

Report of the First ASEAN-SEAFDEC Regional Technical Consultation on Information Gathering for Inland Capture Fisheries in ASEAN Countries



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Marine Fishery Resources Development and Management
Department Southeast Asian Fisheries Development Center
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edited by
Mahyam Mohamad Isa



**Marine Fishery Resources Development and Management
Department Southeast Asian Fisheries Development Center
(SEAFDEC) 2004**



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Regional Technical Consultation on Information Gathering for Inland Capture Fisheries in
ASEAN Countries
Kuala Lumpur, Malaysia
4-6 August 2003

REPORT OF THE FIRST ASEAN-SEAFDEC REGIONAL TECHNICAL CONSULTATION ON INFORMATION GATHERING FOR INLAND CAPTURE FISHERIES IN ASEAN COUNTRIES

I. INTRODUCTION

The ASEAN-SEAFDEC Regional Technical Consultation (RTC) on Information Gathering for Inland Capture Fisheries in ASEAN Countries was organized by the SEAFDEC Marine Fishery Resources Development and Management Department (MFRDMD) in Kuala Lumpur, Malaysia from 4 to 6 August 2003. The Consultation was organized as part of the project on “Information Gathering for Inland Capture Fisheries in ASEAN Countries” under the Special 5-year Program. The Project aims to assist the Member Countries in the implementation of the Resolution and Plan of action on Sustainable Fisheries for Food Security for the ASEAN region adopted at the 2001 Millennium Conference on “Fish for the People”.

The Consultation was attended by delegates from the ASEAN and SEAFDEC Member Countries namely Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam. The Consultation was also attended by resource persons and observers from Cambodia, Malaysia and Thailand as well as representatives from the Food and Agriculture Organization of the United Nations (FAO), the Mekong River Commission (MRC) and SEAFDEC. The list of participants appears as **Annex 1**.

The objectives of the Consultation were to review current status of information on inland capture fisheries in the ASEAN Member Countries, identify strategies to strengthen future collection and compilation of information to support planning and management of inland fisheries resources, and finalize plan and arrangement for the project at both regional and national levels.

II. OPENING CEREMONY

The meeting was welcomed and officially opened by Chief of MFRDMD, Mr. Ibrahim Saleh. The full text of opening remark is outlined in **Annex 2**.

III. ADOPTION OF THE AGENDA

The meeting adopted the Provisional Agenda and Time Table that appear in **Annex 3**.

IV. CONCLUSION AND RECOMMENDATIONS

1.0 REVIEW OF CURRENT INFORMATION ON INLAND CAPTURE FISHERIES IN THE ASEAN MEMBER COUNTRIES

While noting the review of information on inland capture fisheries in the ASEAN Member Countries as presented by MFRDMD (**Annex 4**), the RTC made the following recommendations:

- There is existing available information related to inland capture fisheries such as fish taxonomy, ecology, and fishery management. However, much of the information is only available as grey literature either in English or in riparian languages of the Lower Mekong Basin (LMB) countries. MFRDMD is requested to compile and make available the information for regional reference;
- With regard to information on fishery resources, focus should not only be given to fish species but other aquatic organisms such as shrimps, mollusks, frogs, and insects, which are generally used for consumption and may seasonally be more important than fish for protein supply; and
- With respect to species coverage for information gathering, all aquatic species either freshwater, brackish water and marine that are harvested in inland water bodies should be covered including catadromous and anadromous species.

2.0 EXPERIENCE PAPERS ON INFORMATION REQUIREMENT AND ITS GATHERING TO SUPPORT MANAGEMENT OF INLAND FISHERIES RESOURCES

The RTC took note of the presented experiences on the topic from Cambodia (**Annex 5**), Thailand (**Annex 6**), Malaysia (**Annex 7**), and RAP/FAO (**Annex 8**) and made the following conclusion and recommendations reflecting the lessons learned from the experiences:

- Considering the dynamic and often small-scale nature of inland fisheries in various habitats, involvement of fishers and their communities under co-management approach is found essential for effective management of small-scale inland fisheries;
- Under the adaptive co-management approach, government intervention should focus on protection of major habitats and spawning areas and dialogue between the government and community should be promoted; and
- Purpose of information gathering should be clearly defined whether for management of fisheries, habitat protection or integrated water resources use.

2.1 Stock Enhancement for Reservoir Fisheries (Annex 5)

- In response to the increasing impacts of over-fishing, stock enhancement for reservoir fisheries was identified as a viable strategy to tackle the problem;

- To ensure successful implementation of stock enhancement exercises, the following consideration should be taken into account:
 - Effective monitoring and evaluation mechanism are essential to assess their impacts to the resources, environment and livelihoods of fishers;
 - Target only on indigenous species to avoid biodiversity impact and ecosystem changes in the water bodies; and
 - Carrying capacity should be studied in future research undertaking for stocking purposes.
- Awareness building for concerned communities should be promoted to ensure their cooperation for sustainable use of the resources.

2.2 Flood Plains and Riverine Systems (Annex 6)

- Since productivity and fishing practices of flood plains and riverine systems are very much affected by flood regime, efforts should be exerted to acquire understanding on the dynamics between flood, flood timing, duration and area of inundation in relation to fish production;
- Considering the relation between fisheries production and non-fisheries factors, an integrated management approach should be adopted that focuses on management of aquatic habitats in preference to management of fishery resources themselves i.e. environmental management rather than focusing only on fisheries management with catch and effort restriction;
- For cost-effectiveness, timing and location of data gathering should be considered in data collection in large areas. This can be achieved by various methodologies e.g. frame survey, consumption survey, and other standardized methods; and
- The concept of integrated catchment approach was suggested for riverine fisheries management.

2.3 Fisheries in Reservoirs and Lakes (Annex 7)

- In response to the need for timely information for management of fisheries for reservoirs and lakes, the Morphoedaphic Index (MEI) was presented as a quick and easy method to generate first estimates for potential fish yield while more detailed or precise information could be obtained through catch statistics and local information. However, interpretation of the result should reflect local situation;
- Considering that prime objective for dam construction is never for fisheries purposes, fisheries concerns and requirements including construction of fishways and other mitigation measures should be properly addressed in the design stage; and

- Management approaches for each water body should be tailored in response to characteristics of its eco-system and usage.

2.4 Alternative Information for Supporting Fisheries Management and Decision (Annex 8)

- Recent initiatives conducted with the view to improve quality of data and information supporting development and management of inland fisheries as presented by FAO could be further examined and where appropriate applied to local needs;
- Regional cooperation among SEAFDEC, FAO and MRC on areas of mutual interests should be promoted to mobilize expertise and experience across their Member Countries;
- Coordination and linkages with other relevant SEAFDEC programs such as in the area of fishery statistics should be promoted;
- As far as small-scale inland fisheries are concerned, consumption and household surveys are found relevant for data and information collection. Statistical data collection for catch and efforts for management of small-scale inland fisheries may not be appropriate. However, data requirements should be based on country's priorities and usage; and
- The guidelines on collection of fishery statistics for inland and coastal fisheries currently being prepared by the SEAFDEC Secretariat was suggested as a reference for methods and approaches for data collection.

3.0 REGIONAL DATABASE SYSTEM AND GIS FOR INFORMATION GATHERING ON INLAND CAPTURE FISHERIES

The RTC took note of the development plan for regional database system and use of GIS to facilitate information gathering of inland capture fisheries (**Annex 9**). After deliberation, the RTC made the following suggestions:

- The Member Countries were requested to provide available information to support system design and update of database particularly on aspects of fishing gear and methods, list of species and scientific biological information on commercial species caught in inland waters, environmental conditions and socio-economic information;
- Considering that production from inland fisheries are locally consumed with no specific landing sites, landing data may not reflect the actual production, data from other sources should also be considered;
- Guidelines on data compilation for the regional database should be developed to facilitate data exchange by the Member Countries;

- Cooperation on linkage between national and regional databases should be promoted. SEAFDEC in collaboration with FAO and MRC should identify data requirement and its mechanism for sharing;
- Experience of MRC in developing the Mekong Fish Database and guidebook of fish taxonomy should be mobilized by SEAFDEC to non-MRC countries;
- Considering the current statistical data and information in the Member Countries, classification of data and information by major inland water habitats should be revisited; and
- With support from MRC, the available format of data and information and data exchange protocols will be provided to facilitate data and information compilation for the ASEAN region.

4.0 PILOT PROJECT PROPOSALS BY MEMBER COUNTRIES

The RTC confirmed the objectives, format and requirements of pilot project proposals as presented by MFRDMD (**Annex 10**). The RTC also took note with appreciation of the proposed pilot projects presented by the participating countries as listed below. The project is to be implemented under the cost-sharing policy with some contribution from SEAFDEC.

Country	Project Title	System	National Project Leader
Cambodia (Annex 11)	Biodiversity, Fishery and Socio-Economic of Fisheries in Stung Treng Province, Cambodia	Riverine	Mr. Lieng Sopha
Indonesia (Annex 12)	Fishery Information on Rawa Pening reservoir, Central Java, Indonesia	Reservoir	(to be confirmed)
Lao PDR (Annex 13)	Biodiversity and Fishery of Mekong River (Siphan Done), Lao PDR	Riverine	Mr. Duangkham Sihanouvong and Mr. Bounma Luangamath
Malaysia: - Peninsular (Annex 14)	Project 1 – Biodiversity, Limnology and Fishery of Pahang River, Malaysia	Riverine	Ms. Mahyam Mohd. Isa and Mr. Jamaluddin Ibrahim
	Project 2 - River Catfish (<i>Pangasius sp.</i>): Status, Abundance and its relationship with Macroenthos and Other Environmental Factors from middle to lower reaches of Pahang River, Malaysia	Riverine	Ms. Mahyam Mohd. Isa and Mr. Jamaluddin Ibrahim
- Sabah (Annex 15)	Biodiversity, Socio-economics, and Fishery of Kinabatangan River in Sabah, Malaysia	Riverine	Mr. Jephrein Wong and Dr. Ahmade Sade

- Sarawak (Annex 16)	Diversity, Ecology and Utilization of Fishery Resources of Loagan (Lake) Tujuh, Baram, Sarawak, Malaysia	Lake	Mr. Stephen Sungan and Mr. Ken Edward
Myanmar (Annex 17)	Inland Fisheries Resources and Evaluation of the Fishery Management	Flood Plain and Riverine	Mr. Myint Oo
Philippines (Annex 18)	Fisheries Ecological Assessment of Lake Naujan, Oriental Mindoro, Philippines	Lake	Mr. Abundio Galicia Jr. and Mr. Fileonor Eleserio
Thailand (Annex 19)	Management of Economically Important Fisheries Resource in Vachiralongkorn Reservoir, Kanchana Buri Province, Thailand	Reservoir	Mr. Boonsong Sricharoendham and Ms. Jintana Damrongtripob
Viet Nam (Annex 20)	Data Collection and Information of Inland Capture Fisheries For Management in the Mekong Delta	Flood Plain and Riverine	Mr. Nguyen Van Trong

After deliberation, the RTC requested the participating countries to make appropriate adjustments to the proposals taking into consideration the following suggestions:

- Considering the timeframe, capacity and resources, the proposals should be specific particularly on the following:
 - Objectives and outputs,
 - Focused species,
 - Data to be collected,
 - Collecting methodologies.
- The project should address priority concern of the country as well as be manageable within budgetary and staff capacity of the countries and project duration;
- Considering different scales of inland fisheries, socio-economic data was found relevant for management of small-scale inland fisheries while catch and effort data was found relevant for medium and large-scale inland fisheries;
- Collection of information on fishing gear is useful, but in view of the wide variety of gear in use, the required level of description of fishing gear needs to be taken into account before cataloging; and
- With regard to data and information collection methods, local ecological knowledge (LEK) was viewed as an effective tool and its use should be promoted;

5.0 PROJECT WORK PLAN AND FOLLOW-UP ACTIVITIES (2003 to 2005)

The RTC took note of the overall project work plan for 2003 to 2005 by MFRDMD (**Annex 21**), highlighting on project justification, objectives, activities both at the regional and national levels, conceptual plan and agreed to the follow-up actions/activities below:

No.	Actions/ Activities	Responsibilities	Expected Date of Completion
1.	Refine, strengthen and add information on "Current Information of Inland Capture Fisheries."	Participants: First RTC (4 - 6 August 2003)	By October 2003
2.	Submit revised and refined proposals of the pilot projects for consideration.	Participants: First RTC (4 - 6 August 2003)	By August 2003
3.	Provide available information (refer to checklist on fish species and water bodies) and fishing gears and methods to MFRDMD.	Participants: First RTC (4 - 6 August 2003)	By December 2003
4.	Develop a draft ASEAN fish list database.	TD and MFRDMD	By June 2004
5.	Develop GIS base map for water resources of ASEAN region.	TD	By April 2004
6.	Develop a draft ASEAN fishing gear and methods database.	TD and MFRDMD	By June 2005
7.	Implementation of pilot projects.	Participants: First RTC (4 - 6 August 2003)	September 2003 - September 2005
8.	Development of website for dissemination of output on Information Gathering of Inland Capture Fisheries.	TD and MFRDMD	By December 2003

Considering that experiences gained from the pilot projects will contribute to future promotion of information gathering to support planning and management of inland capture fisheries in the Member Countries, the RTC emphasized the need for closer collaboration among the Member Countries, SEAFDEC and other international/regional organizations.

The Summary Report of the ASEAN-SEAFDEC Regional Technical Consultation on Information Gathering Inland Capture Fisheries in ASEAN Countries was adopted on 6 August 2003.



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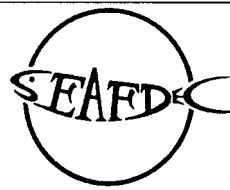
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**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

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**WELCOME ADDRESS BY MR. IBRAHIM SALLEH
CHIEF, SEAFDEC/ MFRDMD**

Good Morning Ladies and Gentlemen

Welcome to Malaysia and to Kuala Lumpur. It is my privilege and pleasure to extend my warmest welcome to all participants from SEAFDEC member countries and various organizations to witness this very important event in our first Consultation; The Information Gathering for Inland Capture Fisheries in ASEAN Countries. This is one part of the component 1: Fisheries Management; under the Special Five-year Follow-up Program on the Contribution of Sustainable Fisheries for Food Security in the ASEAN Region.

The significant role of inland fisheries in the socio-economy for the rural areas of the countries in Southeast Asia is widely recognized. However, their importance especially in relation to the competitive use of water resources with the more glamorous sectors of the economy is undermined, and the production is underestimated, due to the lack of information and statistical data. As a result, inland capture fisheries are often ignored or undervalued by decision makers and development agencies. In order to document and make available of their role in local food security and livelihoods through reviewing the status of inland fisheries, it is therefore necessary to improve the collection and analysis of required data and information, to assist in planning and management of inland fisheries resources.

As we already know, the wealth of inland aquatic resources is very limited since the volume and area covered by the freshwater/inland waterbodies on this world is so small compared to the vast ocean and sea. However, millions of people in the region still depends on these limited resources in duration of their life and contributes to the countries GNP.

At the Second International Symposium on the Management of Large Rivers in Phnom Penh on 11-14 February 2003, several fisheries issues are being put forward as a statement and recommended actions. One issue which very much connected to our regional social structures is the social, economic and institutional aspects of the inland fisherfolks. Study on those aspects of inland fisheries is a relatively recent development. However, the current global emphasis on rural poverty and sustainable livelihoods, together with deeper understanding of fisheries, has shown that knowledge of the human dimension of fisheries is essential for proper management. Understanding of the social organisation of the fishery and the relationships between fisheries and other livelihood strategies is poor in most cases. However, the recent establishment of co-management arrangements for fisheries in some river basins and the involvement of users and other stakeholder in decision-making are forming the basis for better recognition of the relationship between people's livelihoods and their aquatic resources.

The successful cooperation in all fields of sustainable development under the MRC member countries pertaining to Fisheries Programme in the region is a well known latest achievement in this millennium. Their cooperation in the fields of utilisation, management and conservation of the water and related resources of the Mekong River Basin can be a good example in the SEAFDEC near future program planning of our regional inland fisheries especially to non-MRC countries.

As far as inland capture fisheries statistics is concerned, SEAFDEC is in the process of developing project details on improvement of national fishery statistical systems through human capacity building. The project aim at developing a standard training packages on improvement of national fishery statistics which will be used for human capacity building in the ASEAN member countries. The standard training package will also be serving as a regional reference to be used to facilitate national plan and actions to improve national fishery statistics.

The project aims to strengthen the collection of data and information for inland capture fisheries management in ASEAN countries. This will be promoted through mobilizing expertise and experience on research work, activities and fishery statistic projects; survey and assessment for management and conservation of inland aquatic food fish species existed in the ASEAN region in order to ensure sustainable inland fisheries.

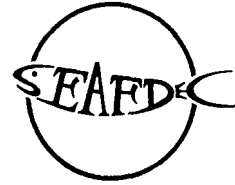
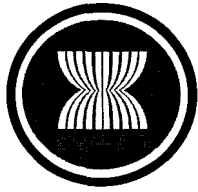
Although it has been frequently justified that aquaculture should to some extent meet the shortfall to the demand for fish as food, effective management of capture fisheries probably still remains the main viable option to ensure the supply of the bulk of fish as food for the people. Thus, sustainable contribution of fisheries to the food security is one which regard as a very important issue to our people to be assured of their quality of life, free from hunger and have adequate food for consumption.

Ladies and Gentlemen

Now, the hard works begin as we take actions to meet the challenges of achieving sustainable fisheries and food security of the region. I understand that all member countries and SEAFDEC Secretariat have put a lot of efforts in preparing for all the documents that we have, the outcomes of your efforts and deliberations at this consultation will be used to help make better decisions on inland fisheries management around the Southeast Asia countries. This is a work and we pursuing to accomplish it, which I believe will benefit all member countries in sustaining fisheries resources for our future generations.

In conclusion, I hope that we will have a very successful and fruitful consultation. I also hope besides spending time only in this room, you will be able to enjoy lives in KL and panoramic view of our famous landmark, PETRONAS twin tower. I wish you have a very pleasant stay in Kuala Lumpur.

Thank you.



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

PROVISIONAL AGENDA AND TIME TABLE

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROVISIONAL AGENDA AND TIMETABLE

Date	4 August 2003 (Monday)
0830 - 0845	Registration
0845 - 0900	Arrival of guest and participants
0900 - 0915	AGENDA 1 Opening Session
0915 - 0920	Opening address by Mr. Ibrahim Salleh, Chief of MFRDMD Adoption of Agenda for Regional Technical Consultation by Mr. Ibrahim Salleh, Chief of MFRDMD
0920 - 1000	Chairperson: Mr. Ibrahim Salleh AGENDA 2 Review of current information on inland capture fisheries in ASEAN countries by MFRDMD, Kuala Terengganu
1000 - 1030	Group Photo Session Coffee Break
1030 - 1100	AGENDA 3 Experience papers on information requirement and its gathering to support management of inland fisheries resources:
	(a) Stock Enhancement in Reservoir Fisheries by Mr. Ouk Vibol, Deputy Chief, Fisheries Domain and Extension Office, Department of Fisheries Cambodia
1100 - 1130	(b) Flood plains in Thailand (Songkram River) by Dr. Mali Boonyaratpalin, Fisheries Resources Management Specialist, Department of Fisheries Thailand
1130 - 1200	(c) Management of Inland Water Bodies in Malaysia by Assoc. Proff. Dr. Khoo Khay Huat, School of Biological Sciences, University Science Malaysia
1200 - 1230	(d) Alternative Information for supporting fisheries management and decision by Mr. Shunji Sugiyama, Technical Officer (Fishery Statistics) FAO Regional Office for Asia and the Pacific
1230 - 1400	Lunch
1400 - 1500	AGENDA 4 Regional Database and GIS for Information gathering of Inland Capture Fisheries by Dr. Somboon Siriraksophon, SEAFDEC Training Department, Bangkok
1500 - 1530	AGENDA 5 Presentation on Proposal of Pilot Projects by member countries:

- Brunei Darussalam

1530 - 1600 Coffee break

1600 - 1700 Presentation on Proposal of Pilot Projects by member countries:

- Cambodia
- Indonesia
- Lao PDR

Date 5 August 2003 (Tuesday)

Chairperson: Mr. Ibrahim Salleh

0900 - 1000 **AGENDA 5**

Presentation on Proposal of Pilot Projects by member countries:

- Peninsular Malaysia
- Sabah, Malaysia
- Sarawak, Malaysia

1000 - 1030 Coffee Break

1030 - 1230 **AGENDA 5**

Presentation on Proposal of Pilot Projects by member countries:

- Myanmar
- Philippines
- Thailand
- Vietnam

1230 - 1400 Lunch

1400 - 1530 **AGENDA 6**

Presentation on work plan of project: Information Gathering for Capture Inland Fisheries from 2003 to 2005 by MFRDMD

1530 - 1600 Coffee break

1600 - 1700 **AGENDA 7**

Discussion on Follow-up activities

Date 6 August 2003 (Wednesday)

Chairperson: Mr. Ibrahim Salleh

0900 - 1230 Preparation of reports

Excursion to KLCC Petronas Twin Tower

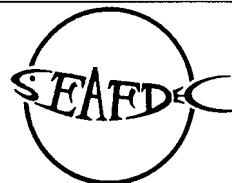
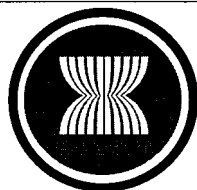
1230 - 1400 Lunch

1400 - 1700 **AGENDA 8**

Adoption of Work Plan and Follow-up activities

AGENDA 9

Closing session



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**REVIEW OF CURRENT INFORMATION ON
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

MAHYAM MOHAMMAD ISA AND JAMALUDDIN IBRAHIM

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

REVIEW OF CURRENT INFORMATION ON INLAND CAPTURE FISHERIES IN ASEAN COUNTRIES

Mahyam Mohammad Isa and Jamaluddin Ibrahim

Marine Fishery Resources Development and Management Department (MFRDMD)

Fisheries Garden, Chendering, Kuala Terengganu

1.0 Introduction

The purpose of this report is to make a review on the current information of inland capture fisheries in ASEAN countries. Only five countries have submitted their country reports on inland capture fisheries and the information below consists of a compilation of inland capture fisheries for Cambodia, Malaysia, Myanmar, Philippines and Viet Nam.

2.0 General Description of Inland Fisheries

Table 1: General Description of Inland Fisheries in Four ASEAN Countries (Cambodia, Malaysia, Phillipines and Viet Nam).

No.	Country	Topography
1.	Cambodia	<ul style="list-style-type: none"> • Main fishing grounds: Central floodplains of Cambodia, comprising wide range of different habitat types (marshes/swamps, flooded grasslands, flooded forest, flooded shrub land and rice fields). • Flood regime influences the extent of floodplain area, covering an area of 23,400 km² during rainy season and only 4,111 km² during dry season.
2.	<p>Malaysia: Inland Capture Fisheries refers to landing of fish from public water bodies i.e. rivers, lakes, ex-mining pools and reservoirs. The river systems consist of 1,800 rivers with a total length of 38,000 km.</p>	
	Peninsular Malaysia	<ul style="list-style-type: none"> • 100 river systems, the longest is Pahang River (475 km) • 46 reservoirs in Peninsular Malaysia, ranging in size from 10 ha (Mahang Dam) to 36,900 ha (Kenyir Dam)
	Sabah	<ul style="list-style-type: none"> • Inland capture fisheries is mainly from rivers and very little from lakes, reservoirs and flood plains • 27 river systems, the biggest and longest river is Kinabatangan River (>560 km) • 3 reservoirs

		<p>and 116,290 km², respectively. The systems contribute significantly to inland capture fisheries, followed by lakes (mainly oxbow lakes), flood plains and man-made reservoirs.</p> <ul style="list-style-type: none"> • 2 man-made reservoirs: Batang Ai HEP reservoir (about 8,700 ha) in the Sri Aman Division and the upcoming Bakun HEP dam (about 695 km²) in the Kapit Division • Major rivers systems: Rajang, Baram, Lupar, Kemena, Saribas, Limbang, Sadong and Oya. Baram River is the only river system that has the greatest number of oxbow lakes.
3.	Myanmar	<ul style="list-style-type: none"> • Major river systems: Ayeyerwady (2,150 km), Chindwin (a tributary of the main Ayeyerwady: 844 km), Sittaung (563 km) and huge Thalwin (2,400 km, started from China). The river systems and tributaries cover an area of 737,800 km² and contribute eight major basins • Two major lakes: Indawgyi Lake in the northern part of Myanmar (18 miles long and 6 miles wide) and Inle Lake (11 miles long and 4 miles wide) • About 220 dams and reservoirs with 4.3 millions acres foot of water bodies • Potential total surface water is approximately 1,081,885 cubic km/ annum and 1 million acres of swampland • One fifth of the country has turned into floodplain during four to five months of monsoon and post monsoon periods.
4.	Philippines	<ul style="list-style-type: none"> • Inland fisheries consist mainly of lakes, rivers, reservoirs, swamps, marshes and small water impoundments • It occupies an area of approximately 330,000 hectares • The origin of most lakes is closely related to volcanic and seismic activity, or a combination of both.
5.	Viet Nam	<ul style="list-style-type: none"> • Inland capture fisheries in South Viet Nam consists of large delta of the Mekong River, with an area of approximately 39.000 km² and covers 12 provinces • The Mekong river system made up of two branches, Mekong River and Bassac river, with the length of 230 km each • Flood from Mekong River caused immense flood plains along the mainstream with the total area of about 1,632,000 hectares • In the Northern part of Viet Nam, especially in Red River and Central part of the country, the river systems has disappeared due to human activities and agricultural developments.

3.0 Inland Fisheries Resources

3.1 Status and Contribution of Inland Capture Fisheries to Economy

Table 2: Status and Contribution of Inland Capture Fisheries to Country's Economy.

No.	Country	Status	Contribution
1.	Cambodia	<ul style="list-style-type: none"> • Inland fisheries cover about one third of the country area and the people live close to Mekong River. • About 85% are rural farmers and most of them are full or part time fishers. Fishing is an all-year round activity whereas farming activities are mainly from February to August. • At least 2.3 million people are engaged in fisheries-related activities. 	<ul style="list-style-type: none"> • Inland fisheries contributed 90% of the total fish production. • Annual income from inland fish catch is around USD 200 millions with average production of about 430,000 tons. • Contributes 16% to the national GDP. • Export fish is estimated at 50,000 tons year⁻¹
2.	Malaysia:		
	Peninsular Malaysia	<ul style="list-style-type: none"> • The production from inland capture fisheries shows an increase since 1999 with landing at 3,446 tones in 2001. This contributes only 0.24% to the total fish production (1,408,308 tones) • No significant variation in catch throughout the year. 	<ul style="list-style-type: none"> • Fish production is insignificant and accounts for less than 1% of the country's total fish production.
	Sabah	<ul style="list-style-type: none"> • Landings from inland capture fisheries have decreased from 1,700 tones in 1994 to only 74.45 tones in 2002. 	<ul style="list-style-type: none"> • Fish production is insignificant and accounts for less than 1% of the country's total fish production • It plays an important role in the socio-economic conditions of the rural people through generation of employment, income and a higher source of protein.
	Sarawak	<ul style="list-style-type: none"> • In 1999, 3.17% of the population has engaged in inland capture fishery. 	<ul style="list-style-type: none"> • Inland fish resources provide cheap sources of food and protein to the inland

		<ul style="list-style-type: none"> • In Batang Ai HEP reservoir, the catch was highest in 1985 (the first year of impoundment) with an average of 270 kg of fish per day. In the last three years of impoundment, it was between 30 and 300 kg of fish per day. 	<p>population but its contribution to total fish production and export value is very insignificant.</p> <ul style="list-style-type: none"> • Local market of inland fishes is estimated to be more than RM100, 000 per year.
3.	Myanmar	<ul style="list-style-type: none"> • Production from freshwater fisheries showed an increase of more than 3.5 times from 143 tones in 1992 to 530 tones in 2002. 	<ul style="list-style-type: none"> • Contribution to total fish production has increased from 19.6% in 1992 to 33.8% in 2002. • There is an increasing trend of export of freshwater fish such as rohu, catfish, sheath fishes and hilsa to India, Bangladesh and Middle East, generating income for the country.
4.	Philippines	<ul style="list-style-type: none"> • Inland fisheries production is in decreasing trend. • More than 60% of the landings consist of molluscs, followed by finfish species (35%) and crustaceans (5%). • More than 90% of the molluscs consist of freshwater snails (suso). 	<ul style="list-style-type: none"> • Inland municipal waters has contributed minimal amount to the national fish production, with contribution decreased by 8.8% (229,673 tones) in 1992 to 4.0% (131,644 tones) in 2002. • In term of value, it remains stable from 1994 to 2001.

