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Improving the Information Base for Aquatic Genetic Resources for *The State of the World's Aquatic Genetic Resources*

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Cover photograph:
Good-sized Nile tilapia (*Oreochromis niloticus*) from a freshwater pond in Jamalpur/Bangladesh, 2008 (Courtesy of Mohammad Hasan/FAO).

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Preparation of this document

The document has been prepared by the Technical Secretariat with the coordination of Matthias Halwart (Senior Aquaculture Officer), Devin Bartley (Senior Fisheries Officer), Ruth García Gómez (Associate Aquaculture Officer) and Kathrin Hett (Associate Aquaculture Officer).

All papers and abstracts have been reproduced as submitted.

Abstract

The International Expert Workshop on Improving the Information Base for Aquatic Genetic Resources for The State of the World's Aquatic Genetic Resources was convened by FAO in collaboration with the Spanish Aquaculture Observatory Foundation (FOESA) from 1–4 March 2011 in Madrid, Spain.

The workshop was attended by international aquatic genetic resources database experts, representatives of regional aquaculture and fisheries bodies and networks, the consultants responsible for the preparation of the background papers presented at the event, and representatives of international organizations involved in the topic.

The main objectives of the workshop were to discuss and to review two background papers that are part of the work of the FAO Fisheries and Aquaculture Department with the FAO Commission on Genetic Resources for Food and Agriculture, which in 2007 included aquatic genetic resources into its Multi-Year Programme of Work.

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The Secretariat also wishes to thank all the participants for their presentations and their valuable contributions to the workshop discussions.

Contents

Abbreviations and acronyms

AbNJ	Areas beyond national jurisdiction
AFLP	amplified fragment-length polymorphism
AGRDEU	Aquatic Genetic Resources in Germany
AG	Regional Advisory Group
AKI	Institute for Agricultural Economics (Hungary)
ANAF	Aquaculture Network for Africa
APO	Associate Professional Officer
AqGR	aquatic genetic resources
ASFIS	Aquatic Sciences and Fisheries Information System
ATCC	American Type Culture Collection
BCC	BIOTEC Culture Collection
BCCM	Belgian Coordinated Collections of Microorganisms
BGSC	Bacillus Genetic Stock Center
BIF	biodiversity information facility
BIS	Biodiversity Information System
BLE	Federal Office for Agriculture and Food (Germany)
BMELV	German Federal Ministry of Food, Agriculture and Consumer Protection
BMU	Beach Management Unit (Kenya)
BOLD	Barcode of Life
CABRI	Common Access to Biological Resources and Information
CAS	California Academy of Sciences
CBD	Convention on Biological Diversity
CBOL	Consortium for the Barcode of Life
CBS	Centraalbureau voor Schimmelcultures
CCAP	Culture Collection of Algae and Protozoa
CCINFO	Culture Collections Information Worldwide
CCUG	Culture Collection, University of Göteborg
CGRFA	FAO Commission on Genetic Resources for Food and Agriculture
CGSC	Coli Genetic Stock Center
CIAD	Centro de Investigación en Alimentación y Desarrollo A.C.
CITES	Convention on International Trade in Endangered Species in Wild Flora and Fauna
CoF	Catalog of Fishes
COFI	FAO Committee on Fisheries
CoL	Catalogue of Life
CPCC	Canadian Phycological Culture Centre
CRAAS	Chinese Research Academy of Aquatic Science
CSAB	Chairs of the Scientific Advisory Bodies
DFO	District Fisheries Officer (Kenya)
DiGIR	Distributed Generic Information Retrieval
DPD	Program of Research and Development of Fisheries (Brazil)
EAS	European Aquaculture Society
EATIP	European Aquaculture Technology and Innovation Platform
ECOSURV	Ecological Survey of Surface Waters (Hungary)
EEZ	exclusive economic zone
EFARO	European Fisheries and Aquaculture Research Organisation
EFMIS	Enhanced Fish Market Information Services (Kenya)
EIFAAC	European Inland Fisheries and Aquaculture Advisory Commission

EoL	Encyclopedia of Life
ESTATPESCA	IBAMA Fisheries Monitoring Program (Brazil)
EST	expressed sequence tags
FA	Fisheries Assistant (Kenya)
FD	Fisheries Database (Hungary)
FEAP	Federation of European Aquaculture Producers
FIGIS	Fisheries Global Information System
FIN	FishBase Information and Research Group, Inc.
FIPS	FAO Statistics and Information Service
FOESA	Fundación Observatorio Español de Acuicultura - Spanish Aquaculture Observatory Foundation
FO	Fisheries Officer (Kenya)
FVM	Ministry of Agriculture and Rural Development (Hungary)
GBIF	Global Biodiversity Information Facility
HAKI	Research Institute for Fisheries, Aquaculture and Irrigation (Hungary)
HAMBI	Microbial Culture Collection, University of Helsinki
HBMMD	Harbor Branch Marine Microbe Database
HIT	Harvesting Index Toolkit
IBAMA	Institute for Environment and Natural Resources (Brazil)
IEGM	Institute of Ecology and Genetics of Microorganisms
IFB	Inland Fisheries Potsdam-Sacrow (Germany)
INVAM	International Culture Collection of Arbuscular and VA Mycorrhizal Fungi
ISSCAAP	International Standard Statistical Classification of Aquatic Animals and Plants
IUCN	International Union for Conservation of Nature
IUMS	International Union of Microbiological Societies
JCM	Japan Collection of Microorganisms
JSCC	Japan Society for Culture Collections
KMFRI	Kenya Marine and Fisheries Research Institute
LAN	local area network
LVFO	Lake Victoria Fisheries Organization
MARM	Ministry of Environment, Rural and Marine Environment (Spain)
MEA	Multilateral Environmental Agreement
MGD	Microbial Germplasm Database
MGR	marine genetic resources
MICH	University of Michigan Fungus Collection
MIRCEN	World Data Centre for Microorganisms
MMA	Ministry for Environment (Brazil)
MOHOSZ	Hungarian Association of Anglers
MoU	Memorandum of Understanding
MPA	Ministry of Fisheries and Aquaculture (Brazil)
MSDN	Microbial Strain Data Network
MYPOW	Multi-Year Programme of Work
NACA	Network of Aquaculture Centres in Asia-Pacific
NACEE	Network of Aquaculture Centres in Central and Eastern Europe
NCBI	National Center for Biotechnology Information
nei	nowhere else included
NFBR	National Fish Broodstock Registry
NIG	National Institute of Genetics (Japan)
OBIS	Ocean Biogeographic Information System
OECD	Organisation for Economic Co-operation and Development
OIE	World Organisation for Animal Health
PIIB	Latin American Platform for Biodiversity Information
QAAD	Quarterly Aquatic Animal Disease Report
RDPII	Ribosomal Database Project II

R&D	research and development
RIS	Ramsar Information Sheet
RSIS	Ramsar Site Information Service
SCAR	Scientific Committee on Antarctic Research
SEAP	Special Secretary for Aquaculture and Fisheries (Brazil)
SOFIA	State of World Fisheries and Aquaculture
STRP	Ramsar's Scientific & Technical Review Panel
SUDEPE	Agency for Development of Fisheries (Brazil)
SWIO	South-West Indian Ocean
TAPIR	TDWG Access Protocol for Information Retrieval
TCP	Technical Cooperation Programme
TDWG	Taxonomic Databases Working Group – Biodiversity Information Standards
UNSW	University of New South Wales
USDA	United States Department of Agriculture
VKM	All Russian Collection of Microorganisms
VM	Ministry of Rural Development (Hungary)
VMS	vessel monitoring system
VPN	virtual private network
WDCM	World Data Center for Microorganisms
WDPA	World Database of Protected Areas
WFCC	World Federation for Culture Collections
WoRMS	World Register of Marine Species

WORKSHOP SUMMARY

INTRODUCTION AND OVERVIEW

The International Expert Workshop on Improving the Information Base for Aquatic Genetic Resources for The State of the World's Aquatic Genetic Resources took place on 1–4 March 2011 in Madrid, Spain, as part of the work of the FAO's Fisheries and Aquaculture Department with the Commission on Genetic Resources for Food and Agriculture (CGRFA).

A Letter of Agreement was signed between FAO and the Spanish Aquaculture Observatory Foundation (FOESA), a semi-autonomous body under the Spanish Ministry of Agriculture, Fisheries and Nutrition.

The workshop brought together experts of different backgrounds: international aquatic genetic resources database experts, representatives of regional aquaculture and fisheries bodies and networks, the consultants responsible for the preparation of the background papers, and representatives of international organizations involved in the topic (a complete list of participants is given in Annex 1).

The workshop focused on assessing the existing information base and information sharing systems on aquatic genetic resources, and ways of improving collection and sharing information on these resources. The key issues and proposed process for the production of The State of the World's Aquatic Genetic Resources Report were reviewed and discussed.

ACTIVITIES

The workshop was opened by Carmen-Paz Martí Dominguez, representative of the Ministry of Environment, Rural and Marine Environment, Spain. Matthias Halwart (Senior Aquaculture Officer, Fisheries and Aquaculture Department, FAO, Rome, Italy) and Devin Bartley (Senior Fishery Resources Officer, Fisheries and Aquaculture Department, FAO, Rome, Italy) guided and facilitated the workshop (the detailed agenda and the prospectus may be found in Annexes 2 and 3).

The workshop participants presented their area of work and explained if and how aquatic genetic resources are considered in their database, regional fisheries body, aquaculture network or international organization, respectively. The abstracts of those presentations are reproduced in the next chapter of this report.

During the workshop, two documents, which were presented at the 13th Session of the CGRFA in July 2011, were introduced by the consultants responsible for their preparation (Roger Pullin and John Benzie), and subsequently discussed and reviewed (executive summaries of the documents are given in Chapters 3 and 4).

- Background Paper 1 - Preparation of a first report on The State of the World's Aquatic Genetic Resources: key issues and proposed process. This document was used by FAO to prepare the working document on the preparation of The State of the World's Aquatic Genetic Resources which was presented to the CGRFA during its 13th Session held in Rome, Italy, in July 2011.

- Background Paper 2 - Status report on the existing information base for aquatic genetic resources. This document was presented as an information document during the 13th Session of the CGRFA.

An official FAO news release was prepared with the kind assistance of Enrique Yeves of the FAO Spain office, which is gratefully acknowledged.

PREPARATION OF A FIRST REPORT ON THE STATE OF THE WORLD'S AQUATIC GENETIC RESOURCES: KEY ISSUES AND PROPOSED PROCESS

The participants agreed on the key issues for The State of the World's Aquatic Genetic Resources report; the executive summary of this document may be found in the third chapter of this report.

The participants highlighted the importance of a broad scope of The State of the World's Aquatic Genetic Resources: aquatic genetic resources (AqGR) for fisheries and aquaculture should be included. Emerging issues such as recreational fisheries, ornamental fisheries, uses of marine genetic resources (MGR) in areas beyond national jurisdiction (AbNJ) and use of algae for biofuel, pharmaceutical uses and health products should be flagged. However, resource limitations may require a prioritization and a stepwise approach, initially focusing on cultured species and their wild relatives with significant production and volume in international trade or importance for local food security, species that are threatened or endangered and other priorities that countries may wish to apply. Thematic reviews outlined in the background study papers were endorsed with the addition of a review on protected areas and their role for management of AqGR.

Relevant resources for food security and livelihood living in aquatic ecosystems (such as aquatic plants and aquatic micro-organisms), and that are currently not included under the respective state of the world report for other sectors, such as The State of the World's Plant Genetic Resources and The State of the World's Animal Genetic Resources, will have to be clearly assigned to avoid non-coverage of these resources.

The participants pointed out the importance of capacity building and the strengthening of the information base on AqGR to enable countries to report accurate data to FAO.

Regarding the proposed timeline for the preparation of the report, the establishment of national focal points should take place as soon as possible. Furthermore, the development of guidelines and questionnaires for national reporting on AqGR should be among the most and immediate priorities. There was a general agreement that the 15th Session of the Commission on Genetic Resources for Food and Agriculture (CGRFA15) to be held in 2015 would be a more realistic timeframe for the presentation of The State of the World's Aquatic Genetic Resources report.

THE INFORMATION BASE FOR AQUATIC GENETIC RESOURCES

An executive summary of the document on the information base for AqGR is reproduced in the fourth chapter of this report.

The need for immediate action to strengthen existing databases and provide capacity building to countries was highlighted, as well as the need to establish national focal points to report on AqGR management, and to start working on the development of guidelines for the preparation of country reports.

A series of actions useful to address the gaps identified in main databases and information collection and sharing systems were proposed, some of them are listed below. These actions will require additional financial resources to be achieved, and, in some cases, these actions may also require new legal or formal agreements to be developed or implemented. However, the suggestions to improve established data collections and information sharing systems on AqGR provided potentially highly cost-effective ways to improve collection and sharing of information on AqGR. Regarding possible actions to be developed in the future in order to increase the level of interconnection and exchange among major primary databases on AqGR globally, a project concept note aiming at strengthening the linkages between global major primary databases on AqGR was agreed and finalized between AlgaeBase, SealifeBase and FishBase. The complete concept note may be found in the fifth chapter of this report.

Participants agreed that genetic information will be increasingly important to support more efficient, responsible and sustainable production from aquaculture and fisheries, as well as for enhanced food security, ensured national control of AqGR and improved traceability. There is also an increasing body of information on genetic resources for aquaculture and on genetically distinct fish stocks and cryptic species, and an increasing need for more information to underpin sound management. The technical difficulty and costs associated with collecting information on genetic diversity were recognized. It was highlighted that the additional burden on the often overloaded capacity in developing countries must also be taken into account and clear procedures for sustainable development have to be set and implemented.

Proposed key objectives regarding FAO data collections:

- Strengthening the capacity of the countries to collect, compile, validate and share national information on AqGR, in order to improve their own national management plans and the information officially reported to FAO and other information sharing systems. Specific targets would include:
  - introduction of national and international standard operating procedures;
  - training on standard operating procedures;
  - improvement of FAO databases (e.g. decreasing the high level of data aggregation in certain countries);
  - improvement of AqGR resource identification: at species level and through standardized taxonomical classification;
  - review and linking to the ongoing efforts to improve the FAO fisheries and aquaculture questionnaires.

For the accomplishment of these key objectives, it would be necessary to take into account existing fisheries and aquaculture networks, for both capacity building and technical transfer activities and for the collection and compilation of data at regional level.

Proposed key objectives regarding non-FAO databases:

- Provision of additional resources to key databases for AqGR to allow update of fields not currently completed (e.g. inclusion of information on key stocks, strains, their production systems), the addition of new fields and completion through searching the primary literature. This process could be linked to additional capacity building opportunities in data handling, archiving, collation and dissemination.
- Compilation of scattered information on AqGR through expert consultancies covering specific disciplines, specific resources (wild, cultured or *in-situ* or *ex-situ* collections) or production methods; compilation of case studies. These should be designed to identify and collate primary literature and information from the field to feed into information systems.
- Standardization of the collection of primary and secondary data on AqGR in the actions suggested above, for comparability of information, effective integration of databases, and maintenance of links to major global databases to assist dissemination of the information.
- Development of key targets and indicators necessary to determine the effectiveness of actions and to monitor progress in tracking the state of the world's AqGR and their sustainable use (e.g. indicators of status of resources; area under culture; diversity levels; number of threatened stocks; proportion of fisheries assessed at species level; the proportion of genetically improved stocks used in aquaculture; extent of improved production efficiency; number and/or proportion of AqGR protected).

It was recognized that many of these actions may take time to be completed in depth in every country for all species. It is likely that a number of priority actions will be needed to have sound information for a report on the state of the world's AqGR. These may include:

- Specific actions to collate information in areas for which information in existing databases is inadequate. This could be done through consultancies, the development of small specialist databases for later inclusion in larger programmes, or focused addition of specific information to existing databases.
- Targeted introductions of changes to data collections to industry sectors or countries of particular importance (e.g. because of the volume of production or trade, the threatened nature of the resource, or particular lack of information).

FIELD TRIP

Visit to rainbow trout production facilities of Grupo Piszolla in Alba de Tormes and Encinas de Arriba. Discussion with representatives of the private sector: the problem of data confidentiality – concerns and possible solutions.

A visit to Grupo Piszolla was carried out within the schedule of the FAO workshop with the aim of discussing with a group of representatives from the Spanish inland aquaculture private sector the major problems, concerns and possible solutions to data confidentiality. Grupo Piszolla is one of the most relevant private companies dealing with rainbow trout production in the Mediterranean context, having country offices and aquaculture facilities in Spain, France and Portugal. The biggest farms are located in Spain, specifically in the Castilla León Region, along the Tormes River basin. The total production was around 5 000 tonnes in 2010, which were marketed as fresh, frozen and transformed products in several European markets. The company possesses two processing plants, where a variety of rainbow trout products such as fillets, smoked products, dried products, sushi and caviar are manufactured. The company is structured in a completely closed integrated system, where all the aquaculture productive steps are managed by the same enterprise, starting from the selective breeding programmes, broodstock management, fingerling production and distribution, rearing, processing, commercialization to feed production and distribution. The group of experts visited two of the major aquaculture facilities located next to the Tormes River, located in Spain: the Encinas farm, where royal rainbow trout is farmed, and the Alba farm, where table rainbow trout is produced and processed.

A very interesting discussion regarding selective breeding programmes and improved strains for rainbow trout within the Mediterranean context was held during the visit and the major points of discussion are described below:

- Main topics for discussion focused on the development, maintenance, management and sharing of selected lines or strains of rainbow trout, and the establishment of appropriate selective breeding programmes and broodstock management.

The enterprise is currently developing its own improved rainbow trout strain, adapted to the specific Mediterranean context; brooders are kept in a different farm, and the selective breeding programme is being developed in collaboration with public research institutions. Fertilized eggs are used for own production and also sold in several European countries. Detailed information regarding major genotypic and phenotypic characteristics of the improved strain, as well as specific technical information on the selective breeding programme are not easily available, and the enterprise is not willing to share them with the public or the rest of the sector. The manager of the group stated that this concurrent situation regarding the lack of exchange and dissemination of technical knowledge and skills is always a hindrance to a proper and coherent development of the sector worldwide.

ABSTRACTS

Part 1: Organizations contributing information on aquatic genetic resources

IMPROVING THE INFORMATION BASE FOR AQUATIC GENETIC RESOURCES – THE CASE OF THE LAKE VICTORIA FISHERIES ORGANIZATION

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Background and history

The Lake Victoria Fisheries Organization (LVFO) is an institution of the East African Community which was formed by a convention signed in 1994 by the three partner states (Kenya, Uganda and Tanzania) sharing Lake Victoria. The main objective of LVFO is to foster cooperation among the contracting parties in harmonizing national measures, developing and adopting conservation and management measures for the sustainable utilization of living resources of Lake Victoria. At the moment, LVFO houses the Aquaculture Network for Africa (ANAF) Web-based information system to facilitate the exchange of aquaculture information at Africa's regional, subregional and national levels and to develop an informal, flexible and efficient network of regional experts to promote and accelerate the development of the sector. ANAF is also expected to facilitate collaborative research and training, as well as technology transfer between countries so as to maximize and optimize utilization of the scarce resources for aquaculture development in Africa.

