



ICLARM REPORT 1992



INTERNATIONAL CENTER FOR LIVING AQUATIC RESOURCES MANAGEMENT

6th 75-4-18

ICLARM REPORT 1992



**INTERNATIONAL CENTER FOR LIVING AQUATIC
RESOURCES MANAGEMENT**

MCPO Box 2631, 0718 Makati, Metro Manila, Philippines
Telephones: 818-9283, 818-0466, 817-5255, 817-5163

Cable: ICLARM MANILA; Telex: (ETPI) ICLARM PN, 4900010376 ICL UI (USA)
FAX: (63-2) 816-3183; E-MAIL: (CGNET) ICLARM, (SCIENCENET) ICLARM.MANILA

6501

ICLARM REPORT 1992

1993

Published by the International Center for Living
Aquatic Resources Management, Manila, MCPO Box
2631, 0718 Makati, Metro Manila, Philippines

Printed in Manila, Philippines

ICLARM. 1993. ICLARM Report 1992. International
Center for Living Aquatic Resources
Management, Manila, Philippines. 124 p.

Cover: Yellow snappers, important resources of
coral reefs. Photo by Rudic Kuitert

ISSN 0115-4494
ISBN 971-8709-46-0

ICLARM Contribution No. 1025

Foreword

A momentous year for ICLARM, 1992 saw an external program and management review by the Consultative Group on International Agricultural Research (CGIAR) in January, completion of the Center's strategic planning in March, admission into the CGIAR system in May and subsequent development of a Mid-Term Plan for the years 1994-1998. The mid-term planning work was still occupying staff time at the end of the year.

That so much research and related activities were nevertheless carried out as reported herein is a tribute to the dedication of staff at all levels to ICLARM and its social purpose, a feature of the Center well recognized by the external review team.

The concentration on planning, particularly for 1994-1998, has made 1992 the beginning of a transitional period for the Center. The report herein reflects this transitional nature by departing from the traditional focus on project activities. Instead it describes some of the research themes, their background and how they fit together towards aquatic resources management.

As this report of ICLARM's activities during 1992 was being prepared for publication, we were very pleased and fortunate to be able to announce that Dr. Meryl Williams, outstanding Australian scientist, was appointed Director General of the Center, effective April 1994.

We believe that ICLARM, in its new role as a CGIAR center and with a new dynamic leader, is well placed to fulfill its international mandate in aquatic resources research.

John Dillon

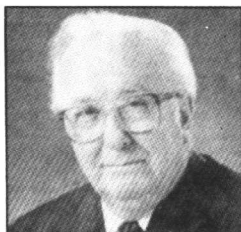
Chairperson, Board of Trustees

Laurence D. Stifel

Interim Director General

ICLARM Board of Trustees

- Dr. Peter A. Larkin (Chairperson) - University of British Columbia
- Dr. Dayton L. Alverson - Natural Resources Consultants, Inc., Seattle, USA
- Dr. Keishi Amano - Tokyo, Japan
- Dr. Agustin Ayala-Castañares - Institute of Marine Science and Limnology, National Autonomous University of Mexico (UNAM)
- Mr. Roberto Sebastian** - Philippine Department of Agriculture (ex-officio)
- Dr. Martin Bilio* - Deutsche Gesellschaft für Technische Zusammenarbeit (German Agency for Technical Cooperation)
- Dr. Barry Keith Filshie - Commonwealth Scientific Industrial Research Organisation, Australia
- Dr. Edgardo D. Gomez - University of the Philippines Marine Science Institute
- Dr. E.A. Huisman*** - Department of Fish Culture and Fisheries, The Netherlands
- Dr. Zimani David Kadzamira* - Chancellor College, University of Malaŵi
- Ms. Hannah R. King* - Food Production and Rural Development Division, Commonwealth Secretariat, London
- Dr. Kenneth T. MacKay - ICLARM Director General
- Dr. David Adolph Philipp Muller - South Pacific Forum Fisheries Agency
- Dr. Cornelia E. Nauen - Commission of the European Communities
- Dr. Nyle Brady** - Consultant to UNDP
- Dr. Masaru Fujiya** - Overseas Fishery Cooperation Foundation (Japan)
- Dr. Jacqueline McGlade** - University of Cambridge, UK
- Ms. Britha Mikkelsen** - COWIconsult, Denmark



Peter A. Larkin
Chairperson

Details of Board membership and committees are on p. 30-34.