5.	Viet Nam	<ul style="list-style-type: none"> • Production of inland capture fisheries is less than 300,000 tones year⁻¹ as compared to 1,700,000 tones year⁻¹ of marine capture fisheries. • In An Giang and Tra Vinh provinces, the production is about 194,000 tones year⁻¹ and 70,000 tones year⁻¹, respectively. • About 58-66% of farmer in the Mekong Delta are involved in fisheries activities, with capture production of 136 - 675 kg household⁻¹ year⁻¹. • Only 4 - 7% of the fishers are full-timer and their captured production may reach to 5 tones household⁻¹ year⁻¹. • The yields from reservoir fisheries range from 30 - 40 kg ha⁻¹ year⁻¹. 	<ul style="list-style-type: none"> • No official report of the contribution of inland fisheries to the economy of the country. • The contribution of inland fisheries is not high but it is considered the most accessible and inexpensive source of protein for rural communities in the Mekong Delta of Viet Nam.
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3.2 Species Compositions

Table 3: Species Compositions of Inland Capture Fisheries in Four ASEAN Countries (Cambodia, Malaysia, Phillipines and Viet Nam).

No.	Country	Descriptions
1.	Cambodia	<ul style="list-style-type: none"> • 500 fish species have been identified • 100 fish species commonly caught every year in the Tonle Sap floodplains • Fish composition and catch level change seasonally with flood regime. The water of the Mekong River floods from May to October and brings along larvae and juvenile from spawning grounds in upstream to the down stream floodplain of the Tonle Sap Great Lake until October. • Fishing season started when the water get the reversed flow from the Tonle Sap Lake and floodplain to the main Mekong channel and downstream.

2.	Malaysia:	
	Peninsular Malaysia	<ul style="list-style-type: none"> • Common species caught are river catfish, cyprinids, snakehead, carps, freshwater prawns, marble goby, eels, Wallago spp. and tilapia.
	Sabah	<ul style="list-style-type: none"> • 168 species of freshwater fish species have been identified • Major commercially important freshwater species caught during rainy season are giant freshwater prawn (<i>Macrobrachium rosenbergii</i>), river catfish (<i>Pangasius</i> spp.), <i>Wallago maculatus</i>, <i>Mystus</i> sp., and during the dry season are <i>Puntius</i> spp., <i>Kryptopterus parvanalis</i>, catfish (<i>Clarias</i> spp.), and <i>Tor duoronensis</i>. • Other commercially important species include <i>Kryptopterus</i> sp., <i>Leiocassis</i> spp., marble gobby (<i>Oxyeleotris marmorata</i>), Snakehead (<i>Ophicephalus</i> spp.) and Tilapia (<i>Tilapia</i> spp.).
	Sarawak	<ul style="list-style-type: none"> • Fish fauna of Borneo is made up of 99 families, 394 species and nearly 40% are endemic. • A total of 249 species of freshwater fishes from the mouth of the rivers to the interiors of Sarawak and Brunei was recorded. • The Lanjak-Entimau Wildlife Sanctuary (LEWS) contains 82 fish species from 31 genera and 8 families. • The Bentuang-Karimun to Lanjak-Entimum (LEWS) Biodiversity area contains 127 fish species and 12 families. • Species composition varied along the river stretch and it is closely associated with habitat types and habits of particular species. For example, <i>Tor</i> species are commonly found in the upper reaches of the river but <i>Mystus</i> spp. tolerate in less favorable conditions of muddy and slow flowing water in the lower part of the river system.
3.	Myanmar	Common species caught are catfish, snakehead, perch, carps, freshwater prawns, goby and eels.
4.	Philippines	Common species caught are silver perch, white goby, ornate sleeper, snakehead, eleotrids, gouramy, freshwater sardines, tilapia, climbing perch, carp and freshwater prawn.
5.	Viet Nam	<ul style="list-style-type: none"> • More than 250 species, consisting of various ecological groups (swamp fish or “black fish”, riverine fish or “white fish”, brackish water fish, anadromous fish) have been identified in the Mekong Delta. • About 50 species are commercially important species due to big catch, large size or high selling price.

3.3 Fishing Gears

Table 4: Fishing Gears and Methods Used in Exploiting Inland Fisheries Resources in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Country	Descriptions
1.	Cambodia	Fishing gears range from stationary to fixed gears operating in flowing and stagnant water bodies and categorized as follows: <ul style="list-style-type: none"> • Large-scale (industrial) fisheries - using fishing lot and bagnet fisheries in limited access area • Middle-scale (artisanal) fisheries - using about 200 fishing gears in open access area and during open season • Family (subsistence) fisheries - operating in open access area all year round, during closed fishing season in limited access area and also in flooded rice fields.
2.	Malaysia:	
	Peninsular Malaysia	Common fishing gears are seine net, gill net, barrier net, stow net, cast net, and trap.
	Sabah	Common fishing gears are gill net, trammel net, portable trap, hook and line and the use of destructive methods of fishing such as electrical and poison fishing (rotenone).
	Sarawak	Common fishing gears are cast net and gill net. Other types include “selambau”, lift nets, hooks and lines, fish guns and spears. Destructive fishing methods are also being practiced.
3.	Myanmar	Common fishing gears are angling and other hook fishing, drift and float nets, plain (straight) fixed nets, casting and drop nets, pushing, scooping or dipping equipments, pouch or big nets, anchored entrapments, fishing enclosures and artificial fish shelters, entrapment structures, traps and fish fences.
4.	Philippines	Common fishing gears are gillnet, fish trap, longline, cast net and snail dredge for freshwater snails.
5.	Viet Nam	Common fishing gear in the Mekong Delta is bamboo trap. For reservoirs, the most popular fishing gears are gill net, fence net, lift net, cast net, hook and lines.

3.4 Per Capita Fish consumption

Table 5: Per Capita Fish Consumption of Inland Fisheries Resources in Four ASEAN Countries (Cambodia, Malaysia, Phillipines and Viet Nam).

No.	Country	Descriptions
1.	Cambodia	Average per capita fish consumption for the central Cambodia is 67 kg year ⁻¹ and fishing community may consume up to 76 kg year ⁻¹ . Fish contributes about 75% of the total animal protein intake.
2.	Malaysia:	Information on per capita fish consumption of freshwater fish species is not available for the country.
3.	Myanmar	Fish is major source of easy and affordable animal protein to the rural people. Average consumption of fish per capita per year has increased from 17.30 kg in 1990 to 26.18 kg in 2002 and contributing 70% of total animal protein. Meat consumption is only 9.85 kg year ⁻¹ .
4.	Philippines	Consumption of fish and fishery products is 36 kg capita ⁻¹ year ⁻¹ , which is broken down as 24 kg fresh and cooked fish; 4 kg dried; 4 kg processed (paste, sauce, smoke, canned) and 4 kg crustaceans and mollusc. Supply and consumption of fish and fishery products has showed a decreasing trend from 31 kg capita ⁻¹ year ⁻¹ in 1995 to 27 kg capita ⁻¹ year ⁻¹ in 1997 with an average of 29 kg capita ⁻¹ year ⁻¹ .
5.	Viet Nam	The inland fisheries have an important role in providing main animal protein source to the people's diet in the Mekong Delta. Average fish consumption in An Giang and Tra Vinh provinces is about 59 kg capita ⁻¹ year ⁻¹ , accounting for 62 - 75% of total animal protein.

3.5 Fish Price

Table 6: Fish Price of Major Commercial Species of Inland Fisheries Resources in Four ASEAN Countries (Cambodia, Malaysia, Phillipines and Viet Nam).

No.	Country	Descriptions
1.	Cambodia	Fish is generally very cheap around 0.10 USD/Kg for small sized fish. But for commercially important species such as <i>Oxyeleotris mamorata</i> , the price is expensive.
2.	Malaysia: Market prices vary according to species, locality, season, consumer demand and relative quality and quantity available for sale. Peninsular Malaysia	Prices ranging from as low as USD 1.0 kg ⁻¹ to as high as USD 45 kg ⁻¹ . The most favored and high valued fish is River catfish (Family: Pangasiidae - 'Patin Muncong' (<i>Helicophagus</i> cf. <i>waandersii</i>) which can fetch more than USD 50 kg ⁻¹ .
	Sabah	No information is available
	Sarawak	Prices ranging from as low as USD 0.90 kg ⁻¹ to as high as USD 40.0 kg ⁻¹ . The most favored and high valued species are cyprinid species such as <i>Tor tambroides</i> , <i>Tor duoronensis</i> and <i>Puntius schwanenfeldii</i> . The high prices are also favored for species that are more than one kg in weight and freshly caught. In the early 1960s and 1970s, the fish price ranged from USD 0.35 - USD 0.70 kg ⁻¹ but during logging industry in the 1980s, the much-favored species was fetched up to more than USD 30.0 kg ⁻¹ .
3.	Myanmar	Price of the fish varies according to species, season, areas, demand and ready access to markets.
4.	Philippines	Price of fish varies according to fishing season and weather conditions. It is also determined by supply and demand of major species of fish that are sold in the market and exported to nearby countries, where the prices are much higher.
5.	Viet Nam	No information is available.

4.0 Environmental Conditions

Table 7: Environmental Conditions in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Country	Environmental Conditions
1.	Cambodia	NE monsoon occurs from November to March and brings relatively dry, cool air and little precipitation. The SW monsoon prevails from May to September with high precipitation. Most areas receive rainfall of more than 1,500 mm year ⁻¹ except at Tonle Sap floodplain that receives up to 5,000 mm year ⁻¹ . Precipitation is lower at less than 2,000 mm on the Mekong basin side, which is in the shadow of the Cardamom and Elephant hills.
2.	Malaysia:	
	Peninsular Malaysia	East Coast of Peninsular Malaysia (i.e. Kelantan, Terengganu, East Johore, and Pahang) experiences NE monsoon season in the months of November, December and January with maximum rainfall. June and July are generally the driest months in these states. In other states of the peninsula, rainy season occurs during two periods: October - November and April-May. In between these months, very little precipitation was observed. In the north-western region (Perlis & Kedah) the driest months occur in January-February and June-July and February (inter-monsoon months). The rainfall pattern in the Southwest coastal areas (West Johore and Malacca) is also affected by "Sumatra-rains" between May and August. In these areas, October and November are the wettest months and February the driest.
	Sabah	Average rainfall is 2,400 mm year ⁻¹ and not uniformly distributed throughout the year. The dry seasons are between February and April/May and the wet seasons are during NE and SW monsoons. The NE monsoon occurs from October to January/ February and brings heaviest rains to the eastern coast of Sabah. The SW monsoon occurs from May to August/ September and brings heavy rains to the western coast of Sabah.
	Sarawak	The wet season is from November to March and coincides with the NE monsoon. The dry and hot season is from April to October.
3.	Myanmar	Three seasons with monsoon season started during second week of May. During this season, the country experiencing rainy season with peak rainfall pattern occurred during the middle of the season. Annual rainfall records in the coastal areas is around 200 inches, 110 inches in delta region, 60 - 80 inches in the Northern and Eastern hilly and about 40 inches in the central dry zone.

4.	Philippines	<p>NE monsoon occurs from November to February and SW monsoon between July and September. The inter monsoon prevails during the rest of the year. The country has four climatological conditions/type:</p> <ul style="list-style-type: none"> • Type I - very pronounced season with dry season occurs from November to April and wet season during the rest of the year; • Type II - no dry season but with pronounced maximum rain between November and January; • Type III- seasons are not very pronounced, relatively dry from November to April and wet during the rest of the year • Type IV- rainfall is evenly distributed throughout the year with annual average rainfall at 236.9 mm, rainfall season from September to January.
5.	Viet Nam	<ul style="list-style-type: none"> • Rainy season occurs during SW season from May to November and dry season, during NE monsoon (December to April). During rainy season, rainfall accounts for 80 - 90 % of total annual precipitation and reaches two peaks in June and September. • An average temperature is between 26 - 28 °C with highest temperature between April and May at 27 - 29 °C, and lowest in December and January at 23 - 25 °C.

6.0 Socio-economy

Table 8: Socio-economic Information and Dependency of Inland Fisheries Resources in Four ASEAN Countries (Cambodia, Malaysia, Phillipines and Viet Nam).

No.	Country	Descriptions	Status of Information Available
1.	Cambodia	Family economy of the fishing community depend entirely on fisheries as a source of income. A household family engage in small-scale fishing activities may catch fish around 647 kg year ⁻¹ , and middle-scale about 3,319 kg year ⁻¹ . About 84% of the fresh fish is sold in local markets and the other 16% is processed as smoked fish, fish sauce, salted dry fish and fish paste. Women are more active in farming activities than in fishing.	Good accumulation of data. The first comprehensive socio-economic survey on small and medium scale fisheries was carried out in 1995/96. The estimate covered mainly the central part of Cambodia.
2.	Malaysia:		
	Peninsular Malaysia	Inland capture fisheries play insignificant role toward contribution of total fish production. The fish act as food source especially for rural people. Only small amount is for sale.	Data on socio-economy is still scanty due to scattered, remote areas and labor intensive to obtain them.
	Sabah	Inland fisheries contributed only 1% of the total state fish production (2001) and it plays an important role in the socio-economic conditions of rural people through generation of employment, income and source of protein. The demand for freshwater fish is high in the rural areas especially in two villages along the Kinabatangan River. The livelihood of the villagers depends on the income from the catches of the freshwater giant prawn <i>Macrobrachium rosenbergii</i> .	In-depth study on the socio-economy of the people involved in the inland capture fisheries has not been carried out.

	Sarawak	For the vast majority of the communities living near the inland water bodies, the fish resources are important sources of food, protein and side-income. Marine fish is difficult and expensive to obtain in these areas and therefore freshwater water fish is more preferred either as fresh or in preserved forms (salted, preserved wet or dried, smoked).	Very little statistics are available with respect to data on household consumption (e.g. per capita consumption, percentage of fish in diet, percentage of catch for sale and actual quantity sold). Data is very unlikely to be completed because of the part-time nature of the fishing activities.
3.	Myanmar	Almost all catch are sold in the market or in village after some portion has been reserved for family consumption and process. The head of the business is usually man but the business is diversified at lower level to the woman i.e. finance, market, processing, managers, brokers, etc. Wife or daughter is also involved in fishing activities using cast net, long line or gill net.	No thorough survey has been conducted yet.
4.	Philippines	High dependencies on capture fishing as their means of livelihood. In some large lakes, aquaculture (cage culture) is the major source of generating income. About 60% of the catches are marketed while 40% for family consumption. Fishing is mainly dominated by men (age between 30 -59 years old), with women involved in repairing/ mending fishing net; processing fish and fish trading in wet markets.	Well documented on socio-economic information.
5.	Viet Nam	Based on the household survey conducted in An Giang province, there are 59.6 % part-time fishers, 6.4 % full-time fishers, 14.6% aquaculturists, 10.5% involved in processing, 4.7 % as fish saler and 1.5% as labors. About 81% of the individuals involved in fishing activities are male and 65% of them are the household heads, having an average age of 46 years old.	Well documented on socio-economic information.

7.0 Statistical Data Collection of Inland Fisheries

Table 9: Statistical Data Collection of Inland Fisheries Resources in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Country	Responsible agencies
1.	Cambodia	<ul style="list-style-type: none"> • Statistical Section of the Department of Fisheries (DoF) • The Capture Fisheries Project in collaboration with MRC and DoF has carried out stratified sampling schemes to estimate fish catch and value by month, gear, season, district and province for large, medium and small-scale fisheries.
2.	Malaysia:	
	Peninsular Malaysia	<ul style="list-style-type: none"> • Statistical Section of the Department of Fisheries (DoF) • The state DoFs is divided into district offices and responsible to collect and compile data and information on monthly basis. The collection involves visual market surveys, enquiries and observations techniques without any format reporting or sampling. The estimates by species are made by production system: river, ex-mining pools, embankments /reservoirs/ dams and others.
	Sabah	<ul style="list-style-type: none"> • Statistical Section of Sabah Fisheries Department • Proper method of data collection has been carried out at fish market or landing sites and compiled in the district fisheries offices before they are submitted on monthly basis to the head office in Kota Kinabalu. • The yearly data are send to the DoF Malaysia, Kuala Lumpur.
	Sarawak	<ul style="list-style-type: none"> • Since 2001, Department of Agriculture, through its Inland Fisheries Division had initiated proper monthly data collection on freshwater fish landings at selected places. • The prices and quantity of each species offered for sale are also collected. • The data are compiled at respective divisional office and then submitted to the Headquarters for compilation on monthly basis.
3.	Myanmar	<ul style="list-style-type: none"> • Department of Fisheries under Ministry of Livestock • The department is divided into State and Division, Districts, Townships and villages and employed 110 out of 370 townships offices for fishery activities. All fishing license holders, lease holders, fish farmers and processors are obliged by regulation to report their catch, product and fishery related information to the township offices. • The township officer obtain reports approximately every two weeks and relay these reports to the head office through district, state and divisional offices. The local officers will check the reported data and actual status by visiting the fishery areas.

		<ul style="list-style-type: none"> • The annual reporting period used its fiscal year, from first April to the end of March, the following year.
4.	Philippines	<ul style="list-style-type: none"> • Collection on production by species for inland municipal sector has started in 1977 under the Bureau of Fisheries and Aquatic Resources until 1987. • From 1988 until present, Bureau of Agricultural Statistics (BAS) under the Department of Agriculture serves as the major agency for the collection, compilation and release of agricultural statistics.
5.	Viet Nam	<ul style="list-style-type: none"> • Regular statistics data are collected by two systems, namely, the statistical system of the Ministry of Fisheries and General Statistics Office. These two mechanisms have different methods and requirements for economic information and statistics data. • In the Ministry of Fisheries, the main agency for collecting fisheries statistics in the provinces is the Provincial Department of Fisheries (PDoF) for coastal provinces and Provincial Department of Agriculture & Rural Development (PDARD) for inland provinces. The data are produced by PDoF or PDARD on a quarterly, six-month and one-year basis and submitted to Fisheries Information Center (FICen) in Hanoi. • FICen also receives reports from the General Customs Department on the production and fisheries products exported through border gates and the center is responsible for processing and analyzing data submitted from the local authorities and other sources and submit on monthly, quarterly, six-month and annual reports to management and policy making bodies of MoFi and local authorities. • The General Statistics Office that belongs to the Prime Minister Cabinet also produces statistical data on fisheries sector with a network of Provincial Departments of Statistics, Bureaus of Statistics at district level and officials in charge of statistics work at commune level.

8.0 Inland Fisheries Management System

Table 10: System in the Management of Inland Fisheries in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Country	Management System of Inland Fisheries
1.	Cambodia	<ul style="list-style-type: none"> • Formerly, regulations based on French colonial legislation. • Nowadays, using regulation formulated by fishing community and approved by relevant local authorities. More than 200 fishing communities were established through out the country.
2.	Malaysia:	
	Peninsular Malaysia	<ul style="list-style-type: none"> • Development and management of inland water bodies are under the jurisdiction of the respective State Governments, which controls the issuance of licenses for inland fishing vessels and appliances. • Two levels of management systems: direct management techniques - control types and amounts of fish being caught; and secondly, by using water quality and river classification as basis for the protection of aquatic life and fisheries
	Sabah	<ul style="list-style-type: none"> • Management is under the responsibility of State Fisheries Department using new fisheries law: the Sabah Inland Fisheries and Aquaculture Enactment 2003. • The department has successfully implemented Community-Based Resource Management (CBRM) program on many rivers and it empowers local community to rehabilitate, restore and make rules of managing their riverine fish resources.
	Sarawak	<ul style="list-style-type: none"> • Management is under the jurisdiction of the State Ministry of Agriculture and Food Industries (MAFI), through the State Department of Agriculture (DoA). • The Inland Fisheries Division is the implementing arm of the State DoA in all matters relating to inland fisheries and using Sarawak Inland Fisheries Rules (SIFR) for regulating aquaculture activities and inland fisheries.
3.	Myanmar	<ul style="list-style-type: none"> • Ministry of Livestock and Fisheries and Department of Fisheries are the responsible agencies at ministerial and departmental levels. • Local authorities at division, district and township levels also take part in managing the fisheries resources and comply with administrative and legislative procedures. • Myanmar Fisheries Federation and non-government organization act as coordinator between the department, fishery communities and local authorities
4.	Philippines	<ul style="list-style-type: none"> • Bureau of Fisheries and Aquatic Resources (BFAR) is the main agency that involved in the conservation and

		<p>management of inland fisheries and aquatic resources of Philippines.</p> <ul style="list-style-type: none"> • Under new “Philippine Fisheries Code of 1998” or RA 8550, the jurisdiction over the management, conservation, development, protection, utilization and disposition of all fish and fishery aquatic resources in inland bodies of water, streams, lakes and tidal water shall be under the jurisdiction of the municipality or city government
5.	Viet Nam	<ul style="list-style-type: none"> • The central agencies involved in the management of inland fisheries under Ministry of Fisheries (MoFi) system are Department of Fisheries and Department for Fisheries Resources Conservation. • For the local management, Divisions for Fisheries Resources Conservation (FRC) of PDoF and PDARD are assigned to be responsible for management of the inland fisheries.

9.0 List of Publications Available on Inland Capture Fisheries in ASEAN Countries

Four countries namely Cambodia, Malaysia, Philippines and Viet Nam have responded in giving list of publications available on Inland Capture Fisheries in their respective countries. The publications are classified according to various subjects as listed in Table 11. Malaysia and Philippines are outnumbered in providing matters relating to Fish Taxonomy and Biology of freshwater species, respectively. Full list of the publications is tabulated in Table 12. A total of 133 articles on inland capture fisheries are compiled from four participating countries.

Table 11: List of Publications by Subjects on Inland Capture Fisheries in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Subjects	Cambodia	Malaysia	Philippines	Viet Nam
1.	Aquaculture	0	1	0	0
2.	Biology	0	6	16	2
3.	Biodiversity / Fish Communities	1	6	6	0
4.	Ecology	1	3	0	0
5.	Environmental Conditions	0	0	6	0
6.	Fish Taxonomy	1	12	4	1
7.	Fisheries	1	6	7	2
8.	Fisheries Resources	4	5	2	0

9.	Fishing Gears	0	3	0	0
10.	Fish Stocking	0	5	2	0
11.	Life history/ Fish Larvae	0	0	2	1
12.	Management	5	2	3	0
13.	Population / Stock Assessment	0	1	5	0
14.	Socio-economy	4	1	4	0
15.	Statistics	0	2	0	0
16.	Others	0	0	2	0
-	Total	16	53	58	6

Table 12: Compilation on List of Publications Available on Inland Capture Fisheries in Four ASEAN Countries (Cambodia, Malaysia, Philippines and Viet Nam).

No.	Subjects	Country	List of Publication
Aquaculture			
1.		Malaysia	1. Jothy, A.A. 1977. Aquaculture in tin mining pools in Malaysia. ASEAN 77/FA. EgA/Doc. WP22. Pp.123-4.
Biology			
2.		Malaysia	1. Tan, E.S.P. 1980. Some aspects of the biology of Malaysian riverine Cyprinids. Aquaculture, 20:281-289.
3.			2. Mohsin, A.K.M. and Law Ah Theem, 1978. Length-weight relationship and condition factor in ikan seluang, <i>Rosbora sumatrana</i> . Mal. Appl. Biol. 7(1):81-86.
4.			3. Teoh, H.C. 1978. The reproductive biology of <i>Puntius gonionotus</i> Bleeker. 101 p. "Tesis Ijazah Sarjana" University Malaya, Kuala Lumpur.
5.			4. Mohsin, A.K.M. 1977. Some aspects of biology of <i>Doryichthys artensii</i> (Peters) from Selangor. (Pisces - Syngnathidae). Mal. Appl. Biol.6 (1): 78-89.
6.			5. Ang, K.J. 1971. The reproductive biology of some Malaysian <i>Anabantids</i> with special reference to <i>Betta pynax</i> Cantor, 112 "Halaman Tesis Ijazah Sarjana", Universiti Malaya, Kuala Lumpur.
7.			6. William Chang Wei Say. Features of indigenous fish species having potential for aquaculture. 49 pages. Edited and compiled by Inland Fisheries Division, Dept. Of Agriculture, Sarawak.
8.		Philippines	1. G Galicia, Jr. A. M. and N.A. Lopez Feb. 2000. The Biology and Fishery of Indigenous Gobies of Lake

			Mainit, Philippines. In Reservoir and Culture-Based Fisheries: Biological Management edited by Sena S. De Silva, ACIAR proceeding no. 98.
9.			2. Aypa, S.M., A.M. Galicia, Jr. and E.S. Lapasaran. 1999. The reproduction biology and life cycle of the freshwater pelagic sardine <i>Harengula (Sardinella) tawilis</i> (Clupeidae) in the volcanic Lake Taal, Philippines. 1 - 14p. 1999; In Fish and Fisheries of Lakes and Reservoir in Southeast Asia and Africa, Edited by WLT Van Densen and ML Morris.
10.			3. Pauly D. and Felimon C. Gayanilo, Jr. 1997. "A Bee". An Alternative approach to estimating the Parameters of a length-weight relationship from length-frequency samples and their bulk weights. Copyright 1997. ICLARM, MC PO Box 2631, 0718 Makati City, Philippines.
11.			4. Galicia, A. M. Jr., L.L. Penolio and S.M. Aypa 1991. A Study on the Biology of Sinarapan (<i>Mistichthys Luzonensis</i>) in Lake Manapao, Camarines Sur, Bureau of Fisheries and Aquatic Resources, unpublished report.
12.			5. Millar F.J.D. and A.N. Vallejo, Jr. Jan.-Dec. 1987. A Contribution to the Biology of <i>Ophiocara aporos</i> (Bleeker). Fish. Res. J. Philipp.12: 1-2. 29-43p.
13.			6. Mercene, E.C. and Cabrera, L.P. 1985. Contribution to the Biology of "Ayungin", <i>Therapon plumbeus</i> (Kner). Philip. J. Fish. (1991) 22:79-85. 79-85p.
14.			7. Saji, A.P. 1987. A Contribution to the Biology of <i>Priacanthus eayenus</i> (Richardson. 1846) in Lingayen Gulf, M.S. Thesis University of the Philippines in the Visayas, Diliman, Q.C.
15.			8. Ingles, J. and D. Pauly. 1984. An atlas of the Growth, Mortality and Recruitment of Philippines fishes. ICLARM Tech. Rep. 13. 127 p. International Center for Living Aquatic Resources Management, Manila, Philippines.
16.			9. Escudero, P.T. et al 1980. Biological Studies of <i>Glossogobius giurus</i> (Hamilton & Buchanan)) and <i>Puntius sirang</i> (Herre) in Lake Lanao. Journal of Fisheries and Aquaculture 1 (1): 11 – 154. Univ. Research Center, MSU, Marawi City Philippines.
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20.			13. Marquez, J. Sr. 1960. Age and Size at Sexual Maturity of goby, @ <i>Glossogobius giuris</i> @, a common fish species of Laguna de Bay, with notes on its food habits. <i>Philipp. J. Fish.</i> 8(1): 71-89.
21.			14. Enriquez, G.L. 1960. Studies on the spawning

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22.			15. Bertalanffy, L.Von. 1938. A quantitative theory of organic growth (Inquiries on growth laws II) Hum. Biol. 10(2): 181-231.
23.			16. Mane, Andres M. 1934. Spawning and Feeding Habits of ayungin, <i>Mesopristes plumbea</i> (Kner), a common theraponid fish in Laguna de Bay. <i>Philipp. Agric.</i> 23(6): 502-516.
24.		Viet Nam	1. Mekong River Commission Fisheries Programme. 2002. Fish migrations of the Lower Mekong River Basin: implications for development, planning and environmental management. MRC Technical Paper No.8, October 2002.
25.			2. Nguyen Thanh Tung, Tran Quoc Bao and Truong Than Tuan 1998. Fish Migration & Spawning Report in An Giang Province Vietnam Delta. (Field Trial from 1 st August to 1 st September). Vientiane: Assessment of Mekong Fisheries Project.
Biodiversity / Fish Communities			
26.		Cambodia	1. Smith, J.D. (Ed.) 2001. Biodiversity, the life of Cambodia- Cambodian Biodiversity status Report 2001. Cambodia Biodiversity Enabling Activity. Phnom Penh, Cambodia.
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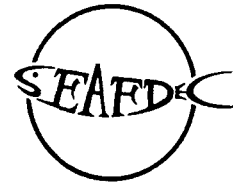
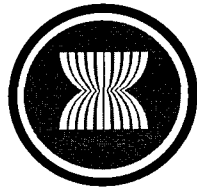
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**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

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**STOCK ENHANCEMENT IN RESERVOIR
FISHERIES**

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STOCK ENHANCEMENT IN RESERVOIR FISHERIES

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Abstract

Reservoir fisheries are one of the water resource ecosystems, which contribute to inland fish catch for family consumption and income for the poor people. To support government policy to regenerate fish species that have been lost and to increase the fish catch in the reservoir, stocking fish in the reservoir are option for consideration. A research activity on stocking of native species in Thmorda reservoir was conducted. The objective of the research was to evaluate if stocking in the reservoir could enhance the fish catch to increase food and income for the people living in the area.