Lake Victoria is one of Africa's great lakes and the second largest in the world covering 68 000 km^2. The lake is shared by Kenya, (6 percent by area) Uganda, (43 percent) and Tanzania (51 percent). It has a mean depth of 40 m, maximum depth of 84 m and a shoreline of 3 450 km. Its rich natural resources support the livelihood of 30 million people living in its basin. A great number of factors, both human and natural, come together to make the management of aquatic genetic resources of Lake Victoria a very challenging task. Understanding the impact of these factors, monitoring their development and considering them when managing the aquatic genetic resources all depend on accurate and up-to-date information.

Databases dealing with the genetic diversity of Lake Victoria

EAFish, the Regional Information System for the Lake Victoria Fisheries Organization is the principle means of capturing and processing collected datasets around/on the lake for the organization and the institutions that work with it. The internal structure of the system is based on the architecture of the modern Relational Database Management Systems, but it also includes spatial information which includes georeferenced landing sites of Lake Victoria and major aquatic genetic resources breeding areas. The database has been developed based on the Standard Operating Procedures that guide survey activities in the basin. Currently, it has seven modules namely: Dagaa (*Rastrineobola argentea*), Fish Biology, Frame, Gillnet, MCS (Monitoring, Control and Surveillances) and Trawl surveys. They can be adapted to capture other Aquatic Genetic Resources when required.

The other databases that exist in the East Africa Region include those for the aquaculture information system and the biodiversity database which is an interactive data repository designed to be a comprehensive listing of observations of biological organisms on the Lake Victoria Basin. It consists of three linked subdatabases: the Observation database, the Taxa database, and the Location database. The Observation database is designed to contain reported sightings of an organism and information regarding the name of the organism, the individual responsible for the sighting, the location and habitat in which the organism was found, its abundance therein, and the date it was sighted. Pictures associated with the sighting can also be included. The Taxa database is designed to include both basic, as well as detailed information on each observed species. The Location database, likewise, is established to hold basic and detailed information on sites where observations have been made.

These databases are not structured enough to enable easy mining of the required information on Aquatic Genetic Resources, but can be remodelled to accommodate the desired fields and features.

Data collection and use

The data collection is done both by researchers from collaborating institutions and Beach Management Units at landing sites around Lake Victoria, who then insert the collected datasets into specially prepared excel format sheets where data validation is carried out. The validated datasets are compiled and then exported into the database for processing before required reports are made available for disseminations. The other method used is where data from collection forms are captured directly into the databases, validated and finally compiled before being made available for sharing with the stakeholders.

The main users of the information produced by the organization are National Management and Research, International and Collaborating Institutions. Some of the information is given out to Beach Management Unit Members and institutions of higher learning.

Constraints and challenges

It has been difficult to keep track of the immense data collected due to poor storage mechanisms. Consequently, managers and policy makers at all levels still find it difficult to access quality information about aquatic genetic resources and in particular, fish stocks, environment and socio-economic issues. Most of the earlier reports in the Lake Victoria Basin are unpublished technical reports, workshop/conference proceedings or even in raw data formats not easily accessible to readers outside the holding institutions or even the decision makers at all levels. Collecting information is an expensive undertaking and managing that information once it is collected is a continuous process that requires good systems and human resource capacity which are luxuries around the basin. Ownership of data already in regional database becomes more complex as there are a number of institutions and entities that can claim the right to its ownership. They include: researchers/officers who collected data, all researchers/officers contributing to the database, institutions of the researchers/officers, all institutions contributing data to the database; LVFO Secretariat; financing institution, Project Management institution; and even National parent Departments/Ministries.

The other threats around the basin include: decline in fish stocks; decline in diversity/variety of fish species; deterioration in water quality; invasion and proliferation of aquatic weeds especially water weeds; degradation of the catchment area; market demands and fish quality and safety concerns. Data sharing, integrity and security are challenges that need continuous attention. A good data and information sharing policy should sort out some of these difficulties.

Outlook

In order to improve the required information, the organization is collaborating with FAO, the Great Lakes Commission and relevant intergovernmental organizations. The following actions are proposed to improve the current situation:

- Improvement of the data storage mechanisms by establishing Network Storage Systems.
- Concerted efforts to transform the records in cabinets into electronic format by budgeting for the exercise.
- Information and data sharing policy is being put in place to help sort out issues on data ownership and dissemination. The countries involved are reviewing their policies to enable proper implementation of the policy.
- The fisheries departments and research institutions have been advised to employ relevant officers to curb the shortage.
- Efforts are being put in place to restrict fishing activities and it is hoped that this will have some effect on fishing efforts.
- There is a fully fledged organization , Lake Victoria Basin Commission, which has been assigned to deal with cases of poor water quality and water weeds.
- Sourcing of funds to ensure that enough research is carried out to keep management informed on the state of the basin.

INFORMATION BASE FOR AQUATIC GENETIC RESOURCES IN BRAZIL

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Brazil

Background and history

Brazil is the 21st country in the World Fisheries and Aquaculture Production in 2008, according to FAO´s FISHSTAT with 1 156 423 tonnes. According to the Brazilian Ministry of Fisheries and Aquaculture, this production was 1 240 813 tonnes in 2009.

The historical overview from 1950 to 2009 of the total Fisheries and Aquaculture Production in Brazil shows that there was a growth in the fisheries production from 1950 to 1985, year with the best production of capture fisheries alone without aquaculture (956 684 tonnes). After that year, there was a decline on Fisheries and Aquaculture Production until 2000, when the combined production of capture fisheries and aquaculture started to increase and obtained the best ever production in 2009.

The responsibility of statistical information on fisheries and aquatic genetic resources in Brazil was with the Ministry of Agriculture during many years between the 1950s and the 1960s. In 1968, an International Cooperation of FAO together with the Brazilian Government created the Program of Research and Development of Fisheries (DPD) which had as its main objective to generate and organize the statistical information on Brazilian fisheries. After 1978, this responsibility was transferred to the "*Superintendencia do Desenvolvimento da Pesca*"(SUDEPE), the first "Agency for Development of Fisheries" in Brazil. This official information has been used by FAO for the Fisheries Statistics from Brazil.

In 1989, Federal Law No. 7 735 transferred the responsibility of collection, validating and compiling fisheries information from SUDEPE to the Brazilian Ministry of Environment (MMA) and its Institute for Environment and Natural Resources (IBAMA). In 1992, the Fisheries Monitoring Program (ESTATPESCA) was created inside IBAMA. This information was reported to FAO for the Fisheries Statistic Production in Brazil.

The Special Secretary for Aquaculture and Fisheries (SEAP) was created by the Brazilian Federal Government in 2003 and was the embryo of the Ministry of Fisheries and Aquaculture (MPA), created in June 2009. Since then, the MPA is in charge of compiling and validating the fisheries and aquaculture information in Brazil. In October 2010, the MPA published the first document on this, titled "Fisheries and Aquaculture Production: 2008/2009 Statistics".

Today, the aquaculture and fisheries data reporting to FAO is the responsibility of the Brazilian Ministry of Fisheries and Aquaculture (MPA), the methodology for collection is from the Ministry of Environment (MMA), and the compilation, validation and sharing has been performed by MPA since 2009.

Aquatic biodiversity in Brazil

Maintaining aquatic biodiversity in capture fisheries is fundamental to guaranteeing the productivity of the world's fish stocks, their resilience and their adaptability to environmental change, including climate change. The world's capture fisheries harvested an estimated 1 731 aquatic species or species groups in 2008. The majority of this diversity was finfishes (1 268 species), followed by crustaceans (181 species), mollusks (145 species) and other species. As such, capture fisheries use a greater variety of biological diversity than any other food production sector, according to FAO database.

In Brazil, the capture fisheries estimated 219 aquatic species or species groups in 2009. The majority of this diversity was finfishes (193 species), followed by crustaceans (15 species), mollusks (11 species) and other species, according to MPA database.

Data collection and compilation

With the number of farmed fish strains, hybrids and other genetic resources increasing in Brazilian aquaculture, development of information systems are needed to identify and determine their relative contributions to farmed fish production. Similarly, better information on the genetics of wild fish populations should contribute to better understanding the needs for conservation and sustainable use.

After an agreement between the Ministry of Fisheries and Aquaculture (MPA) and the Ministry of Environment (MMA), the structure and scope of the 2008/2009 Brazilian fisheries information which generated the "Fisheries and Aquaculture Production: 2008/2009 Statistics" document was based on data collected by the Fisheries Monitoring Program (ESTATPESCA) from IBAMA, an Institute of MMA.

The type of information included or generated includes information of fisheries and aquaculture in each of the 27 Brazilian States which were collected and compiled by technicians from ESTATPESCA since the first day of each year in thousands of municipalities. These collected information included capture and aquaculture production.

The methodology of Multiple Imputation was used for compiling the information of fisheries and aquaculture in 2008 and 2009. Imputation, the practice of 'filling in' missing data with plausible values, is an attractive approach to analyzing incomplete data. It apparently solves the missing-data problem at the beginning of the analysis.

Multiple Imputation is a Monte Carlo technique in which the missing values are replaced by m>1 simulated versions, where m is typically small. In Rubin's method for 'repeated imputation' inference, each of the simulated complete datasets is analysed by standard methods, and the results are combined to produce estimates and confidence intervals that incorporate missing-data uncertainty. Rubin[1] addresses potential uses of MI primarily for large public-use data files from sample surveys and censuses. With the advent of new computational methods and software for creating MI's, however, the technique has become increasingly attractive for researchers in the biomedical, behavioural, and social sciences whose investigations are hindered by missing data. These methods are documented in a recent book by Schafer[2] on incomplete multivariate data.

Constraints and limitations

The main limitations of the strategies of collecting, inserting, validating, compiling and sharing fisheries information are related with the continental size of the Brazilian territory. With 8 500 kilometres of ocean coast and the biggest continental water river system in the world (composed by the Amazon River and Tocantins River systems) it is impossible to collect fisheries and aquaculture data all over this huge area.

DATA FOR FAO STATISTICS ON AQUACULTURE AND INLAND FISHERIES IN GERMANY

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Origin of German fishery data for FAO statistics

The Institute of Fisheries Ecology of the Johann Heinrich von Thünen-Institute, the Federal Research Institute for Rural Areas, Forestry and Fisheries, is responsible to provide the annual data on aquaculture and inland fisheries in the Federal Republic of Germany for FAO statistics. Our institute delivers the data in the questionnaires "FISHSTAT_AQ", "FISHSTAT_IW" and "FISHSTAT_276AQNS1".

Most of the data are extracted from the "Annual Report on the German Inland Fishery", which is produced by the Institute for Inland Fisheries Potsdam-Sacrow (IFB) on behalf of the German states. The colleagues from IFB obtain the data through questionnaires, which they send to the fisheries authorities in the 16 German States. In the Federal Republic of Germany, inland fishery is under the responsibility

[1] Rubin, D.B. 1987. Multiple Imputation for Nonresponse in Surveys. J. Wiley & Sons, New York
[2] Schafer, J.L. 1997. Analysis of Incomplete Multivariate Data. Chapman & Hall. London.

of the States. Within the States, the data are usually obtained by telephone calls with the producers or estimates of the production based on areas and/or previous year's data. Questionnaires may also be used. In some States, fishermen are obliged to deliver catch statistics, partly in the frame of management plans for their waters. Probably, the quality of the data is best for recirculation systems (only few companies), whereas for the big number of very small pond farms, estimates are necessary. To our knowledge, there is no real validation of the data.

Sectoral census

Since data on areas, number of units etc., are not updated every year, data of previous years have to be used in some cases. The aim is to have a complete census of the whole sector roughly every ten years, even if not all data are of high quality. The last sectoral census was conducted in 2004 with data from 2003 (published 2005). The next census will be organized in 2012 by the Federal Statistical Office (Statistisches Bundesamt) for the year 2011. This will hopefully be a reasonable update of basic data and production data for the whole sector. It is mainly done with regard to new European Union-legislation, but of course the data will be useful also for FAO-statistics. Following the census in 2012, the Federal Statistical Office plans to obtain subsamples on an annual basis by using the structures from the complete sectoral census.

Excluded categories

The Annual Report on Inland Fishery in the Federal Republic of Germany (which gives us most of the data for our FAO report), does not include aquaculture and fisheries in marine and brackish waters. Yet, this is only a rather small sector in the Federal Republic of Germany. Since these data are part of the FAO questionnaires, the information is either gathered directly from the companies (by telephone) or in case of the mussel fishery from official publications of the regional authorities.

In the Annual Report on Inland Fishery in the Federal Republic of Germany, there are also data given on recreational fishery. Even though there are some catch statistics from this part of the sector and also a few studies (mainly regional), the degree of uncertainty is probably higher than for aquaculture and commercial fishery data. For this reason, so far, this information has not been included in the report to FAO. However, after discussing it with colleagues from FAO, the best available estimate of catches of the recreational fishery in the future will be presented.

Problems, constraints

The aquaculture production in Germany is dominated by two species – carp and rainbow trout. These two dominating groups of production systems are dominated by small-scale companies. E.g. for the pond culture of carps, compared to approximately 170 full commercial companies in this field, there are more than 11 000 part-time producers (carp pond culture). These small producers often have only about 0.5–2 hectares pond area. Similarly, in case of cold/cool-water culture (small ponds, raceways; mainly rainbow trout but also other salmonids) there are about 500 full commercial companies and again more than 11 000 part-time producers.

It seems simply not possible to get detailed production data of all these small companies with a reasonable effort and therefore, estimates are necessary.

The fact that the sector is dominated by such small structures at least partly explains that the precision of the data is limited and that some uncertainties exist. Yet, the implementation of new EU legislation for aquaculture statistics, including the new sectoral census in 2012 and the planned annual data collection by the Federal Statistical Office will hopefully increase the quality of the statistical data on aquaculture production in Germany in the future.

BRIEF HISTORICAL OVERVIEW OF THE FISHERY INFORMATION SYSTEM IN HUNGARY

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Relevant information systems in Hungary

At the moment of writing this overview, four types of information systems on Aquatic Genetic Resources exist in Hungary:

1. Fisheries Database.
2. Fisheries/Aquaculture Production Statistics.
3. EU Water Framework Fisheries Database.
4. Special publications on Aquatic Genetic Resources.

1. Fisheries Database (FD)

Structure and scope of the information system/network/fisheries organization

The Fisheries Database exists from 1998. Before that time, statistics about catches were collected, analysed and published by the Hungarian Association of Anglers (MOHOSZ), since all the natural water bodies were public property and the "use right" belonged to MOHOSZ.

Details regarding the Fisheries Database (FD) are described in the Fisheries Law (1997). According to it, each water body operator should provide certain data about the water body in their use. Yearly stocking and fishing data are statistically analyzed by the Research Institute for Fisheries, Aquaculture and Irrigation, shortly HAKI (www.haki.hu/), being the institute responsible for the management of FD. The "Fishing" part of statistics is published every year in the journal Halászat (Fisheries), being the basic professional publication in this field (four issues a year). The "Stocking" part is not published.

Type of information included or generated

The following data are included in the FD:

I. Fisheries water body/surface: (Fisheries water body: given lake, of reservoir, river or canal, or parts of these.)

1. Water body code, water body name, other names of the water body, regional belonging: county, region, etc.
2. Nature protection category, catchment area category, water type category.
3. Area registered.
4. Owner of the water body (address of the owner, if not the state).
5. Owner of the fishing right (in some cases the fishing right belongs to the state in spite of the fact that the water body is not a state property).
6. Name of the leaseholder of the fishing right, if the fishing right does not belong to the state.
7. Operator of the water body: in case of state water bodies this is identical with the leaseholder, while in case of private water bodies it is decided by the owner.
8. Main data of the leasing contract.
9. Fisheries management plan, in case of state water bodies, the stocking plan and other duties related to the water body have to be presented in a year-to-year format.

II. Water body operator should present a yearly report on:

1. Catch statistics: species of special interest: grass carp, eel, asp, silver carp, pike, European catfish, mullet, Volga perch, pikeperch, carp and others. Reporting other species is not obligatory, so only few are reporting it in a concrete way. Usually, all the other species appear here.
2. Stocking data: fish species, age class, stocked numbers, stocking mass, date of the stocking.

Strategies of collecting, inserting, validating, compiling and sharing information
Right of access to detailed data of FD is strictly regulated by the Fisheries Law. Only citizens or legal person having strong connection to the water body can access the detailed data.

Main users (if known) and targeted audience
Usually professionals and researchers are using the FD, requesting statistics of certain water bodies. The Ministry of Agriculture and Rural Development (FVM), recently called Ministry of Rural Development (VM) is requesting special statistics systematically. Furthermore, in disputed cases, courts (through experts) request concrete/particular data about a given water body.

Readers of journal Halászat are the targeted audience.

Collaborative approaches with other partners/stakeholders
There is a close cooperation with water body operators (approximately 350).

2. Fisheries/aquaculture production statistics

As part of the Hungarian Food and Agricultural Statistics, the Statistical Department of Research Institute for Agricultural Economics, shortly AKI (www.aki.gov.hu/) publishes a yearly report about Fisheries starting from 2006. These reports are available in Hungarian; generalized overviews are also available in English.

The reports are based on data collected by the Ministry of Agriculture and Rural Development (recently Ministry of Rural Development) through its data collection system. These databases contain information from all natural and legal identities who own fish ponds and/or intensive fish production units. Identities differentiated are: State Enterprises; Agricultural Cooperatives; Fisheries Cooperatives; Angling Organizations; Others; and Total.

Data are structured as follows, including fish species registered:

- Pond fish culture (carp, grass carp, silver carp, bighead carp, European catfish, pikeperch, pike, other white fish, total and nursed fish)
- Intensive fish culture (Rainbow trout, African catfish, sturgeons, other, total and nursed fish)
- Data on pond surface, production characteristics, employment.

Part of this database is accessible to everyone; part is available only through registration.

3. The European Union Water Framework Fisheries Database

The Ecological Survey of Surface Waters (ECOSURV), of the Republic of Hungary has been implemented using the standardized European Union-methodology between 2002 and 2005. The project was financed by the European Union. A database with ecological information of Hungarian surface waters was established, which also includes a list of fish species. The data of the survey is available online: www.eu-wfd.info/ecosurv/. The survey will be repeated.

4. Special publications on aquatic genetic resources

Maintenance of live gene banks is common in most of the carp producing countries, including Hungary. The database of maintained carp varieties has been published by FAO.

J. Bakos & S. Gorda, 2001: Genetic Resources of Common Carp at the Fish Culture Research Institute, Szarvas, Hungary. FAO Fisheries Technical Paper, 417. It is also available online: www.fao.org/DOCREP/005/Y2406E/y2406e00.htm

As a part of the EUROCARP project (http://eurocarp.haki.hu), a bilingual catalogue of common carp strains in Central and Eastern Europe[1] was created in 2008. All together, 60 “national strains” and 25 “foreign strains” are described in seven major carp producing countries. The catalogue is not yet available online.