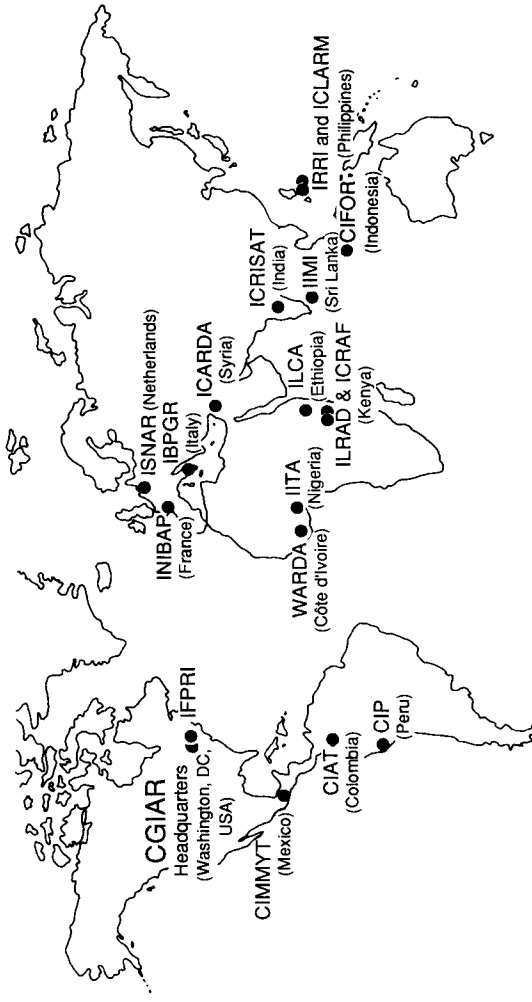
*Retiring Board members

**New Board members

***Resigning to join the Technical Advisory Committee of the CGIAR

The Consultative Group on International Agricultural Research (CGIAR) is an informal association of 41 public and private sector donors that supports a network of 18 international agricultural research centers. The group was established in 1971.

Consultative Group on International Agricultural Research (CGIAR) Centers



CIAT - Centro Internacional de Agricultura Tropical
 CIMMYT - Centro Internacional de Mejoramiento de Maíz y Trigo
 CIFOR - Center for International Forestry Research
 CIP - Centro Internacional de la Papa
 IBPGR - International Board for Plant Genetic Resources
 ICARDA - International Center for Agricultural Research in the Dry Areas
 ICLARM - International Center for Living Aquatic Resources Management
 ICRAF - International Council for Research in Agroforestry
 ICRISAT - International Crops Research Institute for the Semi-Arid Tropics

IFPRI - International Food Policy Research Institute
 IIMI - International Irrigation Management Institute
 IITA - International Institute of Tropical Agriculture
 ILCA - International Livestock Center for Africa
 ILRAD - International Laboratory for Research on Animal Diseases
 INIBAP - International Network for the Improvement of Banana and Plantain
 IIRI - International Rice Research Institute
 ISNAR - International Service for National Agricultural Research
 WARDIA - West Africa Rice Development Association

Contents

FOREWORD	v
ICLARM BOARD OF TRUSTEES	vii
CONSULTATIVE GROUP	
ON INTERNATIONAL AGRICULTURAL RESEARCH	viii
ICLARM'S STRATEGY FOR INTERNATIONAL RESEARCH	
ON LIVING AQUATIC RESOURCES MANAGEMENT	1
FROM FISHERIES TO AQUATIC RESOURCES	5
Towards An Understanding of Tropical Fisheries	6
Filling the Fisheries Management Tool Box	9
Tropical Fish Husbandry: From Art to Science	14
Teaching Scientists to Learn from Farmers	17
Conservation of Biodiversity	20
Intersectoral Issues	21
Passing the Message	24
Future Research: A Resource Systems Basis	27
ADMINISTRATION AND FINANCE	29
Governance	30
Board Officers and Committees, 1992	32
Statement of Revenues, Expenses	
and Fund Balance	35
1992 Sources of Support	36
MEETINGS ATTENDED, PAPERS PRESENTED	40
ADVISORY SERVICES, TRAINING, SEMINARS	48
PUBLICATIONS AND CONSULTANCY REPORTS	53
ICLARM STAFF	59
ANNEX: Project Descriptions	66
Coastal Area Management Program Project Summaries	
ASEAN/US Coastal Resources Management Project	66
Geographic Information System for Coastal	
Area Management and Planning (GISCAMP)	68