Twenty one thousand and five hundred fingerlings of native fish; 10,000 *Barbonymus gonionotus*, 10,000 *Barbonymus altus*, 500 *Pangasianodon hypophthalmus* and 1000 *Trichogaster pectoralis*; were stocked in Thmorda reservoir on 5 November 2002. Monthly monitoring, informal discussions and catch assessment activities with fishers were conducted to collect information on captured stocked fish. According to the survey and discussions with fishers, stocked fishes grew 5 to 6 times faster than pond based aquaculture system. Up to 30-50% of stocked *Barbonymus gonionotus* and *Barbonymus altus* were recaptured, reaching a total weight of about 1,000kg, with an estimated value of about US\$1,400.

Stocking fish in reservoir is widely accepted by fishers as one of the most practical option to improve the livelihood of the people living in the reservoir. However, the ecological status and constraints after stocking should be studied and research conducted on how stocking native fish in the reservoir fisheries may affect the ecology of the reservoir or the socio economic conditions of the people living in the reservoir area.

1.0 Introduction

Literature on Cambodia's inland fisheries makes frequent reference to the abundance of fish in the Tonle Sap and Mekong ecosystem and the expertise of the fishers who exploit this boundary. Together with rice, without a doubt, inland fisheries form the backbone of Cambodia's food security accounting for 3/4 of animal protein consumption and provide invaluable revenue and full or part time employment to around 2 million people, especially among rural households that still comprise almost 90% of the country's poor. Inland fisheries produce an estimated 290,000-430,000 tones of fish each year with an estimated value at landing of around US\$ 150m to US\$ 200m (DoF, 2002). In fact, the contribution of freshwater capture fisheries' to national food security and the Cambodian economy is deemed higher than in any other country in the Southeast Asian region.

The natural resource is rich in the 1.8 million-hectare freshwater system composed of rivers and lakes, reservoir, flooded forests, grasslands, rice fields, and swamps. Reservoir fisheries are one of the water resource ecosystems, which supply a lot of inland fish for family consumption and income for the poor people. There are approximately more than 600 reservoirs throughout the country. While reservoir fisheries may have adverse effects on existing fish habitats and stocks, they can also serve as new environments in which fisheries and fish culture can be developed. This is recognized by the government of Cambodia, who emphasize the need for adequate reservoir fisheries management in order to sustainably utilize their existing potential.

Yet, attention is increasingly being drawn to the impacts of over fishing and destructive practices. Illegal fishing with homemade bombs or dynamite, electro fishing or fishing with fine mesh nets are prohibited but are still being used by a number of fishers and have destroyed many fishes and other organisms. However, due to effective management, blast with bombs or dynamite fishing has decreased throughout the country.

Two rehabilitation options for natural aquatic resources are improved management through community involvement and stock enhancement. The objective of the study is to evaluate if stocking in reservoir could enhance the fish catch to increase food and income for the people living around the reservoir.

2.0 Characteristics of Thmorda Reservoir Fisheries and its Ecology

Thmorda reservoir is located in Kampong Cham province to the north of the country and this reservoir is 135km from the capital city of Phnom Penh and 17km from Kampong Cham town. Thmorda reservoir was built during the Pol Pot regime (1976 to 1977) by human labor and it was renovated from November 1994 to May 1996 under a Royal Government Loan from the ADB (Asian Development Bank) for US\$1,543,000.

Figure 1 shows the location of Thmorda reservoir in Kampong Cham Province. The Thmorda reservoir covers 200 hectares in size but its water surface is approximately 70m² with a maximum dept of 4 meters. The reservoir has a capacity of 2,300,000 cubic meters of water, which can irrigate 2,000 hectares of rice fields. During rainy season, the water from the reservoir is channeled out through the gate and flows along the canal to the Tonle Sap River. During dry season, the reservoir is disconnected from natural water body but its water is used for irrigation in the two communes.

There are 749 families in the four villages living around the Thmorda reservoir. The main occupation is rice cultivation, followed by fishing which accounts for 30% of the total livelihood sources of families. However, around 15 families keep fishing as their main source of livelihood because they have no paddy field and garden, so they are depend mostly on the natural production in the reservoir.

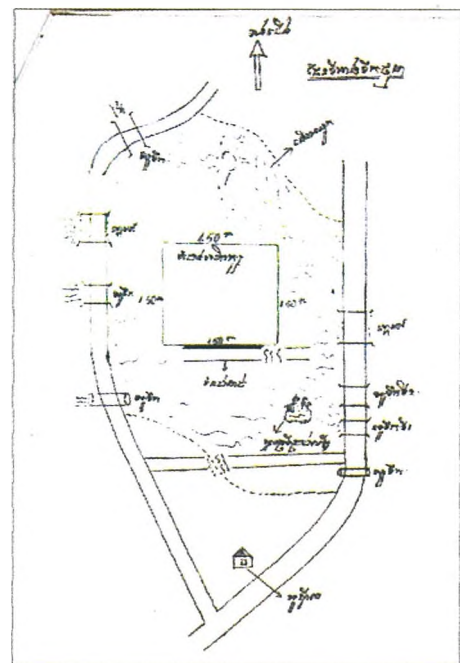
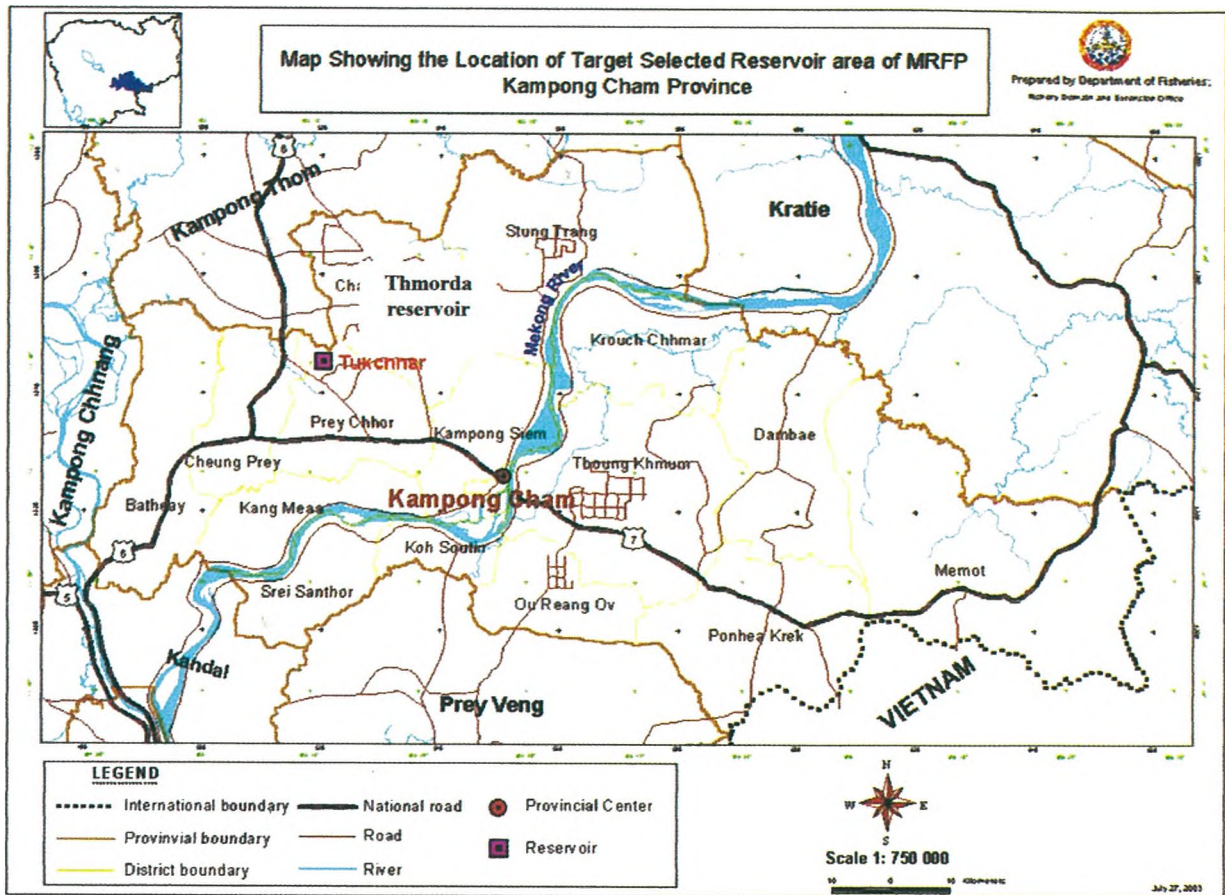


Figure 1: Map Showing Location of Thmorda Reservoir in Kampong Cham Province.

4.0 Fishing Activities in Thmorda Reservoir

The Thmorda reservoir is rich in natural stock including many fish species and snails. Estimation from the catch assessment in the reservoir illustrated that in 2001 and 2002 the fish production was approximately between 13,000-15,000kg. Most fishers in the village use small-scale fishing gears to catch fish and some fishers collect snail manually. The common fishing gears used in the reservoir are cast net, gillnet, seine, hook, long line, spear gun etc. and with these types of fishing gear a fisher could catch fish amounting to about 8-10kg per day during rainy season and 2-3 kg during dry season. The major species found in the reservoir are *Hampala dispar*, *Pristolepis fasciata*, *Oxyeleotris marmorata*, *Channa striata*, *Clarias batrachus*, *Clarias macrocephalus*, *Notopterus notopterus*, *Henicorhynchus caudimaculatus*, *Anabas testudineus*, *Pseudabassis notatus*, *Mystus nemurus*, *Monopterus albus*, *Tilapia nilotica*, *Macragnathus siamensis*, *Macragnathus maculates*, etc. Some species that are lost in the last 5 years due to over and illegal fishing are *Barbonymus gonionotus*, *Cyclocheilichthys repasson*, *Cyclocheilichthys armatus*, *Osteochilus hasseltii* and *Wallago attu*.

Illegal fishing activities in the Thmorda reservoir have occurred during the last 5 years and these activities continue to date, even though community fisheries and local authority try to address them. Two types of illegal fishing gear used for fishing in the reservoir are electro fishing (Figure 2) and used of very fine mesh net (Figure 3). With these two prohibited fishing gears, fish stock in the reservoir decreased drastically from year to year, causing some species to disappear, especially *Barbonymus gonionotus*, *Barbonymus altus*, *Trichogaster pectoralis*, etc.



Figure 2: Electro Fishing



Figure 3: Used of Very Fine Mesh Net

5.0 Community Fisheries Establishment in the Thmorda Reservoir

Because of their involvement in fishing activities, the people of the four villages surrounding the reservoir has organized community fisheries with technical support from the Department of Fisheries and financial support from the Component of Reservoir Fisheries Management of MRC. The main objective of the community fisheries management is the sustainable fisheries management and development of the reservoir region for food security and poverty alleviation.

With support from the Department of Fisheries and a component of the Reservoir Fisheries Management program, a reservoir committee was elected and formed. An internal fisheries regulation for the community fisheries of Thmorda reservoir has also been discussed among members of the committee and local authority under the technical supervision and support of the Department of Fisheries. The regulation was signed officially by the chief of committee and local authority and disseminated to the people living in and outside the reservoir region. Since the formation of the fisheries community in the reservoir, illegal fishing activities seem to have decreased and the fisheries resource in the reservoir seemed to have improved.

6.0 An Example of Stock Enhancement in Thmorda Reservoir Fisheries

6.1 Why do we Stock?

Stocking indigenous fish species in the reservoir might be an option to enhance reservoir fisheries in order to increase fish catch and improve the livelihood of the people living around it. In this connection, stocking of fish in the natural water body was considered as an effective measure to regenerate fish that has been lost and a sub-decree was officially signed by the Prime Minister of the Royal Government of Cambodia on 25 August 2002, effective immediately and also proclaiming July 1 of every year as the National Fish day.

To support this proclamation, the Thmorda reservoir was selected as a target place for fish stocking. Before stocking, a consultation with Thmorda reservoir community fisheries was conducted to identify which fish species will reintroduced and to discuss how to manage the stocked fishes. *Barbonymus gonionotus*, *Barbonymus altus* and *Trichogaster pectoralis* fish species have come under considerable pressure in the reservoir, and were under threat of disappearing in the past. On the other hand, according to the reservoir ecology, geographical feature and productivity, these three species were suitable for stocking. The fish species and number is shown in the Table 1 below:

Table 1: Fish Species and Number of Stocked Fish in Thmorda Reservoir

Stocked species	Number of Stocked Fish	Average weight (g)
<i>Barbonymus gonionotus</i>	10,000 seeds	2.60
<i>Barbonymus altus</i>	10,000 seeds	1.60
<i>Pangasianodon hypophthalmus</i>	1,000 seeds	1.30
<i>Trichogaster pectoralis</i>	500 seeds	2.50
Total	21,500 seeds	

The broodstocks were collected from the Tonle Sap River and bred at the Chrang Chamres station. The fish seeds from the station were transferred and stocked in the reservoir on November 6, 2002. The stocking ceremony was organized by the community fisheries and participated by local authorities, Department and provincial fisheries officers and local villagers. The ceremony was also used as an occasion to advice the people how to manage

stocked fishes and avoid using prohibited fishing gears. Figure 4 shows the participation of fishers in fish stocking activities.



Figure 4: Participation of Fishers in Fish Stocking Activities in Thmorda Reservoir.

6.2 Monitoring and Data Gathering

Every month, data such as number, species, fish weight, fishing gears and market price information were gathered from 40 fishers in the reservoir by district facilitator. In order to get accurate data, the record lists were distributed to fishers to record the information related to recapture stocked fishes. These activities were started since the end of the stocking month and now these activities are still on going. During monitoring, informal discussions with community fisheries and fishers have been conducted very often in order to get some feed back from fishers on fish stocking advantages and disadvantages and to share information among fishers. The discussion on yearly catch assessment with fishers has also been conducted in order to evaluate the catch after community fisheries formation and indigenous fish stocking.

6.3 Result of Stock Enhancement

The growth of stocked fish in the reservoir was significantly faster than in the pond. It must be due to low stocking density and high productivity in the reservoir than in the pond. The data from the survey showed that the growth rate per day of *Barbonymus gonionotus* and *Barbonymus altus* was 4.5g and 2.2g respectively, and they would be 5 to 6 times higher than in the pond base culture system. According to the survey, *Barbonymus*

gonionotus species reached 0.8 kg and *Barbonymus altus* reached 0.4 kg during 7 months period.

Only a small number of *Trichogaster pectoralis* and *Pangasianodon hypophthalmus* were recaptured from the reservoir. However, the growth of these species was found to be faster if compared to its growth in the pond base culture system.

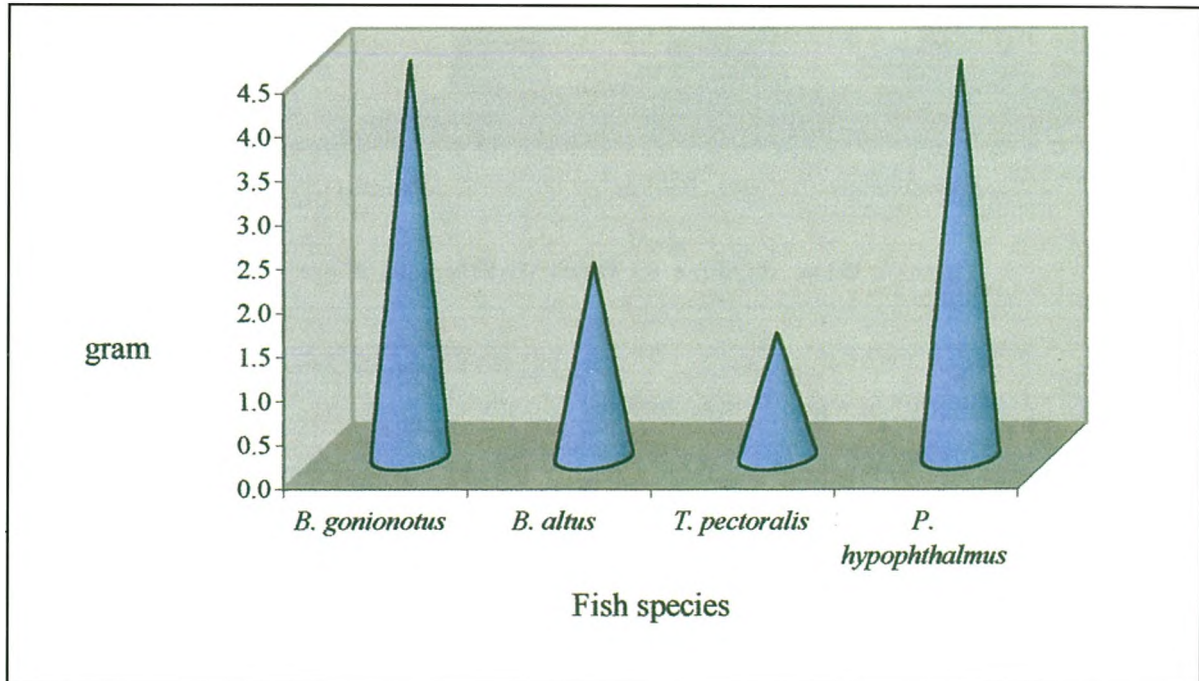


Figure 5: Average Growth of Stocked Fish

The stocked fishes have been caught since the end of November 2002 and the peak number of stocked fish was caught in December 2002 and then it decreased drastically from January to May 2003. . In Figure 6, around 1,000 *Barbonymus gonionotus* fishes were caught in December 2002 and from May 2003 only 30-50 fishes were caught. Among the stocked species, around 50% and 30% of *Barbonymus gonionotus* and *Barbonymus altus* were recaptured and only a small number of *Trichogaster pectoralis* (10%) and *Pangasianodon hypophthalmus* (2%) were recaptured respectively from the reservoir from November 2002 to May 2003.

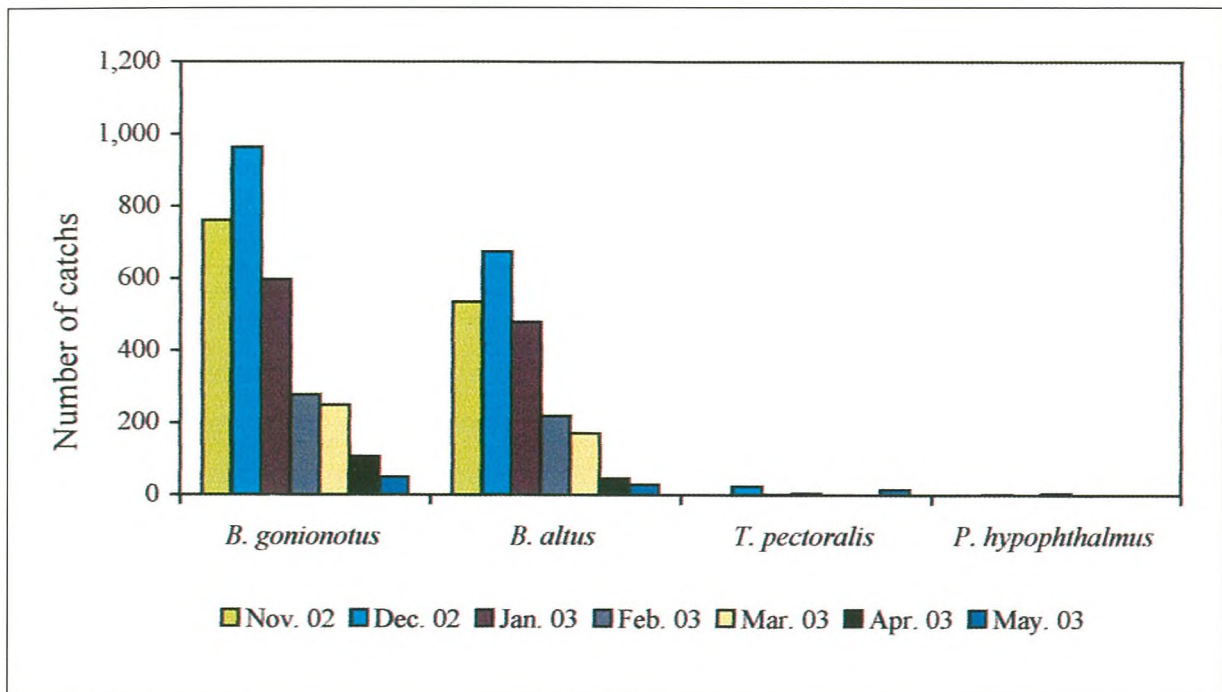


Figure 6: Number of Stocked Fish Caught by Month

Table 2 shows that from November 2002 to May 2003 the total weight of stocked fish catch was 972.7kg. Of this amount *Barbonymus gonionotus* contributed up to 705 kg (72%) and followed by *Barbonymus altus*, 258kg (26%). An even higher number of stocked fish was caught in December 2002 and January 2003 but the biggest weight of the stocked fishes caught extended from December 2002 to March 2003.

According to the catch assessment data, fish catch increased from 15,000 kg in 2002 to 18,720kg in 2003 (Figure 7). It means that after the fisheries community formation and stocking, fish catch increased by 20% wherein stocked fish contributed up to 26% of the increased catch and compared to the total catch in 2003 stocked fish contributed around 5.4%. When calculated in US Dollars the total income from stocked fish caught is about \$1,470.

Table 2: Total Weight of Stock Fishes Caught by Species and Month (kg)

Species	Nov-02	Dec-02	Jan-03	Feb-03	Mar-03	Apr-03	May-03	Total Weight (kg)
<i>B. gonionotus</i>	65.0	150.0	155.0	95.0	120.0	70.0	50.0	705.0
<i>B. altus</i>	25.0	50.0	55.0	40.0	50.0	20.0	18.0	258.0
<i>T. pectoralis</i>		1.8	0.5	0.3			4.5	7.1
<i>P. hypophthalmus</i>		0.6		2.0				2.6
Total Weight	90.0	202.4	210.5	137.3	170.0	90.0	72.5	972.7

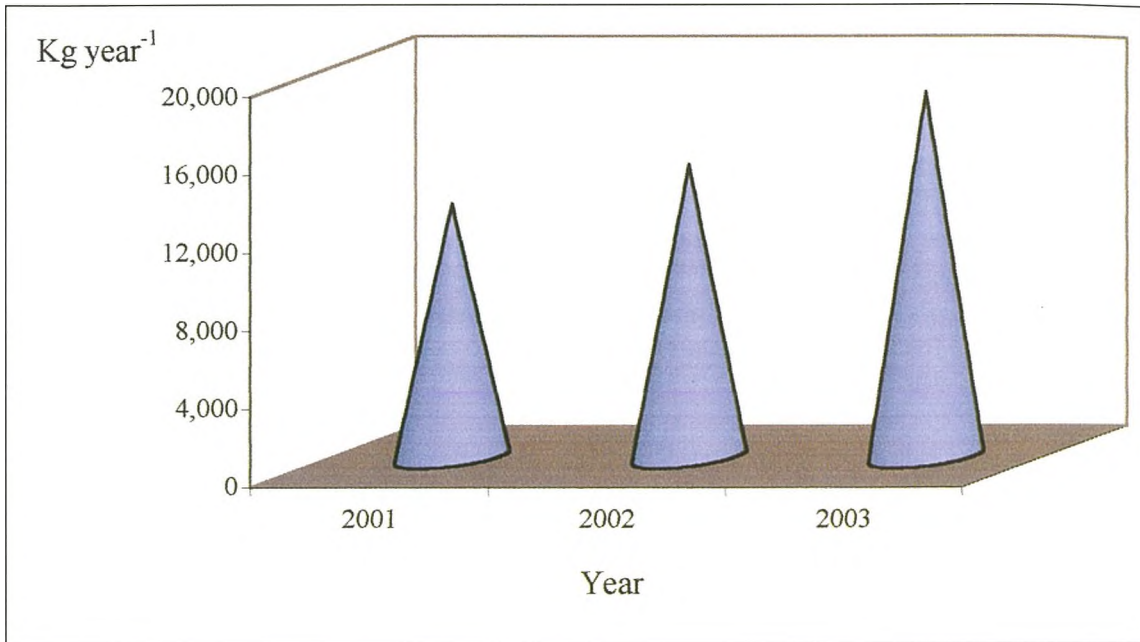


Figure 7: Total Fish Catch by Year (kg year⁻¹)

The fishers in the reservoir area usually used gillnet, cast net, seine, hook line and knife to catch fishes. Gillnet is one of the most effective fishing gear that fishers used to capture the stocked fish. Around 80% of stocked fish was caught by gillnet and 15% by cast net. The mesh size of gillnet was increased every month in order to hunt *Barbonymus gonionotus*. In Figure 8, when the *Barbonymus gonionotus* grew from 0.0026kg at stocking month to 800g in May 2003 the mesh size of gillnet was changed from 4-5cm to 9-10cm.