[1] Bogeruk, A. (Editor), 2008. Catalogue of carp breeds of the countries of Central and Eastern Europe (available in English and in Russian).

NETWORK OF AQUACULTURE CENTRES IN CENTRAL AND EASTERN EUROPE

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Background and history

The idea of the Network of Aquaculture Centres in Central and Eastern Europe (NACEE) emerged in 2003 during the work of the Eastern European Committee of the European Aquaculture Society (EAS). NACEE was officially founded in November 2004 in Szarvas, Hungary, with the participation of 23 institutions from 13 countries and the support of FAO.

In the six years passed since its establishment, NACEE doubled its membership, which included 45 research institutions, universities and producer associations from 15 countries in 2010. In addition to the annual Directors' Meetings, NACEE organized a number of professional meetings, conferences, workshops and exchange visits of farmers, researchers and policy-makers in the past years. Among these, the international conferences of young researchers, started in 2009, play a special role. The last such conference, held in 2010 in Szarvas, Hungary, was attended by young researchers of ten countries. NACEE also participated in the compilation of professional reviews of the region's aquaculture, such as the European aquaculture review presented at the Global Aquaculture Conference in Phuket, Thailand in 2010, which was prepared in cooperation with FAO, EAS and NACEE.

In spite of these successes, there were a number of obstacles to the successful operation of the Network. Increasing the efficiency of NACEE's structure and the commitment of members seemed necessary. However, the lack of legal personality seemed to be the most important obstacle, greatly impeding the participation of NACEE in major projects. As a solution, a transformation into a legal intergovernmental or non-governmental organization was proposed already in 2008. After evaluating the options, the Board of Directors of NACEE decided in 2009 to start the process of transformation into a registered non-governmental organization. The Founding General Assembly of the new NACEE Association was held in Szarvas, Hungary, in December 2010, and the association was legally registered on 26 January 2011.

Structure and scope of the information system/network/fisheries organization

The objectives of NACEE are promoting aquaculture, as well as related educational, scientific and innovation activities, sustainable development of the Central and Eastern European Region, conservation of living aquatic resources and integration into the European Research Area and the European Higher Education Area.

The main directions of the association's activities are as follows:

- Initiating joint research and training programmes.
- Facilitating better involvement of CEE institutions in European-level programmes directed towards aquaculture development and biodiversity conservation of aquatic ecosystems.
- Initiation of and participation in regional aquaculture development projects supported by the European Union, FAO and other international organizations and funds.
- Organization and supporting of regional scientific fora (symposia, meetings, conferences).
- Development of educational programmes in the field of aquaculture and the exchange of students.
- Exchange of information relevant to aquaculture development within the region.
- Exchange of scientists among the members, with special regard to young ones.
- Facilitating the improvement of partnership between science and practice within the entrepreneurial and production sector.
- Organization and hosting of training courses for fish farmers and entrepreneurs.
- Development of collaboration between NACEE and other regional networks/organizations.
- Publishing scientific and innovative results and dissemination of information on aquaculture development, as well as the rational use of aquatic ecosystems and preserving their biodiversity.
- Compiling and publishing NACEE's own papers, journals, other printed publications and a Web site.

- Organization and hosting of professional competitions, especially for young researchers, specialists and students.
- Supporting of and participation in international fora and exhibitions on aquaculture, biodiversity conservation and protection of aquatic resources.
- Organization of the annual meetings of the association members and the working groups covering all fields of aquaculture and living aquatic resources.

The main decision-making body of NACEE is the General Assembly, consisting of all the individual members and the official representatives of the institutional members. The day-to-day operation of NACEE is executed by the Executive Board, consisting of three members. The Executive Board is assisted in its decisions by the Technical Advisory Committee and it is controlled by the Supervisory Board.

In addition, the association may establish thematic working groups on specific issues to improve cooperation and serve as a basis for possible research consortia. Currently, there are six such working groups:

- New species in aquaculture.
- Fish genetics.
- Sturgeon farming.
- Education in aquaculture.
- Innovation in aquaculture.
- Mariculture.

Type of information included or generated

One of NACEE's main tasks is to facilitate information exchange among its members, as well as between NACEE members amd other institutions and organizations. Basically, all information that the members feel relevant and interesting for others can be circulated. Currently, most of the distributed information concerns conferences, trainings and other events, relevant publications, as well as project possibilities. However, the NACEE Web site also includes information on the training possibilities offered by NACEE Members, as well as innovative technologies developed by them.

In addition, the NACEE information network is frequently used for collecting information for different research topics and projects, or providing feedback on strategic/policy documents. One of the last examples was the compilation of the Regional Review of Aquaculture Development in Europe, where NACEE Members were asked to contribute their ideas, suggestions and case studies to the document, and the drafts were circulated among members on several occasions in order to receive their feedback.

Strategies of collecting, inserting, validating, compiling and sharing information

The information is collected in a highly informal way. The NACEE Secretariat acts as an information hub, distributing the information provided by the members, as well as from outside. Mainly e-mail and the NACEE Web site are used for information exchange. Of course, members can also communicate with each other directly.

As NACEE is a bilingual organization, relevant information is generally translated to both official languages of the network, English and Russian.

Overview of regional strategies for aquaculture and fisheries data reporting to FAO: responsible, methodologies for collection, compilation, validation and sharing

No particular regional strategy exists. When information is collected for a job commissioned by FAO (e.g. the Regional Review of Aquaculture Development in Europe), information is collected according to FAO guidelines. NACEE has also assisted FAO to locate relevant institutions in some countries (such as Moldova) to improve statistical data collection from those countries.

Main users and targeted audience

The main users are the members of NACEE, however, farmers, researchers and students in the countries of the CEE region are also targeted.

Collaborative approaches with other partners/stakeholders

NACEE has an official liaison status with FAO, which is its key partner. In addition, it maintains relations with many key organizations of the European and international scene, AquaTT, the European Aquaculture Society (EAS), the European Aquaculture Technology and Innovation Platform (EATIP), the European Fisheries and Aquaculture Research Organizations (EFARO), the European Union, EUROFISH, the Federation of European Aquaculture Producers (FEAP) and the Network of Aquaculture Centres in Asia-Pacific (NACA) being the most important ones. It also works towards strengthening relations with other newly-established networks in Central Asia, Africa and Latin America. Currently, a Technical Cooperation Programme project (TCP) is being prepared for improving their cooperation, with the participation of FAO, NACA, NACEE, as well as African and Latin American networks.

Constraints and limitations

The main constraints are the passivity of many members (receiving, but not providing information). When information is collected for statistical purposes, information is often received from too few members to draw meaningful conclusions, while the received information is often impossible to compare due to different data collection, processing and presentation standards.

THE GERMAN NATIONAL TECHNICAL PROGRAMME ON THE CONSERVATION AND SUSTAINABLE USE OF AQUATIC GENETIC RESOURCES (NATIONAL PROGRAMME AGR)

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Background

The Convention on Biological Diversity (CBD) constitutes the legal basis at the international level for the protection and sustainable use of genetic resources as a part of biodiversity. In this regard, the German Federal Ministry of Food, Agriculture and Consumer Protection (BMELV) drew up an overall concept on the conservation and sustainable use of genetic resources for food, agriculture and forestry in 1999. The national programme envisaged by the concept consists of sectoral technical programmes concerning the individual subsections of genetic resources. Within this framework, the National Programme of Aquatic Genetic Resources was developed by an expert group composed of representatives from the fisheries administration, research and associations, and was approved by the German State Ministries for Agriculture in October 2005. In its present state, the National Programme AGR is confined to bony fishes, cyclostomes, mussels and decapods, as well as their spawning or larval stages. However, it is planned to be extended to cover cartilaginous fish, marine mammals, octopuses or aquatic plants etc., in a future update.

The actual programme is structured into the following sections:

- Importance and vulnerability of aquatic genetic resources including definition of terms, structure of the fisheries sector in Germany, and causes of danger.
- Legal and political framework conditions at the international, the European Union and national level.
- Current conservation and support schemes covering coastal and deep-sea fisheries, lake, river and recreational fisheries, as well as aquaculture.
- Aims of the technical programme.
- Future measures for conservation and use including definition of "needs for action".
- Organization and implementation describing the roles of the Expert Committee on Aquatic Genetic Resources and other selected institutions, bodies, actors and their responsibilities.

The six major aims of the National Programme AGR are defined as follows:

1. Preserving the diversity of aquatic genetic resources in the long term in a scientifically substantiated and cost-efficient manner *in situ* and *ex situ*, tapping them and making them usable through suitable measures, such as evaluation, characterization and documentation, and intensifying their use for economic purposes, notably in aquaculture.
2. Fostering the reintroduction of fish species that used to inhabit specific waters, e.g. Atlantic salmon, sturgeons.
3. Making a contribution to the conservation and rehabilitation of aquatic ecosystems.
4. Supporting all activities for the conservation and sustainable use of aquatic genetic resources.
5. Establishing more transparency in the allocated responsibilities and competencies of the Federal Government, states and municipalities, as well as among the persons, organizations and institutions working in this field.
6. Using and promoting synergies that may arise from increased collaboration at national, supranational, regional and international levels.

The Expert Committee on Aquatic Genetic Resources performs the following functions:

- Provides advice on technical issues in connection with the implementation of the programme.
- Analysis and assessment of measures for the conservation of aquatic genetic resources.
- Formulation of new proposals for actions to be taken or to improve existing measures and update the technical programme.
- Coordination of measures with relevant actors, notably with the Federal Government, the State Governments, scientific community and practitioners.
- Receipt and discussion of reports on the implementation and results of the programme.
- Exchange of information and experience.

In addition, the committee can comment on all technical issues of the conservation and sustainable use of aquatic genetic resources and make recommendations for scientific opinions and statements.

Inventory of aquatic genetic resources

In order to implement the National Programme on Aquatic Genetic Resources in the sector of freshwater aquaculture, the Federal Office for Agriculture and Food (BLE) initated the project "Inventory of Aquatic Genetic Resources" focusing on the major species of pond fish culture and production of salmonids in Germany: common carp (*Cyprinus carpio*), tench (*Tinca tinca*), pike-perch (*Sander lucioperca*), rainbow trout (*Oncorhynchus mykiss*), brown trout (*Salmo trutta fario*), brook trout (*Salvelinus fontinalis*), Arctic char (*Salvelinus alpinus*) and grayling (*Thymallus thymallus*).

Objectives of the project running from the middle of 2005 till the beginning of 2008 were:

- Inventory and documentation of fisheries enterprises with own broodstocks.
- Inventory of broodstocks including their morphological characteristics and performance traits.
- Genetic characterization of selected broodstocks by microsatellite markers.

In collaboration with the main contractor (Inland Fisheries Institute in Potsdam-Sacrow) together with local fisheries authorities/institutions of the German States, a total of 189 main acquisition enterprises maintaining their own broodstocks could be identified. An initial survey of 171 enterprises revealed 484 broodstocks comprising 35 fish species. A subset of 163 broodstocks representing the above-mentioned eight most important species was considered for a more detailed characterization regarding the rearing conditions and intensity of breeding activities. Morphological parameters of adult and subadult individuals of these species were measured in 117 broodstocks. Microsatellite genotyping (ten loci per species) was performed on 143 broodstocks in order to describe the within stock variability, as well as between stock differentiation. To enable a broad dissemination of the project results, all data obtained were anonymously coded for broodstock and deposited in the publicly accessible database AGRDEU maintained by BLE. In addition, a German printed version of the final project report was published by Müller-Belecke *et al.* (2009).

Additional projects

Besides the above-mentioned project, a few other projects are also engaged in conservation and utilization of aquatic genetic resources in Germany, such as a research project on genetics and aquaculture potential of Arctic char ("Documentation, analysis and potential of natural aquatic genetic resources: Populations of Arctic char (*Salvelinus* cf. *umbla*) in Germany", funded by BLE). In the study, recent populations of nine Bavarian lakes were monitored, analysed by microsatellite genotyping and amplified fragment-length polymorphism (AFLP), and later on compared with historic material. Moreover, a performance test under aquaculture conditions of the offspring was carried out to gather information on the suitability for production purposes (Wedekind, *et al*. 2010).

References

Federal Office for Agriculture and Food

- Information System Genetic Resources, Web site on Aquatic Genetic Resources: www.genres.de/en/aquatic-genetic-resources/
- English version of the National Programme AGR is available at: www.genres.de/fileadmin/SITE_GENRES/downloads/publikationen/national_programme_agr_eng.pdf
- Database AGRDEU (Aquatic Genetic Resources in Germany): http://agrdeu.genres.de/agrdeu/index

Müller-Belecke, *et al.* (2009). Aquatische genetische Ressourcen – Laichfischbestände von Wirtschaftsfischarten in Deutschland (Aquatic Genetic Resources – brood stocks of economically important fishes in Germany). Schriften des Instituts für Binnenfischerei e.V. Potsdam-Sacrow. The German version of the report is available at: www.ifb-potsdam.de/institut/institut.htm (select menu Publikationen/Vorträge)

Wedekind, *et al.* (2010). Angewandte Genomics: Dokumentation, Analyse und Aquakultur-potential natürlicher aquatischer genetischer Ressourcen: Seesaiblings-Populationen (*Salvelinus* cf. *umbla*) in Deutschland. Projektbericht BLE (unpub.): 99p.

NETWORK OF AQUACULTURE CENTRES IN ASIA-PACIFIC (NACA)

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Introduction

This paper entails the work associated with the Network of Aquaculture Centres in Asia-Pacific (NACA), prepared in concurrence with it, and spans the period 2005 to date, when a work programme on genetics and biodiversity commenced.

Asia-Pacific is the hub of aquaculture production, and consequently, a considerable extent of exchange of AqGR occurs (planned and ad hoc). Despite this fact, only limited initiatives have been undertaken to develop suitable information systems and related mechanisms to support, facilitate, augment and/or to regulate the use and exchange of AqGR, in particular those related to aquaculture development, and perhaps even less for wild AqGR.

A good example are the genetic resources of common carp, perhaps the most domesticated aquatic species which has also been the subject of genetic improvement over almost two millennia, and where much exchange of genetic material has taken place over nations, continents and water sheds. However, until now, there are no proper records of the developed strains of common carp, the location of the founder stocks and to what extent each stock is used for aquarium and/or food production purposes.

Consortium on freshwater fish genetics and breeding

In regards to the above, an initiative was made by NACA and NACEE to establish a consortium on freshwater fish genetics and breeding. It was agreed that the collaborative activities of the consortium would initially focus on common carp, as it is of much interest to most countries in Asian, Central and Eastern Europe, and also due to the economic and cultural significance of this species. The consortium would aim to facilitate Research & Development (R&D) in relation to freshwater fish genetics and breeding. Proposed initial collaborative activities included:

- Preparation of a review on previous/current R&D activities.
- Inventory and documentation of common carp strains.
- Establish a catalogue on common carp strains in Asia, in conjunction with an existing catalogue for Central and Eastern Europe.
- Facilitate exchange of expertise, including through interregional meetings.

If this initiative is taken further for the first time, there will be a proper documentation of the nature and the extent of the genetic resources of the most domesticated species, perhaps the first step in proper documentation to be followed for other important species.

The need for research and documentation

We are all aware that in aquaculture, only the life cycles have been closed for a handful of species, and even in some species where this has been achieved, broodstock replenishment/augmentation still occurs from wild catches.

Equally, there are many instances that aquaculture has developed, particularly in nations and regions where there is a relatively poor fauna suited for aquaculture, through alien species. The founder stocks of relevant translocations may have been small and old, when proper broodstock management procedures were less understood and even less applied. In such instance, there are many, and therefore, many dependent livelihoods and related food security issues, needing broodstock replenishment and a structured protocol developed would make matters easier for these to be properly affected, while conserving genetic diversity.

As such, there is a need to develop a relevant database in this regard incorporating the crucial information as a starting point. Such a database would facilitate the relevant procurement and translocation mechanisms. It would also be useful if information on centre of origin is documented.

NACA's potential role in the management of aquatic genetic resources

NACA does not currently have a mechanism for obtaining the relevant information from different nations on the use and exchange of AqGR. However, it is best suited to be assigned this task as it could facilitate the process through its very extensive network, and networking capabilities.

NACA in conjunction with FAO and OIE Regional Representation (Tokyo, Japan) has developed a strong reporting system for aquatic animal diseases in the Asia-Pacific region (Quarterly Aquatic Animal Disease Report or QAAD) which could be used as a model reporting system for information collection in AqGR. QAAD started the second quarter of 1998 and continues to provide a useful mechanism for aquatic animal disease information sharing amongst 21 participating governments in the Asia-Pacific Region.

The QAAD list of diseases is revised annually by the Regional Advisory Group (AG) on Aquatic Animal Health which is composed of ten experts. The list is based on OIE-listed diseases and other diseases that are considered important in the region. The QAAD list does not have any legal ramifications and the fact that a disease is listed does not *per se* provide a justification for sanitary measures. Members of AG are well-known aquatic animal health experts in the region and are also recognized worldwide. Some of AG members have also been tapped by OIE and other international organizations to serve as member of their aquatic animal health programme (e.g. OIE's Aquatic Animal Health Standards Commission).

Overall, aquatic animal disease surveillance in the region through QAAD reporting, or through the World Animal Health Information System Regional Core on Aquatic Animal Diseases (once implemented) is a useful mechanism for recognizing existing and emerging diseases. Through its more than ten years of existence, it has generated important information on aquatic animal diseases that are present or absent in different areas of the region.

IMPROVING THE INFORMATION BASE FOR AQUATIC GENETIC RESOURCES IN KENYA

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Background

The Ministry of Fisheries Development was created in May 2008. Prior to this, the Ministry existed as the Fisheries Department in various Ministries such as Natural Resources, Tourism and Wildlife, Regional Development, Water Development, Agriculture and Rural Development, and Livestock and Fisheries Development. The Ministry is mandated to provide leadership in the management and development of the fisheries resources, which comprises of the Department of Fisheries as the technical arm, the Kenya Marine and Fisheries Research Institute (KMFRI), a semi-autonomous research institution, and the Administration Department. The Fisheries Management technical arm comprises four directorates: the Directorate of Marine and Coastal fisheries; the Directorate of Inland and Riverine Fisheries; the Directorate of Aquaculture; and the Directorate of Fish Quality Assurance. The fisheries resource base covers coastal and marine fisheries, inland fisheries, and aquaculture development. To develop this resource, the Ministry is engaged in the provision of extension services and fisheries research, product development, as well as promotion of fish quality assurance, value addition and marketing. Kenya is a member of the Aquaculture Network for Africa (ANAF) working group which is expected to facilitate collaborative research, training, technology transfer and information sharing for aquaculture development within Africa.

Existing network on the ground

Field stations consist of administrative offices, landing sites, Aquaculture Centre for Research and Training and Multiplication Centres. It is at this level that basic information on the fisheries industry within each district is gathered and sent each month to the Regional Fisheries Offices Offices for onward transmission to the Head Office. Some stations are served by a District Fisheries Officer (DFO), who supervises a team of a few Fisheries Officers (FOs) and several Fisheries Assistants (FAs); at others, the staff establishment may consist of just one or two officers working on their own. Effective coverage is obviously facilitated by the presence of a full staff establishment at the field station level. But in reality, the situation is unfortunately quite the opposite.

