



**International Center for Living Aquatic Resources Management**

**A PROPOSED AGENDA FOR  
ADDITIONAL RESEARCH INTO LIVING AQUATIC  
RESOURCES MANAGEMENT, WITH EMPHASIS ON  
AFRICA AND WEST ASIA  
SUBMISSION TO THE  
TECHNICAL ADVISORY COMMITTEE  
OF THE  
CONSULTATIVE GROUP ON INTERNATIONAL  
AGRICULTURAL RESEARCH**

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## EXECUTIVE SUMMARY

ICLARM is proposing to conduct additional research into living aquatic resources management for Africa and West Asia from the existing facilities of the Central Laboratory for Aquaculture Research in Abbassa, Egypt. The formal development of ICLARM's proposal began in early June 1995 with planning for a workshop to be held in Cairo in late September 1995. The purpose of the workshop was to identify research needs and issues for the region.

ICLARM sought a comprehensive range of expertise and knowledge for the workshop, rather than representation of official country and organization views, and consulted widely to prepare a list of invited expert participants to the workshop. Invitations were sent to individuals and research organizations in Africa and West Asia, three regional governmental bodies, all CGIAR donors and other donor organizations, all CGIAR centers, international fisheries organizations, a number of international aquatic resource experts, and key ICLARM staff.

Six resource systems and research related activities were identified for discussion at the Cairo workshop as follows:

- Coral reef systems
- Coastal aquatic resource systems
- Inland aquatic resource systems
- African great lakes and reservoirs
- Co-management and social sciences
- Partnerships between NARS and ICLARM in Africa and West Asia

The following three sets of documents were used as inputs to the Cairo workshop:

1. Participants were asked to provide to ICLARM a brief description of the major fisheries, aquaculture, and aquatic resource research issues and needs for the Africa and West Asia region. These descriptions were summarized and tabled at the workshop.
2. Selected participants, including ICLARM staff, prepared brief background documents on a specific resource system or research related activity. These documents contained background information on the resource system or research related activity and a discussion of the relevant research issues and needs. These papers were also presented orally at the workshop.
3. A preliminary set of researchable issues was developed by ICLARM to provide a basis for discussion at the Cairo workshop. These researchable issues were developed in an objective fashion at an internal planning workshop held in Manila on 10 & 11 August 1995 by following a structured evaluation process. Particular attention was given to how the preliminary agenda fitted ICLARM's priorities as defined in its 1992 Strategic

Plan in combination with how the location and facilities at Abbassa could be utilized. These preliminary research ideas were included in the background documents prepared by ICLARM staff and were summarized in a document prepared for the Cairo workshop.

A total of 55 participants attended the Cairo workshop held from 23 to 27 September 1995. Participants came from 11 African and West Asian countries, one regional African body, two international bodies with interests in fisheries, four donor organizations, three CGIAR centers, fisheries experts from three countries, and ICLARM.

During the morning of the last day six working groups, corresponding to each of the resource systems and research related activities described above, met to develop a draft research agenda for each of these six topic areas. Each working group was provided with a set of suggested operational guidelines for developing the draft research agenda. The guidelines included a request to develop a list with a maximum of 9 researchable issues, and to assign 3 into each of high, medium, and low priority groupings. The working groups reported back to a plenary session on the afternoon of the last day.

On the day after the workshop (28 September) members of ICLARM's management team present in Cairo met to prepare a summary of the priority research issues resulting from the workshop. These were included as the recommended research agenda in a report presented to the Program Committee of the ICLARM Board on 29 & 30 September. In the report of the ICLARM management team to the Program Committee the research priorities were selected on the basis of their fit with:

1. ICLARM and CGIAR mandates
2. ICLARM's Strategic Plan and existing programs, including whether:
  - they will produce significant international goods likely to have a major impact on low income beneficiaries in Africa and West Asia;
  - they will contribute to resource sustainability;
  - ICLARM has a comparative advantage; and
  - the work will strengthen or contribute to ICLARM's overall capacity to deliver its mission.

A total of 23 research issues were identified by ICLARM's management team and were ordered into three groups:

- Group A- Coral reefs, coastal, and African great lakes resource systems (five researchable issues were identified for each of the three systems, for a total of 15 issues for this group)
- Group B- Inland aquaculture and reservoir systems (six researchable issues)
- Group C- Policy research (two researchable issues)

A fourth group (Group D) consisted of four activities aimed at fostering NARS partnerships and building NARS capacity.

The purpose of the Program Committee meeting was to consider the draft research agenda resulting from the Cairo workshop and to develop and approve a preliminary research agenda for Africa and West Asia that could be carried out by ICLARM from the Abbassa facility. The information available to the Program Committee was:

- All the background documents prepared for the Cairo workshop
- The minutes of the ICLARM Planning Workshop held in Manila on 10 & 11 August 1995
- The list of priority researchable issues resulting from the discussions by the six working groups on the last day of the Cairo workshop
- The summary of the priority researchable issues prepared by ICLARM's management team after the Cairo workshop

The list of priority researchable issues resulting from the Cairo workshop clearly exceeds realistic estimates of the resources that are likely to be available to conduct research and research related activities in Africa and West Asia. A priority setting process was developed for ICLARM's 1992 Strategic Plan to determine research priorities for the different resource systems, regions, and activity types. This process incorporated information on fish production, potential for increased production, and threats to sustainability and equity to determine priorities. While the Program Committee recognized that it was desirable to carry out a similar exercise to determine the research priorities for Africa and West Asia, there was insufficient time to obtain the detailed information required to perform the calculations for this region. These production figures and indices will be updated in the future to enable more detailed research planning to be carried out.

The Program Committee adopted a pragmatic approach to priority setting. Each member present assigned a score to each of the researchable issues described in the ICLARM management report from the Cairo workshop. The scores were based on each member's assessment of the priority for ICLARM to address that particular research issue in Africa and West Asia. The scores were then summed for each researchable issue to obtain a total score for each issue, and the issues then ranked from highest to lowest total score. The research related activities included in the section on fostering partnerships with NARS were not included in the priority setting process. These activities cut across all the resource systems and will need to be accounted for when assigning resources to the different activity types.

The Program Committee has decided to recommend to TAC that the top nine priority researchable issues identified through this priority setting process be supported. The top nine issues in priority order are:

- 1= Determination of linkages in Integrated Coastal Area Management Systems
- 1= Genetic characterization of aquaculture species and protection of aquatic biodiversity
- 1= Integrated aquaculture-agriculture systems
- 1= Macro policy settings
- 5= Development of cost-effective data acquisition systems for marine coastal aquatic systems
- 5= Trade and living aquatic resources
- 5= Fish health and disease
- 8= Evaluation of the status of coral reef resource systems
- 8= Development of cost-effective data acquisition systems for great lakes resource systems

The results of research into each of these nine issues will contribute to the alleviation of poverty, the sustainability of the resource base, and they will qualify as international public good research. Research activities into each of these issues will fit with ICLARM's present research activities and will enjoy a high likelihood of success. Where alternate suppliers have been identified, it is considered that ICLARM will have a comparative advantage by virtue of its existing skills base and/or its mandate and general institutional strengths. For each of these nine issues the geographical area of interest, opportunities for partnerships, spillover effects to other resource systems, and the ability to carry out the research from the Abbassa facility have been identified and links to existing ICLARM work given. Abbassa could serve as a center for training, communication, and information exchange.

Preliminary estimates for the refurbishment costs of the Abbassa facility and operating costs for the first five years have been made. A future sequence of events in the further development of ICLARM's research program for Africa and West Asia and the use of the Abbassa facility has been proposed.

It is recommended that TAC

- **NOTE** the research planning process undertaken to date, including early stage consultation with African and West Asian NARS and regional and international agencies; and
- **ENDORSE** the 9 priority researchable issues and various activities to foster NARS partnerships as additional to ICLARM's present approved work program as summarized above and described more fully in this document.

## **1. INTRODUCTION**

The present Submission proposes an agenda for additional research into living aquatic resources management, with emphasis on work in Africa and West Asia. It describes how the proposed agenda was developed, including an outline of relevant CGIAR and ICLARM issues; and the offer of the use of a research facility by the Government of the Arab Republic of Egypt. It also sets the proposed research into the context of the existing approved ICLARM work program and foreshadows the next steps in developing research projects under the program.

## **2. BACKGROUND TO THE PROPOSAL**

This section addresses the circumstances which led to the present proposal for an enhanced CGIAR African and West Asian research agenda for living aquatic resources management through ICLARM and refers to the new CGIAR priority setting exercise being developed.

### **2.1 Research for Living Aquatic Resource Management in the CGIAR**

At the 1992 Mid Term Meeting of the CGIAR, ICLARM was admitted to the system based on the recommendations of an External Program and Management Review (Stifel et al 1992) and TAC, and as part of an expansion of the CGIAR to include research into living aquatic resources management, forests and water management. In preparing for entry into the CGIAR, ICLARM prepared a document (commonly called the ICLARM Strategic Plan) entitled 'ICLARM's Strategy for International Research on Living Aquatic Resources Management' (ICLARM 1992).

Using a structured priority setting process familiar to TAC, the Strategic Plan recommended work in three aquatic resource systems - coral reefs, coastal resource systems and inland ponds. Highest priority by region was accorded to Asia and the Pacific, second to Sub-Saharan Africa, third to Latin America and the Caribbean and fourth to West Asia and North Africa.

The Strategic Plan served as the basis for the ICLARM Medium Term Plan (1994-1998) which was eventually approved by the TAC and then the CGIAR at the Mid Term Meeting in May 1993. A core budget allocation of \$4.4 million was made to ICLARM, rising to \$4.8 million by 1998 in the event that overall CGIAR budgets improved. In addition, ICLARM was to be subject to a mid term review, on the basis of which an additional \$1 million (the fisheries reserve) was to be allocated, originally in two tranches - \$0.5 million in 1996 and a further \$0.5 million in 1997.

Commencing at the Mid Term Meeting of the CGIAR in May 1994, a vigorous process of renewal of the CGIAR set in train several events relevant to the proposal presented here. In the context of the renewal, ICLARM proposed in its 1995 Program and Budget Proposal

that the fisheries reserve be brought forward to 1995 and allocated in one tranche, conditional on a successful outcome of the Mid Term Review. TAC approved this and at the Mid Term Meeting of the CGIAR in May 1995, the fisheries reserve was approved for ICLARM.

