ASIAN DEVELOPMENT BANK
TECHNICAL ASSISTANCE
TO THE KINGDOM OF CAMBODIA
(ADB TA Nº. T4025-CAM)

CAPACITY-BUILDING OF THE INLAND FISHERIES RESEARCH AND DEVELOPMENT INSTITUTE

DRAFT OF FINAL REPORT

Submitted by

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Asian Development Bank
Technical Assistance to the Kingdom of Cambodia
Capacity-Building of the Inland Fisheries
Research and Development Institute
(ADB TA No. T4025-CAM)

FINAL ACCOMPLISHMENT REPORT
Executive Summary

1. Background

The productivity of Cambodia's inland fisheries is among the highest in the world. Together with rice, fisheries form the backbone of food security of Cambodia's 12 million people. The sector supplies more than 80-90% of animal protein consumed by the country's population and it provides employment to over two million Cambodians, directly or through associated activities.

The growing population in the Tonle Sap basin and increased overall demand for fish has led to over harvest of fish and destruction of critical natural habitats with potential negative impacts on the future supply of fish. So far, rural livelihoods have largely been dependent on the access to the fishery and aquatic resources. The Tonle Sap provides vital services to the rural population in terms of flood protection, water purification, waste disposal, and nutrient enrichment for agriculture, fishery and wildlife. It also serves as breeding grounds and nursery for the aquatic habitats of Cambodia and benefits other riparian countries in Mekong region.

The Royal Government of Cambodia recognizes the importance of inland fishery resources in the country's social and economic development. The Department of Fisheries (DoF) in the Ministry of Agriculture, Forestry and Fisheries (MAFF) has realized the importance of socioeconomic and biological research that will generate reliable scientific information for improvement of policies and generation of appropriate technological and management interventions toward the sustainable use of the fishery resources.

The Inland Fisheries Research and Development Institute (IFReDI) was established by Declaration 357 of the MAFF on October 2002 under the supervision of the DoF. The creation of IFReDI was demand-driven. There is a high demand for scientific data that are needed in averting the environmental degradation in the riparian regions, and in developing technological and management arrangements for the inland fisheries resources.

The Asian Development Bank (ADB), in December 2002, approved a grant for the capacity building of IFReDI (ADB TA No. T4025-CAM). ADB's technical assistance (TA) aimed to kick-start the Institute into becoming a relevant and efficient research and development (R&D) arm of the government that will help in the sustainable development of the country's fishery resources, particularly the Tonle Sap, Southeast Asia's largest lake.

The TA Project has dealt with four components: institute management (setting up of an operational and sustainable institute), research and development (development of capacities in biology and socioeconomics), technology transfer (efficient diffusion of information produced by R&D), and policy development and dialogue (improvement of mechanisms for fisheries management).

The Cambodian Government and the ADB invited the WorldFish Center to implement the TA Project. WorldFish (formerly International Center for Living Aquatic Resources Management

or ICLARM) is an autonomous, non-government, non-profit organization established in 1977 as an international center committed to the promotion of food security, eradication of poverty, and conservation of the environment in developing countries. Headquartered in Penang, Malaysia, WorldFish has offices in nine other countries, and undertakes research and project management in 50 countries. It collaborates with 39 regional and international organizations.

The summary of the accomplishments of all of the components are presented below:

2. Institute Management and Project Administration

The Institute Management Component has accomplished the task of defining the management framework for the operation of IFReDI as a credible organization. The task was accomplished through the conduct of planning exercises and training courses on organization development and management, accounting and budgeting, procurement and asset management, and human resources development.

The IFReDI Management Plan has been finalized and submitted to DoF/IFReDI for approval. Manuals on administrative and financial procedures and the human resource development plan have been drafted and discussed with concerned IFReDI staff through meetings and consultations. The 2004 Operational Plan of IFReDI has been prepared, which also includes the 2004 budget.

Learning-by-doing or on-the-job training was a very effective method for imparting knowledge and skill to the IFReDI staff. Almost on a daily basis, one-on-one tutoring was undertaken on standard office procedures such as filling up of forms, recording, filing, writing/editing correspondence, and bank transactions, as well as preparation of research proposals and report.

Activities:

2.1. Training

The training courses aimed to increase knowledge and skill of the IFReDI management and staff to: 1) apply the basic concepts of organization development, team-building, and institute management; 2) construct project frameworks, plan and set directions and priorities that will enable them to prepare short-term and medium-term research and development plans; 3) improve accounting and financial record-keeping; 4) prepare budget and design monitoring instruments; 5) formulate human resource development plans, including rewards and incentives schemes and career planning; 6) operate the Institute efficiently and effectively; 7) apply proper values and work ethics in their jobs to ensure efficient and effective team-working; and, 8) transfer skills and knowledge they have learned through the TA implementation to their stakeholders. Trainings were conducted and organized in steps as follows:

- On-the-job trainings on administrative and standard office operating procedures were conducted mainly through consultations, meetings, and one-on-one tutoring.

- Five specific training courses were designed for implementation during the Project period, namely;

    a. Organizational Development and Team-building, on 23-24 July in Kampong Cham Province; 25 participants

b. Basic Concepts and Principles of Management, on 30-31 July at the IFReDI Offices; 15 participants

c. Accounting Systems, on 18-20 August in Penang, Malaysia for the Project Accountant, and on 17 September and 6-7 October at the DoF Offices; 4 participants

d. Budgeting Systems, on 9-10 October at the IFReDI Offices; 15 participants

e. Human Resource Development on 5-6 January 2004 in Sihanoukville; 29 participants

In addition to the above training courses, a Priority-Setting Workshop/Training Course was also held for 10 management staff and senior researchers of IFReDI on 5-9 August in Penang, Malaysia. The objectives of the workshop were to: 1) provide skills for priority setting for research; 2) determine Cambodia's research priorities in inland fisheries for the next three years; and, 3) develop a draft medium-term research plan for IFReDI.

Tangible outputs of the training courses are drafts of IFReDI's 2004 budget and medium-term research plan, which were finalized in November and December, respectively.

Outcomes (Deliverable outputs): Financial and Administrative Manuals

Financial Management Systems: The manual provided overall guidelines, document systems and procedures in cash handling, accounting and reporting. The manual also provided procedures for accurate and timely information on the sources and uses of funds for directing human and capital resources in the most cost efficient manner. The manual also ensures proper and accurate reporting of all financial transactions and wise use of funds.

Budgeting Manual: The manual laid out a general guideline and procedures in budget planning, process and formulation of annual budgets including identification of the sources and application of funds, implementation of approved budgets, budget monitoring, reporting and control, budget calendar and flow charts and forms to be used.

Purchasing Manual: It provided the overall guidelines in requesting, purchasing, receiving, and issuing of items needed by different units/offices of IFReDI and to ensure honest and efficient purchasing practices.

Asset Management Manual: The Asset Management Manual has been finalized that will serve as guide in acquiring, issuing, recording, storing, and disposing of unserviceable fixed assets and equipment.

Travel Procedures: The Manual on Travel Procedures provides guidelines for making travel arrangements for IFReDI staff and official guests.

Human Resources Development Plan: The HRD Plan states the IFReDI policy and procedures of attracting qualified applicants, developing the present workforce, and adopting plans to maintain competent and loyal employees. Career planning and development strategies are explained in the manual for all IFReDI staff from research, technology transfer and information, and administration divisions. The career paths under the different divisions are shown in order to provide the staff with a clear vision of their career at IFReDI.

The methods of performance evaluation of all IFReDI staff are explained in the manual. For the semi-skilled workers such as clerks, assistants or those without decision-making responsibilities, the basis of evaluation will be on their inputs. Performance evaluation of unit and section supervisors and middle to top management (Division heads, Director and Deputy Director) will be based on outputs. The Key Result Areas (KRAs) of each management personnel shall be agreed upon at the start of the evaluation period with his/her immediate superior.

IFReDI 2004 Operational Plan: The 2004 IFReDI Operational Plan contains the activities to be undertaken in research, technology transfer and information dissemination, and administration. The research activities are the on-going studies in bio-ecology and socioeconomics under the TA. Four priority research proposals have been prepared for submission to donors, which hopefully, will be implemented in 2004.

The Plan also includes the training in Web site design and desktop publishing to enable IFReDI to produce information materials under the technology transfer and information dissemination component.

The proposed 2004 budget has been incorporated in the Operational Plan.

2.2. Networking

Networking with other organizations and development agencies in Cambodia was primarily in the form of information-exchange and work coordination. The Institute Management Component liaised with officers and staff of the MRC, FAO, UNESCO, WWF, DFID, OXFAM, and government agencies such as the Supreme National Economic Council under the Office of the Prime Minister.

Discussions on possible links with the following organizations were also done: 1) Japan International Cooperation Agency on aquaculture as livelihood in the rural areas; 2) Agri-systems Inc. on the project preparation for a possible ADB TA on sustainable livelihood in the Tonle Sap area; 3) University of Tasmania on development and production of documentaries as information materials; and 4) Live and Learn Environmental Education of Australia on possible link up in the use of research information gathered from WorldFish study sites in the Tonle Sap Area.

2.3. Project Administration

The Project employed three Cambodians on secondment for the positions of Administrative Assistant cum Accountant, Computer/LAN Administrator, and Research Associate.

Project fund management followed judicious budgeting and expenditure policies to ensure optimization of funds for the benefit of IFReDI and its staff. Monthly financial reports were submitted to WorldFish Financial Management Unit in Penang following proper accounting procedures.

The Project Accountant, Mr. Ou Sary, underwent training on different accounting systems including donor reporting, cash advances and liquidations, travel and purchasing procedures, bank statements and reconciliation, and petty cash system. A training course on computerization of the accounting systems was conducted for the Project and IFReDI accountants.

Mr. Chuop Sokhan, Project Computer/Internet Administrator, attended a WorldFish-sponsored training on the capacity building for developing National Information Systems held in Los Banos, Philippines on 30 November to 7 December 2003

For logistical and administrative support, the Project purchased 10 units of IBM desk-top computers, 5 units of printers, I unit photocopier, 6 sets of office tables and chairs, one safety box, an internet system with 75 access points, one unit external hard disk, 3 units USB memory flasks, 2 telephone lines with fax facilities, and, one white board with sliding aluminum frame.

The savings in the first half of the Project period were reallocated to purchase equipment and library shelves and furniture. The equipment included LCD, cameras, desktop publishing hardware and software, and scanner. Reference books for the library were purchased using a US$5,000 budget.

3. Research and Development

3.1. Bio-ecology and Modeling Sub-Component

The research objectives of the bioecology and modeling component (BioMod) were to expand knowledge in the bio-ecology of key fish species, to design a model of the flood-fish relationships in the Tonle Sap, and to train IFReDI staff.

1. Training

- Sixteen IFReDI staffs, as well as 19 students from the Faculty of Fisheries, have received 30 hours of formal training in fish biology, research methods and data analysis. Lecture notes have been published in the form of a training manual.

- Five IFReDI biologists have been trained on-the-job in fish taxonomy, fish biology, research methods and data analysis. They have been enabled to perform field biology as per international standards, to analyse data and to produce research reports.

- One week of training course on Fish Base (fish information database) in the Philippines has been offered to two IFReDI staffs, for the development of long term collaboration with FishBase.

IFReDI staffs have also been trained in writing research proposals and one BioMod counterpart has produced a project proposal.

- Two counterparts have been trained in Bayesian modeling and they are now able to run and modify existing models, as well as to develop new simple networks.

- Two counterparts have been accepted for a Master's degree at the Asian Institute of Technology.

2. Bioecology

- The sites suitable for monitoring of fishes with gill nets in all seasons have been identified (including two sites in common with the Socio-Economic component).
- A reliable methodology for long term monitoring of fishes by a combination of gill nets and other gears has been defined and budgeted in a report.

- Gillnets have been constructed and experimental fishing operations have been conducted according to FAO standards during 34 days in two seasons (gathering of information on fish taxonomy, size, weight, reproduction and diet).
- A biology database has been created and filled with biological data from 3412 fishes analysed on the field; a manual for data entry and cleaning has been produced.
- Key commercial fish species have been identified in a publication. The top-ten fish (recorded under Khmer names) actually correspond to 38-47 scientific species and the problems inherent to the naming of fishes have been highlighted and presented in a regional fisheries symposium.
- All published information on 10 dominant species has been compiled and summarized in a publication. This publication in English is being translated into Khmer.
- A dictionary of Khmer-Latin fish names has been produced.
- A dictionary of valid species names for Mekong species has also been produced.
- A reference fish collection could not be set up at IFREDI due to the no-show of the expected expert in taxonomy. As Dr. Chavalit Vidthayanon accepted the work in August 2003 and ultimately declined in March 2004 it was not possible to find upon very short notice an alternative consultant among the four remaining Mekong fish taxonomists.

3. Modeling

- A model of the Tonle Sap fish resource has been designed through successive consultations with 38 stakeholders. This model includes:

- knowledge of researchers, technicians, fishers and farmers;
- information drawn from a collection of databases in hydrology, land use and water quality (one-months expert consultation and 60 pages long detailed report);
- a specific study of fish-dependant communities around the Tonle Sap Lake (publication of 63 pages).

- The model integrates the interactions of 35 variables leading ultimately to fish harvest. Among those variables are rainfall and river flow, flood descriptors, dissolved oxygen, floodplain vegetation, fishers groups and fishing pressure.
- The outputs of the model are probabilities of having a good or bad fish harvest given the state of the previous variables. The model could forecast the catch if catch and effort data were available. As it stands the model can be very helpful in assessing qualitatively the consequences of various basin management options (scenario study).
- A CD-ROM of the model (with open sources) has been produced
- This model has been presented to the annual meeting of the MRC Fisheries Program in May 2004.
- A paper focusing on the lessons learnt from stakeholders consultations for parametrization of Bayesian models in environmental management has been submitted to an international symposium on environmental modeling (September 2004, Penang, Malaysia).

4. Networking

- Close collaborations have been set with:

- representatives from 4 institutions, 3 local communities, 2 scientific projects and 2 NGOs;
- the MRC/WUP-FIN Tonle Sap modeling project;
- the Mekong River Commission, in particular about the integration of the fisheries model outputs into their global basin management strategy.

- Three project proposals involving IFReDI have been developed. Two project have been accepted by the Water and Food Challenge Program, with a funding of $86,700 for IFReDI. One project will start in June 2004 and the other should start in January 2005.

5. Recommendations and follow-up actions

The experience drawn from this project has led to the identification of five thrusts proposed for further development in the field of bioecology and modeling:

a. Naming fish properly- Keep on strengthening the capacity of IFReDI biologists in taxonomy;
- Produce species identification keys, which do not exist yet;
- Collaborate with socio-economists for a proper naming of fishes
- Collaborate with various institutions for more taxonomists get involved in the region.

b. Provision of information on the state of the resource- Initiate a long-term monitoring of dominant fish species with gill nets and additional gears;
- Analyse and make use of biological data on dominant species;
- Publish scientific results in the form of policy briefs and brochures.

c. Integration of information for management- Deepen the "fisheries" component of the Bayesian model
- Integrate an economic component to the model
- Integrate the results to the MRC Decision Support Framework and the Integrated Basin Flows Management.

d. Protection of species and production - Study freshwater protected areas, with a particular focus on:
- the freshwater sanctuaries in the Tonle Sap (location, mode of operation, requirements), and
- the deep pools in the Northern part of the Cambodian Mekong (test of the biological impact of conservation measures).

e. Continued on-the-job training - data analysis and report writing.

3.2. Socioeconomic Sub-component

The socioeconomic sub-component of the TA has two broad objectives: 1) to provide training to the IFReDI staff (on-the job and formal) on natural and agricultural resources economics, research methods and data analysis, and database development and analytical tools; 2) to undertake research as part of learning-by-doing so that staff are able to initiate and conduct research independently. The resource specialist for this component spent six months as required by the TA.

On-the-job training

Activities:

- Staffs of Socioeconomic Division of IFReDI were provided continuous “on-the-job” training on research methods such as sampling and data collection methods, questionnaire preparation, data cleaning (checking and rechecking), database development and maintenance, coding, data documentation and data entry, data analysis – frequency distribution, summary tables, cross tables, etc.
    - They got hands-on experience in field data collection, and were exposed to various field situations in collecting data from different stakeholders during the project period.

Outcome:

- Nine staffs of IFReDI and DoF were benefited from the "on-the –job" training on research methods, sampling design and data collection methods. A few of them are now capable of leading field data collection, designing and selecting samples.
- Six staffs of IFReDI and DoF (HQs) and four provincial fisheries officers were exposed to field data collection methods and various ways of rapport building with the respondents.

Formal training

Activities:

- A three-day training session was conducted during 19-21 August 2003 on economic valuation, data collection methods and on the contents of questionnaires as to how these are related to the objectives of the research topics. The training also focused on the methods and techniques of drawing representative samples.
- A weeklong training was conducted on "Research Design and Statistical Analytical Methods" in December 2003.
- A comprehensive training on "Natural Resources Economics and Research Methods" was conducted during 23 February 2004 to 03 March 2004 in Penang, Malaysia.

Outcomes:

- Ten staffs of IFReDI and DoF were benefited from the three-day training.
- Thirty staff of IFReDI, DOF and CFDO participated in the December training on research design and statistical analytical techniques.
- Sixteen IFReDI staffs from Biology and Socioeconomics Division were benefited from the training held in Penang.
- A training manual (draft) on "Natural Resources Economics and Research Methods" was prepared as part of the training in Penang and circulated to all the participants.

Learning-by-doing (Research)

As part of "learning-by-doing" three research topics were identified as below:

a. Circumscribing value of aquatic resources to elucidate policy directions
b. Investigate marketing, distribution and utilization of key fish species,
c. Study cost and benefits, markets, and livelihoods opportunities in fish processing.

The staffs of Socioeconomic Division of the IFReDI attained significant knowledge and skills through the implementation of the research topics. They are now proficient in identifying and implementing any research problem relating to socioeconomics and natural resources management. They are able to develop questionnaires, interview guidelines, database in MS Excel and Access. They are also proficient in data entry, data analysis using different data analysis software. The component achieved significant progress in collecting and analyzing data on the on the proposed research topics. The research topics undertaken in this TA addressed the following objectives that are vital for policy and development. The objectives are:

a. To provide an estimate of economic values of the aquatic resources and its importance to the livelihoods of fishers, farmers, traders and exporters;
b. To indicate the extent of dependence of the households on the resources of the Great Lake;

c. To provide sensitivity analyses of the changes in the resource environment (a gradual decline in fish catch to ecological collapse) on the livelihoods of the fishers and farmers, and on the national economy.
d. To identify key fish species to the households, traders and exporters;
e. To identify fish distribution channels and supply chains and constraints of marketing of fish and fish products;
f. To provide an inventory of infrastructures of marketing and post harvest fish handling and identify development needs;
g. To describe the existing status of fish processing in the country and suggest development needs in the context of WTO, health and sanitary requirements by the fish exporting developed countries and other non-technical barriers.

Circumscribing value of aquatic resources to elucidate policy directions

Research Methods and Activities:

- Made exploratory field visits to villages and interviewed village chiefs.
- Selected nine villages from three Provinces, namely Siem Reap, Kendal and Kampong Chnang, three villages from each province.
- From each province three villages – fishing village, fishing cum farming village, farming cum fishing village were selected.
- Households of each village were stratified into three groups – poor, middle and upper, and 15 households from each group were selected randomly.
- A detailed questionnaire was prepared, field tested and finalized; three teams were formed and trained.
- First round data collection began in the first week of September and finished by the end of September 2003.
- Second round data collection was conducted in January 2004.
- Developed databases in Access for entering and storing data, entered, checked and crosschecked data.
- Analyzed and tabulated key information and draft preliminary report is in progress. Summary results are provided in the main report.

Investigation of marketing, distribution and utilization of key fish species

Research Methods and Activities:

- Identified key stakeholders in fish trading and marketing.
- Selected 3 fish markets in the city, one provincial market in each Province, and one rural market in and around each of the selected villages.
- Selected 6 landing sites to monitor and interview fishers, fish collectors, middlemen and agents.
- Interviewed fresh and live-fish exporters and provincial fisheries officials.
- During second round data collection, selected 19 retail fish markets were interviewed
- Six landing sites were observed and monitored again during second round data collection.
- Observed 11 markets, interviewed 61 retailers of fresh and processed fish during first round data collection.
- Interviewed as many as 15 exporters of fresh and processed fish products.
- Data are processed, tabulated and being analyzed. Summary results are provided in the main report.

Costs, Benefits, Markets, and Livelihoods Opportunities in Post Harvest Fish Handling and Processing

Research Methods and Activities:

- Visited fish processing zones in Kampong Chnang and Siem Reap to understand the industry and to help preparing questionnaires and observation guidelines.
- Selected areas from which sample should be drawn in Kampong Chnang, Siem Reap and Poursat
- Prepared questionnaire for the survey of fish processing units
- Surveyed 61 fish processing units in Siem Reap and Kampong Chnang and Poursat
- Data were checked and crosschecked.
- A database for the fish-processing questionnaire was prepared and data entry completed.
- Data analysis and tabulation have been completed, report writing in progress. Summary results are provided in the main report.

Other Activities

The resource specialist participated and contributed in the training workshop on "Co-management" held in Kampot province for the IFReDI staffs held in March 2004. Participated as a resource person in the training workshop on "Project Proposal Preparation and Technology Transfer" held in March 2004 and contributed to draw the technology transfer pathways and stakeholders involved and helped to finalize draft research proposals for IFReDI.

Conclusions and Recommendations

The socioeconomic staffs of IFReDI have achieved significant knowledge in field research and skills in analytical techniques through "learning-by-doing" and on-the-job experiences over the project period. They tried their best to learn and apply by doing research in their own. However, all these knowledge and skills will sustain only if there are follow up research activities and refreshers training arrangements. Twining and long term partnership with International Agencies/Advance Scientific Institutions are critical for sustainable capacity building in research. Continuous collaboration with national and international research institutes and organizations is necessary to implement the medium term research and development plans.

IFReDI staff still requires developing skills in analyzing and translating research results into policy analysis. They need to understand the policy domain and policy environment to initiate meaningful policy dialogue for sustainable management of the fisheries resources. Therefore, the ADB and WorldFish should consider further support to IFReDI in the areas of technology transfer, research and policy analysis.

4. Technology Transfer Component

The objective of the Technology Transfer component is: (i) to develop a technology transfer and information dissemination framework for IFReDI and (ii) provide skill training to staff of IFReDI in various aspects of technology transfer and information dissemination. This to be achieved through a series of on the job and class room training to enhance effectiveness and efficiency of IFReDI in conducting research and transfer of research results for sustainable management of aquatic resources. These objectives have been achieved through the following activities:

***Development of framework for technology transfer and information dissemination*:** In consultation with staff of IFReDI, DoF and provincial authorities a framework has been developed that included identification of outputs/products that are expected to be generated by

IFReDI in the next 10 years; beneficiaries/users of this information; dissemination methods and pathways for different outputs and stakeholders; cost recovery mechanisms for self sustenance of IFReDI; and proposing an institutional structure that could efficiently and effectively address the needs of technology transfer activities.

Preparation of research proposals: Since the government funding for research is limited, the staff of IFReDI have been trained in research proposal preparation and 4 proposals have been prepared by IFReDI staff with the assistance of WorldFish consultants.

Training: Sharing of research findings and information with different stakeholders will be a major activity of IFReDI in the coming years. Keeping this in view a number of training programs have been organized for strengthening the capacity of IFReDI staff. The training programs conducted were:

Library management: Three staff members of IFReDI have been trained at WorldFish HQ in Penang, Malaysia and in Phnom Penh during 10-22 December 2003 and 22 March – 2 April 2003 respectively in library management, organizing and dissemination of information, cataloguing, processing of library loans, establishment of gift and exchange programs with other libraries and networking with other libraries in Cambodia and regional/international organizations. CDS/ISIS for Windows software has been installed as the library information storage and retrieval system and staff have been trained in its use.

Project proposal preparation: Training workshop was organized for 24 IFReDI and DoF staff to improve their skills in project development and writing of proposals and better understanding of intricacies in getting project funding from donors. This was followed by review and finalization of 4 research proposals for submission to donors.

Web-page designing: Eight staff members of IFReDI have been trained in web-page designing and maintenance which included how to upload and configure files in remote site, write code with HTML, edit code for other home pages, and use new generation web design application. The tangible output of the course is an IFReDI Web Page be ready for use and will be linked with other relevant national/regional and international organizations.