Currently, data collection is carried out at: the beach level by fisheries extension staff and the Beach Management Units (BMUs) - a comanagement approach; aquaculture data by the fisheries extension staff; export and imports by fisheries staff at the Head Office. Data handling at field stations is generally poor due to the lack of adequate facilitation, training and supervision. Data processing is a lengthy and laborious undertaking in field stations, due to lack of adequate computers leading to delays in submission. The authenticity of the data collected is a challenge, thus, introducing a good deal of uncertainty and inaccuracy into the data handling system. The information generated includes fish landings, fishing capacity, aquaculture production and coverage (hectares) and exports and imports of fish products. Data entry is done at the District after which it is sent to both the regional and national offices for generation of documents such as: Statistical Bulletins; Annual Reports; Samaki News Magazine; and FAO Yearbook. The information generated is also sent to the Kenya National Bureau of Statistics which is a semi-autonomous government agency mandated to act as the custodian of official statistics and also the principal agency of the government for collecting, analysing and disseminating statistical data in Kenya. The main users of the information are the government for making policy decisions, researchers, universities, investors and fishers.

Regional surveys

A number of data collection activities/surveys are undertaken regionally. The Frame Survey of Lake Victoria involves all the three Partner States; Kenya, Uganda and Tanzania using a harmonized data collection methodology; Country-Stat – where data collected is for the agriculture sector, uses a harmonized data capture methodology; South-West Indian Ocean (SWIO) – FINSS – is a database for data collected from the Exclusive Economic Zones (EEZ). The data capture methodology is harmonized for South-West Indian Ocean Member States, yet it has never worked due to lack of capacity building/training on its use. There is also a Regional Information System known as EAFish, a database for Catch Assessment housed at Lake Victoria Fisheries Organization. The Ministry has installed a Strategic Information System at Mombasa station - the Vessel Monitoring System (VMS). This is linked to the Department of Fisheries Headquarters' LAN at Museum via Virtual Private Network (VPN) over the Internet.

Enhanced Fish Market Information Services

The Kenyan fisheries sector is piloting a project known as Enhanced Fish Market Information Services (EFMIS), initially focusing on the three main species of Lake Victoria, tilapia, Nile Perch and Dagaa (*Rastrineobola argentea*). The project is implemented by the Kenya Marine and Fisheries Research Institute (KMFRI) and aims at improving the business capacity and incomes of Lake Victoria's fisher community by enabling them to get current fish market information easily, cheaply and faster. The project generates key fish market information from about 140 fish landing sites and markets. Among the variables collected are fish quantities and prices at landing sites and inland markets. EFMIS has a large database of market information updated on a daily basis and releases market information principally on demand by sms. Synthesized market information is also disseminated through various media, including radio and the Internet, through a monthly EFMIS Market Bulletin. Two new data packages are currently being worked on to complement the information services to the fishermen; the information offered will enable consumers to easily assess quality of the products while fish farmers will be updated on the availability and pricing of feeds, fingerlings and harvested fish.

Constraints and limitations

The aquatic genetic resources are significant in economic, social and socio-economic terms in professional and recreational fishing. The decline of high value fish species stocks (Nile perch and tilapia) as a result of increased fishing effort/increased illegalities in Lake Victoria which traditionally has the largest fishery in Kenya, brings to mind the insight that natural resources are finite and the need for their conservation and diversification of livelihoods such as aquaculture. The interventions should aim at conserving and using the diversity of aquatic genetic resources in the longterm in a way that is backed up by science. In Kenya, there is no monitoring and no measures to protect the genetic base of the species kept in aquaculture. Any threat to already established species such as trout, tilapia and catfish is hard to assess due to lack of data. There is a need for precise monitoring and assessment of these culture species.

Collection of data is an expensive and time consuming activity that requires adequate funding, which more often than not is not available in the districts, leading to compromised data. The staff capacity in the districts, in terms of numbers and also training is inadequate. Poor record keeping by farmers and inefficient statistical data collection has impeded information dissemination on viability of aquaculture. Currently, the department has no in-house platform or database that can house the immense data/information collected. Harmonization of data collection within the region continues to be a challenge due to different methodologies of data collection being used by member states. Sharing of information is still a challenge, with issues of ownership taking centre stage.

PRESERVATION AND INFORMATION-SHARING NETWORK OF AQUATIC GENETIC RESOURCES IN THE PEOPLE'S REPUBLIC OF CHINA

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Background and history

During 2003 to 2009, the Chinese Government initiated a national programme of information-sharing platform on genetic resources as a base for science and technology development, of which there is a subprogramme specific to aquatic genetic resources. The main tasks for the subprogramme is to organize and integrate the current aquatic genetic resources distributed in various institutions, and to share the information through a network. This subprogramme was headed by the Chinese Research Academy of Aquatic Science (CRAAS), under the Ministry of Agriculture, comprised of 44 institutions. All the institutions are involved in collective preservation of aquatic genetic resources and relevant databases, and they are not limited by the CRAAS system under the agricultural (fishery) sector, but also under the responsibility of other departments, such as some marine institutions under the State Oceanic Administration, some under the Chinese Academy of Science, some are universities and others are under local governments.

The first step for the subprogramme implementation is to develop the standards for grading, classifying and description of aquatic genetic resources. Following the standards, the second step is to document all the aquatic resources by digital expression. The final step of the subprogramme should focus on establishing databases and an information-sharing network.

Preservation of aquatic genetic resources

During the past years in the People's Republic of China, a lot of different kinds of aquatic genetic resources were preserved in different institutions. It is important to inventory all the aquatic genetic resources. For example, in the 44 institutions above, 328 species are preserved for living bodies, 2 300 species for specimen, 120 species for DNA sample, 36 species for germ cell and 28 for other cell forms. They belong to six categories of fishes, shrimps, crabs, shellfishes, algae and others (Table 1).

Table 1. Status of preservation for aquatic genetic resources in the People's Republic of China

Types of aquatic genetic resources	Living bodies (No. of sp.)	Specimen (No. of sp.)	DNA (No. of sp.)	Germ cell (No. of sp.)	Cells (No. of sp.)
Fishes	167	2094	82	36	28
Shrimps	19	56	13		
Crabs	7	61	2		
Shellfishes	48	45	18		
Algae	80	10	3		
Others	7	34	2		
Total	328	2300	120	36	28

Information sharing network for aquatic resources

In addition, an information-sharing network for aquatic genetic resources was established at the end of 2005 by implementing the subprogramme for aquatics, which includes all the existing databases and datasets from the 44 institutions. The information of the network covered all preserved living species and varieties, specimen, DNA samples, germ cells and other cells, with digital records of 46 100 accessions. Based on the digital information and requirements for data management, 20 standards and guidelines were formulated and 34 meta-databases were developed. The network also includes the information of 36 national protected farms, especially for aquatic germplasm preservation. Furthermore, a network for public information inquiry was developed with the help of the GIS approach. Users can inquire some relevant information through the following Web site: www.cafs.ac.cn/english.

This network has collected the basic data of habitat conditions for 3 872 aquatic species; data of fry breeding, feeds, disease control, harvest and processing technologies for 174 main aquatic economic species; data of distributions and populations for 1 772 aquatic species; data of updated research progress on molecule biology, biochemistry and genetics for 58 key artificial breeding species, as well as over 9 800 literacy reference on aquatic genetic resources and researches. This network consists of 25 datasets with numerous records as listed in Table 2.

Table 2. Databases of aquatic genetic resources for the information-sharing of the platform

No.	Name of data sets	Records	No.	Name of data sets	Records
1	Basic information	5 413	14	Composition of amino acid	374
2	Classification information	5 410	15	Chromosome	354
3	Preservation information	4 694	16	Analysing data for isoenzyme	786
4	Growth characteristics info.	387	17	Analysing data for AFLP	102
5	Quantitative character info.	566	18	Analysing data for RFLP	42
6	Internal conformation info.	421	19	Analysing data for ITS	45
7	Habitat environment info.	563	20	Analysing data for mtDNA	943
8	Reproductive character info.	566	21	Analysing data for RAPD	688
9	Disease control info.	1 771	22	Analysing data for micro- satellite	801
10	Introduction info.	116	23	Linkage map	5
11	Breeding technology info.	345	24	cDNA library	16
12	Oxygen-consuming rate info.	191	25	Genome library	9
13	Components info.	393			

THE RAMSAR CONVENTION ON WETLANDS AND THE SCIENTIFIC AND TECHNICAL REVIEW PANEL

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Background information

Brief overview of the Convention

The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty established in 1971 that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their natural resources.

Upon joining the Ramsar Convention, a Contracting Party is obliged by Article 2.4 to designate at least one wetland Site for inclusion in the List of Wetlands of International Importance. Today, there are 160 Contracting Parties with an established network of 1 913 Ramsar Sites.

Wetlands of International Importance & its criteria

Sites are selected by the Member States for designation under the Convention by reference to the Criteria for identifying Wetlands of International Importance, *inter alia*:

Group A of the criteria

Sites containing representative, rare or unique wetland types

Criterion 1: A wetland should be considered internationally important if it contains a representative, rare, or unique example of a natural or near-natural wetland type found within the appropriate biogeographic region.

Group B of the criteria. Sites of international importance for conserving biological diversity

Criteria based on species and ecological communities

Criterion 2: A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities.

Criterion 3: A wetland should be considered internationally important if it supports populations of plant and/or animal species important for maintaining the biological diversity of a particular biogeographic region.

Criterion 4: A wetland should be considered internationally important if it supports plant and/or animal species at a critical stage in their life cycles, or provides refuge during adverse conditions.

Specific criteria based on waterbirds

Criterion 5: A wetland should be considered internationally important if it regularly supports 20 000 or more waterbirds.

Criterion 6: A wetland should be considered internationally important if it regularly supports 1 percent of the individuals in a population of one species or subspecies of waterbird.

Specific criteria based on fish

Criterion 7: A wetland should be considered internationally important if it supports a significant proportion of indigenous fish subspecies, species or families, life-history stages, species interactions and/or populations that are representative of wetland benefits and/or values and thereby contributes to global biological diversity.

Criterion 8: A wetland should be considered internationally important if it is an important source of food for fishes, spawning ground, nursery and/or migration path on which fish stocks, either within the wetland or elsewhere, depend.

Specific criteria based on other taxa

Criterion 9: A wetland should be considered internationally important if it regularly supports 1 percent of the individuals in a population of one species or subspecies of wetland-dependent non-avian animal species.

Data generation

The Ramsar Information Sheet (RIS)

Data on designated wetlands are communicated by the Parties to the Treaty Secretariat by means of a Ramsar Information Sheet (RIS) including accurate data on various scientific and conservation parameters and a map precisely delimiting the boundaries of the site. Parties have to provide updated information on the already designated Ramsar Sites at least every six years.

The RISs allow analysis of Ramsar-listed wetlands around the world at any given time, provide baseline data for measuring changes in the ecological character of wetlands listed under the Ramsar Convention, and provide material for publications which inform the public about Ramsar Sites. The template of the RIS currently in use is available here. Information in the RIS includes listing of fauna and flora species, endemism, land uses, physical functions, hydrological values, etc.

A new version of the RIS format is being developed for better gathering of standardized information, as well as to allow online submissions.

Data management and sharing

The Ramsar Site Information Service (RSIS)

The online Ramsar Sites Information Service (RSIS) managed by Wetlands International is an online service consisting of several components of which the core one is also called the Ramsar Sites Database, http://ramsar.wetlands.org. This core Ramsar Sites Database is a searchable database, fully accessible through the Internet with a password protected data entry system, and an unprotected reporting system for public use. Other components include the Ramsar Sites Directory and the graphical profiles.

The data included in the database derives from the Ramsar Information Sheet and the Ramsar National Report provided triennially by Contracting Parties. This includes information on wetland types, floral and faunal values, land uses, threats, hydrological values of the sites, etc. The core Ramsar Sites Database is primarily a tool to look at Ramsar Sites across geographic and thematic boundaries, useful and necessary for maintaining an overview of a global network of well over 1 900 internationally important wetlands from 160 countries. Through the database, it is possible to build queries on a number of topics, for example, to obtain the list of all those Ramsar Sites whose faunal values are "important for fish reproduction" or "important for aquatic mammals", "suffer from aquatic invasive species", etc., in a specific region or country; however, with the new online RIS format, it is likely that there will be also the possibility to search by species name.

Fish and fisheries data and information
Under Criteria 7 and 8 (see above), Ramsar Contracting Parties designate Wetlands of International Importance for their importance to fish, including for their relevance of 'fish-related' ecosystem services (benefits and/or values), and for the key role of such wetlands in fish life-cycles, many species of which are commercially or artisanally fished.

Waterbird biogeographic populations
Under Criterion 6 (see above), Ramsar Contracting Parties designate Wetlands of International Importance for their importance for migratory waterbirds at the biogeographic population level (i.e. below the species level of biodiversity). Data and information on key sites and on status and trends of biogeographic waterbird populations is compiled and supplied by Ramsar International Organisation Partner Wetlands International, held and managed in databases. A recent assessment (Wetlands International 2010 The State of the World's Waterbirds) reports on global, regional and taxonomic population trends. Many waterbird populations are hunted, for food or for recreation, and excessive harvesting of wild waterbirds is recognized as one of the drivers of their population declines.

Additional information

Collaboration between Ramsar's Scientific & Technical Review Panel (STRP) & FAO
FAO is the Observer Organization to the STRP and collaborative efforts have been ongoing since many years, under a number of thematic areas, particularly in relation to Wetlands, Agriculture and Fisheries.

The two organizations reciprocally share data when useful and continue monitoring new opportunities to support each other's activities.

Collaboration between Ramsar and other Multilateral Environmental Agreements on species nomenclature.
Although the Convention's Secretariat collects information on species at listed Ramsar Sites, it has hitherto, had no universally adopted taxonomic standards. The exception has been for waterbirds, where it urges Parties to use the Wetlands International's publication - Waterbird Population Estimates. The STRP has recognized the inadequacies of the current system in that it fails to capture significant amounts of important data and information already being submitted by the Contracting Parties. In this regard, a process of harmonization between the MEA community to move towards a more universally adopted (and maintained) reference system will be discussed this February at the 4th Meeting of the Chairs of the Scientific Advisory Bodies (CSAB).

Network of technical experts in the Ramsar Contracting Parties
The Ramsar Convention benefits from broad Network of Focal Points and other experts in all the regions.

Specifically for the members of the STRP and its invited experts, a password-protected work space (the STRP Support Service) provides an efficient platform to share information, documents, and review draft technical material.

Part 2: Databases

FISHBASE AND SEALIFEBASE: THE DATABASE STRUCTURE CAN MANAGE DATA AND INFORMATION ON AQUATIC GENETIC RESOURCES FOR ALL MARINE AND FRESHWATER ORGANISMS

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Brief historical overview, structure and scope of the information system/network/fisheries organization

FishBase is a Biodiversity Information System (BIS) on all finfishes of the world, both marine and freshwater, primarily at species level[2]. However, it was designed since the start in 1990 to store information at population level for wild stocks, and strain level for aquaculture[3].

Type of information included or generated: (as of 31/12/2010)

In total, FishBase holds ca. 3 million records in more than 200 tables (ca. 60 main topic tables on biology, [trophic] ecology, life history, population dynamics, taxonomy, distribution, fisheries, etc.), without the occurrence point data that are gathered from various sources (but mainly the Global Biodiversity Facility [GBIF] and the Ocean Biogeographic Information System [OBIS]).

Strategies of collecting, inserting, validating, compiling and sharing information

See the chapter on SeaLifeBase that applied the same strategy as FishBase. However, note the difference with respect to taxonomy and nomenclature at a time where few name lists were available electronically, and barely accessible in the absence of the Web.

FishBase is indebted altogether to Walter Fischer and Kent E. Carpenter, FAO who provided the FAO ISSCAAP species list at the start, and William N. Eschmeyer, CAS, who made available his Catalog of Fishes later on.

The database structure

Figure 1 presents the general structure of FishBase that is quite simple. FishBase makes an empirical balance between the "Normal Forms" of the database relational model developed by Codd (1970)[4], and simplicity (and simplification) for practical, easier maintenance and faster execution time reasons.

In summary, the main table is the table Species, other tables being scattered over different conceptual modules:

- The taxonomy module that contains the necessary taxonomic backbone (tables Genera to Kingdoms for SeaLifeBase).
- The nomenclatural module (tables Synonyms and ComNames).
- The bibliographic module (table Refrens and Biblio).
- The topic modules (Distribution, Life history, Population dynamics, Trophic ecology, etc.).

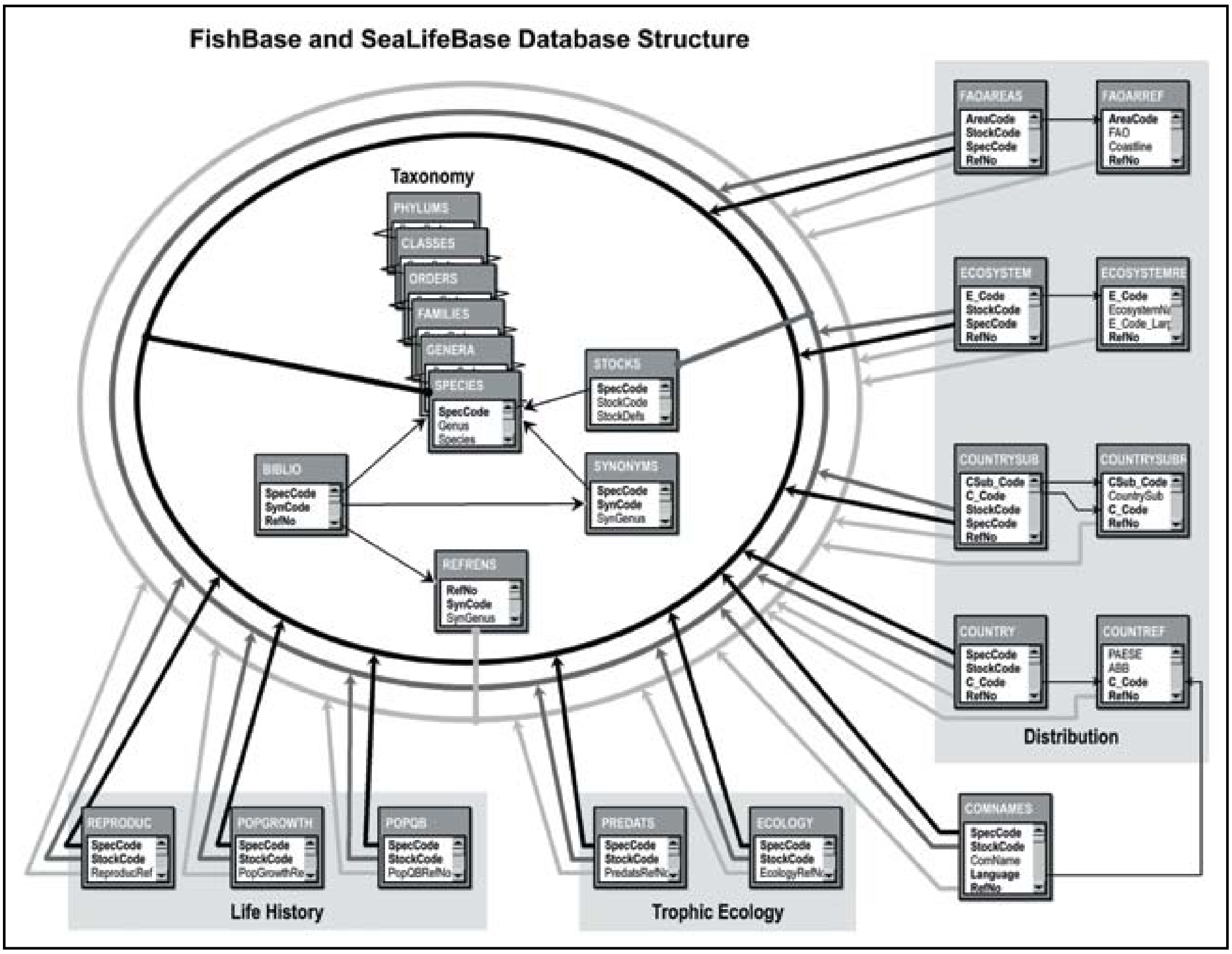
All information points to a bibliographic reference. All records in all tables must be linked to a species through a SpecCode (black links, Fig. 1), to a reference through a RefNo, (light gray links, Fig. 1), and

[2] Froese, R.; Pauly, D. (eds.) 2000. FishBase: Concepts, design and data sources. Los Baños (Philippines): ICLARM. 346 p. [Distributed with 4 CD-ROMs]. [See www.fishbase.org/manual/contents.htm].