Resource and Ecological Assessment of San Miguel Bay, Philippines	70
Asian Fisheries Social Science Research Network	71
Capture Fisheries Management Program Project Summaries	
Tropical Fish Stock Assessment Project	76
Network of Tropical Fisheries Scientists (NTFS)	77
Socioeconomic Valuation of Coastal Resources of Southwestern Latin America	78
The ICLARM Software Project	79
Global Comparisons of Aquatic Ecosystems (ECOPATH)	80
Climate and Eastern Ocean Systems (CEOS)	81
Establishment of a Fisheries Database for the Development and Management of the National Fisheries of Sierra Leone	82
Improved Management of Openwater Fisheries in Bangladesh	84
Development of a Database on Fisheries Resources (FishBase)	86
Aquaculture Program Project Summaries	
Network of Tropical Aquaculture Scientists	89
Asia-Africa Cooperation to Develop Aquaculture Technology	90
Genetic Improvement of Farmed Tilapias	91
FARMBASE	94
Integrated Rice-Fish Research	96
Agricultural Research Project-II (Supplement)	98
Socioeconomic Impact of a Fish Culture Extension Program on the Farming Systems of Bangladesh	101
Research for the Future Development of Aquaculture in Ghana	105
Research on the Tilapia Genetic Resources of Ghana for their Future Conservation and Management in Aquaculture and Fisheries	106
Aquaculture Development in Africa: Learning from the Past and Implementing Research Results on Small-scale Farms	108
Coastal Aquaculture Centre Project Summaries	
Giant Clam Mariculture Project	115
Reef Ranching Research Project	119
Status of Cultivation of Pearl Oysters in the Indo-Pacific Region: A Review	120
Coastal Aquaculture Network	120
A Collaborative Investigation of Predation on Cultivated Giant Clams (Tridacnidae: Bivalvia)	121

ICLARM'S STRATEGY FOR INTERNATIONAL RESEARCH ON LIVING AQUATIC RESOURCES MANAGEMENT

In 1992, ICLARM published a Strategic Plan for its future international, strategic fisheries research. The Plan was developed at the request of the Consultative Group on International Agricultural Research (CGIAR - see opposite page) which had invited ICLARM to join the Group conditional upon developing a Plan acceptable to the Group.

One outcome of the Plan was a redefining of ICLARM's goal and objectives from the broad "Statement of Purpose" shown in previous Reports, to the following:

Goal

Improved production and management of fisheries resources for sustainable benefits of present and future generations of low-income users in developing countries.

Objectives

Through international research and related activities, and in partnership with NARS (National Aquatic Research Systems), to:

1. improve the biological, socioeconomic and institutional management mechanisms for sustainable use of aquatic resource systems;
2. devise and improve production systems that will provide increasing yet sustainable yields; and
3. strengthen national programs to ensure sustainable development of aquatic resources.

Below is a summary of the Plan and its development.

Rationale

Aquatic resources are important for livelihood and consumption. Fish, including finfish, crustaceans, molluscs and seaweeds, are the fifth most important agricultural commodity. Developing countries catch and produce 52 million tonnes annually, over half of the world production. At least 50 million persons are involved in small-scale fisheries.

There have been substantial increases in fisheries catches (35%) and aquaculture (100%) in the past decade. This, however, is misleading as it reflects exploitation of new stocks, heavy fishing pressure on previously fished stocks and a large increase in aquaculture in one country, China. A close examination reveals that most developing-country fisheries have levelled off or are declining. Their sustainability is threatened by overfishing, destructive fishing practices and land-based pollution. In aquaculture, major increases have occurred nowhere other than in China. In spite of these issues, there has been only limited international research effort directed to aquatic resources.

