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PROGRESS REPORT ON FISHBASE
THE GLOBAL BIOLOGICAL DATABASE ON
LIVING AQUATIC RESOURCES

by

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ABSTRACT

The paper presents the current status of FISHBASE, a global biological database on fish, crustaceans and molluscs. FISHBASE is being developed by the International Center for Living Aquatic Resources (ICLARM) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and with the support of the Commission of the European Communities (CEC). It is planned to make the database available at marginal costs to institutions in developing countries. The paper also incorporates the report on FISHBASE of the ICES Study Group established in October 1990 to report on this database.

1 Introduction

The International Center for Living Aquatic Resources Management (ICLARM) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and with the support of the Commission of the European Communities (CEC) is developing a database (called FISHBASE) to summarize global information on living aquatic resources (fish, crustaceans and molluscs), to be made available on CD-ROM to institutions in developing and other countries (see attached reprint of Froese 1990a). Following a recommendation of the Biological Oceanography Committee at the 1990 Statutory Meeting, ICES established a Study Group to a) determine interest and identify sources of data from national laboratories, b) review current specifications of FISHBASE, in particular for disease and morphometric data, and c) identify related databases and act as liaison with these projects (see also Froese, 1990b). The present paper describes the status of FISHBASE as of August 1991 and presents the Study Group report.

2 Status of FISHBASE

The status of data entry into FISHBASE as of August 1991 is shown in Fig. 1. A large number of entries on nomenclature and distribution as well as some ecological data have been downloaded from SPECIESDAB, a database already generated at FAO (see below). Some areas of FISHBASE need additional comments:

2.1 Population dynamics

A major effort has been initiated to increase the amount of population dynamics data (growth parameters, natural mortality rates, length/weight relationships) in FISHBASE. The corresponding tables have been revised and optimized. A published compilation of 1500 sets of growth parameters for 515 species accompanied by a bibliography of more than 650 references (Pauly 1978) has already been checked and transferred into FISHBASE.

2.2 Aquaculture

As can be seen in Fig. 1 there are hardly any aquaculture data in FISHBASE to date. This will change soon because i) two major data sets with several hundred records on aquaculture experiments have been identified, ii) the

aquaculture tables have been revised and modified to accommodate these and comparable data sets, and iii) a research assistant with a strong background in genetics has been hired in August 1991, who is responsible for the aquaculture part of FISHBASE.