[3] Palomares, M.L.D.; Bailly, N., 2011. Organizing and disseminating marine biodiversity information: the FishBase and SeaLifeBase story. In: Christensen, V.; Maclean, J. (eds.), Ecosystem approaches to fisheries. A global perspective. Cambridge (UK): Cambridge University Press, pp. 24–46.

[4] Codd E.F. 1970. A relational model for large shared data banks. ACM Comm., 13(6): 377–387.

FIGURE 1
Principles of the structure of FishBase and SeaLifeBase (there are more tables structured like 1) the ones on the right with a "references" table, which contains the controlled vocabulary for the topic, and a joint table describing the topic for the species; and 2) on the ones at the bottom with simple relationships with the species table).
[NB: Contact the Cambridge University Press for any further use of that picture.]



relevant for the genetic resource level to a stock through a StockCode (medium gray links, Fig. 1).

Figure 2 illustrates the main field definitions. A "Stock" is defined by its taxonomic rank (field Level), by its distribution (field StockDefs), and obviously, by its assignment to a species (field SpeciesCode): the 3 make the key of the table. Forty topics may be recorded at "stock" level.

The field Level defines at which aggregating level the piece of data or information is stored. Most usually, it is at the species or subspecies level. But below the subspecies rank, one can define any "group" as needed, in particular stocks for fisheries and strain for aquaculture, with an ad hoc definition.

In addition, it can be specified if the stock is a broodstock, an egg, fry, or larval nursery. As for the level, any other group can be added as needed (with a controlled vocabulary if possible).

Therefore, it is believed that FishBase and SeaLifeBase are already structured to store AqGR information.

FishBase/SeaLifeBase have the capacity to link with various other datasets through their unique identifiers, or through names. Relevant in the present case are the links with GenBank (sequences), FIGIS (FAO data; note that FishBase stores and links to the successive versions of ASFIS/ISSCAAP), FishTrace (sequence and occurrence data for ca. 200 European marine species/stocks), BOLD (Barcode of Life). All these links are updated annually.

FIGURE 2
Main field definitions of the table Stocks.

	Field Name	Data Type	
►	StockCode	AutoNumber	Code to identify a stock or strain; for internal use.
	StockDefs	Memo	Distribution of species or subspecies, or definition of stock or strain.
	SpecCode	Number	Code number for internal use.
	Level	Text	Level (species, subspecies, stock, strain) to which the data refer.
	LocalUnique	Text	Short definition of a stock or strain, used as replacement of StockDefs, which is a memo and
	IUCN_Code	Text	Two letter abreviation of the status-of-threat classification.
	IUCN_Assessment	Text	Assessment that led to the status-of-threat classification.
	Protected	Yes/No	Is the species legally protected anywhere in its ditributional range?
	StocksRefNo	Number	Main reference used for the information in this record.
	Northernmost	Number	Northernmost latitude of occurence of a species/stock in degrees.
	NorthSouthN	Text	Hemisphere of northernmost latitude.
	Southernmost	Number	Southernmost latitude of occurence of a species/stock in degrees.
	NorthSouthS	Text	Hemisphere of southernmost latitude.
	Westernmost	Number	Westernmost longitude of occurence of a species/stock in degrees.
	WestEastW	Text	Hemisphere of westernmost longitude.
	Easternmost	Number	Easternmost longitude of occurence of a species/stock in degrees.
	WestEastE	Text	Hemisphere of easternmost longitude.
	BoundingRef	Number	Reference from which the bounding box coordinates were taken.
	BoundingMethod	Text	Method by which the bounding box coordinates were derived.
	TempMin	Number	Minimum temperature tolerated by the species/stock/strain, in degrees celsius.
	TempMax	Number	Maximum temperature tolerated by the species/stock/strain, in degrees celsius.
	TempRef	Number	Reference used for temperature range.
	EnvTemp	Text	Preferred climate: tropical, subtropical, temperate, boreal
	Resilience	Text	Resilience / productivity in: Hogh, Medium, Low, Very low.
	ResilienceRemark	Text	Method used to classify resilience: rm, K, Fec., tm, tmax.
►	pHMin	Number	Lower tolerance range for acidity.
	pHMax	Number	Upper toleranc erange for acidity.
	pHRef	Number	Reference used for pH values.
	dHMin	Number	Lower tolerance range for Calcium Carbonate, measured as degrees German Hardness.
	dHMax	Number	Upper tolerance range for Calcium Carbonate, measured as degrees German Hardness.
	dHRef	Number	Reference used for hardness of water.
	Broodstock	Yes/No	
	EggNursery	Yes/No	
	FryNursery	Yes/No	
	LarvaNursery	Yes/No	
	Entered	Number	Code number of person who entered.
	DateEntered	Date/Time	Date when the record was first entered.
	Modified	Number	Code number of person who last modified this record.
	DateModified	Date/Time	Date of last modification of record
	Expert	Number	Code number of person who has checked this data.
	Date checked	Date/Time	Date when the data has been checked by an expert.

Constraints and limitations

The notion of stocks is not shown yet on the Web because there are too few records. Such pages remain to be developed.

When subspecies are recognized as valid, FishBase does not have a record for the species rank in the table Species. The management of subspecies in all BIS is quite difficult because data recorded at species rank requires deep investigations to assign them to the correct subspecies. It has some impact on the interoperability between BIS, in particular with occurrence databases.

The main constraint is to define the stocks and coining a "name" whatever it can be (but not a strict numerical code), i.e. to define a nomenclature of stocks.

The main limitation is to get a funded project on a long-term basis to hire fully dedicated encoders as the further informatics developments are limited to webpages and webservices.

Main users and targeted audience

The primary main target of FishBase were the fishery managers, extended after to aquaculture managers, and then to biodiversity conservationists and managers.

Since the development of the web, the number of visits to the FishBase and SeaLifeBase Websites (ca. 500 000 and 40 000 resp. per month) is mainly due to the general public, but regular requests for specific datasets are received from colleagues and students.

Collaborative approaches with other partners/stakeholders

At individual level:

- There is no registration system.
- Anybody is welcome to provide documents (paper and illustrations). Any piece of information is linked to its source (bibliographical references, or photographer contact for pictures) to give due credit. There is a page to upload picture, and another one to give detailed report on observations.
- Anybody is welcome to provide comments, corrections, critics, and constructive suggestions.
- A forum and Facebook pages are up and running for any question.

At institution level:

- Staff is hired starting January 1st, 2011 by FIN (FishBase Information and Research Group, www.fin.ph), a Philippine NGO. The Scientific Committee of FIN is the FishBase Consortium constituted by 9 members, 3 museums, 3 universities, 1 national fishery agency, and 2 international organizations.
- Memorandums of Understanding with various bodies and initiatives are developed.

GLOBAL BIODIVERSITY INFORMATION FACILITY (GBIF)

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GBIF: Brief historical overview

GBIF is an international government-initiated and funded initiative focused on making biodiversity data available to all and anyone, for scientific research, conservation and sustainable development.

GBIF provides three core services and products:

1. An information infrastructure – an Internet-based index of a globally distributed network of interoperable databases that contain primary biodiversity data – information on museum specimens, field observations of plants and animals in nature, and results from experiments – so that data holders across the world can access and share them.
2. Community-developed tools, standards and protocols – the tools data providers need to format and share their data.
3. Capacity-building – the training, access to international experts and mentoring programmes that national and regional institutions need to become part of a decentralized network of biodiversity information facilities.

The genesis of GBIF is in the work of the OECD (www.oecd.org) Megascience Forum Working Group on Biological Informatics that was established in January 1996. The proposal that OECD member countries establish a Global Biodiversity Information Facility was the major outcome of their work. As a result, representatives of 17 interested countries participated in an ad hoc meeting on the implementation of GBIF in March 1999. The result of these meetings was the Memorandum of Understanding (MoU), which was opened for signature in December, 2000. An invitation to participate in GBIF was sent to the Science Ministers of all countries and economies.

The MoU provided that GBIF would be considered established once ten countries had signed and pledged their monetary contributions. This was achieved before March, 2001 (initially 17 countries), when the first Governing Board meeting was held in Montreal, Canada.

Participants in GBIF are countries (governments), economies, intergovernmental or international organizations, or organizations with an international/global/regional mission. Nowadays, 55 participant countries and 46 associate participants (mainly international associations) are part of GBIF.

Structure and scope

GBIF is a decentralized network of biodiversity information facilities (BIFs) established and maintained by its participants. In the GBIF community, a participant BIF refers to a network of data holders, users, and other stakeholders established by a GBIF participant to promote, facilitate, and coordinate the biodiversity data sharing activities within its domain. Normally, this network includes museums, universities, projects, administrations, non-governmental organizations (NGOs) and, in general, any entity that generates or compiles biodiversity information. Functional BIFs also include the user's communities. A participant BIF typically includes a coordinating team, a governance structure, informatics infrastructure, and a framework for collaboration. The coordinating team of a participant BIF is referred to as the participant node.

Participant nodes are the conduit by which GBIF participants meet their own biodiversity information needs, while benefiting from and contributing to the GBIF network's mission and goals.

One of GBIF's main purposes is to establish a global decentralized network of interoperable databases that contain primary biodiversity data and provide a unified access to information. GBIF's mission is to make the world's biodiversity data freely and universally available via the Internet. As a megascience initiative, GBIF aims to provide an essential global informatics infrastructure for biodiversity research and applications worldwide.

Main users and targeted audience

GBIF's success can be measured in part by how much use of the data is done. Indeed, this is a key rationale for all the work across the entire GBIF network.

As the world's largest single data portal, one of GBIF's strategic objectives is to make possible scientific research that has until now been impossible. These data are an important source of information for the biological researcher. They can be used for taxonomic revisions, environmental niche modelling, compiling redlists of threatened species and biodiversity assessment.

438 professional publications citations mention the use of GBIF-enabled data from 2007. See www.gbif.org/communications/resources/publications/ for more information.

Collaborative approaches with other partners/stakeholders

Some of the associate participants are international associations. Examples of collaboration with this kind of international associations are:

- Consortium for the Barcode of Life (CBOL) (www.barcoding.si.edu/): CBOL proposed a method for linking sequence records to voucher specimens to GenBank at the National Center for Biotechnology Information (NCBI) in 2005. This method was developed in collaboration with the GBIF and other major biodiversity database initiative. GBIF and CBOL cosponsored with other partners e-Biosphere (www.e-biosphere09.org/) in 2009.
- Species 2000 (www.sp2000.org/): Species 2000 is used by the Global Biodiversity Information Facility (GBIF) and Encyclopedia of Life (EoL) as the taxonomic backbone to their Web portals.
- Encyclopedia of Life (EoL) (www.eol.org/): GBIF and the EOL partnered to develop common approaches to accessing, using and acknowledging sources of taxonomic and nomenclatural content through the development of the Global Names Architecture. In collaboration with EOL, GBIF has developed a generic, rich Web-based Internet mapping application to dynamically represent species occurrence density.
- Ocean Biogeographic Information System (OBIS) (www.iobis.org/): a network providing to GBIF network more than 13 million of records from 185 datasets.
- Scientific Committee on Antarctic Research (SCAR) (www.scar.org/) is an entity providing to GBIF network more than 274 000 records from 74 datasets.
- Biodiversity Information Standards (TDWG) (www.tdwg.org/): Standards for data sharing are being developed by GBIF in partnership with TDWG.

- Ibero-American Platform for Biodiversity Information (PIIB) (www.recibio.net/PIIB_en.php): the activities in collaboration to GBIF are mainly focused on creating capacity (training workshops, e-learning platforms, on line resources, etc.), as well as establishing communication and collaboration infrastructure (virtual communities, bioinformatics tools developments, etc.).

Type of information included or generated

Through appropriate standards and tools, the infrastructure is designed to serve the following types of data: (i) information associated with specimen occurrences documented in biological collections; (ii) records of plants and animals in nature; (iii) organism names and metadata on curating institutions and projects; (iv) descriptions of data holdings.

Specimen occurrence data nearly always have certain common attributes, such as scientific name, location and collection date. So, they can easily be recast into a common data format and shared across the globe using Internet-based protocols.

Since its inception, GBIF has focused its data digitization and mobilization activities on natural history collections data. However, over 60 percent of the data records accessible through GBIF are observational records.

As of 5 June 2012, GBIF offers 367 354 825 data records (321 731 442 with coordinates) occurrence records from 8 872 databases.

Strategies of collecting, inserting, validating, compiling and sharing information

GBIF network is founded on the principles of free and open access to primary biodiversity data in a decentralized, global network. In practice, this means that original data is never ‘handed over’ to GBIF, but instead always remain under the direct control of their originators and curators.

Historically, primary biodiversity data has been collected and archived in a multitude of data structures, digitization systems and file formats – all with widely different focuses of interest. Compiling all of these in an integrated information system with a unified search access requires standard interfaces, both for the content itself and for the interaction between datasets, or between datasets and the GBIF index. This means that all providers should use a common data format with a fixed structure which clearly defines how the information is to be shared. Adherence to standards is essential to ensure interoperability, especially in a global network of data publishers. This applies both to the data communicated through the network and to the modes of communication that connect databases, registries, data portals and a variety of other components. GBIF’s informatics infrastructure builds on existing and emerging standards and tools and takes an active part in their development, in close collaboration with Biodiversity Information Standards (TDWG) (www.tdwg.org/).

In the case of specimen occurrences, GBIF has identified two different standards as suitable formats for this data exchange, the Darwin Core (http://rs.tdwg.org/dwc/index.htm) elements and the ABCD Schema (www.tdwg.org/standards/115/). Both of these standards allow data on individual specimens to be shared as electronic documents which can be transmitted across the Internet. GBIF, therefore, needs a simple model which will allow institutions to share their data using the structured formats described, regardless of what formats they use in their own databases. In order to achieve that, GBIF use Web services to make all of the connections between different providers. Examples of Web services interfaces used by GBIF are DiGIR (Distributed Generic Information Retrieval) (http://digir.sourceforge.net/), TAPIR (TDWG Access Protocol for Information Retrieval) (www.tdwg.org/standards/449/) and BioCASe protocol (www.biocase.org/) .

The GBIF global bioinformatics infrastructure is divided into five major components:

- Data publishing. Includes the set of standards, protocols, Web services and hardware infrastructure that make possible that thousands of datasets are available and searchable online in a unified way.
- Data discovering. GBIF maintain and develop a metadata system that provides discovery, description and access to datasets information in such a way that users can identify, download and exploit them for a suitable and responsible use of data.
- Data indexing. The Harvesting Index Toolkit (HIT) (http://code.google.com/p/gbif-indexingtoolkit/) is an open-source, Java-based Web application that simplifies the otherwise complicated process of harvesting biodiversity data from a distributed network of data publishers.

- Integrating data. GBIF data portal (http://data.gbif.org/) and the integration with other systems. An example of this is the GBIF-WDPA widget (http://widgets.gbif.org/pa/index.html#/country/ES), based on the World Database of Protected Areas (WDPA) (www.wdpa.org/) and on GBIF-mediated data.
- Retrieving data. The GBIF data portal (http://data.gbif.org) offers a range of services to support the use of biodiversity data in other applications and analyses. The Occurrence Search page (http://data.gbif.org/occurrences/) allows users to download occurrence records in various formats. The portal includes a range of Web services that can be used by other portals and applications to directly access XML-formatted GBIF data.

Constraints and limitations

The main constrains and limitations in relation to GBIF global infrastructure are:
- Insufficient support for data digitalization, archiving, duration and publication online.
- Scientific culture is focused on result publication and not on data publication. Data publication is not considered a scientific merit and so it is despised.
- Inadequate mechanisms to give due attribution of credit to data publishers.

AQUATIC MICROORGANISMS DATABASES AND INFORMATION SHARING SYSTEMS

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Introduction

The biosphere of our planet contains a large number of ecosystems in which microorganisms play an important part. Water is the dominant environment of these ecosystems, since the ocean covers about 71 percent of the globe's surface. Although water forms the basis for all aquatic environments, the differences in the characteristics of natural waters constitute the basis for several different aquatic ecosystems. Thus, microbial ecology of natural waters remains an important and diversified field. In spite of the continuing researches in aquatic microbiology, much has to be deciphered on aquatic microorganisms.

Main databases and information sharing systems

World Federation for Culture Collections (WFCC):

The WFCC is a Multidisciplinary Commission of the International Union of Biological Sciences (IUBS) and a Federation within the International Union of Microbiological Societies (IUMS). The WFCC is concerned with the collection, authentication, maintenance and distribution of cultures of microorganisms and cultured cells. Its aim is to promote and support the establishment of culture collections and related services, to liaise and set up an information network between the collections and their users, to organize workshops and conferences, publications and newsletters and work to ensure the long-term perpetuation of important microbial collections. The WFCC pioneered the development of an international database on culture resources worldwide.

The result is the WFCC World Data Center for Microorganisms (called WDCM). http://wdcm.nig.ac.jp/DOC/menu3.xml

World Data Center for Microorganisms (WDCM):

- There are currently 586 culture collections in 68 countries registrated in WDCM.
- This data resource is now maintained at the National Institute of Genetics (NIG), in Japan: National

Institute of Genetics, WFCC-MIRCEN World Data Centre for Microorganisms, Shizuoka, Japan.
- The records contain data on the organization, management, services and scientific interests of the collections.
- Each of these records is linked to a second record containing the list of species held.
- The WDCM database forms an important information resource for all microbiological activity and also acts as a focus for data activities among WFCC Members.