That there is a need for concerted research effort directed to aquatic resources for the benefit of low-income producers and consumers in developing countries was recognized as early as 1971 by the CGIAR but it was not until 1990 that they endorsed the recommendation by the Group's Technical Advisory Committee (TAC) to include fisheries research and invited ICLARM to develop a strategic plan as part of the process of ICLARM joining the CGIAR.

Process

The planning process involved all ICLARM professional staff, the ICLARM Board, and some 150 managers and scientists from other institutions.

ICLARM planning was facilitated by recent studies by the TAC, the International Development Research Centre (IDRC) and the Study of International Fisheries Research Needs for Developing Countries (SIFR). The SIFR reports were particularly useful as they included the findings of several task forces and missions to various regions of the developing world.

A resource system approach was developed to assist in setting priorities for research. Seven resource systems which reflect the aquatic habitats and the people who rely on the resource have been used. They are similar in concept to agroecological zones used in agriculture. The freshwater systems are ponds (including ricefields); reservoirs and lakes; and streams, rivers and floodplains; and in the marine systems, estuaries and lagoons; coral reefs; soft-bottom shelves; and upwelling area shelves.

The analysis showed that future gains in capture fisheries are possible, especially in coral reefs, upwelling areas and reservoirs. In coastal fisheries, a major concern will be sustaining them at present levels in the face of pollution and competing coastal resource users. Gains are also possible in aquaculture and enhanced fisheries in ponds, lakes and reservoirs.

Indications are that even without intersectoral conflict, the rate of increase in fish supply will not keep up with projected demand. The supply gap will be further challenged by those factors outside the sector: human population growth, domestic and industrial pollution, competing demands for the same resources, erosion and siltation from unsustainable agricultural and forestry practices, and the overriding but unknown consequence of global climate change. While difficult to predict, the

impact of these changes will be to reduce potential growth in fisheries resulting in an increased supply gap.

To decrease the supply gap will require concentrated strategic research. The research must help improve the management and sustainability of current fisheries and establish the biological and social basis for increased aquaculture and enhanced fisheries potential.

The research must focus on the interaction between populations of fish and humans. In addition, the guiding principles must be concern for gender, equity, sustainability, participation of users and a systems approach.

Thus, the priority for research in each resource system was derived by taking into account not only potential for gain but also "modifiers" as used recently by TAC - threats to sustainability and equity. Priorities were assessed on a regional basis.

Research Priorities

The seven emerging priority issues for ICLARM's international research using these criteria are:

- Sustainability of coastal fisheries systems
- Improved management of coral reef fisheries
- Improved fish productivity through genetics and husbandry
- Removal of socioeconomic and environmental constraints to aquaculture growth
- Development of farming systems
- Assessing and developing the potential for enhanced fisheries
- Strengthening of national research systems

Asia is to receive the highest priority for research and related activities, followed by SubSaharan Africa, Latin America/Caribbean and West Asia/North Africa.

Using the activity types of TAC, the types of research activities and their proportions to address the priority research issues above were determined to be:

Resource conservation and management	35%
Fish productivity	25%
Social sciences	20%
Institution building	20%

An assessment of the priority for each research type in the various resource systems concluded that the research will focus in ponds, estuaries and lagoons, and coral reefs.

Programs

The focus on resource systems provided the basis for research programs. There will be three research programs:

- Inland Aquatic Resource Systems (focusing on ponds)

- Coastal Resource Systems (focusing on estuaries, lagoons)
- Coral Reef Resource Systems (focusing on coral reefs)

This program structure allows a high degree of integration, with common themes and methodology underlying clear discrete thrusts to respond to the seven international research issues noted above.

A fourth program, National Research Support, will provide a strong institutional building role for ICLARM. Closely linked to the research programs, it will often rely on their output for NARS strengthening activities.

The Inland Aquatic Resource Systems Program will direct its research activities towards the adoption of sustainable inland aquaculture by resource-poor small-scale producers in three thrusts: improved fish productivity through genetic gain and better husbandry; development of integrated agriculture-aquaculture farming systems; and removal of socioeconomic and environmental constraints to aquaculture development.

