the fishery and aquaculture sectors, both past and future. The INTERNET address and a description of each WEB site is given.

Table 3 Domain 3 – Information: announcements and exchange of information

Database	Description	Contents
Historical	Seminars, congresses, conferences, round tables, meetings,	Location, dates category, networks of origin
Announcements	Announcements of the above	Location, dates, sector, participants, interventions, network of origin
Documents	Documents and communications	Title, data bank, language
Internet	WEB pages of the congresses, etc.	Name of the site and means of access

7.4 STATISTICS

This domain contains the statistics collected in Italy, with particular reference to fishery and aquaculture statistics.

The national statistical system provides for the collection and distribution of fishery and aquaculture data in various formats and aggregations. This module is not intended as a duplication or replacement of systems already in operation. It is proposed simply as an interface of the statistical aggregations in order to integrate them in the global design of ITAFISH. If it is decided to incorporate a new data bank, or a part of it, into ITAFISH, the System will already be preset to replace the elementary module with the new one (see para. 6.6).

In a regional and national context this domain takes on a strategic dimension. Therefore, before applying it, it is vital that it be linked to and comparable with the basic data collection systems used in the country. If this model is applied without interaction and a continuous link with the results produced directly by the data collection systems in the field, problems of reliability, coherence and redundancy of the data will certainly arise.

At present, this domain is considered more as a model for determining concepts, potential and management strategy, rather than as an application. It is believed that it will be a valid instrument for those who have to work with primary data collection systems.

Fisheries

This data bank contains the official statistics of fish production in Italy, in internal waters and in the sea. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of fishery activities.

The data are given by:

- fishing area: region, marine unit, coastal
- period: year of collection
- type of fishery, species groups
- effort: fishing system used, type of boat used
- production: tonnage of fish caught

The source of each datum is indicated.

The links with the Documentation and Graphic support domains enable users to obtain accurate information on source bibliographies and to consult national/regional maps of the geographic location of the statistical data.

Aquaculture

This data bank contains official statistics regarding the Italian aquaculture sector, both in internal waters and in the sea. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of aquaculture activities.

The data are given by:

- production area: region, province, rearing environment
- period: year of data collection
- species groups reared (up to 3 groups)
- technology: type of hatchery
- market: market selling the production
- production: tonnage, number, etc.

The source of each datum is indicated.

The links with the Documentation and Graphic support domains enable users to obtain accurate information about source bibliographies and to consult national/regional maps of the geographic location of the statistical data.

Production plants

This data bank contains official statistics regarding aquaculture production plants in Italy. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of productive plants.

The data are given by:

- location: country, region, province, internal or marine waters
- period: month, year of data collection
- species groups reared (up to 14)
- type of hatchery
- number of plants

The source of each datum is indicated.

The links with the Documentation and Graphic support domains enables users to obtain accurate information about source bibliographies and to consult national/regional maps of the geographic location of the statistical data.

Fishing effort

This data bank contains official statistics regarding the Italian fishing fleet in relation to the fishing effort. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of fishing effort.

The data are given by:

- location: country, region, province, marine department, internal or marine waters
- period: month, year of data collection
- fishing typology, species groups
- technology: motorised or non-motorised boats
- capacity: number of boats, number of crew members, horse power, tonnage, registered tonnage
- activity: duration of the fishing activity periods

The source of each datum is indicated.

The link with the Documentation domain enables users to obtain information on the source bibliographies, while that with the Boat register data bank and the Infrastructure domain gives access to accurate information on the structural and functional characteristics of the fishing fleet.

Imports

This data bank contains official statistics regarding the importation of marine products into Italy. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of imports.

The statistics are given by:

- destination: country, region, province, importers
- period: month, year of data collection
- fish typology, species group
- technology: method of conservation, type of packing

- amount: tonnage of product imported and economic value
- origin: place of origin of imported product

For each datum, the source is indicated.

The link with the Documentation domain enables users to obtain information on the source bibliographies.

Exports

This data bank contains official statistics regarding the exportation of Italian marine products. It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of exports.

The statistics are given by:

- destination: country, region, province, exporters
- period: month, year of data collection
- fish typology, species group
- technology: method of conservation, type of packing
- amount: tonnage of product imported and economic value
- origin: place of origin of imported product

The source of each datum is indicated.

The link with the Documentation domain enables users to obtain information on the source bibliographies.

Macro-economy

This data bank illustrates the socio-economic profiles of Italy and countries on the Mediterranean from the statistical point of view. In particular, it contains data on the work force in the agricultural, fishery and aquaculture sectors, on production, imports and exports of fishery and aquaculture products, and on the fishing fleet. Other information in the bank is strictly economical, such as Internal Gross Product, per capita consumption, and VAT.

It is a diachronic data bank, which provides updated data as well as a reconstruction of the historic series of the socio-economic trend of the country.

The source of origin of each datum is indicated.

The data bank is enhanced by links to the other data banks in the same domain and to the Legislation, Documentation, Research and Development and Infrastructure domains. The inventory of the sources of origin of each statistical datum (ISTAT, ICRAM, EU, FAO, etc.) is stored in this domain.

The following information is given for each source of origin:

- title and author of document
- editor, year of publication
- official classification code
- key words.

Table 4 Domain 4 – Statistics: national statistical elements

Database	Description	Contents
Fisheries	Fish production	Fishing area, period, type of fishery, effort, production
Aquaculture	Aquaculture production	Area of production, period, type, technology, market, production
Productivity	Aquaculture plants	Location, period, type, method, number
Effort	Active fishing fleet	Location, period, type, technology, activity
Imports	Marine product exports	Destination, period, type of fish, conservation, technology, amount, origin
Exports	Marine product exports	Destination, period, type of fish, conservation, technology, amount, origin
Macro economy	Socioeconomic profiles	Work force, internal gross product, consumption, IVA

7.5 BIOSPECIES

This domain represents a scientific databank on marine species: systematics, distribution, biology, use in fishery and aquaculture. It assembles data in encyclopaedic format (static), as well as dynamic data on marine stocks, their biological dynamicity, the species reared in Italy, associated with hatchery data and parameters.

SpeciesDab-Ita

This data bank is the national version of SpeciesDab (FAO). It was created to provide ITAFISH with a classification code of marine species in Italy and in the region.

The data is organised by species along the lines of the "FAO Species Identification and Data Programme", which is considered the basic document in this field.

SpeciesDab-Ita contains scientific data, e.g., nomenclature, national and local names, biological elements of the species, geographic distribution, as well as the level of importance of the fishery and aquaculture activities.