Information provided by WDCM:
- Statistics of Culture Collection.
- Database Search.
- Home Pages of Culture Collections in the World.
- REGISTRATION/UPDATE of culture collections/Bio-resource center(CCINFO).
- CCINFO update information.
- REGISTRATION/UPDATE of list of holdings (STRAIN).
- Agent to help microbial information integration (AHMII).
- Workbench for classification, identification and comparative genomics.
- Phylogeny packages.

Relevant WDCM collections of aquatic microorganisms
1. CAIM WDCM813: Collection of Aquatic Important Microorganisms CIAD/Mazatlan Unit for Aquaculture and Environmental Management. Responsible: Dr Bruno Gómez-Gil, CIAD, Mazatlan Unit for Aquaculture, Collection of Aquatic Important Microorganisms. www.ciad.mx

Mission:
The primary goal of the collection is to acquire, study, and preserve bacterial strains obtained from aquatic ecosystems and from aquaculture facilities.

Special interest is given to isolates of the Vibrionaceae family, as this family holds one of the most important genera in the culture of many aquatic species and as members of the marine and estuarine environments.

The collection was formerly named Collection of Aquacultural Important Microorganisms, but changed to the actual name because the interests of the collection have now broadened also to the study of microorganisms that have the aquatic environment as habitat, and not only those restricted to aquaculture.

2. CPCC WDCM605: Canadian Phycological Culture Centre (formerly University of Toronto Culture Collection of Algae & Cyano bacteria), University of Waterloo, Canada. (http://wdcm.nig.ac.jp/CCINFO/CCINFO.xml?605)

3. CCAP WDCM522: Culture Collection of Algae and Protozoa Scottish Association for Marine Science. (http://wdcm.nig.ac.jp/CCINFO/CCINFO.xml?522)

Meta-genome approach collections:
CAMERA (http://camera.calit2.net/index.shtm)
VAMPS (http://vamps.mbl.edu/)

Main General Microorganisms Collections and Databases:
Agricultural Research Service USDA (www.ars.usda.gov/)
ALGAE a world catalogue of algal collections (http://wdcm.nig.ac.jp/simple_search.html)
ATCC American Type Culture Collection (www.atcc.org/)
BCCM Belgian Co-ordinated Collections of Microorganisms (www.belspo.be/bccm/)
BGSC Bacillus Genetic Stock Center (www.bgsc.org)
BCC BIOTEC Culture Collection, Thailand (http://bcc.biotec.or.th/)
CABRI (Common Access to Biological Resources and Information) by EC (www.cabri.org/)

CBS Centraalbureau voor Schimmelcultures (www.cbs.knaw.nl/databases/)
CCAP The Culture Collection of Algae and Protozoa (www.ife.ac.uk/ccap/)
CCUG University of Goteborg, Sweden (>38 000 strains) (www.ccug.gu.se/)
CGSC E.coli Genetic Stock Center (http://cgsc.biology.yale.edu/)
Developmental, Cell and Molecular Biology Group Duke University (http://cmb.duke.edu/)
Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH (www.dsmz.de/)
Fungal Genetics at U. Texas Houston Medical School (www.med.uth.tmc.edu/)
MA (Real Jardin Botanico, Madrid) cryptogamic collections (www.rjb.csic.es/herbario/crypto/crydb.htm)
HAMBI University of Helsinki, Finland (http://honeybee.helsinki.fi/mmkem/hambi/)
IEGM Institute of Ecology and Genetics of Microorganisms (www.ecology.psu.ru/iegmcol)
IMI CABI Bioscience Genetic Resource Collection (www.cabi.org/)
INVAM The International Culture Collection of Arbuscular and VA Mycorrhizal Fungi (http://invam.caf.wvu.edu/collection/generalinfo/orders.htm)
JCM Japan Collection of Microorganisms (www.jcm.riken.go.jp/)
JSCC Japan Society for Culture Collections online database (www.nbrc.nite.go.jp/jscc/idb/search)
MGD Microbial Germplasm Database (www.nacse.org/top/interfaces/indexdata.html)
Microbial Information Network of China (www.im.ac.cn/)
MICH University of Michigan Fungus Collection (http://herbarium.lsa.umich.edu/)
MSDN Microbial Strain Data Network mirrored in Japan (http://wdcm.nig.ac.jp/msdn/MSDN.html)
Quinone Database (http://wdcm.nig.ac.jp/simple_search.html)
RDPII (Ribosomal Database Project II) (http://rdp.cme.msu.edu/)
The Chlamydomonas Genetics Center (www.chlamy.org/)
UNSW University of New South Wales (www.babs.unsw.edu.au/about/centres/micro_culture.html)
VKM All Russian Collection of Microorganisms (www.vkm.ru/)
World Phytophthora Collection, University of California Riverside (http://phytophthora.ucr.edu/default.html)
HBMMD Harbor Branch Marine Microbe Database (www.hboi.edu/dbmr/dbmr_hbmmd.html)

Constraints and challenges

The difficulties in the study of aquatic microorganisms and their environment are slowly being overcome with the introduction of modern techniques. Studying aquatic microorganisms is quite difficult due to the nature of their habitat and their unique characteristic features.

Research on aquatic microorganisms is particularly difficult when the samples are from sea or deep areas in general, Pelczar *et al.* (1986) analysed some of the problems associated with the study and data collection of aquatic micro flora, as follows:

- Most aquatic microorganisms do not grow on the usual laboratory media such as nutrient agar or nutrient broth. Thus, a number of microbes still have to be discovered from estuaries and oceans.
- A large proportion of aquatic bacteria have a natural tendency to grow attached on solid surfaces, like particulate matter or on large organisms.
- The time period between the sample collection and its transport to the laboratory usually leads to loss of viability of many microorganisms. This necessitates the use of laboratory-equipped ships for on-location culturing of specimens, which is very costly.
- The study requires special sampling devices especially for collecting samples from the deeper regions of the estuary or ocean.
- Lack of routine techniques for the isolation of aquatic viruses.

ALGAEBASE

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What is AlgaeBase?

Presently, AlgaeBase is primarily a taxonomic database with extensive nomenclatural, distributional, and bibliographic information on marine, freshwater and terrestrial algae. Some 67 seagrasses are currently included for convenience. Some incidental information such as images, common names, chemical compounds and other economic data are included, but funding to develop these aspects has not been available since 2004 and the data are not currently being maintained. The existing data are freely available on the Internet and are extensively used daily in over 200 countries, particularly among workers with poor access to taxonomic resources.

What are Algae?

Within the algae, a whole range of phylogenetically unrelated photosynthetic (light-harvesting) organisms have been included that basically do not fit anywhere else in the general category of "plants" and photosynthetic "animals", and are mostly aquatic, requiring water for reproduction and considered phylogenetically primitive. Freshwater algae and seaweed (which in some parts of the world includes seagrasses) are the main components, but benthic (attached) and pelagic (free-floating) forms are included, as are prokaryotic (lacking a nucleus) and eukaryotic (possessing a nucleus) organisms.

What does AlgaeBase currently include?

AlgaeBase presently includes about 58 taxonomic Classes arranged in three Empires, four Kingdoms, and 15 Phyla, although the classification at the class level is changing almost daily. About 127 000 names of species and infraspecific names (subspecies, varieties, formae) are currently included of which about 16 500 have been verified as taxonomically valid species (Table 1), with the seaweeds and terrestrial algae being the most complete, and the diatoms (about 75 000 names) being the most incomplete.

About 7 000 generic names are included, of which about 5 250 are currently valid taxonomically, with the type species (for taxonomic reasons) identified for a majority of those in current use. The names of about 1 000 taxa above the level of genus (Order, Subclass, Class, Phylum, Kingdom, etc.) are also included, with the nomenclatural authorities listed for most. Over 45 000 bibliographic references are listed with about 3 000 downloadable pdfs available, mostly obscure and difficult to find, out-of-copyright eighteenth and nineteenth century literature. In excess of 168 000 distributional records from 250 countries and states (of larger countries or units) are included worldwide, mostly from critical national lists and taxonomic monographs. Only published information is currently utilized. Some 10 500 images are available free of charge for educational and/or non-profit use. Embossed images are available, suitable for presentations, but high-resolution images with embossing are available on request free of charge for non-profit educational use.

Table 1. Species and infraspecific taxa of algae in AlgaeBase according to habitat (January 2011)

	Marine	Freshwater	Terrestrial	No habitat
Species	10 628	5 275	434	16 033[1]
Subspecies	57	15	0	108
Varieties	793	1 972	76	2 873
Formae	511	572	10	735
Names	24 632	11 777	707	7 335

[1] Mostly chlorophytes, diatoms, euglenoid flagellates and dinoflagellates.

Who uses AlgaeBase?

The site uses Google Analytics (www.google.com/analytics) to track usage by means of Javascript code embedded in each page. For the year 31 January 2010–31 January 2011, there were 410,000 individual visitors from 208 countries of the 220 recognized by Google, with 2 567 000 page views, which is equivalent to 25 million so-called "hits" or two million "hits" per month, an increase overall of 25 percent on the previous year. The average number of pages viewed by visitors was 6.27. The top ten countries using AlgaeBase were, the United States of America (72 712 visitors), Spain (19 629), Brazil (19 099), the United Kingdom (17 756), Germany (16 620), France (14 290), Canada (14 290), Mexicos (13 959), Italy (11 773) and Portugal (11 201). The United States of America accounts for 18 percent of all usage, unsurprisingly. The lowest usage is from the Caribbean and Pacific Islands and from African and South American countries with poor infrastructures. In the scientific literature, AlgaeBase achieves about 200 citations a year, although it is clear from many publications that their authors use the data but do not cite the source. Unfortunately, the countries that need the resources in AlgaeBase most are able to use it least because of poor Internet penetration.

Who funds AlgaeBase?

AlgaeBase was initially a private attempt in 1996 on my part to put information on seaweeds on the Internet using a personal site, and initially required no funding. However, it became apparent very soon that data-entry would require funding, and from 2000 funding was sought from various national sources in Ireland (mainly Structural Funds, and the Higher Education Authority of the Department of Education and Science) and from the European Community (INCO-DEV, FP6 and FP7).

What has AlgaeBase cost?

It is estimated that, to date, AlgaeBase has cost about EUR 850 000 in data-entry, EUR 180 000 in programming, and EUR 65 000 in capital equipment, a total investment of over 1 million Euros, and which does not include the host's overheads.

Whither AlgaeBase?

With the enormous interest in algae as a source of biofuels and biopharmaceuticals, and as a CO_2 sink, the development of worldwide awareness of biodiscovery and the expansion of seaweed aquaculture in developing countries in the Indian Ocean, South-East Asia and Brazil, AlgaeBase is a prime platform for the development additional modules:

- A central source of information on and links to the world's culture collections, particularly of strains that are being used for cultivation and for biodiscovery.
- A repository of genetic information on algae, particularly in relation to the burgeoning fields of genomics and proteomics.
- A compilation of legal information on cultivation and foreshore and offshore regulations governing cultivation.
- A searchable dictionary of compounds described from algae.

Such information needs to be collated with the existing information in AlgaeBase and each module would out of necessity have to be integrated with the others.

What are the impediments to AlgaeBase's future development?

Particular difficulties include:

- Replacement of servers and improvement of service.
- Legal problems with ownership of data, particularly pdfs of publications.

SPECIES-SPECIFIC DATABASES OR DATABASES INCLUDING DATA AT THE SUBSPECIES LEVEL

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Databases related to aquatic model species

Most species specific databases are targeting the research community and providing outcomes of research projects. The major part of these databases deals with genomic data, expressed sequence tags (ESTs), genetic markers, developmental information and gene expression in certain tissues. The aquatic organisms that are addressed are mostly model organisms that have been chosen as study objects for various reasons like observability of developmental stages in the zebrafish *Danio rerio* or the Japanese medakafish *Oryzias latipes*, high tolerance to physical and pharmacological manipulation of embryos like in the African clawed frog *Xenopus laevis*, their special position in the evolution of organisms like the lamprey *Petromyzon marinus* or the sea squirt *Ciona intestinalis*, their ability to regenerate most body parts and ease of breeding like the axolotl *Ambystoma mexicanum* or, more recently, due to the special structure of their genome like the two species of pufferfish *Takifugu rubripes* and *Tetraodon nigroviridis*. Special attention is also given to Cichlids because their rapid adaptive radiation that led to a very high number of species.

Databases containing genomic transcriptomic data of cultured aquatic species

Recently, with the huge progress made in the sequencing and annotating technology that led to reduced costs, whole genome sequencing projects and gene expression studies are also undertaken for commercially relevant species that are widely used in aquaculture. However, these projects are often still at an initial stage. The outcomes of these projects are made available through databases. The Gene Index Project uses the available EST and gene sequences, along with the reference genomes wherever available, to provide an inventory of likely genes and their variants and to annotate these with information regarding the functional roles played by these genes and their products.

Strain-specific information and genetic information reflecting intraspecific variability

Databases providing strain specific information for wild and cultured species are still very scarce. Fishbase made a first attempt to include strain specific data for tilapia (24 strains) and carp (24 strains). The National Fish Broodstock Registry (NFBR) is a cooperative project of the US Fish and Wildlife Service division of Fish Hatcheries and the National Biological Service, Research and Development Laboratory. The NFBR consists of a series of databases designed to catalogue performance information on managed wild and domestic broodstocks of six fish families: Salmonidae, Ictaluridae, Acipenseridae, Polyodontidae, Percidae, and Centrarchidae.

Ex-situ conservation

Ex-situ conservation is still at the beginning for aquatic genetic resources and databases making information about resources stored in *ex-situ* genebanks available are still very scarce. The National Animal Germplasm Program of the United States Department of Agriculture, which is focused mainly on livestock, contains limited *ex-situ* genebank resources from aquatic invertebrates, freshwater and marine fish (mostly semen) (e.g. 730 specimens of freshwater fish, 15 marine fish, 213 aquatic invertebrates, for comparison, there are more than 5 000 individuals from dairy cattle).

Live gene banks (or strain collections) of common carp breeds are kept and new forms are continually tested in, for example, the Research Institute for Fisheries, Aquaculture and Irrigation, Szarvas, Hungary (www.haki.hu), the Institute of Ichthyobiology and Pond Culture of the Polish Academy of Sciences, Golysz, Poland (www.fish.com.pl), the University of South Bohemia, Research Institute of Fish Culture and Hydrobiology, Vodnany, Czech Republic (www.vurh.jcu.cz/en/informace-o-ustavu) and the Federal

Center for Fish Genetics Research, the Russian Federation. No databases related to these live gene banks are currently online.

Constraints and limitations

Most of the databases providing species specific and data at the subspecies level are targeting the research community and are focused model organisms. The data contained in these databases are mostly genomic and ESTs. However, they are also databases (mostly with a limited geographical or taxonomical focus) which provide information about available strains, intraspecific genetic variability and morphological characteristics and performance traits of different strains. Lack of available information at the subspecies level and lack of dedicated projects aiming at including available information in existing or new databases are major constraints.

Table 1. Examples of databases containing genomic/transcriptomic data of important cultured aquatic species

Scope	Internet address	Data provided
Aquaculture species like catfish, oyster, shrimp, tilapia, striped bass, salmonids	www.animalgenome.org/aquaculture/	Collection of links to species-specific databases
Ictalurid catfish *Ictalurus* spp (hybrid?)	www.catfishgenome.org/cbarbel/	Genomic data, ESTs, single-nucleotide polymorphisms (SNPs), microsatellites
Atlantic salmon	www.cgrasp.org/index.html	Genetic maps, EST data, BAC sequences,
Salmo salar and other salmonids		
	http://web.uvic.ca/grasp/	EST database
	http://grasp.mbb.sfu.ca/GRASPphysicalmap.html	physical map
	www.asalbase.org/sal-bin/index	Linkage map
Rainbow trout *Oncorhynchus mykiss*	www.animalgenome.org/cgi-bin/host/rainbow/viewmap	Linkage map
Striped bass *Morone saxatilis*	www.animalgenome.org/cgi-bin/host/ncsu/seqdbinfo	Ovarian transcriptome
Whiteleg shrimp *Litopenaeus vannamei*	www.shrimp.ufscar.br/en/index.php	EST database
oyster, salmon, trout, seabream	www.sigenae.org/	EST database
Giant tiger prawn *Penaeus monodon*	http://pmonodon.biotec.or.th/database.jsp	EST database
Rainbow trout, Killifish, Atlantic salmon, Catfish	http://compbio.dfci.harvard.edu/tgi/tgipage.html	Gene ndices
Tilapia *Oreochromis niloticus*	www.broadinstitute.org/science/projects/mammals-models/vertebrates-invertebrates/tilapia/tilapia-genome-sequencing-project	Sequencing is currently done
	http://reprobio.nibb.ac.jp/	Gonad cDNA sequences

Table 2. Examples of databases containing strain-specific data and genetic data reflecting intra specific variability

Scope	Internet address	Information provided
Fishbase strain related data: Tilapia and carp	Fishbase.org	Strain code, stock definition, reference.
US National Fish strain registry: Salmonidae, Ictaluridae, Acipenseridae, Polyodontidae, Percidae, Centrarchidae	https://systems.fws.gov/nfsr/ This database is not public use	Performance information on managed wild and domestic broodstocks, currently e.g. 418 strains of rainbow trout, 113 of brown trout.
Species kept in aquaculture in Germany: mostly Salmonidae, Cyprinidae,	http://agrdeu.genres.de/agrdeu/index Most information is not public, access on request	Inventory, morphological characteristics and performance traits of broodstocks, genetic characterization of selected broodstocks
Commercial marine fish species from European waters	www.fishtrace.org/	Genetic data of voucher specimens from different localities (Cytb and Rhodopsin) from more than 200 commercial marine fish.
Marine species of interest for the Canary, Spanish and European Union fisheries	Pescabase.org	92 species, very Fishbase-like, additionally Cytb and Rhodopsin sequences. In Spanish!

Table 3. Databases related to *ex-situ* collections of aquatic genetic resources

Scope	Internet address	Information provided
Animals	www.ars-grin.gov:8080/j2ee/nagppub/jsp/nagp/drilldown2.jsp	Genebank resources from aquatic invertebrates, freshwater and marine fish (mostly semen) (e.g. 730 specimens of freshwater freshwater fish, 15 marine fish, 213 aquatic invertebrates).

SEALIFEBASE

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Brief historical overview of the information system/network/fisheries organization

SeaLifeBase is an information system for marine organisms other than fish (about 200 000 species), patterned after FishBase. For each species included, SeaLifeBase aims to provide available biological information necessary to conduct biodiversity and ecosystem studies, taking advantage of lists of species already available on paper and electronically, and using the scientific names as 'hook' to organize biodiversity information. SeaLifeBase, born in 2006 with funding from the Oak Foundation (Geneva, the Swiss Confederation), is headed by Daniel Pauly (Principal Investigator) and run by Maria Lourdes D. Palomares (Project Coordinator), both of the Sea Around Us Project (Fisheries Centre, University of British Columbia, Vancouver, Canada) in close collaboration with the FishBase Project. FishBase and SeaLifeBase together make a potentially powerful information tool that covers all life from the world's oceans, a mandate which the FishBase Consortium embraced in 2008 when SeaLifeBase was accepted into its fold.