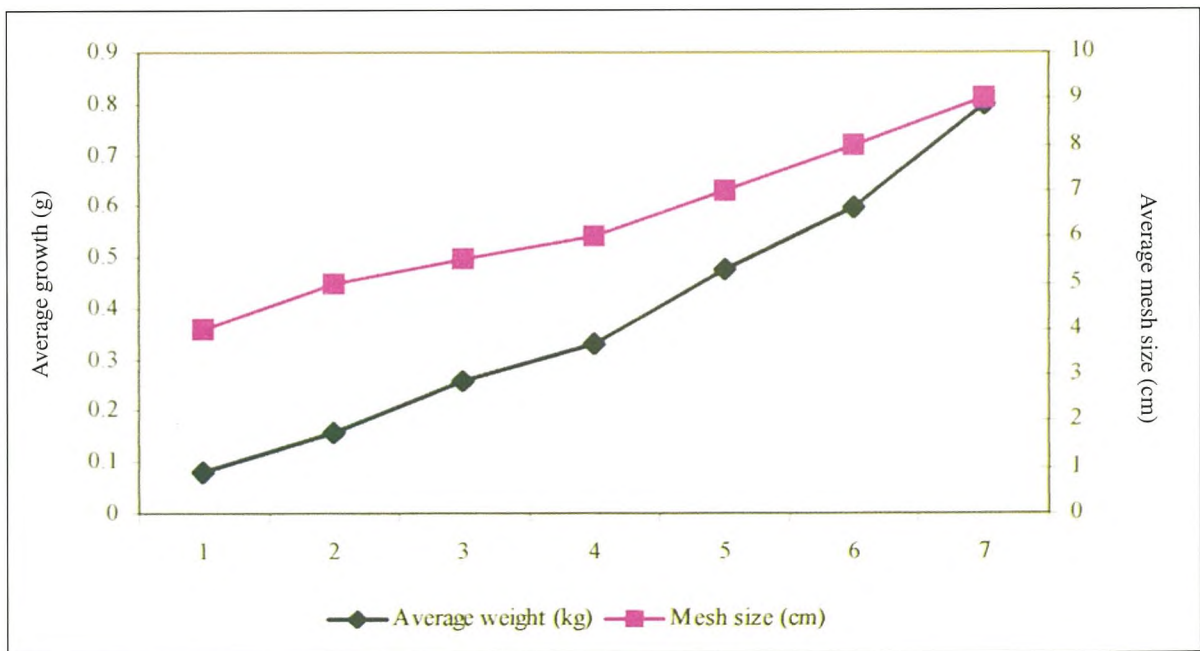


Figure 8: Relationship between Growth of *Barbonymus gonionotus* and Mesh Size.

6.4 Attitude of Fishers Towards Fish Stocking Programmes

The people in the reservoir fisheries of Thmorda are very happy with this activity because of increased food and income, especially since they were able to catch fish species that have already disappeared. According to the survey, around 60% of fish catch was sold in the village and 40% was kept for household consumption. Some fishers recommended that after stocking, the community fisheries should set up a fishing regulation, for instance, restriction of mesh size of gillnet used and time for fishing. However, some people complained that poor fishers could not catch the stocked fish because they were not able to buy fishing gear for target these fishes.

7.0 Lessons Learned from Fish Stocking Programmes

Fish stocking in reservoirs is widely accepted as one of the most practical and effective method to enhance fish catch and preserve aquatic resources in the reservoir fisheries.

As a result of the practical work on releasing native fish in the Thmorda reservoir, fishes grew very fast and recapture was also very high (up to 50%), especially *Barbonymus gonionotus* and *Barbonymus altus* because these species could adopt well to the reservoir ecology, natural productivity and physical feature. Therefore, before stocking native fish species in the reservoir, selection of fish species must be done based on their adaptability and suitability to the reservoir environment.

Fishers were very happy with the fish stocking because they gained some benefit such as more fish for consumption and more income through increased catch, which helped to improve the livelihood of the fisher families. As a result, after fisheries community formation and stocking the total catch per year increased up to 20%, 26% of which valued at US\$ 1,470 came from stocking.

Stocking in close reservoir is more profitable than in open reservoir because stocked fish will not migrate to other places and lead to higher recapture rate (50%).

What is the next step with the stocking in the reservoir; should continue or stop. Two options might be consider as recommendation for community fisheries to manage the fish recruitment and fish catch. First option is that the community fisheries should intervene by preparing some regulation on fishing activities such as restriction of mesh size and time for fishing. If it's effective, fish catch will increase and stocked fish can be recruited by natural reproduction without needing manual stock. But sometime this option is not effective to implement because fishers in the reservoir may be difficult to be changed their habitude. However, the secondary option might be more effective. The community fisheries should promote one fisher to become the fish seed producer. This seed producer should be responsible for producing and stocking fingerling in the reservoir. But to keep sustainability operation of seed production, all fishers in the Thmorda reservoir must pay a small amount of money to the fish seed producer.

Therefore, this practice is being recommended to be continued and applied to other reservoirs throughout the country but selection of stocked fish must be consider depending on ecology, productivity and physiology of the reservoir.

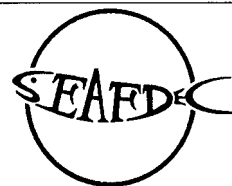
8.0 Recommendations for Further Study

The following are some recommendations for further study:

- Social impact of fish stocking
- Constraints of fish stocking faced by fishers
- Ecological change in reservoir after stocking

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**REGIONAL TECHNICAL CONSULTATION
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**INLAND FISHERY MANAGEMENT IN
SONGKRAM RIVER, THAILAND**

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INLAND FISHERY MANAGEMENT IN SONGKRAM RIVER, THAILAND

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1.0 Introduction

Thailand has 25 large basins, each with code. Khong Basins is one of 25 with code 02. Khong Basin in Thailand has 3 subbasins, Kok in Chiengrai-Chiengmai provinces Huaymong in Nongkai and Songkhram Basin covering 33 amphoes in 4 provinces, i.e. Udon Thani, Nongkai, Sakonakorn and Nakornpanom with area of 13,451 m² most of the area are stepped plain and low-lying floodplains (KhonKaen University, 1997). Songkhram river originates from Phuphan hill with altitude 300 m above MSL. The river passes north crossing Udon Thani province and diverts southeasterly to Sakonakorn and Nongkai provinces and drain into Sri Songkhram area of Na Korn Panom province and confluent with Khong river in Chaiburi with total distance of 430 km (Asian engineering consultant limited *et. al.*, 1992).

2.0 Hydrology

The rainfall of upper Songkhrom Basin is about 1600-2700 mm annually, 1000-2200 mm annually for lower Basin with average 1300-2450 mm annually. About 90% of rainfall is in rainy season, e.g. May-September with highest rainfall of 50-60% of the year in August-September. The surface water run violently due to different altitude of 300 m above MSL for a distance of about 230 km at lower Songkhrom Basin which is 150 m above MSL. The lower Songkhram Basin has a length of 200 km. Before confluencing between Songkhram and Khong rivers, there is slight difference in altitude. Also due to meandering of lower stream and diverting of stream near the confluence with Khong river and intrusion of water from Khong river into Songkhram river for a distance of 100 km in early rainy season, it causes strong flow of upper Songkram to unable to drain into Khong river, this results the overflow into tributaries and low-lying areas of 500,000 Rai in lower Songkhram Basin (Asian engineering consultant limited *et. al.*, 1992).

3.0 Ecosystems

Due to difference in geography and variation in flood regime in different seasons, it results in 3 types of ecosystem, namely, riverine, flood plain and lacustrine (Boonyaratpalin *et.al.*, 2002)

4.0 Water Quality

Physical properties of water in low-lying area (Boongtham) during flood period is noted for high total suspended solid (TSS) and total dissolved solid (TDS) over the peak and stable periods. This is due to presence of vegetation in flood area that cause the lower velocity of running water and precipitation and reduction in TSS and TDS. High turbidity is noted in Songkhram Basin during flood period, which is higher than in dry period. However, TSS and TDS are lower than in drought period due to less amount of water and higher concentrations of nutrients.

The chemical properties of water in catchment area are not different between the draing and stabilized periods, i.g. pH 5.2-5.4, alkalinity 15 ppm which are lower than in the river with pH 7.0 and alkalinity 19.3 ppm for the discharge period and become higher to pH 7.4 and alkalinity 36.3 ppm in dry period. The low pH in floodplain area is due to the presence of plant debris, animal excreta that are decomposed during flood period by microorganisms, causing lower pH and the presence of natural food for young fish life. (Boonyaratpalin *et.al.*, 2002)

5.0 Plankton and Benthos

The study in 2002 in floodplain area showed the presence of 195 species of phytoplankton constituting 121 species of green algae and 78 species of desmids thrive the weak acidic water and low level of hardness. The phytoplankton density was 815 units/ml or equivalent 0.32-1.28 g/m³ biomass which is 12 and 1.5 times higher than in Songkhram river, respectively.

152 species of zooplankton were found in Songkhram Basin with average density 250 organisms/l mainly over 100 μ in size. The diversity was greater for the catchment area than for Songkhram River. The benthos of 27 families was found with highest abundance of Tubifex sp. There was similarity in distribution between the benthos in Songkhrom river and the catchment area. However, the density for benthos in low-lying was cross 1225 organisms/m² while for Songkhrom river, the density was 195 organisms/m².

6.0 Fishery

The Songkhram River is well known in fisheries context due to its high bio diversity and high productivity, both of which are due to the relatively pristine environment. Songkhram is not dammed, and the floodplains along the river are relatively undisturbed. Many species migrate from the Mekong up the Songkhram to These floodplains. These features provide the basis for high fish productivity that benefits the people along the Songkhram, its tributaries and floodplains. Boonyaratpalin *et al.* (2002) reported the presence of 149 fish species in 33 families in lower Songkhram Basin. 61 out of 149 species are in cypricidae with very high diversity index (Shanon-Weiner) of 4.96 and 91 kg/ha fish production. However we noted high production potential in lower Songkhrom Basin. About 1,400 tone of fish were harvested annually. Comparing the fish harvested from large reservoirs during 2000-2002, the harvest was larger than from 3-5 reservoirs. For example, the estimated harvest was larger than average fish harvest during 2000-2002 from Bhumiphool, Sirikit reserroirs, Pasak Cholasith, Srinakarind and Vachiralongkorn put together.

7.0 Livelihood

The structure and environment of flat area of the basin with large wetland area during wet season lead to the limitation uses for many agricultural activities. In many communities, a traditional rice crop is commonly done during dry season and fishing is becoming of the main activity of local people. In the Baseline Fisheries Study conducted by the Assessment of Mekong Capture Fisheries Component of MRC in 1999-2000 found more than 60% of total households in the lower basin were involved in fishing and high percentage of part time fishing households as shown in Fig1. High number of local inhabitants involve in fisheries altogether with long history of development, local management in fisheries is found in this area such as fishing gears used, fishing habitat, fish preservation, fish processing (Pla Ra) and etc. Fish is a major source of the daily protein intake of over 80 per cent of the people in the Songkhram. Smaller fish, which may be of little commercial value, provide dietary calcium as their soft bones are chewed and eaten. Evidence of fishing as a key livelihood activity.

Fig 1: Percentage of part time fishing households from Baseline Fisheries Study of the AMCF, MRC in 1999-2000.(Sjorslev et.al.,2000)

8.0 Fish Migrations and Traditional Milk of the Songkhram

Fish migrations are an important feature of river ecology in most major tropical rivers. Migration pattern of fish in the Songkhram is same as the other area for completing their life cycle. This cycle is also influences the local inhabitant livelihood. Long-distance migrations within main river and tributaries referred to as 'longitudinal' whilst those from the main river and tributaries into flood plain areas during the flood season and back again during the dry season are referred to as 'lateral'. During the flood season, larvae of many species may scatter in the big flood plain area of the Songkhram. Lateral migrations from flood plains back to the river are often followed by longitudinal migrations within the main river channel and found in big group at the same time downstream migrate back to the Mekong. About three months of the year (June to August), pushing water upstream from the Mekong into the Songkhram cause many Mekong species migrate upstream the Songkhram to complete their life cycle. Huge area of flood is an important breeding, spawning and nursing grounds for many species. Boonyaratpalin et.al.(2002) notes 59 larvae fish species in flood area. During upstream migration, the fishermen do fishing by specific gears to catch the big fish. Young fish are swept in with the water and thrive in the flooded plains. When the water level rapidly drops in the Mekong during the beginning dry season (from September to October), the flow reverses once more and the fish migrate back to their refuges downstream. The difference in hydrological condition not only lead to fish migration but also to fishing gear developed to use in different season and management style.

9.0 Fishing Ingenuity

Enormous ingenuity has been demonstrated in the design and construction of fishing gears in the Songkhram River Basin. Local fishermen apply their knowledge and experience of fish behavior and characteristics to the invention of new gear designed specifically to target certain species. These selective fishing gear are different kind of trap. The reason

that trap is used to catch some fish species is that they have different shapes its or placed at different levels in the water or different bait used.

Local people make the most use of this downstream mass migration and are ready with their gears. Some kinds of big gears such as Bagnet (Tong) and lift net on raft (Yo Yai) were developed to this huge production in a short time of water receding. Huge quantities of fish are caught in bag net along the river to be consumed mainly locally and sale to other province in the Northeast. When migration is at its peak (few days in the period September to October) the bags are emptied every 2 to 3 hours. Each bag may hold up to 500 kilograms of fish, though on days when few fish are migrating the frequency of lifting is much less (2 times a day). Composition of fish eatch at night time are valuable catfish and feather back, fish eatch at daytime are relatively lower value scale fish or cyprinid.

The Barrier Net situated at the month of canal, the mesh size are every small and the fishing period from water receding till dry out that it is extremely unlikely that a species inhabiting the area and have to migrate into Songkharm river can avoid being caught by these fishing gears.

10.0 Gender Issues

It is common for women to be involved in the fishing and related activities. In the lower part of the basin that capture is important found of highly involvement. In some villages found of women do fishing more often and 1/3 found accompany their husbands in fishing. In the Songkhram, especially in the lower area, women tend to fish in river more often but in the upper part women tend to go fishing in rice fields, swamps and small streams.

Women in the Songkhram river area found highly involve in fishery, especially in small purse seine which is operated by husband and wife, fish sorting, processing, preserving and fish marketing. The local pattern of management is to preserve fishery product for their household consumption through out the year and also for sale. Last few years, many village women form the group in order to join their knowledge, labor and investment for processing in the rural development program of *One Tambon One Product*. (OTOP) In this particular case, they can ask for support from the government and non-government organizations for new technology in producing valuadded product and assist in ,funding support to the group.

Women are found highly involved in fish marketing that benefit the fishing activities in this area. Fish production, both fresh fish and processing fish (pla ra) are not sold only in the Songkhram River but also export to Bangkok and many parts of Thailand

11.0 Fishery Management

Fishes have been main food for Thai since ancient time “Eat rice, eat fish” s0, the fishery resources are managed for sustainability by the issue of Fisheries Act 1947 that specify the conservation areas, concessioned areas or aquaculture and require licenses from authorities. The licenses must comply with the conditions prescribed in the permit and public area that anyone can fish. Types and size of gears are restricted. The gears should not obstruct communication or affect the fish stock. The Act also prohibit the activities

that lead to the dryness of water source. The Act categorizes the fishing gears into 2 types: license, non-licensed. The licensed fishing gears have following details:

1. Kind, dimension and mesh size of fishing gear which in permitted in fisheries
2. The distance between each stationary gear;
3. Fishing gear and method of fishing in spawning and breeding grounds and seasons
4. Kind of fishing gear or implement which is absolutely forbidden in fisheries such as poisoning

The results of Top-down management is not effective as some types of fishing gears, e.g. bag net which is not allowed, are still used in Songkhram Basin (Table 1). Bag net is vary efficient in fish catching and is operated only about one and half months a year. The position of gears are governed by the water velocity. Barrier nets are highly destructive to fish stocks and should be changed. It is still commonly used because thy are auctioned to the Tambon Administrator Organization and the sale in used for public benefits. In the local community fishery management,(Table 2) the local people are unaware of the conservation practices such as the fine mesh sizes of barrier net which set across the mouth of the canal and fish untill water in canal dry out. Smaller fishes are harvested and used unprofitably and left no for tuture fish generations.

The problems of Top-down management and local community fisheries management and Constitutional Law 1999 regarding the decentralization policy, the Department of Fishery has a policy to manage the fishery resources in Songkhram Basin in the form of Co-Management about Government and community to dissolve the conflict and to find out the best solution fishing gear used, stock enhancement and best regulation which is practical and can serve the aim to preserve and conserve fishery resources, which are staple food of people in Songkhrom River Basin.

Table 1: Types of Main Fishing Gears in Songkhram Basin as Classified by Fishery Act

Vernacular name	Licensed	Non-licensed	Not allowed
Barrier net			+
Stationary trawl net, set bag net			+
Beach seine net	+		
Set bamboo trap (2.5 cm.)		+	
Big lift net, raft mount lift net, crane lift net	+		
V-shape dip net, boat dip net	+		
Bush-pile&lure		+	
Drift gill net	+		
Large bamboo trap		+	
Small bamboo trap		+	
Bush-pile&lure		+	

Table 2: Fisheries Management and its Feature in the Songkhram by Community

Type of Management	Feature of Management
Conservation zone	<ul style="list-style-type: none"> • A common type of local management found in many villages • Have the rule and local enforcement • Aim to preserves and conserve fishery resources
Fishing gear development and prohibition	<ul style="list-style-type: none"> • More than 34 types of gears are used for fishing. ▪ Long history of fishing gear development including the lesson learn for fishing habitat ▪ Illegal gears are prohibited such as electricity and chemical.
Fishing right	<ul style="list-style-type: none"> • Traditional fishing rights • Long history develops the fishing right. • Preserving the valuable role played by social communities • Giving the right of fishing to private and take benefit from the fishing right for local community development. This fishing right is mainly control by the local authorities and no villager is allowed to harvest any resources. This is to avoid conflict between villagers and private operators.
Conflict management	<ul style="list-style-type: none"> • Group and network strengthening to reduce conflict in 3 levels; between user groups (different gears used, between user group and community, and communities and outside, especially the government)
Woman group	<ul style="list-style-type: none"> • Group strengthening to produce new products with the support from local communities and also investment from outside.

12.0 Conclusion

There is no single efficient fisheries management system. The successful system must be based on cultural, physical factors, economic and scientific information. In addition, the system must be established and implemented by stakeholder and government officer, or so call co-management system. Fisheries resources in the Songkhram is the common property that need management system to ensure that resources will conserved and provide high and equal benefit to the local people for sustainable uses.

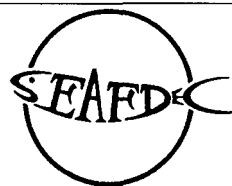
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**FISHERIES OF INLAND WATER BODIES
IN MALAYSIA**

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FISHERIES OF INLAND WATER BODIES IN MALAYSIA

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1.0 Introduction

Malaysia covers an area of about 336,700 square kilometers and comprises the Malay Peninsula known as Peninsular Malaysia and the northwestern part of Borneo Island known as Sabah and Sarawak. The two parts are separated by about 645 km of the South China Sea. Temperature and humidity is always high. The average rainfall is 245 cm a year.

Peninsular Malaysia, covering an area of about 154,680 km², has a series of mountain ranges, the highest peak being Gunung Tahan (2,190 meters). The heavy tropical rainfall gives rise to many rivers, the largest of which are the Sungai Kelantan, Sungai Pahang (459 km) and Sungai Perak (522 km).

Sabah and Sarawak has an area of 202,020 km² and are crisscrossed by low mountains. Sabah has a narrow coastal plain that gives way to a mountainous jungle-covered interior with Mount Kinabalu rising to 4,103 meters being Malaysia's highest peak. Other high peaks are Mount Trus Madi (2,591 meters) in Sabah and Mount Murud (2,438 meters) in Sarawak. Sarawak has a broad alluvial coastal plain crossed by a number of rivers. The more important rivers in Sarawak are the Sarawak (115 km long), the Batang Lupar (228 km), the Rajang (565 km), the Baram (402 km) and the Limbang (196 km). In Sabah the important rivers are the Kinabatangan (565 km), the Sungut, the Lubuk, the Segama, and the Padas River. Yap (1992) reported yields for four principal rivers: Rajang (Sarawak, 100 kg/ha/year); Baram (Sarawak, 142-169 kg/ha/year; Gombak (Selangor, 180 kg/ha/year), Perak (Perak, 11.64 kg/ha/year).

Lotic waters dominate the Malaysian aquatic environment. There are very few natural lakes in Malaysia. There are only two principal lentic environments in Malaysia. They are Tasek Chini and the Tasek Bera/Tasek Dampar complex. Both of these lakes located in Pahang, are relatively small in size. Tasik Bera is more of a freshwater swamp than a true lake, covered with stands of littoral, floating, emergent and submerge vegetation, such as *Lepironia articulata* and *Pandanus helicopus*, and very few truly open water spaces (Furtado & Mori, 1982). They reported 95 species of fishes from Tasik Bera. Almost all of these species were endemic to Peninsular Malaysia. They also highlighted the difficulties of estimating fish abundance in Tasik Bera because of the small size of fish, presence of large numbers of refuges where the fish are inaccessible and the low intensity of fish catches by the natives.

Tasik Chini consists primarily of water bodies joined together to form a string of small lakes (Ali, 1988). Other small bodies of water, either permanent or semi-permanent, such as the Paya Bungur and Tasik Beringin, are more shallow wetland ecosystems than lakes (Fatimah *et al.*, 1984, Nather Khan, 1990).

Man-made lakes or reservoir dominates the Malaysian lentic environment. In Malaysia, there are 63 large impoundments with a total storage of 25 billion m³ ranging in size from 10 ha (Mahang Dam) to 37 000 ha (Kenyir Dam) and 150 major river systems (100 in Peninsular Malaysia, more than 50 in Sabah and Sarawak (Mohd. Azhar 2000). Currently the largest reservoir is Tasik Kenyir that has a surface area of 36.9 km². Other major impoundments, that are those larger than 10 km², are presented in Table 1. These large impoundments were building either for irrigation or hydroelectric power generation. In some, as indicated in Table 1 they have an additional role in flood mitigation. The rest of the man-made lentic environment comprises small reservoirs whose main functions are flood mitigation, irrigation, domestic and industrial water supplies. These small reservoirs do not support a fishery. The current estimate of the total Malaysian lentic environment is about 1000 km², with another 1000 km² in the planning or implementing stages.

Khoo *et al.* (1987) reported that inland capture fisheries in Malaysia are dominated by cyprinids and silurids in the country's larger river systems, and that there have been sharp declines in catches during recent decades. These declines are attributable to a combination of factors, including river regulation (particularly dewatering of stream reaches below dams), (Jackson & Marmulla, 2001) and pollution, siltation, damming, illegal gear/methods, and overfishing (Khoo *et al.* 1987). In the Selangor River, flows have been reduced from 5 482 000 m³/day to 300 000 m³/day and in Sabah, the release from the Babagon Reservoir dam has reduced streamflow to 5.5-21.0% of the natural river flow (Yap 1992).

2.0 Limnology of Malaysian Reservoirs

In general, the physico-chemical properties of natural Malaysian lakes and reservoirs are favorable to fisheries development. A lentic environment usually acts as a settling basin thereby reducing the turbidity of water. Hence, light penetration is deeper than in river conditions leading to greater productivity. An example of the physico-chemical properties of a typical reservoir, Tasek Chenderoh is presented in Table 2 (Ali 1996).

The concentration of dissolved oxygen in a shallow reservoir such as Tasek Chenderoh varies from 2,5 to 9.5 mg/L. There is a decreasing gradient in dissolved oxygen level with the low levels being detected near the bottom of the impoundment. In a deep reservoir such as Tasek Kenyir, a characteristic dissolved oxygen profile was observed. There is a sharp stratification of dissolved oxygen level between 7 m and 8 m depths. The environment below this depth was anaerobic. This is caused by the decomposition of decaying vegetation. Within the anaerobic environment, high levels of sulphide were detected. This anaerobic zone is not conducive to fisheries development and may have an adverse effect on the fishes in the lake.

Table 1: Major Impoundments (above 10 km²) in Malaysia.

Name	Function*	Completion Date	Area (km ²)	Estimated Fish Yield (ton)
Chenderoh	HY/FM	1929	25.0	300
Bukit Merah	IR	1934	35.2	100
Ringlet	HY	1956	56.0	Nil
Pedu	IR	1972	64.0	Negligible
Muda	IR	1972	25.6	50
Temenggor	HY/FM	1978	152.0	100
Kenering	HY/FM	1983	60.0	100
Kenyir	HY/FM	1985	369.0	500
Pergau	HY			

- ❖ IR - irrigation
- ❖ HY - hydropower
- ❖ FM - flood mitigation

Table 2: Summaries of Water Quality Parameters for Chenderoh Reservoir and the Downstream Area (Ali, 1996)

Water Quality Parameters	Chenderoh Reservoir (1994)	Chenderoh Downstream (1986)
Mean depth (m)	3.7 - 4.0	0.3 - 3.0
Surface current (m/s)	0.3	0.5
Temp. (°C)	26.9 - 29.4	28.0 - 31.0
PH	6.0 - 6.9	6.2 - 7.6
Conductivity (µs/cm)	24 - 66	40 - 70
Dissolved Oxygen (mg/L)	3.9 - 6.7	6.0 - 8.5
Secchi Disk (m)	0.6 - 1.7	-
Total suspended solids (mg/L)	3.3 - 9.3	54 - 134
Ortho-phosphate (mg/L)	0.775	0.01 - 0.069
Nitrate	3.982	0.9 - 1.544

3.0 Capture Fisheries

These reservoirs, which were constructed for hydropower generation, irrigation or flood mitigation, have always contributed towards the inland fisheries of Malaysia. Its contribution towards the total fish landings in Malaysia is poorly documented. Until very recently there were very limited concerted efforts towards the management or monitoring of reservoir and lake fisheries in Malaysia. It is only in the past few years that the importance of studying and monitoring fisheries in the impounded waters was realized.

The contribution and status of the fisheries in there Malaysian reservoirs vary quite a bit. The smaller reservoirs especially those constructed for domestic and industrial water supplies do not support any fisheries. This is a consequence of a policy to prohibit fishing and other activities in the reservoirs so as to ensure the quality of the water.

Some tropical fish exhibit the same migratory breeding behavior as their relatives in temperate countries. Species such as *Helostoma temmincki*, *Leptobarbus hoevenii*, *B. schwanefeldii* and *Thynnichthys vaillanti* are known to migrate during the breeding season that coincides with the flooding of river banks (Christensen 1992). In the upper Perak River, breeding schools of *T. thynnoides* have been observed to migrate in the Rui River system, which is in the upper reaches of the Bersia Reservoir, during the wet season of October to November. Other species reported to migrate during spawning season include *H. macrolepidota*. Lack of knowledge concerning the migratory behavior of tropical fish species has resulted in the construction of dams without facilities for fish to proceed to the breeding grounds beyond. Many local fish populations are on the verge of disappearing from large tropical river systems due to their inability to spawn properly. Thus, further studies are needed to study the migratory behavior and patterns of tropical fish especially in the context of spatial and temporal characteristics of these migratory runs.

In Malaysia, dams not only obstruct the migration of fish but also the migration of the giant freshwater prawn, *Macrobrachium rosenbergi*. This freshwater prawn normally breeds in brackish waters at the estuaries. After metamorphosis they migrate upstream, sometimes a few hundred kilometers inland such as in the upper reaches of the Pahang and Kelantan rivers. In the Perak river system they are only found below the Chenderoh dam.

Not all effects of dams are deleterious, the construction of a dam results in the creation of a reservoir with increase water area for fish production. In most Malaysian reservoirs the increase fish production have benefited the rural population residing near the reservoir, here are problems of overexploitation and use of illegal gears in some reservoirs. In some Malaysian reservoirs environmental problems have significantly reduced fish production and in the case of Ringlet reservoir it has no fisheries production at all.