Desktop publishing: Arrangement with a local consultant is being arranged. Meanwhile, self-learning by IFReDI staff is being done**.** Eight staff will be trained in desktop publishing.

Printing and audio-visual materials production skills development: Arrangement for a local expert to train selected IFReDI staff is being done.

Procurement of equipment: Some basic equipment needed for the library and technology transfer has been procured. These equipment include LCD, digital and video cameras, desk top publishing hardware and software, overhead projector, and scanner.

Remarks and Recommendations: IFReDI staffs are new to technology transfer and information dissemination activities and need to be further trained and provided technical backstopping. DoF should provide budget for technology transfer activities till such time IFReDI is able to generate revenues from technology transfer.

5. Policy Development and Dialogue

The Policy Development and Dialogue Component has clarified what are the major inland fisheries policy issues and concerns in Cambodia at the international (regional), national, and local (geographical and administrative) scale. This also includes the identification of stakeholders, legal frameworks, organizations involved and the role and direction of policy research at the various scales/levels.

In addition to on-the-job training the IFReDI staff training activities have included weeklong out-of-office training workshops in priority setting in fisheries research (August 2003) and co-management research (March 2004). The priority setting workshop which took-off from the identification of critical policy and management issues in Cambodian inland fisheries led to the formulation of the IFReDI Medium-term Research Plan 2003-2006.

The identification of research issues related to the development of co-management arrangements and the design of research projects was a major outcome of the co-management training. The outcome and all presentations made is available on Cd-ROM. Dialogue meetings with selected policy research stakeholders and partners have been held/are scheduled and a "Guide to fisheries policy research" will be completed and presented before the end of May 2004.

6. Conclusions and Recommendations

a. The TA has been very successful in kick-starting IFReDI through capacity building of research and administrative staff in institute management, research and development (biology and socioeconomics), technology transfer, and policy development and dialogue.

b. IFReDI is now a functioning institution capable of managing and administering itself to support research and development the inland fisheries sector. IFReDI staff attained sufficient knowledge and skills to continue with the administrative, financial and human resources management that were developed and implemented under the TA. However, they may need further support to strengthen their capability in technology transfer and information dissemination.

c. A number of research outputs from the TA can be translated into useful policy and recommendation materials that can be targeted to different stakeholders. For instance, research results on the economic valuation of Tonle Sap provide indicative values of the fishery and other aquatic products that can help stakeholders and policy makers in selecting management interventions for sustaining these resources.

d. Although research staff in IFReDI have been trained and exposed to bio-ecology and natural resources research and data collection methods, database development and maintenance, and data analysis, staff will require further follow up training and coaching to sustain these knowledge and skills.

e. IFReDI research staff of both biology and socioeconomics division will require advisory and financial support to conduct studies that were prioritized in the operational plan for the year 2004 – 2005.

f. IFReDI staff will require further training in writing reports, research papers for journals/symposia to translate research results into meaningful policy dialogue.

g. To sustain knowledge and skills that were achieved through the TA effort ADB and WorldFish should consider further support to IFReDI staff especially in the areas of technology transfer, research and policy analysis.

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2. The growing population in the Tonle Sap basin and increased overall demand for fish have led to over harvest of fish and obstruction of critical natural habitats with potential negative impacts on the future supply of fish. So far, rural livelihoods have largely been dependent on the access to the fishery and aquatic resources. The Tonle Sap provides vital services to the rural population in terms of flood protection, water purification, waste disposal, and nutrient enrichment for agriculture, fishery and wildlife. It also serves as breeding grounds and nursery for the aquatic habitats of Cambodia and benefits other riparian countries in Mekong region.

3. The Royal Government of Cambodia recognizes the importance of inland fishery resources in the country's social and economic development. The Department of Fisheries (DoF) in the Ministry of Agriculture, Forestry and Fisheries (MAFF) has realized the importance of socioeconomic and biological research that will generate reliable scientific information for improvement of policies and generation of appropriate technological and management interventions in the sustainable use of the fishery resources.

4. The Inland Fisheries Research and Development Institute (IFReDI) was established by Declaration 357 of the MAFF on October 2002 under the supervision of the DoF. The creation of IFReDI was demand-driven. There is urgent demand for scientific data that are needed in averting the environmental degradation in the riparian regions, and in developing technological and management arrangements for the inland fisheries resources.

5. The Asian Development Bank (ADB), in December 2002, approved a grant for the capacity building of IFReDI (ADB TA No. T4025-CAM). ADB's technical assistance (TA) aimed to kick-start the Institute into becoming a relevant and efficient research and development (R&D) arm of the government that will help in the sustainable development of the country's fishery resources, particularly the Tonle Sap, Southeast Asia's largest lake.

6. The four components of the TA are:

   Institute Management: This component aims to provide develop appropriate administrative skill and management capability of IFReDI personnel through off-site and in-site training courses and seminar-workshops, and learning-by-doing.

   Research and Development (R&D): R&D has two sub-components: biology and socioeconomic. The broad objectives are to: 1) develop the capability of the IFReDI staff

to undertake research and impact assessment independently; and, 2) initiate research on fisheries bio-ecology and socioeconomic studies on marketing, post-harvest processing, distribution and supply chains of fish products.

Technology Transfer: Under this component, the IFReDI staff will be trained how to package research results – information generated and technology developed – and how to disseminate these to various stakeholders so that they may be able increase their fish production, and manage and utilize their common resources in harmony.

Policy Development and Dialogue: With the objectives to help reduce conflicts in fishery resources use and to develop pro-poor laws and policies, this component will review relevant fisheries institutions and existing laws and regulations, conduct consultations with different stakeholders, train the IFReDI staff on policy development, and initiate mechanism to place the Institute in an acceptable position in policymaking.

II. Accomplishments

1. Institute Management

7. The Institute Management Component has accomplished the task of defining the management framework for the viable and sustainable operation of IFReDI. The task was accomplished through the conduct of planning exercises and training courses on organization development and management, accounting and budgeting, procurement and asset management, and human resources development. English proficiency courses in three levels were also undertaken to improve the oral and written communications of the IFReDI staff (Table 1).

8. The IFReDI Management Plan has been finalized and submitted to DoF/IFReDI for approval. Manuals on administrative and financial procedures and the human resource development plan have been drafted and discussed with concerned IFReDI through meetings and consultations. The 2004 Operational Plan of IFReDI was drafted including the proposed 2004 budget.

9. The training courses and workshops were designed to build the administrative and management capacities of the Institute personnel. It also set the framework in the participatory approach in the preparation of administrative and financial manuals and the human resources development plan.

10. Learning-by-doing or on-the-job training was a very effective method for imparting knowledge and skill to the IFReDI staff. Almost on a daily basis, the Team Leader-cum-Management Specialist in charge of the Institute Management Component conducted one-on-one tutoring on standard office procedures such as filling up of forms, recording, filing, writing/editing correspondence, and bank transactions, as well as preparation of research proposals and report.

1.1. Training

Formal training courses

11. The first planning session held prior to the Inception Workshop was on the SWOT analysis (Appendix A-1) of the Institute. Participated by researchers, administrative staff, and management people, the exercise was able extract their perceptions on the strengths and weaknesses of the organization as well as the opportunities and external threats that

may affect the Institute. This exercise provided insights on the outlook of the IFReDI staff on the newly established Institute that will affect their career in fishery research and development.

12. Five formal training courses on Institute Management were designed and implemented during the Project period, namely: 1) Organization Development and Team-Building; 2) Basic Concepts and Principles of Management; 3) Accounting Systems; 4) Budgeting; and, 5) Human Resources Management and Development.

13. An additional "hands-on" training course on the computerization of the accounting systems, using a simple, easy-to-learn "Quick Books" program, was conducted for the accounting staff.

14. English proficiency courses in three levels were conducted for 40 employees of IFReDI and DoF. All the students were given diagnostic test to determine the level of their proficiency and aptitude in English.

15. The training courses aimed to equip the IFReDI management and staff knowledge and skills to: a) apply in their work the basic concepts and principles of organizational development, team-building and institute management; b) construct frameworks, plan and set directions and priorities that will enable them to prepare short-term and medium-term research and development plans; c) do accounting and asset management; d) prepare budget and design work monitoring instruments; e) formulate human resources development plans, including rewards and incentives systems and career planning; f) manage and operate efficiently and effectively the Institute; g) apply in their work proper values and work ethics that promote pleasant interpersonal relationship and efficient team-working; and, h) teach to their stakeholders the skills and knowledge on organizational development and institute management that they have learned.

Highlights of the training Courses

Training Course No. 1 - Organization Development and Team-Building
23-24 July 2003
Kampong Cham Province
25 participants

16. Course Objectives

At the end of the two-day training-cum-workshop, the participants should be able to describe the current picture and situation of the Institute in terms of structure, vision, mission and goals, and have some degree of understanding of the concepts of organization development and team-building.

17. Course Participants' Expectations
Co-facilitators: VBNK

The participants expected to learn the theories and strategies to promote participation, good team building, work efficiency and effectiveness, motivation, and good communication. They also expected to hear about the experiences of research institutes in other countries, and learn management techniques that are best suited for the development of IFReDI. They also wanted to know how to develop string cooperation among team members and apply this to their Institute to hasten its development.

18. Course Content

Lecture: *IFReDI and the Environment*
R F Agbayani
(Appendix A-2)

The lecture discussed the following topics: 1) IFReDI as an institution; 2) challenges of the millennium, with emphasis on the global trade and, changing consumer and social behaviors, etc; 3) information and technologies, and the influence of the Internet on the exchange of knowledge and information; 4) knowledge and its effects on global competition; and 5) IFReDI stakeholders analysis (description and needs).

19. Lecture: *Hierarchy of Objectives*
Review of IFReDI's Vision, Mission and Aims
Facilitator: VBNK
(Appendix A-3)

The lecture discussed IFReDI's objectives and how each objective is linked to one another and why they are linked. The importance of the organization's vision, mission and goals and how each contributes to each level within the organization was stressed. The influences of the internal and external environments including that of the stakeholders were discussed.

20. Lecture/Discussion/Exercises: *Organization and Team-building*
Facilitator: VBNK

The lecture and subsequent discussions covered the following: 1) definition of a team, and the roles of each member in a team; 2) definition and basic concepts of organization development; 3) organizational life cycle; 4) levels of organizational complexities; and, 5) stages of team development.

21. Team building exercises were held. All the participants joined the activities. The exercises were: 1) "chair exercise" which illustrated the different issues that each team may face, such as communication, negotiation, clarity of roles and responsibilities, and the need for each team member to see the big picture of their organization; 2) "picture of IFReDI exercise" tasked the participants to look at IFReDI according to the different levels of situations, from the most tangible to the most abstract; 3) "tinker toy game" which demonstrated to all the participants the importance of issues, and the quality of work of each of the team members and the team as a whole; and, 4) "human sculpture construction exercise" provided the participants an opportunity to express their feelings regarding the importance of their role in the success of IFReDI.

22. Course output

A commitment exercises was conducted at the end of the course. Each participant was asked to write a letter (addressed to their self) listing down things that they commit to do in the next 6 months for the development of IFReDI. These letters were kept and will be opened after six months (in January 2004).

Training course No.2 - Basic Concepts and Principles of Management
30-31 July 2003
IFReDI Offices, Phnom Penh City
15 participants

Lecturer: Renato F, Agbayani
(Appendix A-4)

23. Course objectives

At the end of the training course, the participants were expected have understood the basic concepts and principles of management, and able to review, revise and favorably endorse the draft of the Management Plan of IFReDI.

24. Course content

The lecture covered the following topics: 1) definition of management; 2) functions of management; 3) planning: definition, objectives, how to plan, why plan, types of plan, planning tools and techniques, management by objectives, criteria of good performance objectives; 4) organizing: definition, organization structures, trends in organizing in the new workplace; 5) leading: definition, leadership and vision, leadership and power, leadership and empowerment, and, ethical aspects of leadership; 6) controlling: definition, steps in controlling, and types of controls.

25. Course output

The tangible output of the training course is the revised draft of the IFReDI Management Plan (Appendix A-5) and the Terms of References of the Management Team of IFReDI (Director, Vice Director, Divisions Chiefs and Vice Chiefs of Biology, Socioeconomics, Administration, and Kendal Field Research Station). The participants reviewed, revised and finalized the documents.

Training Course No. 3:
Part 1 - Accounting Systems (Project level)
18-20, 2003
World Fish Center, Penang, Malaysia
One trainee (Project Accountant)
(Appendix A-6)

Part 2 – Accounting Systems (Institute level)
17 September & 6-7 October, 2003
IFReDI/DoF Offices, Phnom Penh City
4 IFReDI administrative staff

Part 3 – Tutoring on accounting systems
(Project Level) March 23-26, 2004
Conducted by WorldFish Accountant
For the Project Accountant
IFReDI Offices, Phnom Penh City

Part 4 – Computerization of Accounting Systems
(Institute level) April 24 and May 1, 2004
IFReDI Offices, Phnom Penh City
Three administrative staff
(Appendix A-7)

26. Course objectives

At the end of the training courses in Accounting Systems, the participants were expected to learn how to prepare accounting reporting systems on: a) monthly liquidation report; b) cash position report; c) bank reconciliation; d) petty cash reports; e) check payment report; and f) bank statement report. The Project Accountant trainee was expected to learn donor reporting requirements and reporting systems.

The accountants were expected to efficiently use the computer program in the recording of accounting transactions and preparing financial reports.

27. Course Contents

The course was a one-on-one "hands-on" training course conducted by the staff of the Finance Management Unit of the WorldFish Center in Penang. The topics included: a) donor reporting system; b) cash advances and liquidations; c) petty cash system; payments for consultancy and purchases; d) travel procedures; and, e) procurement procedures.

Training Course No. 4 – Budgeting
9-10 October 2003
IFReDI Offices, Phnom Penh City
15 IFReDI staff
Lecturer: R F Agbayani
(Appendix A-8)

28. Course objectives

At the end of the course, the participants were expected to: 1) learn the budgeting procedures in the Cambodian government; 2) know the principles and concepts of budgeting; 3) prepare a tentative annual budget for IFReDI.

29. Course Contents

The topics of the course were: a) budgeting in the government of Cambodia: constitutional provisions on budgeting, role of Cambodia government agencies in budgeting, and budget preparation procedures; b) basic concepts in budgeting: definition, functions, importance and limitations of budgeting; c) budget process: budget preparation and forecasting techniques, budget review and approval, budget execution, and budget monitoring and control; d) types of budget: operating and maintenance budget, capital budget, cash flow budget, and zero-based budget; e) budget calendar and budget revisions; and, f) checklist guide to better budgeting.

30. The tangible output of the training course was the tentative 2004 budget of IFReDI. The tentative budget includes the core-operating budget from the national government of Cambodia and the proposed budget for three research projects for implementation in 2004. These research activities are part of the Medium-Term Plan of IFReDI.

Training Course No. 5 – Human Resources Management & Development
5-6 January 2003
29 IFReDI Staff and Provincial Fishery Officers
Main lecturer: R.F. Agbayani
Co-lecturer: Mr. Chun Sophat (MRC)

31. Course objectives

At the end of the course, the participants were expected to learn to concepts and principles of human resources management and development with emphasis on attracting qualified applicants, as well as developing and maintaining quality workforce for IFReDI.

32. Course Contents

The training courses covered the following topics (Appendix A-9): a) definition and concepts of human resources management; b) strategic human resources management; c) job analysis and description; d) recruitment and selection processes; e) developing a quality workforce through employee orientation, on-the-job training, off-the-job training, and other special training courses; f) performance management; g) career planning and development; h) retention and turnover; i) promotions and transfers; j) compensation and benefits; k) management relations; l) motivations, rewards and incentive schemes; m) job design; n) performance evaluation; o) discipline and disciplinary actions; p) communications; and q) conflict resolutions.

33. Course Output

Job analysis of each Division (Administration, Biology, and Socioeconomics) were drawn which became part of the Human Resource Development (HRD) Plan of IFReDI. A separate section is devoted to the HRD Plan.

Training Course No. 6 – English Proficiency Course in Three Levels

34. The English Language Training Institute in Phnom Penh was engaged to conduct English courses for IFReDI and DoF personnel. All trainees underwent a diagnostic test to determine the level of their proficiency and aptitude in the English language. The duration of the training is 50 hours per level. During regular meetings held by the Team leader, the staff is encouraged to speak in English to slowly gain confidence. The breakdown of trainees is: 1) 13 in level 3; 2) 9 in level 4; and 3) 18 in writing skills or a total of 40 trainees.

1.2. Learning-by-doing

35. “Learning-by-doing” or on the job training was an effective way to impart knowledge and develop skills for standard office work. Almost everyday, the Institute Management Specialist is consulted or gives one-on-one tutoring on administrative and management matters, as well as on research matters like proposal and report writing.

36. Series and meetings and consultation with IFReDI management and administrative staff were conducted in the process of preparing the administrative and financial manuals, the HRD Plan, and the 2004 IFReDI Operational Plan. The participatory approach gives "ownership" to the IFReDI management and staff of the administrative and financial

manuals, HRD Plan and operational plans. The sense of "ownership" of plans, rules and regulations gives a better chance for adherence and compliance among the staff.

1.3. Deliverable outputs

Manuals of Operation

37. Drafts of administrative and financial manuals were completed including the following: 1) Financial Management Systems including Budgeting Systems, Cash Accounting and Management; 2) Purchasing Systems and Procedures; c) Asset Management; d) Travel Procedures; and, e) Human Resources Development Plan.

Manual No.1 – Financial Management Systems (Appendix A-10)

38. The objectives of the Manual on Financial Management Systems are to provide overall guidelines, systems and procedures in cash accounting and reporting. The manual also provides procedures for accurate and timely information on the sources and uses of funds for directing human and capital resources in the most cost efficient manner. The manual also ensures proper and accurate reporting of all financial transactions and wise use of funds.

39. On a daily basis, the Manual on the Financial Management Systems provides guidelines on the disbursement and accounting of cash and ensures smooth operations of IFReDI by making available sufficient cash at any time and properly secured. It also identifies the responsible people involved in the transactions and defines their respective accountabilities on funds entrusted to them.

40. The computerized accounting systems enables to generate the financial statements and other routine daily financial reports about fund deposits, petty cash, expenditure reports, and other transactions. The "Quick Books" computer program is updatable from the Internet and is available in computer stores.

41. The Financial manual provides the flow charts for easier understand and the appropriate forms.

Manual No. 2 – Budgeting Manual (Appendix A-11)

42. The objectives of the Budgeting Manual is to provide a general guidelines and procedures in budget planning, process and formulation of annual budgets including identification of the sources and application of funds, implementation of approved budgets, budget monitoring, reporting and control, budget calendar and flow charts and forms to be used.

43. The budgeting manual provides a tool for planning, implementing and controlling research and development activities of IFReDI.

44. The manual identifies the cost centers and the responsible people in the different units of IFReDI involved in the use and control of budget.

Manual No. 3 - Purchasing Manual (Appendix A-12)

45. The objectives of the Purchasing Manual are to provide the overall guidelines in the requesting, purchasing, receiving, and issuing of items needed by the different units/offices of IFReDI and to ensure honest and efficient purchasing practices for the good of IFReDI.

46. The Purchasing manual provides control measures in the allowable amounts of purchases and identifies the responsible persons who can make decisions in approving purchase requests depending on the amount of purchase.

47. The Manual also includes flow charts and the required forms for requesting and purchasing of items.

Manual No. 4 – Asset Management Manual (Appendix A-13)

48. The objective of the Asset Management Manual is to serve as guide to in acquiring, issuing, recording, storing, and disposing of unserviceable fixed assets and equipment.

49. This manual ensures the safekeeping and maintenance of IFReDI's fixed assets and equipment in order to prolong their useful and economic lives.

50. A Fixed Asset Registry is established that will identify the location of the asset and the persons accountable of the safekeeping and maintenance of the equipment and fixed assets.

Manual No. 5 – Travel Procedures (Appendix A-14)

51. The Manual on Travel Procedures provides guidelines for making travel arrangements for IFReDI staff and official guests.

52. It ensures that money used for travel are disbursed and liquidated properly and on time.

53. The flow charts and required forms are included in the manual.

Manual No. 6 – Human Resources Development Plan (Appendix A-15)

54. The HRD Plan states the IFReDI policy and procedures of attracting qualified applicants, developing the present workforce, and adopting plans to maintain competent and loyal employees.

55. The HRD Plan describes the procedures on recruitment and the selection process and criteria in hiring new personnel. It also defines the main responsibilities of newly hired personnel.

56. The Plan describes the policies and procedures in developing a quality workforce for IFReDI including proper employee orientation, staff training and development, formal training courses, and pursuit of graduate degree courses.

57. Career planning and development strategies are explained in the manual for all IFReDI staff from research, technology transfer and information, and administration divisions. The career paths under the different divisions are shown in order to provide the staff with a clear vision of their career at IFReDI.

58. Management relations with the staff in terms of open communications, regular staff meetings and consultations, and conflict resolution mechanisms are discussed in the manual for general guideline of management and staff.

59. The methods of performance evaluation of all IFReDI staff are explained in the manual. For the rank and file (semi-skilled workers, clerks, assistants) or those without decision-making responsibilities, the basis of evaluation will be on their respective inputs. As a general rule, the rank and file staff will be evaluated based on: 1) quantity of work; 2) quality of work; 3) timeliness of work; 4) job knowledge; 5) work attitude: 6) discipline; 7) relationship with co-workers; and 8) care of property.

60. Performance evaluation of unit and section supervisors and middle to top management (Division heads, Director and Deputy Director) will be based on outputs. The Key Result Areas (KRAs) of each management personnel shall be agreed upon at the start of the evaluation period with his/her immediate superior. Generally, the KRAs shall include: 1) preparation of operational plans and budgets; 2) milestones in the implementation of plans and activities of their respective units/section/divisions; 3) Monitoring mechanisms such as monthly reports on the accomplishments of the concerned offices; 4) development of linkages and networking with other external agencies especially donors; and, 5) contribution in the improvement in the organizational policies and programs.

61. Senior researchers and technology transfer staff will be evaluated based on outputs. These are tangible outputs such as publication, technical reports, proceedings, information and extension materials (brochures, pamphlets, CDs, audio-video tapes, etc).

62. The output (KRA) method of evaluating the senior staff of IFReDI will guarantee that reliable scientific information are generated and disseminated to the various stakeholders of IFReDI. As such, the long-term goal of becoming a reliable provider of scientific information on inland fisheries resources in Cambodia will be realized.

63. The HRD Plan recognizes the overriding legal provisions of the Cambodian Constitution and the Common Statute of Civil Servants of 1994 as contained in the Cambodian Civil Servant Texts and Commentaries of the Thematic Publication of Legal Reform Unit dated February 2000.

IFReDI *2004 Operational Plan* (Appendix A-16)

64. The IFReDI 2004 Operational Plan describes the plans and activities in research, technology transfer, human resources development and other administrative matters.

65. Under the Research projects, there are three socioeconomic studies and two research studies under bio-ecology. All of these research studies are under the ADB TA. Technical reports will be submitted in due time.

66. Under technology transfer and information dissemination, most activities will be in training of selected staff in Web page design, network administration, skills development in desk top publications, and training in production of information materials. Equipment for the production of information materials, such as digital camera, video camera, desktop publishing hardware and software will be purchase. Probable tangible outputs are publications such as Latin-Khmer dictionary of fish names and dictionary of Mekong fish species (synonyms and valid names based on Fishbase.

67. The manuals on administrative and financial systems will be operationalized once a new external funding comes.

1.4. Project-wide Workshops: Organized, facilitated, and attended

68. The Team Leader organized/coordinated/facilitated/attended the following Project-wide workshops in pursuit of the project objectives.

69. Organized: Pre-inception Workshop, 29 May 2003, IFReDI Offices
This workshop was attended by IFReDI staff who voiced out their expectations of the Project. An analysis of IFReDI's Strength, Weaknesses, Opportunities and Threats (SWOT) was undertaken during the workshop. The strength of IFReDI lies in the youthful idealism and dedication of its staff and in the support of the national government and funding agencies like ADB and DANIDA. On the other hand, the Institute suffers from the personnel's lack of management, research, and computer skills, and from their low morale due to low wages, absence of reward and incentive program and security of tenure. All these issues and concerns were taken into consideration in the implementation of the Project

70. Coordinated and participated: Inception Workshop, 10-12 June 2003, at the IFReDI Offices. The workshop provided a vehicle for the scrutiny and critiquing of the Project and served as a forum for sharing experiences, discussing issues and suggesting courses of action relevant to fisheries initiatives in the Tonle Sap basin Mekong region. Insights, issues and information that affect the Project were brought to light during the workshop. There were 47 participants and observers from 12 national agencies and regional and international organizations undertaking parallel initiatives in the riparian areas of Cambodia.