A critical milestone towards renewal of the CGIAR was a ministerial-level meeting in Lucerne in February 1995. This was the highest level meeting on the CGIAR since the 1971 Bellagio Conference which established the system. The Lucerne Declaration and Action Program included recommendations to the CGIAR on its research agenda. The CGIAR was urged to:

- ‘Address more forcefully the international issues of **water scarcity**, soil and nutrient management, and **aquatic resources**’;
- ‘Pay special attention to **Sub-Saharan Africa** and South Asia, which face the greatest challenges in eradicating poverty and malnutrition’;
- ‘Ensure that the research programs address the problems of the poor in **less-endowed areas**, in addition to continuing its work on high potential areas’;
- ‘Reinforce the series of notable actions already taken to protect the human heritage of **genetic resources**’;
- ‘Work in closer partnership and collaboration with public and private **research organizations in the South**, including farmer groups, universities, NGOs and international institutions to design and conduct research programs’
- ‘Work in closer partnership and collaboration with public and private research organizations and universities from **developed countries** to design and conduct joint research programs’; and
- ‘Ensure that the setting of its research agenda reflects **the views and goals of global and regional forums** on agricultural research’.

During the Lucerne meeting, Australia stressed the importance of aquatic resources research, especially in the land-limited Asia Pacific regions. The Government of Arab Republic of Egypt announced it was joining the CGIAR and it would, in addition, make available the facilities of the Central Laboratory for Aquaculture Research (CLAR) at Abbassa to ICLARM.

## **2.2 Recent ICLARM Program and Budget Matters**

Major factors which affect the future shape and size of ICLARM’s program and budget are the outcomes of the ICLARM Mid Term Review, the program and budget consequences of the Lucerne meeting, and the program and budget consequences of the offer of the use of the Abbassa facility. They are each dealt with in this section.

### 2.2.1 ICLARM's Mid Term Review

During early 1995, the Mid Term Review of ICLARM was conducted. The Review panel's report to TAC and the CGIAR resulted in the Mid Term Meeting of the CGIAR endorsing the recommendations of the panel, including:

- 'calling on the CGIAR (and other sources) to increase its (ICLARM's) funding base and diversify the funding mode from project to program based, thus providing ICLARM with the necessary flexibility in managing resources';
- 'pursuing the enhancement of the scientific capacity of the Center'.

### 2.2.2 The Offer of the Use of the Egypt Facilities

ICLARM's Board of Trustees determined that acceptance of the offer of the use of the Abbassa facilities would have to conform to a number of conditions in order to enhance and protect the existing high priority work program, and they determined that the processes of the CGIAR should be respected at all stages. The Board stressed the need to protect the existing ICLARM priority research programs in Asia and Africa since an extensive planning process determined that these are clearly of the highest priority globally; they are all underway; and they include many commitments to partners and beneficiaries. They also determined that tight project planning must be used throughout and that national partners must be involved from the outset in setting and carrying out the research and related agenda.

Regarding the opportunity offered by the use of research facilities at Abbassa, the 1995 Mid Term Meeting 'saw it as a unique opportunity for a CGIAR center to work closely, from the onset, with many NARS (in Africa and worldwide). It supported ICLARM's strategy and proposed plan of action, while emphasizing caution with regard to:

- the impact of such expansion on ICLARM's strategic capacity;
- the financial implications of operating the facilities, which should be funded from non-competitive sources *vis-a-vis* other CGIAR undertakings; and
- the program implications of moving into a sub-tropical ecoregion, which ought not divert ICLARM's efforts in the tropics'.

Following submissions to TAC66 from ICLARM (March 1995), TAC deferred any consideration of funding for the possible work program based out of the Abbassa, pending ICLARM's technical evaluation of the Abbassa site. The present Submission is part of that technical evaluation.

### 2.2.3 Program and Budget Consequences of the CGIAR Renewal

Following the emphasis given to living aquatic resources research by the ICLARM Mid Term Review and the Lucerne Meeting, ICLARM presented to TAC66 and TAC67 (March and July 1995, respectively) proposals for an increase to the core budget of \$1 million to support policy research, fisheries resource assessment and fish productivity research and a request to transfer \$2.5 million from its complementary to core program, with a corresponding change in the core budget of ICLARM. 'TAC endorsed both requests, although it considered that the supporting documentation from ICLARM required more work.' TAC requested ICLARM to submit revised proposals in due course and to submit a detailed progress report on its activities at TAC69 in March 1996.

For 1996, therefore, the new ICLARM core budget is \$8.5 million, plus \$0.3 million for a system-wide initiative on the Coastal Environment, and excluding work out of the Abbassa site. The revised documentation has now been submitted to TAC and preparations are being made for the March 1996 progress report.

In Section 6.1 below, the work proposed in the present submission is related to that in the 1994-98 ICLARM Medium Term Plan. Table 1 lists the present ICLARM work program which is based on thrusts within research, information and special programs.

Table 1: Existing ICLARM Work Program

| Program                                 | Thrust   |
|---|--|
| Inland Aquatic Resource System          | Fish Productivity  |
|   | Integrated Resources Management  |
| Coastal and Coral Reef Resource Systems | Dynamics of Resource Systems   |
|   | Management of Marine Resource Systems  |
|   | Improving Coral Reef Productivity  |
| Special Projects                        | Asian Fisheries Social Science Research Network                              |
|   | Fisheries Co-management Project  |
|   | International Network on Genetics in Aquaculture                             |
|   | Dissemination and Evaluation of Genetically Improved Tilapia Species in Asia |
| Information                             | Production (publications, translation)                                       |
|   | Library and Information Services   |
| Management Services                     |  |

### **2.3 The Next Major CGIAR Priority Setting Exercise**

The presently approved 5 year plans for each of the CGIAR centers run from 1994 to 1998 and TAC is well advanced in considering the next major priorities exercise for the system. The nature of this and future priorities processes will likely be quite different to the last exercise which was an 'across the board', 5 yearly event. A more dynamic and ongoing process is envisaged in future. New emphasis in planning and priority setting is given by the advent of more system-wide programs, each involving many centers; the need for greater involvement of NARS, advanced institutes, the private sector and NGOs; and the redefinition of the imperatives as outlined in the Lucerne Declaration and Action Plan.

Early indications from TAC are that priority setting will emphasize:

- the contribution of the research to poverty alleviation both for poor producers and consumers,
- conservation of the natural resource base;
- likelihood that the research is successful;
- the potential impact of the outcomes; and
- possible alternative suppliers of the research.

### **3. CONSULTATION BY ICLARM ON THE DEVELOPMENT OF THE PROPOSED RESEARCH AGENDA**

The formal development of ICLARM's draft research agenda for Africa and West Asia began in early June 1995 with planning for a workshop to be held in Cairo in late September 1995 whose purpose was to identify research needs and issues for the region. Planning was preceded by visits to the Abbassa site by senior ICLARM staff and some members of the ICLARM Board Program Committee. ICLARM consulted widely to prepare a list of invited expert participants to the workshop. Invitations were sent to individuals and research organizations in 23 countries in Africa and West Asia as well as to three regional governmental bodies. In addition invitations were sent to all CGIAR donors and other donor organizations, all CGIAR centers, international bodies with interests in fisheries (e.g. FAO, UNDP, IDRC), a number of international aquatic resource experts, and key ICLARM staff.

The letter of invitation included a request that intending participants provide to ICLARM a brief description of the major fisheries, aquaculture, and aquatic resource research issues and needs for the Africa and West Asia region. The letters were accompanied by a background document describing ICLARM and its current research activities, potential areas for future research for ICLARM, the Abbassa facility and possible areas of work from the facility, and the nature and purpose of the Cairo workshop.

ICLARM sought a comprehensive range of expertise and knowledge for the workshop , rather than representation of official country and organization views. The responses to the invitations were used by ICLARM to determine which individuals ICLARM would offer to fully fund to attend the Cairo workshop. Individuals whom ICLARM chose not to fund were subsequently invited to attend the workshop at their own expense. Individuals who failed to respond to the initial invitation letter were sent follow-up letters.

During the first week of August 1995 three ICLARM staff attended the Fisheries Society of Africa's First Pan African Fisheries Congress in Nairobi. The ICLARM staff gave a presentation describing existing ICLARM activities and proposed plans for expansion into Africa and West Asia. Congress attendees were given a copy of the background document and invited to express an interest in attending the Cairo workshop. A number of Congress attendees expressed interest in the Cairo workshop, and some were subsequently funded to attend.

For the Cairo workshop, selected invited participants and ICLARM staff were asked to prepare brief background documents on a specific resource system or research related activities. The documents contained information on the resource system or research and related activity and a discussion of the relevant research needs and issues. Individuals were also asked to present their papers orally at the Cairo workshop. Six resource systems and research and related activities were identified for discussion at the Cairo workshop as follows:

- Coral reef systems
- Coastal aquatic resource systems
- Inland aquatic resource systems
- African great lakes and reservoirs
- Co-management and social sciences
- Partnerships between NARS and ICLARM in Africa and West Asia

The background documents at the workshop (see Appendix 1) included an FAO summary of 'downstream' or development research priorities for aquaculture as articulated in a recent extensive series of regional consultations by FAO.

To provide structure and develop suggestions for consideration at the Cairo workshop, ICLARM held an internal planning workshop in Manila on 10 & 11 August 1995. A preliminary set of researchable issue was developed to provide a basis for discussions at the Cairo workshop. These researchable issues were developed in an objective manner by following a structured evaluation process. Particular attention was given to how the preliminary agenda fitted ICLARM's priorities as defined in its 1992 Strategic Plan<sup>1</sup> in

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<sup>1</sup>In the Strategic Plan, ICLARM said (p. 23): 'In Africa, freshwater fisheries account for 54% of the total catch and production. It is even higher (64%) if upwelling fisheries are excluded. Therefore, a special case can be made for a focus on the freshwater resource systems which have previously been excluded from the global research agenda - reservoirs and lakes, and streams, rivers and floodplains - to address specifically the

combination with how the location and facilities at Abbassa could be utilized. These preliminary research ideas were included in the background documents prepared by ICLARM staff for the Cairo workshop and covered each of the six resource systems and research and related activities described above. In addition, a list of the main researchable issues resulting from the Manila workshop was tabled in a document prepared for the Cairo workshop.