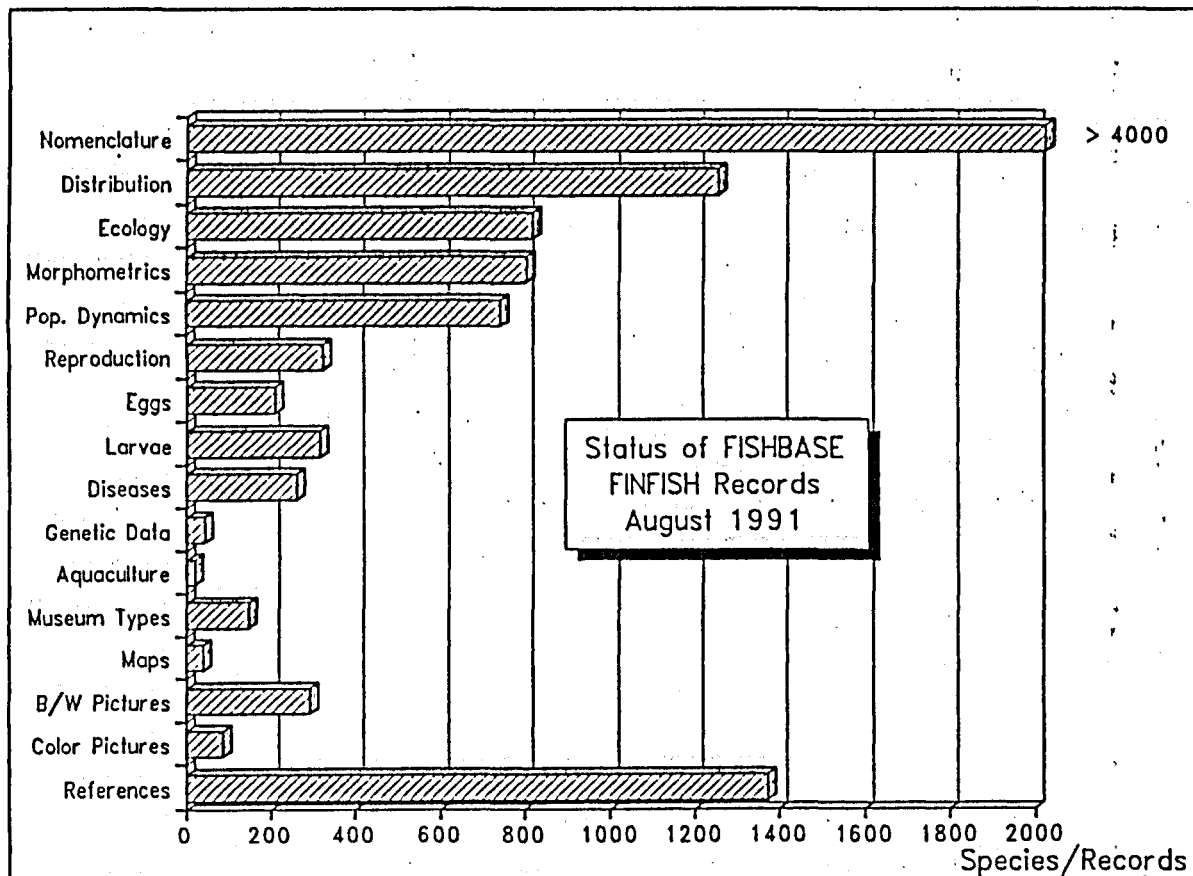


Figure 1: Content of FISHBASE as of August 1991

2.3 Fish genetics / germplasm / strains

Conservation of germplasm is needed not only to provide sources of genetic material useful in aquaculture but also to maintain genetic diversity - within species and within ecosystems. For technical reasons as well as high cost, it is not practical to embark on highly centralized collection and conservation of fish germplasm. Instead, ICLARM plans to expand FISHBASE to record not only all available genetic information on a species but also to state the localities of populations as well as their status of threat. For cultured strains it is planned

that FISHBASE will play the role of a "strains registry", including information on where the strains can be obtained.

2.4 Catches and aquaculture production

When originally conceived, FISHBASE contained tables for catches and aquaculture production by species and country. While it is possible in principle to attach this kind of information to a species, it is now felt that this task could be more adequately handled by other databases where the country is the basic unit. Such databases allow the accommodation of catch and production data that are available only by genus or species group as is often the case in tropical fisheries. Also, FISHBASE should concentrate on biological features of resource species, which usually remain valid over a long period of time as opposed to, e.g., time series data of catches, market prices, and management regimes, which need continuous updating. It is thus planned to omit catch and aquaculture production data from FISHBASE. It will remain possible, however, to link FISHBASE to a database containing such information.

3 FISHBASE outputs

3.1 Checklist by country

FISHBASE can be used to produce preliminary checklists of fishes by country. In such checklists, the printout is grouped by family and contains the scientific name, the common name(s) used in that country, and a general indication of the commercial importance of each species for fisheries, aquaculture and aquarium trade. It is planned to have such preliminary lists checked and completed in cooperation with the respective national organizations. Such studies have already commenced in Malawi and in the Philippines and a third one is expected to start before the end of the year in Ghana.

3.2 Annotated bibliography

Although FISHBASE was not intended to be a bibliographical database, it can be used to produce a preliminary annotated bibliography for a given species. The fact that all important entries in the database are referenced and that thus the context of a citation is known can be used to produce a list of all references referring to the species, together with notes on the content of the

reference, e.g., Growth, Length/Weight data, Reproduction, Swimming speed, Food consumption, etc..

3.3 Identification help

FISHBASE includes a preprogrammed routine for a preliminary quick identification of a species based on environment (freshwater / brackishwater / saltwater), FAO statistical area, and spines and soft ray counts of the dorsal and anal fin. The user typically ends up with a list of less than 10 possible species, often of the same family or genus. The user can then compare the digitized pictures and check the morphological descriptions to confirm an identification.