71. Co-facilitated: Priority-setting Workshop for IFReDI, 5-9 August, WorldFish Center, Penang. This training/workshop was a joint undertaking of the Policy Development and Dialogue Component (K. Viswanathan, S. Sverdrup-Jensen, and P. Degnbol) and the Institute Management Component (R. Agbayani). Workshop objectives were: 1) to provide skills for priority-setting for research; 2) to agree on priorities on inland fisheries research for the next three years; and, 3) to develop a draft medium-term research plan for IFReDI.

72. Training/workshop methodology was a combination of lectures and group discussions on research, management and policy issues concerning inland fisheries in Cambodia. There was also a lecture on priority-setting methodology. In order to stress "IFReDI ownership" of the Project, the facilitators encouraged a participatory approach in the planning by forming discussion and planning groups among the IFReDI participants.

73. The workshop worked on the basis of a hierarchy for research planning by identifying policy issues to be supported by research. Based on the consolidated issues, a list of research questions and contributions were generated. Prioritization of research issues and contributions was done by ranking their relevance to IFReDI's mandate and to Cambodia's development, and whether the question could be addressed realistically by research. A draft of the Medium-Term Research Plan of IFReDI was prepared.

74. Coordinated and co-facilitated the Mid-Term Workshop on November 13, 2004. The Workshop reviewed the mid-term accomplishments of the TA and the recommended some amendments in the work plan and reallocation of budget to enable the Team to undertake the revised plans.

75. Co-facilitated and lectured in the Workshop-training course on Fisheries Co-management training course held in March 16-19, 2004 in Kampot Province under the Policy Development and Dialogue component.

76. Attended: a) ADB-sponsored conference/seminar on "Tonle Sap Basin Strategy – Fighting Poverty", 18 July at the ADB Cambodia Office; b) Workshop on "Improving Regulatory and Management framework for Inland Fisheries", 11-12 August at the DoF Offices; c) Workshop on "The role of fish in food and nutrition security in developing countries: focus on combating micronutrient deficiencies", 9-10 Sept. at the IFReDI Offices; and, d) Workshop on "Framework, Methodology and Questionnaire Review of the Aquatic Resources Valuation and Policies for Poverty Elimination in the Lower Mekong Basin", 11 September at the DoF Offices.

1.5. Networking

77. Networking with international and regional organizations and government agencies was in the form of work coordination and information exchange. Among the institutions that the Institute Management Component linked with are: 1) Mekong River Commission and Denmark's Institute of Fisheries Management (IFM), on the IFM-IFReDI Twinning Arrangement Project; 2) Department for International Development (DFID), on policy-related issues on economic valuation of the Lower Mekong River Basin; 3) FAO, on improving the regulatory and management framework for inland fisheries; 4) UNESCO, on the environment awareness program, and on possible tie-up with the Technology Transfer component of the Project; 5) World Wildlife Fund (WWF), on the synergies and overlaps of their projects with that of the ADB TA Project; and 6) Oxfam America, on the policy-related matters pertaining to community fisheries projects of both Oxfam and WorldFish Center; 7) Japan International Cooperation Agency on aquaculture as livelihood in the rural areas; 8) Agrisystems Inc. on the project preparation for a possible ADB TA on sustainable livelihood in the Tonle Sap area; 9) University of Tasmania on development and production of documentaries as information materials

1.6. Project Administration and Logistical Support

Project Staff

78. The Project hired three Cambodians on secondment to assist the IRS-Team Leader in the administration of the Project. Their positions are Administrative Assistant cum Accountant, LAN/Computer Administrator, and Research Associate. Their tenure of duty is from 1 July 2003 to 19 June 2004.

Project Fund Management

79. Project fund management and judicious budgeting and expenditures were followed to ensure that the use of funds is optimized for the benefit of IFReDI and its staff. Monthly financial reports were submitted to WorldFish Finance Management Unit in Penang following proper accounting procedures.

80. An accounting systems in the Project level has been installed. This system includes cash handling and liquidation, petty cash system, travel and purchasing systems. A corporate account was established with the Foreign Trade Bank of Cambodia.

Training of the Project Staff

81. The Project Accountant, Mr. Ou Sary, underwent training on different accounting systems including donor reporting, cash advances and liquidations, travel and purchasing procedures, bank statements and reconciliation, and petty cash system. A training course on computerization of the accounting systems was conducted for the Project and IFReDI accountants.

82. Mr. Chuop Sokhan, Project Computer/Internet Administrator, attended a WorldFish-sponsored training on the capacity building for developing National Information Systems held in Los Banos, Philippines on 30 November to 7 December 2003.

Purchase of equipment

83. Proper canvassing procedures were followed in order to get good quality items and equipment at the best prices from reliable suppliers. This enabled the Project to purchase more items from the approved budget to the benefit of IFReDI.

84. At the start of the project, the following equipment were purchased for use of the project: 10 units desk-top IBM computers, 5 units printers, one unit photocopier, six sets of office tables and chairs, and a cash safety box. An Internet with 75 access points all over the IFReDI building and telephone systems with three lines were installed.

85. Additional equipment and office furniture were purchased during the second half of the project period after realizing some savings in the first project operations. The items purchased will be used for technology transfer, information dissemination, and library operations. These items are: 1) two units of computer; 2) one unit digital camera; 3) one unit video camera; 4) one unit LCD; 5) overhead projector; 6) scanner; 7) desk top publishing hardware (computer) and software; and, 8) library book shelves and furniture.

86. References books budgeted at US$5000 are being purchased for use of researchers and students who use the IFReDI library.

Research-related activities

87. The Project-hired Research Associate, Dr. In Monirith, attended and participated in the following seminar- workshops: 1) Workshop on The role of Fish in Food and Nutrition Security in Developing Countries: Focus on Combating Micronutrient Deficiencies, sponsored by DANIDA on 9-10 September 2003. A research proposal on "The role of fish in food and nutrition security in Cambodia" was submitted to DANIDA for funding; 2) Pesticides Forum on 10 October 2003 sponsored by the Ministry of Agriculture, Forestry and Fisheries; 3): Seminar on the Stockholm Convention on Persistent Organic Pollutants (POPs) on 15-16 October 2003 at Juliana Hotel (Ministry of Environment), sponsored by UNEP and GEF

88. Dr. Monirith won the Roland W. Frei Award for best poster presentation entitled "Contamination by Organochloride Compounds in Fish and Green Mussels from Cambodia" in December 3 2003. The occasion was the 2nd Asian Pacific International Conference on Plloutants Analysis and Control held in Ho Chi Minh City.

89. Dr. Monirith traveled to the Center for Marine Environment Studies, Ehime University, to discuss the project concerning chemical pollution in Mekong delta and gave a lecture to graduate and undergraduate students on the persistent organic pollution in Cambodia. His travel was sponsored the Ehime University.

1.7. Conclusions and recommendations

90. The Institute Management component has generally achieved the overall objective of defining the organizational management framework of IFReDI.

91. The TA has generally improved the knowledge and comprehension in organizational development, teamwork, and basic concepts and principles of management.

92. The recommended administrative and financial systems and procedures will require close supervision and monitoring to ensure adherence and compliance by all concerned employees.

93. A staff training and development program will have to be set in place in the HRD Plan so as to sustain the initial interventions of the ADB TA in further improving their administrative and management skills.

94. For the senior research staff, they should be encouraged to pursue graduate degree courses to improve their skills in research.

95. In the Administration Division, the supervisors and head of division are encouraged to enroll in graduate management courses in order to gain more confidence in the management of an institution like IFReDI.

96. All IFReDI staff are encouraged to improve their proficiency in the English language in their own initiatives.

97. The DoF/IFReDI officials should implement the recommended administrative and financial systems as well as the HRD Plan to show to donors that the Institute is managed professionally.

2. Research and Development

2.1. Bioecology and Modeling Sub-component

98. Overall the accomplishments of the Bioecology-Modeling component (BioMod) meet all the target activities (Table 2) and even go beyond (e.g. publications produced, submission of projects for funding). The only constraint experienced consisted in the impossible contribution of a taxonomist specialized in Mekong fishes (see below, section "A reference fish collection set up at IFREDI").
The overview of accomplishments vs. target activities is given in Table I.

2.1.1. Training

Formal training in fish biology, research methods and data analysis

99. Activity completed. As planned, three sessions of 10 hours each of formal training have been conducted in August, October and April. These training sessions have been tailored

to meet the needs formulated by IFReDI biologists; they focused on 1) tools for basic data analysis and reporting (MS Excel and Word), and 2) research methods and principles (formulation of research questions, appropriate data gathering; data formatting for analysis); 3) fact sheets about the Mekong basin and its fish resources (for knowledge and proposal development); 4) introduction to multivariate statistics (for exploratory analysis of multi-species fishery data).

100. The lecture notes of these sessions are given in Annex B1. These lecture notes are being published as a training manual and as a contribution to the Technology Transfer component, for use by IFReDI staff beyond the life of the current project.

101. A total of 16 persons have been trained, from the Bio-Mod component, the Administrative, Technology Transfer and Socio-Economic components of the project, as well as from the Library, the MRC projects and the DoF. In addition to that, 19 students and teachers from the Faculty of Fisheries have also been trained, as the lectures were open to all and have been advertised at the Royal University of Agriculture.

102. In addition to training, assistance has been provided to trainees for applications to M.Sc. degrees (AIT Bangkok, USM Penang), and two counterparts (MM. Chheng Phen and Touch Bun Thang) have been accepted for a Master's degree with partial funding by the Asian Institute of Technology. The complementary funding remains to be found.

On-the-job training in fish biology, research methods and data analysis

103. On-the-job training has been conducted in particular with five counterparts, all biologists: MM. Chheng Phen (BioMod); Hort Sitha (BioMod); Touch Bun Thang (Techno Transfer); Hem Rady (MRC project) and Bun Racy (head of the laboratory and MRC project).

104. On-the-job training in fish biology has been conducted during several field trips (34 days on the field) during which 279 kg of fish and 109 species were caught, identified and analyzed. The focus was on:
- implementing a scientific and systematic sampling protocol based on gill nets;
- following standard rules for taxonomic identification;
- gathering basic biological data (lengths and weights for cohort analyses and stock monitoring)
- identification of sexes and sexual stages of fishes (for monitoring of age at first reproduction)
- identification of stomach contents (for improved ecological knowledge)
- rigor and standardization in procedures and data entry

105. On-the-job training in research methods and data analysis has consisted in:
- the definition in common of the sampling protocol;
- the progressive supervision of the logistical aspects of the research activities (buying and mounting nets; hiring fishermen; dealing with local authorities and organizing field trips);
- the precise reporting about activities and field trips (Annex B2)
- the entry/analysis of data and production of data analysis reports (Annex B3)
- the writing of a manual on data processing, of a research paper and of a final report on gill net monitoring (Annexes B4, B5 and B6).

Overall a strong emphasis was put on data analysis and reporting, in order to enable the IFReDI biologists to work as autonomous researchers, and to enable them to answer practical questions in their field.

On-the-job training in modeling

106. A permanent license of the Netica software has been bought for IFReDI. Two of the IFReDI biologists (MM. Hort Sitha and Chheng Phen) have been trained in Bayesian networks. A regional consultant having integrated databases to the model has given a series of lectures on databases available in the country and their contents, as well as on the process of integrating such databases to a Bayesian network. The counterparts in modeling have contributed to the development of a new model of the Tonle Sap fish resource (*BayFish-Tonle Sap*) and they are now able to run and modify existing models, as well as to develop new simple networks. They have progressively organized the stakeholders consultations and have entirely driven the two last ones (see stakeholders consultations reports, Annex B7). One of the counterparts in modeling has recently been hired as a consultant for a project on fish resource modeling in Southern Vietnam.

On-the-job training in taxonomy

107. The rules and methods of taxonomy have been taught and followed during field trips. Emphasis has been put on the use of identification books and keys, of morphological criteria and of Latin names instead of Khmer names. Facilitating tools such as FishBase have also been provided, and multiple copies of FishBase 2000 and FishBase 2004 have been distributed, with a training session on this the use of this resource. WorldFish and the FishBase team have also offered a training course in the Philippines at the end of November 2003 to two IFReDI staff: MM. Chheng Phen and Choup Sokhon. Both have become the FishBase contact persons in Cambodia, exchanging taxonomic and biological information about fish Cambodian species with FishBase.

On-the-job training in proposal writing

108. Material, advice and mentoring have been provided to IFReDI staff for writing up proposals; additional assistance has been provided in editing. Four project proposals have been developed, in particular on "Fish sanctuaries as conservation measures and improvement of fish production of Tonle Sap Lake" (development by Mr. Chheng Phen, the counterpart in BioMod).

2.1.2. Research

Expand knowledge of the bioecology of key fish species

Target: Key fish species identified, and information about their bioecology gathered and synthesized.

Indicator: Ten key fish species identified from literature review and from existing DoF datasets.

109. Activity completed. Key fish species have been identified from an analysis of DoF data sets (all fisheries, period 1994-1996) and a corresponding report has been produced (Annex B5). This report has been converted into a publication to be submitted to Asian Fisheries Science. These results have also been presented by the counterpart in Biology (M. Chheng Phen) at the 6th MRC Technical symposium on fisheries (November 2003, Lao PDR, trip funded by WorldFish).

110. Some critical issues have been highlighted by this work.
National fisheries statistics being currently collected in Khmer, and our rigorous analysis of equivalences between Khmer and scientific names shows that the top-ten commercial fish (Khmer names) actually correspond to 38-47 scientific species (Latin names). Subsequently:
1) top ten commercial fish species caught in Cambodia are still unknown to science;
2) the equivalence tables used so far to convert Khmer names into scientific species names are inaccurate;
3) socio-economic statistics detailing species and based on these previous conversion tables are inaccurate (they might be accurate as long as the fish name is expressed in Khmer, but not when it becomes converted into a Latin scientific name)

Target: Bioecological monitoring program of key species initiated

Indicator: Two exploratory surveys to identify sampling sites

111. Activity completed. Five sites visited during four exploratory trips in Kampong Chhnang, Pursat, Siem Reap and Battambang provinces (see field trip reports in Annex B2); three sampling sites were selected (fishing lot nº 3 in Kampong Chhnang; Chong Khneas in Siem Reap and Lhal Prek Spaut in Battambang). These sites corresponding to three distinct environments (floodplain, flooded forest, Tonle Sap islands) meet the technical requirements of sampling with gill nets over several seasons (low current in the flood recession period, possibility to set nets, sufficient security, etc). For the purpose of comparisons two of these sites (Kampong Chhnang and Chong Khneas) are common to the Socio-economic component of the TA and one (Chong Khneas) is also common to the 1997 FAO bioecology study.

Indicator: Experimental fishing operations conducted 2 times in each of the 3 sites.

112. Activity completed. Five sets of standardized nets were built; regular field partners were identified and equipment was bought. Eighty-five day and night fishing operations have been conducted during 34 days in the 3 sites in September/October (wet season) and March/April. (dry season). Data have been analyzed by counterparts (Annex B3) and have contributed to the final report in which a sustainable sampling protocol for long-term fish monitoring is defined (Annex B6).

Indicator: Gathering of biological information (size, weight, reproduction, diet) on at least 10 species

113. Activity completed. Information about the bioecology of dominant species has been gathered during the field trips. Significant information on 30 species for which more than 10 individuals were caught has been collected. Overall 19,300 fishes have been caught and 3412 have been analysed individually. Data is reposed in a new database of 3682 records and this rich information is still to be analyzed in detail beyond the current project.

Indicator: Gathering of physico-chemical data on the sites of fishing

114. Activity completed. Probes have been bought for IFReDI and physico-chemical data have been gathered during fishing operations. Additional data about oxygen have been also provided by the MRC/WUP-FIN project for the purpose of detailed analyses. This parameter neglected in previous ecological studies can be critically low in wetlands and drives fish abundance in catches.

Indicator: Sampling of 2 to 3 types of fishing gears operated by fishermen

115. Activity completed. A questionnaire was designed by the counterparts and forty-eight fishers were interviewed about their activity during 3 field trips. This resulted in a report (Annex B3) that contributed to a modified design of the principal gill net sampling for increased efficiency.

Indicator: Production of brochures in English and Khmer synthesizing known biological information on at least 10 selected species

116. Activity completed. All published information on 10 dominant species has been extracted from FishBase 2004 and edited in the form of a technical paper of 10 monographs (Annex B8). These publications have been translated into Khmer.

117. In addition to this planned activity, the problems faced in taxonomy led to the production of two additional significant publications: a dictionary of Khmer-Latin fish names (Annex B9), and a dictionary of valid species names for Mekong species (Annex B10).

Indicator: A report defining a realistic procedure aimed at monitoring the biology of 10 selected species

118. Activity completed. The report produced (Annex B6) shows that the long-term monitoring of the dominant commercial fish species should be done through a combination of a) scientific sampling using gill nets that catch white fish, and b) sampling of artisanal "lot" fishery that catches black fish. Methodology for both methods and costs are detailed. This approach relying on the monitoring of fishes allows the gathering of information necessary for fishery management (evolution of catches per unit effort, relative frequency of each species and size of individuals) and is much more easy and cheap to implement than the monitoring of the fishers and gears attempted in the previous projects.

Target: A reference fish collection set up at IFREDI

119. Activity not achieved, due to the no-show of the expected expert in taxonomy. As a matter of fact Dr Chavalit Vidthayanon from the Department of Fisheries in Thailand accepted in August 2003 to take part to this project as a regional consultant in taxonomy. However upon his request his coming had to be rescheduled twice (issue highlighted in the mid-term report) and ultimately Dr Chavalit made clear at the end of March 2004 that he would not be able to come at all, due to a change of employer in February.
It was not possible to find upon very short notice an alternative consultant among the four remaining Mekong fish taxonomists (Dr. Maurice Kottelat in Switzerland and Walter Rainboth in the USA, Dr. Tyson Roberts on long field trip in Myanmar, Pr. Mai Dinh Yen not available).

Model flood-fish relationships in the Tonle Sap

Target: Knowledge of fishers and field officers gathered

120. Activity completed. Beside meetings with stakeholders (see below), two rounds of interviews of fishers and specialists in fisheries were conducted in November 2003 (wet season) and April 2004 (dry season). The results of the interviews contributed to the design of the model. One of the two field trip was joined by a journalist from the New Scientist (USA).

Target: A consensus conceptual framework built through meetings and critical parameters identified

Indicator: Two meetings convened with stakeholders to define the content and the parametrization of the model

121. Activity completed. Stakeholders identified thanks to interactions with the MRC Basin Development Plan and the Inland fisheries regulatory framework project. Instead of the two meetings initially planned, four meetings have been convened with the same budget. Thirty eight stakeholders were consulted, with a particular attention given to the consultation process itself. The meetings allowed the progressive definition of the model by the stakeholders, and the reports of the three consultations are given in Annex B7.

122. A consultant specialized in databases management and GIS had been hired one month to permit the integration of recent databases to the model. His contribution allowed a quantification of land use, hydrology and water quality to the Tonle Sap fish resource model. A report detailing the databases exploited, the analyses done and providing inputs to the Bayesian model has been produced (Annex B11) and thus improve considerably the reliability and representativeness of the model.

123. WorldFish contributed to this project a study of Tonle Sap fishery stakeholders done on the field in February-April 2003 by a D. Nettleton, a volunteer with a MSc in Aquatic resources management (see Annex B12). This detailed study supplements and strengthens the stakeholders consultation on the social aspects of the fishery.

124. Integrating multiple perspectives and opinions from a diversity of stakeholders is an essential step in the construction of the model, and this integration through a consultation process is a research topic in itself. A paper dedicated to stakeholders consultation processes for environmental modeling has been submitted to the "Regional conference on ecological and environmental modeling" to be held in Malaysia in September 2004 (see Annex B13).

Indicator: Final computer model presented to stakeholders

125. Activity completed. The feedback meeting provided stakeholders an opportunity to see the final outcome of their work and to discuss the model developed. During the presentation given by M. Hort Sitha (counterpart in modeling) they could modify the model proposed and agree about the final version that represents the synthesis of and compromise between their views.
The Tonle Sap fisheries Model was also to be presented to 12 members of the MRC Basin development plan and the the Water Utilization Program in April 2004 and to the Annual MRC Fisheries technical symposium, in May 2004.

Target: Ecological traits of 10 key species incorporated

126. Activity not done. This activity was originally planned on the assumption that the stakeholders would recommend such an incorporation, but actually they recommended a simple classification of fishes that makes sense to all: "black fish" and "white fish" (sensu Welcomme 1985, black fish being those that migrate on short distance between ponds and floodplains, like the snakehead, and white fish being mostly cyprinids that undertake long migrations in the river mainstream). Subsequently the dominant species were identified as white or black fishes, but their ecological traits were not specifically incorporated to the model; the model rather integrates the generic traits of black and white fish, as preferred by stakeholders.

Target: Computer model developed and counterpart staff trained

127. Activity completed. A CD-ROM of the "BayFish-Tonle Sap" model has been produced (Annex B14) and presented to the annual meeting of the MRC Fisheries Program in May 2004. See also section "Training" of this report about the on-the-job training in modeling. The model developed is presented in the Fig. 1 below.

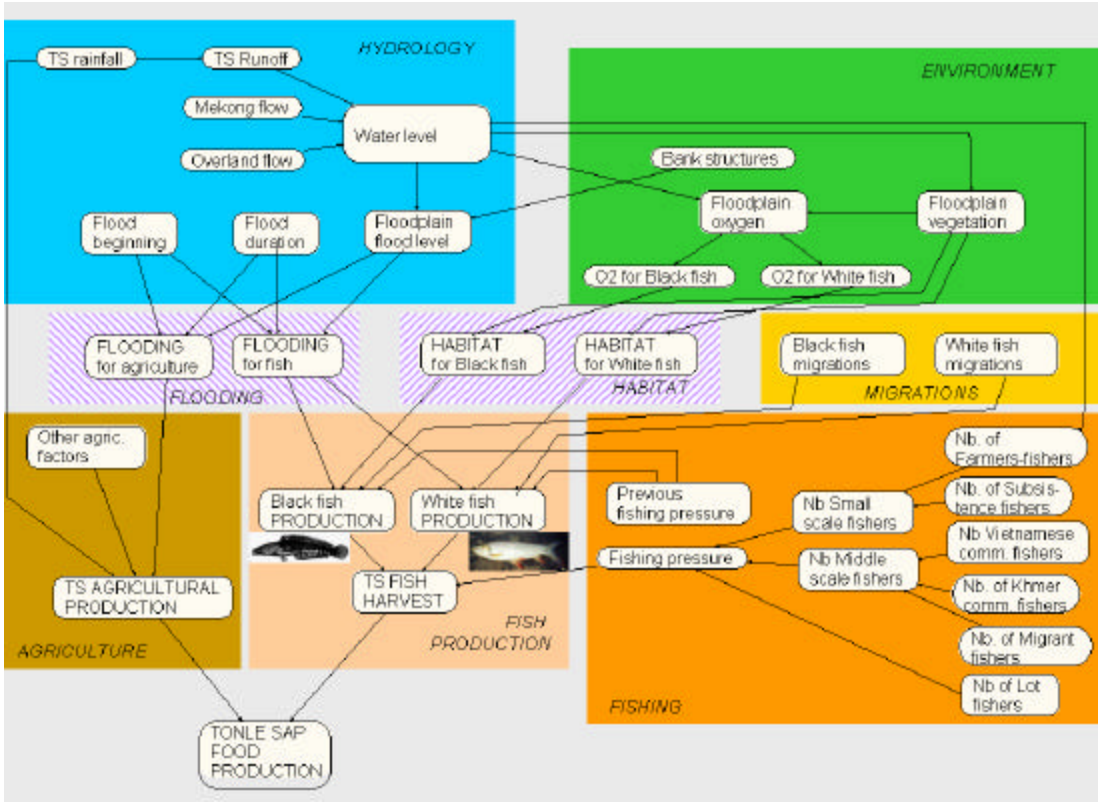

Figure 1: Model of the factors influencing fish and food production in the Tonle Sap basin, as defined by stakeholders and additional studies. Each variable can be varied and its impact on fish production can be assessed.