The workshop to develop a draft research agenda for ICLARM for the Africa and West Asia region was held in Cairo from 23-27 September 1995. A total of 55 participants attended all or parts of the workshop. Participants came from 11 African and West Asian countries, one regional African body (COMESA), two international bodies with interests in fisheries (FAO and UNDP), four donor organizations, three CGIAR centers (IIMI, ISNAR, ICARDA), fisheries experts from three countries, and ICLARM.

The first day of the workshop consisted of a day long visit to the research facility at Abbassa. Introductory talks were given by the Director of CLAR and the Director General of ICLARM. These were followed by tours of the laboratory and pond facilities. The morning of the second day was set aside to allow participants to read the background documents. The afternoon of the second day was devoted to the presentation of opening remarks and introductory background material on the structure of the workshop, the ICLARM Strategic Plan and planning process for the Manila workshop, and information on trends in population size, food consumption, and fish production in Africa.

The third and fourth days were devoted to the presentation of the background documents by the invited speakers in each of the six resource systems and research related areas described above. Each speaker was allocated 30 minutes followed by discussion. Two or three papers were presented in each of the six sessions followed by a general discussion after the last paper in each session.

During the morning of the fifth day six working groups, corresponding to each of the resource systems and research related activities, met to develop a draft research agenda for each of the 6 topic areas. Each working group had a chair and rapporteur and was provided with a set of suggested operational guidelines for developing the draft research agenda. The guidelines included a request to develop a list with a maximum of 9 researchable issues, and to assign 3 into each of high, medium, and low priority groupings.

The working groups were asked to refer to the following documents when developing the draft agendas:

- List of researchable issues for each of the six topic areas resulting from the ICLARM Planning Workshop held in Manila on 10 & 11 August 1995

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special African conditions. These issues will be addressed as the mid-term planning proceeds and the results of exploratory research in Africa become clearer.' The Strategic Plan also foreshadowed a need for outreach offices in Africa.

- Background papers from invited participants and ICLARM staff
- List of research needs and issues submitted by invited participants prior to the Cairo workshop

The chair and rapporteur of each working group prepared a report from the working group with a list of the priority researchable issues resulting from the group. The reports were presented at a plenary session held during the afternoon of the fifth day. Questions and comments were invited from all participants during the plenary session on the contents of the working group reports.

On the day after the workshop (28 September) members of ICLARM's management team present in Cairo met to prepare a summary of the priority researchable issues resulting from the six working groups. These were included as the recommended research agenda for Africa and West Asia in a report presented to the Program Committee of the ICLARM Board on 29 & 30 September.

#### **4. CAIRO WORKSHOP DRAFT RESEARCH AGENDA**

The following draft research agenda was developed by ICLARM's management team from the results of the Cairo workshop which produced a very comprehensive set of research and related activity topics on the basis of inputs from workshop participants, other experts who responded in writing but who did not attend the workshop and ICLARM scientists.

In presenting them for consideration on 29 and 30 September 1995 by the Program Committee of the ICLARM Board, the topics were pre-selected on the basis of their fit with:

- ICLARM and CGIAR mandates;
- ICLARM's strategic plan and existing programs; and whether:
  - \* they will produce significant international goods likely to have a major impact on low-income beneficiaries in Africa and West Asia;
  - \* they will contribute to resource sustainability;
  - \* ICLARM has a comparative advantage; and
  - \* the work will strengthen or contribute to ICLARM's overall capacity to deliver its mission.

The list of researchable issues in the draft agenda are ordered into 3 groups, namely: Group A - coral reef, coastal and African great lake resource systems, Group B - inland aquaculture and reservoir systems, and Group C - policy research. A fourth group, Group D, consists of those activities aimed at fostering NARS partnerships and building NARS capacity. Table 2 lists all of the issues.

At this stage of research planning, research sites and case studies have yet to be selected. Site or case selection criteria will be developed taking into account suitability of the location/case for addressing the research issue, willingness of partners, chances of a successful outcome and likelihood that results will be used.

Table 2: List of Researchable Issues

| Issue   |                 |             |             |
|---|-----------------|-------------|-------------|
| Group A: Coral Reefs, Coastal and Great Lakes Resource Systems  | Coastal Systems | Coral Reefs | Great Lakes |
| Evaluation of the status of aquatic resource systems  | Y               | Y           | Y           |
| Development of cost-effective data acquisition systems  | Y               | Y           | Y           |
| Determination of linkages in integrated coastal area management systems                                   | Y               | Y           | Y           |
| Development of fisheries management strategies  | Y               | Y           | Y           |
| Evaluation of the effects of reserves and protected areas on aquatic resources and on fishing communities | Y               | Y           | Y           |
| <b>Group B: Inland aquaculture and reservoir systems</b>  |                 |             |             |
| Genetic characterization of aquaculture species and protection of aquatic biodiversity                    |                 |             |             |
| Integrated aquaculture-agriculture systems  |                 |             |             |
| Feeding strategies for aquaculture species  |                 |             |             |
| Evaluation of water, land use, environment and human health issues in aquaculture                         |                 |             |             |
| Fish health baseline studies and diagnostics  |                 |             |             |
| Stock enhancement of reservoirs and small water bodies  |                 |             |             |

Table 2 continued

| Issue  |
|--|
| <b>Group C: Policy and Management Research</b> |
| Macro policy settings                          |
| Trade and living aquatic resources             |
| <b>Group D: Fostering NARS Partnerships</b>    |
| Professional networks and organizations        |
| Information                                    |
| Training                                       |
| Other institutional support                    |

#### 4.1 Group A - Coral Reefs, Coastal and Great Lakes Resource Systems

In Africa, capture fisheries production relies on the natural productivity of the coastal and estuarine systems, coral reefs, the lakes (especially the Great Lakes), rivers and floodplains, the coastal shelves, upwelling systems and the open ocean. Reservoirs and smaller lakes may also contribute. In ICLARM's 1992 Strategic Plan, open oceans and upwellings were explicitly excluded as these are largely exploited by capital-intensive methods.<sup>2</sup>

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<sup>2</sup>Nevertheless, upwelling systems produce about 70% of the catch by weight (but less by value) in African capture fisheries. Much of this catch goes to industrial uses, such as fishmeal and oil, but there is potential, with improved post harvest handling, to divert significant quantities for human food, thus improving the food security in adjacent African countries such as Morocco, Namibia, South Africa and west African countries surrounding the Gulf of Guinea.

The Cairo Workshop identified the research priorities for upwelling systems as improving predictions of sustainable catch of the small pelagic fish species common in these systems, and finding better ways of post harvest handling so that the more of the large supplies of upwelling fish could be turned into safe and affordable human food.

The Program Committee noted that since ICLARM rejected research in upwelling systems in 1992, several other organizations such as ORSTOM, CEOS, the IOC and various NARS, with some involvement by ICLARM staff, were carrying out work in the area; however, there was still considerable scope for a greater ICLARM involvement as part of the larger effort. ICLARM could contribute its expertise in trophic modeling (e.g., through the use of the ECOPATH model), and help involve a wider range of NARS in learning and developing new modeling methods of relevance to upwelling fisheries in Africa.

Each of the following researchable issues could be applied to any of the three aquatic resource systems, although some issues are more critical to the future management of some of the systems than others. The Cairo Workshop originally considered each system separately and The Program Committee subsequently evaluated the systems separately.

It should also be noted that little mention was made at the workshop of researchable issues in rivers and floodplains, though the ICLARM Strategic Plan (ICLARM 1992) noted the dependence of large numbers of small scale fishers on these systems. The priority of work in these systems should be revisited.

#### **4.1.1 Evaluation of the Status of Aquatic Resource Systems**

In order to manage these systems properly, the available information needs to be documented. The status of these resource systems is not well known in many countries, although it is clear that they are under heavy fishing pressure, pollution and habitat degradation close to population centers, and play a vital role in the economies of local communities and the nutrition of the people.

For coral reefs in east Africa (South Africa to Eritrea), a regional project is required, directed towards acquiring the needed information. This would include the recovery of data from past surveys, which often exist but have never been published. These data should be added to the data already available in ICLARM's global database on coral reefs, ReefBase, the full implementation phase of which is about to commence. Information on the status of west Asian, Egyptian, Maldives and Seychelles, Madagascar, Mauritius and Red Sea coral reefs is thought to be more complete but still not readily accessible. This work could be linked to the International Coral Reef Initiative (ICRI) with which ICLARM is closely involved (ICRI 1995).

The great lakes contain a significant and unique treasure trove of fish biodiversity, including genetic resources of great present but unknown and vast future value to fisheries, aquaculture and pharmaceutical enterprises. They are also of spiritual significance to the peoples of the countries surrounding the lakes. Despite this and the present threats to the conservation and sustainable utilization of the resource base, suitable field identification guides are not available for many species. ICLARM could help support FAO who is now tackling this task, and should make maximum use of FishBase to assist the exercise (e.g., though supplying and enhancing biological and geographical information on the species already in FishBase and depositing new data and the field guides into FishBase). Reliable field guides are essential for many aspects of lake fisheries assessment and management, as well as in biodiversity studies.

In all three aquatic resource systems, ecosystem management requires development of new approaches to assessing multispecies assemblages since most of the fisheries in all three systems in Africa and West Asia are multispecies in nature. Most of the fisheries in this region require improved assessment approaches. ICLARM has an excellent track record in the development of appropriate software and analytical procedures, and this should be

extended to new approaches to assist the fisheries in this region. Approaches, such as the use of artificial intelligence techniques and neural networks and other non-parametric approaches which are more suitable where data are scarce, could be investigated.

ICLARM needs also to consider whether its role should extend to the assessment and prediction of small pelagic fisheries in upwelling systems since these are significant in many parts of Africa, including in the great lakes (see also footnote 1). Some workshop participants stressed the high priority need for assessment research, especially with the use of new mathematics and linking climate and oceanography to the resource in the predictions.