The Coastal Resource Systems Program has a clear focus on the sustainability of coastal aquatic resource use. The Program aims to improve the biological, socioeconomic and institutional management mechanisms for sustainable use of coastal resource systems, involving both intra- and intersectoral issues. The Program will accomplish this by: understanding the dynamics of the resources; developing management strategies for the resources; and seeking to integrate management strategies into generalizable management options and policy recommendations compatible with sustainable coastal resource use.

The Coral Reef Resource Systems Program will focus on the sustainable utilization of the reef resources for the benefit of the adjacent coastal communities. This will be accomplished by addressing thrusts in: developing aquaculture and enhanced fisheries systems for coastal communities; understanding the interaction between people and the reef resources; and developing sustainable fisheries management systems suitable for coastal communities.

The National Research Support Program is designed to strengthen NARS through: information (publications, workshops, conferences); training (focusing on researchers); and assisting in priority setting of NARS research policy and research management.

The impact from these research and related activities on fisheries will be: improved fisheries management leading to sustainable increases in fisheries catches; increased aquaculture and enhanced fisheries production; and stronger national programs able to continue the research efforts for the benefit of low-income producers and consumers in developing countries.



FROM FISHERIES TO AQUATIC RESOURCES

ICLARM's research covers a broad spectrum of topics on aquatic and coastal resources. Most deal with aspects of managing the resources, through first understanding their dynamics, especially by models; through breeding programs and improved farming systems for cultured species; and through understanding the social, economic and institutional context of aquatic resource use.

For administrative purposes, the work is presently divided into three research programs - Coastal Area Management, Capture Fisheries Management, and Aquaculture - with a supporting Information Program.

As noted above in the summary of ICLARM's Strategic Plan, the Center's future research will focus on several aquatic resource systems and the program names will reflect those resource systems.

For this transitional report, we highlight aspects of the Center's research under rather different categories, which reflect common questions about ICLARM's role and features that have not been emphasized in our previous program-based reports.

Towards An Understanding of Tropical Fisheries

Underpinning any decision on aquatic resources management is the need for knowledge of the sustainable yields the resources can provide. In the tropics, the numbers do not come easily and ICLARM has been addressing this issue for over a decade.

In 1992, there was a continuation of efforts on two fronts to improve the level of advice that biologists can provide to managers of tropical fisheries: a broadening of perspective to embrace whole ecosystems on the one hand, and consolidation of our knowledge of individual fish resources on the other.

The Aquatic Numbers Game

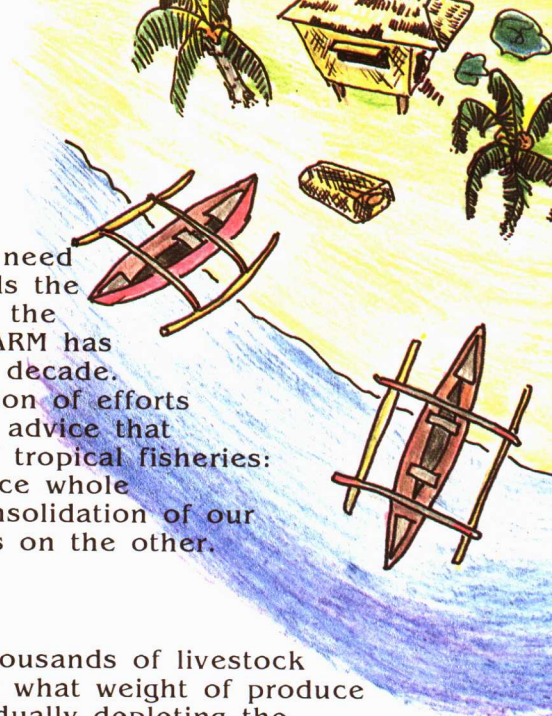
You have a large estate with thousands of livestock scattered over the land. How many or what weight of produce can you obtain each year without gradually depleting the stock? To find out, one simply needs to know their birth, growth and mortality rates, easily determined by observation.