Structure and scope of the information system/network/fisheries organization

The structure of the SeaLifeBase information system is the same as that used by FishBase (see www.fishbase.org/manual/English/fishbasefishbase_has_60_main_tables.htm). The main difference between FishBase and SeaLifeBase lies in their taxonomic backbones. FishBase, though in itself a global species database for one species group, i.e. fishes, measures its taxonomy with that of the Catalog of Fishes (CoF). SeaLifeBase, on the other, covers different marine species groups, and thus, does not have one, but several global species databases making up its taxonomic backbone, the major ones of which are the Catalogue of Life (CoL) and the World Register of Marine Species (WoRMS), the first is enhanced by the second and the second is enhanced by smaller species databases which contribute to it. In spite of these two large aggregators, a lack of species databases remained for some inconspicuous groups. Because of this, SeaLifeBase opted to standardize into digital format published checklists of smaller invertebrate groups, e.g. sipunculids, and encode them much like FishBase did for fishes before the CoF was made available as a taxonomic backbone. Thus, SeaLifeBase may include species which are still not found in either the CoL or in WoRMS and which are, thus subject to taxonomic scrutiny.

Type of information included or generated

As of 7 December 2010, SeaLifeBase contained 135 239 scientific names of marine metazoans; 86 percent of which are valid scientific names; 44 percent of which are valid names from our taxonomic provider (Catalogue of Life) and 56 percent were encoded by our Philippine encoding team from independent sources (published reviews, guides, catalogues, etc.). SeaLifeBase covers 941 commercially important species whose commercial statuses were verified with the Sea Around Us and FAO databases. SeaLifeBase also contains 25 320 common names for 9 138 species. SeaLifeBase's geographical content is complete for 37 309 species, 98 percent of which are assigned to FAO areas, 90 percent are assigned to countries, and 81 percent are assigned to ecosystems (mostly large marine ecosystems). There are 1 548 species with bounding boxes for mapping purposes, 33 percent of which are provided with AquaMaps.

SeaLifeBase is updated annually for the IUCN and CITES status for all threatened species updated except Scleractinia (which is only 24 percent updated).

Search tools

The SeaLifeBase Web search page was made available through www.sealifebase.org in June 2008. In-house testing was done on March 2008 and collaborator testing was completed in May 2008. The search page was patterned after the FishBase Web search page which provides species search by common names, scientific names, country and functional group.

Checklist tools

The SeaLifeBase Web search page provides listings of species by country, functional groups, and ecosystems.

Strategies of collecting, inserting, validating, compiling and sharing information

TECHNOLOGY AND METHOD

The FishBase database and Web site structures were used as a shell. Graphical charts were progressively modified and fields were adapted in tables where some aspects of the taxonomic groups required changes. The FishBase IT Team is consulted for suggested and new developments in SeaLifeBase. Changes in SeaLifeBase as approved by the FishBase IT Team are adapted in FishBase and all changes in FishBase are concurrently adapted in SeaLifeBase.

STRATEGY OF DATA ENCODING

Scientific Names

All information at species level is hooked to scientific names. Taxonomic references validate the choice of the current accepted names. Synonyms are not priority (unless in electronic format). The source is always recorded.

Distributions

In addition to the country, the state/provincial levels are considered. A geographic standard was established for the marine areas on the same model as the TDWG geographic standard for the terrestrial areas.

Maximal Size

This data is a crucial key point for biodiversity and ecosystem studies, but rarely available from electronic sources. This information is extracted on opportunistic basis mainly from FAO publications and printed monographs. Targeted species searches were performed for important species, e.g. threatened, invasive and commercially important species.

Habitats

This information is rarely available from electronic sources. Moreover, various standards are used, and may depend on the taxonomic group. The FishBase standard is used after it is reassessed and completed for invertebrates.

Growth, Food and Reproduction

This information is extracted on opportunistic basis when large datasets are available. A priority list of desired data was established at the beginning of the project, using the selection criteria established for FishBase. Targeted species searches were also performed for important species, e.g. threatened, invasive and commercially important species.

Constraints and limitations

Since information system development is tied up with that of FishBase, SeaLifeBase suffers from implementation delays. Also, SeaLifeBase follows priorities set by the Sea Around Us project and the FishBase Consortium, which may not necessarily be compatible. Finally, SeaLifeBase can include only CoL and WoRMS checked names; like FishBase, it may suffer from lack of studies on some important species groups which have escaped scientific scrutiny but which are or may be caught for consumption, e.g. small squid species or shrimps.

FAO WORLD AQUACULTURE STATISTICS DATABASE: AN INTRODUCTION

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Fisheries and Aquaculture Department
The Food and Agriculture Organization of the United Nations
Rome, Italy

The Database and its purpose

The Food and Agriculture Organization of the United Nation (FAO) is the only international body that is mandated to collect and disseminate the fisheries and aquaculture related statistics globally. As a regular programme activity of FAO, the World Aquaculture Statistics Database is maintained and updated annually by the Statistics and Information Service (FIPS) of Fisheries and Aquaculture Department, FAO. To maintain such a database is to provide official knowledge and information system for the purpose of monitoring and assessment of the status and trend in the aquaculture development, including natural resource utilization, to facilitate the policy formulation and decision making in aquaculture development.

Sources of information and statistic data

In terms of the sources, there are generally three types of statistic data stored in the database maintained by FAO Fisheries and Aquaculture Department.

1. Data reported by national reporting offices: These statistic data are collected by FAO annually through specially designed questionnaires, in both hard copies and electronic forms, sent to and returned by the national or territorial fisheries authorities. This is the most important source of information and data for annual update of the database.
2. Data retrieved from the national statistics product(s): For each year, if some national authorities could not report the data directly to FAO in the required structural format for reporting, FAO retrieves the aquaculture statistic data from their national statistics product(s) (such statistic yearbooks) obtained through the national reporting offices or other possible channels.
3. Data estimated by FAO: For certain non-reporting countries, if it's not possible for FAO to retrieve the statistic data, FAO would make estimates for these countries based on indirect information available to FAO. However, such data are clearly labelled as "FAO estimates".

For a particular country, it is possible that its aquaculture statistic data time series in the FAO database consists of a mixture of all the aforementioned three types of data. It is also possible for a country to have a mixture of the three types of data for a particular year or years.

Nature of the Database

To a great extent, the FAO World Aquaculture Statistics Database could be considered an information system that illustrates the worldwide status and trend in the utilization of aquatic genetic resources by the aquaculture sector. Because the information contained in the database is both quantitative and qualitative in nature, the database is perhaps the only one that quantitatively measures and monitors the aquatic genetic resources utilization for aquaculture on a global scale. Being a statistics database, it is different from other databases dealing with aquatic biodiversity that are primarily taxonomic in nature.

ASFIS List – One of the standards for aquaculture statistics

Although the FAO World Aquaculture Statistics Database is NOT a taxonomic database, the basic framework and scientific knowledge in taxonomy have been used to set the basis for the database to sort and organize the aquaculture statistic data. The ASFIS List of Species for Fishery Statistic Purpose, simply known as ASFIS List, is used by FAO as the international standard to classify the statistic data for aquaculture production statistic data (also for capture production statistics). ASFIS stands for Aquatic Sciences and Fisheries Information System. The ASFIS List enables FAO to collate and classify aquaculture statistic data at species, genus, family or higher taxonomic levels in statistical categories called "species items" in the ASFIS List. The ASFIS List is maintained and updated in March-April every year by the Statistics and Information Service (FIPS) of FAO Fisheries and Aquaculture Department, and it is published online at www.fao.org/fishery/collection/asfis/en.

The most recent ASFIS List published in March 2010 contains 10 900 species items. The species items can be grouped into nine divisions according to the International Standard Statistical Classification for Aquatic Animals and Plants (ISSCAAP).

1. Freshwater fishes
2. Diadromous fishes
3. Marine fishes
4. Crustaceans
5. Molluscs
6. Whales, seals and other aquatic mammals
7. Miscellaneous aquatic animals
8. Miscellaneous aquatic animal products
9. Aquatic plants (algae)

What are contained in the database presently?

The database contains globally collected aquaculture production quantity data time series starting from the reference year 1950, as well as the production value data time series starting from the reference year 1984.

Aquaculture countries

There were 166 countries and territories recorded with aquaculture production in 2008, including three first time additions, namely Angola, Timor-Leste and Zanzibar. Twenty four countries and territories with historic record of aquaculture production show no production in 2008 including those that ceased to exist (such as ex-Yugoslavia).

Number of aquaculture species

1. The largest number of species items recorded in FAO aquaculture statistics database, such as Nile tilapia (*Oreochromis niloticus*) and Silver carp (*Hypophthalmichthys molitrix*), refer to single taxonomic species.
2. There are many species items that refer to groups of species, that could be under various level of taxonomic division, such as "Cyprinids nei" (any number of species in the family of Cyprinidae) and "Groupers nei" (*Epinephelus* spp.).
3. A few species items refer to certain hybrids, such as "Striped bass, hybrid" (*Morone chrysops* x *M. saxatilis*) and "Catfish, hybrid" (*Clarias gariepinus* x *C. macrocephalus*).
4. Within aquaculture, some subspecies are used for culture for certain desirable traits. However, the ASFIS list does not accommodate subspecies. Nationally reported data on subspecies have to be merged or aggregated to the species level for storage in the FAO database.

Table 1 below shows the number of species items ever recorded as cultured in the FAO aquaculture statistics database and the number that were cultured and harvested in 2008. The actual number of food fish species in taxonomic terms cultured in 2008 worldwide should be greater than 333 because some species items reported by certain countries included the production of more than one species, and the productions of such species have never been reported individually. For example, snubnose pompano (*Trachinotus blochii*) and tongue sole (*Cynoglossus semilaevis*) have been farmed in the People's Republic of China, but their production has been invisible at national level statistics because they both have been reported in aggregation, along with many other species, as "marine fishes nei", and there is no other country reporting on these two species.

Quantitative vs qualitative

When dealing with the data reported to FAO in aggregated form for a mixture of more than two species, it has always been a struggle to strike a balance between the qualitative information and the quantitative information that FAO aquaculture statistics database would illustrate. Splitting the aggregated data to associate with more species could illustrate details about the diversity of aquatic genetic resources being utilized by aquaculture production. But, if the splitting is done with inadequate information pertaining to the ratio between/among the species reported in aggregation for production, the data accuracy may be lost.

Access to the Database, data uses and analysis

Dataset: Freely available/downloadable online, for use with FAO's specially developed data handling software called FishStat plus.
Query panel: Online, www.fao.org/fishery/statistics/global-aquaculture-production/query/en
Yearbooks: State of World Fisheries and Aquaculture (SOFIA)

What information is missing?

- Aquaculture area statistics.
- Aquaculture facilities statistics: information regarding farming systems is collected as part of the FAO questionnaire, but not analysed.
- Seed production statistics from aquaculture hatcheries, information regarding hatchery/nursery operations is collected as part of the FAO questionnaire, but not analysed.
- Production statistics of wild collection of seeds for use in aquaculture.
- Non-food aquaculture production statistics (ornamental, etc.).
- Interim products (live food organisms, etc.).
- Aquatic macrophytes.

Table 1. Number of species items ever recorded as cultured in the FAO aquaculture statistics database and the number that were cultured and harvested in 2008

	Food fish	Algae	Total
Number of "species items" ever recorded as cultured	451	29	480
Number of "species items" recorded as cultured in 2008	333	25	358

EXECUTIVE SUMMARY OF BACKGROUND PAPER 1

PREPARATION OF A FIRST REPORT ON THE STATE OF THE WORLD'S AQUATIC GENETIC RESOURCES: KEY ISSUES AND PROPOSED PROCESS

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Aquatic genetic resources, for the development of sustainable and responsible aquaculture and capture fisheries, are included within the Multi-year Programme of Work of the FAO Commission on Genetic Resources for Food and Agriculture, which calls for the preparation of a first report on The State of the World's Aquatic Genetic Resources. Key issues and a recommended preparatory process and costs are presented here. The information base on aquatic genetic resources will be reviewed in a parallel report.

Aquaculture and capture fisheries provide about 50 percent each of the world's supply of about 100 mmt of food fish and fish products. Seaweed farming produces over 15 mmt of aquatic products, worth over US$7 billion. Farmed and wild-harvested fish (finfish and aquatic invertebrates) and aquatic plants (seaweeds and freshwater macrophytes) are vital contributors to world food security, especially for provision of animal protein, micronutrients and essential lipids, as well as livelihoods for the producers, processors and sellers of food, ornamental, sport and bait fish. Aquatic genetic resources underpin the productivity and sustainability of all of these activities.

Aquaculture involves the farming of over 300 species of finfish, molluscs, crustaceans and other invertebrates, about 50 species of microalgae and invertebrates as food organisms in hatcheries, about 20 species of seaweeds, over 30 species of freshwater macrophytes, and a few species of amphibians and aquatic reptiles. Capture fisheries for food, industrial (fishmeal and fish oil), ornamental, and sport and baitfish species target many more species, probably as many as 5 000. The productivity and sustainability of aquatic ecosystems depend upon many species of aquatic microorganisms, some of which are cultured as fish feeds or probiotics. Marine Genetic Resources in Areas Beyond National Jurisdiction (MGRs in ABNJ), including some of the biota associated with hydrothermal vents, are thought to have high potential value.

This report summarizes the following key issues for a first report on The State of the World's Aquatic Genetic Resources: information; policy; capacity building; economic value, access and benefit-sharing; threats and countermeasures; climate change; alien and invasive species; diseases and parasites; ecosystem approach; biotechnology; biosafety, biosecurity and precaution; *in situ* conservation on farms; *in situ* conservation in open waters and wetlands; *ex situ* conservation; twinning conservation and production; properties and prospects for the major production systems – inland and marine aquaculture, inland and marine capture fisheries, culture-based fisheries, capture-based aquaculture; MGRs in ABNJ; and cross-sectoral collaboration.

Aquaculture (farming) and capture fisheries (hunting) have largely separate institutions, policies, legislation and governance, but share some of the same aquatic genetic resources and ecosystems. This has few parallels in agriculture. Applications of genetics in aquaculture and in the management of capture fisheries are less developed than in the farming of crops and livestock, but fish breeding programmes and fish genomics are advancing rapidly. Aquatic genetic resources, for much of aquaculture and for almost all capture fisheries, are wild types and wild populations.

The scope of a first report on The State of the World's Aquatic Genetic Resources must be broad and inclusive, though there are options concerning whether or not to cover the important aquatic plants, aquatic micro-organisms and farmed aquatic animals that are not being covered in other State of the World reports. The recommendation here is to include all of the above, so as to contribute as fully as possible to the Commission's eventual goal of a comprehensive report on The State of the World's Biodiversity for Food and Agriculture. MGRs in ABNJ should also be included, in order to help FAO to respond to a request from the UN General Assembly.

State of the World reports for plant, animal and forest genetic resources are based largely on country reports, for which substantial capacity building is always needed, with regional workshops and stakeholder consultations. International, regional and other organizations, experts and, where possible, the private sector, furnish additional reports. Thematic Background Studies are commissioned to review key issues and to fill gaps. Preparation of the first report on The State of the World's Aquatic Genetic Resources will require similar sources and activities. A State of the World report must be widely reviewed before its final publication, which is typically accompanied by a large International Technical Conference.

For aquatic genetic resources, this preparatory process will require parallel strengthening of information systems and databases, for their progressive use at national and regional levels, through capacity building.

The process requires a strong hub at FAO, adequately staffed to drive, coordinate and complete all activities, up to and including publication of the report. The process relies heavily on the hiring of consultants and on productive partnerships with international, regional and national organizations and networks.

Preparation of the first report on The State of the World's Aquatic Genetic Resources will strengthen the FAO Code of Conduct for Responsible Fisheries and contribute to improvement of aquaculture and capture fisheries statistics and the FAO Fish Finder Programme.

Considering the importance of aquatic genetic resources for world food security and their historical neglect compared with the attention given to plant, animal and forest genetic resources, it is clear that a thorough process and substantial investments will be needed to prepare the first report on The State of the World's Aquatic Genetic Resources. The process proposed here follows largely the same processes used for preparing State of the World Reports on plant, animal and forest genetic resources.

The report's scope should include all aquatic organisms of current and potential future importance, in aquaculture and capture fisheries, to produce human food, provide livelihoods and contribute to human health and well-being. Genetic resources of ornamental fish, sport fish and bait fish, fish of importance in ecotourism and fish used for medicinal purposes should also be included. The report should also cover important aquatic plants and microorganisms that provide food and other benefits to humans, as well as MGRs in ABNJ and the farmed amphibians and aquatic reptiles that are not considered to be animal genetic resources. The current importance and potentials of aquaculture, inland and marine fisheries, and of target species for use in human food chains or for provision of livelihoods, all vary greatly among countries.

The main sources of data and information for the first report on The State of the World's Aquatic Genetic Resources will be Country Reports on Aquatic Genetic Resources and Reports from International and Regional Organizations and the private sector, together with Thematic Background Studies. The process requires capacity building from its outset, together with the improvement of structures for the collection, compilation and sharing of information on aquatic genetic resources.

FAO will request the establishment of National Focal Points on aquatic genetic resources. Detailed guidelines for the preparation of country reports will be prepared and reviewed thoroughly before being finalized and sent out. Upon requests, FAO and its partners will provide technical assistance for the preparation of country reports. FAO will convene regional and subregional meetings, covering both aquaculture and capture fisheries, to review Country Reports and to discuss common issues.

FAO will provide technical coordination for preparation of the first report on The State of the World's Aquatic Genetic Resources. The FAO Fisheries and Aquaculture Department is well positioned to coordinate its preparation, and to ensure cooperation with other FAO, UN and other organizations. The FAO Committee on Fisheries (COFI), its Sub-Committee on Aquaculture, the FAO Regional Fisheries Commissions and other relevant bodies will be informed and invited to comment.

FAO will seek cooperation and synergy with global programmes and organizations such as, *inter alia*: the Convention on Biological Diversity; the Millenium Development Goals and the Millenium Ecosystem Assessment; the Ramsar Convention on Wetlands: the UN Environment Programme; the Convention on International Trade in Endangered Species; the UN Convention on the Law of the Sea; the UN Fish Stocks Agreement; the UN Framework Convention on Climate Change; the Consultative Group on

International Agricultural Research; the International Union for the Conservation of Nature and Natural Resources and the World Wildlife Fund; the Marine Stewardship Council; the Marine Aquarium Council; and Ornamental Fish.

Intergovernmental and non-governmental organizations will be invited to report and, where appropriate, to become partners in this process including, *inter alia*, those established for specific subregions, ecosystems, seas, lakes, rivers, water basins, conservation, and product certification; ornamental fish, sport fish, and bait fish. An indicative cross-section of private aquaculture, commercial fishing, aquarium, sport and bait fish corporations will also be invited to report their activities for aquatic genetic resources.