2.1.3. Networking

128. Close collaboration as well as field trips in common has been undertaken with members of the MRC project entitled "Assessment of Mekong Capture Fisheries" (in particular with MM. Hem Rady, Bun Racy, Chea Tharith and Kent Hortle).

129. Considerable cooperation has been done with the MRC/WUP-FIN Tonle Sap modeling project, with the exchange of material and data, and the integration of their outputs as inputs to our fish production model.

130. Stakeholders consultations gave an opportunity to develop links with 6 representatives from 4 institutions, 3 local communities, 4 fisheries officers form 3 provinces, 4 project scientists and 2 NGOs.

131. Links have been set and information as well as documents have been shared with the Inland fisheries regulatory framework project, in particular with its biological component.

132. IFReDI has been associated to the development of 3 project proposals submitted to the Challenge Program on Water and Food, together with 23 other partners. The total budget requested *for IFReDI* is next:

- Project CN 67 ("Living with floods", with UNESCO-IHE): USD 135,727 (291 man-days over 4 years)
- Project CN 160 ("Mekong catfishes", with IUCN): USD 38,268(152 man-days over 3 years)
- Project CN 342 ("Mekong productivity", with WUP-FIN): USD 77,492 (1418 man-days over 3 years)
- *Total*: 251,487 US Dollars over 3 to 4 years

Among those the project on "Mekong productivity has been successful and subsequently will be funded by early 2005.

2.1.4. Deliverable outputs

Training

133
- Sixteen IFReDI staff, as well as 19 students from the Faculty of Fisheries, have received formal training in fish biology, research methods and data analysis.
- Five IFReDI biologists trained on-the-job in fish biology, research methods and data analysis. They have been enabled to perform field biology as per international standards, to analyse data and to produce research reports.
- Five counterparts in biology have been trained in writing research proposals.
- Two biology counterparts have been trained in Bayesian modeling and are now able to develop similar models on their own.
- Several seminars have been given to staff by outsiders, in particular on the integration of databases to Bayesian models and on the analysis of fishery databases.
- Two counterparts accepted for a Master's degree at the Asian Institute of Technology in Bangkok.
- Lecture notes have been published in the form of a training manual for use by IFReDI staff beyond the life of the current project.

Bioecology

134.
- Sites suitable for long term monitoring of fishes with gill nets in all seasons have been identified.
- Field equipment has been bought and handed over to IFReDI.
- A reliable methodology for long term monitoring of fishes by a combination of gill nets and other gears has been defined, tested and budgeted.
- A biology database has been created and filled with records from 3412 fishes (length-weight relationships; reproduction; stomach contents) and a manual for continued data entry and cleaning has been produced.
- Key commercial fish species have been identified in a publication.
- Issues dependant upon the unreliable naming of fishes have been highlighted and presented in a regional symposium.
- All published information on 10 dominant species has been synthesized in a publication also translated into Khmer.
- A dictionary of Khmer-Latin equivalences in fish names has been produced.
- A dictionary of valid species names for Mekong species has been produced.

Modeling

135.
- A study of the fish-dependant communities around the lake has been done, so that results can be integrated to the model of the fish resource.

• A series of databases on hydrology, land use and water quality has been collected and integrated to the model; these databases have been handed over to IFReDI.
• A model of the Tonle Sap fish resource has been designed through consultations with stakeholders.

This model includes
- knowledge of fishers, farmers, field officers
- information drawn from a collection of databases in hydrology, land use and water quality
- a specific study of fish-dependant stake holders around the lake

• A CD-ROM of the model (with open sources) has been produced.

Networking

136. • Close collaborations have been set with:
- representatives from 4 institutions, 3 local communities, 2 scientific projects and 2 NGOs.
- the MRC/WUP-FIN Tonle Sap modeling project
- the Mekong River Commission, in particular about the integration of the fisheries model outputs into their global basin management strategy.

• Three project proposals involving IFReDI have been developed and submitted to donors for a budget of $ 251,000. One project has been accepted by the Water and Food Challenge Program ($77,500 for IFReDI).

2.1.5. Remarks and constraints

The few constraints experienced have been detailed in the above section

2.1.6. Recommendations and follow-up actions

An analysis of FAO statistics show that Cambodian fishery ranks fourth worldwide in terms of catches, after China, India and Bangladesh. However what is usually forgotten is the fact that this catch results from the efforts of a very small population (12 million people, whereas other countries amount to 1.2 billion, 1 billion and 140 million respectively). Thus in terms of catch per inhabitant (or intensity of fishing), Cambodia is by far the first country in the world, as shown in Fig. 2 below.

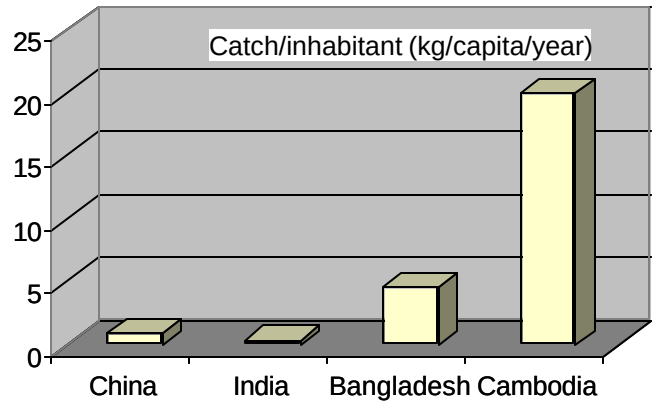

Figure 2: Fish catch per inhabitant and per year (2000 FAO and population statistics)

137. This highlights the fact that IFReDI is the new research and development institute of the country having the most intense and productive fishery in the world; his potential and

perspectives are therefore enormous. We propose below five avenues for continued activities in the field of bioecology.

138. Naming fish properly The current TA has highlighted the problems inherent to the proper identification of fishes; hence the following proposals:
- keep on strengthening the capacity of IFReDI biologists in taxonomy;
- produce species identification keys, which do not exist yet;
- collaborate with socio-economists for a proper naming of fishes, in order to overcome the major misidentifications in catch statistics and socio-economic studies;
- acknowledging the very limited number of Mekong fish taxonomy specialists, -- collaborate with various institutions such as the British Museum or the Museum National d'Histoire Naturelle for more taxonomists get involved in the region.

139. Providing information on the state of the resource- Initiate a long-term monitoring of dominant fish species with gill nets and additional gears, in line with the findings of the current TA;
- analyse and make use of biological data on dominant species, through publications on species biology;
- publish scientific results in the form of policy briefs and brochures for diffusion to a large audience and use by decision makers.

140. Integrating information for management Through further refinement and use of the fish resource model developed; this can be done in particular via 1) a deepening of the "fisheries" component of the Bayesian model (with for instance integration of Dai fishery data), and 2) the integration of an economic component to the model (from fish catches to economic impact).
There is a very good potential for the integration of the these results to the Decision Support Framework (DSF) and the Integrated Basin Flows Management currently developed at the MRC. There is also a very strong potential synergy with the MRC/WUP-FIN Bayesian policy model that contributes to the DSF and is based on the same Bayesian approach but that does not include the fish resource so far.

141. Protecting species and sustain production Cambodia is one of the very few countries in the world, with Lao PRD, to have freshwater protected areas. With species and resource protection in mind, the study of these freshwater protected areas should be addressed in a systematic way, with a particular focus on 1) the freshwater sanctuaries in the Tonle Sap (location, mode of operation, requirements) and 2) the deep pools in the Northern part of the Cambodian Mekong (test of the biological impact of conservation measures).

142. Continued training In order to strengthen the position of IFReDI at the regional or even international level, it is proposed that on-the-job training in data analysis and report writing be continued. The team of biologists who have worked with the TA has an excellent potential, a good motivation and has remarkably progressed within a short period, but the art of analysing data, of reporting and of publishing in English requires more than one year of training to be mastered.

143. The five thrusts highlighted here constitute a possible integrated strategy for the biology division of IFReDI in the coming years.

2.2. Socioeconomic Sub-component

144. The broad objectives of the socioeconomic sub-component (Research and Development component) of the TA are: 1) to provide training to the IFReDI staffs (on-the job and

formal) on natural and agricultural resources economics, research methods and data analysis, and database development and analytical tools; 2) As part of "learning-by-doing" to undertake research so that staffs are able to initiate and conduct studies independently.

145. The socioeconomic sub-component successfully accomplished all the activities on training and "learning-by-doing" (research) (Table 3) as outlined in the log frame. The time allocation of the international resource specialist of the sub-component was six-person months that were accomplished in four trips. The first trip of the Resource Specialist to Phnom Penh was seven weeks long during July and August 2003.

146. The initial 15 days of the first visit involved extensive fieldwork to understand the contribution of the Tonle Sap Lake to the life of the people of Cambodia. During the field trip, the team organized participatory rural appraisal in the selected villages in Kamong Chnang and Siem Reap to understand the importance of aquatic and non-aquatic resources of the Tonle Sap area. In addition the team observed landing sites and retail fish and processed fish markets in Phnom Penh, Kampong Chnang and Siem Reap provinces. Several consultations with the exporters in the provinces and Phnom Penh were also made during the first trip.

147. During the same trip the resource specialist carefully assessed the training needs of the IFReDI staffs. Accordingly, the resource specialist finalized training and "learning-by-doing" (research) methods. As part of both on-the-job training and learning-by- doing, the resource specialist helped and coached the socioeconomic staffs of IFReDI to develop research methods for the three research topics, preparation of questionnaires for households, exporters, and observation and monitoring guidelines for landing sites, retail markets and other stakeholders. A three-day formal training on economic valuation and data collection methods was also organized for the socioeconomic team.

148. Following the first trip to Phnom Penh, the resource specialist made follow up visits in December 2003 and in February 2004 to supervise and guide the data collection and data processing activities of the team and to conduct on-the-job and formal training. The final trip to Phnom Penh started on 10 March and continued until 19 May to wrap up all the activities as laid out in the TA. In this report we briefly discuss accomplishments of the socioeconomic sub-component since the inception of the project and provide key findings of the research topics undertaken as part of the capacity building of the IFReDI staff. Table 1 provides a summary of the activities undertaken and accomplishments against the performance indicators as laid out in the TA document.

2.2.1.Training

149. The ADB Technical Assistance (TA) in collaboration with the WorldFish Center was intended to build capacity of the IFReDI staff in the areas of research and development, institute management, technology transfer and policy development and dialogue. The Project took "on-the-job" training and "learning-by-doing" as principle strategy to build research capacity and analytical skills of the IFReDI staffs. In addition, formal training courses on specific topics were also offered. As part of "learning-by-doing" the socio-economic subcomponent implemented three research projects. Series of formal and on-the-job trainings on socioeconomic research methods, evaluation and research design, statistics and valuation techniques of non-market resources.

150. Counterpart team members and other staff of IFReDI and DOF were provided continuous on-the-job training on data collection methods, sampling methods, questionnaire preparation and the logical and theoretical aspects of the studies. In

addition, they were provided hands on experience on field data collection, data processing and validation, exposed with the villages and other stakeholders during field trips. Nine staffs of IFReDI and DoF were benefited to have the on-the–job training on research methods, sampling design and data collection methods. Few of them are now capable of leading field data collection, designing and selecting samples. Six staffs of IFReDI and DoF (HQs) and four provincial fisheries officers were exposed to field data collection methods and various ways of rapport building with the respondents.

151. A three-day training was organized on theories of economic valuation and on the contents of the questionnaires, and how the questionnaire is related to the theories and the Project objectives in July 2003. Some parts of the questionnaires were translated into Khmer for the interviewer's better understanding. Ten staffs of IFReDI and DoF were benefited from the three-day training.

152. A weeklong training on research design, program evaluation and statistical techniques was provided in December 2003. A total of 35 participants attended the training that included officers and staff of IFReDI, CFDO and DOF. Important topics of the training program included experimental and non-experimental research design and program evaluation concepts and methods, sampling theory and preliminary statistics.

153. A comprehensive training on "Natural Resources Economics and Research Methods" was organized in Penang, WorldFish head quarters during 23 February to 03 March 2004. This training workshop was carefully designed to address IFReDI's immediate needs for skill development that included participants from across disciplines to make them understand the crucial importance of resource economics and impact analysis in policymaking. The most important strength of the training program was its comprehensiveness in contents and ability to mobilize resources from within and outside of WorldFish. A detailed report on the training is provided in Annex 1.

154. The broad objective of the training workshop was to provide comprehensive understanding on natural resources economics, research methods and statistical analysis. The specific objectives of the training were:

- To provide orientation on a set of tools on economics and management of natural resources
- To provide hands-on experience on data analysis, database management and development
- To impart skills on quantitative and qualitative techniques for interdisciplinary research in fisheries and aquatic resources
- To develop a training manual

155. The workshop had two parts – theory and applications. The theory part of the training provided basic concepts of economic efficiency and causes and sources of market failure with reference to natural and environmental resources management. The applied part of the training included basic concepts in research methods and analytical techniques (both descriptive and inferential) that included training on database development and management, data manipulation and data analysis using MS Access, Excel and SPSS; and hands on experience using data set that were collected by the IFReDI staff as part of the socioeconomic sub-component.

156. The training included field trip to the University Science Malaysia and its Marine Resources Research Center. The participants spent whole day visiting the Dean and Faculties of the School of Biological Science the Marine Resources Research Center, USM. They also spent some hours in the afternoon for site seeing. The results of the visit

to USM were encouraging both for research and capacity building for IFReDI. USM expressed interest to collaborate with IFReDI in undertaking joint research, exchange visits, providing grants and scholarships for diploma and graduate level training for the IFReDI staff. Participants explored research collaborations in a number of fields such as biodiversity and production monitoring using remote sensing technologies in Tonle Sap.

2.2.2. Learning-by-doing (Research)

157. As part of "learning-by-doing" the component undertook three research topics:
- To circumscribe value of aquatic resources in the Tonle Sap Area.
- To study marketing, supply chain and trade pattern of fish and fish products of Tonle Sap Area.
- To benchmark and study cost and benefits of post harvest fish handling and fish processing in and around Tonle Sap.

158. The "learning-by-doing" strategy of capacity building in research and improving analytical skills proved effective. The socioeconomic staffs got hands-on experience in planning and implementation of research projects. The strategy provided opportunities to the IFReDI staffs to learn the techniques of sampling, data collection and supervision, data entry, data validation, database development and data analysis. The component accomplished significant progress in conceptualizing and formulating research methods, collecting and analyzing data, and report writing on the three research topics. Detailed methods and summary results of the research topics are provided below:

2.2.3 Circumscribing Values of Aquatic Resources in the Tonle Sap Basin

159. People in and around the Great Lake receive both economic and non-economic benefits in many ways. The contribution of the Lake would be underestimated if valuation exercise were limited to the resources inside the Lake without considering the value chains it creates through resource extraction and other productive activities.

160. The value chain or benefit flows may be generated through both forward and backward linkages. Forward values create through trade and marketing of fish and fish products, post harvest fish handling and processing, and the backward values are generated through input demand for fishing and farming activities such as gear making and other fishing and farming related inputs and services. Lake resources and its backward and forward benefit flows generate income and livelihoods of the millions of people in and around the Lake and its basin areas. However, it is unlikely to capture the flows of values with a single study. The value chain effects on values of Tonle Sap have been captured by the proposed studies on marketing and processing of fish and fish products. The valuation study focuses on aquatic and non-aquatic values of the Lake for a reference period of one year. Due to time and resource constraints the study could not be as comprehensive as it should be, rather the study may be indicative with small samples and low expectation. Although this will provide us less than accurate results, the methodology can be carried over by the IFReDI staff for future intensive studies on both economic and non-economic valuation of resources in and around the Tonle Sap Basin.

161. There are number of approaches for valuation of resources, livelihoods and environment such as direct market approach, surrogate and simulated market approach. The market value approach simply estimates the value of the resources based on market price and volume or total catch, as in the case of river fishery. Widely used method under surrogate

market approach is the travel cost method mostly for estimating recreational value of any resource/resort or recreational fishery. The simulated market approaches call for contingent valuation or conjoint valuation methods for any type of resources that has no established market price. As the Great Lake has been contributing in many ways to the livelihoods of the 1.2 million people living in and around it, only market approach to measure values may be incomplete and provide grossly under-estimated values.

162. In addition to measurable benefits, households in the Tonle Sap area derive indirect benefits and other indigenous direct benefits that have significant use value although these are not usually considered economic benefits such as river transport, animal grazing, use of lake/river water for household activities, recreational activities of the children (swimming and other sports related activities) and adults (boat racing, swimming, etc.). Therefore, the study seeks to understand the value of the resources of the Lake and its estuaries by putting emphasis on both market and non-market approaches. The non-market approach will be applied to value the resources that are extracted by the households from the Lake that may not have market price. Even if market prices are available for these resources, households may value them differently as they are easily accessible. Specifically, the study will follow "willingness to pay" approach to measure values of the non-market resources and scaling the importance of the resources to their daily lives.

163. The study also seeks to estimate values of the market and non-market resources of the Tonle Sap by using household level value attributes and information available on medium scale and commercial fisheries (lot and dai fisheries). The study also focuses on the impact on the livelihoods of the fishers and farmers who depend on the resources of the Great Lake putting imaginary scenarios of resource degradation or ecological collapse. Principle objective of the study is to provide importance of the resources of the Tonle Sap Basin to the lives of the households. Specific objectives of the study are:
    a. To provide an estimate of economic values of the aquatic resources and its importance to the livelihoods of fishers, farmers, traders and exporters;
    b. To provide an indication of the dependence of the households on the non-aquatic resources of the Great Lake and their economic and non-economic importance;
    c. To provide an estimate of per capita fish consumption and per household fish harvest by the subsistence fishers and farmers;
    d. To provide sensitivity analyses of the changes in the resource environment (a gradual decline in fish catch to ecological collapse) on the livelihoods of the fishers and farmers and on the economy.

164. In addition to valuation of resources, the household survey is designed to cover marketing and post harvest fish processing aspects that will help to understand the micro level marketing behavior, distribution process and family scale fish catch and fish processing. The data collection methodology for the household survey is provided in the Flow Chart (Figure 3).

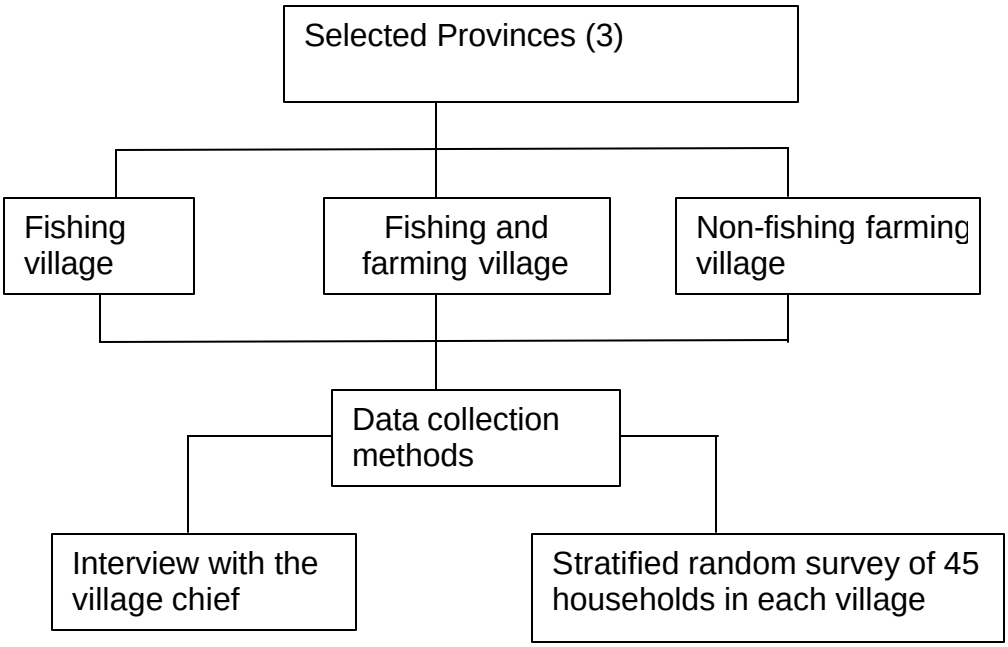

Fig. 3. Methodology Flow Chart: Economic Valuation

165. Three provinces were selected for the valuation, marketing and post harvest processing studies. From each province three villages were selected: fishing, fishing cum farming, and farming only village. Total sample households from each province were 135, taking 45 from each village. Total sample households in three provinces were 405. Households were selected from each village following stratified random sampling procedure. All the households in each of the villages were ranked using available economic indicators and divided into three categories, and 15 households from each stratum were selected randomly.

166. Sample households in the selected villages were interviewed twice – during the open and closed seasons. The first cycle of data collection included socioeconomic, fishing and non-fishing activities, weekly or monthly fish catch in the close season, processing and marketing activities, and extraction of other resources and their value for their livelihoods. The second cycle of data collection was held in the open season that was limited to fish catch, consumption and marketing activities. Key results of the survey are provided below and detail results and report for this study is provided in Annex 2.

Key Results

167. The demographic composition of the households in Tonle Sap area over the past decade shows a marginal change. A large share (42%) of the sample household members is still less than 16 years old and the working age (16-60) population (including household head) constitutes 55%[1]. This shows an improvement in the dependency status of the rural households, as fewer members are dependent on others' income even though the average household size increased from 5.9 in the year 1996 (Ahmed et al 1996) to 6.3 in 2004, meaning that the overall dependency of the households on the resources have

[1] The benchmark survey of the households in the fishing communities (Ahmed et al 1996) found 44.5% and 51.4% of the household members (including household head) under 16 years and in the working age group, respectively.

increased that has been creating overcapacity in fishing and extraction of other resources. The survey results also show a decline in number of female-headed households from 19% in the year 1996 (Ahmed et al 1996) to 15% and in the ratio of male to female from 49.5 to 48.3.

168. The survey also shows a significant improvement in the literacy rate. Only 29% of the household members cannot read and write, 36% have one to three years of formal education and the remaining 35% have at least 4 years of formal education. Almost 57% and 39% of the household heads in all the selected villages have fishing (and related activities) and farming as principle occupation, respectively. Considering all the eligible members of the selected households in all villages, almost 32% are engaged in fishing and related (fish processing, trading, fish culture, etc.) activities while this ratio is the highest (53%) in the fishing villages and lowest (11%) in the farming villages. Conversely, the highest percentage (47%) of the household members has farming as the principle occupation in the farming villages. On the average, the second most important activity of the household members in all villages is schooling. Day laboring, housekeeping, small business and professional jobs also came out as important occupation among members of the households.

169. Access to basic necessities and amenities of life among the households in all the villages are scanty. More than 26% of the households live in floating houses. The average values of the houses are USD 1920, 3182 and 2067, respectively in the fishing, fishing cum farming and farming villages. Only eight out of 410 households are connected with national electricity grid, while 34 households (8%) have access to electricity either through generator or national electricity grid. Survey results show that 75% of the households still use traditional lamps, and 73% and 13% of the households occasionally use battery and candle, respectively for lighting. There is no significant difference between village types with respect to lighting. Almost 98% of the households rely on firewood for cooking and only 2% in the fishing villages use bio gas burner. The average use of firewood among the households of all villages is 1943 kg.

170. Access to better sanitation and hygiene is not encouraging in the villages surveyed. Only 4% of the households have access to sanitary latrine, and 57% of the households have no latrine and 39% of the households use open latrine. The situation is worse in the farming villages where 75% of the households have no latrine. Almost 93% of the households in fishing villages rely on lake/river water for drinking water with treatment. On the other hand, 63% of the households in the farming villages drink tube well water and 36% of the same use pond water. Over all in all the villages, 58% and 34% of the households use river and tube well water, respectively.

171. Besides fishing equipment and land, households on the average own USD 3484 worth of assets including house, appliances, furniture, farm equipments and other assets of which value of house constitutes 55%. The value of house and other assets is the highest ($ 4413) for the households in the fishing villages and it is lowest ($ 2641) for the households in the farming villages. On the average, households in all the villages own 12147 m^2 of land of which almost 89% is agricultural land. The average total land ownership is the highest among the households in fishing cum farming villages followed by the households in the farming villages.

172. As expected, average number of ownership of fishing equipment is the highest for the households in the fishing villages followed by the households in the fishing cum farming villages. On the average, each household own 2.11, 1.67 and 1.14 fishing equipments in the fishing, fishing cum farming and farming villages, respectively. Households in all the

villages use both traditional and modern gears. Among the traditional gears, bamboo made traps and fences, folded woven traps, harpoon and hook long lines are used most frequently. Use of gillnet is the most frequent, almost 70% of the fishing households use such gear. Almost 10% of the households in all the fishing and fishing and farming villages use gill net while 9 out of the 410 households reported to use seine net. Thirteen households in the fishing and farming, and farming villages together reported to use the most destructive type of gears - mosquito net.