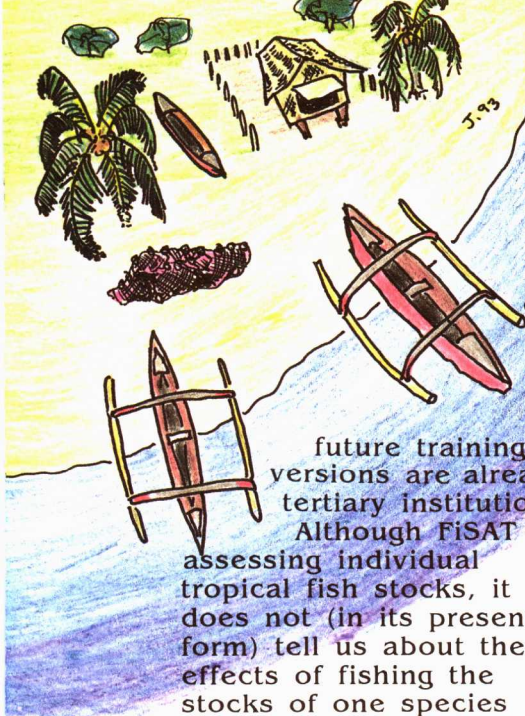
Now imagine making the calculations when you cannot see the animals on the estate. That is the situation for fisheries scientists. They can only see relatively minute samples of the stocks after they are caught - by traps and nets that are size selective. The samples are thus not very representative at all.

In the tropics, where ICLARM's research is centered, there are a few other complications. While our large estate in temperate areas would contain only a handful of important species, in the tropics there is a whole zoo! For example, hundreds of species make up a tropical trawl fishery. And one cannot easily tell the age of tropical fish, unlike their temperate counterparts.

ICLARM has pioneered methods to deal with this problem by using size (length) rather than age of fish as a basis of estimations. The manuals and software that have resulted from the research are used in many countries, both tropical and temperate. For the

Tropical trawl fisheries involve hundreds of species.





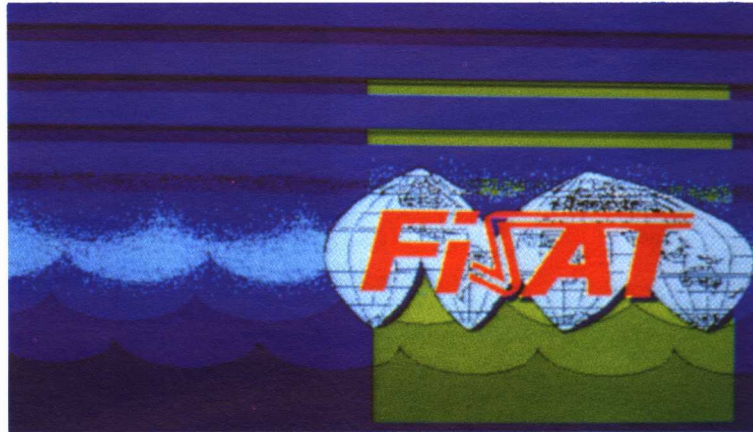
relatively short-lived fish of the tropics, the methods give information required by our hypothetical estate owner.

The culmination of this work is a joint FAO-ICLARM set of software incorporating routines from both organizations, called FiSAT: FAO-ICLARM Stock Assessment Tools (p. 79).

Development of this software began in 1989 and continued through 1992. It will be used by FAO and ICLARM in all

future training of scientists in stock assessment. Early versions are already being used by students in several tertiary institutions.

Although FiSAT represents the state-of-the-art in assessing individual tropical fish stocks, it does not (in its present form) tell us about the effects of fishing the stocks of one species on the stocks of all the other species nor the effects of concurrently fishing all species, but at different rates in multispecies, multigear tropical fisheries. More needs to be known about the ecosystem "framework" within which fisheries operate. New knowledge of ecosystems is coming from ICLARM's modeling research described below.