WinPopDyn-Ita

This database, derived from PopDyn (FAO), was developed to file population dynamics analyses data and stock/species estimates in a systematic and coherent manner. It also contains material that has not been published.

The use of WinPopDyn will contribute to introducing and accelerating standardisation in this field, in which many people are working, both at the national and regional levels. In this connection, since WinPopDyn has been adopted as the standard population dynamics data bank in the Mediterranean and FAO contexts, it is useful for workgroups because its data can be compared with those of other researchers and for other geographic areas.

WinPopDyn-Ita handles data and parameters of the stocks and species in the various Mediterranean areas, associated with growth indicators, mortality, fisheries and resources, as well as the managerial decisions taken for a particular stock, its level of exploitation, and recommendations by scientific bodies/authorities.

The source of each datum is indicated.

AquaDab-Ita

This database, derived from AquaDab (FAO), was developed to assemble systematically and coherently data from studies on marine species reared in Italy. It also contains unpublished material.

The use of AquaDab will contribute to introducing and accelerating standardisation in this field, where many people are working both at the national as well as at the regional level. In fact, AquaDab was designed to encourage researchers working in the aquaculture sector to store information in a format easily accessible to third parties.

AquaDab-Ita is organised in two modules (AquaDab-general and Bibliography), the first being divided into four sections: Environment, Reproduction, Nutrition, Pathology.

A bibliographic source is given for each datum stored in AquaDab-Ita.

Integrated

The integrated Bio-Species system is not a data bank (it does not contain information). It is an instrument which permits the user to access directly and simultaneously the three data banks in this domain, in order to have a complete picture of the marine species.

Table 5 Domain 5 – Biospecies: typology and consistency of the marine resources

Database	Description	Contents
Speciesdab	Classification of biological marine and aquaculture species elaborated by international experts	Identification, specific characteristics
Popdyn	Fish stocks	Identification, location, biomass
Aquadab	Aquaculture Stocks	Identification, location, biomass
Integrated	Instrument to access <i>Speciesdab</i> , <i>Popdyn</i> and <i>Aquadab</i> simultaneously	Location, typology, dimensions

7.6 INFRASTRUCTURES

Infrastructures is the domain which comprises the data banks where all information is stored concerning fixed and mobile structures used in professional fisheries and aquaculture in Italy.

Ports

In this data bank information are stored on the Italian ports with a fishing fleet. The information concerns: location, available telecommunications, administrative details, operating limits, technical, commercial and servicing infrastructures:

- location: geographical coordinates, province, region, postal reference
- telecommunications: telephone, fax, electronic mail, WEB site
- administrative details: marine department, harbour office, legal authority, RINA Office
- operating limits: access limits, draft, length, tonnage, maximum admissible size of fishing boats
- technical, commercial and servicing infrastructures: presence and characteristics of refrigerating and freezing plants; oil/petrol pumps, electricity, water, ice; medical emergency services; laying-up services; boatyard; sale of electronic items and engines; fish market; associations, marine agent.

The link to the Associations register in the same domain enables users to obtain information on the associations present at the port.

Boat register

This data bank stores information on the boats carrying fishing in Italian waters. The information includes the data of each boat and the names of its owners, administrative data, functional data, fishing gear, conservation and transformation of the product.

- personal data and owners: boat name, anagraphic data and name of owner; origin and year of construction; year launched
- administrative data: registry inscription, number, port and harbour of residence, available fishing authorisations
- functional data: typology and status of the boat; structural parameters (length, height and width of the hull; net and gross tonnage; construction material); motorization (typology of motor and propeller, origin and year of

construction, axle power); navigation equipment; auxiliary deck gear (winches, mooring systems); communication equipment

- fishing, conservation and transformation equipment: equipment for research and production (probes, echosounder, sonar, lifting mechanisms, sieves for molluscs, etc.); conservation gear and plants (hold for fresh fish, hold for live fish, refrigerated hold, deep freezing plants); transformation plants (production of flour, oil, transformation into fillets).

Aquaculture plants

This data bank contains an inventory of the aquaculture plants in Italy. For each plant information is first of all given about the company: its name and location, its trade name, available telecommunications.

Production is divided into four categories: fish, molluscs, crustaceans, and seaweed, and for each category the following characteristics are given:

- fish: hatchery, extensive, intensive, semi-intensive
- molluscs: hatchery, long line, on piles, other
- crustaceans: hatchery, extensive, intensive, other
- seaweed: typology.

Within each category information is assembled for the species produced (up to 19 species).

Protected marine areas

This data bank contains information on official Italian marine parks, as follows:

- location: name, region, province, coast (internal or sea)
- administrative data: year of constitution, managing body, director of managing body, harbour office, postal and telecommunications addresses
- social factors: counties and inhabitants affected by the park, fishermen present
- functional factors: total area, personnel employed, sector and sub-sector concerned
- natural characteristics, by area (up to 5): geology, maximum depth, area, biocenosis, endangered species.

- parameters of production: fishing activity, species fished
 - map of the protected marine area.
- The link with the Legal norms data bank in the Legislation domain allows users to refer to the law which established the park, while the link with the Map data bank in the Graphic support domain permits the maps of the area to be viewed and printed.

Table 6 Domain 6 – Infrastructures: infrastructures available at the ports for fisheries

Database	Description	Contents
Ports	Fixed and mobile structures to exploit the marine resources	Identification, location, accessibility, structures, logistics
Boat Register	Archive of mobile structures for fisheries (boats)	Location, typology, size
Aquaculture plants	Aquaculture plants	Identification, name, location, species reared, type of plant
Protected marine areas	Protected areas for the conservation and management of the sea	Identification, location, accessibility, structures, logistics, area, species

7.7 LEGISLATION

This domain contains elements relating to national and EC legislation for fisheries, aquaculture and the marine environment.

Laws

This data bank contains an inventory of the national and EC laws for fisheries, aquaculture and the marine environment, as follows:

- official reference: title of law, number, date passed, date of coming into force, Official Gazette publication number
- complete text of the law.

The link with the Protected marine areas data bank in the Infrastructures domain allows the institutional law for each park to be consulted.

Law summaries

Summaries describing the norms included in the Laws data bank in the same domain are stored in

this data bank. The following information is available for each norm:

- formal: promoting authority, juridical form of the norm, territory covered and period in force
- substantive: sectors and sub-sectors of activities concerned (up to a maximum of 4), marine species involved (up to a maximum of two)
- description: summary of the norm (in Italian and English), key words.

Internet

The Internet data bank is the inventory of WEB sites that normally and systematically provide information on fishery, aquaculture and marine environment norms. For each WEB site the INTERNET address is available together with an illustrative note.