3.4 Species synopsis

FISHBASE can be used to produce a structured printout of all the available information on a certain species. This printout can be used as a preliminary species synopsis. It will be used to have the information on a species checked by appropriate experts. It is assumed that a printout from FISHBASE containing a preliminary species synopsis, a preliminary annotated bibliography, a morphological drawing and a distribution map will be useful for courses, e.g., in "Special Ichthyology" in developing countries, especially for freshwater species for which no FAO catalogs or identification sheets are available.

It must be stressed that the capabilities listed above are limited to those species for which the database contains the appropriate data.

4 Ensuring the quality of FISHBASE contents

Ensuring the quality of the information in a large database with many contributors is a major problem. FISHBASE makes intensive use of standard techniques such as probability checks and reference tables to prevent the entering of false information in the first place. In addition, we tried to tackle the problem by making the origin and reliability of every bit of information transparent to the user. We used a four-step approach to ensure the quality of information contained in FISHBASE:

- 1.) FISHBASE data encoders are well trained research assistants with a University degree in fisheries or aquaculture;
- 2.) Every record in FISHBASE has several fields stating who contributed the data and who entered or modified them, together with the date when this was done. The full name and address of the contributors and/or inputters are available in the database, allowing the user to directly contact the persons;
- 3.) Every record has a field stating whether the information in the record has been checked by an external expert. If this is the case, the full name and address of the expert is available in the database. The user thus has the option to work with "checked" information only and to contact an expert directly;
- 4.) Every record has a reference number on it allowing access to the complete citation. In addition, many fields in a record have their own reference numbers. Thus the user is able to trace information back to its source.

While these precautions will not prevent FISHBASE from containing errors it is hoped that they provide an efficient way of quickly identifying and eliminating errors.

5 Interest in FISHBASE

Following a press release and a publication in December 1990 the FISHBASE project has received a considerable number of information requests. As shown in Fig. 2, the requests originated in equal parts from developing and developed countries, most of the latter from the ICES area. Main interest groups were scientific institutes and National Research Organizations, but also the private sector. There were several offers to collaborate with FISHBASE by contributing or checking data.

FISHBASE has been developed using the commercial relational database software DataEase. A Developer module of this software has now become available. This will allow distribution of free executable versions of FISHBASE. It is planned to distribute preliminary versions to reviewers from December 1991

onwards. Distribution of version 1.0 is planned for September 1992. FISHBASE is to be distributed both through ICLARM and FAO.

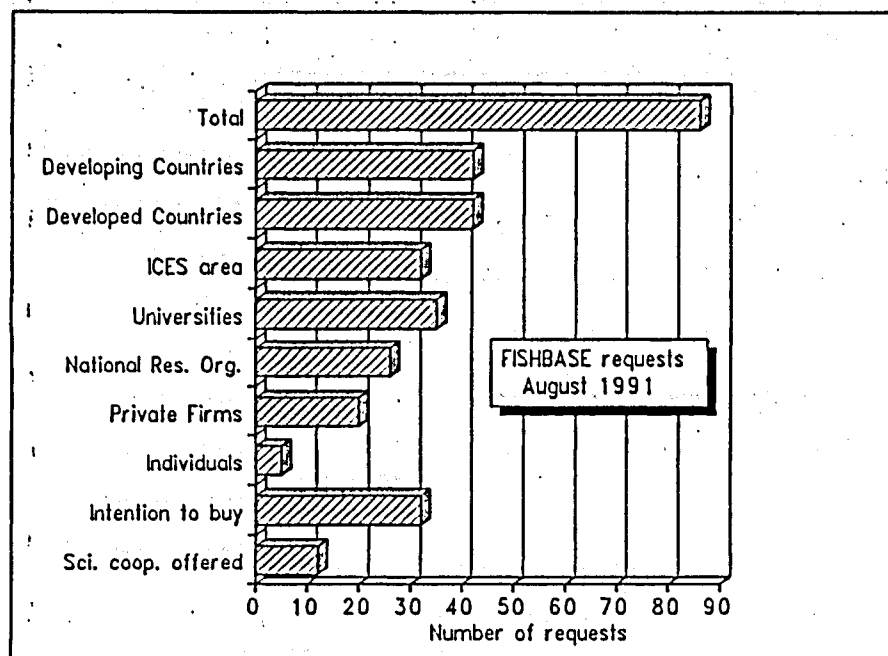


Figure 2: Number of information requests on FISHBASE as of August 1991.