#### **4.1.2 Development of cost-effective data acquisition systems**

The lack of adequate datasets is a main reason for the lack of stock assessments, and hence, of management strategies for fisheries. Most importantly, as human stresses increase their impacts on aquatic resource systems, the resource managers are starting to demand better information bases on the resources and their users. Past approaches to data acquisition were often driven by researchers only and data collected was often not used. With demands for management information and fisheries department staff reductions in most countries due to structural adjustment, cost effective approaches to data acquisition need to be developed, and the various options and their robustness need to be tested.

ICLARM could carry out research into cost effective, innovative, and multidisciplinary methods on the following topics: a) monitoring and assessment of catch and effort data; b) collection of socioeconomic data; and c) design of resource surveys. The data acquisition systems should be designed for specific purposes and various options tested through pilot scale projects.

The demands for cost-effective data acquisition systems are high in all aquatic resource systems and large spillovers are expected from work done in any one system, and also to the needs of data collection on small scale fisheries in other regions of the world.

#### **4.1.3 Determination of Linkages in Integrated Coastal Area Management Systems**

The linkages between the various components affecting coastal zones (including the lakeshore) need to be determined to develop effective coastal environment management strategies relevant to living aquatic resources management. Research could be carried out on the following topics: a) the impacts of watershed management and water use rights; b) the impacts of land use practices and use rights; c) the impacts of tourism; d) the use of decision theory in developing management systems; e) the development of systems models (including bioeconomic modeling); f) the development of models to determine the size and rate of recovery from impacts; and g) women and gender issues. Research in this area would support the CGIAR Coastal Environment Initiative.

#### **4.1.4 Development of fisheries management strategies**

All three resource systems require research in this area to provide support for fisheries management, and more broadly for fisheries governance<sup>3</sup>. Research could suggest alternative patterns of interaction in the processes of resource management and should be aimed at developing methods for incorporating evaluation of the current status of the resource, their potential yields and environmental and social impacts of management decisions. Research could be carried out on the following topics: a) community based approaches including fisheries co-management; b) property rights and tenure arrangements over aquatic resources; c) rules and enforcement procedures for management; d) evaluation of biodiversity issues including bioprospecting and the protection of genetic resources; e) developing models of exploitation, including approximate methods; f) estimation of uncertainty and risk with special reference to application of the precautionary approach; and g) incorporation of decision analysis techniques into management strategies.

#### **4.1.5 Evaluation of the effects of reserves and protected areas on aquatic resources and on fishing communities.**

Reserves and protected areas are being widely adopted as management tools. In marine resource systems, the International Union for the Conservation of Nature (IUCN) and the World Bank have given high priority to developing adequate reserve systems in all marine ecosystems. At IUCN's request, ICLARM will convene a meeting on fisheries and marine protected areas at the October 1996 IUCN World Conservation Congress.

Little information is available on the effects of reserves and protected areas. Research could be carried out on the following issues: a) determination of their optimum size, number, and distribution; b) determination of their value to tourism; c) the economic benefits or losses resulting from alternative uses, including fisheries, tourism, bioprospecting and the aquarium trade; d) determination of their effects on harvest in adjacent areas; e) evaluation of their impacts on the economic and social well being of adjacent fishing communities, and (f) the role of fishing communities inside protected areas.

ICLARMs mandate suggests that particular emphasis should be given to d), e) and f).

#### **4.2 Group B - Inland Aquaculture and Reservoir Systems**

The following topics relate to research within pond aquaculture, enhanced reservoir and integrated aquaculture-agriculture systems, including rice-fish systems.

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<sup>3</sup> Governance is the pattern of interaction between society and government and has come to the fore in considering management of commons such as fisheries resources, forests, water and other natural resources.

#### **4.2.1. Genetic characterization of aquaculture species and protection of aquatic biodiversity**

There is great potential for improving the growth rate, food conversion capability, resistance to disease, tolerance to salinity and temperature variability and other desirable characteristics through selective breeding programs, development of monosex generations, induction of polyploidy, high-tech gene manipulation and better hatchery and broodstock management. NARS are looking to ICLARM for advice on biotechnologies, especially since the uses of aquatic biodiversity are developing rapidly. Developments are influenced technically by new technologies in aquaculture and bioprospecting, and legally by new arrangements which govern intellectual property rights under the International Convention on Biological Diversity (ICBD) and the General Agreement on Tariffs and Trade.

At the same time there is cause for concern over the potential loss of genetic integrity from over-harvesting, deliberate alteration of natural breeding strategies and the translocation of species or strains. Concerns for aquatic biodiversity are markedly different from those for terrestrial biodiversity because, aquatic biodiversity is generally less well documented, its uses are less developed and aquatic systems bear greater risks of negative impacts from introductions which are almost always irreversible and can spread rapidly and far in connected water bodies.

Parts of the Abbassa facility could be quarantined giving the potential for secure and scientifically controlled experimentation and possible germplasm storage, but there are seasonal climatic constraints to doing this outside with tropical species.

#### **4.2.2 Integrated aquaculture-agriculture systems**

African countries, development assistance agencies and FAO have directed significant research and development activities to integrating fish production into agricultural systems, with generally limited success except where aquaculture has been part of the system design from the start. Alternative strategies for the further development of integrated farming systems warrant further investigation, especially the socio-economic analyses on the adoption of aquaculture technology.

The reasons for success or failure of the broad spectrum of integrated systems from large scale fish ponds, to rice-fish systems and the smallest subsistence ponds (tens of square meters in area) are not understood. Hypotheses being tested by ICLARM on the benefits of such systems are a) that through encouraging integrated resource management, they contribute positively to the sustainability of the natural resource base, and b) through contributions to food production (i.e., fish and other crops such as vegetables) and economic well-being at household and community levels, they improve food security in rural areas. More generally, we do not yet know how small scale aquaculture contributes to the overall intensification of farming systems and therefore their ability to support greater human populations. ICLARM is also testing hypotheses on the role of farmer participatory research in designing workable systems.

ICLARM could join with other CGIAR centers such as IITA, ICRAF and WARDA in studying integrated aquaculture-agriculture systems, especially with respect to social and economic questions, including women and gender issues.

Given the potential for adoption of aquaculture technology in Africa which presently produces only 1% of total world aquaculture production, there is much scope for analyses of factors affecting the rate of adoption, constraints (e.g., credit), the impact of adoption on farm/household resource use and allocation, income, nutrition and the impact of the technology on the community.

There is scope for some of this work to be assisted by experiments and analyses at Abbassa but field work would need to be performed in selected national partnerships because of climatic and other site requirements.

#### **4.2.3 Feeding strategies for aquaculture species**

Low input small scale integrated aquaculture-agriculture may not produce sufficient fish for local needs. If aquaculture is to play a much more significant role in bridging the gap between fisheries production and demand, then aquaculture systems will need cheap and readily available feeds which take advantage of available local ingredients. Working within resource systems, ways of utilizing local wastes and local surplus of perishable crops or agricultural by-products are being identified in many countries. There is great scope for the application of multi-disciplinary modern science to a wide variety of problems and opportunities.

Although a relatively specific scientific field, investigation of feeding strategies for aquaculture species, i.e., fish nutrition and nutritional value of alternative ingredients, is vital to most current and proposed aquaculture projects. In most African aquaculture systems, additional feeds rather than complete diets are used. Feeds and fish nutrition studies were given high priority as issues by experts on African aquaculture systems. Optimizing feeding strategies using local sources of additional feed is considered vital to integrated resource management and to pond dynamics.

Improved bio-availability of dietary nutrients by simple treatments of ingredients, such as heating, extrusion or fermentation will not only increase productivity from aquaculture systems but will also help manage the “down-stream” environmental impacts, both good and bad, of aquaculture.

Intensive scientific analyses of a wide variety of ingredients, target fish species and alternative pond-management systems, including the use of fertilizers, could be carried out at Abbassa. Whereas alternative ingredients will vary considerably with location, ICLARM should develop a capacity to contribute, especially drawing on the expertise on crop nutritional composition in other CGIAR centers and in collaboration with fish nutrition and fish feeding experts from developed countries.

#### **4.2.4 Evaluation of water, land use, environment and human health issues in aquaculture**

Aquaculture is a major human-controlled use of natural resources. The changes it brings to the natural and human environment and how it integrates or competes with other uses should be investigated. Biodiversity issues have been covered in 4.2.1. The present research issue concerns other major factors.

Water and land are two critically limiting factors for aquaculture. Government policy and management of land and water use bear on aquaculture development. In some countries, agricultural land, coastal mangroves and estuaries are being turned over to aquaculture. In some West African countries, farmers migrating to the lowlands must use state land for farming and the lack of tenure acts against investments in ponds for aquaculture.

Fish crops are rarely considered when determining water use policies and management. Aquaculture often competes for adequate water of suitable quality with agriculture and other industrial and urban uses. Egypt and other arid and semi-arid countries would be prime cases for detailed research. In Sub-Saharan Africa, water policies are presently almost non-existent. Water use projects should be done in partnership with the IIMI-led CGIAR system wide initiative in water resource management, as well as direct collaboration with IIMI and relevant NARS. ICLARM should collaborate with WARDA and partners in west Africa agroecosystems.

Environmental and policy studies should target the effects and costs of offsite and on-site pollution by and of aquaculture, including farm and industrial run-off, and habitat destruction. This work could also cover the potential positive environmental impacts of integrated farm systems.

Many human diseases are spread by vectors which live in or depend on water. The spread of aquaculture should not exacerbate these diseases. ICLARM takes human health issues into account when undertaking its work in water use, and has worked with health agencies including the World Health Organization of the United Nations on this important issue. Abbassa provides opportunities for experimental work on snail and mosquito control.

#### **4.2.5 Fish Health Baseline Studies and Diagnostics**

Experience in terrestrial agriculture and animal husbandry and in aquaculture expansion in Asia has given many unfortunate lessons in health and disease of the cultured plants and animals. Fish diseases are now considered a major constraint facing Asian aquaculture. Estimated crop losses in China alone are estimated at hundreds of millions of dollars. Two key lessons from Asia were that a) disease diagnosis and prevention suffered from lack of baseline data on diseases; and b) lack of an international or at least regional approach caused serious delays and inefficiencies in diagnosing and managing some diseases.