Table 7 Domain 7 – Legislation: archive of laws, decrees, norms, orders and sentences

Database	Description	Contents
Legal norms	List of laws	Identification, title, date passed, text
Law file	Data bank of laws	Identification, local, national, international institution, typology, sector concerned, waters concerned, abstract, keywords
INTERNET	Italian and EC laws available on Internet	Site identification, means of access

7.8 SUPPLIERS

This domain contains the inventory of operators and private Italian companies working in the fishery and aquaculture sectors.

Suppliers

A list of Italian companies which produce and supply goods for marine hatcheries and professional fisheries is provided in this data bank. For each company the following information is given: firstly, name, legal position, location, telecommunications available, and then by type of goods and type of production.

Consultants

This data bank contains data on Italian consultants who work in the fields of marine hatcheries and professional fisheries and who are not employed in public institutions, as follows:

- anagraphic information: name and surname, address, available telecommunications
- academic qualifications: degree/diploma obtained, year of graduation, institute or university attended, languages known, computer technology acquired
- professional employment: employer (private institution), positions held, network
- professional qualifications: sectors and sub-sectors of competence (up to 9), species groups studied (up to 8)

The link to the Network data bank in the Research and Development domain enables users to acquire reference information of the network (association) of the consultant.

Table 8 Domain 8 – Suppliers: private operators in fisheries and aquaculture

Database	Description	Contents
Suppliers	Producers and distributors of equipment and plants	Identification, location, accessibility, plants, logistics
Consultants	Consultants, excluding public researchers	Identification, name, accessibility, sector of activity

7.9 GRAPHIC SUPPORT

In comparison with the major part of the information stored in ITAFISH, this is a complementary domain. On the one hand, through geographic reference, it enables a territorial representation of the information (mainly statistics and infrastructures) to be made and, on the other, it provides graphs, images, designs, etc., for presentation in reports and general documents.

Maps

This data bank holds the national and regional maps necessary to localise geographically the information available in the domains Infrastructures (data banks Protected marine areas and Ports) and Statistics (all the data banks except for the macroeconomy data bank).

For each map the following information is available:

- title and description
- origin: author, source, year published
- digital file

Graphs

This data bank stores the support graphs, where available, of the information given in the ITAFISH data banks. The graphs are taken from documents in the Documents data bank in the Research and

development and Information domains; in the Documentation domain; in the data bank of the Statistics domain.

For each graph, which can be viewed on the screen and reproduced in hard copy, the following information is available:

- title and description
- type and source of origin (books, meeting documents, newspapers and magazines, statistical manuals)
- stored graphic format

Objects

This data bank contains the supporting images to the ITAFISH information in the other data banks. The images are of different types (photographs, designs) and from different sources (books, meeting documents, newspapers and magazines, statistical manuals, Internet).

For each object, which can be consulted on the screen and reproduced in hard copy, the following information is given:

- title and description
- type and source of origin
- stored graphic format.

Table 9 Domain 9 – Graphics: cartographic support for reports and documents

Database	Description	Contents
Maps	Reference maps at national and regional level	Reference area, definition, digital format
Graphs	Supporting graphs	Title, description, source, graphic format
Objects	Supporting images	Title, description, source, graphic format

7.10 LINKS AND CONNECTIONS

This domain can be considered as the ITAFISH "window" to the outside world.

ITAFISH was designed and implemented as an open information system, i.e., as a node of a wider system comprising information systems managed by other countries and/or other national organisations. A "window" towards external systems is therefore an indispensable element of ITAFISH, both for the automatic capture of external information as well as for the transfer of its own information outside.

The Links domain is not an aggregation of data banks (therefore it does not contain any information). Instead, it is a complex aggregation of functions, procedures, coherence checks, reference tables, links, tools to manage the errors and recognise pieces of information that are similar, whose aim is the exchange of data in an appropriate and consistent manner.

It is therefore purely a sophisticated data management tool for use only by the ITAFISH management nucleus and not by the end users. It envisages stable and automatic links with:

- SIPAM
- COPEMED
- MiPAF (Ministry of Agricultural and Forestry Policies), Directorate General of Fisheries and Aquaculture
- FAO-GFCM

To each of these links must correspond a bidirectional matching system, from the ITAFISH experts (towards the outside world) and from the experts of other information systems (from the outside world), in order to guarantee the synchronisation and coherence of all the tools that make up the module.

A set of procedures and functions have been developed to permit ITAFISH to communicate with external systems. In this version, only the SIPAM connection has been used. Through these functions SIPAM uses the ITAFISH updating and revision procedures, thereby saving on human resources, as well as achieving high coherence control and a more efficient management of the information.

8. TECHNICAL INFORMATION

8.1 Use

ITAFISH users are conceptually divided into four classes:

1. The first class of user is the Director-General of Fisheries and Aquaculture of the Ministry of Agricultural and Forestry Policies.
2. The second class comprises the FAO and GFCM supranational organisations.
3. The third class of user is made up of all operators interested in using or participating in the information system: i.e., central administrations, local administrations, research institutes, producers, associations in the sector, students.
4. Finally, ITAFISH is addressed to countries in the Mediterranean involved in projects like SIPAM and COPEMED.

Given the basic strategy of the ITAFISH project, i.e., to establish a virtuous circle of action/reaction, where each user is also a potential supplier of information, it appears evident that as the audience in the last two classes increases, so the ITAFISH information system becomes more effective, both in terms of the information made available as well as the valued added to the existing information.

8.1.1 Access levels

ITAFISH is an information tool of a medium-high technological level that is not directly accessible in all its parts by any type of user. Four different user access levels have been provided:

Non-expert and occasional user

This is the typical function for occasional users, i.e., for persons not of the sector who wish to consult ITAFISH, as well as for those who use ITAFISH systematically for standard contacts, reports or other. Access for these users is guided, either by the very detailed explanatory interfaces or by a "Help on-line" which introduces in colloquial format all the possible operations at each point of the System. At this access level the user has absolutely no autonomy and may only consult the data and produce reports generated by predefined routines. The non-expert user can therefore query ITAFISH only through the automatic production of reports pre-established

by the system manager, such as extent and characteristics of the fishing effort in Italy, by area fished, etc.

Semi-expert and frequent users

This is probably the profile that characterises the largest pool of ITAFISH users. This group also has guided access to all the functions described above, can also generate new "research keys" and compile complex reports using the different data banks. These users are qualified to access all the interfaces and links to MS-Office Pro™ products. In practice, they can export and transfer formatted and non-formatted documents to other analytical systems for further processing. The semi-expert users, therefore, have a limited degree of autonomy. They are allowed to ask questions and obtain reports of varying complexity according to established procedures, e.g., the relationship between effort, catch and consistency of fish stocks.