173. Almost 69% and 64% of the households in all villages reported fishing during last week from the date of survey during close season and open season, respectively. On the average two members of the households reported fishing and the female to male ratio was 0.33 and 0.18 during close season and open season, respectively. That is for every 3 members of the households one female member was fishing during close season and for every 5 members one female member was fishing during open season. Each of the households who reported fishing last week spent on the average 54 and 48 hours per week during close and open season, respectively with one day off of fishing. As expected households in the fishing villages spent quite longer time per week than those of other village types. Most of the households (49%) in all the villages used gill net as the primary gear followed by traps and hook long line. Few households also used traps and scoop net as secondary gear.

174. Average close season weekly catch per household was 12.6 kg and the same for the fishing villages and fishing cum farming villages was 17 kg and 15, respectively. The average catch for the households in the farming villages was only 3 kg. Together in all the villages, almost 73% of the weekly total average catch during close season was sold, more than 12% consumed and nearly 14% used as fish feed by the households themselves. The households processed a negligible portion of the total average catch. Average selling price of fresh fish is USD 0.39 in all the villages. The price of fish is significantly lower in the fishing villages (USD 0.38) than farming villages (USD 0.46). Considering all the villages, households caught as many as 107 species of which top twenty species constitute 79% of the total catch volume during the week. Among the species caught, different strains of gourami (***Trichogaster trichopterus),*** freshwater prawn, river barb, climbing perch are important. The share of gourami among the total catch was more than 20%. Only 8% of the total catch by the households belong to top 20 species in terms of value that ranges between USD 0.54 to 1.25 with the average price of USD 0.69.

175. During open season 2003, the average total catch was 3501 kg. Almost 75% of the total average catch was sold, 9% processed and 11% used by the households for fish feed and the remaining 5% used for household consumption. The average catch during the same time was only 244 kg for the fishing households, 29% and 64% of the total catch were consumed and sold. A few proportion of the total catch was also used fish feed and processing. The average catch in the fishing villages is the highest (7612 kg) and 75% of the total catch was sold, 10% processed, 11% used as fish feed and the remaining proportion (4%) kept for household consumption. The average catch in the fishing cum farming villages is less than one-third of that in the fishing villages.

176. The average catch was significantly low (489 kg) during the close season in 2004 in all the villages. The average catch in the fishing villages was 855 kg, which is more than double the catch level (433 kg)) of fishing cum farming villages and almost 7 times the average catch in the farming villages. A significant proportion (77%) of the total catch was sold by the fishing and fishing cum farming households (77% and 74%, respectively).

177. There is a significant positive relationship between gear value and total average catch, consumption of fish and selling during both open and close season. The average catch is 13.215 tons for the households who owns more than USD 300 worth of gear, which is more than 6 times the catch of the households who owns USD 200 to 300 worth during the open season. The same is 2.6 times higher during close season for the highest value gear owners. The lowest value (less than USD 15) gear owners have the lowest production in both open and close season, which are 36 kg and 22 kg, respectively.

178. Simultaneously with fishing, many households are also engaged in fish culture either in cages or ponds. A total of 113 (28%) out of 410 sample households are involved in fish culture of which 72% (81) are cage farmers. Almost 59% of the cage/pond farmers are belong to the fishing villages, 33% belong to the fishing cum farming villages and the remaining few (8%) belong to the farming villages. Most important species for cage/pond culture are giant snakehead, pangusius and chevron snakehead. On the average each cage/pond farmers produce 4000 kg of fish while the average production 7750 kg in the fishing villages, 3512 kg in the fishing cum farming villages and only 745 kg in the farming villages. The farmers collect naturally breed fingerlings from the lake.

179. In the close season, an average household consumes 7.91 kg of fish products including fresh fish (5.57 kg), fish ball (1.38 kg) and fish egg (0.96 kg) per week. The average fish consumption is the highest (8.81 kg) among the households of fishing villages followed by fishing cum farming villages (8.47 kg). The same is the lowest in the farming villages (6.41 kg). In addition to fish products, the average consumption of processed fish products per household in all the villages is 2.95 kg, which includes fermented (0.58 kg), prahoc (0.45 kg), salted dry (1.30 kg) and smoked fish (0.62 kg). The average per household consumption of fish sauce in all the villages is 0.77 kg while the consumption is the highest among the households in the fishing villages and lowest in the farming villages. The average consumption of meat products (chicken, beef and pork) is much lower than that of fish, which is 2.54 kg for the households in all the villages. The percentage share of fish to total animal protein is almost 76% excluding fish sauce and eggs.

180. Households living in the Tonle Sap Lake area are dependent on its resources in various ways that provide livelihoods, income and subsistence. Fishing and related activities are the major economic benefits that are measurable in any scale. Nevertheless, households in the lake area derive enormous direct and indirect benefits from the lake resources. Although these resources are most essential in their daily life, scientific analysis of dependence on these resources has not yet done. In this study we followed willingness to pay and contingent methods of valuation to measure the importance of these resources to the people living in the lake area. Households collect firewood, different kinds of vegetables, fruits, aquatic/wild animals and derive indirect benefits of water transportation, animal/duck grazing. Almost hundred percent of the households collect firewood, 84% morning glory, 65% water lily, 70% troyraug, 63% phkasnor, 41% wild fruits, and 20 to 40% collect other fruits and vegetables. Different kinds of aquatic and wild animals are collected by 10 to 40% of the households. Almost 42% of the households derive indirect benefits of water transportation, and 10% animal grazing.

181. Given the scarcity of alternative energy resources, sample households predominantly rely on the collection of firewood from the lake. On the average, each household collects 1943 kg of firewood in all the villages for which they are willing to pay USD 29.00. Although not many people reported to have the benefits of animal grazing, the average value to the households is higher than many other resources, which is USD 19.00. The average value of bamboo/canes and mat making materials are USD 10.00 and 7.00, respectively. On the average, taking all the resources together except fish and fisheries related activities an

average sample household gets USD 6.00 worth of value from the lake. The estimated total value of the non-fisheries resources to the all households living in the lake area is around USD 1.18 million (assuming 1.2 million population in the lake area and household size 6.1).

182. Almost every household in all the selected villages has secondary occupation – for the fishing households farming is the dominant secondary occupation and for the farming households fishing is the dominant occupation. In the year 2003-2004 households in all villages on the average earned USD 1159 from all sources. The most out of this average income came from fishing (USD 496), fish culture (USD 207), fish trading and processing (USD 44), and from farming (USD 231).

183. The most important crop in terms of area cultivated and production is rice followed by watermelon, chilies, beans and vegetables.

2.2.4. *Marketing, Distribution and Supply Chains of Aquatic Resources*

184. Like fish catch statistics, there is no reliable information on quantity of inland fisheries traded domestically and internationally, although the sector has a significant contribution to the country' foreign exchange earning. Information on export of fisheries products is available from two official sources – the Ministry of Commerce and the DOF. According to the Ministry of Commerce, the country exported only 517 tons of fish and fisheries products valued at USD 4.34 million in 1998. According to the DOF estimate total fish export was 40.2 thousand tons in the year 1998 and in the following year the estimate was 44.6 thousand tons.. However, many observers believe that the actual exports are much higher than the DOF estimate, as over the last decade along with the state owned fisheries export and import company (KAMFIMEX), private exporting companies have been increasingly participating in the international trade of fish and fisheries products. During the same period of time, the government of Cambodia has relaxed the monopoly status of the KAMFIMEX to encourage private initiative in fisheries exports. Recently, many private export houses including four big companies[2] who have modern processing facilities are actively involved in the international trade of fish.

185. Given the private sector initiatives, export markets have been expanding from the neighboring countries like Thailand and Vietnam to other countries in Asia[3], Australia and USA over the last ten years and the export markets have been diversified to include fresh water fish, processed fish, other aquatic animals such as crocodiles and snakes along with marine fish. The demand for exports of both freshwater and marine fish products have also been significantly increased since 1993 in Thailand and Vietnam (Tana 2002). Therefore, one can reasonably be skeptical about the current official estimates of exports of fisheries products, given the expansion and intensification of fish exports over the past years. The official estimate of export data may not be reliable as it is principally based on statistics provided by the custom officials, which according to many observers are under reported due to illegal practices[4] (Tana 2002, Navy 2003). Despite these weaknesses in

[2] One of these processing plants are located in Phnom Penh specialized in processing fresh water fish and the remaining three are located in the port city of Shihanoukville mostly process and export shrimp, squid and marine fin fish. One trading company manages two processing plants – one in Phnom Penh and the other in Shihanoukville.

[3] Other Asian markets such as Singapore, Malaysia, Taiwan, Japan, Hong Kong and mainland China import high value fish (live sand goby, crocodiles, snakes, shrimp, squid, etc.) as reported by Tana (2002).

[4] Illegal practices are in the form of under reporting actual volume to evade taxes and custom duties, border crossing through illegal check points to avoid custom officials.

the data collection methods of the DOF, no independent attempt has been made to get a more reliable estimate until now.

186. In addition, there are many constraints of fish marketing and trade, some of which are sparsely mentioned elsewhere at a very rudimentary level. Available information on both domestic and international trade of fisheries products suggest that entire supply chain from the fishing grounds to retail market and border points is traditional and subject to loss of value in terms of spoilage and weight loss due to improper handling and preservation techniques. A recent study by Chea and McKenney (2003) that observed two exporters from the landing site to the border points provides a grave story about the constraints and challenges faced by the exporters[5] in terms of fee payments at different checkpoints of the export route to Poipet. The study is a bold step towards exploring complexities and improper activities in fish trade that are main obstacles in the expansion and development of fish trade in the country. Nevertheless, traders and exporters face many other constraints that need to be addressed in an urgent manner for the development of a class of efficient and competitive entrepreneurs who will be able to overcome new challenges of globalization and health safety barriers in the form of Sanitary and Phyto-Sanitatry (SPS) and HACCP processes.

187. Given the importance of fish trade to the developing countries in the world market, Cambodia has to revisit its fish import and export policy, constraints and prospects of fish exports, and existing infrastructure of fish handling, processing and distribution channels. A comprehensive study on the needs to develop market infrastructure from fishing ground to the export points and retail markets, on constraints to fish marketing and trade, species important for export and domestic markets, price formation and trade margins and the over all supply chain of fresh water fisheries, etc. are needed for the development of an efficient and competitive markets for both domestic and external markets. This study addresses these issues in an exploratory manner based on observation and field survey, which may generate interests for further in depth studies on these topics.

Objectives

188. There exist numerous reports, seminar and symposia papers focusing socioeconomics, livelihoods, marketing and trade on inland fisheries sector, but few of them are based on primary information. Specifically, studies based on primary data collection are almost absent. The most recent study by Chea and McKenney (2003), as mentioned above, is the only study that explores constraints of fish exports. The pioneering report by Ahmed et al (1998) is the only available study that was based on household survey of fishing communities and covered fish production, consumption, livelihoods in the fishing communities, and fish marketing pattern at the producer and consumer level. However, providing a broader picture of fish marketing and trade constraints was out of the scope of the study. Tana's (2002) report provides comprehensive information on the fishery sector as a whole, largely based on official secondary. Tana provides some interesting information on fish marketing, trade and fish processing from his experiences and

[5] The study observed that the exporters paid fees 28 times (including 3 payments in Thai side) of which 8 times to economic police, 3 times to provincial fisheries, 2 times to military police and other stakeholders with or without legal basis. Among these, payment to Thai customs (no legal basis) was the highest, which is more than double the official tax paid to the Cambodian customs. Other major fee payments went to KOMFIMEX, to an Investment Company as road fee, and to the authorities of DOF and provincial fisheries office at Poipet. All these fee payments took 33% of their gross margin while 52% of the same was expenses on transport, labor and other management, and the remaining 15% was credited to their net profit.

observations. However, the report lacks scientific basis to be generalized for policy purposes, although it generates many interesting questions regarding proper working of the system as a whole.

189. In the light of paucity of information and lack of in depth analysis on marketing and trade of fish and fisheries products, the broad objectives of this study is to generate meaningful primary information on marketing infrastructure and distribution channels of fish and fish products in Cambodia. Specific objectives of the study are:

- To identify major stakeholders and beneficiaries of fish marketing and trade;
- To identify constrains of marketing and trade of fish and fish products;
- To explore existing marketing and trade infrastructures for policy suggestions for development;
- To identify important species for exports and domestic consumption and assess the importance of fish marketing and international trade in the economy;
- To explore the existing conditions of fish handling and means of transportation for policy suggestions and development;

Research Methods

190. Given the complexities of interactions across agents and stakeholders in market exchanges, research methods that measures market attributes from a single agent is unlikely to provide a clear picture about the inherent dynamics of fish marketing in the country. For instance, marketing of fish begins from fishing grounds up to middlemen, landing sites, whole sellers, retailers and finally to the domestic and external consumers. Therefore, research methods in market analysis should take approaches that will vertically integrate all the agents and stakeholders where exchanges take place. The study uses secondary information from government and other sources to complement primary data and observations.

191. The study design is detailed and comprehensive that takes into account stakeholders at different level in the supply chain. Given its focus in Tonle Sap area, the study uses information of the household survey undertaken as part of valuation study to assess ground level fish marketing. Important landing sites around the Phnom Penh city and in the selected provinces; three retail markets (one urban and two rural) of fish and processed fish were observed and monitored. Out of total 29 fish markets in the Phnom Penh city, the study selected 10 markets (2 big, 3 medium and 5 small) following proportionate random sampling procedure.

192. The study also interviewed fish exporters in Phnom Penh city, Kendal, Kampung Chnang, Siem Reap, Kratie and Stung Treng provinces following snowball-sampling procedure[6]. Following this method we were able to find four fresh fish exporters in Phnom Penh, two in Kampong Chnang, and two in Siem Reap. In addition, we conducted case studies of two big exporters in Phnom Penh and Stung Treng. We also interviewed provincial fisheries officials about fish catch, exports of fish and important fish species for exports. The whole process of observations, interview and household survey was done once in the close season[7] and again in the open season to capture seasonality in market dynamics. Key

[6] Although non-probability sampling, this method of sampling is useful when there is inadequate information about the population to be sampled. The Department of Fisheries (DOF) has lists of registered exporters by province most of which are either out of business or have not yet started the business.

[7] Close season includes months from June 01 to September 30, and open season includes months from October 01 to May 31. To reserve the rights to access to inland fisheries, government has categorized three different scale of fishing operations. These are large-scale highly commercial operations in designated water area (lot fishing), and medium scale commercial operations in open waters and family scale subsistence fishing, which may or may not be commercial purposes. For the first type of fishing operation

results of the study are provided below and detail analysis of data are provided in Annex 3.

193. Most of the fishers sell their products at the fishing ground to mobile fish collectors at a lower price than they would get in the landing site. These small scale-fishing units cannot catch enough fish to make a profitable trip to the landing site. Again, they have little storage and icing capacity in their small boats to accumulate enough for an economically justifiable trip to the landing site or to a wholesale point. Fish collectors move around the lake in their small boats and pay cash for each transaction. Around 45% of the households who reported fishing last week sold their products to the collectors on site, 42% carried their catch to the landing site and 9.5% of the fishers sold to the fish cage farmers.

194. Observation of the landing sites in the selected provinces reveal that infrastructure and storage facilities are inadequate in almost all the landing sites. Although physical conditions and facilities of the landing sites are better in Phnom Penh, fish handling such as loading/unloading, sorting and packaging practices are still traditional. Although there are structures to accommodate 20 to 25 traders, they usually work on open spaces. Fish starts to land at around 2 pm in the morning and brokers who help to sell products on commission basis become active in opening the boxes, sorting, heading and repacking them so that they are able to charge higher prices for better quality products. Brokers do their business in open space although there exists plenty of rooms inside.

195. We observed two landing sites in Kampong Chnang province –one of them located in the periphery of the provincial head quarters and the other (Chnok Tru) is more than 50 km away from the provincial head quarters. Most of the fish landed to provincial head quarters landing site are live, transported in boats with capacity 2 to 5 tons. The landing site has no structure, although government collects revenues through leasing out to a private operator based on competitive bidding. The leaseholder of the site charges 50 riel/kg from the sellers. The site has a small jetty that can provide space for 10 to 12 boats at a time. During peak time there is always a long queue of boats waiting for fish landing. Sorting and heading are done on the floor of the jetty and on the beach of the river. There are 10 to 15 brokers who facilitate selling of the products to retailers and whole sellers from local and distant markets.

196. In this landing site almost 90% of the total supplies of fish come from Phat Sandai (Kampong Thom) and Chnok Tru (Kampong Chnang) fishing grounds and cages, and the remaining 10% come from other communes of Kampong Chnang province. Most of the high value fish such as snakeheads and pangusius go to Phnom Penh and other (Udoan) wholesale markets in Kampong Chnang. Some of the high value fish and most of the white fish go to the local retail markets and medium scale fish processors. We observed women and children to heading and separating eggs of snakeheads in the landing site. By doing so they add value to their products, and charge different prices for head, body and eggs. The average prices of the body, head and eggs of the snakehead are USD 1.2/kg, 0.5 and 6.25, respectively; while the average price of the whole fish is one dollar or less. The body of the snakehead goes to Phnom Penh for processing, the head goes to the local markets for further processing as animal feed, and the eggs go to the city markets some of which will be sold fresh and some will be preserved for future sale.

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government collect revenue through leasing out fishing lots, for the second type of fishing operation fishers are required to obtain licenses from the government, and the third type of fishing operations are waived from paying taxes. The former two types of fishing operations are allowed to fish only in the open season, and the family scale fishing gears are allowed to fish all the time.

197. There is no structure in the Kampong Kleang-landing site in Siem Reap. It moves down several kilometers as floodwater recedes. Most of the fish are landed on the edge of the road cum beach from the adjacent fishing communes loaded in boats without icing. Buyers of the fish are the exporters, cage and crocodile farmers and fish processors. Most of the fish landed in the site are white fish that are mostly destined for feeding poultry, crocodile and fish in cages, and for processing by the commercial fish processors. The exporters who have permanent export shop in the landing site buy best quality fish such as big catfish, *chitala*, giant snakehead, and different strains of eels for exporting to Thailand through Banteay Mean Chey and Otdor Mean Chey.

198. Monitoring results suggest that top 20 species occupy 86% of the total volume landed in all the selected landing sites, and the average price of these species was USD 0.49 during the last open season (2004), and the average price for all fish landed during this time was USD 0.63. Considering price of each fish species, top 20 species occupy 48% of the total volume landed and the average price of these high value species is USD 1.02 as against the average price (USD 0.63) of all species. If we compare the quality of fish products among landing sites by province, it reveals that the highest percentage of fish in Siem Reap are grade one (75%) while the share is 37% and 36% in Phnom Penh and Kampong Chnang, respectively. On the other hand, the average price of grade one fish among the three provinces differs significantly. The average price of grade one fish in the landing sites of Kampong Chnang province is the highest (USD 1.46) followed by those of Phnom Penh (USD 0.87) and the lowest in Siem Reap (USD 0.74). However, the average price of all fish together does not vary significantly, although it is the highest (USD 0.69 in Kampong Chnang and lowest in Siem Reap (USD 0.54).

199. Among the 19 markets surveyed, 15 markets are daylong, one evening and the rest three are morning markets. Each market, on the average, has 47 fresh fish and 26 processed fish sellers. On the average in each market 32% of the fresh fish retailers and 58% of the processed fish retailers have permanent stall inside market. As expected the city and urban markets have higher number of both fresh and processed fish retailers. In addition to the retail sellers, city markets have 17 fresh fish and 36 processed fish wholesalers. Important species both in terms of volume and value in retail markets have been identified. During close season top 10 species occupied 63% of the market volume in the close season. These species are trey *chhdaur* (26%), *pra,* (9%), *chhkok* (6%), *sanday* (4%), *po* (4%), *raws* (4%), *riel* (4%), *chhpin* (3%) and *chhlaing* (2%). In the city markets the share of top ten species such as *chhdaur, sanday, po, carp samahn, pra, chhkok, proul, slat* and *korlaing* is 66%; in the urban markets the share of top ten species (*chhdaur, riel, pra, chhkok, chhlaing, raws, chhnoht, sanday, bankang* and *chhpin*) is 82% and in the rural markets the share of top ten species (*chhdaur, pra, chhkok, chhdaur, chhpin, chrakaing, kdaung, riel, chhnoht* and *krum*) is 72% during close season.

200. During open season 2004, share of top ten species in the total volume supplied on the day of survey was 65% in all the markets and the share of top ten high value fish was only 5% of the total volume and the average price of these top ten species was USD 2.54 as against the USD 1.06 of the top high volume fish. In the city markets the top ten high volume fish are trey *raws, chhdaur, chrakaing, kran srai, andaing toun, chhpin, chhlaing, proul, krum* and *riel*. These species altogether constitute 69% of the day's volume in the market and the average price of these species is USD 1.25. The share of top ten high value fish in the city markets is only 8% with the average price of USD 2.48. These high value fish species are giant freshwater shrimp, greater bonny lipped barb, twisted jaw sheatfish, panasius krempfi, peacock eel, royal featherback, soldier river barb, Malayan bonytongue and seven-line barn.

201. It is hard to isolate supply sources of fish in the retail markets as each of the retailers receives fish and processed fish products from different locations. Retailers in the Phnom Penh city markets collect products from almost all the locations/ fishing grounds of the country. However, in terms of volume around 70% of the fresh fish supply in the city markets come from different fishing grounds/lots in the kanadal province. A substantial share of fish also comes from Kampong Chnang and Kampong Cham provinces. A few percentages of fish come from Takeo and Prey Veng provinces. Supply of fish in Kampong Chnang markets predominantly come from the communes within the province. Less than 5% of the total supplies in these markets are also come from Poursat province. Retail markets in Siem Reap provinces receive fish from the province itself and Battambang. Majority share of fish in the Kandal markets come from Kandal province itself and the landing sites in Phnom Penh.

202. Although KAMFIMEX is still a major player in the export of inland fisheries products, there are plenty of private small-scale fish exporters in the country. These exporters are located in Phnom Penh, Kampong Chnang, Siem Reap, Kandal, Stung Treng and Prey Veng provinces. In Kampong Chnang and Siem Reap provinces exporters are located in the landing sites, and they have fish collectors who collect desired species for them from the adjacent fishing grounds. In the remaining provinces, exporters have office cum stores where they stock fish collected by their agents in different fishing grounds across the country. Exporters stock fish in plastic iced containers until it becomes a sizable amount of a truck (small or big) load. Fish collectors or agents collect the desired exportable species from the fishing ground for days, sometimes it may be one week, packed them in plastic bags and carry these either by motor taxi or small push truck to the exporter. Exporters then sort by quality and again pack in plastic bags, weight them to determine price per kg according to quality, and put them in containers with crushed ice. Every exporter has ice crushing machine, weight machine and several plastic containers. Most of the exporters in Phnom Penh have their own transport to carry the products to the export points.

203. The study identified top ten species both in terms of average value and total volume exported during one week from the survey date in close season 2003. Top ten species in terms of volume represent 82% of the total exports and the average buying price is USD 2.60/kg and the average price at the export point is USD 3.80/kg. The gross profit USD 1.20/kg includes cost of transport, plastic bags, ice, labor and different legal and illegal taxes, fees and tolls on road. These top ten species are *chhpin* (39%), *kanchos thmo* (9%), *slat* (7%), *chhlaing* (9%), *chhdaur* (6%), *Kanchak sla* (5%), *sanday* (3%), *kray* (2%), *damrey* (2%). Top ten species in terms of value represent only 23% of the total volume of exports and the average buying and export prices are USD 6.79 and 10.93, respectively. Important species in terms of export value are trey *damrey* (live and fresh 4%) *promah* (0.5%), *khya* (1.35%), *kanchos thmo*r (9%), k*aok* (1%), *sanday* (3%), *kchoeung* (2%) and *kray* (2.43%).