6 Cooperation agreements

As of August 1991, three formal cooperation agreements have been signed and one is being prepared.

As stated in a Letter of Agreement between FAO and ICLARM, the FAO Species Identification Programme for Fishery Purposes provides scientific and vernacular nomenclature as well as core, ecological and fisheries information on marine and brackishwater species. This is accomplished through the FAO database SPECIESDAB, whose data has been built up in FAO for over four years. Much of the data contained in FISHBASE was directly downloaded from SPECIESDAB, and FISHBASE will continue to benefit from data entered in SPECIESDAB. FAO is the nomenclatorial authority for all species included in FISHBASE that originated from SPECIESDAB and for those portions of FISHBASE reviewed by FAO. The primary source for the data included in SPECIESDAB is from the species catalog series of the FAO Species Identification Programme for Fishery Purposes. In addition, FISHBASE directly incorporates information from

other FAO publications such as the species synopsis series. FISHBASE is to be distributed both through ICLARM and FAO.

The Zoologisches Institut and Zoologisches Museum Hamburg (ZIM) contributes data on the global availability of types of the tilapiine genera *Tilapia*, *Oreochromis*, and *Danakilia*. For these genera ZIM staff will check, correct and supplement all information contained in FISHBASE. A similar agreement is in preparation with the Musée Royal de l'Afrique Centrale, Tervuren, for West African freshwater fishes.

A Letter of Intent has been signed with the Expert Center for Taxonomic Identification (ETI), Amsterdam, which is developing a large database and expert system for species identification. It is intended to interchange data, share expertise, and cooperate on new developments such as vectorized distribution maps.

The FISHBASE project has cooperation agreements with the Malawi Fisheries Department and the Marine Science Institute, University of the Philippines. Both institutions - representing typical users in developing countries - host FISHBASE outposts and contribute data on the local fish fauna. It is anticipated that an additional FISHBASE outpost will be established in Ghana in November 1991.

7 FISHBASE Study Group report

The Study Group on FISHBASE was to work by correspondence. The following colleagues agreed to become members of the study group: E. Cohen, North East Fisheries Center (NEFC), J. Moreau, Ecole Nationale Supérieure Agronomique de Toulouse (ENSAT), U. Piatkowsky, Institut für Meereskunde, Kiel (IfM), and S. Swaby, Marine Biological Association of the United Kingdom, Plymouth. M. Sinclair, Bedford Institute of Oceanography (BIO) preferred not to become a formal member of the Study Group but informed BIO staff of the existence of FISHBASE.

The Study Group on FISHBASE had the following terms of reference: a) determine interest and identify sources of data from national laboratories (in the ICES area), b) review current specifications of FISHBASE, in particular for

disease and morphometric data, and c) identify related databases and act as liaison with these projects.

a+b) As can be seen from Tab. 2 there is considerable interest in FISHBASE among institutes from the ICES area. Several individual scientists offered to contribute data. The Instituto Centrale per la Ricerca Scientifica e Tecnologica Applicata alla Pesca Marittima (ICRAP), Rome, reviewed the specifications on fish larvae and checked all entries (about 250) on Mediterranean fish larvae; the IfM has offered to check the entries on fish eggs from the Baltic and the North Sea, and ENSAT will collect and supply data on population dynamics of freshwater species from Francophone countries of Africa.

As of August 1991, an agreement is being negotiated between the French Agence de Cooperation Culturelle et Technique (ACCT) and ICLARM regarding a French-language version of FISHBASE, using the French version of DataEase. This will be supported by a fellowship to a Francophone FISHBASE staff (to be hired at the end of 1991) offered by the Association des Université Partiellement et Entièrement de Langue Française (AUPELF), whose main task will be the incorporation into FISHBASE of data from Francophone West Africa.

Staff from several institutes from the ICES area (Institute of Aquaculture, Stirling; University of Wales, Swansea; Institut für Hochseefischerei, Rostock) have expressed their willingness to cooperate with FISHBASE given that an appropriate funding source could be identified.

c) Several related databases have been identified:

The University of Wales, Swansea, has a database containing about 17,000 records with electrophoretic data on fishes. This information corresponds to the ELECDAT table in FISHBASE with currently 332 records. Dr. Skibinski, who is in charge of the Swansea Allozyme Database, has agreed in principle to exchange data but lacks resources for doing so.