Expert user

This user is an expert in the sector/sectors and also has good computer knowledge. He/she is often part of a support team to planning and decision making, and defines intersectorial research models. Models and queries defined by these users can be introduced into the system for future and regular use by other users. The expert user, therefore, has a completely autonomous access to the System and is allowed to build his/her own strategy for queries and producing reports outside the established procedures. It is envisaged that once the queries and reports elaborated by the expert user have been consolidated, they can be made accessible to the previous types of user.

System management

This level defines the System "management" and comprises not only the System designer, but also the administrator and subject-matter experts of each domain. These people are allowed to access and intervene at all levels in each component of the System. For example, they can modify the information, the data structure, and the applications, and set up connections, management operations and system maintenance.

The communication interfaces to the System of the above users (non-expert, semi-expert and expert) are extremely simple and immediately understandable.

8.1.2 Means of distribution and access

When the project is completed and given its dual ownership (FAO and Fishery DG, Italy), it is envisaged that the System will be used in two ways:

- in Italy: the Directorate General of Fisheries and Aquaculture of the Ministry of Agricultural and Forestry Policies will be responsible for the institutional management of access to the System (acceptance of user, means of and procedures for use)
- for FAO: the System can be used as a prototype by FAO in its technical assistance to member countries. The means of distribution and partial or total re-use of the System will depend on the type of involvement. Technically speaking, it is envisaged that the System will be used by:
 - isolated work stations
 - local and geographical networks
 - Internet and Intranet
 - CD Rom
 - DVD
 - publications and reports.

8.1.3 Operational language

ITAFISH has been developed in Italian for immediate use. However its structure enables a quick re-elaboration in English or any other national language (Latin characters).

8.2 Technical structure

8.2.1 Software configuration

The project has been developed in WINDOWS '95 and comprises:

- A management system for interacting data bases, Microsoft ACCESS version 7, equipped with Visual Basic ACCESS graphics, version 5.0
- Microsoft computer tools: WORD, EXCEL, PowerPoint, OUTLOOK.

To install the System only the Microsoft package is necessary on the workstation. However, for a more efficient use of ITAFISH access to INTERNET and electronic mail is advised.

The System alone, complete with test data, occupies about 379 Mbytes.

8.2.2 Hardware platform

The ITAFISH software has been designed and developed with the aim of facilitating to the maximum access by all interested users. Provision has therefore been made for its installation on any operative stand-alone workstation under WINDOWS '95 and later versions.

The minimum configuration necessary is:

- Computer in the PENTIUM series
- 32 Mbytes RAM memory
- Hard disk 1.2 Gbytes (free)
- Graphics level SVGA
- 15" colour monitor
- Floppy disk 1.44 Mbytes
- CD ROM reader 12x
- Laser or ink jet printer

A backup unit such as the IOMEGA ZIP drives or others are recommended.

8.3 Graphics and publicity

The ITAFISH System has been achieved with the clearest possible graphics interface for users (annex 2). In addition to the System described above, during its development ITAFISH produced a set of accessories that are included in the final package:

Logo

The ITAFISH spiral logo illustrates the mass of information in the data bank system. It appears on all the main screens of the data banks, as well as on all the reports produced by the System.

Brochure

A pamphlet has been prepared, in English and Italian, giving a brief description of the project and of each data bank. This brochure has the same presentation graphics as the ITAFISH video screens.

ITAFISH Home Page on Internet

The ITAFISH home page is on FAO's official INTERNET site in English and Italian since 12

December 1997 at: <http://WWW.FAO.ORG/WAICENT/FAOINFO/FISHERY>. This is not the project's 'real' page, but has been designed to provide basic information on the project and to occupy an important and prestigious position in the overall FAO home page. It is exclusively for information purposes and is not used to diffuse the data. It:

- informs the scientific community and people working in fisheries and aquaculture about the project, the reasons for its establishment, and its objectives;
- enables users connected to Internet to rapidly contact the institutions of interest by electronic mail. The electronic mail address is situated at the bottom of the page dedicated to the Ministry, the Directorate-General, FAO, ICRAM and ISTAT;
- is open to all Internet users;
- contains the title of the project, its logo and the name of the institutions involved (Director-General, ICRAM, FAO) on the first page.

Documentation

- Help manual (text)
- Help manual (on-line)
- Technical manual with System specifications
- Manual describing ITAFISH
- Installation manual
- ITAFISH brochure (PowerPoint)
- Structure and functions of ITAFISH (PowerPoint).

8.4 Location

The System has been installed on two workstations in Rome, one at FAO and the other at ICRAM. The Fisheries Resources Division (FIR) of the FAO Fisheries Department gave the necessary coordination and technical support directly since the Division provides the most support to the GFCM Technical Secretariat.

Coordination for making the project activities operational was ensured by the Team Leader (S.R. Coppola, FAO) and the responsible Scientific Officer (D. Crosetti, ICRAM).

9. TRAINING

The project organised two training courses for personnel involved in the development of ITAFISH.

The first training course, held from 6-27 February 1995 at ICRAM headquarters, covered operating systems; computer viruses; Word, Excel and Internet software. The 40-hour course was divided into ten lessons and covered Microsoft Windows (ver.3.1 and 95), Word, Excel and an introduction to Internet. In addition to the ICRAM staff involved in the project who participated in the course, other personnel attended specific lessons. On average, 6-7 persons attended each lesson. Because of the different levels of computer knowledge, the course dealt briefly with computer basics so that the participants would all start at the same level. After a brief introduction to the hardware, the course dealt with operating systems such as DOS and Windows 3.1 up to the installation, functioning and use of Windows 95; computer viruses; and Word, Excel and Internet functions and commands from the theoretical and practical points of view.

The second course was held from 9-19 December 1996 and was a series of specific lessons given in the form of a seminar. The lessons covered four basic subjects:

- database design and management
- ACCESS relational data bank management
- software theory in general and its applications
- basic elements to programming with ACCESS and VISUAL BASIC.

Both the theoretical and practical aspects were considered. This activity was considered very important, and was planned within the framework of specific training for personnel collaborating in the project development, and to prepare a team of technicians to "maintain" the system after its completion. On this occasion, the "Statistics" module was used as the example to better formulate both the theory and the practical. The seminar was conducted by the Team Leader and Analyst/programmer. Participants were the ITAFISH group and other interested ICRAM personnel.

10. WORK PLAN

10.1 Operating phases

The project was completed in 30 months, from January 1996 to July 1998.