204. The study also identified top ten species both in terms of value and volume of exports during open season 2004. Top ten species during open season in terms of volume occupy 90% of total volume of exports. These species are *changwa poht*, (27%), *kray* (20%), *raws* (18%), *chhdaur* (7%), *Chhlonh chhnoht* (4%), *chhlaing* (3%), *kes* (3%), *slat* (3%), *sanday* (2%) and *kanchrouk chhnoht (*2%). The average buying and export price of these species are USD 2.55 and 2.97, respectively. The top ten high value species represent only 9% of the total volume exported. These species are *trey damrey*, (1%), *promah* (0.3%), *khya* (0.18%), *kes* (3%), *kchoeung* (.43%), *sanday* (3%), *ta aun* (.03%), *ruschek* (2%) and *tanel* (0.13%). The average buying and export price of these species are USD 7.25 and USD 9.27, respectively.

205. On the average, each of the small export houses export 30 tons/month during peak months March and April, 5 to 10 tons per month during June through September and 3 to 5 tons per month during off peak months of January and February. Majority of the fish from these export houses are exported to Thailand via Poippet and Chnong Sa Ngan (in Srisaket province of Thailand) through Otdar Mean Chey province. There few non-permanent/unofficial border points of fish export- one of them is Pailin once closed for security reasons, now ready for trading. Some suspects most of the illegal trades might happen through this route. Two such points are in Otdar Mean Chey/Surin Province in Thailand. Another such point exists in Tapaya in Sakeaw province of Thailand. Tambon Klongjeam village at Uboltratchathani province of Thailand and Lao border is another fish trade point where all fish come from Stung Treng province of Cambodia. Most important species are traded through that point are river catfish and river carp.

206. Among the small export houses in Phnom Penh, two of them are specialized in exporting live sand goby (*trey damrey*), the most high value fish to Hong Kong, China, Malaysia and Singapore. They collect these fish through middlemen from Kandal, Kampong Chnang, Battambang, PoursaEach of them has 30 to 40 collection agents in different parts of the count, Kampong Thom and Kampong Cham. In each of these provinces they have at least two middlemen most of them are women buy fish for them and the exporters pay some advance. On the average, each exporter buy live sand goby from the middlemen at the rate of USD 12 to 14 for grade one (>400 gm), USD 6 to 8 for grade two (300 to 400 gm), and USD 3 to 4 for grade three (<300 gm) fish. This price is inclusive of DOF license fee, transport cost and other legal and illegal payments to police, economic police and other toll collectors. On the average, such payments may be up to USD 3 for 200 to 500 kg. As these products are exported through airport, exporters only have to pay 10% customs duty and the airfare for the destination port. The exporters sell their products at the rate of USD 30 to 35 per kg.

207. Consultations with the exporters and provincial fisheries officials suggest that there are several routes of illegal trade along Vietnam border. Almost thirty to 40 percent of the export volume of the export houses goes to Vietnam, which are undocumented and the government is deprived of taxes. Main species exported to Vietnam are bronze featherback and small white fish for fish feed. Vietnamese import bronze featherback for making fish ball. According to fisheries officials much of the small fish catch from Bassac River goes to Vietnam through Bakdai border point and across Trey Thom in Champal Pune commune. There are incidences of importing fish from Vietnam and Thailand during January and February months. Giant snakehead from Vietnam and cultured pangusius from Thailand are imported to Cambodia as they are cheap compared to river fishes in Cambodia.

2.2.5. Post Harvest Fish Handling and Fish Processing

208. Post harvest fish processing and handling of fish and fisheries products are important elements for many of the peoples' livelihoods in the Mekong region and in the Great Lake, and provide food security to the millions in the region especially when fresh fish are scarce in the dry season. The world has experienced a significant shift in fish trade while many of the fish exporting developed countries became net importers since early 1990s (Delgado and Courbois 1997; Ahmed et al 2003). Simultaneously, developing countries, especially Southeast Asia and South Asia have become home of the most exports of fish and fish products in the world. Developing Asian countries have been competing each other for increasing exports and the competition is likely to increase in near future.

209. In the face of globalization as mandated by the World Trade Organization (WTO) and increasing pressure of implementing SPS and HACCP procedures from the developed fish importing countries, survival in the competition will increasingly depend on efficiency and quality in health safety measures of these countries. Cambodia is falling far behind among its Asian competitors not only in terms of volume of export but also in its ability to exporting quality products. Currently, most of its exports are fresh and semi-processed fish to Thailand, Laos and Vietnam, loose value in weights and value additions from processing. It is believed that Thailand and Vietnam re-exports by adding value through industrial processing. Until now there is no study that addresses the fish processing status and the measures of quality control in Cambodia. It is necessary to undertake an exploratory study on the status and nature of fish processing and post harvest handling of fish. This study addresses these issues based on observation and field survey that will generate interests for further in depth studies on these topics.

210. The broad objective of the study is to document the existing post harvest fish processing facilities, products processed, utilization and marketing of processed products, conversion ratio and quality of the processed products, and cost and benefit analysis of the commercial and traditional family processing units. Processing units, both medium and family-scale, are scattered on both land and floating villages. The household survey will provide information on family level subsistence and, to some extent, commercial processing units and their livelihoods. A total of 60 medium scale commercial processing units have been selected from different processing clusters in Kampong Chnang, Poursat and Siem Reap. To have a full picture of the fish processing industry in the country, it is essential to take into account the migrant fish processors during open season who gather on the bank of the Lake and rivers. Although it was originally planned, the study could not collect information on migrant processors due to non-availability of such processors. Due to low and late flood there was not enough catch to attract people to migrate for fish processing. To understand the marketing and price formation of the processed fish products, retail market of processed fish products in the cities and rural areas were observed and monitored simultaneously with the retail fresh fish market survey. Key results of the study are given below and the detail analysis of data are provided in Annex 4.

Key Results

211. Fish processing in Cambodia is an important livelihood for many households in and around Tonle Sap. It is done at the household level for mainly subsistence. Commercial processing may be broadly distinguished as medium and large scale industrial processing. Medium scale processing units are mainly family owned and operated by the household members with fewer labor from outside during peak season. Among the medium scale processing units surveyed, single family owns 93% and the remaining 7% are jointly owned. Among the managers of these units, almost 54% are illiterate, 28% has primary and rest 18% has lower secondary and higher secondary level of education. As we observed during interview, the processing units do not maintain health standard, and especially the prohoc and sauce making process are unhealthy. The jars and cubes are kept open for months; all kinds of animals and birds are vulnerable to be drowned and rotten along with the fish products.

212. The survey of households reveal that more than 63% of the households in the selected villages make prohoc, 45% make fish sauce, fermented fish and smoked fish are made by 11% of the households. Few households also process fish products such as salted dried and fish fillet. On the average, each households who reported processing produce 157.31 kg and 2083 kg of prohoc and semi processed prohoc, most of which are sold. The

average production of smoked fish and salted dry fish are 365 kg and 140 kg, respectively. Processors of these products sell almost all of their products. In addition, each household also produces other products such as dried fish, fermented fish, and fish sauce and fish ball. The medium scale fish processors also produce the same products as produced by the households for subsistence. Among the 61 processing units surveyed, 22 of them process salted dried fish, 10 smoked fish, 11 prohoc with bone and 8 salted fish. The average production of salted fish, prohoc with bone, fish sauce and semi-fish fillet are 129,083 kg, 106,550 kg, 39,489 liters, 19,417 kg, respectively. The average net profit pr unit is the highest for salted fish processors followed by prohoc with bone. There is a clear correlation between average production and net profit. That is processing units with large operating capital earn higher net profit.

2.2.6. Other Activities

213. The resource specialist participated and contributed in the training workshop on "Co-management" held in Kampot province for the IFReDI staffs held in March 2004. Participated as a resource person in the training workshop on "Project Proposal Preparation and Technology Transfer" held in March 2004 and contributed to draw the technology transfer pathways and stakeholders involved and helped to finalize draft research proposals for IFReDI.

2.2.7. Conclusions and Recommendations

214. The socioeconomic staffs of IFReDI have achieved significant knowledge in field research and skills in analytical techniques through "learning-by-doing" and on-the-job experiences over the project period. They tried their best to learn and apply by doing research in their own. However, all these knowledge and skills will sustain only if there are follow up research activities and refreshers training arrangements. Twining and long term partnership with International Agencies/Advance Scientific Institutions are critical for sustainable capacity building in research. Continuous collaboration with national and international research institutes and organizations is necessary to implement the medium term research and development plans.

215. IFReDI staff still requires developing skills in analyzing and translating research results into policy analysis. They need to understand the policy domain and policy environment to initiate meaningful policy dialogue for sustainable management of the fisheries resources. Therefore, the ADB and WorldFish should consider further support to IFReDI in the areas of technology transfer, research and policy analysis.

3. Technology Transfer

3.1. Technology Transfer and Dissemination Framework

216. The success of IFReDI in carrying out its mandate to provide scientific information and technical support for the sustainable management and development of inland living aquatic resources of Cambodia depends on how efficient and effective the Institute is in transferring appropriate technologies and disseminating information to various stakeholders. In view of the existing weaknesses of institutions in technology/information dissemination, it is recommended that IFReDI in addition to dissemination of information generated by its own research, should take lead in synthesizing available information from other sources that is relevant, and disseminate it to the stakeholders that need this information. Before a framework/strategy could be developed for transfer of technologies and dissemination of information it is necessary to have an understanding of: (i) the nature

of various technologies/information that will be generated by IFReDI; (ii) identification of stakeholders/beneficiaries for each of the expected outputs and characteristics of these recipients; (iii) dissemination methods for different categories of outputs that need to be disseminated; (iv) pathways for dissemination of research results; (iv) existing methods for technology transfer and their shortcomings; (v) resources (financial and human) needed; (vi) an organizational structure that can maximize use of limited resources; and (vii) methods for cost recovery for the sustainability of IFReDI. Taking these into consideration, Technology Transfer and Information Dissemination (TTID) framework has been developed in consultation with various stakeholders through a two-day workshop held in March 2004 and are detailed below.

217. ***Research Outputs and TTID Products:*** Annex 1 provides details of research results expected to emerge from IFReDI in the next 5-10 years along with beneficiaries/stakeholders identified for each of these outputs.

218. The research outputs will be disseminated in the form of policy briefs, technical reports, journal publications, extension materials (brochures, flyers, "how to" manuals, CDs, tapes, posters, etc.), technology and market updates, and a newsletter/magazine that will cater to different stakeholders. Updates on technology, market, environment and policies can be disseminated regularly through the web page.

219. ***Stakeholders:*** Stakeholders identified for each of the expected outputs of IFReDI research (Annex 1) can be classified into four major groups: (i) the national level government policy makers and planners and donors; (ii) R&D institutions, collaborating regional/international organizations, NGOs and academe; (iii) local/provincial government agencies and fishing/farming communities, fish traders and middlemen, fish processors, private entrepreneurs and NGOs; and (iv) internals stakeholders – IFReDI and DoF staff.

220. ***Technology Transfer Pathways:*** Delivery and pathways for transfer of research outputs depends on the beneficiaries/stakeholders and their capacity to understand/adopt the research outputs. The delivery systems include: i) policy briefings and dialogues; ii) scientific and trade exhibits; iii) seminars, workshops and conferences; iv) training and extension activities including demonstrations and pilot programs; v) internet/web page; vi) print, radio and television; and vii) direct delivery.

Proposed technology transfer pathways of research outputs to different stakeholders of IFReDI are presented in Fig.4.

221. ***Multi-media Mix Strategy***: IFReDI will employ both print and broadcast media and person-to-person contact in disseminating information and technology to its various stakeholders such as the fishing communities, fish vendors and middlemen, fish processors, government policymakers and bureaucrats, fishery schools faculty and students, biological and social science researchers, personnel of regional/international organizations and non-government organizations involved in fishery development work, and decision-makers of funding agencies. Person-to-person contact (policy dialogues, seminars/workshops, in-situ training), backed up by audio-visual tools, is the backbone of IFReDI's technology transfer drive.

222. ***Radio.*** The radio will be used primarily to reach out to fishing communities, fish vendors and middlemen, and fish processors. Techno-tips and calls for community assembly and participation in seminars/workshops and training courses may be broadcast in early morning, noontime, and evening programs.

223. ***Television.*** Some local television stations have public affairs programs for issues discussion and for showcasing government development projects. These public affairs programs may be used by IFReDI to showcase its own projects and to disseminate information regarding its training courses and seminars/workshops. The television may also be used for demonstration of technologies for fish culture, handling and processing of fish, and environmental care and other technologies/research/information generated by IFREDI.

224. ***Audio-visual aids (video/audio clips, and tapes and CDs for documentaries and instruction/demos):*** The Institute will produce documentaries on its programs and projects for showing to visitors; video and audio clips for TV and radio broadcast; and instructional/demo tapes and compact discs on technologies for fish processors, fishery faculty and students, researchers, and development workers. The last may be an income-generating project. The documentaries produced in English will be dubbed into Khmer for easy understanding.

225. As of now, IFReDI has no staff that are capable of writing scripts for a/v documentaries, and video and audio clips. No one, as of now, is also capable of doing a/v production work. It will, therefore, be necessary to engage the services of professional scriptwriters and documentary producers, as well as voice talents for dubbing.

226. ***Newspapers/magazines.*** Newspapers and magazines will be used to disseminate information – in straight news and feature story forms – regarding important activities and research results of IFReDI.

227. As of now, there is no personnel of the Institute who is capable of writing news and feature stories for press release, so IFReDI may have to engage the services of professionals to write the stories for them, or call press conferences for important events. Depending on the nature of the information being disseminated, IFReDI may use either the local English newspapers/magazines, or the Khmer newspapers/magazines, or both.

228. ***Flyers/brochures/posters.*** IFReDI will produce institutional flyers in English and Khmer for distribution to its different stakeholders. It will also produce instructional manuals on the technologies it aims to propagate. The latter may be an income-generating project.

229. At this point, none of the IFReDI staff is capable of technical writing suitable for good-quality flyers and brochures in English. It will, therefore, be necessary to engage the services of professional technical writers or editors to work with the IFReDI staff in the production of flyers and brochures in English and Khmer.

230. ***Person-to-person contact.*** Seminars/workshops and in-situ training will be the main vehicles for technology transfer, and community assemblies and policymaker/law enforcer conferences will be used for policy dialogue and development.

231. ***Internet.*** As of now, the Internet is used by IFReDI primarily for email and information search. But in the days to come, the Internet will play an increasingly important role in IFReDI's information dissemination and technology transfer drive. The capability to harness the Internet for this purpose is a major part of IFReDI's human resource development program. Many of IFReDI's stakeholders – researchers, students and academicians, government policy-makers and decision-makers, fund donors, collaborators – are wired.

232. A website is being developed and installed in 2004. Initial releases will be the mid-term reports on bio-ecology, socioeconomics, and policy issues. Techno-tips, market updates and environmental issues on Cambodia's inland fisheries will also be disseminated through the website.

233. In 2005, technical reports, publications, and policy briefs will be uploaded.

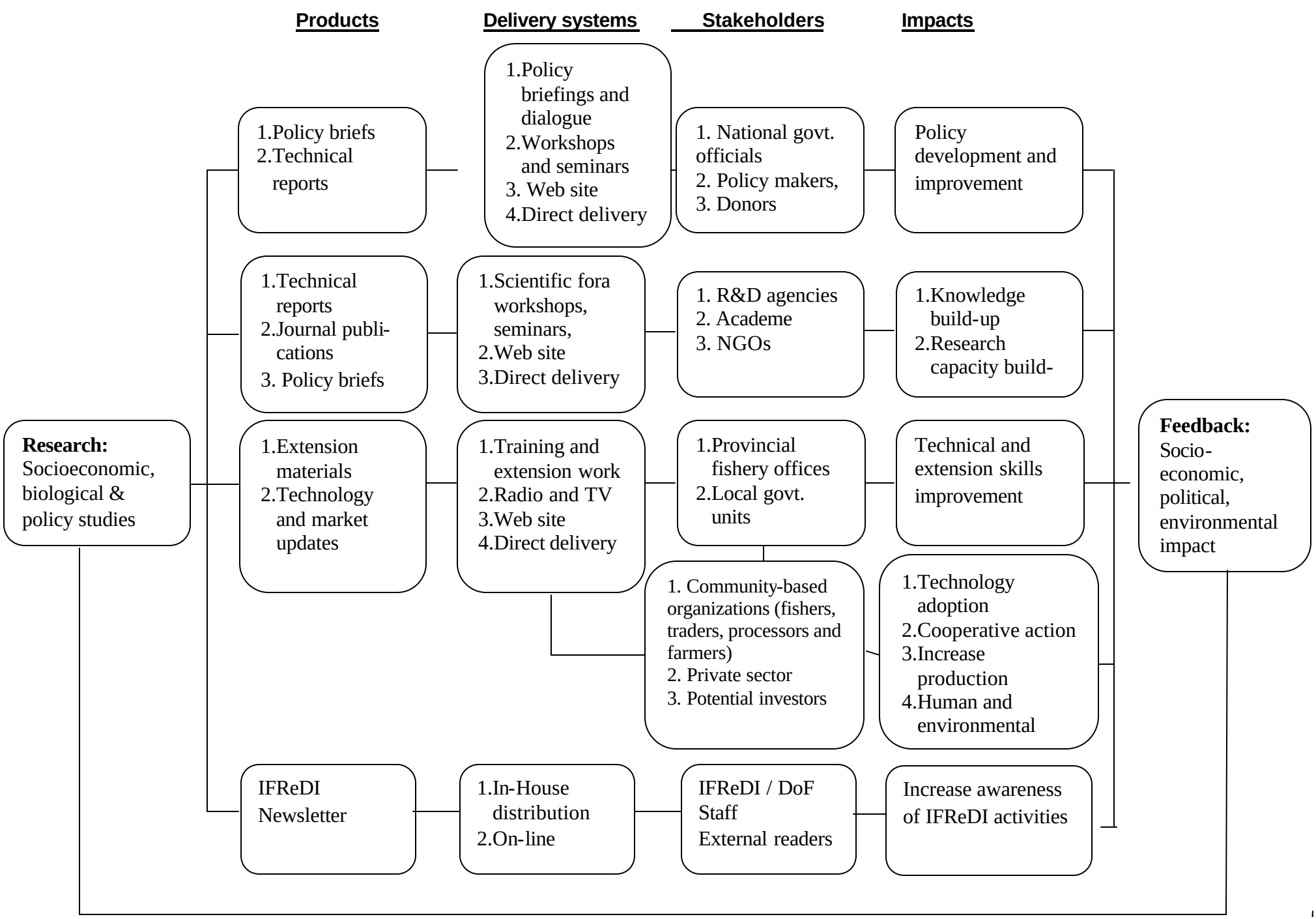

Fig.4: Technology Transfer Pathways

3.2. Organizational Structure and Responsibilities for Technology Transfer

234. The mission of IFReDI is to undertake research and provide scientific information and technical support for the sustainable development of inland fisheries in Cambodia. However, the organizational structure of IFReDI as it exists now does not provide for an office that will be specifically responsible for technology transfer and information dissemination (TTID). In view of the importance of this activity, it is recommended that the present organizational set-up of IFReDI be restructured to be more responsive to the attainment of the mission of the Institute. It is recommended that a division on Technology Transfer and Information Dissemination be created. Under the supervision of the Director/Deputy Director, the Division head shall be responsible in the planning (including budgeting and sourcing of funds) and implementation of technology transfer and information dissemination activities. The proposed organizational structure is in Fig. 5.

235. In the interim, a responsible Scientist of IFReDI should be designated as In-Charge of TTID reporting directly to the Director/Deputy Director in order to sustain the initial activities undertaken under the Technology Transfer component.

236. IFReDI, through the Director, should formally link up with Director General of DoF on matters related to extension activities, which will involve provincial fisheries officers. IFReDI researchers and TTID staff should then coordinate with the provincial fishery officers on specific extension activities that will be jointly implemented by IFReDI and DoF field staff.

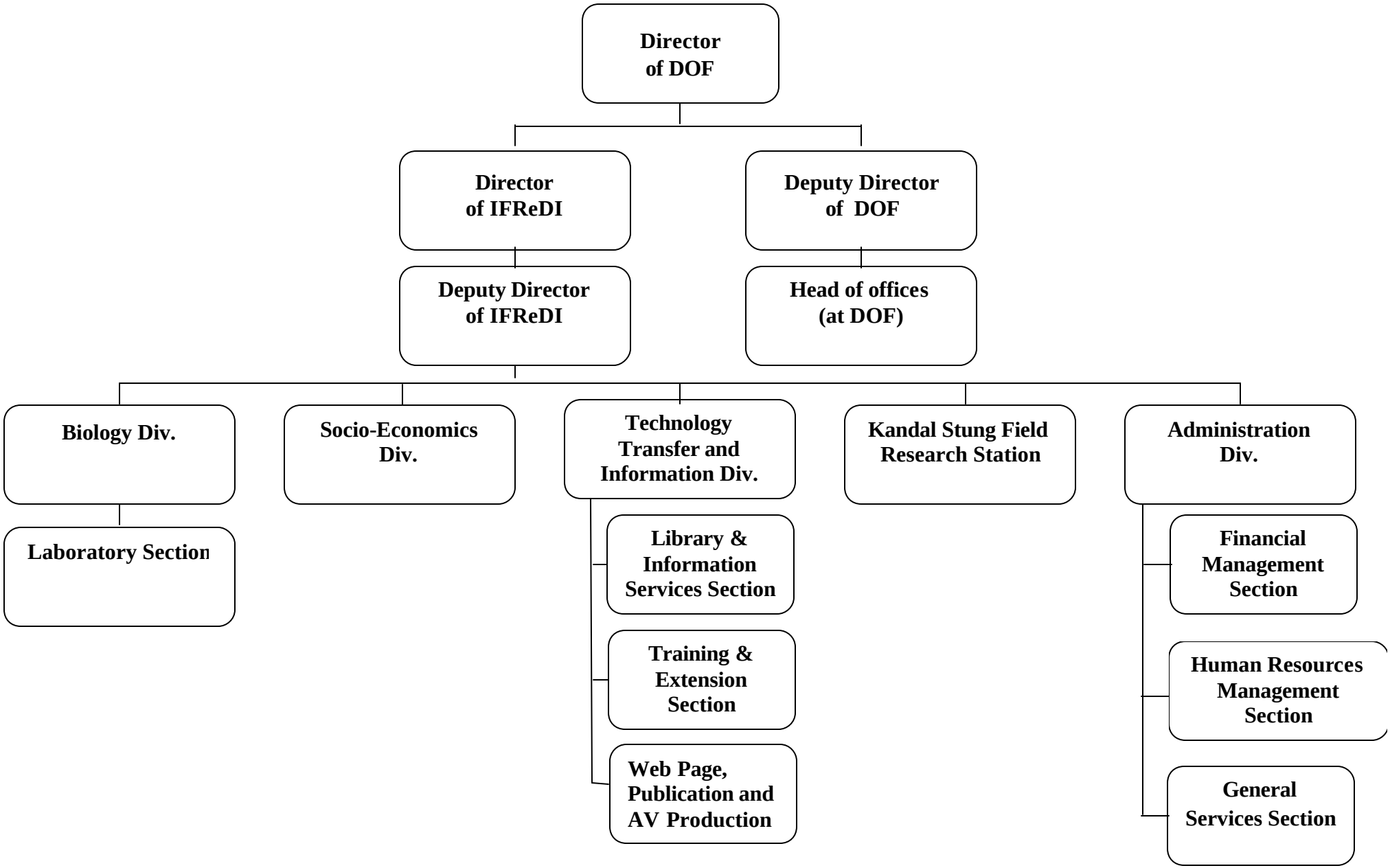

Fig. 5. Proposed IFReDI Organizational Structure

4.3. Funding and Cost Recovery Mechanisms for Technology Transfer

237. It is essential that IFReDI establishes institutional stability by incorporating the principles of full cost recovery for the services provided. This is particularly important in order to encourage efficiency and financial sustainability within the operational aspects of IFReDI that are consistent with relevant Government policies.

238. Information and extension materials intended for fishers, farmers and extension workers are normally given free of charge. IFReDI should request for a separate budget from the national government for the production of information and extension materials intended for fishers, farmers, and extension workers. IFReDI could also produce the materials jointly with other agencies such as Ministry of Environment, Ministry of Education, other research and development organizations/projects, NGOs, etc. in order to share the cost of production. Some donors may be approached through proposals to provide funding for production and dissemination of specific information materials.

239. Some TTID products (in print and a/v forms) should be sold to generate income for IFReDI or to defray some of the expenses in the production of information materials.