The International Game Fish Association has a WORLD RECORD FISH database containing maximum length and weight of fishes. Mr. Elwood K.

Harry, who is in charge of the database, has offered to make the data available.

Dr. Gehrke from the New South Wales Agriculture and Fisheries Centenary has a database with 6800 records on fish oxygen consumption covering 250 species. He is willing to contribute the data, but requires extra funding for updating his database.

The Fish and Wildlife Service, USA, has a database with over 700 records on exotic fishes in the USA. Mr. D. Jennings has offered to make the data available.

The Marine Biological Association of the United Kingdom has a database on rare British marine fishes. Mrs. S.E. Swaby has offered to make the data available for inclusion in FISHBASE on the condition that she gets the permission from the Nature Conservancy Council.

MEDIFAUNE is a database developed at the Laboratoire d'Océanographie Biologique Université de Nice (Fredj 1989). It offers online query service and contains data on about 5000 Mediterranean species including 638 fishes. No contact has been established yet.

The Pond Dynamics/Aquaculture Collaborative Research Support Program (CRSP), Oregon State University, has compiled a large database on aquaculture experiments, predominantly with Nile tilapia. Negotiations are underway to include the summarized information on the outcome of the experiments in the FARMSYS table of FISHBASE.

Also Dr. Ram Myers, Department of Fisheries and Oceans, St. John's, has volunteered to contribute to FISHBASE an updated version of his database on indices of recruitment variability of fishes (see Myers et al. 1990 for an early version of this database).

A meeting of the Study Group is scheduled for the 79th ICES meeting in La Rochelle, 1991. The outcome of the meeting will be presented in the oral report to the Biological Oceanography Committee.

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FISHBASE: An Information System to Support Fisheries and Aquaculture Research*

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Abstract

The International Center for Living Aquatic Resources Management (ICLARM) in collaboration with the Food and Agriculture Organization of the United Nations (FAO) and with the support of the Commission of the European Communities is developing a database (called FISHBASE) to summarize global information on living aquatic resources (fish, crustaceans and molluscs) in a standardized form to be made available on CD-ROM to institutions in developing countries. For all species, stocks and strains relevant to fisheries or aquaculture, FISHBASE summarizes information comparable in scope to that normally provided in species synopses such as those published by FAO. FISHBASE provides not only fast access to information on a given species but also allows for comparative studies between species groups or geographical areas. In more than 1,200 fields, the database contains information on nomenclature, distribution, ecology, morphometrics, population dynamics, reproduction, eggs and larvae, diseases, genetics, and aquaculture. The first version of FISHBASE will be distributed by the end of 1992.

Introduction

Fisheries have enormous importance for rural and coastal dwellers in developing countries. To sustain and improve the contribution of fisheries to their nutritional well-being and livelihood, effective management is essential. This in turn depends on the availability of accurate information for researchers, planners and managers. Knowledge on fisheries and aquaculture is distributed in numerous textbooks and thousands of papers with hardly any standards in terms and units. Bibliographic databases, such as Aquatic Sciences and Fisheries Abstracts (ASFA) provide access to key terms, titles and abstracts, but lack structured data; hence, their users must access the original literature to extract the information of interest. As institutions in developing countries often cannot afford to maintain extensive libraries, scientists thus often lack such access, and even if possible, such data retrieval is very costly and time-consuming.

To help solve this problem, the International Center for Living Aquatic Resources Management (ICLARM) in collaboration with the Food and Agriculture Organization of the United Nations

(FAO) and with the support of the Commission of the European Communities is developing a database (called FISHBASE). FISHBASE summarizes global information on living aquatic resources (fish, crustaceans and molluscs) in a standardized form to be made available to institutions in developing countries. It also contains high quality color pictures (see Fig. 1).

FISHBASE will be used by scientists (biologists, economists, environmentalists and sociologists) and by educators, planners and policymakers. It will



Fig. 1. "Painting" of a coral reef fish (*Balistoides conspicillum*) as incorporated in FISHBASE. Such figures are usually found only in expensive taxonomic books, often not available to developing-country libraries.

*ICLARM Contribution No. 691

compensate, in part at least, for a fisheries science and development reference library in laboratories and other institutions in developing countries.