The work plan was divided into four phases, each aimed at obtaining one or more results through specific activities.

Phase 1 – January 1996 – September 1996

- Conceptual design of the data bank system and its components
- Analysis of the data and of the functions
- Analysis of the information
- Design of the user interface
- Validation of the conceptual design by a direct comparison with the main components
- Data collection in the field
- Presentation of the conceptual model to selected users
- Analysis of standard industrial hardware and software and of related cost/benefits
- Analysis of specialised personnel, costs and availability.

Phase 2 – October 1996 – June 1997

- Revision of conceptual design
- Development of the System design and the development methodology
- Structure of file management (software specifications)
- Data and information representation models (software specifications)
- Data and information integration models (software specifications)
- Definition of procedures for interfaces with the outside
- Definition of coding systems for international and internal information
- Development of elementary data bank software

Phase 3 – July 1997 – March 1998

- Intensive development of the software
- Data collection in the field
- Development of the domains in which the System is organised
- Data collection in the field
- Design and development of the module for the integrated management of the coding system and of the links between domains
- Integration of the elementary data banks in the computerised system
- Verification and validation of the data entered
- General revision of the system's outputs
- Modification and adaptation of all the user interfaces in an integrated architecture
- Design and development of interfaces with the SIPAM regional system
- Collaboration agreement for the ICRAM activities "Plants" and "Legislation".

Phase 4 – April to July 1998

- Quality control of the system and delivery to the Directorate General
- Documentation
- Testing of printing formats
- Testing of functions
- Support documentation and transfer of the system to ICRAM
- Customising the commercial software
- General improvements.

10.2 Variations to the initial project

During the development of a system such as ITAFISH, which is conceptually very dynamic in the initial programme of work, various changes were introduced. This was mainly due to the method used which envisaged strong interaction between the system design and the actual reality, each domain was designed and developed with the direct and continuous contribution of the workers and specialists in the sector (from the biologist, to the statistician, up to the lawyer, etc.). During its development, timely interventions were also introduced in order to provide an-up-to date final product.

The following is a summary of the main changes which characterised this work.

1) Mobility of personnel: the various colleagues who collaborated in the development of ITAFISH were selected on the basis of their professional experience as well as on the requirements of the project at the different phases of implementation. There was therefore a certain mobility of the persons, also due to budgetary constraints, which while causing some confusion on the one hand, created work opportunities as well.

2) The Law on privacy: another disturbing factor in the development of the system was caused by the introduction in Italy of Law 675 of 31.12.96 on privacy. In particular, one of the ITAFISH data banks (Experts) was designed to contain personal data which are now subject to privacy. On the date of enforcement of the Law, this data bank already contained data regarding some 700 experts. In order to avoid all possible implications, and in accordance with the Law, experts included in the data base were contacted and their specific approval to include their personal data was requested. This resulted in a drastic reordering of the data, with the elimination of many files, and the re-adaptation of the applications.

3) Statistics domain: An unexpected technical problem occurred in the Statistics domain. In fact, updating the catch data automatically imported from the ISTAT data proved to be a very complex operation because ISTAT had changed the format of the data it disseminated, and might possibly change it again. This meant, firstly, that the catch data had to be entered manually, and, secondly, that this activity would have to be reviewed in order to maintain the reliability of the national data and the possibility of linking to new data bank formats.

4) Collaboration with other ICRAM projects: ICRAM is undertaking a research project to set up a data collection system for aquaculture data (FARM). The ITAFISH and the research project teams cooperated to join efforts as also to avoid duplication. In fact, this project envisaged the development of a data bank for some types of aquaculture plants in Italy. A temporary data bank was therefore developed by ITAFISH and in the near future the same team will undertake the design and development of the FARM system, and will also ensure the compatibility of the two systems.

11. RESOURCES

11.1 Financial resources

ITAFISH was financed by the Directorate-General of Fisheries and Aquaculture of MiPA within the framework of the Third Three-year Plan for Fisheries and Aquaculture (Law 41/82) in an amount of four hundred million Italian Lire. Two hundred million Lire were transferred to FAO for its technical scientific contribution.

11.2 Human resources

Many people collaborated in the project and their contribution was always important even when it was only for a short period. In fact, with the exception of two grantees who worked on the project for two years, all the personnel was recruited ad hoc according to specific needs.

The following persons collaborated in the project:

Responsible scientific officer:

Donatella Crosetti, Research Scientist, ICRAM, responsible for the technical/administrative conduct of the project. Data collection and quality control. Design and finalisation of the user interfaces and of the outputs. Terminology revisions.

Project Coordinator (ITAFISH):

Salvatore R. Coppola, Fishery Resources Officer (FAO-FIRM), responsible for the design and development of the system.

Technical support, data collection and input, quality control, comments, etc.:

- Luca Garibaldi, Biologist (FAO), Data Manager
- Sabrina Agnesi, Biologist (recipient of ICRAM grant)
- Gabriele La Mesa, Biologist (recipient of ICRAM grant)
- Tommaso Luciano, Nautical technician (ICRAM technician)
- Luigi Ferro, Statistician (ICRAM contract)
- Ferruccio Tata Nardini, Engineer (FAO contract)
- Paolo Panunzio, Lawyer (ICRAM contract)
- Giacomo Bettocchi, Engineer (FAO contract)

Programming:

- Riccardo Bugliosi, Computer expert (FAO contract), programme analyst

- Andrea Gallucci, Programmer (FAO contract), computer programmer
- Marco Spinelli, Programmer (FAO contract), computer programmer
- Fabrizio Freda, Programmer (FAO contract), computer programmer

Graphics:

- Tomaso Favale, Graphics expert (ICRAM contract)
- José Luis Castilla Civit, Graphics expert (FAO contract)

11.3 Computer resources

The system was developed internally without any external assistance. Supporting software and the hardware configuration used are given below:

- Microsoft WINDOWS 95™, Italian version
- Microsoft Office Professional 95™, 4.3 (8 manuals + 28 floppy disks)
- Microsoft Office 97™ Update (Manual + 1 CD)
- Microsoft Office 97 ODE Tools™ (Manual + 1 CD)
- VisualBasic Pro Upgrade™ (3 manuals + 2 CD)
- Visual J++™ (2 manuals + 1 CD)
- Corel Web Graphics Academic Version™ (1 CD)
- Corel Draw 7™ Italian (3 CD)
- Corel Web Master Suite™ (2 manuals + 2CD)

- Norton Uninstaller 4™ (manual + 1 CD)
- Norton Utilities 2.0™ (3 manuals)
- PCAnyWhere 32™ English (manual + 4 floppy disks)

CONCLUSIONS AND RECOMMENDATIONS

If the multi-disciplinary information needed for research and resource management is collected and managed in a systematic and coherent manner, then it represents a strong investment, both in terms of human resources as well as of work produced.