240. The guiding principles in costing and pricing the products are affordability and competitiveness. The pricing mechanism will follow the full-cost approach in the long term. The full-cost approach will include the direct cost of labor and materials, the indirect cost of management and production overhead, and depreciation of production equipment. In the short-term, however, it is suggested that direct cost or the variable cost of production (inputs such as paper, ink and other supplies, and hired labor, if any) should be fully covered.

241. Depending on the "marketability" of the products, a reasonable mark-up should be added to the direct cost to cover partially the fixed and other overhead costs. This should be the initial selling price of the products. Some materials, which are produced with external donor funding, may be given/distributed free.

242. Any advice that IFReDI staff provides to other projects and agencies should be charged on consultancy rates. IFReDI should charge for the information/databases it provides to other agencies/projects.

243. To cite some examples of research outputs from the project that could be published and sold in 2004 and costs recovered are:

i) Latin-Khmer and Khmer-Latin Dictionary of fish names based on MRC fish database (prepared by E. Baran)
ii) Dictionary of Mekong fish species: synonyms and valid names from Fish Base (prepared by E. Baran and C. Garilao);
iii) Poster of dominant inland fish species of Cambodia;
iv) Technology and market updates (fact sheets);
v) Fisheries calendar.

Fishing Calendar

244. A "Fishing Calendar" for the year 2004 has been designed and prepared by the local specialist counterpart in close coordination with the Team Leader and IFReDI

biologists and socioeconomists. It contains information useful to Cambodia fishing households, such as: i) moon days; ii) closed and open seasons of different fishing gears and practices in some parts of Cambodia; and iii) other important events such as National Fish Day, Forest Day, and holidays. The calendar has been distributed to fishing families.

4.4. Preparation of research proposals

245. Sustained funding for undertaking research and dissemination of research results/outputs is necessary for IFReDI to make an impact on sustainable management and development of aquatic resources. Since the government funding for research is limited, IFReDI staff should develop proposals for funding research projects in identified priority areas and submit to the donors. Keeping this in view, a two day training workshop was organized to train IFReDI scientists in the intricacies involved in preparation of research proposals, identification of donors and approaches to donors. Based on this training, IFReDI staff have identified 5 priorities for research and with the help of project staff prepared brief proposals for submission to donors. These proposals are:

246. ***Assessment of existing fish sanctuaries in conservation of resources and improvement of fish production:*** The objective of this project is to assess the status of fish sanctuaries established in 1940s in Tonle Sap Great Lake including the status/effectiveness of enforcement of laws and make recommendations for efficient management of fish sanctuaries for conservation of resources and increasing fish production. It is proposed to undertake this project in two phases.

247. ***Fisheries Co-management in selected communities along Tonle Sap Lake (Great Lake):*** The Objectives of this project are to: to document the fisheries co-management arrangements in Tonle Sap area such as communities organized by DoF, NGOs and others and assess their effectiveness in management of fisheries and suggest improvements for equitable distribution of benefits.

248. ***Impact of fishing right system on fish production and economic performance.*** The objective of this study is to determine the productivity of fishing lot, medium and small-scale fishing; compare productivity with open fisheries system (medium and small-scale fishing); determine the distribution of benefits from the lot and open system; and suggest policies to improve the efficiency of sustainable fisheries resources management and equitable distribution of benefits among fishing communities.

249. ***Role of fish in diet/nutrition of people of Cambodia:*** The objective of this project is to understand the importance of fish in the diet and nutrition of people in areas near to fishing lots and those away from fishing lots and among different income groups.

The detailed proposals for these four activities are in Appendix D-1.

3.5. Training

250. Conducting research activities and sharing of research findings with different stakeholders will be a major activity of IFReDI in the future. Therefore, capacity building for IFReDI staff on these aspects is extremely important in order to achieve the objectives of the new research institute through information dissemination and communications. In view of this, the following capacity building programs have been undertaken:

On-the Job training in Library and Information Systems

251. Organized for 3 staff of IFREDI: Ms. Him Bunthay, Mr. Choup Sokhan and Ms. Sim Thavary during 10-22 December 2003 at WorldFish Center Hq in Penang, Malaysia with the objective of providing them with the essential library management skills and practical experience in organizing information and information dissemination. The training modules focused on: collection development and management; systems and technology; cataloguing; information services; Library cooperation and networking; and Library management;

252. The trainees had access to the microcomputers available in the Library and the Internet, and the bibliographic tools used by the WorldFish librarians.

253. The short training provided at WorldFish Hq was not enough since the trainees lack experience in managing a library and do not have much experience in using computers, internet and database management, excepting for Mr. Sokhan. In view of the above, second training course was organized in Phnom Penh on 22 March – 2 April 2004. During this period, the following activities were undertaken: (i) CDS/ISIS for windows (winISIS) software was installed as the library information storage and retrieval system and staff trained in its use; (ii) staff trained in processing books (ownership stamp, assigning accession numbers, preparing loan slips and book pockets, and preparing and pasting the call numbers on the spine of the books, etc.); (iii) prepared a listing of reference materials and textbooks for IFReDI scientific staff to select; (iv) set up a lending service using a revised version of the Browne issue system; (v) trained staff on how to process interlibrary loan requests; (vi) provided the library with a mailing list of 155 fishery libraries that could be used to establish a gift and exchange program and five requests were sent to the libraries of FAO Fisheries Department; SEAFDEC Thailand and Philippines; Central Inland Fisheries Research Institute, India; and Central Institute of Brackishwater Aquaculture, India; (vii) trained the staff on how to use the catalogues of libraries of WorldFish Center, SEAFDEC, U.S. Library of Congress and the US National Agriculture Library to do copy cataloguing; (viii) emphasized the need to establish information support services with other fishery libraries such as FAO Fishery Department, WorldFish Center, SEAFDEC etc.; (ix) order placed for steel shelves for storage of books.

Training in project proposal preparation

254. A two-day training workshop was organized in March 2004 with the objective to: (i) improve the skills of IFReDI staff in project development and writing proposals, and (ii) better understanding of intricacies in getting project funding from donors. The training covered aspects such as: what a research proposal should convey; how to start with proposal preparation; 12 steps in writing proposals; basic information needed in proposals; preparation of work plans, budgets and log-frames; market research on donors and their priorities; donor required formats; reasons for failure to attract funding; proposal development process.

255. This was followed by review of 4 research proposals prepared by IFReDI staff, identifying weaknesses in the proposals and revising/strengthening them appropriately and makes them ready for submission to donors.

Web-Page designing

256. Eight staff members of IFReDI have been trained in web-page designing and maintenance. The trainees are expected to design home pages on their own, how to upload and configure files in remote site, write code with HTML, edit code for other home pages, and use new generation web design application. The tangible output of the course is a IFReDI Web Page that will be ready for use. A "friendly search" function will be incorporated that simultaneously examines other web sites such as WorldFish Center's. All TA reports and research publications will be uploaded on th4e web site including reports from ADB TA T3993-CAM on "Improving the Regulatory and Management Framework for Inland Fisheries".

Desk-top publishing and Printing and audio-visual materials production skills development

257. Arrangement for local experts to train selected IFReDI staff is being done. Meanwhile, self-learning by IFReDI staff is being done.

3.6. Equipment procured

258. Some equipment as listed below has been procured to support the technology transfer and information dissemination activities.

Furniture for the Library – one set
Computer - 1
Reference books
LCD projector - 1
Still-photo Camera – 1
Digital camera - 1
Video camera - 1
Desk-top publishing hardware and software – one unit
Paper binding machine -
Overhead projector - 1
Notebook computer -1
Wall projection screen with remote control - 1
Scanner - 1

3.7. Networking

259. While main role of IFReDI is to undertake research, it also has to disseminate its research results to stakeholders. This has to be accomplished in collaboration with other agencies involved in dissemination of information – DoF, provincial fisheries authorities and NGOs. Hence official links need to be developed with these agencies and responsibilities identified.

260. IFReDI library is new and in its infancy and the staff are yet to be well conversed with library management and information dissemination. However, there are opportunities for IFReDI staff to take advantage of expertise/knowledge available at the National Library of Cambodia and the documentation center of the Royal Agricultural University of Cambodia. WorldFish staff consultant held discussions on library issues and ways of establishing linkages and resource sharing with other libraries in Cambodia. The need to establish information

support services with other fishery libraries such as FAO Fishery Department, WorldFish Center, SEAFDEC etc. was highlighted.

261. While research is the mandate of IFReDI some activities that are related to IFReDI are being undertaken by DoF and other agencies in Cambodia (e.g. co-management research projects undertaken by DoF and IFReDI). In view of this, links have been established between these agencies and IFReDI.

3.8. Remarks and Constraints

262. IFReDI is new and its staff are young with limited experience in technology transfer and information dissemination. They need to be trained in production of extension materials

263 glish language and knowledge management and dissemination skills of Library staff are low. They need further training.

264. There are no staff positions in IFReDI for technology transfer activities. Till a new division is established with staff positions as recommended by the project, a senior staff member of IFReDI be given the responsibilities for these activities.

3.9. Recommendations and Follow-up Actions

265. Till such time capacity has been developed within IFReDI for writing and production of extension materials, these services be contracted externally. In the meantime, this capacity needs to be developed among IFReDI staff.

266. Extension is prime responsibility of DoF and provincial authorities. However, IFReDI should have close links with these organizations and develop formal links and identify responsibilities of each of the organizations in dissemination of information and feedback from field to research;

267. DoF/government should provide budget for technology transfer/information dissemination activities till the time IFReDI could recover costs and self sustain;

268. The Library staff need to be further trained in knowledge/information dissemination;

269. IFReDI needs to pay adequate attention to maintenance and updating information on its web site.

270. IFReDI being new institution and staff are young, need technical support for at least another 5 years.

4. Policy Development and Dialogue

271. Fisheries policy and management in Cambodia addresses issues and concerns on different administrative and geographic scales and relates to different groups of stakeholders with different interests. The institutional set-up (laws and regulations and management organization) reflects these different levels of policy and management and so does the needs for research related to policy making and management.

272. At the international (regional) level, the issues and concerns relate to joint management of shared living aquatic resources and management of water

resources and habitats with critical implications for fisheries productivity. The stakeholder at this scale are national governments, international government organizations and international NGOs. The legal framework consists of international conventions (such as the Convention on Biodiversity), guidelines (such as the FAO Code of Conduct for Responsible Fisheries) and agreements such as the MRC Agreement and the policy research focus relates to the establishment of appropriate management institutions.

273. At the national level, the issues and concerns are national aspect of international issues, overall management objectives (food security, production, biodiversity, equity and efficiency and management of water resources and habitats on which fisheries productivity depends. At the national scale the stakeholders are the resource users and the people involved in fish processing and distribution, the consumers, various line agencies, NGOs and donors. The legal framework is the Fisheries Management and Administration Law and associated sub-decrees and proclamations. Policy research focus is on governance. The role of policy research is identification of resources and habitat linkages, identification of stakeholder interests, clarification of options and trade offs between policy objectives, clarification of management means and assessment of management outcomes.

274. At the local level, the issues and concerns are resource access, rights and protection of interests, resource user conflicts, fisheries infrastructure, external influences (e.g. from military), and alternative livelihoods. Stakeholders are resource users, people in the processing and distribution chain, consumers, line agencies at national, provincial and district levels, NGOs and donor agencies/projects. The legal framework is the Fisheries Management and Administration Law and associated sub-decrees and proclamations, the local fisheries management plans and traditional, informal law. Organizations involved include community fisheries associations, traditional community associations and project organizations. At this level the focus of policy research is on identification of resources and habitats and their state, identification of stakeholder interests, options and trade offs for management, management means (technical and institutional) and outcome of management (sustainability, equity, efficiency).

275. IFReDI is in the process of developing skills and competences to prioritize and address the research issues mentioned for the different scales of policy and management. This involves the acquisitions of knowledge in disciplines of institutional economics, political science and organizational sociology and in appropriate, participatory research methodologies.

4.1 Training

276. The major training activities undertaken by the component comprise:

A. Priority setting workshop (Penang, Malaysia, 5-9 August 2003). 10 participants

The workshop worked on the basis of a hierarchy for research planning which would start out identifying policy issues to be supported by research and how research could contribute to support decisions and implementation. After a prioritisation of research contributions which IFReDI could work on in the short term the prioritised research contributions were then developed into draft research projects. Over this sequence a draft medium term research plan was developed as a master table. The steps were as follows:

1. Identifying issues

The first task was to identify the core issues for policies, which were to be supported by the research of IFReDI. A general introduction about issues in the fisheries sector in Cambodia was made. The participants worked in two groups, which discussed issues in the fisheries sector in Cambodia and produced lists of issues. These were then consolidated into an overall list of issues in the medium term plan table, which was refined and finalised in plenary. This resulted in a list of issues within the following main groups:

a. Resource Issues

- Exploitation Rate (Increase fishing effort and overfishing)
- Aquatic Environment issues (Pollution, ecological change)
- Destruction of aquatic habitats/ migration patterns
- Loss of aquatic diversity

b. *Management Issues*

- Illegal fishing (New fishing technology)
- Monitoring, Surveillance and Control (MSC)
- Fishery Policy and Reform

c. Production Issues

- Lack of marketing information
- Inadequate marketing distribution infrastructure and facilities
- Lack of processing facilities
- Aquaculture still less developed

d. External Factors/ Socio Economic Factors

- Increasing demand for fish (Food supply, 2.3% birth rate)
- Conflicts among stakeholders
- Lack of other forms of livelihood
- Lack of credit/financial facilities

2. Identifying research contributions/questions

Based on the consolidated issues list research questions or contributions for the issues were generated. Two groups discussed each their subset of issues and provided lists of research contributions for each issue. These were consolidated into the medium term research table in plenary.

3. Prioritisation of research contributions

Before proceeding to actual research project proposals, the potential contributions from research were prioritised. The research questions were scored and ranked on basis of three criteria: relevance to the IFReDI mandate, contribution to Cambodian development (and whether the question could realistically be addressed by

research within the capacities available to IFReDI on the medium term. This resulted in a list of research questions selected for development of actual research project proposals.

B. Co-management research workshop (Kampot, Cambodia 15-19 March 2004) 24 participants

The objectives of the training course were:

1. IFReDI researchers familiarized with basic principles and concepts of fisheries co-management

2. IFReDI researchers informed of findings from recent fisheries co-management research projects in developed and developing countries and of the major fisheries co-management issues debated among researchers

3. IFReDI researchers understand the role of research vis-à-vis development and implementation of co-management arrangement in the field (augmenting of the information base for co-management in response to stakeholders' needs)

4. IFReDI staff can formulate proposals on co-management research in consultation/collaboration with stakeholders

The target group for the training course was mainly IFReDI researchers but in order to enable interaction between research, development and implementation participants also included staff from the Community Development Office of the Department of Fisheries and provincial fisheries officers.

The course was implemented in four stages:

Introduction to co-management concepts and issues.

Stage 1 was an introduction to co-management concepts and issues with an emphasis on research aspects. (Day 1 and morning of day 2).

Introduction to research methodology for co-management research

Stage 2 was an introduction to research methodology (.Day 2 afternoon).

Field studies

Stage 3, which was the core of the course, was a field study during which the participants should plan, implement and report on field studies on four selected cases (last part of day 2, day 3, 4 and early part of day 5).

The field studies were introduced by an account of the coastal context.

The four case studies were introduced and an indicatory table of contents for reports from the case studies was presented. The purpose of the case studies were to examine the issues at stake in the cases which might call for co-management, to investigate existing or potential organisations for co-management and to present the role of research and a research plan for research to support the development of co-management to address the issues. The participants were divided in four groups, which made plans for the field studies on day 2. The case sites were visited by the four groups on day 3 and on day 4 the groups analysed the information collected, prepared presentations. Presentations were made and discussed. Some modifications were made to the research plans presented as a result of the discussions.

Lessons learnt and research plan for IFReDI

The last stage concerned lessons learnt and implications for IFReDIs research agenda (day 5). The case studies were summarised and a summary was made which identified major areas for IFReDI research for fisheries co-management. The research requirements identified in the coastal setting were not found to be different from what would apply in freshwater. (Annex 18).

The overall conclusion was that IFReDI should emphasise the following issues in its research to support fisheries co-management:

- Zonation – the biological basis for fishing zones
- Stakeholder analysis (resource use, gender, economic interests, negotiation strength) - local, provincial, national
- Institutional analysis and proposals (legal basis and organisation) – local, provincial, national
- The interaction between institutional levels
- Institutional resiliency (funding, transaction cost, benefit to participants)

4.2. Networking

277. The component has established good working relations with the Tonle Sap Environmental Management Project, Component 1: Technical Assistance Improving the Regulatory and Management Framework for Inland Fisheries, (ADB/FAO TA No. 3993-CAM) and made extensive use of factual information from working papers and reports produced by that project.

4.3. Deliverable outputs

278. Outputs generated by the component comprise:

1. Report of Priority Setting Workshop, September 2003 (Report)

2. IFReDI Medium Term Research Plan 2003-2006, Draft November 2003

3. Training Seminar on Fisheries Co-management Research, March 2004. (Report and Cd-ROM)

4. Guide to Fisheries Policy Research´(to be completed in May 2004).

4.4. Recommendations and follow-up actions

279. It is strongly recommended that funding is provided for IFReDI to fully implement its Medium Term Research Plan 2003-2006. IFReDI research based inputs to ongoing policy initiatives related to small, medium and industrial scale fisheries might provide valuable contributions to clarification of management needs and means.

4.5. Accomplishments versus Planned Activities

280. Over the period June 2003 to April 2004, the work planned and the achievements made are shown in Table 6.

4.6. Culminating Activities of the Project period (mid-April to May 2004)

281. The "Guide to Fisheries Policy Research" will be completed and presented to DOF during the "Policy Research Seminar" at IFReDI. On-the job training of staff will continue through May, involving, in particular, discussions on the Five Year General Fisheries Plan for Management and Development of Tonle Sap and the implications for fisheries policy research at IFReDI.

III. Overall Conclusions and Recommendations

282. The TA has been very successful in kick-starting IFReDI through capacity building of research and administrative staff in institute management, research and development (biology and socioeconomics), technology transfer, and policy development and dialogue.

283. IFReDI is now a functioning institution capable of managing and administering itself to support research and development the inland fisheries sector. IFReDI staff attained sufficient knowledge and skills to continue with the administrative, financial and human resources management that were developed and implemented under the TA. However, they may need further support to strengthen their capability in technology transfer and information dissemination.

284. A number of research outputs from the TA can be translated into useful policy and recommendation materials that can be targeted to different stakeholders. For instance, research results on the economic valuation of Tonle Sap provide indicative values of the fishery and other aquatic products that can help stakeholders and policy makers in selecting management interventions for sustaining these resources.

285. Although research staff in IFReDI have been trained and exposed to bio-ecology and natural resources research and data collection methods, database development and maintenance, and data analysis, staff will require further follow up training and coaching to sustain these knowledge and skills.

286. IFReDI research staff of both biology and socioeconomics division will require advisory and financial support to conduct studies that were prioritized in the operational plan for the year 2004 – 2005.

287. IFReDI staff will require further training in writing reports, research papers for journals/symposia to translate research results into meaningful policy dialogue.

288. To sustain knowledge and skills that were achieved through the TA effort ADB and WorldFish should consider further support to IFReDI staff especially in the areas of technology transfer, research and policy analysis.

Table 1. Accomplishments of the Institute Management Component (based on Technical Assistance Framework)

Output/Activities	Performance Indicators/Targets	Achievements	Remarks and Constraints
1. Conduct planning exercises	1. Participatory consultation on the strengths, weaknesses, opportunities and threats of IFReDI.	1. Prepared a SWOT analysis of IFReDI as a whole and the individual outlook of the present staff regarding their future with IFReDI. (See Appendix A-1)	1. Low morale due to low wages, lack of incentives and reward system and shaky job tenure
2. Conduct training in organizational development and team work	2.1. Trained 25 IFReDI and Provincial Fishery Officers 2.2. Prepared and distributed training proceedings and lecture notes (Appendix A-2)	2. All 25 participants made written commitment to help and cooperate in building IFReDI into a reputable research institute.	2. Low understanding of the English language required Khmer translation that prolonged the course.
3. Training on Concepts and principles of management	3.1. Trained 15 IFReDI management and administrative staff 3.2. Produced and distributed lecture notes on management	3.1. Revised and submitted to DoF/IFReDI officials the IFReDI Management Plan (Appendix A-5) 3.2 Prepared the draft of the first Operational Plan for 2004 (Appendix A-13) as part of the Medium-term R&D Plan.	3. Most of the supervisors and managers have no knowledge and/or actual experience in management prior to their designation to the positions.
4. Training on Accounting and asset management	4. 1. Trained IFReDI and Project staff accountants on how to prepare	4.1. Produced the drafts of the manual on Financial Management	4. IFReDI staff doing accounting work have nor formal training course in

	accounting reporting systems. 4.2. Trained the accountants on the application of the accounting computer program to enhance the financial reporting systems. 4.3. Prepared and distributed training materials in the use of the accounting computer program.	Systems (Appendix A-9) and Asset Management (Appendix A-11) 4.2. Produced drafts of Purchasing Manual (Appendix A-10) and Travel Procedures (Appendix A-12)	accounting. Their experiences are confined to simple cash handling, transaction, and reporting. This made it difficult for them to learn and adopt to internationally-accepted accounting practices.
5. Training on Budgeting	5. Trained 16 management and administrative staff in the budget process in Cambodia, basic concepts in budgeting, budget preparation, monitoring and control.	5. Prepared the draft of the Budgeting Manual (Appendix A-10) and the first IFReDI annual budget for 2004 (Appendix A-13)	5. The training in budgeting became more hypothetical since IFReDI as an office does not have any budget of their even from the government. DoF still manages budget and finances.
6. Training on Human resource development, career planning, and performance evaluation methods	6.1. Trained 29 IFReDI management and administrative staff and provincial fishery officers. 6.2. Prepared job analysis of the staff from research (biology and socio-economics) and administration divisions. 6.3. Prepared and distributed lecture notes for future reference. (Appendix A-8)	6.1 Produced the first Human Resources Development Plan (Appendix A-12) which includes career planning and career paths for all IFReDI staff. 6.2. The HRD Plan also provides for the methods of evaluating the performances of all IFReDI. 6.3. The HRD Plan also provides bases for giving	6. To make the HRD plan more meaningful, IFReDI will have to generate external funds for additional incentives and rewards to the staff especially to the researchers.

		incentives and rewards from research projects with external funding	
7. Arranged for the English language courses in three levels depending on the proficiency and aptitude of the IFReDI staff.	7.1 A total of 40 IFReDI and DoF personnel are attending the different levels in English courses.	7.1 From initial observation, most of the trainees have started to gain some confidence in speaking, reading and writing in English.	7. IFReDI staff should on their initiative continue to learn English either through formal courses or through self-study.
8. Co-facilitated the Priority Setting workshop-training course	8. Trained 10 senior staff of IFReDI in priority setting methodology, agreed on priorities on inland fisheries, and developed a medium-term plan.	8. Prepared the first Medium-term Research Plan	8. Donor is very critical in pursuing the research and development plan of IFReDI if it aspires to be a reliable provider of scientific information in inland fisheries of Cambodia.