All species introductions and transfers carry risks of disease transfer. Africa has many contiguous water systems through which pathogens could easily spread. Once introduced, disease pathogens, like exotic species in aquatic systems, are not able to be eradicated and therefore create chronic, cumulative and perpetual problems. Environmental safeguards are so critical that some experts now consider introductions as non-precautionary activities. Existing guidelines on introductions (e.g., those of the International Council for the Exploration of the Sea) are not considered sufficient, and ICLARM is working with various agencies, including FAO, to devise more practical, user-friendly guidelines.

In agriculture, international science has been essential to managing health risks. The same is now proving true in aquaculture and stock enhancement and ICLARM should consider developing a strategic research capacity out of the Abbassa laboratory. There are possible spillover effects for the studies of health and disease in other freshwater and marine environments.

#### **4.2.6 Stock Enhancement of Reservoirs and Small Water Bodies**

As demands for fish increase and fish production technology improves, greater attention is being paid to fish stock enhancement of man-made reservoirs and small water bodies. Although technological considerations (e.g., hatchery production of large numbers of suitable species, feeding strategies) are important, property rights are likely to be the most important determinants of the success of enhancement. Research into institutional and organizational arrangements for management, property rights and tenure, decision-making processes and the dynamics of control over small water bodies could suggest alternative management models.

### **4.3 Group C - Policy and Management Research**

This section deals with policy and management research critical to improving the contribution of aquatic resources to food security in Africa where the problems are most serious, although there are spillovers to other regions such as Asia. The researchable issues have been selected in view of the current state of world and African fisheries and aquaculture, the decrease in development assistance to the fisheries sector, reductions in national governments' operating staff and funds, and the overall squeeze on research funds; including for aquatic resource research. The research would be directed to understanding the impacts of macro-policy settings and trade on the fisheries commodity sector.

#### **4.3.1 Macro-policy Settings**

Contributions of living aquatic resources to food security and decisions affecting their sustainability in Africa and West Asia are affected by trade, world and regional economic conditions, the policies of development banks, multilateral and bilateral development assistance agencies and the articles of international conventions and treaties (such as the UNCLOS, the International Convention on Biological Diversity and the General Agreement on Tariffs and Trade (GATT)). The impacts of such macro-policy settings are

little studied and therefore poorly understood. On the other hand, agricultural policy, especially structural adjustment policies, has received considerable attention for its impacts on agricultural development and transformation.

Research is required at the national level on the impacts of macro policy instruments on fish production, access to fish supplies and natural resource management. This research should be carried out by ICLARM in close collaboration with IFPRI and national partners. It should also be used to stimulate full integration of living aquatic resources sustainability issues into IFPRI general food security research.

Examples of research topics are:

- Investigation of the mechanisms and policies that development banks and development assistance agencies should use to support sustainable and equitable development and prevent over-capitalization, especially since many past fisheries projects are considered poor value for money;
- Examination of alternatives for reversing the decline in fisheries sector aid by suggesting new options for sectoral assistance based on a better understanding of intersectoral linkages and wider trends in development assistance, including an emphasis on natural resource management and greater participation in project planning;
- Determination of the impacts on food security of national policies which emphasize exports of product and of the growing market demands for fisheries products in Asia and Europe;
- Investigation of the impacts of the intellectual property rights articles under GATT and the ICBD in the future management of African aquatic resources for fisheries, aquaculture and bioprospecting (for fish, Africa is a center of biodiversity);
- Determination of the impacts of the withdrawal of fishing fleets from the former USSR on fisheries, especially in West Africa;
- Determination of the impacts of reduced supplies of many fish species and over-supply of fishing capacity in the north Atlantic on African fisheries, especially in North and West Africa;
- Assessment of the benefits of fisheries and aquaculture research derived from generating knowledge and technologies to improve sustainable development of the sector, assist research priority setting and monitoring of research achievement;
- Investigation of the impacts of assigning property rights to fish producers.

National partners, IFPRI, FAO and ICLARM could collaborate to design and implement a policy research thrust in selected countries for which fish is a significant dietary item. The feasibility of regional or sub-regional analyses should also be investigated.

### **4.3.2 Trade and Living Aquatic Resources**

Living aquatic resources and their products including food fish, fishmeal and oil, food additives, jewelry and other decorations and aquarium organisms, are highly traded compared to most other CGIAR mandated crops. The level of trade has increased over the last 15 years, especially as prices have risen for most products. The signing of the GATT and other factors such as the devaluation of the CFA are already having negative impacts on small scale fishers in many African countries such as Ghana and Senegal.

Although fish market information is well coordinated internationally and globally (INFOFISH, INFOPECHE, etc.), little research into trade is conducted. Therefore, the effects of domestic, inter-regional and international trade flows and related policies on markets, prices and hence access to fish are little known. Global (e.g. the World Trade Organization), national and regional bodies are not as well served with fisheries policy advice compared with other commodities. ICLARM is in a unique position to develop a strategic research capacity to assist with the understanding of the issues and the consequences of trade and trade policies and to suggest options which benefit poor people.

Most African countries have relatively low international exports of fish compared to, for example, many Asian countries. However, will this be so in the future? Domestic trade is important and trade within the region (across national boundaries) is probably much greater than recorded.

Research would focus on selected products and countries within the region. It could analyze trends in trade flows, the adequacy of knowledge of these flows and their impacts on consumers and producers and food security in the region.

Research partners would include the regional market networks (INFOFISH, etc.), IFPRI, FAO and relevant NARS and ASIs, depending on the specific topics and countries selected.

### **4.4 Group D - Fostering NARS Partnerships**

ICLARM recognizes three modes of partnership with NARS - collaborative research including networks, information development and dissemination, and training. Collaborative research is covered throughout the presentations on researchable issues. In the main, ICLARM's work with NARS should be targeted to specific research projects. For example, most collaborative research networks, training and information dissemination would be program-related. Some possible exceptions are given in 4.4.1 below.

#### **4.4.1 Professional Networks and Organizations**

There is a weak capacity in living aquatic resource science research in general, and in social science research in particular in many parts of Africa. Most NARS have far fewer social scientists even than biologists, even though the importance of economic, social and policy factors is now recognized. There is no mechanism in the region to coordinate economists

and other social scientists for strengthening research and training in fisheries social sciences. ICLARM could play a key role in developing an African Social Science Research Network. The organization would work through institutions and be involved in networking, research support and information dissemination, education and training activities.

More generally, the Fisheries Society of Africa (FISA) has just been reformed and the *African Journal of Tropical Fisheries and Hydrobiology* has been re-incarnated after a gap of nearly 20 years. The first Pan African Fisheries Congress was held in August 1995 and was attended by 3 ICLARM staff. Future events are still not assured and small measures of assistance in this early stage could help establish a firmer foundation for FISA.

Future FISA congresses could provide a venue for ICLARM to consult with African NARS partners.

With relatively small resources, ICLARM could assist FISA by funding good young scientists to conferences, aiding the organization of conferences and assisting with the Society's journal. Similar assistance was given by ICLARM to the Asian Fisheries Society (AFS) which has just reached its 10th year in an extremely strong position. ICLARM now provides minimal assistance to the AFS.

#### **4.4.2 Information**

Comprehensive library services and electronic communication channels are urgently needed if the region's professionals are to develop and perform effectively. This is considered a very high priority. ISNAR and other CGIAR centers could help advise on communications strategies in Africa and West Asia.

#### **4.4.3 Training**

Any training should be needs based in content, carried out in a manner to match the requirements and be cost-effective. ICLARM has specialized in training activities which are specific to its products or project areas and in on-the job training through time spent at ICLARM offices and sites.

Generic training needs have been identified for a) scientific writing; b) research management and administration, including priority setting and evaluation of research; and c) experimental design and fisheries assessment techniques.

#### **4.4.4 Other Institutional Support**

The countries bordering the great lakes have developed a proposal for a regional research and management institute to assist the rational use of the lakes. This proposal is designed to build on the Inland Fisheries Planning Project that covered the great lakes from 1989-1993. Each of the lakes is surrounded by more than two countries on average, making international collaboration essential. ICLARM could play an important role in technically

supporting the establishment of the institute once funded, keeping in mind that this is a regionally driven project. Such support would provide a good opportunity for ICLARM to develop close partnerships with national and regional research organizations.

## **5. ICLARM BOARD PROGRAM COMMITTEE PRIORITY SETTING PROCESS**

The Program Committee of the ICLARM Board of Trustees met in Cairo on 29 & 30 September 1995. The purpose of the meeting was (1) to consider the draft research agenda resulting from the ICLARM Planning Workshop held in Cairo from 23 to 27 September; and (2) to develop and approve a draft research agenda for Africa and West Asia that could be carried out by ICLARM from the Abbassa facility.

The information available to the Program Committee was (1) the minutes of the ICLARM Planning Workshop held in Manila on 10 & 11 August 1995 and the summary of researchable issues resulting from that workshop; (2) the list of research issues and needs submitted to ICLARM by invited participants to the Cairo workshop; (3) the background documents presented at the Cairo workshop by invited participants and ICLARM staff; (4) the list of priority researchable issues resulting from the discussions at the six Working Groups at the Cairo workshop; (5) the summary of the priority researchable issues from the six Working Groups prepared by ICLARM's management after the Cairo workshop.

The list of priority researchable issues resulting from the Cairo Workshop clearly exceeds realistic estimates of the resources that are likely to be available to conduct research and research related activities in Africa and West Asia. A priority setting process was developed for ICLARM's 1992 Strategic Research Plan to determine research priorities for the different resource systems, regions, and activity types. This process incorporated information on fish production, potential for increased production and threats to sustainability and equity to determine priorities. The principles of a) sustainability; b) systems approach; c) equity; d) gender sensitivity; e) participatory methods; and f) anticipatory approach, guide the design and selection of research activities in ICLARM's work program.