This process would benefit from the establishment, as and when deemed by the Commission to be appropriate and necessary, of an Intergovernmental Technical Working Group on Aquatic Genetic Resources, having the same size (27 Commission Member Nations) as those for terrestrial genetic resources for food and agriculture (plant, animal and forest), but with a regional composition to reflect the regional importance of aquaculture and fisheries including, for example, the whole Asia-Pacific Region. The following regional composition is suggested in terms of numbers of participating countries: Africa, 5; Asia-Pacific, 7; Europe, 5; Latin America/Caribbean, 5; Near East, 3; North America, 2.

A consolidated first draft of The State of the World's Aquatic Genetic Resources will be made available for review: through National Focal Points; by an Intergovernmental Working Group on Aquatic Genetic Resources; and, subject to available resources, by convening a Technical Consultation for the purpose.

The proposed timeline is as follows. At the Commission's Thirteenth Regular Meeting in 2011, endorsement will be sought for the preparatory process. Given that endorsement, FAO will invite all member countries to establish their National Focal Points by December 2011. FAO will convene an Expert Consultation on Aquatic Genetic Resources in the last quarter of 2011: to review all materials available for the process and, in particular, to consider Draft Guidelines for Country Reports on Aquatic Genetic Resources, prepared by FAO staff and consultants in advance of the meeting. The Guidelines for Country Reports on Aquatic Genetic Resources will be finalized by March 2012 through review by members of the Commission and by experts.

FAO will request the preparation of Country Reports, to be submitted by 31 December, 2012. Their preparation will be assisted through capacity building workshops, covering wherever possible, aquaculture and capture fisheries at the same meetings and taking advantage of combining these with other international and regional aquaculture and fisheries meetings during 2012. Regional workshops will be held in Asia-Pacific; Europe; Latin America/Caribbean; sub-Saharan Africa; and North Africa/Near East. Regional aquaculture and capture fisheries organizations will be invited to host or cohost these meetings. Concurrently, international and regional organizations and others will be informed of the process and invited to prepare reports on their activities in relation to aquatic genetic resources for submission by 31 December, 2012. The preparation of the Thematic Background Studies will be initiated in 2011 for their completion by March 2012, subject to the availability of financial resources.

Subject to the receipt, appraisal and collation of sufficient Country Reports, as well as Reports from International and Regional Organizations and the private sector and the completion of Thematic Background Studies, a first draft report on The State of the World's Aquatic Genetic Resources will be presented to the Commission at its Fourteenth Regular Session in 2013. If this is not possible, because of insufficient numbers of reports received and/or insufficient time for appraisal, collation and drafting, a progress report will be submitted. The review process in advance of that session will involve: members of the Commission; the Intergovernmental Technical Working Group on Aquatic Genetic Resources, if established; and experts.

A draft consolidated report on The State of the World's Aquatic Genetic Resources will be prepared by FAO in early 2014; for further review by governments and stakeholders, by an Intergovernmental Technical Working Group on Aquatic Genetic Resources, and by experts. FAO will then prepare a final draft The State of the World's Aquatic Genetic Resources, for consideration of the Commission during its Fifteenth Regular Session in 2015. The final draft of the first The State of the World's Aquatic Genetic Resources will also be presented to the FAO Committee on Fisheries and its Sub-Committee on Aquaculture, the Conference of Parties to the Convention on Biological Diversity, and other relevant bodies.

A senior officer of the FAO Fisheries and Aquaculture Department will be assigned full-time responsibility to coordinate the preparation of The State of the World's Aquatic Genetic Resources and will be supported by an APO and a visiting scientist, in order to establish the necessary hub at FAO, as well as by consultants.

Total indicative costs, all as extra-budgetary resource requirements, for the overall process to prepare the first report on The State of the Worlds Aquatic Genetic Resources are estimated at US$ 4 757 300. This will provide the necessary hub at FAO; to support the full participation of countries in the process, including assistance for the preparation of Country Reports, the convening of national consultations and workshops, and participation in regional meetings; to hire consultants; to conduct expert meetings; to prepare Thematic Background Studies; to organize regional meetings, to undertake reviews of the first draft of The State of the World's Aquatic Genetic Resources; and to complete final editing and layout.

EXECUTIVE SUMMARY OF BACKGROUND PAPER 2

STATUS REPORT ON THE EXISTING INFORMATION BASE FOR AQUATIC GENETIC RESOURCES

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The present assessment of existing information sharing systems and databases on aquatic genetic resources has identified that the existing FAO data collections and a few information sharing systems that targeted fish, algae and general marine resources, are key sources of information on AqGR and their use for food and agriculture. The majority of these are focused at the species level, although they may variously contain some information related to population, stock or subspecies structure, as well as DNA sequence. Small, local databases recording intraspecific variation, fish stocking histories or breeds and varieties of fish exist, but they are not easily accessed and the scope is highly limited. Information is scattered, not easily accessible and insufficient regarding the scope and the aim proposed for the future State of the Worlds' Report.

Large databases aimed at recording global diversity, at the ecosystem or species level, or focused on gene sequence or molecular level include aquatic species as part of their effort but are not necessarily focused on them. There are major gaps in recording of aquatic genetic variation at levels below that of the species, and for different kinds of resource (such as gene variants, gametes, aquaculture strains).

Lack of data and information and inadequate standardization has resulted in poor understanding of the status and trends of AqGR to support sound management of the resources, which has resulted in unsustainable practices in some instances. There is, however, growing recognition that genetic information will be increasingly important to support more efficient, responsible and sustainable production from aquaculture and fisheries, as well as for enhanced food security, and to ensure increased national control of AqGR and improved traceability. There is also an increasing body of information on genetic resources for aquaculture and on genetically distinct fish stocks and cryptic species, and an increasing need for more information to underpin sound management. At the same time, the technical difficulty and costs associated with collecting information on genetic diversity need to be recognized. The additional burden on the often overloaded capacity in developing countries must also be taken into account; and clear procedures for sustainable development set and implemented.

CONCEPT NOTE OF THE PROJECT "STRENGTHENING THE LINKAGES BETWEEN GLOBAL MAJOR PRIMARY DATABASES ON AQGR"

GATHERING, PUBLISHING, SHARING AND USING ACCURATE INFORMATION ON AQUATIC GENETIC RESOURCES, THROUGH FISHBASE, SEALIFEBASE AND ALGAEBASE

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RATIONALE

The FAO Commission on Genetic Resources for Food and Agriculture (CGRFA) has called for a first report on the State of the World's Aquatic Genetic Resources for Food and Agriculture, as part of its Multi-Year Programme of Work towards the preparation of a complete report on the State of the World's Biodiversity for Food and Agriculture.

The Commission, at its 11th Session, "agreed that improving the collection and sharing of information on aquatic genetic resources was of high priority" (page 10, sentence 60, CGRFA-11/07/Report). Furthermore, it "confirmed the need to review and strengthen information systems" (page 10, sentence 61, CGRFA-11/07/Report), i.e. the subject of the workshop held in Madrid 1–4 March 2011 at which the authors of this concept note participated as Biodiversity Information System experts.

The Commission's resolution provided a mechanism, through this workshop, to address the urgent need to gather, structure, and share information on genetic resources for already exploited and potentially exploitable aquatic species. It also made apparent the paucity of information on these genetic resources, notably at the stock, strain and population levels.

Stock, strain and population data are available for some of the aquatic species that make large contributions to human food security and nutrition. These data have not yet been used sufficiently to strengthen the management of responsible aquaculture and fisheries because of the weakness of information systems for aquatic genetic resources and the need for capacity building at these levels. Moreover, information at these levels and at the species level is scattered across publications and other sources that can be difficult and costly to access. This poses a serious barrier for the gathering, sharing and use of aquatic genetic resources information, especially in developing countries.

The well-established global information systems on aquatic biodiversity, such as FishBase, SeaLifeBase and AlgaeBase, are well positioned to become the means for crossing this barrier. They are already equipped to provide authoritative nomenclatural, geographical, biological and ecological information at the species level. With modest additional support, building upon their existing and planned structures, they can also provide well-correlated information at stock, strain and population levels. For species where such information is lacking, the species data already encoded may be used as a surrogate while waiting for more detailed studies to become available.

FishBase (www.fishbase.org) has information on all fishes of the world (more than 32 000 species) spanning fresh, brackish and marine waters. In spite of its name, SeaLifeBase (www.sealifebase.org), not only covers non-fish vertebrates and invertebrates from brackish water and marine habitats, but also commercially important freshwater species (about 115 000 species altogether). AlgaeBase (www.algaebase.org) contains information for 30 000 species of aquatic and terrestrial algae of the world.

The scientific structure and direction of FishBase and SeaLifeBase are governed by an international FishBase Consortium with membership as follows: FAO; a government body (the Chinese Academy of Fisheries Science, Beijing, China); an international NGO (WorldFish Center, Los Baños, Laguna, the Philippines); three museums (Natural History Museum, Stockholm, Sweden; Muséum National d'Histoire Naturelle, Paris, France; and Royal Africa Museum, Tervuren, Belgium); and three universities (IFM-GEOMAR, Kiel, Germany; Aristotle University, Thessaloniki, Greece; and the Fisheries Centre, University of British Columbia, Vancouver, Canada).

The FishBase Information Research Network (FIN), a Philippine-based NGO, acts as the administrative body for the FishBase Consortium and hosts the FishBase and SeaLifeBase teams in the Philippines. AlgaeBase is currently operated by its founder, Michael Guiry, on behalf of the National University of Ireland Galway, but is seeking a longer-term management structure that will ensure the continuance of the service to the worldwide community.

A critical *modus operandi* for all three information systems is their transnational operation, which capitalizes on worldwide scientific collaboration and cooperation, with extensive support from developed countries, and a stated intent to operate for the benefit of both developed and developing countries. These information systems provide cost-free and reliable, integrated information for all users, regardless of location and resources. The operators of these information systems, especially FishBase, are experienced in building capacities in developing countries for gathering, sharing and using information on aquatic biodiversity.

FishBase, SeaLifeBase and AlgaeBase together comprise the necessary taxonomic backbone and hierarchy that hooks pieces of data, including genetic data, to the species level. This backbone is the result of the compendium of expert-provided knowledge produced since Linnaeus. Because this backbone is in place and in use, the establishment of a data structure to encode more genetic information will be straightforward and highly cost-effective.

At its inception, FishBase was designed to store genetic information at the stock, strain, hybrid and population levels, and can easily be modified to include any life stage or production level as needed, e.g. broodstock, eggs, larval, and fry nurseries. This is true also for SeaLifeBase, which is patterned after FishBase. AlgaeBase, on the other hand, needs some adaptations, such as data structures for stocks, genetics and aquaculture, country and associated geographic information, FAO fisheries and aquaculture production, and treaties and conventions. The advanced structures of these three information systems makes the addition of features and data fields on genetics data straightforward. In response to the need to share and make widely available information on aquatic genetics data, it is thus proposed to enhance the structures and contents of FishBase, SeaLifeBase and AlgaeBase and to interlink them further with existing genetic information systems, such as GenBank. This work can be accomplished with funds not exceeding US$ 600 000, to be expended over three years, commencing with a workshop that will determine the information to be added for the enhancement of these three information systems, which are run by two independent institutions. The data that will be gathered and shared, for its progressive use by FAO and CGRFA Members, through these three information systems are seen as vital contributions to the preparation of the first report on the State of the World's Aquatic Genetic Resources for Food and Agriculture and thereby to ensuring good coverage of aquatic biodiversity in the State of the World's Biodiversity for Food and Agriculture.

HUMAN RESOURCES

In order to initiate the process of extraction and integration from published scientific literature, the FishBase, SeaLifeBase and AlgaeBase teams will need to hire two database programmers, one for FishBase and SeaLifeBase and one for AlgaeBase, which as outlined above requires some development; at least three additional full-time data extractors/encoders (preferably with primary degrees in genetics) under the direct supervision by the senior geneticists responsible for the genetics suite of tables, as well as on introduced species, all based with the FishBase team in the Philippines. The senior geneticists will work under the part-time guidance of scientific advisers and in collaboration with the FishBase Consortium.

ACTIVITIES

An initial workshop will be held, under FAO auspices, to bring database custodians and managers of related genetic resources activities in terrestrial food and agriculture sectors (plant, animal, forestry and micro-organism) together with the FishBase, SeaLifeBase and AlgaeBase teams and others, such as Bioversity International. The goal of the workshop is to exchange knowledge and experiences on database structure and to standardize terminologies, structures and protocols on genetic resources such that these can be applied to the development of the genetic suites of tables in FishBase, SeaLifeBase and AlgaeBase.

Table 1. Time required

Task/Person months	Programmer	Encoder	Supervisor/ Quality Control	Adviser	Total
Adaptation of AlgaeBase structure for genetic data	9			2	11
Synchronization of AlgaeBase and SeaLifeBase	3			1	4
Assignment of FishBase and SeaLifeBase species-level data to stock-level for a number of topics: life-history (growth, maximum age and length, mortality), spawning and reproduction, diet composition and feeding, genetics (e.g. allele frequencies)	6	12	3	4	25
Creation of new fields and tables in the structures of all 3 information systems as decided on in the workshop described above under activities	9		4	6	19
Compilation of priority data from published sources	6	108	12	6	132
Compilation of new data from Internet sources	3		6	6	15
Total number of person/months	36	120	25	25	206

Table 2. Timeline

Month	Event/Milestone
4	Initial workshop takes place
9	Workshop results integrated in all three information systems and all three ready for connection
12	List of major references for encoding finalized. First set of available data provided to SoWAqGR. Data updates will be provided on a monthly basis, in line with monthly updates of online systems' mirror sites, thereafter.
24	50 % of data from references encoded.
36	100 % of data from references encoded. All data verified and included in SoWAqGR.

Table 3. Budget

Item	Unit	No. persons or units	Cost/unit	Total
Personnel				
• Programmer 1	person year	1	$60 000	$60 000
• Programmer 2	person year	2	$25 000	$50 000
• Encoder	person year	10	$15 000	$150 000
• Supervisor/ Quality Control	person year	2.1	$30 000	$62 500
• Advisers	person month	25	$5 000	$125 000
Travel	number of trips	6	$2 500	$15 000
Operating cost	annual	3	$3 000	$9 000
Workshop				$50 000
Subtotal				$521 500
Overheads			$78 225	
Total				$599 725

ANNEX 1 – LIST OF PARTICIPANTS

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ANNEX 2 – PROSPECTUS

FAO INTERNATIONAL EXPERT WORKSHOP – IMPROVING THE INFORMATION BASE FOR AQUATIC GENETIC RESOURCES FOR THE STATE OF THE WORLD'S AQUATIC GENETIC RESOURCES

Background

The Commission on Genetic Resources for Food and Agriculture (CGRFA), at its Eleventh Regular Session, recognized the importance and vulnerability of aquatic genetic resources for their roles in an ecosystem approach for food and agriculture. The CGRFA agreed that its Programme of Work should include coverage of aquatic genetic resources for the development of sustainable and responsible fisheries and aquaculture.

The Programme of Work's major outputs and milestones in the area of aquatic genetic resources include:

- a review of the information base for aquatic genetic resources and the key issues for The State of the World's Aquatic Genetic Resources;
- the presentation of The State of the World's Aquatic Genetic Resources; and
- the development of elements related to the Code of Conduct of Responsible Fisheries aimed to maintain a broad genetic basis to ensure sustainable use and conservation of aquatic genetic resources.

The present workshop will focus on assessing the existing information base and information sharing systems on aquatic genetic resources and on ways of improving collection and sharing information regarding these resources. Special attention will be paid to explore ways and means of improving FAO member data collection at species level and the future strategy to follow in order to produce The State of the World's Aquatic Genetic Resources.

Scope

The workshop will consider aquatic genetic resources as broadly as possible: aquatic genetic resources which are relevant for human consumption, for use in food production and food processing, providing good and services for humans, as well as resources with a key role in agriculture ecosystems.

Objectives

The workshop will discuss and review two background papers:

Background Paper 1 – Preparation of a first report on The State of the World's Aquatic Genetic Resources: key issues and proposed process.

- Proposed process, structure and scope for The State of the World's Aquatic Genetic Resources.

Background Paper 2 – Status report on the existing information base for aquatic genetic resources.

- Main information sharing systems and databases for aquatic genetic resources, major information gaps and inconsistencies, and means and strategies to improve the collection, compilation and sharing of aquatic genetic resources information.
- Needs for upgrading collection, compilation and sharing of aquaculture and fisheries statistics (in relation to aquatic genetic resources) by FAO.

ANNEX 3 – AGENDA

TIME	ACTIVITY	PRESENTER/MODERATOR
	DAY 1	
08.45–09.00	Welcoming of participants	OESA, FAO and Spanish Ministry of Environment, Rural and Marine Environment (MARM)
09.00–09.15	Background information with regard to the CGRFA and MYPOW towards The State of the World's Aquatic Genetic Resources	Linda Collette
09.15–09.30	Main objectives of the workshop	FAO Fisheries and Aquaculture Department
09.30–10.30	Introduction of participants (with presentation of preliminary documents)	Participants
10.30–10.45	Tea/coffee break	
10.45–12.15	Introduction of participants (with presentation of preliminary documents)	Participants
12.45–14.00	Lunch break	
14.00–14:45	Introduction of participants (with presentation of preliminary documents)	Participants
14.45–15.30	Presentation of draft Background Paper 1	Roger Pullin
15.30–15.45	Tea/coffee break	
15.45–16.30	Presentation of draft Background Paper 2	John Benzie
16:30–18.30	Discussion of draft Background Paper 2 – structure/contents/potential gaps	John Benzie
	DAY 2	
09.00–11.45	FAO statistical data collections for fisheries and aquaculture: data reporting system, current status, main gaps and the way forward	Xiaowei Zhou
10.30–10.45	Tea/coffee break	
11.45–12.15	Group discussion: Main Information sharing systems for The State of the World's Aquatic Genetic Resources	Devin Bartley
12.15–14.00	Lunch break	
14.00–15.30	Group discussion: Improvement of information sharing systems for The State of the World's Aquatic Genetic Resources	Devin Bartley
15.30–16.00	Tea/coffee break	
16.00–17.15	Group discussion: Approaches to standardization of information for aquatic genetic resources	Roger Pullin
17.15–18.30	Group discussion: Approaches to upgrade the collection, compilation and dissemination of aquaculture and fisheries statistics by FAO	John Benzie
	DAY 3	
9.00–16.00	Field trip	All participants
12.00–14.00	Discussion with representatives of the private sector: The problem of data confidentiality – concerns and possible solutions	All participants
16.00–18.00	Group reflection on Background paper 1: Basic structure of The State of the World's Aquatic Genetic Resources	All participants
	DAY 4	
09.00–11.15	Discussion of draft Background Paper 2 – summary and final recommendations	John Benzie
11.15–11.30	Tea/coffee break	
11.30–13.00	Refinement of draft Background Paper 1 – summary and final recommendations	Roger Pullin
13.00–14.30	Lunch break	
14.30–16.00	Refinement of draft Background Paper 1 – summary and final recommendations	Roger Pullin
16.00–16.30	Final conclusions	Matthias Halwart
16.30–17.00	Closing	OESA and MARM