Inside FISHBASE

For all species, stocks and strains relevant to fisheries or aquaculture, FISHBASE summarizes information comparable in scope to that normally provided in species synopses such as those published by the Food and Agriculture Organization of the United Nations (FAO). FISHBASE provides not only fast access to information on a given species but also allows for comparative studies between species groups or geographical areas.

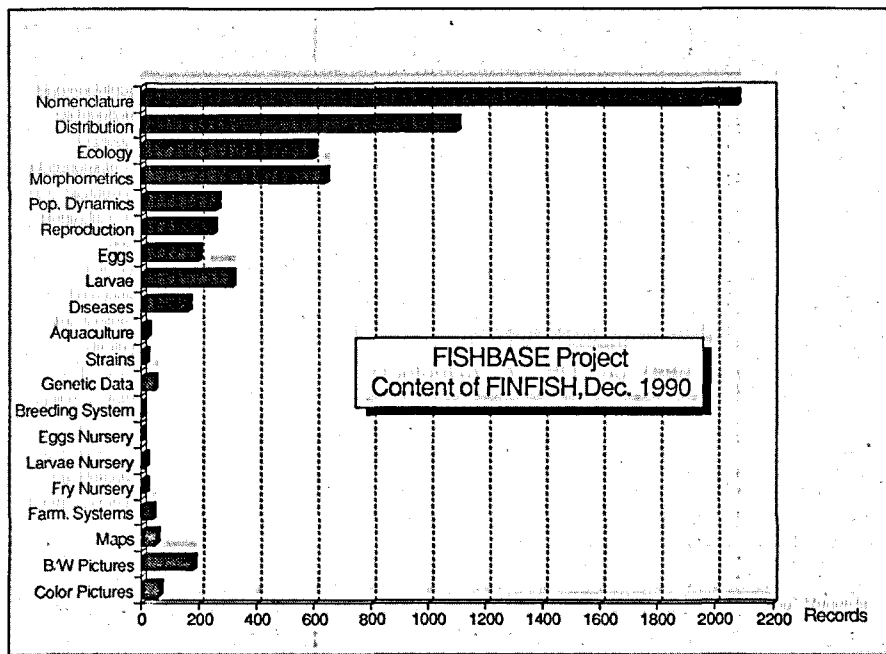


Fig. 2. Content of FINFISH, the part of FISHBASE dealing with fishes, as of December 1990. Efforts are underway to increase the information contained in the various areas presently not well covered, notably the aquaculture section.

Taxonomy, Distribution and Importance

FISHBASE contains valid scientific names and synonyms, valid FAO names, common names by country and species distribution by FAO areas and countries. Several fields describe the economic importance of a species. This information is derived from the FAO Species Identification and Data Programme. As of December 1990, this information has been entered for about 2,000 fishes (Fig. 2) and about 500 crustaceans.

Morphology, Identification and Museum Collections

For eggs, larvae and adults, FISHBASE contains morphometric measurements, meristics and detailed descriptions including pictures, which allow quick, easy and accurate identification. Complete morphometric descriptions of all fish larvae occurring in the North Sea and Mediterranean have already been entered. The data on museum collections inform scientists where to find type specimens for taxonomic purposes. This part of FISHBASE also draws upon and assists the conservation of archival material, including drawings and descriptions from publications dating back to the last century.

Ecology

FISHBASE contains structured information on abundance, habitats, behavior, reproduction, food items, food consumption, predators, competitors, status of

threat and ecological parameters, which help environmental and related studies in the context of global change.

Population Dynamics

The need for structured population dynamics data was a primary reason for establishing FISHBASE. Important parameters related to growth, mortality and length-weight relationships are included by species and stock. In addition, time series data on catches are entered when available.

Aquaculture

FISHBASE is the first database to provide an organized and easily searchable structure to the highly heterogeneous data produced by the rapidly evolving world of aquaculture. In addition to general data on the performance and tolerance of farmed species or strains, FISHBASE contains genetic data, time series data on production by country, information on breeding, hatchery and nursery systems, and on the farming systems used for growout.

Germplasm and Biodiversity

For technical reasons as well as high cost, it is not practical to maintain large-scale collection and conservation of fish germplasm. In order to assist researchers in selecting the most suitable species for

aquaculture, culture-based fisheries or genetic studies, FISHBASE combines information on characters, performance and genetics of a species with a detailed description of where the species can be obtained or collected in case it is needed. These data will also help to identify threatened species and habitats in order to preserve biodiversity.