3.1 First Estimates

Morphoedaphic Index concept and technique was first developed and introduced by Ryther (1965) to estimate fish productivity in Northern Temperate lakes and impoundments. He established the relationship between these temperate lakes where adequate data existed and fish yield. Subsequent to this there were many attempts to use this empirical method as well as others to estimate potential fish yields from impoundments, compelling Ryther *et al.* (1974) to discuss the use and abuse of this method. This empirical method provides an estimate of fishery potentials of lakes and reservoirs especially during the early stages of development.

Morphoedaphic Index formulations vary with climatic zones (Henderson *et al.*, 1973), thus it is essential that the appropriate formula be used. The concept in the MEI methodology is that they provide first estimates of the potential fish yields from impoundment especially new ones where there are very little previous studies on it and no existing fishery to provide details of fish yields. This is most appropriate, as we have seen some very wild projections of potential fish yields by foreign consultants doing EIA's on new dams in this region. These foreign consultants tend to boost the proposed fish production to enhance the value of the proposals. Unfortunately, these are just extreme projections without adequate basis. The morphoedaphic index methodology provides fishery biologist a method to evaluate these wild projections on new reservoirs. They also provide fishery biologist a very quick method to provide rough estimates of potential yield from new reservoirs and the level of fishery infrastructure needed to support the new fishery. This will ensure that there will not be overcapitalization of fishery development, which will be the case if the fishery scientists were to depend exclusively on the EIA of some of these proposals.

For the tropical zone the most appropriate morphoedaphic index formulations are those defined by Henderson & Welcomme (1974) based on data from a large number of tropical lakes and reservoirs. Their formulation states that, the Morphoedaphic Index (MEI), is given by the formula,

$$\text{MEI} = \frac{\text{Conductivity } (\mu \text{ mhos/cm})}{\text{Mean depth (meters)}}$$

Normally, mean depth is obtained by dividing the volume of the lake by its area. The relationship between MEI and potential fish yield is assumed to be characteristic for water bodies, which has similar limnological characteristics. For the tropical zone, the potential fish yield from tropical lakes and reservoirs is given by the relationship,

$$\text{Potential Fish Yield (kg/ha/yr)} = 14.3136 * \text{MEI}^{0.4681}$$

This method provided a simple estimation of potential fish yield, which can be easily accomplished, for most newly impounded reservoirs. Thus based on this relationship we have estimated that the potential fish yield from the Temenggong reservoir is 10 to 20 kg/ha/yr or a potential fish yield of about 150 - 300 tons per year for the entire reservoir. This means a potential daily catch of only 400 - 800 kg of fish per day. Thus the reservoir, while relatively large, with a surface area of 15,000 ha. will not be able to sustain a large fishery.

Other methods of relating fish yields to nutrient status and primary productivity for tropical lakes and reservoirs have been established (Meleck, 1976). Data on primary productivity or detailed analysis of nutrient status of reservoirs are not easily available. Further it is not proven that estimates of potential fish yield based on these methods are more accurate. Thus for most purposes first estimates based on the morphoedaphic index formula is adequate for planning purposes.

3.2 Creel Census

This involves studying the fishing activities within the reservoirs and then observing where they are landed. Then implement creel census at the fish landing sites. This is followed by detailed analysis of some catches where all the fishes are identified, weighed and measured. For example at Temengor Reservoir, most small-scale commercial landings are at Pulau Banding along East-West Highway. Normally information pertaining to the method of fishing and details of fishing gear were obtained from the fishers. This is only part of the daily fish catch within Temengor Reservoir. At the southern end of the reservoir near Pos Kemah some 30 - 40km south of Pulau Banding, there is a large local population of aboriginal inhabitants estimated at about 5,000 individuals. They fish daily for their own consumption as part of their own animal protein requirements. They do not market their catch, yet their daily catch is substantial. It is not easy to implement creel census on this extensive artisanal fishing.

The older large reservoirs, i.e. those constructed before 1972 have supported fairly large artisanal fisheries. Their status is very much different from the newer and much larger reservoir such as Temengor and Kenyir.

The older reservoirs such as Bukit Merah and Chenderoh have supported an artisanal fishery with a large number of participants. At Bukit Merah reservoir a total of 1,000 people from five nearby villages participated in the fishery at its peak during the 1950's and 1960's. Of these only about 100 were active fishers, the rest participated on a part-time basis. These fishers both part-time and full time use non-powered boats with a variety of fishing gears including cast nets, traps and gill nets of various mesh sizes to exploit the fisheries. The common species of fish landed in Bukit Merah reservoir are *Osteocheilus hasselti*, *Cyclocheilichthys apogon*, *Puntius schwanenfeidii*, *Labiobarbus lineatus*, *Channa striatus*, *Mystus nemurus*, *Oxyeleotris marmoratus* and *Wallago attu*.

It has been estimated that at its peak, over 700 metric tons of fish were landed annually. Unfortunately the fisheries in Bukit Merah are faced with problems of over fishing and deterioration the water quality within the reservoir. These problems have significantly reduced the fish stocks in the reservoir. At present there are only about 15 active fishers fishing within the reservoir. Current estimate of the annual fish landing is about 100 tons. The larger fishes are sold immediately in surrounding villages and also the townships of Taiping, Selama and Ijok. Most of the smaller fishes, consisting of *O. hasselti*, *C. apogon* and *P. schwanenfeidii*, are salted and dried before marketing.

A similar fishery exists at the Chenderoh reservoir. This fishery at Tasek Chenderoh supports a larger population from 15 nearby villages. Unlike Bukit Merah reservoir fisher people here use 5 hp. outboard motors to power their boats.

Chenderoh Reservoir supports an artisanal fishery, which is important as a source of supplementary income to the local economy (Ali & Lee 1995). The main modes of catching fish are gill netting using multi-filament nets and cast netting. The main species exploited are *P. bulu*, *T. thynnoides*, *P. schwanefeldii*, *O. melanopleurus*, *O. hasselti*, *Osphronemus goramy* and *C. lopis*. In the late 1980s, the total annual catch and values associated with the fisheries were 25 713 kg and RM 63,179.00 (US\$1.00 - RM2.60), respectively (Ali & Lee 1995).

The fisheries, however, have been declining in importance due to overfishing as well as migration of able-bodied young men to industrial urban areas. In the early 1980's Ajan (1983) reported a total of 60 fishers with an estimated harvest of 79 kg ha⁻¹. In their study, Ali and Lee (1995) identified only 30 full-time fishers in Chenderoh Reservoir with a harvest of 12.2 kg ha⁻¹. Recent studies (Khong 1995) indicated that the number of fishers have declined by almost 50% of the number identified by Ali and Lee (1995), with a concurrent drop in catch to 6.7 kg ha⁻¹ level. Generally, between 8 and 16 species of fish are landed regularly by fishers. Daily catch and daily income per person show tremendous fluctuation. This explains why fishing is essentially a secondary occupation for the littoral communities of Chenderoh Reservoir.

Fishing activities within the Muda, Pedu and Temengor reservoirs are more limited. In the Muda and Pedu reservoirs, fishes such as *B. gonionotus*, *B. schwanefeldii*, *O. gorami*, *H. temmincki* and *P. fasciatus*, dominated the catch. In addition to these fishes, other fishes such as *Tor tambroides*, *H. macrolepidota*, *C. striata* and *O. hasselti* are sometimes caught. Only a few fishers living on the periphery of the reservoir are permitted to participate in these fisheries.

The fisheries in Temengor reservoir support a large population of aboriginal people who live on the periphery of this reservoir, especially at Pos Kemar. Subsistence fishing is mainly carried out in the southern portion of this reservoir. These rural fisher people use small bamboo rafts to fish with hand lines, traps or a small cast net. They only catch their daily dietary requirement. Recently a few fisher people using motorized boats with large gill nets have entered the fisheries at the northern portion of this reservoir.

The fisheries potential in Temengor reservoir have been estimated to be about 15 kg ha⁻¹ yr⁻¹. This reservoir is large with a surface area of 15,000 ha but it is also a fairly deep reservoir with an average depth of about 38 m. Unfortunately the reservoir suffers from problems of eutrophication arising from the impoundment of a very rich tropical rainforest. The area was not logged nor was any vegetation removed prior to impoundment. Currently only the top 7 m is oxygenated, the waters below 7 m are anoxic. This may seriously restrict fisheries development within this reservoir,

The largest reservoir in Malaysia, Lake Kenyir, has a surface area of approximately 36,000 ha, with a maximum depth of 145 m, and a mean depth of 37 m. The reservoir sustains a small-scale commercial fishery as well as a popular recreational fishery, with yields estimated at approximately 20 kg/ha/year (Yusoff *et al.*, 1995). These overall low yields are the result of an anoxic hypolimnion, lack of forage in the pelagic zone and few lacustrine fish species (Yusoff *et al.*, 1995).

3.3 Experimental Fishing

In addition to the creel census, we have carried out very extensive experimental fishing using various types of gear on the majority of the large dams in Malaysia. In these studies we have use traps, electrofishing, and gillnets. The main gear we use is the gillnet of various mesh sizes. Usually we fished with mesh size 2.5 cm, 5.0 cm, 7.5 cm, 10.0 cm and 12.5 cm. The samplings were located on various sampling locations based on the objectives of the study plan. The nets were set at 1800 hr and checked at six hours intervals. All fish caught were separated based on mesh sizes, identified, weighted (g), and measured (standard and total length). For each species caught, 3-5 specimens were preserved in 10% formalin for further identification in the laboratory using standard taxonomic keys.

The main focus of our studies is to define the species diversity of the fishes in each of the dams. In addition we have carried out extensive studies on the ecology and distribution of selected species of fish. Table 3 is a list of the species of fish caught from Chenderoh reservoir, which is one of the oldest reservoirs in Malaysia (Ali, 1996). A total 67 species of fish were caught within the reservoir as oppose to only 37 species caught downstream of the reservoir.

The species diversity of one of the newer inland water bodies, Temenggor reservoir that we have studied, are as shown in Table 4. This table only records the fish diversity from the creel census as well as the catch from gillnet fishing. It does not include the data from the electrofishing experiment, as these fishes were caught from the small streams and tributaries flowing into the reservoir.

A total of 33 species from eight families were caught and identified. Cyprinidae was the dominant taxa (64 %) followed by Channidae and Bagridae, (each 9 %) whereas Belontiidae, Clariidae, Eleotridae, Gobiidae and Sisoridae make up the rest. Being a relatively new reservoir the ecology and distribution of fishes within it is still changing.

3.4 Electro Fishing

In addition to the experimental fishing using traps and fishing nets, we have carried out experimental fishing using electroshockers that have been specially modified for fishing in such soft waters. Initially six small streams (1st & 2nd orders) were selected for studies to determine the biodiversity and abundance of fish as these streams were postulated to be the spawning/breeding ground for several fishes within the reservoir. The streams were divided by segment (pools and riffle), nets were use to block fish from swimming upstream or downstream of the sampling site.

Table 3: Fish Biodiversity in Chenderoh Reservoir, Malaysia. (Ali, 1996)

Species	Downstream	Reservoir
Anabantidae		
<i>Anabas testudineus</i> (Bloch)	+	+
Belontiidae		
<i>Betta pugnax</i> (Cantor)	+	+
<i>Osphronemus goramy</i> (Lacepede)	+	+
<i>Trichogaster trichopterus</i> (Pallas)	-	+
<i>Trichogaster pectoralis</i> (Regan)	-	+
Helostomatidae		
<i>Helostoma temminckii</i> (Cuvier)	+	+
Pristolepidae		
<i>Pristolepis fasciatus</i> (Bleeker)	+	+
Bagridae		
<i>Mystus baramensis</i> (Regan)	+	+
<i>Mystus nemurus</i> (C&V)	+	+
<i>Mystus macronemus</i> (Bleeker)	+	+
<i>Mystus negriceps</i> (C&V)	+	+
<i>Mystus vittatus</i> (Bloch)	+	-
Belonidae		
<i>Xenentodon canciloides</i> (Bleeker)	+	-
Channidae		
<i>Channa lucius</i> (Cuvier)	-	+
<i>Channa maruloides</i> (Bleeker)	-	+
<i>Channa micropeltes</i> (Cuvier)	-	+
<i>Channa striata</i> (Bloch)	+	+
Cyprinidae		
<i>Acrossocheilus deuratus</i> (C&V)	-	+
<i>Aristichthys nobilis</i> (Richardson)	-	+
<i>Barbodes gonionotus</i> (Bleeker)	+	+
<i>Barbodes schwanenfeldii</i> (Bleeker)	+	+
<i>Barbichthys laevis</i> (Valenciennes)	+	-
<i>Oxygaster anomalura</i> van Hasselti/ <i>Chela anomalura</i>	+	+
<i>Ctenopharyngodon idellus</i> (C&V)	-	+
<i>Cyclohelichthys</i> spp.	+	+
<i>Cyclohelichthys heteronema</i> (Bleeker)	-	+
<i>Cyclohelichthys apogon</i> (Valenciennes)	+	+
<i>Hampala macrolepidota</i> Kuhl & van Hassett	+	+
<i>Hypophthalmichthys motitrix</i> (C&V)	-	+
<i>Labiobarbus burmanicus</i> (Day)	-	+
<i>Labiobarbus leptochilus</i> (Valenciennes)	-	+
<i>Labiobarbus lineatus</i> Sauvage	+	+
<i>Labiobarbus sumatrana</i> (Bleeker)	-	+
<i>Leptobarbus hoevenii</i> (Bleeker)	-	+
<i>Mystacholeucas marginatus</i> (Valenciennes)	+	+
<i>Neolissochilus hexagonolepis</i> (M'Clelland)	-	+
<i>Osteochilus hasselti</i> (Valenciennes)	+	+
<i>Osteochilus melanopleurus</i> (Bleeker)	-	+
<i>Osteochilus vittatus</i> (C&V)	+	+
<i>Probarbus jullieni</i> Sauvage	-	+

<i>Puntioptites bulu</i> (Bleeker)	+	+
<i>Puntius binotatus</i> (Valenciennes)	-	+
<i>Puntius daruphani</i> Smith	+	+
<i>Puntius partipentazona</i> (Fowler)	-	+
<i>Rasbora dusonensis</i> (Bleeker)	-	+
<i>Rasbora einthovenii</i> (Bleeker)	+	+
<i>Rasbora myersi</i> Brittan	-	+
<i>Rasbora cf sumatrana</i> (Bleeker)	+	+
<i>Thynnichthys thynnoides</i> (Bleeker)	+	+
<i>Tor tambra</i> (Valenciennes)	-	+
<i>Neolissochilus soroides</i> (Duncker)	-	+
Cichlidae		
<i>Oreochromis mossambicus</i> (Peters)	-	+
<i>Oreochromis niloticus</i> (L)	-	+
Clariidae		
<i>Clarias batrachus</i> (L)	+	+
<i>Clarias macrocephalus</i> Guthrie	-	+
Eleotridae		
<i>Oxyeleotris marmorata</i> Bleeker	-	+
Gobiidae		
<i>Glossogobius giuris</i> (Hamilton)	+	+
Hemiramphidae		
<i>Hemiranphus pogognathus</i> (Bleeker)	+	-
<i>Dermogenys pussilla</i> van Hasselti	+	+
Mastacembelidae		
<i>Mastacembelus armatus</i> (Lacepede)	-	+
<i>Mastacembelus erythrotaenia</i> Bleeker	-	+
<i>Mastacembelus maculatus</i> (Valenciennes)	-	+
<i>Mastacembelus spp.</i>	+	+
Notopteridae		
<i>Chitala lopis</i> (Bleeker)	+	+
<i>Notopterus notopterus</i> (Pallas)	+	+
Siluridae		
<i>Ompok bimaculatus</i> (Bloch)	+	+
Synbranchidae		
<i>Monopterus albus</i> Zuiew	+	+
Pangasiidae		
<i>Pangasius micronemus</i> Bleeker	-	+
<i>Pangasius sutchi</i> (Hamilton)	-	+
Tetraodontidae		
<i>Tetraodon leiurus</i> Bleeker	+	-
Total	37	67

Note: + present; - absent

Table 4: Fish Biodiversity in Temengor Reservoir, Malaysia.

Species	Reservoir
Belontiidae	
<i>Osphronemus goramy</i> (Lacepede)	+
Bagridae	
<i>Mystus nemurus</i> (C&V)	+
<i>Mystus macronemus</i> (Bleeker)/ <i>Mystus nigriceps</i> (C&V)	+
<i>Mystus planiceps</i> (Val.)	+
Channidae	
<i>Channa micropeltes</i> (Cuvier)	+
<i>Channa striata</i> (Bloch)	+
<i>Channa lucius</i> (Bleeker)	+
Cyprinidae	
<i>Barbodes schwanenfeldii</i> (Bleeker)	+
<i>Barbichthys laevis</i> (Bleeker)	+
<i>Balantochelilus melanopterus</i> (Bleeker)	+
<i>Oxygaster anomalura</i> van Hasselt/ <i>Chela anomalura</i>	+
<i>Cyclochelichthys heteronema</i> (Bleeker)	+
<i>Cyclochelichthys apogon</i> (Valenciennes)	+
<i>Danio regia</i>	+
<i>Hampala macrolepidota</i> Kuhl & van Hassett	+
<i>Luciosoma trinema</i> (Val.)	+
<i>Labiobarbus lineatus</i> (Sauvage)	+
<i>Lobocheilus rhabdoura</i> (Fowler)	+
<i>Macrochirichthys macrochirus</i> (Cuv. & Val.)	+
<i>Mystacholeucas marginatus</i> (Valenciennes)	+
<i>Neolissochilus hexagonolepis</i> (M'Clelland)	+
<i>Osteochilus hasselti</i> (Valenciennes)	+
<i>Puntioptites bulu</i> (Bleeker)	+
<i>Puntius daruphani</i> Smith	+
<i>Rasbora cf sumatrana</i> (Bleeker)	+
<i>Thynnichthys thynnoides</i> (Bleeker)	+
<i>Tor tambra</i> (Valenciennes)	+
<i>Neolissochilus soroides</i> (Duncker)	+
Clariidae	
<i>Clarias teijsmanni</i> Bleeker	+
Eleotridae	
<i>Oxyeleotris marmoratus</i> (Bleeker)	+
Gobiidae	
<i>Pseudogobiopsis oligactis</i> (Bleeker)	+
Sisoridae	
<i>Glyptothorax major</i> (Boulenger)	+
<i>Glyptothorax platypogonoides</i> (Bleeker)	+

This list does not include fishes that were caught by electrofishing.

A total of 37 species from 14 families were identified during the study (Table 5). The northern part of Temengor Reservoir more diverse compared to the southern part of the reservoir. In this electrofishing experiments many species of fishes were caught and identified which were not present in the creel census as well as the experimental fishing using nets as the sampling gear. These were the smaller species of fish such as *Glyptothorax platypogonoides* and *Pseudogobiopsis olligactis* which were too small to be caught by gillnets. Also all the commercially exploited fish species sampled were juveniles. Thus indicating that these low order streams flowing into the reservoir were indeed important breeding grounds for these species. Further studies are being carried to confirm this finding as well as to determine the seasonal distribution and abundance of these fishes. Also we are extending the studies to include a larger number of streams flowing into the reservoir. Similar studies are being planned for the other reservoirs.

4.0 Acknowledgements

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** Professor Ahyaudin Ali died on 5 July 2003 soon after the initial draft of this paper was completed. We dedicate this paper to him.*

Table 5: Distribution of Fish Species from Six Small Streams at Temengor Reservoir Base on Electrofishing Studies.

Species	S. Enam	S. Telang	S. Rokan	S. Tahain	S. Temin	S. Kaik
<i>Amblyceps mangois</i>	-	+	-	-	+	-
<i>Barbodes schwanenfeldii</i>	+	-	-	-	-	-
<i>Channa gachua</i>	-	+	-	-	-	-
<i>Channa lucius</i>	-	-	+	-	-	-
<i>Channa micropeltes</i>	+	+	-	-	-	+
<i>Channa striatus</i>	+	+	+	+	-	+
<i>Channa maruliodes</i>	-	-	-	-	-	+
<i>Clarias teijsmanii</i>	+	+	-	-	-	+
<i>Cyclocheilichthys apogon</i>	+	-	-	+	+	-
<i>Danio regina</i>	+	+	+	+	+	+
<i>Glyptothorax platypogonoides</i>	-	-	-	+	-	-
<i>Hampala macrolepidota</i>	+	+	+	+	+	+
<i>Labiobarbus cf. lineatus</i>	-	-	-	-	+	-
<i>Lobocheilos cf. rhabdoura</i>	-	-	-	+	-	-
<i>Mastacembelus armatus</i>	-	-	-	+	-	+
<i>Monopterus albus</i>	+	-	+	+	+	-
<i>Mystacoleucus marginatus</i>	+	+	-	+	-	+
<i>Mystus nemurus</i>	-	-	+	-	-	-
<i>Mystus planiceps</i>	-	+	+	+	+	-
<i>Mystus macronema</i>	-	-	-	-	-	+
<i>Nemachilus cf. Fasciatus</i>	-	-	-	+	-	-
<i>Neolissochilus soroides</i>	+	+	+	+	+	-
<i>Osphronemus gouramy</i>	+	+	+	+	+	-
<i>Osteochilus hasseltii</i>	+	+	+	+	+	+
<i>Osteochilus microcephalus</i>	+	-	-	+	-	+
<i>Oxyeleotris marmoratus</i>	-	-	-	+	+	-
<i>Parachela oxygastroides</i>	+	-	+	-	-	-
<i>Poropuntius deauratus</i>	+	+	+	+	+	-
<i>Pristolepis fasciatus</i>	-	-	-	-	-	-
<i>Pseudogobiopsis olligactis</i>	+	+	+	+	+	-
<i>Puntius binotatus</i>	+	+	+	+	+	-
<i>Puntius lateristriga</i>	-	+	-	-	+	-
<i>Rasbora caudimaculata</i>	+	+	-	+	+	-
<i>Rasbora sumatrana</i>	+	+	+	+	+	+
<i>Tetraodon cf. leiurus</i>	-	-	-	+	-	-
<i>Tor tambra</i>	+	+	-	-	-	-
<i>Xenentodon canciloides</i>	+	+	+	+	-	-
Total	21	20	16	23	17	12

Note: + present; - absent

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**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**ALTERNATIVE INFORMATION FOR
SUPPORTING INLAND FISHERIES
MANAGEMENT AND DECISION-MAKING IN
THE SOUTHEAST ASIA**

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ALTERNATIVE INFORMATION FOR SUPPORTING INLAND FISHERIES MANAGEMENT AND DECISION-MAKING IN THE SOUTHEAST ASIA

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1.0 Inland Fisheries in the Southeast Asia

There is an increasing recognition that inland fisheries play an important role for food security and the livelihoods of rural people in the Southeast Asia. Given the situation that there are significant water resources, seasonal inundation and wet rice production, it is natural that people in this region rely on easily accessible aquatic resources for various aspects of livelihoods. Hence fishing and/or collection of aquatic organisms in inland water bodies are commonly observed throughout the region and the vast majority of rural households, regardless of whether they consider themselves as farmers or fishers, engage in some sort of activities to harvest aquatic resources at some sort time of the year. Fish/aquatic organisms of all sizes are utilized with little discard or wastage.

Although people's livelihoods and aquatic resources are seasonally and spatially highly variable, the consumption and sale of products derived from aquatic resource systems are critical to livelihood strategies of rural communities. It is particularly so when people have to cope with vulnerability. Food security is often considered rather narrowly in terms of food staples and does not fully address the complex coping strategies that are crucial to the rural poor. Fish can provide not only crucial food and income to rural communities in times of stress, but also more routinely have an important and often crucial function in the maintenance of nutritional quality in the diet.

In cultural terms, aquatic resources mean more than a mere source of food or income. Traditional fishery products such as fish sauce, fermented fish and fish-based condiments have been important ingredient of people's diet. People in this region are traditionally and culturally attached to such products and these are not easily substituted.

It is in this area that governments and international society are just beginning to appreciate the hidden role of inland fisheries in achieving livelihoods of rural sectors.

2.0 Recent Initiatives

International and regional organizations have recognized the importance of improving the quality of information on inland fisheries and initiated related programs. The Committee on Fisheries has agreed on the strategy for improving information on status and trends of capture fisheries (Strategy-STF). The project for implementation of the Strategy-STF has components on determination of national data requirements for fishery policy making and

management, and development of simple sustainable cost-effective data collection schemes for small-scale fisheries that include fisheries in their scope. The FAO Regional Office for Asia and the Pacific reviewed the current status of inland capture fishery statistics in the Southeast Asia (FAO RAP 2002). A regional project to address the quality of the information on inland fisheries¹ has been developed and waiting for financing. The Mekong River Committee has been conducting Fisheries Programme Component, in which the information on inland fisheries in the Mekong river basin is compiled. The results of the field evaluation of new approaches were presented at an adhoc expert consultation on new approaches for the improvement of inland capture fishery statistics in the Mekong Basin². The Southeast Fisheries Development Center also conducted a regional technical consultation meeting on fishery statistics³ and developed regional guidelines as a reference for improving fishery statistics, which puts special attention to inland and coastal fisheries.

There seems no use of inland fisheries statistics for management and the above two meetings coincidentally stressed the same point, namely the importance of revisiting four basic questions in order to ensure the validity and relevance of national statistical system. These questions are:

- 1) Are inland fishery statistics used for management?
- 2) Why do countries need the inland fisheries statistics? (What are the objectives of collecting information?)
- 3) What are the information requirements to meet these needs? and
- 4) How can data and information be obtained in efficient and cost effective way?

These are highly relevant when considering solutions for problems associated with data and information collection on inland fisheries.

3.0 Difficulties Associated with Data and Information Collection on Inland Fisheries

Information generation on inland fisheries has not been very successful in many countries in this region. FAO RAP 2002 has identified sources of error in the official statistics as well as constraints with existing statistics. It can be said that the poor status of inland fishery statistics is generally attributed to the chronic problems of fishery data and information collection system as a whole, namely a) insufficient budget allocated b) limited number of staff assigned c) lack of training opportunities for fishery officer, d) conflicts with other duties given to the field staff, etc. These problems, which are common in both inland and marine fisheries, are critical and serious enough to undermine the system. However, the unique characteristics of inland fisheries also bring additional challenges to tackle in order that the importance of the sector is properly valued. The first step in improving the quality of data and information on inland fisheries would be to clearly identify and recognize these specific difficulties associated with inland fisheries so

¹ Addressing the Quality of Information on Inland Fisheries (AQUIIF); a regional technical cooperation project

² Ad hoc consultation on new approaches for the improvement of inland capture fishery statistics in the Mekong Basin, 2-5 September 2002, FAO/MRC/ Government of Thailand/ Government of Netherlands

³ The Regional Technical Consultation Meeting on Fishery Statistics, 16-20 June 2003, ASEAN-SEAFDEC

that appropriate strategies can be formulated. The following sections attempt to summarize and categorize these problems.

3.1 Policy Aspects

Policy aspects are mainly concerned with process of improving relevance of fishery data and information.

Lack of Attention/ Prioritization

Inland fisheries are frequently given very little attention and hence low priority in the eyes of governments. This lack of attention/ prioritization probably stems from the fact that inland fisheries are not visible part of income generation and staple food production. Thus the information on aquatic resources use in inland areas is often limited and the quality of that information is very poor. This situation further leads to the absence of proper policy development. There is also possibly a feeling that nothing can be done with inland fisheries and that they cannot generate significant revenue.