Table 2. Accomplishments of the Bio-ecology and Modeling Component (based on Technical Assistance Framework)

Activities	Performance Indicators	Achievements	Remarks and Constraints
2.1 Expand knowledge of the bioecology of key fish species			
2.1.1 Key fish species identified, and information about their bioecology gathered and synthesized	Ten key fish species identified from literature review and from existing DoF datasets	Activity completed; report produced; results presented to the MRC annual Fisheries meeting; publication scheduled	
2.1.2 Bioecological monitoring program of key species initiated	2.1.2.1 Two exploratory surveys to identify 3 sampling sites in dry and wet season	Activity completed; 3 surveys actually done	
	2.1.2.2 Experimental fishing operations conducted 2 times in each of the 3 sites.	Activity completed; equipment designed and built; database built	
	2.1.2.3 Gathering of biological information (size, weight, reproduction, diet) on at least 10 species	Activity completed; database filled and data analysed by counterparts	
	2.1.2.4 Gathering of physico-chemical data on the sites of fishing	Activity completed	
	2.1.2.5 Sampling of 2 to 3 types of fishing gears operated by fishermen	Activity completed; database filled and data analysed by counterparts	
	2.1.2.6 Production of brochures in English and Khmer synthesizing known biological information on at least 10 selected species	Activity completed; brochures produced and translated	
	2.1.2.7 A report defining a realistic procedure aimed at monitoring the biology of 10 selected species to be implemented by IFReDI on a regular basis in the coming years	Activity completed; report produced	

2.1.3 A reference fish collection set up at IFREDI	Fish species are collected, referenced and stored according to international standards in taxonomic museography	Activity not done	The taxonomist who accepted the consultation in August 2003 ultimately declined coming in March 2004; alternative specialists not available

2.2 Model flood-fish relationships in the Tonle Sap			
2.2.1 Knowledge of fishers and field officers gathered	Knowledge of fishers and fisheries specialists gathered during interviews	Activity completed	
2.2.2 A consensus conceptual framework built through meetings and critical parameters identified	2.2.2.1 Two meetings convened with stakeholders to define the content and the parametrization of the model	Activity completed. Three meetings actually convened	
	2.2.2.2 Computer model presented to stakeholders	Activity completed	
2.2.3 Ecological traits of 10 key species incorporated	The specific traits of dominant species will be identified and taken into account in the model	Activity not done	Activity incompatible with the indications given by stakeholders for model development. Integration instead of several databases to the model
2.2.4 Computer model developed and counterpart staff trained		Activity completed; model produced and available on CD; two IFReDI staff trained to Bayesian modeling	Compilation of all hydrological, land use and water quality data for the Tonle Sap area handed over to IFReDI

2.3 Training in biology			
2.3.1 Research methods in fish biology	Contents: I Bases in research methods, II Bases in fish biology, III Data manipulation with MS Excel, IV Exploratory analysis of data	Activity completed; lectu re notes published	
2.3.2 Research methods in fisheries economics and biology	Contribution to arguments and fact sheets about the importance and role of Mekong fish and fisheries.	Activity completed; lecture notes published	
2.3.3 Statistical methods, database management and data analysis	Contribution to the training in multivariate methods	Activity completed; lecture notes published	

Table 3. Accomplishments of the Socioeconomics Component (based on Technical Assistance Framework)

Planned Activities	Performance Indicators/Targets	Achievements	Constraints
1. Investigate for improvement marketing, distribution, and utilization of key fish products	• Participatory rural appraisal in 8 sites and 2 seasons	• Focus group discussions with traders, exporters and observation and monitoring of landing sites, retail markets; and survey of exporters and fish retailers in three provinces have been completed.	
	• Distribution and pricing of key fish products in the Tonle Sap basin understood, and options for improvement recommended	• Market infrastructure and supply chain and distribution channels of Tonle Sap fisheries have been understood and specific recommendations are made for improvement.	
	• Key stakeholders, exporters, importers, and traders are identified and consulted on issues affecting marketing	• Stakeholders of fish marketing have been identified and consulted. Key constraints of fish trade and exports are identified and important fish species for domestic and external consumption are quantified. Best-value fish for both domestic and export markets are also identified.	
2. Circumscribe better the value of fisheries to elucidate policy directions	• Survey of selected households in 8 sites	• Survey of 410 households has been completed that were randomly selected in 9 villages of three purposively selected provinces – Kandal, Kampong Chnang and Siem Reap.	
	• Economic values determined and reported, using market-	• Based on the survey data key	

Planned Activities	Performance Indicators/Targets	Achievements	Constraints
	based methods, methods based on surrogate market values, and methods based on potential expenditure or willingness-to-pay	resources including aquatic products of the Tonle Sap have been identified and valued using market and non-market methods such as willingness to pay and contingent valuation techniques.	
3. Study cost and benefits, markets, and livelihood opportunities in fish processing	• Key stakeholders in fish processing are identified and economic benefits are estimated		
4. Training and capacity building	• Resource specialists conduct on-the-job and specialized training in marketing, natural resource and agricultural economics and data analysis	• Continuous on-the-job training on data collection, sampling methods, questionnaire preparation, and logical and theoretical aspects of socioeconomic research. • A 3-day training course was organized on theories of economic valuation and on the contents of the questionnaire, and how it is related to the theories and objectives. • A weeklong training on program evaluation methods and statistical analysis was organized. A total of 35 participants from IFReDI, DOF and CFDO attended the training. • A comprehensive training on “Natural Resources Economics and Statistical Analytical Methods” was organized in Penang during Last week of February and first week of March 2004. Sixteen participants attended the training. A training manual has been developed as part of the training.	

Table 4. Accomplishments of the Technology Transfer Component (based on Technical Assistance Framework)

Activities	Performance Indicators	Achievements	Remarks and constraints
Technology Transfer and capacity building			
• Develop a strategy for technology transfer and dissemination of information	A strategy developed	Technology dissemination strategy developed in consultation with stakeholders	Human and financial resources would be needed to implement the strategy
• Identification of pathways for technology transfer for each expected output	Pathways for technology transfer identified	Pathways identified for each category of research output and for each category of beneficiaries	Funding would be needed
• Cost-recovery for technology transfer activities identified	Cost recovery strategies in place	Cost recovery strategy has been developed for implementation by IFReDI management	In the short term till IFReDI credibility established it would be necessary for government/project to finance activities
• Train staff in proposal writing	Increased capacity of IFReDI staff for proposal writing	Training workshop on proposal writing organized for IFReDI staff	
• Formulation of project proposals	Project proposals ready for submission to donors	4 research proposals developed	The staff need continued technical assistance in identification and preparation of project proposals for more time. IFReDI need to continue preparing proposals.

• Training staff in library and information management	Training programs organized	Trained 3 IFReDI library staff in Penang and Phnom Penh	Inadequate English language skills and basic knowledge of library management has been a constraint. The staff need to improve English language skills and need further training in library management
• Operational documentation and information exchange mechanism established	Documentation and Information exchange mechanisms in place	Needed software has been installed and library staff trained and information exchange mechanism in place	The staff need further training

Table 5. Accomplishments of the Policy Development and Dialogue Component (based on Technical Assistance Framework)

Activities	Performance indicators	Achievements	Remarks and Constraints
Review relevant institutions at the central, provincial and local levels.	Review documented	A review was undertaken on the basis of the document "Review of Fisheries Management System for Inland Fisheries" drafted by the ADB/FAO TA No 3993-project and other material. Relevant findings are included in the "Guide to Fisheries Policy Research".	
Review existing policies, laws, decrees, regulations and circulars for their efficiency, effectiveness and relevance for inland fisheries	Review documented	. A review was undertaken on the basis of the document "Review of Regulatory Framework for Inland Fisheries" drafted by the ADB/FAO TA No 3993-project and other material. Relevant findings are included in the "Guide to Fisheries Policy Research".	Other material includes international Agreements and Conventions relevant to fisheries policy and management in Cambodia.
Conduct discussions with key fishery stakeholders and assess their roles and interests in relation to inland fisheries resources	Minutes of meetings and workshops.	The five Provincial and one National Workshop organized by ADB/FAO TA No 3993-project has provided substantial information on stakeholder roles and interest..	IFReDI Medium Term Research Plan 2003-2006 reflects topics and issues raised by the stakeholders
Conduct training on stakeholder participation and co-management for IFReDI staff to	Training programme and report	A co-management research training seminar attended by IFReDI, CFDO	The report on the workshop is attached as Annex

enhance their capacity for undertaking co-management research in fisheries		and PFO Staff was organized 15-19 March 2004.	Training activity included interaction with stakeholders on identification of critical issues and related research needs.
Conduct on-the-job training to counterpart staff in the field of policy development and transmit policy development skills to ensure relevant capacity and IFReDI acquires skills in policy analysis and assessments upon the completion of the TA project.	Monthly reports on project activities.	IFReDI staff has been provided training in policy development through dialogue with the consultants and reading of "Guide to Fisheries Policy Research" and other materials.	Skills to be further developed through participation in policy research teams.
Contribute to the development of IFReDI as a vehicle that facilitates communication and information dissemination and establish IFReDI's authority as a center of knowledge and provider of policy inputs	IFReDI communication strategy document	Communication with stakeholders and information dissemination are invariably included and budgeted in all projects in the IFReDI Medium Term Research Plan 2003-2006.	A comprehensive IFReDI communication strategy needs to be developed.
Develop a set of strategic policy options addressing priority issues in inland fisheries based on assessment of present policies.	IFReDI multi-annual research plan.	A workshop to develop the IFReDI Medium-term Research Plan 2003-2006 was organized 4-9 August 2003. The priority research topics in inland fisheries related to the present policies were identified. And research projects	The report on the workshop is attached as Annex The priority research issues will be discussed at a seminar with policy stake-holders to obtain wider endorsement

		conceptualized..	of the research priorities.
Initiate mechanisms for policy dialogue that will place IFReDI in a recognized and accepted position by different stakeholders for the development of policy for inland water fisheries	Minutes of meetings and workshops. Use of other mechanisms are documented.	Discussions with institutions and agencies relevant to IFReDI as research partners and informants such as e.g. the Royal University of Phnom Penh , the Agricultural University and others have been initiated. The group also includes NGOs with an inland fisheries agenda and important development projects such as the ADB/FAO TA No 3993-project. IFReDI stakeholders' consultation was held on May 27 which served as forum to discuss the Medium Term Research Plan of IFReDI.	The professional "standing" of IFReDI will first and foremost be determined by IFReDI research conduct and performance.

Annex 1: Expected medium and long term (5-10 years) research results from IFReDI and beneficiaries of the outputs.

Research Outputs	Beneficiaries/stakeholders
Biological:	
Tools for fisheries management (assessment of stocks; migration; species composition; spawning and feeding grounds; etc.)	Policy makers; R&D agencies; fishing communities; provincial authorities
Strategies for conservation of endangered species and important habitats	Policy makers; R&D agencies; provincial authorities
Development of efficient fishing gear	Fishing communities; fisheries authorities
Taxonomic catalogue for the identification of fish species	R&D agencies; NGOs; policy makers, academe
Improved management of reservoir fisheries	Policy makers, R&D agencies; fishing communities
Guidelines for management of fish sanctuaries	Fisheries authorities; fishing communities
Techniques for fish health management	Fish farmers, extension workers, NGOs
Aquaculture technologies	Fish farmers, extension workers, NGOs
Management of impacts of alien species	Policy makers, fisheries authorities, aquaculture industry
Fish processing technologies Post-harvest technologies	Fishing communities, fish processors, fish traders Fishing communities; fish processors; traders
Genetically improved aquaculture species	Aquaculture industry; extension workers; NGOs
Socioeconomic:	
Market information and supply chain management	Policy makers; traders; fishers; consumers
Health and safety requirements for fish processing	Fish processing industry; policy makers
Institutional arrangements fro co-management	Policy makers; fisheries authorities; fishing communities
Valuation of aquatic resources Trends in fish consumption	Policy makers; fisheries authorities; fishing communities Policy makers
Guidelines for mitigating environmental impacts from human interventions	Policy makers; local authorities; NGOs; R&D institutions; fishing communities;
Strategies for improvement of livelihoods	Policy makers; NGOs, fisheries authorities
Strategies for financial support to fishing communities	Policy makers, financial institutions; NGOs
Guidelines for controlling illegal fishing; deforestation and land encroachment	Fisheries authorities; fishing communities
Issues related to gender in fisheries	Policy makers; NGOs; fishing communities
Policy	
Fishing rights	Policy makers; fisheries authorities; NGOs

Efficient fisheries laws and sub-decrees for fishing communities	Policy makers; fisheries authorities
Policies for effective law enforcement	Policy makers and fisheries authorities
Strategies for mitigating fishery conflicts	Policy makers; fisheries authorities; NGOs; R&D agencies
Recommendations for decentralized fisheries management	Policy makers; fisheries authorities; NGOs and R&D agencies
Strategic plans for fisheries development (medium and long-term)	Policy makers; fisheries authorities; NGOs; R&D agencies

ANNEX 2: TECHNICAL ASSISTANCE FRAMEWORK

(Updated During the Post-Inception Workshop on June 12, 2003)

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
Goal			
Sustainable management and conservation of natural resources and biodiversity in the Tonle Sap basin	• Fisheries research is catalyzed • Systems and the capacity for natural resource management are enhanced • Planning and management follow integrated, cross-sectoral approaches to the Tonle Sap basin • Stakeholders participate in decision-making • Rural livelihoods are sustained and improved • Policies and institutions are pro-poor	• Government statistics • Research program publications • Policy statements • Funding for research	
Purpose			
To kick-start the Inland Fisheries Research and Development Institute (IFREDI) as an efficient, effective, and relevant research and development institute.	• IFREDI plans and undertakes research, and extends and disseminates findings, for sustainable management and conservation of inland fisheries	• Technical assistance (TA) framework • Final report by the WorldFish Center • TA completion questionnaire filled out by the Department of Fisheries (DOF) • TA completion report prepared by IFREDI • TA completion report prepared by the Asian Development Bank (ADB)	• DOF, IFREDI, and other relevant institutions have a clear vision about the sector goal to which the TA will contribute. • Trained counterpart staff remain at IFREDI.
Outputs			
1. The management framework is defined. 2. Research and development are strengthened. 3. Technology transfer capabilities are built. 4. Policy development and dialogue capabilities are established.	• Manuals, plans, and budgets drafted • Research findings publicized • IFREDI staff trained on-the-job • Databases established • Communications and information exchange network established • Management options identified	• TA framework • TA reports and review missions • Tripartite meetings	• DOF and IFREDI understand clearly the purpose of the TA and how it is to be achieved. • TA outputs are publicized and disseminated, and lend themselves to follow-up analysis and action, including status reports and recommendations to DOF for management purposes.
Activities			
1. Define the management framework ▸ Conduct planning	• Accounts and	• TA framework • TA reports and review missions • Tripartite meetings • Research program	• Linked activities are scheduled appropriately. • All logistical and administrative arrangements are

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
exercises • Organization development & team building • Concepts & principles of • management • Accounting and asset management • Human resource development • Budget planning • English language proficiency ▸ Conduct performance monitoring and career planning	administrative manual drafted • First medium-term research plan drafted • First annual operational plan drafted • First human resource development plan drafted • First annual budget drafted • Technical reports and scientific manuscripts • Performance monitoring reports prepared	publications • Workshop findings and recommendations • Brief monthly progress notes • Performance evaluation schemes installed • Rewards systems installed	understood and in place. • The team leader of the resource specialists manages team members effectively. • The team leader of the resource specialists has client management skills • The resource specialists establish an integrated management system comprising management tools such as: hierarchy of objectives; tree analysis; work breakdown structure; bar chart; Gantt chart; organization responsibility chart; and individual task chart. • Stakeholders attend workshops and participate actively. • Appropriate counterpart staff was selected. • Monthly progress notes and TA reports are written clearly and simply.
2. Strengthen research and development ▸ Expand knowledge of the bioecology of key fish species ▸ Model flood-fish relationships in the Tonle Sap	• Key fish species identified, and information about their bioecology gathered and synthesized • Bioecological monitoring program of key species initiated • A reference fish collection set up at IFREDI • Knowledge of fishers and field officers gathered • A consensus conceptual framework built through meetings and critical parameters identified • Ecological traits of 10 key species incorporated	• Species identified in a report before the end of August. • Exploratory surveys done in June and August. • Two field trips of about 13 days each done in September and February Corresponding reports produced the same month or the following month • At least 10 brochures summarizing all known information about 10 key species are produced by the end of the project • At least 30 species are collected and referenced by the end of the project. • At least 30 interviews conducted during a field trip in November. • Meetings convened in August 03, October 03 and April 04.	• At least four IFReDI staff will work full time on the implementation of this biology program. • Counterparts will assist in the making of a standardized gillnet sampling, in the provision of equipment and of logistics. Multi-parameters probe, current meters and depth meters will be available on time • IFReDI staff will produce these brochures under the supervision of the Resource Specialist, and will translate the English version into Khmer • At least one IFReDI staff is identified for the set up and maintenance of the collection • At least 2 IFReDI staff are available to conduct interviews and synthesize gathered information • IFReDI staff will assist in identifying and contacting the stakeholders and

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
	• Computer model developed and counterpart staff trained	• Activity completed by March 04	convening meetings • IFReDI will identify a computer specialist counterpart to develop this section in collaboration with the Resource specialist
▸ Investigate for improvement marketing, distribution, and utilization of key fish products	• Participatory rural appraisal in 8 sites and 2 seasons • Distribution and pricing of key fish products in the Tonle Sap basin understood, and options for improvement recommended • Key stakeholders, exporters, importers, and traders are identified and consulted on issues affecting marketing	• Model produced and counterpart trained by the end of the project	• Logistics and human resources are available • Logistics and human resources are available in doing the research
▸ Circumscribe better the value of fisheries to elucidate policy directions ▸ Study cost and benefits, markets, and livelihood opportunities in fish processing	• Economic values determined and reported, using market-based methods, methods based on surrogate market values, and methods based on potential expenditure or willingness-to-pay • Survey of selected households in 8 sites • Key stakeholders in fish processing are identified and economic benefits are estimated • Resource specialists conduct on-the-job and specialized training in marketing, natural resource and agricultural economics, bioecology, fish taxonomy, modeling, and data analysis		
3. Build technology transfer capabilities ▸ Conduct specialized	• Identify pathways for transfer for each expected research output • Capacities in English		

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
training	and computer science improved by training. • Development of cost effective plans for transfer of research outputs. • Capacity building of IFREDI staff in technology transfer • Training at the WorldFish Center is provided to IFREDI's librarian, fish biologists (taxonomic database) and socioeconomics		
▸ Facilitate communication and disseminate information	• An operational documentation center and information exchange mechanisms is established. • Information resources and services are provided by the WorldFish Center. • Databases are expanded and maintained • Workshops are organized to communicate research breakthroughs. • Information products in the English and Khmer languages are packaged for distribution		
▸ Develop skills in planning research projects and preparing funding proposals	• Resource specialists lead counterpart staff in the planning and formulation of research projects and funding proposals • Develop strategies for cost recovery • Team leader conducts on-the-job training in planning projects and formulating funding proposals		
4. Establish policy development and dialogue capabilities	• Key fishery identify and canvasses stakeholders • Stakeholders consultation carried		
▸ Establish			

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
linkages between IFREDI and key fishery stakeholders ▸ Build consensus for community-based management of aquatic resources	out • Concept of community-based management is promoted • Training on co-management provided • Meetings are organized with stakeholders for opinion gathering and information sharing		
▸ Identify and prepare pro-poor policy options in fisheries	• Pro-poor fisheries management options are identified • Focus group discussions with local communities to understand the acceptance of policies on management. • Inputs for improvement of policies on community-based management of aquatic resources are disseminated • Inputs into inter-sectoral policy development • Seminars for policy-makers are conducted		
▸ Establish IFREDI's authority as a center of knowledge and provider of policy inputs	• Policy inputs are provided to the Tonle Sap Biosphere Reserve Secretariat, the Cambodia Development Council, the National Institute of Statistics, the Ministry of Planning, and the Council on Agriculture and Rural Development • Networking with Tonle Sap Bioshpere Reserve Secretariat • Coordinated with FAO Tonle Sap projects • Networking with		

Design Summary	Performance Indicators/Targ	Monitoring Mechanisms	Assumptions and Risks
	UNESCO environmental education campaign • On-the-job- training on policy		

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Annex 3: T4025–CAM: CAPACITY BUILDING OF THE INLAND FISHERIES RESEARCH AND DEVELOPMENT INSTITUTE

Minutes of the Final Tripartite Meeting

Date:	5 May 2004
Venue:	IFReDI Conference Room
Time:	8:30 – 10:00 AM
Present:	***For the Inland Fisheries Research and Development Institute/Department of Fisheries:*** Mr. Nao Thuok – Director, DOF Mr. Sam Nuov - Deputy Director, DOF Mr. Srun Lim Song - Director/National Project Director, IFReDI-DOF Mr. Lieng Sopha - Deputy Director, IFReDI-DOF ***For the Asian Development Bank:*** Mr. Olivier Serrat - Senior Project Economist For the WorldFish Center: Dr. Modadugu Gupta - Technology Transfer Resource Specialist Mr. Renato Agbayani - Team Leader

Meeting Agenda

To discuss accomplishments under the TA and what remains to be done for capacity building of IFReDI.

General Comments	
Mr. Nao Thuok	• Opened the meeting and noted that he was happy with the joint presentation on accomplishments delivered on 4 May 2004 by the by the WorldFish-IFReDI and FAO-DOF teams. • Observed improved management of IFReDI but identified needs for more assistance in areas such as proposal writing, reporting, and writing scientific publications. • Expected concrete recommendations for plans for IFReDI during the meeting.
Mr. Olivier Serrat	• Quite happy with the presentation of accomplishments and overall TA implementation. • Noted that lessons had been learnt on all sides, including ADB's. • Remarked that the TA had demonstrated the efficiency, effectiveness, and relevance of harnessing CGIAR Centers such as WorldFish to build the capacity of institutions such as IFReDI.
Specific Comments on TA Outputs	
Mr. Olivier Serrat	**Socioeconomics** • ***Economic valuation:*** The socioeconomic output should have circumscribed the value of aquatic resources to elucidate policy directions. It ought to have contributed reliable figures for better valuation of the contribution of fisheries to GDP (as commented by Mr. Sam Nuov during the joint presentation). • **Technology Transfer** • Poor technology transfer is one of the more obvious weaknesses of

	research institutions. • Customarily, intellectual outputs are not transferred effectively to information users. But, the web site is an extremely powerful tool and can be used to disseminate information. • The IFReDI web site at http://www.ifredi.org should be developed further under the TA. It could, for instance, incorporate a "search" function that simultaneously examines other web sites, such as the WorldFish Center's. • IFReDI should spread the word that it has a web site. • All TA reports and research publications should be loaded on the web site. • Reports from T3993–CAM: Improving the Regulatory and Management Framework for Inland Fisheries should also, ultimately, be loaded on the web site.
What Remains to be Done	
Mr. Olivier Serrat	**Within the TA** • All unused funds can be disbursed up to October 2004. Most should be applied to finalization of TA reports and research publications and other technology transfer activities, i.e., further web site development.
Dr. Modadugu Gupta	• Proposed that 2–3 IFReDI researchers attend the Asian Fisheries Forum in Penang in December 2004 to present their research results, charged to the TA, for an estimated cost of about $1,000 per participant. • Mr. Serrat approved the request.
Mr. Renato Agbayani	• Recommended the extension of the services of Mr. Ou Sary (Accountant) and Mr. Chuop Sokhan (Computer Administrator) up to 19 June 2004. Their contracts will expire on 31 May 2004. • Mr. Serrat approved the request provided expenses are within the budget. • Informed Mr. Serrat about the holding of a research output presentation-cum-consultation with stakeholders on IFReDI's medium-term plans. • Endorsed the recommendation of Dr. Eric Baran to purchase a water quality probe for IFReDI. • Mr. Serrat approved the request but specified that the probe should be reasonably priced.
Mr. Sam Nuov	• Requested financial support from the TA for travel to the Lao Peoples' Democratic Republic for a meeting with Larrec regarding the recently signed Memorandum of Understanding with DOF/IFReDI. Mr. Serrat approved the request.
Mr. Olivier Serrat	**"IFReDI II"** • ADB has earmarked $300,000 for a follow-up TA (IFReDI II) to be implemented from January 2005. • An ADB fact-finding mission is likely to visit Cambodia in August-September 2004. • The focus of IFReDI II would in all likelihood be on technology transfer and policy dialogue. • WorldFish may still be tapped to implement IFReDI II.

Other Matters	
Mr. Sam Nuov	**Database Management** • Stressed the need for consolidating databases in such fields as socioeconomics, biology, aquaculture, etc.
Mr. Olivier Serrat	• Stated there is no integrating mechanism at the moment. Encouraged IFReDI to seek donor support to put all the databases into one integrated system.
Dr. Modadugu Gupta	• Emphasized the need for archiving of databases and for prioritizing the updating of the database management needs.
Dr. Modadugu Gupta	**IFReDI Reorganization** • Recommended that DOF approve the creation of a Technology Transfer Division in order to be organizationally responsive to the thrust of effectively providing scientific information to policy makers and other stakeholders.
Mr. Nao Thuok	• Agreed in priori. Would like to receive a proposal from IFReDI.
Mr. Oliver Serrat	• Informed the body that an ADB TA may be financed by Finland to support a study on the influence of built structures on the fisheries of the Tonle Sap. IFReDI might be needed to act as service provider. • Requested WorldFish to formalize all requests to ADB made during this meeting. • Requested Mr. R. Agbayani to submit the draft of the final report to ADB by 19 May 2004.
Mr. Nao Thuok	• Closed the meeting by stating that it was a fruitful tripartite meeting. • Thanked WorldFish for their support and good implementation of the TA, and IFReDI staff for their cooperation.