While the Program Committee recognized that it was desirable to carry out a similar exercise to determine the research priorities for Africa and West Asia, there was insufficient time to obtain the detailed information required to perform the calculations for this region. Estimates of fish catch and aquaculture production by resource system are not readily available in an aggregated form and would have to be assembled from a number of different documents. The indices of increased production potential, threats to sustainability, and equity included in the 1992 Strategic Plan were derived on a global basis. These indices need to be reviewed to determine if they are applicable for the Africa and West Asia region alone. These production figures and indices will be updated in the future to enable more detailed research planning to be carried out.

The Program Committee adopted a pragmatic approach to priority setting at its meeting of 29 & 30 September. Each of the six Program Committee members present at the meeting, plus the Chair of ICLARM's Board of Trustees who was also present, assigned a score to each of the researchable issues described in the ICLARM management report from the Cairo Workshop. The scores were based on each individual member's assessment of the priority for ICLARM to address that particular research issue in Africa and West Asia. Each member assigned a score of A, B, or C to each of the researchable issues, where A was high priority, B was lower priority, and C was the lowest priority. Scores of A were then awarded 3 points, B awarded 2 points, and C 1 point. The numerical scores were then summed for each researchable issue to obtain a total score for that issue. The researchable issues were then ranked from highest to lowest total score.

For the coral reef, coastal aquatic, and great lakes resource systems there were five researchable issues for each resource system, giving a total of 15 researchable issues for these three systems. (Reservoir resource systems were separated from great lakes and assigned into an individual researchable issue of their own, see above.) For inland aquatic resource systems 5 researchable issues were identified and for the social sciences 2 issues. This gave a total of 23 researchable issues that were ranked according to priority. The research related activities included in the section on fostering partnerships with NARS were not considered in the priority setting process. These activities cut across all the resource systems and will need to be accounted for when assigning resources to the different activity types.

## **6. ICLARM'S RECOMMENDED RESEARCH AND PRELIMINARY COSTINGS**

The result of the ICLARM Board Program Committee process is a selected set of researchable issues, each of which is presented here, along with preliminary costings.

### **6.1 Recommended Research**

The priority setting process followed by the Program Committee resulted in a ranking of each of the 23 researchable issues identified by ICLARM's management. The 23 issues consisted of each of the 5 issues in Group A considered in each of the 3 resource systems (coral reefs, coastal and great lakes), i.e., a total of 15 issues for Group A, and each issue in Groups B and C. Because of resource constraints, it is clearly not possible to carry out research activities to address each of these 23 issues. At its meeting of 29 & 30 September the Program Committee decided to recommend to TAC that the top nine priority researchable issues as identified through the priority setting process described above be supported. Details of each researchable issue are provided in Section 4.

It is considered that the results of research into each of these nine issues will contribute to the alleviation of poverty, the sustainability of the resource base, and they qualify as international public good research. Research activities into each of these issues will fit with ICLARM's present research activities and will enjoy a high likelihood of success. Where

alternate suppliers have been identified, it is considered that ICLARM will have a comparative advantage by virtue of its existing skills base and/or its mandate and general institutional strengths. For each of these nine issues the geographical area of interest, opportunities for partnerships, spillover effects to other resource systems, and the ability to carry out the research from the Abbassa facility are described below. Links to existing ICLARM work are given. For each of the nine issues, Abbassa could serve as a center for training, communication and information exchange.

The top nine researchable issues (Table 3) and below (in priority order) are:

Table 3: List of Researchable Issues - Top 9 Priorities and the Underpinning NARS Partnership Support Activities are Shaded

| Issue   |                 |             |             |
|---|-----------------|-------------|-------------|
| Group A: Coral Reefs, Coastal and Great Lakes Resource Systems  | Coastal Systems | Coral Reefs | Great Lakes |
| Evaluation of the status of aquatic resource systems  | Y               | Y           | Y           |
| Development of cost-effective data acquisition systems  | Y               | Y           | Y           |
| Determination of linkages in integrated coastal area management systems                                   | Y               | Y           | Y           |
| Development of fisheries management strategies  | Y               | Y           | Y           |
| Evaluation of the effects of reserves and protected areas on aquatic resources and on fishing communities | Y               | Y           | Y           |
| <b>Group B: Inland aquaculture and reservoir systems</b>  |                 |             |             |
| Genetic characterization of aquaculture species and protection of aquatic biodiversity                    |                 |             |             |
| Integrated aquaculture-agriculture systems  |                 |             |             |
| Feeding strategies for aquaculture species  |                 |             |             |

Table 3 continued

| Issue   |  |
|---|--|
| Evaluation of water, land use, environment and human health issues in aquaculture |  |
| Fish health baseline studies and diagnostics                                      |  |
| Stock enhancement of reservoirs and small water bodies                            |  |
| <b>Group C: Policy and Management Research</b>                                    |  |
| Macro policy settings   |  |
| Trade and living aquatic resources  |  |
| <b>Group D: Fostering NARS Partnerships</b>                                       |  |
| Professional networks and organizations   |  |
| Information   |  |
| Training  |  |
| Other institutional support   |  |

**1 = Determination of linkages in Integrated Coastal Area Management Systems**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, international research and management organizations (e.g. FAO), and local, national, and regional governmental bodies. There will be potential spillover effects into research activities on this issue carried out in the coral reef and African great lakes resource systems (through integrated lakeshore management). Direct experimental research could not be carried out at the Abbassa facility on this issue. Field work would need to be conducted at coastal marine sites away from Abbassa including Egypt. However, the Abbassa facility would serve as a regional center for this activity.

*Related existing ICLARM work:*

- Coastal and Coral Reef Resource Systems Program-Management of Marine Resource Systems Thrust

- (i) Comparative analysis of coastal transects

- (ii) Lagonoy Gulf resource and ecological assessment
- (iii) Rapid assessment of management parameters
- (iv) Coastal area management training
- (v) CGIAR system-wide coastal environment initiative (to commence in 1996)
- Fisheries co-management project
- CGIAR system-wide initiative on property rights and collective actions

### **1 = Genetic characterization of aquaculture species and protection of aquatic biodiversity**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, and international research and management organizations (e.g. FAO, IUCN, UNEP). There will be potential to carry out research activities in inland ponds, the great lakes, rivers, and floodplains. There are possible spillover effects into the marine environment. Direct experimental research could be carried out at the Abbassa facility on this issue after suitable quarantine systems are established to provide for secure and scientifically controlled experimentation. Field work would also be conducted at sites away from Abbassa. However, the Abbassa facility could serve as a regional center for this activity.

#### *Related existing ICLARM work:*

- Inland Aquatic Resource Systems Program
  - \* Fish Productivity Thrust
    - (i) Genetic improvement of farmed tilapia
    - (ii) Research on the tilapia genetic resources of Ghana
- International Network on Genetics in Aquaculture
- Dissemination and evaluation of genetically improved tilapia species in Asia

### **1 = Integrated aquaculture-agriculture systems**

Research activity on this issue could be carried out in all of Africa and West Asia. Because of the nature of the research, the results will tend to be site specific and will not be applicable on a global, regional, or perhaps even national scale. Generic and spillover benefits arise from new participatory research approaches, framework and models for analyzing constraints to adoption and the costs and benefits of integrated aquaculture systems. There will be many opportunities for partnerships with NARS, ASIs, NGOs, other CGIAR centers (e.g. ISNAR) and local and national government organizations. The research activities will be carried out primarily in inland ponds. Field work would need to be conducted at sites away from Abbassa. There is scope for some of this work to be

supported by experiments and analyses at Abbassa. The Abbassa facility could also serve as a regional center for this activity.

*Related existing ICLARM work:*

- Inland Aquatic Resource Systems Program
  - \* Integrated Resource Management Thrust  
All activities are relevant, especially work in Malawi, Bangladesh and the Philippines.

**1 = Macro policy settings**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, other CGIAR centers (e.g. IFPRI) and international research and management organizations (e.g. FAO, IUCN, UNEP, WTO). This research activity will cut across all the resource systems. Field work would be conducted at sites away from Abbassa. However, the Abbassa facility would serve as a regional center for this activity.

*Related existing ICLARM work:*

ICLARM has not previously attempted significant studies in macro-policy research although it has undertaken policy research at the national and community levels. TAC 67 approved extension of ICLARM core program includes policy research. The work foreshadowed in the present proposal has a strong focus on African needs but spillovers to global studies will occur.

**5 = Development of cost-effective data acquisition systems for marine coastal aquatic systems**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, international research and management organizations (e.g. FAO), and local, national, and regional governmental bodies. There will be potential spillover effects into research activities on this issue carried out in the coral reef and African great lakes resource systems. Direct experimental research could not be carried out at the Abbassa facility on this issue. Field work would need to be conducted at coastal marine sites away from Abbassa. However, the Abbassa facility would serve as a regional center for this activity.

*Related existing ICLARM work:*

- Coastal and Coral Reef Resource Systems Program
  - \* Dynamics of resource systems thrust
    - (i) Fishery database for the development and management of the national fisheries off Sierra Leone
    - (ii) Fishery database for Brunei Darussalam

Both (i) and (ii) are recently completed projects. A follow up project for several Asian countries is presently being discussed with a donor in Asia.

More generally, ICLARM is pioneering the use of rapid and participatory appraisal methods for coral reef assessment, inland small scale aquaculture and coastal areas.

**5 = Trade and living aquatic resources**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, other CGIAR centers (e.g. IFPRI) and international research and management organizations (e.g. FAO, IUCN, UNEP, WTO). This research activity will cut across all the resource systems. Field work would be conducted at sites away from Abbassa. However, the Abbassa facility would serve as a regional center for this activity.

*Related existing ICLARM work:*

(See comments for macro-policy settings research).

**5 = Fish health baseline studies and diagnostics**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, and local and national government organizations. The research activities on this issue cut across all resource systems. Direct experimental research could be carried out at the Abbassa facility on this issue. Field work would also be conducted at sites away from Abbassa. The Abbassa facility would also serve as a regional center for this activity.

*Related existing ICLARM work:*

ICLARM has little involvement to date in fish health studies but the ICLARM international mandate, the laboratory facilities available at Abbassa and the development stage of aquaculture, especially in Africa, mean that this is a decisive time for ICLARM to move into fish health research, especially in Africa.