Weak Linkage Between Management Objectives and Information Generated

The linkage between data and information currently collected on inland fisheries and policy and management objectives of the fisheries is very weak in many cases. This suggests that national efforts to clarify information requirements specifically for inland fisheries management may be insufficient or that types of data and information collected have been simply adopted from those used for other sub-sectors. The expert consultation on new approaches⁴ identified information needs for inland fisheries management and policy and also reiterated that the information on inland fisheries are often not collected or adequately analyzed. National statistical systems need to provide information which are more relevant to current policies and in particular those that adequately issues of sustainable livelihoods, rural poverty alleviation, the environment and biodiversity.

3.2 Institutional Aspects

Institutional aspects have major influence on how effectively and efficiently the system can collect the data and information

Invalid Framework of the System

Until fairly recently, fishery policies in many countries in the region focused on the increase of gross production or expansion of fisheries sector. National data/ information on collection systems that were designed during the time typically focused on how much could be caught. During this time, little attention was given to inland fisheries. Fishery information systems need to be reviewed when there is a major shift in national policies and priorities. It is necessary to ensure that the system framework as a whole including strategies to collect data and information are still valid and capable of handling current needs for the fishery data and information.

⁴ See footnote 3

Disproportional Allocation of Resources

Given limited human and financial resources available, it is reasonable that governments distribute their resources according to priority areas where “apparent” significance of fisheries is recognized. The “Invisible” nature of inland fisheries may have worked adversely in securing a share of these resources. As a consequence, there are limited numbers of field staff stationed in inland areas assigned with demanding tasks of covering vast inland areas of limited capacity of transportation and communication. This is also a reflection of the low priority given to inland fisheries.

Lack of Training/ Instructions

Data and information collection systems cannot function properly if there are no sufficient competent staffs to run the systems. Field staff, for example, are not supposed to simply collect or compile fishery data from data sources, but they are also expected to critically examine the way data and information are produced and to validate them if the quality of data is questionable. To capably handle such task, not only general knowledge of fishery statistics is required but also complete understanding of fishery practices in the area. At the same time, field staffs need to bear in mind that it is their job to improve the quality of data and information. In this regard, proper instructions and training of staff should be provided in order for the system to effectively function. This aspect is particularly important in the case of inland fisheries where accumulation of practical knowledge and experiences in the field of data and information collection of the sector within the institute is relatively weak.

3.3 Environmental Aspects

Environmental factors are external elements that are beyond the control of fishery officers. The only way to deal with environmental difficulties is to find the best way to cope with them.

Wide Variety of Inland Water Environments

It is known that there are a wide variety of water resources in the region. They range from man-made water bodies such as rice-field, irrigation and navigation channel, canals, dams and ex-ming pool to natural water bodies such as rivers, lakes, floodplains, estuaries and deltas, etc. Regardless of their size and form, they all provide opportunities for exploitation of aquatic resources. Since each type of inland water environment present distinct characteristics, diverse approaches may be required to produce accurate data and information.

Monsoon Climates and High Seasonal Changes

The Southeast Asia region can be characterized as being under influence of monsoon climates, which alternate distinct wet and dry periods and hence cause significant seasonal changes in inland water environments. Biology and ecology of fish and other aquatic species and the ways of people depending on those resources are usually tied closely with these seasonal changes. Ignorance of such seasonality of inland fisheries in data collection strategies can lead to generate biased information.

3.5 Socio-economic and Cultural Aspects

Considerations of the socio-economic and cultural aspects are always essential in order not to overlook important dimensions of rural livelihoods. Fishing and collection of aquatic species are human activities and hence focusing attention on “people” is as important as looking at fish.

Indiscriminate Nature of people’s Participation and Dispersed Activities

Generally, marine resources are not easily accessible except in cases where people harvest them from shore or in very shallow coastal waters. It is essential for the people who wish to exploit marine resources to obtain some sort of mobility to access fishing grounds (fishing boats) and means to extract marine resources (fishing gears) from the sea. In contrast, inland water environments do not always pose such difficulties to fishers in terms of assets requirements. Some inland waters are shallow or narrow enough to access without using boat and aquatic resources can be harvested with very simple methods or gears. Such fact encourages a wide range of people to participate in inland fisheries. Regardless of possession of boats and fishing gears, or age and gender, anyone including women and children can participate in fishing or collection of aquatic resources. In this regard, the data/ information collection system may need to incorporate greater disaggregation of the data in order to provide a clearer picture of the way people engaging in subsistence fisheries and utilizing resources.

“Informal” Nature of Inland Fisheries

Fish or other aquatic species harvested from inland waters contribute more to local or domestic consumption as compared with either marine fisheries or large-scale aquaculture. Production for such subsistent purposes or local consumption is always very difficult to monitor. In the case of marine fisheries, the harvest has to be brought to shore where they are traded or consumed. Marine landing sites are fairly organized as landing facilities are necessary for offloading from the boats. In this sense, areas to monitor are limited to coastal areas (yet they could be still very expensive to deal with). In inland waters, on the other hand, harvest can occur at any place where there are waters and aquatic resources available. Furthermore, they are often consumed or traded within very small local areas. Such localized activities pose additional difficulties in monitoring.

“Farmers” and “Fishers”

There has been a tendency for fishery policy to view fishing as a full-time occupation taking place within a single, well-defined economic sector. Similarly, there was a necessity for statistical purposes to put rural households into certain categories such as agriculture households, livestock households or fishing households. However, it is not always easy to categorize rural livelihoods with clear definitions. People in rural areas would switch, at any time, from their main activity to another if necessity arises. “Fishers” in wet season, for example, become “farmers” or migrant laborers in dry season. This is a natural and reasonable coping strategy to achieve livelihood security. Therefore care should be taken to the fact that any activity with apparent significance at a time can be merely a part of their livelihoods.

3.6 Technical Aspects

Highly Diversified Fishing Methods Used in a Variety of Environments

Numerous types of fishing gears and methods have been developed and used in this region. This could be in response of the people to accommodate wide variety of inland water environments and their seasonal changes. It is often simply beyond national agency's capacity to handle all the variety of fishing gears/methods used in various inland water environments.

Adoption of Inappropriate Methods

Inland fisheries sector has been viewed as insignificant and therefore not many considerations are given in the process of formulating data collection strategies on the sector. As a result, the framework of data collection mainly developed for marine fisheries might have simply been extended to inland areas. It is apparent from problems described above that inland fisheries require special attention and traditional gear-type/boat-size/catch related approaches originally developed for marine fisheries may not always be applicable to inland fisheries.

4.0 Need for New Approaches and Framework for Cooperation

Having recognized all the constraints described above, the next step is to consider practical measures to clarify the situation.

4.1 Breaking the cycle of Inappropriate Knowledge and Low Priority

Inland fisheries are given little attention and low priority in the eyes of governments. This lack of attention/ prioritization is reflected in allocation of financial and human resources and hence data and information collection activities on inland fisheries are seriously inhibited. This resulted in generating very poor quality of information and in some cases non-existence of information. The resulting incomplete understanding of the sector further led to the absence of proper policy development. Here, there is a reinforcement of the situation that lack of proper knowledge and priority and resources. This "self-reinforcing cycle" has probably hindered adequate valuation of inland fisheries for many years. Unless some efforts are made to end this vicious cycle, inland fisheries will continue to be undervalued. Most often, development decisions are made that favor other sectors, such as agriculture or hydroelectric development, at the expense of inland fishery sector. Appropriate attention needs to be directed to this sector at least to the degree that represents their importance in food production and the number of people depending upon the production.

Financial and human resources are scarce in many developing countries and are not easily increased or enhanced in a short-term. It is fair assumption that limitations on those resources would continue to persist for some time. Therefore it would be important to bear in mind when considering strategies to improve the quality of information on inland fisheries that cost-effectiveness and best use of existing data collection mechanisms would be the key aspects of the strategies.

4.2 Indicative Information to Secure Political Attention and Appropriate Policy Support

Measurements of production, effort and number of “fishers” are the basic data, which provide information on the status of the fishery. Their critical weakness is that the collection of these data for inland fisheries may be too expensive and too demanding to monitor when applied for inland fisheries. Therefore, it is necessary to explore the potential of new approaches that would provide alternative information to indicate the importance of inland fisheries. Possible approaches presently in consideration are those relying on proxy indicators or those involving more qualitative aspects of fisheries practices. The use of alternative information is practical when some sort of justifications is needed to draw political attention to persuade relevant authorities to allocate necessary resources. Such an initiative can be regarded as a first step to obtain continued support to the sector. Once relevant authorities are successfully influenced and adequate support for the sector is secured, selection of variables and indicators can be reviewed with provision of additional resources so as to further improve the quality of information.

4.3 Partnership with the Non-fishery Sectors

Because of geographical overlapping with other sectors in the area of activities and the competing use of water resources, which are a common property utilized by multiple users, inland fisheries cannot exist in isolation from other sectors. This inert-related situation often brings problems to inland sector but also provides opportunities in terms of sharing the burden of data and information collection. Fishery authorities may not have to produce the full spectrum of the necessary data by themselves, as relevant data might already be available from other sources. Other governmental agencies, universities, research institutions, aid projects and NGOs are potential data and information sources. In this respect, it is important to establish good partnership with the non-fishery sectors so as to promote the use of existing information and improve the cost-effectiveness in data collection.

4.4 Regional Cooperation for Sharing Information and Division of Labor

Use proxy indicators may offer an opportunity to promote better understanding of the sector. However other problems of the sector, namely the complexity of inland water systems and associated fisheries practices, still remain. It would be a demanding task for national governments to develop appropriate approaches to suite different settings of environments single-handedly. It is therefore, reasonable for countries in this region to take part and help each other in their efforts to improve the quality of information on inland fisheries and share experiences and knowledge.

5.0 New Approaches and Alternative Information

Some examples of new approaches to gain better understanding of inland fisheries are provided below. Detailed explanations on the technical aspects are not described in this paper as they can be found in related publications.

5.1 Use of Agriculture Surveys

It is unfortunate for fisheries authorities that other agencies such as agriculture departments and general statistics offices are usually equipped with more financial and human resources. However, with geographical overlapping in the areas of activities, there are opportunities for inland fisheries sector to take advantage of the agriculture surveys to obtain valuable data on inland fisheries. This can be done by incorporating fishery related questions in the survey framework. One example of the case is to include simple screening questions asking whether the household harvests aquatic resources or not, in agriculture census questionnaires so that the level participation to inland fisheries can be indicated. National censuses have an advantage in that they have comprehensive area coverage with possible complete enumeration and they reach very remote areas of the country, where fisheries officer usually have difficulties to access. The level of participation can be regarded as more indicative variable in terms of describing real features of inland fishery practices as compared to simple counting of number of “fishers”.

The agriculture census that aimed at providing structural information on agriculture sector could also provide comprehensive listings of households engaged in fishing or collection of aquatic resources. Such information can be used as the frame information for further detailed surveys.

5.2 Use of Household Surveys

Household surveys targeting rural areas provide detailed inside views of local communities that rely on inland water resources. Consumption studies as a component of household surveys indicate the level of fishery product consumption in the area, which will then be used for estimation of regional and national consumption of aquatic resources. This information is useful to validate national fishery production figures. Income and expenditure studies also provide useful information for the purpose of indicating people’s dependence on inland fisheries as well as estimation of fishery production.

5.3 Livelihoods Approaches

Increasing attention has been recently given on issues of sustainable livelihoods, rural poverty alleviation, the environment and biodiversity. Inland fisheries in this region are highly relevant to these issues. Hence the necessity arises for the data and information collection systems to incorporate more qualitative aspects of fisheries practices. Livelihoods approaches provide a framework to view inland fisheries within a wider context of rural livelihoods that usually interact actively with various non-fishery factors.

5.4 Participatory and Co-management Approaches

The framework of co-management or community-based management can help producing quality data on various dimensions of community activities. In co-management arrangement, local communities as the users of aquatic resources take charge of management of their resources. With this arrangement, communities can be more motivated to understand the status of their resources and the critical factors affecting their livelihoods strategies. Therefore it would be worthwhile to explore the possibility of

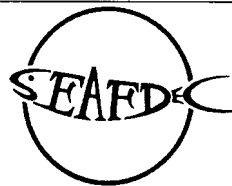
incorporating the data collection mechanism into the framework of co-management. Structural advantage that “producers” of the data are the “user” of the information is expected to contribute to improve the quality (e.g. accuracy and relevance) of the data and information and to widen the scope of information generated. Furthermore, this approach can be highly cost-effective and timely in producing necessary data since it will require less government staff both in terms of number of staff and frequency of their field visits. Government officers will not necessarily engage in data collection directly by themselves but simply request and assist communities to collect and process data and provide them to authorities periodically.

6.0 Conclusions

Data and information collection on inland fisheries has a long list of problems and there is a self-reinforcing cycle of unfavorable situations that hinders the system to produce quality information. The use of alternative information is expected to provide a breakthrough to the situation. Conventional sector specific approaches are found to have limitations when applied to inland fisheries. New approaches that intend to involve proxy indicators and more qualitative aspects of inland fisheries are very much needed. These approaches even have potential to evolve into more integrated way of collecting data and information on the rural livelihoods in the future.

The alternative information can be valued in the sense that they can be produced in a cost effective manner by utilizing existing systems and frameworks readily available and that they can be reliable enough to draw initial political attention to the sector and persuade relevant authorities to allocate necessary resources. Yet generation of alternative information will not be an easy task. Significant efforts still need to be inserted to accumulate experiences and knowledge as to how best to generate this information. In doing so, cooperation with the non-fishery organizations as well as cooperation between countries that share similar inland water environments becomes paramount importance. Frequent communications and mutual consultations are also needed for this purpose.

It should be mentioned that recently agreed Strategy-STF provide a good opportunity for the countries to initiate a move in improving the quality of inland fishery information with the provisions of technical and financial supports by the project. It would be recommended that countries make good use of such opportunity.



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

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**REGIONAL DATABASE SYSTEM AND GIS
FOR INFORMATION GATHERING OF
INLAND CAPTURE FISHERIES**

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REGIONAL DATABASE SYSTEM AND GIS FOR INFORMATION GATHERING OF INLAND CAPTURE FISHERIES

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1.0 Introduction

In present, fishery management tends to be more attractive and widely open in fishery research. Mostly fishery researches provide the information in biological, environmental and socio-economical studies. In Southeast Asian Region, there are many researches on inland capture fisheries, however these information are still not in record gradually and rarely available. Therefore, the gathering information in inland capture fishery becomes more importance and necessary. Developing of regional database system of collected information in inland capture fisheries is one of the most important mechanisms in order to provide the skeleton for more systematic collection of such information. In addition, to know the status and trend of inland capture fisheries information, of which is a key to sound policy-making and management.

Application of Geographical Information System (GIS) for inland capture fisheries is a tool to help in analysis and present the results from complicated information as visualized mapping information of which can reflect exactly the perception of users.

2.0 System Analysis

Generally, in inland capture fishery, researchers have attention in four main information namely: fisheries information, biological information, environmental conditions and socio-economic information. For fisheries information, the main components are fishery species, inland water area, fishing gear and landing. All above are related by some relations, which is shown in Figure 1.

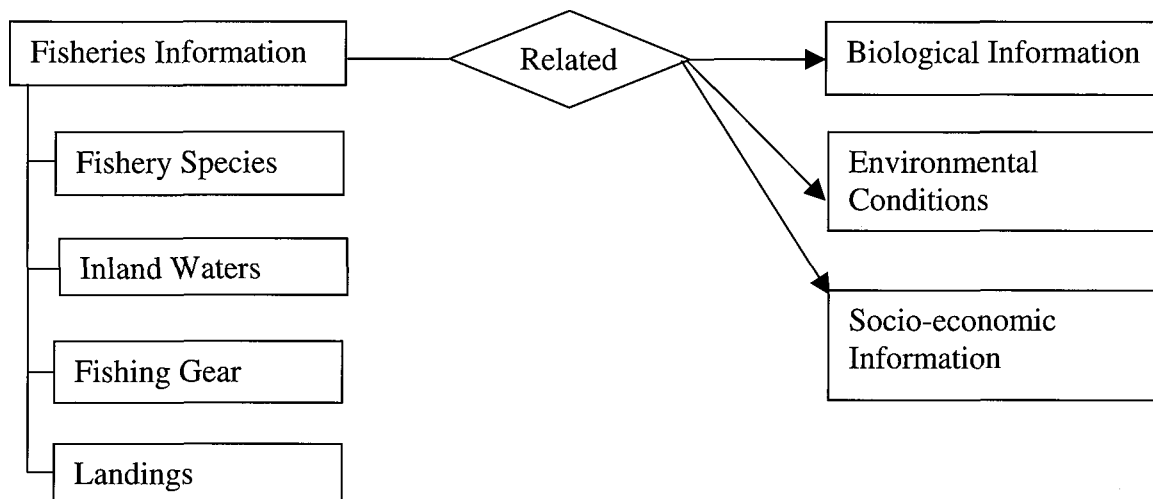


Figure 1: The skeleton of regional database system for Inland Capture Fisheries.

- **Fishery Species:** defines details and information of each fishery species.
- **Inland Waters:** defines details and information of each Inland water resources. (Lakes, Rivers, Reservoirs/dam, Swamps)
- **Fishing Gear:** defines details and information of each fishing gear.
- **Landing:** defines community, market, fish species, quantity and value of each landing place.

3.0 System Design

3.1 Fisheries Information

The data in inland capture fishery will be stored in database as tables. Each table is consisted of details and information for one type of Inland data called 'Entity' as:

- **Fishery_species**(*fish_code*, common_name, family_name, sub_family, order, class, weight, length, bmp_file)
- **Land/Area**(*land_id*, definition, country_reference)
- **Water_type**(*id*, definition)
- **Inland_water**(*inlandwater_id*, watertype_reference, definition, environmental_condition¹)
- **Market**(*market id*, definition, country_reference)
- **Gear**(*gearcode*, definition, bmp_file, remark)
- **Community**(*community_id*, definition)

And these tables represent the relations between/among Entities as;

a. Fish_habitat(*inlandwater_id, fish_code, biology_information*²)

This table is represented a relation between Fishery species and Inland water areas. For example, one fishery species belongs to one Inland water area or many, and in despite, one Inland water area is consisted of one fishery species or many also. Therefore, there is a relation between these two entities, Fishery species and Inland water; which specifies which types of fishery species belong in Inland water area in which types and where. The relation is shown as in Figure 2.

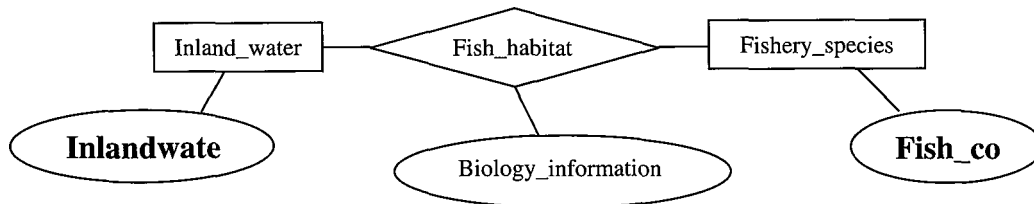


Figure 2: Relation between Inland_water and Fisheries_species entities

b. Water_land (*inlandwater_id, land_id, waterland_id*)

This table is represented a relation between Inland water areas and Land/Area. In one Land/Area may be consisted of one Inland water area or many, in despite, also. Land/Area could be province, district or any kinds of land areas and Inland water area could be lake, river, reservoir/dam or swamp. The relation is shown as Figure 3.

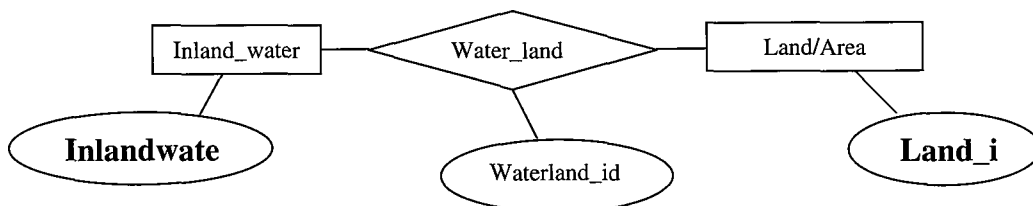


Figure 3: Relation between Inland_water and Land/Area entities.

c. Inland_community (*community_id, waterland_id, socio-economic_information*³)

This table is represented a relation between Community and waterland area. For example, one community exists one or many waterland area, one or many types of Inland water area and one or many Land/Area; and one waterland area may belong to one community or many. Therefore, this relation could specify which community exists which types and which waterland area, including how socio-economic management is. The relation is shown as Figure 4.

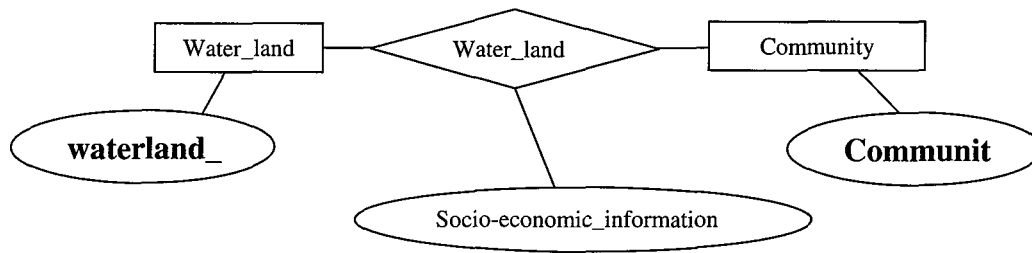


Figure 4: Relation between Water_land and Community entities

d. Landing (*community_id, fish_code, market_id, quantity, value*)

This table is represented a relation among Community, Fishery species and Market place. For example, one community exists one or many market place(s) and one market place sells one fishery species or many species, and as the same way, one fishery species may be sold in one community or many communities. Hence, these three entities could specify which market in which community sells fishery specie in which in how many quantities and how much in value as a relation. The relation is shown as Figure 5.

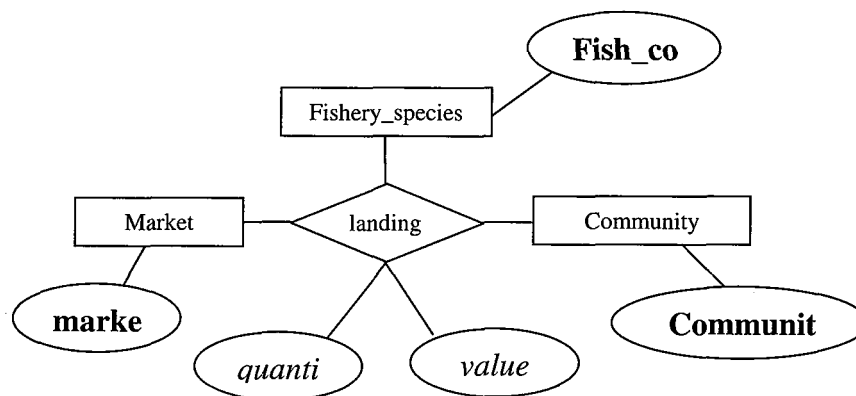


Figure 5: Relation among Market, Fisheries_species and Community entities.

e. Capture (*waterland_id, fish_code, gearcode*)

This table is represented a relation among Water_land, Fishery species and Fishing Gear. For example, in one water_land, which is a relation between Inland water areas and Land/Area; exists one fishery specie or many and the fishery specie(s) is caught by one or many types of gears. Therefore, this relation could specify which fishery species are caught by which types of gears in where and which types of water_land area. The relation is shown as in Figure 6.

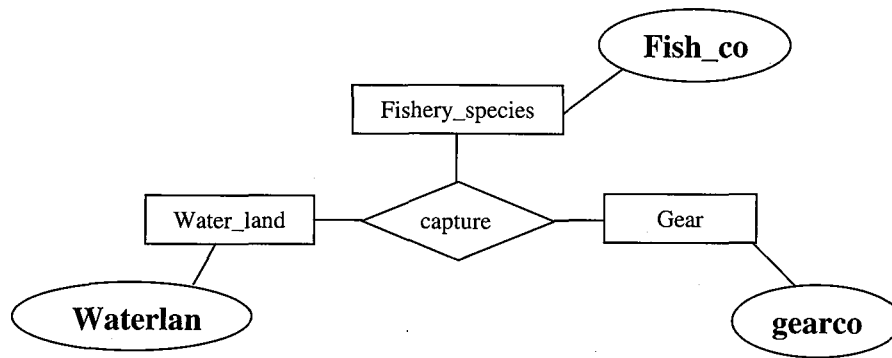


Figure 6: Relation among Water_land, Fisheries_species and Gear entities.

3.2 Environmental Conditions

The parameters are:

Physical: water_depth, water_current- (speed, direction), conductivity, turbidity, alkalinity, hardness, water temperature, air temperature, sediment, temperature, rainfall, etc.

Chemical: Phosphate, Nitrate, Nitrite, Ammonia, Ferric, Dissolved Oxygen, Silicate, etc.

Biological: Chlorophyll, plankton, larvae, benthos, sediments, organic matter, etc.

3.3 Biological Information

Biological information is data such as development, stomach contents, habitat, distribution, sex ratio, etc.

3.4 Socio-economic Information

Examples of data are amount of household in community, race, age group, culture, etc.

4.0 Data Requirements for GIS

Basic data requirements for GIS of Inland Capture Fisheries in the ASEAN region are tabulated in Tables 1 (Brunei Darussalam), Table 2 (Cambodia), Table 3 (Indonesia), Table 4 (Lao PDR), Table 5 (Malaysia), Table 6 (Myanmar), Table 7 (Phillippines), Table 8 (Thailand) and Table 9 (Viet Nam).