Diseases

Diseases are of increasing concern in aquaculture and fisheries, FISHBASE records the diseases reported for a species, stock, or strain, including their prevalence, symptoms, effects, treatment and prophylaxis. Symptoms are classified to allow diagnosis through FISHBASE. Complete descriptions of about 140 important fish diseases have already been entered.

Graphics

FISHBASE has a strong graphical component. It contains images of eggs, larvae and adults as well as distribution maps for all species. Many images are colored (Fig. 1,3 and 5). In addition, numerical data can



Fig. 3. Distribution of the shark mackerel, *Grammatorecynus bicarinatus*, as an example of a distribution map contained in FISHBASE.

be plotted on screen in many different ways through built-in graphic routines.

Mode of Operation

FISHBASE is designed to run on low-cost IBM compatible microcomputers such as those already existing in many institutions in developing countries. Special emphasis is given to user-friendliness.

FISHBASE is built around a relational database. It consists of more than 1,200 fields distributed in 33 linked tables (Fig. 4). Users access information through windows that combine information from several tables. The ECOLOGY window, for example, displays information from the tables FAMILIES, SPECIES, STOCKS, FAOAREAS, ECOLOGY, FOODS, COMPETS and PREDATS. A search is performed by entering the desired characters in an empty form. The Boolean operators AND, OR, NOT, >, < can be used to deal with uncertain characters (Froese et al. 1990).

Inputting is done mainly at ICLARM headquarters in Manila, under the supervision of ICLARM

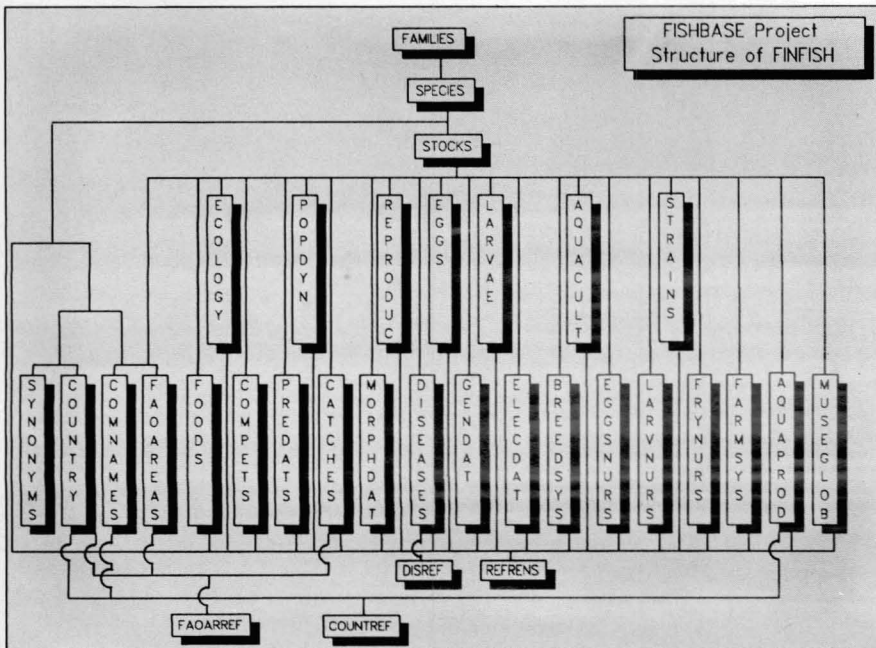


Fig. 4. Outline of the internal structure of FISHBASE. Information is stored in more than 1,200 fields organized in 33 linked tables.

scientists. The FAO Species Identification and Data Programme is responsible for the nomenclature part. Several regional outposts, e.g., at the Malaŵi Department of Fisheries and at the University of the Philippines, provide national or regional information. Cooperation agreements are in preparation with the Expert Center for Taxonomic Identification, Amsterdam; the Musée de l'Afrique Centrale, Tervuren; and the Zoologisches Museum Hamburg. Inputs are also sought from the members of the Network of Tropical Fisheries Scientists (NTFS) and the Network of Tropical Aquaculture Scientists (NTAS).