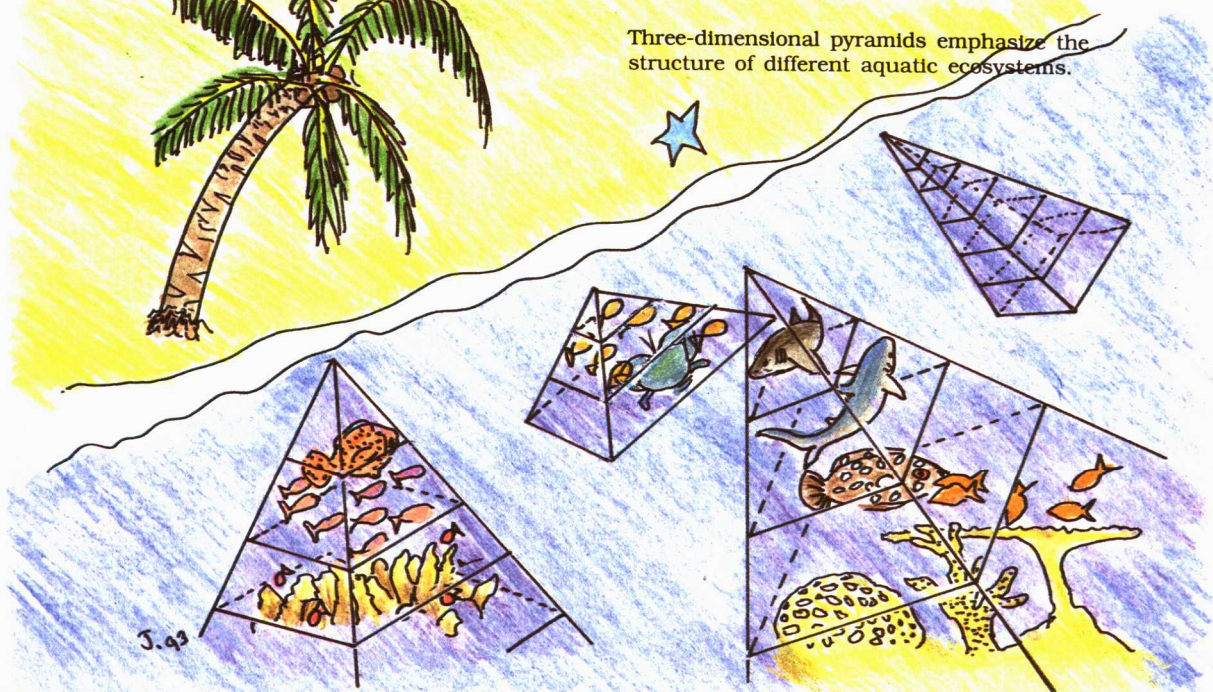
Pyramids of Aquatic Life

A fresh way of viewing ecosystems - as quantifiable three-dimensional pyramids of life - is a minor but significant outcome of ICLARM's ongoing investigations into the bases of fish production. The pyramids are simple representations of aquatic food webs.

These model pyramids can be altered to allow scientists to see the result of changes in the food web. What would happen to a coastal ecosystem if all the anchovies were caught? Is it more productive to catch all the fish that eat the anchovies or to catch the species that eat those fish? And on a coral reef, how much of the herbivorous fish should be left to make sure there is enough food for the prized groupers to eat (before they are harvested)?

A model which we have been developing since 1986, called ECOPATH II (p. 80), allows such questions to be answered - if there is enough information to construct the pyramids. The model also helps identify needed information and thus useful research directions.

Three-dimensional pyramids emphasize the structure of different aquatic ecosystems.



ECOPATH II and its pyramids are by no means whimsical toys. To understand their significance, it should be realized that in recent years, fisheries scientists have increasingly realized that predictions of yields and advice on management, based on species by species assessments and assuming constant predation rates, are not very accurate. The scientists' attention was focused on only one predator - humans. But humans are actually minor predators in aquatic ecosystems. Predation by other organisms in the aquatic milieu wipes out most individuals of most species before they can reach a size of interest to fishers.

In the North Sea, huge international research efforts were made in the 1980s to get a better idea of the true predation rates amongst the important fisheries species.

In the tropics, such large research projects are rare and, as mentioned, the fisheries (and the fisheries scientists) deal with hundreds of species, unlike the few species in temperate water fisheries.