## **8 = Evaluation of the status of coral reef resource systems**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, international research and management organizations (e.g. FAO), and local, national, and regional governmental bodies. There will be potential spillover effects into research activities on this issue carried out in the marine coastal and African great lakes resource systems. Direct experimental research could not be carried out at the Abbassa facility on this issue. Field work would need to be conducted at coral reef sites away from Abbassa. However, the Abbassa facility would serve as a regional center for this activity.

### *Related existing ICLARM work:*

- Coastal and Coral Reef Resource System
  - \* Dynamics resource systems thrust
    - (i) ReefBase: a global database of coral reef systems and their resources
    - (ii) FishBase: a global database on fisheries resources.

## **8 = Development of cost-effective data acquisition systems for great lakes resource systems**

Research activity on this issue could be carried out in all of Africa and West Asia and could be of global significance as well. There will be many opportunities for partnerships with NARS, ASIs, NGOs, international research and management organizations (e.g. FAO), and local, national, and regional governmental bodies. There will be potential spillover effects into research activities on this issue carried out in the coral reef and marine coastal resource systems. Direct experimental research could not be carried out at the Abbassa facility on this issue. Field work would need to be conducted at great lakes sites away from Abbassa. However, the Abbassa facility would serve as a regional center for this activity.

### *Related existing ICLARM work:*

(See comments under this topic for development of cost-effective data acquisition systems for marine coastal aquatic systems).

The nine priority researchable issues and NARS partnerships are related to existing ICLARM work and TAC categories in Table 4.

Table 4: Nine Priority Issues & NARS Partnerships, Existing ICLARM Work and TAC Categories

| Priority Issue   | Existing ICLARM Program Area                    | TAC Category  |
|--|---|---|
| Coral Reefs: Evaluation of the status of aquatic resource system                         | Coastal and Coral Reef Resource System Program  | Protecting the Environment  |
| Coastal Systems: Development of cost effective data acquisition systems                  | Coastal and Coral Reef Resource System Program  | Increasing Productivity: Fish and Fish systems                                |
| Great Lakes: Development of cost effective data acquisition systems                      | New resource system                             | Increasing Productivity: Fish and Fish Systems                                |
| Coastal Systems: Determination of linkages in integrated coastal area management systems | Coastal and Coral Reef Resource Systems Program | Protecting the Environment  |
| Genetic characterization of aquaculture species and protection of aquatic biodiversity   | Inland Aquatic Resource Systems Program         | Saving Biodiversity   |
| Integrated aquaculture-agriculture systems   | Inland Aquatic Resource Systems Program         | Increasing Productivity: Fish and Fish Systems/<br>Protecting the Environment |
| Fish health baseline studies and diagnostics   | New program area                                | Increasing Productivity: Fish and Fish Systems                                |
| Macro-policy settings  | New program area                                | Improving Policies  |
| Trade and living aquatic resources   | New program area                                | Improving Policies  |
| Fostering NARS Partnerships  | Information, networks, training                 | Fortifying National Programs  |

## 6.2 Preliminary Costings

The preliminary costs for ICLARM's proposed research in Africa and West Asia from the Abbassa facility are shown in Table 5 which also includes the assumptions that have gone into the costings.

The estimated refurbishment costs for the Abbassa facility of US \$3,000,000 are based on a study made for ICLARM by the Office For Studies and Finance (OSAF) a Cairo-based firm of consulting engineers. Details of the refurbishment costs are contained in a report prepared by OSAF.

The estimated operating costs are divided into two components - program costs and facility costs. The program costs are based on the existing costs of operating programs by ICLARM. The facility costs are based on a preliminary study of the Abbassa facility carried out for ICLARM by Michael Klass, the Director of Finance and Administration for ICRAF.

The costings are based on the following additional assumptions:

- 1) Refurbishment of the Abbassa facility will be completed in 1996.
- 2) ICLARM will appoint a Deputy Director General in charge of the research program run from the Abbassa facility. This person, plus a facilities manager for Abbassa and an additional international staff member should be appointed in 1996.
- 3) ICLARM will develop programs and appoint international and national staff in a stepped fashion. Three additional international staff will be appointed in 1997 and four in 1998. National staff will be appointed to assist in the research programs as they are developed using the estimated staff requirements as shown in the footnote to the table.
- 4) The support staff costs are based on current Egyptian national salaries and will probably need to be modified upwards.
- 5) Experimental research conducted at the Abbassa site will involve one international staff member full-time and the facility manager part-time. Seven of the final complement of 10 international staff will be involved in research programs conducted away from the Abbassa facility.
- 6) Communication costs are high because of the need to establish a satellite communications link with African and West Asian NARS and ASIs.
- 7) Annual building depreciation costs of US \$ 300,000 are included to provide for future development and maintenance of the Abbassa site.

**Table 5. Preliminary Costings (in US\$'000)**

|   | 1996         | 1997          | 1998          | 1999          | 2000          |
|---|--------------|---------------|---------------|---------------|---------------|
| Number of international staff                                       | 3            | 6             | 10            | 10            | 10            |
| IRS salaries (\$200 K for DDG, \$132 K for others)                  | \$464        | \$860         | \$1388        | \$1388        | \$1388        |
| Support staff (\$43 K per IRS)                                      | \$129        | \$258         | \$ 430        | \$ 430        | \$ 430        |
| Travel (conferences, etc.) (\$15 K per IRS)                         | \$ 45        | \$ 90         | \$ 150        | \$ 150        | \$ 150        |
| Publications (\$10 K per IRS)                                       | \$ 30        | \$ 60         | \$ 100        | \$ 100        | \$ 100        |
| No. of research programs away from Abbassa                          | 1            | 3             | 7             | 7             | 7             |
| Research costs for programs away from Abbassa (\$100 K per project) | \$100        | \$300         | \$ 700        | \$ 700        | \$ 700        |
| Recruitment (\$40 K per IRS staff)                                  | \$120        | \$120         | \$ 160        | \$ 0          | \$ 0          |
| <b>TOTAL PROGRAM COSTS</b>  | <b>\$888</b> | <b>\$1688</b> | <b>\$2928</b> | <b>\$2768</b> | <b>\$2768</b> |

**Facilities Costs (In US\$'000)**

|                 | 1996         | 1997         | 1998         | 1999         | 2000         |
|-----------------|--------------|--------------|--------------|--------------|--------------|
| <b>Supplies</b> | <b>\$155</b> | <b>\$340</b> | <b>\$360</b> | <b>\$360</b> | <b>\$360</b> |
| Office          | \$ 10        | \$ 20        | \$ 20        | \$ 20        | \$ 20        |
| Training        | \$ 5         | \$ 20        | \$ 40        | \$ 40        | \$ 40        |
| Laboratory      | \$ 40        | \$100        | \$100        | \$100        | \$100        |
| Ponds           | \$ 50        | \$100        | \$100        | \$100        | \$100        |
| Maintenance     | \$ 50        | \$100        | \$100        | \$100        | \$100        |
| <b>Services</b> | <b>\$540</b> | <b>\$820</b> | <b>\$820</b> | <b>\$820</b> | <b>\$820</b> |
| Communication   | \$150        | \$330        | \$330        | \$330        | \$330        |
| Utilities       | \$ 50        | \$100        | \$100        | \$100        | \$100        |
| Vehicle costs   | \$ 20        | \$ 40        | \$ 40        | \$ 40        | \$ 40        |
| Library         | \$150        | \$ 50        | \$ 50        | \$ 50        | \$ 50        |
| GIS             | \$150        | \$150        | \$150        | \$150        | \$150        |
| Others          | \$ 20        | \$150        | \$150        | \$150        | \$150        |

**Facilities Costs (In US\$'000) continued**

|                                      | 1996         | 1997         | 1998         | 1999         | 2000         |
|--------------------------------------|--------------|--------------|--------------|--------------|--------------|
| <b>Capital Costs</b>                 | <b>\$675</b> | <b>\$675</b> | <b>\$675</b> | <b>\$675</b> | <b>\$675</b> |
| Vehicles                             | \$ 75        | \$ 75        | \$ 75        | \$ 75        | \$ 75        |
| Laboratory equipment                 | \$200        | \$200        | \$200        | \$200        | \$200        |
| Computer & office equipment          | \$ 50        | \$ 50        | \$ 50        | \$ 50        | \$ 50        |
| Building depreciation                | \$300        | \$300        | \$300        | \$300        | \$300        |
| Other                                | \$ 50        | \$ 50        | \$ 50        | \$ 50        | \$ 50        |
| <b>Miscellaneous</b>                 | <b>\$188</b> | <b>\$284</b> | <b>\$284</b> | <b>\$284</b> | <b>\$284</b> |
| Number of laborers                   | 80           | 160          | 160          | 160          | 160          |
| Labor costs (at \$1200 PY)           | \$ 96        | \$192        | \$192        | \$192        | \$192        |
| Consultants                          | \$ 10        | \$ 10        | \$ 10        | \$ 10        | \$ 10        |
| DDG travel (12 trips x \$4 per trip) | \$ 48        | \$ 48        | \$ 48        | \$ 48        | \$ 48        |
| DG travel (6 trips x \$4 per trip)   | \$ 24        | \$ 24        | \$ 24        | \$ 24        | \$ 24        |
| Board costs                          | \$ 10        | \$ 10        | \$ 10        | \$ 10        | \$ 10        |

**SUMMARY**

|                              |               |               |               |               |               |
|------------------------------|---------------|---------------|---------------|---------------|---------------|
| Program                      | \$ 888        | \$1688        | \$2928        | \$2768        | \$2768        |
| Miscellaneous                | \$ 188        | \$ 284        | \$ 284        | \$ 284        | \$ 284        |
| Supplies                     | \$ 155        | \$ 340        | \$ 360        | \$ 360        | \$ 360        |
| Services                     | \$ 540        | \$ 820        | \$ 820        | \$ 820        | \$ 820        |
| Capital                      | \$ 675        | \$ 675        | \$ 675        | \$ 675        | \$ 675        |
| <b>Total Operating costs</b> | <b>\$2446</b> | <b>\$3807</b> | <b>\$5067</b> | <b>\$5007</b> | <b>\$5007</b> |
| Refurbishment costs          | \$3000        | \$ 0          | \$ 0          | \$ 0          | \$ 0          |

- Salaries of international staff include home-leave, education of children, repatriation, health insurance, etc.
- Support staff costs for programs include (PY = person per year):
  - 1.0 PY for National Researchers at \$10,200 per person per year.
  - 2.5 PY for Research Associates at \$4,800 per person per year.
  - 2.5 PY for Research Assistants at \$3,600 per person per year.
  - 2.5 PY for Administrative staff at \$2,400 per person per year.
- Library costs for 1996 include purchases of library equipment.
- GIS costs for 1996 are for equipment purchase. Subsequent costs are operational expenditure.