The entries for every species in FISHBASE will be checked by appropriate experts before the first release of the software.

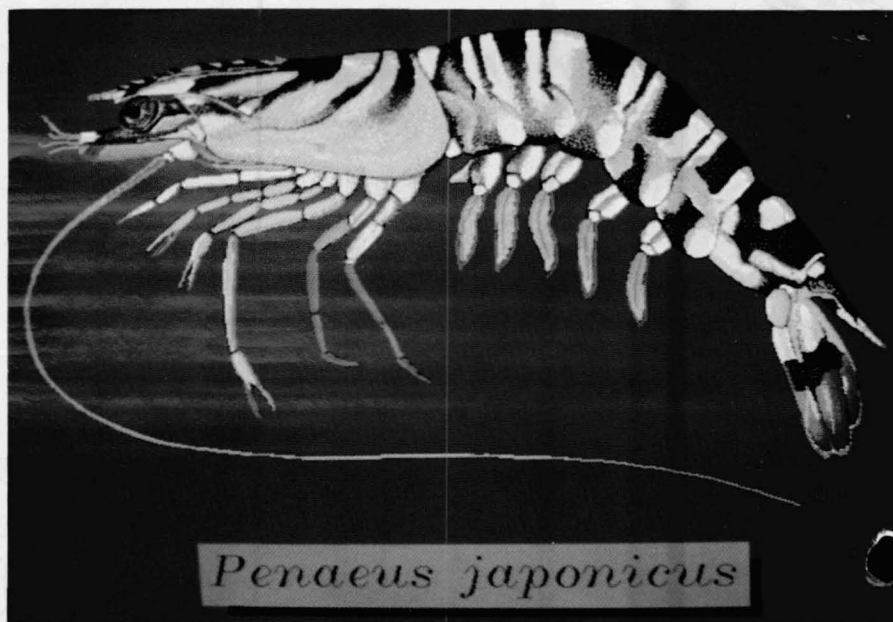


Fig. 5. "Painting" of a shrimp (*Penaeus japonicus*) as incorporated in FISHBASE.

FISHBASE Products

The main FISHBASE product will be a complete database stored on a CD-ROM laser disk for use with IBM-compatible microcomputers. Release of the first version is planned for the end of 1992. Updates will be available on an annual basis. Regional or national output will be distributed on standard diskettes and where appropriate as hard copy. Training courses on the use of FISHBASE will be held in developing countries and at ICLARM headquarters in Manila.

FISHBASE is a research tool whose main strength lies in comparative studies. Such studies have already commenced using the data already entered (Achenbach and Froese 1990; Froese 1990; Froese and Papassisi 1990).

Financial Requirements

The successful development of FISHBASE and its availability to end-users depend upon securing the necessary financial resources. Funds are needed for hiring inputters, advisory services, management training, product development and distribution. At present, FISHBASE is mainly funded by the Commission of European Communities, which is interested in the coverage of African fishes. Additional funding is

provided by FAO for inputting of shrimps and cephalopods. ICLARM is seeking additional support for coverage of specific regions and of aquaculture topics according to needs and donor interests.

Further Information

For more information on the ICLARM Database on Living Aquatic Resources (FISHBASE), contact the Director General, International Center for Living Aquatic Resources Management, MC P.O. Box 1501, Makati, Metro Manila 1299, Philippines.

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Call for Cooperation

Scientists who are interested in contributing data or cooperating on specific topics such as morphometrics, diseases or ecology, may contact directly Dr. R. Froese, FISHBASE Project Leader. Most needed are scientists willing to validate the content of FISHBASE for those species/groups with which they are familiar. Every contribution will be cited using a standard format or, in the case of unpublished data, as "personal communication", with full address of the author. Also, collaborators will get a free copy of FISHBASE.

ICLARM has developed a set of printed DATA COLLECTION FORMS which provide an easy way to accumulate the information on a species that can go into FISHBASE. ICLARM is looking forward to sending out these forms to interested colleagues.

The International Council for the Exploration of the Sea (ICES) has recently created a study group to identify possibilities for including North Atlantic species into FISHBASE. This offers additional opportunities for cooperation agreements with scientists or institutions in the ICES member countries (contact: Chairman R. Froese, ICLARM).