Table 1: Check List of Important Rivers and Reservoir/ Dam/Lake in Brunei Darussalam.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Sungai Temburong					
2.	Sungai Pandaruan					
3.	Sungai Tutong					
4.	Sungai Belait					
	<u>Reservoir and Dam</u>					
1.	Tasek Reservoir*					
2.	Benutan Dam*					
	<u>Lake</u>					
1.	Laboi Lake*					
2.	Pedu Lake*					
3.	Tasek Merimbun Lake*					

Table 2: Check List of Important Rivers and Reservoir/ Dam/Lake in Cambodia.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Sreng					
2.	Svaychek					
3.	Sanker					
4.	Pouthisat					
5.	Sen					
6.	Chinit					
7.	Thnot					
8.	Mekong					
9.	Kong					
10.	Sanker					
11.	Srepok					
12.	Chbar					
13.	Te					
14.	Tonle Sap					
	<u>Reservoir and Dam</u>					
1.	Prek Thnot Dam*					
2.	Kamchay*					
3.	Sambor Dam*					
4.	Ochum Dam*					
	<u>Lake</u>					
1.	Tonle Sap					
2.	West Barai Lake*					
3.	Lak Lake*					

Table 3: Check List of Important Rivers and Reservoir/ Dam/Lake in Indonesia.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Woyla					
2.	Tripa					
3.	Alas					
4.	Asahan					
5.	Rokan					
6.	Mandau					
7.	Siak					
8.	Kampar					
9.	Inderagiri					
10.	Hari					
11.	Tembesi					
12.	Musi					
13.	Mesuji					
14.	Tulangbawang					
15.	Landak					
16.	Kapuas					
17.	Pawan					
18.	Jelai					
19.	Pembuang					
20.	Seruyan					
21.	Melawi					
22.	Sampit					
23.	Katingan					
24.	Kahayan					
25.	Kapuas					
26.	Barito					
27.	Teweh					
28.	Murung					
29..	Mahakam					
30.	Belayan					
31.	Kutai					
32.	Telen					
33.	Kelai					
34.	Kayan					
35.	Iwan					
36.	Bahau					
37.	Sembakung					
38.	Lariang					

39.	Palu					
40.	Karama					
41.	Bangka					
42.	Lalindu					
43.	Lasolo					
44.	Apu					
45.	Kais					
46.	Timbuni					
47.	Siriwo					
48.	Wapoga					
49.	Uta					
50.	Derewo					
51.	Mamberamo					
52.	Tariku					
53.	Van Daalen					
54.	Tor					
55.	Taritata					
56.	Sobger					
57.	Cemara					
58.	Northwest					
59.	Unir					
60.	Baliem					
61.	Palua					
62.	Mapi					
63.	Digul					
64.	Uwimmerah					
65.	Bian					
66.	Merauke					
67.	Jatiluhur*					
	<u>Reservoir and Dam</u>					
1.	Balambano Dam*					
2.	The Wonogiri Multipurpose Dam Reservoir*					
3.	PLTA Kotopanjang*					
4.	PLTA Poso-3 Hydro Dam*					
	<u>Lake</u>					
1.	Danau Lout Tawar					
2.	Danau Toba					
3.	Danau Singkarak					
4.	Danau Kerinci					
5.	Danau Ranau					
6.	Danau Jempang					
7.	Danau Poso					

Table 4: Check List of Important Rivers and Reservoir/ Dam/Lake in Lao PDR.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Tha					
2.	Ou					
3.	Xeng					
4.	Khan					
5.	Ngum					
6.	Nuen					
7.	Ngiep					
8.	Theun					
9.	Kong					
10.	Bang Fai					
11.	Bang Hieng					
12.	Done					
13.	Tale*					
14.	Nam Ma*					
15.	Nam Mat*					
16.	Nam Xa*					
17.	Nam Luang*					
18.	Nam Mo*					
	<u>Reservoir and Dam</u>					
1.	Nam Ngum Dam					
2.	Nam Mouan Dam*					
3.	Nam Ou Dam*					
4.	Nam Hai Dam*					
5.	Nam Ngiep Dam*					
6.	Nam Theun Dam*					
7.	Nam Tha Dam*					
8.	Nam Theun Hinboun Dam*					
9.	Nam Suang Dam*					
10.	Nam Khan Dam*					
11.	Nam Cha Dam*					
12.	Nam Kong Dam*					
13.	Nam Lik Dam*					
14.	Nam Sane Dam*					
15.	Nam Ting Dam*					
16.	Nam Leuk Dam*					
17.	Nam Beng Dam*					
18.	Nam Mang Dam*					

19.	Nam Ko Dam*					
20.	Nam Noua Dam*					
21.	Houay Ho Dam*					
22.	Huay Lamphanh Dam*					
23.	Keng Wek Dam*					
24.	Sebangfai Dam*					
25.	Sebanghieng Dam*					
26.	Sebangnouane Dam*					
27.	Sedone Dam*					
28.	Sekaman Dam*					
29.	Sekong Dam*					
30.	Selabam Dam*					
31.	Senamnoy Dam*					
32.	Sepone Dam*					
33.	Sexou Dam*					
34.	Xeset Dam*					
	Lake					
1.	Nong Chanh Marsh Lake*					

Table 5: Check List of Important Rivers and Reservoir/ Dam/Lake in Malaysia.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	Rivers					
1.	Perak					
2.	Kelantan					
3.	Pahang					
4.	Rajang					
5.	Batang Baleh					
6.	Batang Baram					
7.	Sungai Tinjar					
8.	Sungai Tutoh					
9.	Sungai Limbang					
10.	Batang Trusan					
11.	Sugat					
12.	Lupar Batang*					
13.	Nenggiri*					
14.	Sungai Batu Pahat*					
15.	Lemanak*					
16.	Skrang*					
17.	Terengganu*					
18.	Dungun*					
19.	Endau*					
20.	Sedili*					
	Reservoir and Dam					
1.	Kenyir Reservoir*					
2.	Bakun Dam*					
3.	Chenderah Reservoir*					
4.	Talang Dam*					
5.	Pahang Dam*					
	Lake					
1.	Tasek Kenyir lake*					
2.	Pedu Lake*					
3.	Ulu Lepar Lake*					
4.	Tasek Bera Lake*					
5.	Tasek Chini Lake*					
6.	Tasek Temenggor Lake*					
7.	Biru Kundang Lake*					
8.	Taipung Lake*					
9.	Ayer Keroh Lake*					

10.	Tasek Melati*					
11.	Tasek Timah-Tasoh*					
12.	Tasek Raban*					

Table 6: Check List of Important Rivers and Reservoir/ Dam/Lake in Myanmar.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Nmai					
2.	Mali					
3.	Uyu					
4.	Chindwin					
5.	Shweli					
6.	Manipur					
7.	Myittha					
8.	Mu					
9.	Tu					
10.	Pang					
11.	Nam Hka					
12.	Mon					
13.	Kaladan					
14.	Irrawaddy (Ayeyarwady)					
15.	Sittang (Sittoung)					
16.	Pilu					
17.	Teng					
18.	Salween (Thanlwin)					
19.	Great Tenasserim					
20.	MeKong					
	<u>Reservoir and Dam</u>					
1.	Nyaugyat (Kinda) Dam*					
2.	Yeywa Dam*					
3.	Bilin Dam*					
4.	Paunglaung Dam*					
5.	Ta Sang Dam*					
	<u>Lake</u>					
1.	Indawgyi lake					
2.	Inle lake					

Table 7: Check List of Important Rivers and Reservoir/ Dam/Lake in Philippines.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Cagayan					
2.	Agusan					
3.	Pampanga*					
4.	Agno*					
5.	Mindanao*					
	<u>Reservoir and Dam</u>					
1.	San Roque Dam*					
2.	Ambuklao Dam*					
3.	Masiway Dam*					
4.	Pantabangan Dam*					
5.	Binga Dam*					
6.	Sibuguey Dam*					
7.	Manangga Hydro Dam*					
8.	Matuno Dam*					
9.	Panay River Dam*					
10.	Angat Dam*					
11.	Palangui IV Dam*					
12.	Magat Dam*					
13.	La Mesa Dam*					
14.	Ipo Dam*					
15.	Agus Dam*					
	<u>Lake</u>					
1.	Laguna de Bay					
2.	Lake Taal					
3.	Naujan Lake					
4.	Bato Lake*					
5.	Lanao Lake*					
6.	Lake Sebu*					
7.	Caliraya Lake*					
8.	Lake Buhi*					
9.	Mainit*					
10.	Pinatubo*					

Table 8: Check List of Important Rivers and Reservoir/ Dam/Lake in Thailand.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Chao Phraya River					
2.	Sa Kae Krang River					
3.	Pasak River					
4.	Noi River					
5.	Lop Buri River					
6.	Mae Klong River					
7.	Khwaе Yai River					
8.	Khwaе Noi River					
9.	Tha Chin River					
10.	Phetburi River					
11.	Pran Buri River					
12.	Ping River					
13.	Wang River					
14.	Yom River					
15.	Nan River					
16.	Kok River					
17.	Sala Win River					
18.	Nam Mae Tun					
19.	Moei River					
20.	Kong River					
21.	Chi River					
22.	Mun River					
23.	Lam Ta Khong					
24.	Ta Pi River					
25.	Pat Tani River					
26.	Bang Nara River					
27.	Ko Lok River					
28.	Khlong Phum Duang					
29.	Bang Pa Kong River					
30.	Pra Chin Buri River					
31.	Nakhon Nayok River					
	<u>Reservoir and Dam</u>					
1.	Ban Phu Reservoir					
2.	Bung Don Wai Reservoir					
3.	Bung Katon Reservoir					
4.	Huai Chan Reservoir					
5.	Huai Chorakhe Mak Reservoir					

6.	Huai Khem Reservoir					
7.	Huai Kho Reservoir					
8.	Huai Kut Daeng Reservoir					
9.	Huai Mekha Reservoir					
10.	Huai Raeng Reservoir					
11.	Huai Nong Han Reservoir					
12.	Huai Sai Reservoir					
13.	Huai Saneng Reservoir					
14.	Huai Sap Reservoir					
15.	Huai Sawai Reservoir					
16.	Huai Seg Reservoir					
17.	Huai Som Hong Reservoir					
18.	Huai Talat Reservoir					
19.	Huai Som Poi Reservoir					
20.	Huai Yai Reservoir					
21.	Kaset Reservoir					
22.	Khok Sa Kat Reservoir					
23.	Khok Thom Reservoir					
24.	Krathiam Reservoir					
25.	Kut Sang Reservoir					
26.	Lam Pratiap Reservoir					
27.	Lam Dom Noi Reservoir					
28.	Lam Nang Rong Reservoir					
29.	Lam Phok Reservoir					
30.	Lam Chamuak Reservoir					
31.	Sinaxharin Reservoir					
32.	Krasieo Reservoir					
33.	Huai Thian Reservoir					
34.	Kaeng Krachan Reservoir					
35.	Khlong Som Poi Reservoir					
36.	Huai Chan Reservoir					
37.	Tha Krabak Reservoir					
38.	Angkepnam Nong Nam Khieo					
39.	Angkepnam Bung Phra					
40.	Map Prachan Reservoir					
41.	Huai Dok Krai Reservoir					
42.	Khlong Bang Phai Reservoir					
43.	Ampun Reservoir					
44.	Angkepnam Bang Phuan					
45.	Angkepnam Huai Kan Luang					
46.	Angkepnam Bung Aram					
47.	Angkepnam Huai Aeng					
48.	Angkepnam Huai Kham Pla Khao					
49.	Angkepnam Huai Pho					

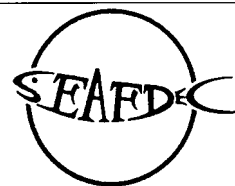
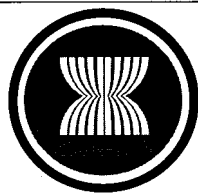
50.	Angkepnam Kaeng Loeng Chan				
51.	Angkepnam Lam pao				
52.	Angkepnam Lam Sam Lai				
53.	Angkepnam Nam Phar				
54.	Angkepnam Nam Phung				
55.	Angkepnam Nong On				
56.	Angkepnam Phong				
57.	Angkepnam Phuttha Utthayan				
58.	Angkepnam Soa Nam Khao				
59.	Ban Ko Kaeo Reservoir				
60.	Ban Khok Yang Reservoir				
61.	Nam Phrom Reservoir				
62.	Nam Un Reservoir				
63.	Nong Fa Reservoir				
64.	Nong Hai Reservoir				
65.	Nong Han Kumphawapi				
66.	Nong Hi Reservoir				
67.	Nong Khaen Reservoir				
68.	Nong Kraman Reservoir				
69.	Nong Lao Hin Reservoir				
70.	Nong Luang Reservoir				
71.	Nong Phu Reservoir				
72.	Nong Sam Nga Reservoir				
73.	Nong Sang Yai Reservoir				
74.	Nong Si Reservoir				
75.	Nong Song Hong Reservoir				
76.	Nong Thalok Reservoir				
77.	Nong Yat Reservoir				
78.	Phu Phek Reservoir				
79.	Ta Kao Reservoir				
80.	Ta Mai Reservoir				
81.	Tha Chok Reservoir				
82.	Thung Kraten Reservoir				
83.	Wang Hin Reservoir				
84.	Kwan Phayao				
85.	Sirikit Reservoir				
86.	Bhuamibol Reservoir				
87.	Bung Boraphet				
88.	Angkebnam Bang Lang				
89.	Lam Phra Phloeng Dam				
90.	Lam Takhong Dam				
91.	Ratchaprapha Dam				
92.	Ubonrat Reservoir				
93.	Kaeng Sua Ten Dam*				

94.	Klong Ta Lew, Klong Ta Rong Dam*					
95.	Lam Dom Yai Dam*					
96.	Mae wong Dam*					
97.	Phong Khut Phet Dam*					
98.	Tasae Dam*					
99.	Pak Mun Dam*					
	Lake					
1.	Songkhla lake					

Table 9: Check List of Important Rivers and Reservoir/ Dam/Lake in Viet Nam.

No.	Name	Location/ Position	Area (unit)	Province/ State	Any Landings	Available map (y/n)
	<u>Rivers</u>					
1.	Gam					
2.	Lo					
3.	Hong					
4.	Da					
5.	Ma					
6.	Chu					
7.	Ca					
8.	Se San					
9.	Ba					
10.	Sai Gon					
11.	Dong Nai					
12.	Tien Giang					
13.	Hau Giang					
	<u>Reservoir and Dam</u>					
1.	Hoa Binh Dam*					
2.	Yali Falls Dam*					
3.	Son La Dam*					
4.	Can Don Dam*					
5.	Dai Ninh Dam*					
6.	Dai Thi Dam*					
7.	Dong Nai Hydropower Project*					
8.	Pleikrong Dam*					
9.	Rao Quan Dam*					
10.	Se San Dam*					
11.	Ta Trach Dam*					
12.	Thuong Kontum Dam*					
13.	Upper Easup Dam*					
14.	Cam Son Dam*					
15.	Thac Ba Dam*					
16.	Dau Tieng Dam*					
17.	Tri An Dam*					
	<u>Lake</u>					
1.	Babe Lake*					
2.	Ho-Tay (West) Lake*					
3.	Ho Tri An*					
4.	Ho Dau Tieng*					

5.	Ho Song Da*					
6.	Ho Thac Ba*					
7.	Ho Kiem*					



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

FORMAT OF PILOT PROJECT PROPOSAL

MAHYAM MOHAMMAD ISA

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

FORMAT OF PILOT PROJECT PROPOSAL

Title

Habitat: *Please state type of habitat: e.g. Riverine System, Lakes, Reservoir, and Flooplains*

Duration: From to

1.0 Background and Rationale

2.0 Goals

3.0 Objectives

4.0 Projects Activities

5.0 Materials and Methods

5.1 Proposed Project Site

5.2 Methods in Data Collection

5.2.1 Primary Data Collection/ Scientific Data Collection

5.2.2 Secondary Data Collection

5.3 Data to be Collected

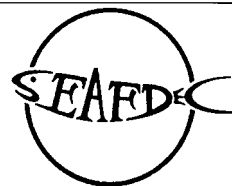
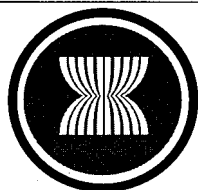
6.0 Envisaged Outputs

7.0 Proposed Activities and Budget Requirement for 2003

Source of Funding from Government of Malaysia:

8.0 Project Team Members

9.0 Project Schedule for 2003



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF CAMBODIA**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Cambodia

Title:

Biodiversity, Fishery and Socio Economic of Fisheries in Stung Treng Province, Cambodia

Habitat: Riverine System

Duration: From September 2003 to December 2004

1.0 Background and Rationale

Fish and its fisheries are well recognized as a source of food, provide employment and subsistent family livelihood. Fish is an important source of protein and is embedded in our Asian culture since ancient time. Fish is a popular food such as fermented fish (prahoc, and phaoc) smoked fish, dry salted fish, and eaten fresh. Fish represents about 70% of all animal protein. Fish and its fisheries also provide job opportunity to people, not only the direct job like fishing, but also other fisheries-related activities such as netting, making fishing gears, and selling fish. Fish and fisheries help improving family economy for many rural farmers and fishers. According to the population census in 1995, about 84% of the Cambodian people live in rural area and most of them are farmers. The socio-economic household survey in 1995/96 which was conducted only in central Cambodia show that many farmers, are also fishers, either part time or full time for subsistent family economy. Fishing fee from commercial fisheries is contributed to the government revenue. The fee from the fisheries is defined through bidding process. About USD one million each year goes to the government revenue.

According to its distinct characteristics of fish biodiversity in Stung Treng Province, the area is selected for paying special attention and to carry out research on Biodiversity, Fishery and Socio economic of fisheries, where the detail understanding of fish species diversity in Stung Treng Province is still not known. Understanding of status of the fish resources in the area will be of great value for the sustainable management and conservation of fish resources in Cambodia and in the Mekong River Basin. Therefore, the research study on fisheries at the site is essential and necessary to be carried out for planning for an option for a proper management of fisheries for sustainable development on the inland fisheries resources.

2.0 Goals

- a) To collect and compile as much information on biodiversities, fishery, and socio-economic of fishers living in Stung Treng Province, Cambodia.
- b) To use information collected as foundation for considering development and management plan for sustainable fisheries resources in the floodplain river of Cambodia.

3.0 Objectives

- a) To collect and compile information on inland capture fishery, and socio-economic of fishers living in Stung Treng Province (Figure 1), Cambodia.
- b) To collect detail information on species diversity, and commercial species in Stung Treng Province and to determine status of inland capture fisheries resources, fishing effort and fishing gears used, fish abundance and distribution of fishes/larvae in rivers, Stung Treng Province.
- c) To compile information on inland fishing gears.

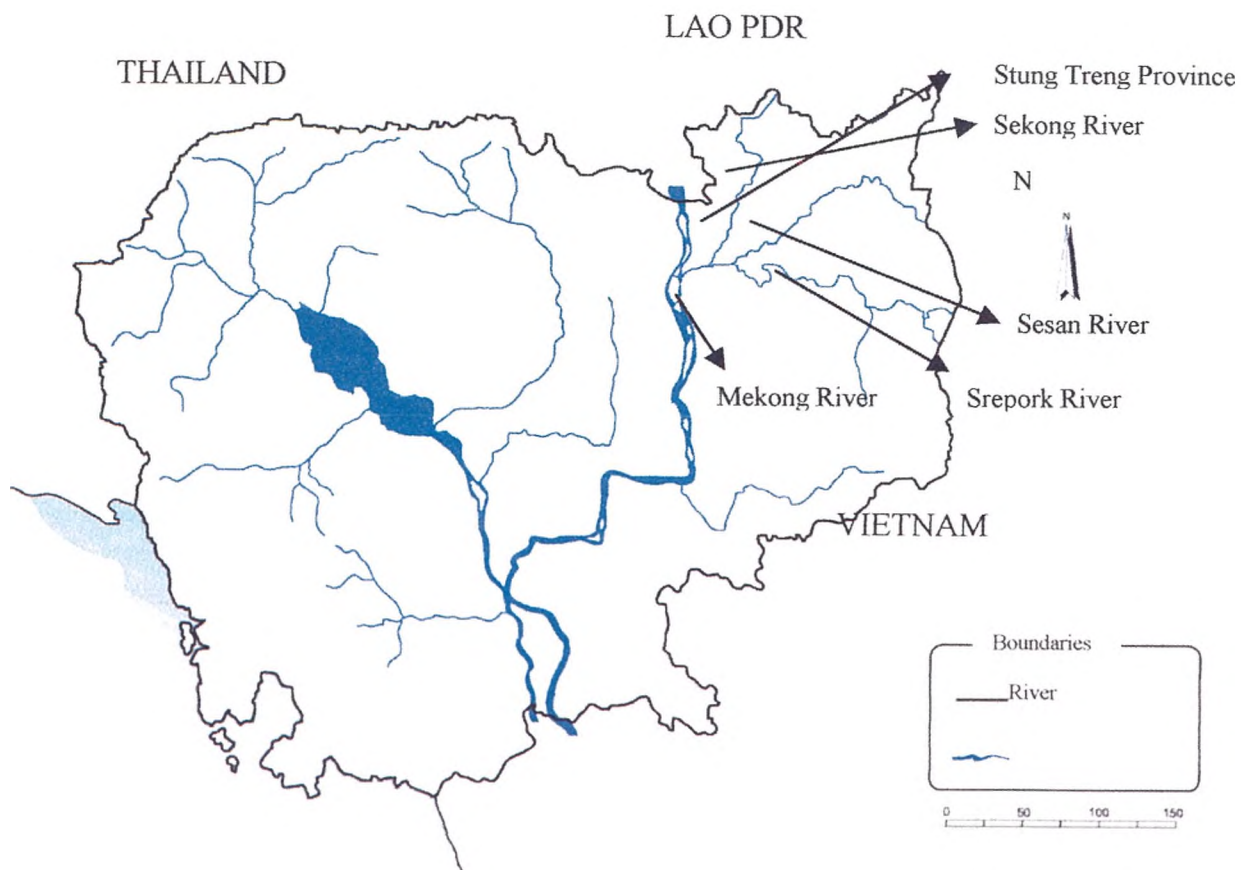


Figure 1: Map showing the location of Stung Treng Province in Cambodia

4.0 Projects Activities

- a) Collection and compilation on socio-economic information on inland capture fisheries in Stung Treng Province.
- b) Collection of detail information on species diversity and commercial species in Stung Treng Province.

- c) Defining status of inland capture fisheries resources, fishing effort and fishing gears used, fish abundance and distribution of fishes/larvae in rivers, Stung Treng Province.
- d) Fishers will be interviewed about the gears used, species caught by, and fishing grounds throughout the country and the type of gears will be photographed.

5.0 Materials and Methods

5.1 Proposed Project Site

Sesan, Sekong and Srepok Rivers, Northeastern part of Cambodia (Figure 1).

5.2 Methods in Data Collection

5.2.1 Primary Data Collection

- a) Survey investigation on the socio economic of the fishing households will be conducted by focusing on fishing household and communities that their income rely on fishing and related activities such as marketing, fishing gears construction, boat building and fish processing. Names and location of fishing communities will be obtained from local authorities in each district. Prior selection of the sample, household data collectors and supervisor will visit the communities and obtain the list of households with name, profession and other information. Sample household will be randomly selected for interview. The questionnaires will be formulated and data will be stored in database for further analysis.
- b) Fish specimen will be collected to identify fish species occurring in the area. The specimens will be taken by using varieties of fishing methods in different habitat. The fish specimen will also be collected from all landing sites and markets both for the dry and wet seasons. For this reasons, the data collection will be conducted in: (1). January 2003, (2). April 2003, and (3). July 2003, covering all types of fish habitats. A fisher will be hired to fish in the area where there are no fisheries or the types of fishing gears are not practiced. The fish specimen will be photographed. The fish species will be identified using fish identification Guidebook available. The survey of fishes at markets in Stung Treng where is a fish collection from everywhere in the province are sold. Fishing effort inventory regarding number and types of fishing gears will be surveyed at each fishing community in the province. The fishers will also interviewed about history of the fisheries.
- c) Fishers will be interviewed about the gears used, species caught, and fishing grounds throughout the country and the type of gears will be photographed.

5.2.2 Secondary Data Collection

Other information available from previous study will be used to compare and observe the relationship of the fisheries, fish biodiversity and the contribution of fish biodiversity of the Northeastern part of Cambodia to the fish abundance in the Tonle Sap Lake and the Cambodian flood plain. This is to further support information about fish larvae drift, bagnet fisheries in the Tonle Sap River, etc.

5.3 Data to be Collected

a) Socio-economic Data

- Information on fishing household, fish price, fish and fishery products, fish consumption, fishing equipment, livelihood activities, population size of fishing communities, income, age groups, and sex etc. Covers at least 25% of total number of fishing households in the province.

b) Biology

- Fish species biodiversity, some commercially important species
- Status of fisheries resources,
- Fishing effort and fishing gears used,
- Fish abundance and distribution of fishes
- Landing data and total fishing effort by fishing gears and district.

c) Fishing Gears

- Types of gears, how the gears are used, species caught by, and fishing grounds throughout the country and photo of each fishing gear.

6.0 Envisaged Outputs

a) Socio-economic

- Socio-economic Information of fishing households in Stung Treng.

b) Biology

- List of species caught by sampling areas, fishing gears and seasons.
- Time series data on fishing operation (operation site, time, target species, fishing effort), catches data (catches and CPUE by species and gear).
- Distribution and abundance of fishes.
- Status of fisheries resources in the province.
- Fisheries database for Stung will be developed.

c) Fishing Activities

Fishing activities will be compiled and described.

7.0 Proposed Activities and Budget Requirement (From September 2003 to December 2004)

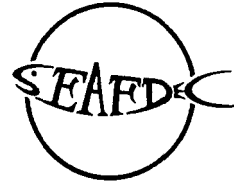
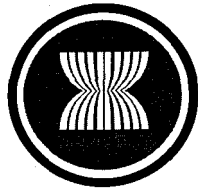
Source of Funding from SEAFDEC and Cambodian Government contribution

No.	Proposed Activities	Budget (USD)	%
1.	Planning of Project	-	-
2.	Procurement of research materials and equipments	1,500	7
3.	Travel expenses and DSA for data collection on fishery, and biology	8,000	38
4.	Travel expenses and DSA for compilation of socio-economic information of fishers	8,000	38
5.	Travel expenses and DSA for compilation of information of fishing gears	5,000	24
6.	Renting of boats for sampling	3,000	14
	Total	25,500	100

Cambodian Government contribution 20% = USD 5,100.00

8.0 Project Team Member

No.	Researchers	Responsibilities
1.	Sam Nuov	Project Coordinator Fishery and Biology
2.	Lieng Sopha	Project Leader Biology/ Fish Taxonomy
3.	Chap Pisith	Socio-economic
4.	Yin Dara	Socio-economic
5.	Deap Loeung	Biology and Fishing gears
6.	Ngor Peng Bun	Biology
7.	Hemrady	Biology
6.	Tan Phalla	Logistics



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF INDONESIA**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Open Water Capture Fisheries of Indonesia

Title:

Fishery Information on Rawa Pening Reservoir, Central Java, Indonesia

Habitat: Reservoir

Duration: 2004 - 2005

1.0 Background and Rationale

- An inland open water fisheries in Indonesia is potential to be developed since it plays important role especially for rural people
- The exploitation of open water fishery resources in Indonesia is still low (26.9 -30.1% of yield potential)
- A little has been done to develop inland open water capture fisheries in Indonesia
- Information and base data concerning Indonesian open waters are still limited and are not well documented
- Rawa Pening Reservoir:
 - One of the old reservoirs in Indonesia
 - Important for people around the reservoir
 - Will be managed through co-management approach

2.0 Goals

To obtain and compile information on statistics, biological and ecological of Rawa Pening Fisheries

3.0 Objectives

- b) To establish fishery statistical data (catch and value, fishing effort, and market) of the study area
- c) To obtain biological information on commercially important species
- d) To obtain ecological information of the reservoir

4.0 Project Activities

Collection and compilation of primary and secondary data on the capture fisheries of the study area:

- Catch volume and value
- Type and number of fishing gears
- Fishing vessel
- Number of fishers
- Aspects of fish marketing

- Fishery potential
- Spawning and migration
- Food and feeding habit
- Fish community structures
- Ecological parameters
- Aquatic plants

5.0 Materials and Methods

5.1 Proposed Project Site

Central Java Province: Salatiga District, Boyolali District and Ambarawa District

5.2 Methods in Data Collection

5.2.1 Primary Data Collection

- a) Statistical data will be collected through sampling activities on quarterly and yearly basis
- b) Biological data on commercially important species will be obtained at selected landing sites
- c) Information on ecology of the reservoir will be collected through sampling activities

5.2.2 Secondary Data Collection

Other fishery related information will be obtained from related offices (District Fisheries Office, District Government, etc)

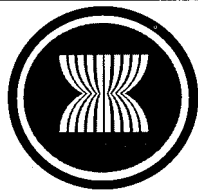
6.0 Envisaged Outputs

a) Statistical Data

- Compilation on fishery related activities: Catch volume and value, type and number of fishing gears, fishing vessel, number of fishers, fish marketing and fishery potential

b) Biology

- List of species caught by sampling areas, fishing gears and seasons.
- Distribution and abundance of fishes.
- Spawning and migration
- Status of fisheries resources in the districts
- Food and feeding habit
- Fisheries database for Central Java Province



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF LAO PDR**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Lao PDR

Title:

Biodiversity and Fishery of Mekong River (Siphan Done), Lao PDR

Habitat: Riverine System

Duration: 2004 to 2005

1.0 Background and Rationale

- Important inland capture fisheries and recreational activities.
- Knowledge on species distribution, taxonomy and biology is essential to understand fish habitats but still lacking.
- Proper management plan is needed for sustainable development on the inland fisheries resources.