The concept of the ITAFISH project was to provide the methodology to develop a made-to-measure computerised system for Italian institutions and laboratories involved in the collection and management of fishery and aquaculture data. It is believed that this has been incorporated in the final product.

The development model and the system architecture make it possible for ITAFISH to integrate with other components, and in turn integrate them, thereby constructing a made-to-measure system as a national model. The conceptual design also envisaged its integration into a regional network, where ITAFISH would be the national interface to connect with other twin systems in the network to give life to a regional system (MEDFISH).

Hardware configuration

Equipment	Model – Description	Remarks
2 personal computer	IBM 6576 – Pentium 90 - 8Mb RAM 1.7 Gbytes Hard Disk - Mouse Video Colour 15" - SVGA	For formulation, controls, data entry, documentation, etc.
1 personal computer	IBM Clone - MMX 200 - 32Mb RAM 1.7 Gbytes Hard Disk - Mouse Video Colour 15" - SVGA Iomega Zip 100 Internal - CD Rom Player	For development and testing
1 reader CD ROM	BackPass 2x - Esterno	
1 dispositivo back up	IOMEGA Bernoulli Box 230 Mb esterno- Parallelo	Back-up
2 portable computers	Compaq 410 - Contura DX2-50	Data collection and testing
2 colour printers	HP 560C DeskJet Colour Printer HP ScanJet + OCR	Printing documents, designs and reports
1 scanner		
1 CD burner	LaCie 4x	

During the course of its development ITAFISH has already produced some positive results, which can be summarised as follows:

- the data banks and conceptual approach of the COPEMED information system model are based on ITAFISH
- ITAFISH contributed to the development of the SIPAM regional network component where the interfaces and the connecting/linking models were developed through the SIPAM-ITAFISH test
- ITAFISH was selected as the base system for the ADRIAMED project, and its application will be used in the Adriatic countries, through a regional component at the Project's headquarters
- ITAFISH was proposed as the national component of a GFCM Mediterranean system (MEDFISH) and accepted by the GFCM Working Group on "Fishery Economics and Statistics" at its meeting in Rome from 2-5 March 1998
- The Workshop on the Coordination of Fisheries Research in the Eastern Mediterranean held in Iraklion (Greece) from 6-8 February 1997, recommended the development of a system like ITAFISH for application in its area of competence
- ITAFISH has contributed to the technical and scientific formation of some young Italian researchers.

Further evolution of ITAFISH

As already mentioned, ITAFISH was designed to incorporate already acquired knowledge, develop new applications, establish standards for exchanging information, and contribute to constructing a network between institutions, users, data and information from a regional (Mediterranean) point of view.

In this connection, two theories for development at the national and regional level can be formulated.

1) National level

Further development at the national level would aim at completion of the system by integrating with other data banks in the sector within the framework of an institution.

ITAFISH was designed for possible inclusion in a larger and more complex structure without having to make large changes. It could be applied at the national level as a prototype for, or complement to, a larger system based on multi-sectorial and grid dynamics for data collection and information dissemination.

For its introduction at the infrastructural level, the following activities are recommended:

- harmonise the multi-disciplinary data collection systems,
- coordinate and standardise the data processing,
- ensure a regular and controlled flow of information towards the multi-user,
- train the personnel assigned to these functions
- establish a team within the institution that is able to undertake the ordinary management of the system
- provide support for the routine work of the various Secretariats and Commissions within the institution
- set up a national network to deal with the fishery and aquaculture problems.

From a purely technical point of view the following initiatives should be considered:

i. Synchronisation of the ITAFISH (version 1) with the other data bank systems already operating at the institution and the institution's requirements

The activities to be undertaken should mainly comprise:

- a critical analysis of the whole ITAFISH (version 1): functions, performance, internal quality controls, etc.
- a comparative analysis of: domains and data banks in the ITAFISH (version 1) with data banks already owned by the institution and other data banks considered necessary for the institution.
- determining the overall content (at domain and data bank level) of the new system (e.g., ITAFISH version 2).

- reorganising the domains to meet the needs of the institution (eliminate duplication, redundancies, etc., at data and function levels).
- a detailed global analysis of the contents (fields) of the data banks with characteristics of origin (redundancy and coherence) of the data and of hierarchical competence (data duplicated in different data banks).
- defining the global dictionary of ITAFISH (version 2).

ii. Revision of ITAFISH version 1 in ITAFISH version 2

Revision of the domains and data banks assigned to ITAFISH (version 2), such as:

- restructuring some of the domains and associated data banks
- revising the ITAFISH (version 2) dictionary in accordance with the global system
- revising the ITAFISH (version 2) coding (programming)
- revising some of the functions and associated fields

iii. Design and develop the System in Intranet technology

2) Regional level

Although ITAFISH still needs some refining, it should be utilised and consolidated as quickly as possible so that the work already undertaken, the methodology used and the results obtained will not be completely or partially lost.

The basic recommendation that comes to mind is that ITAFISH should not be thought of as the final product, but as the architecture of a system to be used and developed further. Certainly, ITAFISH must not be considered as 'the system to be adopted' but, thanks to its architecture, it can be segmented and modelled so as to obtain a system as close as possible to the needs of the primary user. All the ITAFISH components must therefore be verified in the field (i.e., an analysis such as that given in item Results 1 of Activity 1), as also whether a data bank, a domain or some of the simple functions should be modified, improved or even substituted. The need to include other data banks in the existing domains, or add domains not taken into account at the time of the project will also have to be checked. This analysis will give

ITAFISH the dynamism that a modern multi-disciplinary information system requires.

It can already be foreseen that, after a running-in phase, three scenarios will emerge for the future management of ITAFISH:

Scenario 1: An entire ITAFISH domain will be completely accepted in the final System, even if some of the functions or representations are appropriately modified.

Scenario 2: An ITAFISH domain does not contain the data bank(s) that the institution considers necessary to complete the domain. In this case, the data bank concerned is developed following ITAFISH conditions and protocols, and is included in the domain with all the links and accesses that the architecture permits. In this scenario the data bank(s) concerned could already have been developed within the institution, or could exist in another body under the institution's authority. In this case, it will have to be decided whether to completely integrate the new data bank(s), appropriately modified, or to create physical links, even remote ones, to enable ITAFISH to aggregate the data in the new data bank, and the new data bank to access all the ITAFISH data.