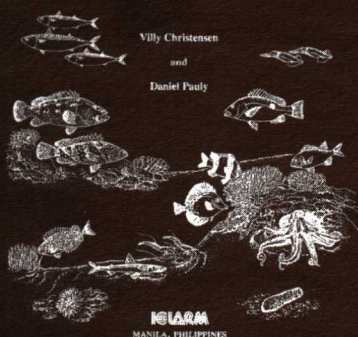
The precursor of ECOPATH II was initially developed for application to a Hawaiian coral reef area by Dr. J.J. Polovina of the US National Marine Fisheries Service. This model could be used to quantify the energy flows (predation primarily) in ecosystems in the relatively data-poor, species-rich tropics.

ECOPATH was then further developed at ICLARM to increase its flexibility and computational power as well as making it more user friendly. It uses easily obtainable data, yet is also applicable to describe ecosystems in temperate waters and in farming systems, ponds, rivers, lakes and oceans worldwide.

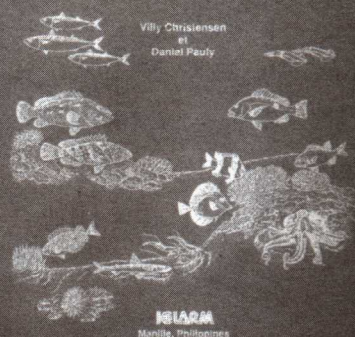
In 1992, a new version (2.1) of ECOPATH II was released to some 200 pilot users, and French and Spanish versions of the manual were released.

"No fish is an island" is the motto of the ECOPATH work.





ECOPATH II models of the four major upwelling systems of the world's oceans are being made as part of ICLARM's contribution to an international study on "Climate and Eastern Ocean Systems" (p. 81). The study is intended to determine the potential effects of global climate change on the living resources of these upwelling systems which support some of the world's richest fisheries.



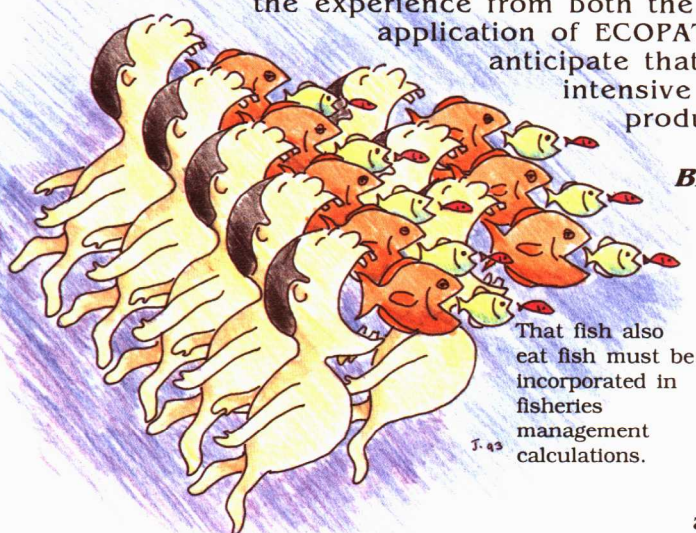
Filling the Fisheries Management Tool Box

Neither FiSAT nor ECOPATH II is sufficient to provide all the answers needed by decisionmakers for sustainable fisheries management. However, both can provide vital inputs into a new way of managing fish stocks. It is now generally accepted that it is necessary to incorporate interactions between the fish stocks in management: fish eat fish. In consequence, development of a suitable methodology for tropical fisheries is to be a priority research area for ICLARM in the future. Focus in the initial stages is on "tropicalization" of an approach called multispecies virtual population analysis (MSVPA). This is a data-intensive method presently used for assessment in several northern temperate systems. Using the methodology, it is possible to answer questions of the type: "what will happen if we increase the number of gill nets in this bay?," or "what consequences will it have on total catches and catch composition if we ban the use of fish corrals?" To answer such questions a dynamic model is needed. By incorporating

the experience from both the development and application of ECOPATH II and the MSVPA, we anticipate that a robust, not too data-intensive methodology can be produced.

Biological Software

Apart from the above, the electronic encyclopedia of fish, FishBase (p. 86), will become an essential component in future management. Under development by ICLARM, FAO and cooperating institutions and individuals, FishBase



That fish also eat fish must be incorporated in fisheries management calculations.