## 7. THE NEXT STEPS

The future sequence of events in the further development of ICLARM's research program for Africa and West Asia and the use of the Abbassa facility will be as follows:

- 1) Negotiations between ICLARM and the Government of Egypt on the host country agreement will continue. It is planned to finalize the host country agreement by mid October 1995.
- 2) Finalize and publish the proceedings of the Cairo workshop.
- 3) A summary of this document to TAC will be prepared for the CGIAR Centers Week meeting in late October 1995.
- 4) When approval is given for ICLARM to develop a research program for Africa and West Asia out of the Abbassa facility, a Deputy Director General in charge of Abbassa, a facilities manager for Abbassa, and one other additional international staff will be recruited in early 1996 subject to funding.
- 5) Refurbishment of the Abbassa facility will begin as soon as approval to proceed is given.
- 6) To develop the approved researchable issues into a set of research program activities, a more quantitative priority setting process will be developed for the region based on, but not limited to, the priority setting process described in the 1992 Strategic Plan.
- 7) The draft research agenda will be refined based on consultation with African and West Asian NARS, ASIs, NGOs, and national and international governmental organizations. Consultation will take place through further workshops, conferences, individual meetings, newsletters, etc. Particular attention will be placed on regions and resource systems not well represented at the Cairo workshop, e.g. West Asia, North Africa, and francophone African countries, and rivers and floodplains.
- 8) The full research program will be developed in a stepped fashion, with ICLARM's partners being fully consulted at each step. International and national staff will be appointed in a stepped fashion that reflects the development of the research program. Consultation with TAC and the CGIAR will occur through the normal annual program and budget approved procedures and as requested by TAC.

## 8. RECOMMENDATIONS TO TAC

It is recommended that TAC:

- **NOTE** the research planning process undertaken to date, including early stage consultation with African and West Asian NARS and regional and international agencies; and
- **ENDORSE** the 9 priority researchable issues and various activities to foster NARS partnerships as additional to ICLARM's present approved work program as follows:
  1. Coral Reefs: Evaluation of the status of aquatic resource systems
  2. Coastal Systems: Development of cost-effective data acquisition systems
  3. Great Lakes: Development of cost-effective data acquisition systems
  4. Coastal Systems: Determination of linkages in integrated coastal area management systems
  5. Genetic characterization of aquaculture species and protection of aquatic biodiversity (inland systems)
  6. Integrated aquaculture-agriculture systems
  7. Fish health baseline studies and diagnostics
  8. Macro-policy settings
  9. Trade and living aquatic resources

## 9. REFERENCE DOCUMENTS

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ICLARM RESEARCH PLANNING WORKSHOP  
23 - 27 SEPTEMBER, 1995  
RAMSES HILTON, CAIRO

LIST OF PAPERS/DOCUMENTS

General

- A Welcome to the ICLARM Cairo Workshop  
Meryl Williams  
John Annala  
ICLARM, Manila
- ICLARM'S Strategic Plan  
John Annala  
ICLARM, Manila
- ICLARM's Process for Developing a Preliminary Research Agenda for the Abbassa Facility  
John Annala  
ICLARM, Manila
- ICLARM's past activities in West Asia/North Africa and Subsaharan Africa  
ICLARM, Manila
- Research needs and issues in aquaculture, fisheries, and aquatic resource management  
ICLARM, Manila
- Africa: Background paper  
Caroline Polak Scowcroft  
Agriculture Australia Consultants
- Research Issues and Needs for Africa and West Asia Identified at ICLARM's Planning Workshop, 10 and 11 August, 1995  
John Annala  
ICLARM, Manila

Coral Reef Systems

- Research on Coral Resource Systems  
John Munro  
ICLARM, Manila
- Coral Reefs of Kenya - Research Activities and Priorities  
Nyawira Muthiga  
Kenya Wildlife Service, Kenya

### **Coastal Aquatic Systems**

- Coastal Fisheries - Prepared for the Cairo, Egypt Workshop  
Saul B. Saila  
University of Rhode Island, U.S.A.
- Aquatic Resource Management in the Western Indian Africa Region  
R.K. Ruwa  
Kenya Marine & Fisheries Research Institute, Kenya
- Coastal Resources Systems  
Annabelle Cruz-Trinidad  
ICLARM, Manila
- Coastal aquatic resources systems in the West Africa: 1995 Status Quo and Research Agenda for Management and Sustainability  
T.O. Ajayi  
Nigerian Institute for Oceanography and Marine Research

### **Inland Aquatic Resource Systems**

- ICLARM's Approach to Integrated Resource Management in Africa  
R.E. Brummett  
ICLARM, Malawi
- Towards an Agenda for Strategic Research and Training on Sustainable Use of Inland Aquatic Resource Systems in Africa  
R.S.V. Pullin  
ICLARM, Manila
- Inland Aquatic Resource Systems  
O.A. Ayinla  
Nigerian Institute for Oceanography and Marine Science, Nigeria
- Aquaculture Development Research Priorities  
Z. Shehadeh and M. Pedini  
Inland Water Resources and Aquaculture Service Fisheries Dept., FAO, Italy
- Aquaculture Development in Egypt - Research Needs and Research Activities  
A.R. El Gammal  
Central Laboratory for Agriculture Research, Egypt
- Restore - A New Tool for Natural Resource Management Monitoring and Evaluation  
C. Lightfoot, M. Prein, H. McArthur  
ICLARM, Manila
- Aquaculture research priorities and the smallholder farmer  
Dr. S.S. Chiotha  
University of Malawi

### **African Great Lakes and Reservoirs**

- The Fishery Resources of African Lakes  
Tony J. Pitcher  
Fisheries Centre, University of British Columbia, Canada
- Notes on the fisheries and socio-economic characteristics of the large East Africa Lakes and Reservoirs.  
Cecil Machena, Lake Kariba Fisheries Research Institute, Zimbabwe
- A case for a higher priority for reservoir-lake system research  
Sena S. De Silva  
Deakin University, Australia
- A strategic research Agenda for the development of tropical reservoir fisheries and aquaculture  
ICLARM, Manila

### **Social Sciences**

- Fishers, Aquaculture and Coastal Resources Social Science Research in Africa and West Asia  
Robert Pomeroy and Madan Mohan Dey  
ICLARM, Manila
- Research needs in the socioeconomics of fisheries in the West African Subregion  
Kofi N. Afful  
Department of Economics and Business Studies - University of Cape Coast, Ghana
- Socioeconomic Research needs for Fisheries and Aquaculture in Africa  
Theophilus R. Brainerd  
South Atlantic Fishery Management Council, USA

### **NARS Partnerships**

- Partnership Between National Aquatic Research Systems and ICLARM in Africa:  
NARS in Sub-Saharan Africa  
Boyd A. Haight  
FAO/ALCOM, Zimbabwe

## FACTS ABOUT AFRICA

### **African Countries**

There are 53 countries in Africa:

- 32 maritime
- 15 landlocked
- 6 small island states

### **African Fisheries**

#### Marine Fisheries

- Major fisheries - mostly industrial fisheries on small pelagics. Small pelagics accounted for 4.8 mt (70%) of the African marine catch of 6.8 mt in 1992.
  - Off South Africa, Namibia, Angola
  - West African coast from Morocco to Liberia
  - Mediterranean Sea
- Artisanal fisheries are locally important

#### Freshwater Fisheries

- Major fisheries - lakes and reservoirs
- Streams, rivers, and floodplains are locally important

#### Aquaculture

- Aquaculture production generally low

#### Fish as Protein

- Generally low as percent of total protein intake
- Can be high as percent of animal protein intake

## Fish Exports

- Low except for countries with large industrial fisheries

## **Total Fish Catch**

Total fish catch (freshwater and marine combined) in 1991 was:

| <b>Country</b> | <b>Fish catch (mt )</b> |
|----------------|-------------------------|
| Morocco        | 593,000                 |
| South Africa   | 511,000                 |
| Ghana          | 365,000                 |
| Senegal        | 320,000                 |
| Egypt          | 298,000                 |
| Nigeria        | 267,000                 |
| Namibia        | 211,000                 |
| Kenya          | 199,000                 |
| Zaire          | 160,000                 |
| Madagascar     | 101,000                 |

## **African Lakes**

The major African lakes and their fish catches in 1991 were:

| <b>Lake</b> | <b>Surface area (sq km)</b> | <b>Fish catch (mt)</b> |
|-------------|-----------------------------|------------------------|
| Victoria    | 68,460                      | 120,000                |
| Tanganyika  | 32,900                      | NA                     |
| Malawi      | 22,490                      | 21,000                 |
| Chad        | 16,600                      | 136,000                |
| Kyoga       | 4,430                       | 138,000                |

## Aquaculture Production

Aquaculture production in 1991 was:

| Country      | Production (mt) |
|--------------|-----------------|
| Egypt        | 39,400          |
| Nigeria      | 16,600          |
| South Africa | 4,000           |

Aquaculture water needs compete with other needs

- Agriculture
- Domestic
- Industrial

## African Rivers

The major rivers (the Nile is the world's longest) are:

| River   | Length (km) |
|---------|-------------|
| Nile    | 6,690       |
| Congo   | 4,670       |
| Niger   | 4,185       |
| Zambesi | 2,650       |
| Orange  | 2,100       |

## AFRICA

- Second largest continent in the world
- Contains 11.9% (750,000 million) of world's people
- Six countries account for half the population
  - Nigeria, Egypt, Ethiopia, Zaire, Morocco, Kenya
- SubSaharan Africa has world's fastest growing population - 876,000 million by 2000
- Disproportionately small share of world trade

**ICLARM RESEARCH PLANNING WORKSHOP**  
**Ramses Hilton, Cairo, Egypt**  
**23-27 September 1995**

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