Scenario 3: A completely new domain must be added to ITAFISH to host a set of data banks that still have to be designed and developed. This is the typical case of another research project that generates, or has generated, a new line of data collection and problems. Also in this case the starting point is a detailed analysis to verify the possibility of integrating the domain or whether to link it through exchange protocols so as to make this domain, or part of it, visible to ITAFISH without this System managing the base.

The ITAFISH project also envisages a supplementary phase that will start once the programmed objectives have been achieved. In this phase the design and development of an interface in Intranet technology for the research and presentation of the data and information contained in ITAFISH will be experimented in a totally integrated and graphics mode.

A last reflection that comes to mind is the use of ITAFISH in the Mediterranean context based on the credibility it has already acquired. It would be useful if FAO-GFCM could also give this tool its regional collocation.

The hypothesis at the regional level is obviously aimed at the construction of a regional system, where ITAFISH, appropriately calibrated to that reality, is the national module, linked through the network to other twin systems, and all converging towards a regional system or centre.

Below is an idea for a project implementing ITAFISH-MEDFISH concepts that would comprise the following tasks:

- Training personnel in the national centres in data collection and quality control
- Establishment of a network of national coordination centres through direct interventions.
- Assistance to other regional networks to fulfil their objectives in the framework of data collection and data management
- Establishment of a national centre of Fishery and Aquaculture data/information (data base/data management)
- Revision, development and installation in the network centres of national databases and assistance to the same in the initial phase. In this activity, the experience, applications and models developed in the ITAFISH project will be used.

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Annex

Examples of computer screens and hard copy reports of the
Institutions data bank, and the *Research and
Development* domain

ITAFISH

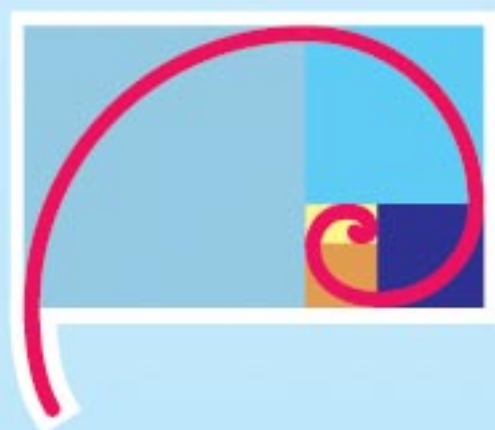


Fig. A 1 - *ITAFISH* introductory screen



Fig. A 2 - *Research and Development* domain - introductory screen



Fig. A 13a - *Institutions* data bank - brief report in hard copy

ricerca e sviluppo		ICRAM - FAO	
banca dati istituzioni			
		progetto di ricerca per lo studio e lo sviluppo di un prototipo di sistema informatizzato per la pesca e l'acquacoltura in Italia	
		15/06/2000	
<hr/>			
Nome istituzione: Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare			
Acronimo: ICRAM			
Dipartimento/sele: Sede centrale			
Indirizzo: Via di Casilotti, 300		Codice postale: 00146	
Città: Roma		Provincia: Roma	
Regione: Lazio		Nazione: Italia	
Prefisso: 06		Telefono: 615701	Fax: 61561906
E-mail:			
URL: http://www.icram.org/			

Fig. A 13b - *Institutions* data bank - standard report in hard copy

ricerca e sviluppo		ICRAM - FAO	
banca dati istituzioni			
		progetto di ricerca per lo studio e lo sviluppo di un prototipo di sistema informatizzato per la pesca e l'acquacoltura in Italia	
		15/06/2000	
<hr/>			
Nome istituzione: Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare			
Acronimo: ICRAM			
Dipartimento/sele: Sede centrale			
Indirizzo: Via di Casilotti, 300		Codice postale: 00146	
Città: Roma		Provincia: Roma	
Regione: Lazio		Nazione: Italia	
Prefisso: 06		Telefono: 615701	Fax: 61561906
E-mail:			
URL: http://www.icram.org/			
<hr/>			
Selezioni di Attributi:			
Acquacoltura		Riproduzione	
Pesca		Valutazione delle risorse	
Pesca		Biologia delle specie	
Ambiente		Rischi marini	
Ambiente		Inquinamento marittimo	

Fig. A 12 - Example of mailing list

Istituto Centrale per la Ricerca scientifica
e tecnologica Applicata al Mare
ICRAM
U.O. di Chioggia
Viale della Stazione, 5
30015 Chioggia
(Venezia) (Italia)

Istituto Centrale per la Ricerca scientifica
e tecnologica Applicata al Mare
ICRAM
Sede centrale
Via di Casalotti, 300
00166 Roma
(Roma) (Italia)

Istituto Centrale per la Ricerca scientifica
e tecnologica Applicata al Mare
ICRAM
U.O. di Palermo
Via E. Amari
90100 Palermo
(Palermo) (Italia)

Istituto di Ricerche sulla Pesca
Marittima, CNR
IRPEM
Largo Fiera della Pesca
60125 Ancona
(Ancona) (Italia)

Istituto di Biologia del Mare, CNR
Riva Sette Martiri, Castello 1364/a
30122 Venezia
(Venezia) (Italia)

Istituto di Tecnologia della Pesca e del
Pescato, CNR
ITPP
Via L. Vaccara, 61
91026 Mazzara del Vallo
(Trapani) (Italia)

Istituto Zooprofilattico Sperimentale delle
regioni Lazio e Toscana
IZSLT
Reparto Ittiopatologia
Via Appia Nuova, 1411
00178 Roma
(Roma) (Italia)

Istituto Zooprofilattico Sperimentale delle
Venezie
Virologia
Via G. Orus, 2
35129 Padova
(Padova) (Italia)

Ministero delle Politiche Agricole
Laboratorio Centrale di Idrobiologia
Viale del Caravaggio, 107
00147 Roma
(Roma) (Italia)

Stabilimento Ittiogenico di Roma.
Regione Lazio
Via della Stazione Tiburtina, 11
00162 Roma
(Roma) (Italia)

Fig. A 11 - Printing option screen

Stampa: opzioni

Seleziona intervallo

- ☒ Questo record
- ☐ Tutti

Seleziona formato

- ☐ Rapporto minimo
- ☒ Rapporto standard
- ☐ Rapporto completo
- ☐ Fax sheet
- ☐ Etichetta per mailing list

Copie

1	2	3
4	5	6
7	8	9
	10	

Uscita Anteprima/Esportazione Stampa ?

Fig. A 9- *Institutions data bank* - screen showing documents produced by an institution

Microsoft Access - [Irm_docs - Maschera]

File Modifica Visualizza Inserisci Formato Record Strumenti Pagina 2

Istituzioni: Documenti

Autore: Mengoni, A. & Rossi, N. (eds)

Anno: 1992

Titolo: Rapporto sull'attività nazionale di ricerca nei settori della Pesca marittima e dell'acquacoltura.

Fonte: Quaderni ICRAP 249 p.

Lingua: Italiano Codice ISBN:

Area di pesca: Mediterranean and Black Sea

Parole chiave: Black Sea, Pesca, Acquacoltura

Visualizzazione Maschera

Fig. A 10 - *Institutions data bank* - screen to undertake research (research keys)

Microsoft Access - [Istituzioni ricerca]

File Modifica Visualizza Inserisci Formato Record Strumenti Pagina 2

Istituzioni: Chiavi di ricerca

Nome Istituzione:

Acronimo:

Città:

Regione:

Nazione:

Status:

Affiliazione:

Network:

Laboratorio attrezzato

Nave di ricerca

Vasche per allevamento

Laboratorio da campo

Biblioteca

Centro computer

Attrezzature multimediali

Sala conferenze

Traduzione simultanea

Fornitura visitatori

Visualizzazione Maschera

Fig. A 7 - *Institutions* data bank - network of origin screen



Networks

Networks

ASFA

CIHEAM

GFCM

MEDIT

SIPAM

Uscita

Riesetta

Fig. A 8 - *Institutions* data bank - screen showing sector concerned



Settori di competenza

Acquacoltura

Pesca

Pesca

Riproduzione

Valutazione delle risorse

Biologia delle specie

Ambiente

Ambiente

Rifiuti marini

Inquinamento acquatico

Uscita

Fig. A 5 - *Institutions* data bank - list of input Institution (selection)

The screenshot shows a Microsoft Access window titled "Microsoft Access - [Selezione]". The menu bar includes "File", "Modifica", "Visualizza", "Inserisci", "Formato", "Record", "Strumenti", and "Finestra". The window displays a table with the title "Istituzioni". The table has three columns: "Nome Istituzione", "Acronimo", and "Dipartimento/Sede". The data is as follows:

Nome Istituzione	Acronimo	Dipartimento/Sede
Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare	ICRAM	U.O. di Palermo
Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare	ICRAM	U.O. di Chioggia
Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare	ICRAM	Sede centrale

At the bottom of the window, there is a status bar with "Visualizzazione Maschera" and "FILT".

Fig. A 6 - *Institutions* data bank - screen showing results of an institution

The screenshot shows a Microsoft Access window titled "Microsoft Access - [Output]". The menu bar is the same as in Fig. A 5. The window displays a form titled "Istituzioni: Risultati prodotti". The form contains the following fields and values:

- Istituzione:** Food and Agriculture Organisation of the United Nations
- Titolo:** Encyclopaedia of Living Marine resources of the Mediterranean
- Informazione:** Database
- Stadi:** Ad hoc survey
- Grafica:**
- Multimediale:** CD-ROM
- Gestione:**
- Vare:**
- Supporto:** Compact Disk digitale per Windows 95/98 e Macintosh/PPC
- Formato:** Web
- Note:** Questo cd contiene dati, informazioni ed analisi disponibili nel Dipartimento di Pesca della FAO

At the bottom of the form, there is a navigation bar with buttons: "Inizio", "Avanti", "Indietro", "Aggiungi", "Salva", "Cancella", "?", and a home icon. The status bar at the bottom shows "Visualizzazione Maschera" and "FILT".

Fig. A 3- *Research and Development domain, Institutions data bank*
introductory screen

Fig. A 4 - *Institutions data bank* - data input sheet

Fig. A 13c - *Institutions data bank* - complete report in hard copy

ricerca e sviluppo		ICRAM - FAO	
		banca dati istituzioni <small>progetto di ricerca per lo studio e lo sviluppo di un prototipo di sistema informatizzato per la pesca e l'acquacoltura in Italia</small>	
		15/04/2000	
<hr/>			
Nome istituzione: Istituto Centrale per la Ricerca scientifica e tecnologica Applicata al Mare			
Acronimo: ICRAM			
Dipartimento/codice Sede centrale:			
Indirizzo:	Via di Carlotto, 300	Codice postale:	00166
Città:	Roma	Provincia:	Roma
Regione:	Lazio	Nazione:	Italia
Prefix:	06	Telefono:	605711
		Fax:	061541904
E-mail:			
URL: http://www.icram.org/			
<hr/>			
Status: Pubblico		Affiliazione: Ministero del Ambiente	
Anno di fondazione: 1982		Lingua straniera: Inglese	
<hr/>			
<input checked="" type="checkbox"/> Biblioteca	<input checked="" type="checkbox"/> Centro computer	<input checked="" type="checkbox"/> Attrezzature subacquee	
<input checked="" type="checkbox"/> Sala conferenze	<input type="checkbox"/> Traduzione simultanea	<input checked="" type="checkbox"/> Focometria video	
<input checked="" type="checkbox"/> Nave di ricerca	<input type="checkbox"/> Vasche per allevamento	<input type="checkbox"/> Laboratorio sul campo	
<hr/>			
<input checked="" type="checkbox"/> Laboratorio	<input type="checkbox"/> Ultrascopi	<input checked="" type="checkbox"/> Spettrofotometro	<input checked="" type="checkbox"/> SPIC
	<input type="checkbox"/> Microscopio elettronico	<input type="checkbox"/> Microscopio elettronico scansione	
<hr/>			
Servizi di Attributi:	<div> Acquacoltura Pesca Pesca Ambiente Ambiente </div>	<div> Riproduzione Valutazione delle risorse Biologia delle specie Rifugi marini Equipaggiamento acquatico </div>	
<hr/>			
Network: GIPAM			
<hr/>			
Note:			

The purpose of the Itafish project, executed jointly by the Italian Ministry of Agricultural and Forestry Policies and FAO, was to design, develop and test a computerized system or methodology for the organization, storage and first analysis of the existing data on fisheries and aquaculture available in the Mediterranean for decision-making. The system is based on a network of institutions and users that exchange data and information using the applications and exchange formats developed by the project. This paper describes the Itafish project regarding: the context in which it was conceived and developed, its contents, the input models, the functioning and the outputs, and how it is managed. A separate manual is also available describing the installation of the system and its more technical specifications. The development model and the system architecture of Itafish make it possible for Itafish to integrate with other components, thereby constructing a made-to-measure decision-support system as a national model. The conceptual design also envisages its integration into an eventual regional network where Itafish would be the national node or interface that connects with other similar systems in the network.