2.0 Goals

- a) To gather as much information including inventory, habitat and migration patterns of important fish species.
- b) To use information collected as basis to develop for long-term management plan for Community awareness, empowerment and participation leading to the emergence of the people in fish resources management.

3.0 Objectives

- a) To collect and compile information on inland capture fishery, biology and socio-economic of fish living in Siphan Done.
- b) To collect detail information on important fish species.
- c) To determine status of inland capture fisheries resources in Siphan Done.

4.0 Projects Activities

- a) Status and Trend of fishery and species distribution.
- b) Scientific biological information on commercial species.
- c) Compilation on socio-economic information of fishers in Siphan Done

5.0 Materials and Methods

5.1 Proposed Project Site

Three main villages in Siphan Done

5.2 Methods in Data Collection

- Primary data collection
- Secondary Data Collection

6.0 Envisaged Outputs

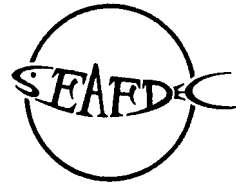
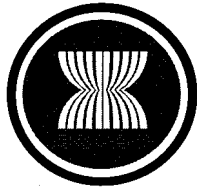
- a) List of species caught by sampling areas, fishing gears and seasons
- b) Time series data on fishing operation (operation site, time, target species, number of fishing effort), catches data (catches by species and operation) and CPUE by sampling gears.
- c) Information on Socio-economic of fishers in Siphon Done
- d) Status of inland capture fisheries resources of Siphon Done
- e) Database for inland capture fisheries of Siphon Done
- f) Recommend an appropriate measurement to manage fishing operation

7.0 Proposed Activities and Budget Requirement (From September 2003 to December 2004)

No.	Proposed Activities	Budget 2004	Budget 2005
1.	Planning of Project	-	-
2.	Procurement of research materials and equipments	2,000	2,000
3.	Travel expenses and DSA for data collection on fishery, and biology	4,000	4,000
4.	Travel expenses and DSA for compilation of socio-economic information of fishers	3,000	3,000
5.	Renting of boats for sampling	1,000	1,000
	Total (USD)	10,000	10,000

8.0 Project Team Member

No.	Researchers	Responsibilities
1.	Duangkam Sihanouvong	<ul style="list-style-type: none">• Project Coordinator• Fishery and Biology
2.	Bounma Luangamath	<ul style="list-style-type: none">• Project Leader• Fishing Gear
3.	Sisomouth Sichan	<ul style="list-style-type: none">• Fish Taxonomy
4.	Akhane Phomsouvanh	<ul style="list-style-type: none">• Fishery and Socio-economy
5.	Staff of Provisional Livestock and Fisheries Office, Champasack Province	<ul style="list-style-type: none">• Secondary data on catch, effort and logistic support



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF PENINSULAR MALAYSIA**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Peninsular Malaysia

Title:

Project 1: Biodiversity, Limnology and Fishery of Pahang River, Malaysia

Habitat: Riverine System

Duration: From January 2003 to December 2003

1.0 Background and rationale

- Complex diversities of species and indigenous communities.
- Important inland capture fisheries and recreational activities.
- Knowledge on species distribution, taxonomy, biology and environmental conditions is essential to understand fish habitats but still lacking.
- Knowledge on socio-economic components of the area is also important but scanty.
- Scanty compiled information except for few selected projects at National Park (Pahang) and Lake Bera.
- No up-to-date information available for the whole Pahang River.
- Proper management plan is needed for sustainable development of inland fisheries resources in Pahang River.

2.0 Goals

- a) To gather as much information on biodiversities, fishery, environmental conditions and socio-economic of fishers living along Pahang River.
- b) To use information collected as basis to develop long-term management plan for sustainable management of fisheries resources in Pahang River.

3.0 Objectives

- a) To collect and compile information on inland capture fishery, environmental conditions and socio-economic of fishers living along Pahang River.
- b) To collect detail information on water quality, environmental conditions and sediments that influence abundance and distribution of fish/larvae in Pahang River.
- c) To identify source of factors that influence concentration of fishing activities.
- d) To determine status of inland capture fisheries resources in Pahang River.

4.0 Projects Activities

- a) Status and Trend of Fishery and Species distribution.

- b) Scientific biological information on commercial species.
- c) Larval identification and distribution.
- d) Role of environmental factors that influence abundance and distribution of indigenous community/ species.
- e) Compilation on socio-economic information of fishers along Pahang River

5.0 Materials and Methods

5.1 Proposed Project Site

Main Pahang River (Total Length - 475 km), Tembeling River (100 km) leading towards National Park and Jelai River (100 km)

5.2 Methods in Data Collection

5.2.1 Primary Data Collection/ Scientific Data Collection

- a. Fish sampling
 - b. Verbal interviews
 - c. Observation
- Sampling areas: Main Pahang River that flows in Five Administrative Districts of Pahang State (Pekan: Lowest reach, Maran: Lower reach, Temerloh: Middle reach, Jerantut: Upper reach and Lipis: Uppermost part of Pahang river). See Annex 1 for detail on site location. Each administrative district has one sampling zone
 - Monthly collections of data from January 2003 to December 2003
 - Data collected for 5 days per trip (Not including travelling days)
 - Samples collected during two seasons (Rainy season: January - April, September - December) and Dry season (May - August)
 - Sampling to be carried out twice for each sampling zone during rainy and dry seasons.
 - Each sampling zone, 3 sampling stations
 - Sampling gears: Stationary/ Fixed Gill nets (7 mesh size: 1.0 cm, 2.0cm, 3.0 cm, 4.0 cm, 5.0 cm, 6.0 cm and 7.0 cm), Drift net and Electric shocker.
 - Biological information of commercially important fish species
 - Sampling equipments for collection of larvae
 - Sampling equipments for determining water quality and sediments
 - Data collections for socio-economic data are based questionnaires from enumerators.

5.2.2 Secondary Data Collection

- State Fisheries Office: Fishing operation - based on records of landing and total number of fishing efforts
- Water work and Channel Department: Environmental data (rainfall, wind, water current) and river structure
- National parks: Tourist information at Fish Sanctuary

5.3 Data to be Collected

- Fishery: Type of fish caught, fishing gears, total fishing effort, total landings
- Biology: Size, maturity stages, stomach contents for some commercially important species
- Environmental condition: physical (water depth, water current, conductivity, turbidity, alkalinity, hardness, temperature, etc.); chemical (Phosphate, Nitrate, Nitrite, Ammonia, Ferric, Dissolved Oxygen, etc.) and biological parameter (chlorophyll, plankton, larvae, sediments, etc.)
- Socio-economic survey on fishers: Information on household, population size, race, age groups, etc.). Covers at least 30% of total number of fishers living along Pahang River.
- Monthly landing data and total fishing effort by fishing gears and district.

6.0 Envisaged Outputs

- List of species caught by sampling areas, fishing gears and seasons.
- Time series data on fishing operation (operation site, time, target species, number of fishing effort), catches data (catches by species and operation) and CPUE by sampling gears.
- Distribution and abundance of larvae by sampling areas and seasons.
- Detail information on environmental conditions that influence abundance and distribution of fishes in Pahang River.
- Information on socio-economic of fishers along Pahang River.
- Status of inland capture fisheries resources of Pahang River.
- Database and GIS outputs for inland capture fisheries of Pahang River.

7.0 Proposed Activities and Budget Requirement for 2003

Source of Funding from Government of Malaysia:

Eight Malaysian Plan under Development Fund - Conservation Ecosystem Habitat and Biodiversity (22502-026)

No.	Proposed Activities	Budget (RM)	%
1.	Planning of Project	-	-
2.	Procurement of research materials (netting materials) and equipments	20,000	16
3.	Procurement of fish samples for biological study	20,000	16
3.	Travel expenses and DSA for data collection on fishery, environmental condition and biology (5 days/ trip/ month)	50,000	44
4.	Renting of boats for monthly sampling	10,000	8
5.	Documentation and seminar (twice)	20,000	16
	Total	120,000 USD 32,00*	100

* 1 USD = RM 3.80

8.0 Project Team Members

No.	Researchers/ Support Staff	Responsibilities
1.	Mahyam Mohd. Isa	Project Coordinator <ul style="list-style-type: none"> • Fishery • Biology
2. 3.	Jamaluddin Ibrahim Mohd. Nazir Taib	Project Leader <ul style="list-style-type: none"> • Limnology - Chemical parameters • Environmental conditions
4. 5.	Ibrahim Johari Osman Muda	<ul style="list-style-type: none"> • Fishery and Socio-economy • Fish Taxonomy and Biology
6. 7.	Ku Kassim Ku Yaacob Muhammad Ibrahim	Limnology - Physical parameters
8. 9.	Zulkipli Talib Rosdi Mohd. Nor	<ul style="list-style-type: none"> • Fish Larvae study • Fish Larvae study
10. 11. 12.	Sharum Yusoff Abd. Aziz Yusoff Abd. Rashid Ismail	<ul style="list-style-type: none"> • Fishing gears, RS and GIS • Fishing gears • Fishing gears
13.	Researchers of KUSTEM	<ul style="list-style-type: none"> • Limnology - Chemical and biological parameters (chlorophyll-a) • Sediment analysis
14.	Researchers of FRI and MACRES	RS and GIS, Database
15.	Staff of Pahang Fisheries State Office	Secondary data on catch and effort, license and logistic supports

9.0 Project Schedule for 2003

No.	Proposed Activities	Jan '03	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '04
1.	Planning of Project	█												
2.	Procurement of research materials and equipments	█	█											
3.	Procurement of fish samples for biological study			█	█	█	█	█	█	█	█	█	█	
4.	Data collection for primary and secondary data of inland capture fisheries of Pahang River			█	█	█	█	█	█	█	█	█	█	
5.	Data analysis on fishery, environmental conditions and biology			█	█	█	█	█	█	█	█	█	█	
6.	Data collection for socio-economic information of fishers			█	█	█	█	█	█	█	█	█	█	
7.	Data analysis on socio-economic data									█	█	█	█	
8.	Progress Seminar												█	
9.	Symposium - Presentation of findings Tentatively, 22 - 23 December												█	
10.	Group Meetings and Report writing									█	█	█	█	
11.	Publications													█

10.0 Sampling Schedule in Pahang River in 2003

Month/ Season	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
January Project Planning																																
February (Rainy) Pekan																																
March (Rainy) Maran																																
April (Dry) Temerloh																																
May (Dry) Jerantut																																
June (Dry) K. Lipis																																
July (Dry) Pekan																																
August (Dry) Maran																																
September (Rainy) Temerloh																																
October (Rainy) Jerantut																																
November No sampling																																
December (Rainy) K. Lipis																																

11.0 Delegations of Responsibilities and Envisaged Outputs

No.	Researchers	Responsibilities/ Outputs
1.	Mahyam Mohd. Isa	Project Coordinator Fishery: Monthly/yearly data on number of fishing boat, Landings Biology: Stomach contents, Gonad Maturity and measurements Document on Fishery and Biological Information Final documents of the project
2.	Jamaluddin Ibrahim Mohd. Nazir Taib	Project Leader Limnology and Environmental conditions: 1. Physical parameters (Water depth, water current, conductivity, turbidity, alkalinity, hardness, temperature, TSS, etc.) 2. Chemical parameters ((Phosphate, Nitrate, Nitrite, Ammonia, Ferric, Silicate, etc.) 3. Biological parameters (Zooplankton) Document on limnology and environmental condition
3.	Ku Kassim Ku Yaacob Muhammad Ibrahim	Physical parameters: 1. Water current and water depths 2. River dimension Document on Physical parameters (e.g. Water current) of Pahang River
4.	Ibrahim Johari Osman Muda	Socio-economic study on fishers: What, How, When and Who? (Income, Dependency rate, Economy, Cost and Earnings, etc) Document on Socio-economy of fishers living along Pahang River
5.	Zulkipli Talib Rosdi Mohd. Nor	1. Fish Larvae study: Species and distributions 2. Drawings with description of each species Document on Fish Larvae
6.	Osman Muda	1. Fish Taxonomy: Photographs, Descriptions on each species 2. Collections of specimens for museum Document on list of species and taxonomy
7.	Sharum Yusoff Abdul Aziz Yusoff Abdul Rashid Ismail	1. Fishing gears: Descriptions and documentation (Photographs, Drawing, Dimensions, etc) 2. RS and GIS: Documentations Document on Fishing Gears
8.	Researchers of KUSTEM Dr. Mohd. Kamil A. Rashid Abd. Azim Mat Yusop Suliman Kassim	Limnology and Environmental conditions: 1. Chemical parameters (Hydrocarbon and Chemical pollutions, BOD, COD, DO) 2. Biological parameter (chlorophyll) 3. Sediment (Particle size) 4. Benthos Document on limnology and environmental condition
9.	Researchers of FRI and MACRES	RS and GIS output and database Database, RS and GIS outputs
10.	Staff of Pahang Fisheries State Office	Secondary data on catch and effort, Logistic supports and supporting staff Document on Fishery related information (e.g. Information of license, fishers)

Title:

Project 2: River catfish: Status, Abundance and its relationship with macrobenthos and other environmental factors from middle to lower reaches of Pahang River, Malaysia

Habitat: Riverine System

Duration: From January 2004 to December 2004

1.0 Background and Rationale

This is a follow-up activities of a project conducted in 2003 for information gathering on fishery, biology, environmental condition and socio-economic aspects of fishers from Pahang River. Preliminary results of the study had indicated that species composition and fishing methods varied all along Pahang River and this is maybe due to differences in ecosystem and environmental conditions. River catfish (Famili: Pangasiidae - 'Patin Muncong' (*Helicophagus* cf. *waandersii*), 'Patin Juara' (*Pangasius micronemus*) and 'Patin Buah' (*Pangasius nasutus*)) is more abundant from middle reach (Temerloh and Maran Districts) to lower reaches of Pahang River (Pekan District) and Malaysian Mahseer ('Ikan Kelah' - *Tor tambroides*, *Tor douronensis*) is more common in the upper reaches of the river. Areas in Pekan, Maran and Temerloh are more sandy as approaching to the lower reaches. Food contents of River catfish (*Helicophagus* cf. *waandersii* and *Pangasius micronemus*) consist mostly of bivalves, 'etak-etak' (Family: Donacidae) but for (*Pangasius nasutus*), the food contents are more varied but mostly wild fruits such as 'buah ara', 'buah perah', etc. which are found abundantly along Pahang River.

Bivalves (Family: Donacidae) are found abundantly in sandy areas of Pekan, Maran and Temerloh. Heavy exploitation of these bivalves were observed during dry season (April - September) not by local people but by those from neighboring states such as Kelantan and Terengganu. Decline in abundance of this resource and its relationship with River catfish (*Helicophagus* cf. *waandersii* and *Pangasius micronemus*) through feeding habit may has caused for the decline in the abundance of River catfish. Based on verbal interviews and landing records, landings of River catfish has declined tremendously since 1980's and *Helicophagus* cf. *waandersii* is now considered as endangered species of Pahang River. The price of this fish can fetch up to more than RM 120.00/ kg (USD 30 – 35/ kg) and the fishers will used all types of fishing methods including electric shock to harvest them.

Therefore, this study is initiated in order to obtain detail information on the status of River catchfish and to confirm linkages between this species with the abundance of bivalves. Information obtained will be used as basis to formulate management plan for the exploitation of fish resources in Pahang River.

2.0 Goals

- a) To obtain information on distribution of bivalves, "etak-etak" (Family: Donacidae) and its relationship with River catfish and environmental conditions.
- b) To use information as basis to formulate suitable management plan for exploitation of fisheries resources in Pahang River.

3.0 Objectives

- a) To identify distribution and density of bivalves by season and area.
- b) To collect and compile detail information on water quality, sediment, benthos and other environmental data that influence distribution of bivalves and River catfish.
- c) To identify whether there is any significant relationship between bivalves and River catfish.
- d) To obtain detail information on biology of River catfish (feeding habits, spawning pattern, recruitment pattern, growth rate, etc.).
- e) To obtain detail information on status of River catfish and bivalves resources of Pahang River.
- f) To obtain information on socio-economy of individuals engaged in harvesting of bivalves and fisheries resources, specifically in Pekan, Maran and Temerloh districts.

4.0 Projects Activities

- a) Status and trend of River catfish and bivalves resources.
- b) Scientific biological information on River catfish.
- c) Role of environmental factors that influence abundance and distribution of River catfish and bivalves.
- d) Compilation on socio-economic information of individuals engaged in exploitation of bivalves in Pahang River.

5.0 Materials and Methods

5.1 Proposed Project Site

Main Pahang River (From Middle part to lower reaches of the river in Temerloh, Maran and Pekan districts)

5.2 Methods in Data Collection

5.2.2 Primary Data Collection/ Scientific Data Collection

- a) Fish sampling
 - b) Verbal interviews
 - c) Observation
- Sampling areas: Main Pahang River that flows in three administrative districts (Pekan, Maran and Temerloh) of Pahang State. From middle part of the river (Temerloh) to Lowest reach, Pekan: See Annex 1 for detail on site location.
 - Monthly collections of data from January 2004 to December 2004
 - Data collected for 5 days per trip (Not including travelling days)
 - Samples collected during two seasons (Rainy season: January - April, September - December) and Dry season (May - August)
 - Each sampling zone, 3 sampling stations

- Sampling gears for fish: Stationary/ Fixed Gill nets (7 mesh size: 1.0 cm, 2.0cm, 3.0 cm, 4.0 cm, 5.0 cm, 6.0 cm and 7.0 cm), Drift net and Electric shocker.
- Sampling gear for bivalves: Hand held Scoop
- Sampling equipments for determining water quality, sediments and benthos
- Data collections for socio-economic data on individuals engaged in harvesting of bivalves are based questionnaires from enumerators.

5.2.2 Secondary Data Collection

- State Fisheries Office: Fishing operation - based on records of landing and total number of fishing efforts
- Water work and Channel Department: Environmental data (rainfall, wind, water current) and river structure

5.3 Data to be Collected

- Fishery: Type of fish caught, fishing gears, total fishing effort, total landings
- Total landings per trip, season for bivalves
- Biology: Size, maturity stages, stomach contents for River catfish
- Biology: Size distribution for bivalves
- Environmental conditions: physical (water depth, water current, conductivity, turbidity, alkalinity, hardness, temperature, etc.); chemical (Phosphate, Nitrate, Nitrite, Ammonia, Ferric, Dissolved Oxygen, etc.) and biological parameters (chlorophyll, plankton, larvae, sediments, etc.)
- Socio-economic component of individuals engaged in harvesting of bivalves.

6.0 Envisaged Outputs

- a) Detail information on water quality, benthos, sediments and environmental factors that influence distribution of river catfish and bivalves in Pahang River.
- b) Biological information on River catfish including feeding habits, gonad maturity, recruitment and growth patterns.
- c) Distribution and density of bivalves by season and area.
- d) Socio-economic information on individuals that engaged in harvesting bivalves.
- e) Present status of River catfish and bivalves resources in Pahang River.

7.0 Proposed Activities and Budget Requirement for 2004

Source of Funding from Government of Malaysia:

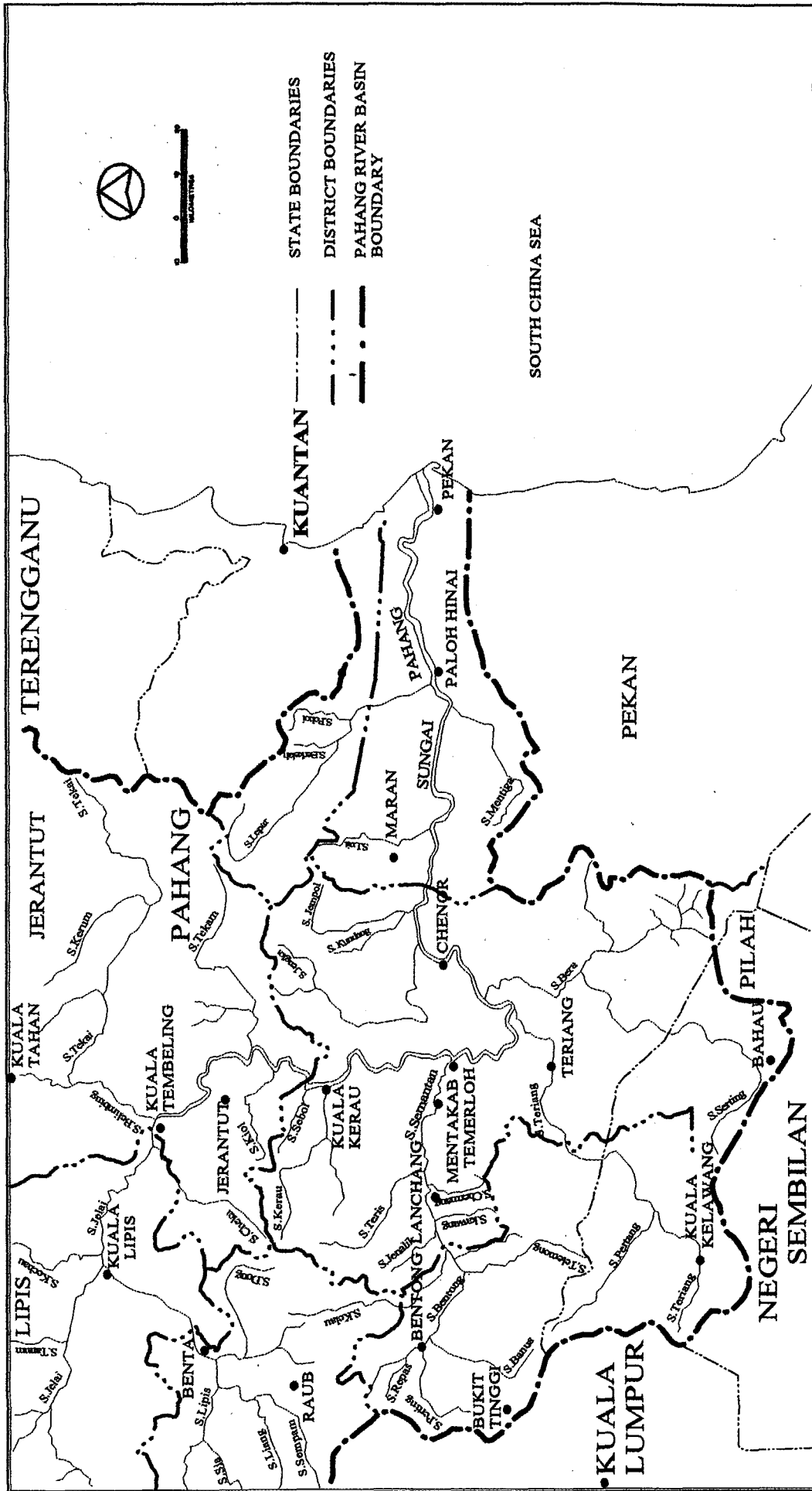
- Eight Malaysian Plan under Development Fund - Conservation Ecosystem Habitat and Biodiversity (22502-026) for year 2004
- Pahang State?
- Intensified Research Priority Area (IRPA) - Ministry of Science and Technology?

No.	Proposed Activities	Budget (RM)	%
1.	Planning of Project	-	-
2.	Procurement of research materials (netting materials, chemicals, etc.) and equipments	10,000	10
3.	Procurement of river catfish and bivalves samples for biological study (feeding habits, gonad maturity, size distribution, etc.)	20,000	20
3.	Travel expenses and DSA for data collection on fishery, environmental condition, benthos, sediments and biology (5 days/ trip/ month)	35,000	35
4.	Renting of boats for monthly sampling	10,000	10
5.	Analysis of plankton, benthos and sediments	10,000	10
6.	Documentation and seminar (twice)	15,000	15
	Total	100,000 USD 26,316	100

8.0 Project Team Members

No.	Researchers	Responsibilities
1.	Zulkafli Abd. Rashid Staff of FRC, Batu Berendam	Project Leader <ul style="list-style-type: none"> • Fishery and Biology • Bivalves study
2.	Zulkipli Talib	• Limnology
3.	Rosdi Mohd. Nor	• Environmental data
4.	Mohd. Nazir Taib	• Larvae study
5.	Researchers of KUSTEM	• Sediments profile • Chlorophyll • Benthos
6.	Staff of Pahang Fisheries State Office	• Secondary data on catch and effort, Logistic support

Annex 1

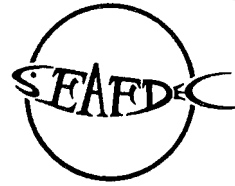


9.0 Project Schedule for 2004

No.	Proposed Activities	Jan '04	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan '05
1.	Planning of Project													
2.	Procurement of research materials and equipments													
3.	Procurement of fish samples for biological study													
4.	Data collection for primary and secondary data of inland capture fisheries of Pahang River													
5.	Data analysis on fishery, environmental conditions and biology													
6.	Data collection for socio-economic information of fishers													
7.	Data analysis on socio-economic data													
8.	Progress Seminar													
9.	Symposium - Presentation of findings													
10.	Group Meetings and Report writing													
11.	Publications													

10.0 Sampling Schedule in Pahang River in 2004

Month/ Season	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31					
January (Rainy)																																				
February (Rainy)																																				
March (Rainy)																																				
April (Dry)																																				
May (Dry)																																				
June (Dry)																																				
July (Dry)																																				
August (Dry)																																				
September (Dry)																																				
October (Rainy)																																				
November (Rainy)																																				
December (Rainy)																																				



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF SABAH, MALAYSIA**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Sabah, Malaysia

Title:

Biodiversity, Limnology and Fishery of Kinabatangan River in Sabah, Malaysia

Habitat: Riverine System

Duration: From mid 2003 to 2005 (Two-half years)

1.0 Background and Rationale

- Kinabatangan River is the largest and longest river in Sabah.
- Complex diversities of species and indigenous communities.
- Important area for inland capture fisheries and recreational activities.
- Knowledge on species distribution, taxonomy, biology and environmental condition is essential to understand fish habitat but still lacking.
- Knowledge of the socio-economic components of the area is also important but scanty. In fact, no study has ever been carried out.
- No up-to-date in-depth information on capture fisheries activity available.
- Proper management plan is needed for sustainable development on the inland fisheries resources in Kinabatangan.

2.0 Goals

- a) To gather as much information on biodiversity, fishery, environmental conditions and socio-economic of fishers living along Kinabatangan River.
- b) To use the information collected as basis to develop action plan for sustainable management of inland fisheries resources of Kinabatangan River.

3.0 Objectives

- a) To collect and compile information on inland capture fishery, environmental conditions and socio-economic of fishers living along Kinabatangan River.
- b) To collect detail information on water quality, environmental conditions and sediments that influence abundance and distribution of fish/larvae in Kinabatangan River.
- c) To update information on fisheries resources and level of exploitation in the inland waters of Kinabatangan River.
- d) To develop inland captured-fisheries database, which is “user-friendly” and contain information related to fisheries resources, environmental condition and socio-economic data.
- e) To link these findings in a holistic scenario and develop interactive plan for managing fisheries resources of Kinabatangan River.

4.0 Projects Activities

- a) Status and trend of fishery and species distribution
- b) Scientific biological information on commercially important species.
- c) Larval identification and distribution
- d) Role of environmental factors that influence the abundance and distribution of indigenous species
- e) Compilation of socio-economic information of fishers (fulltime, part-time, sport) along Kinabatangan River.

5.0 Materials and Methods

5.1 Proposed Projects Site

- Main Kinabatangan River (Total Length = 560 km), from Kampung Tongod down to Kampung Kuala Abai.
- Sampling areas for year 2004: Main Kinabatangan River (Five Zones), at Kampung Tongod, Tangkulap, Kuamut, Pitan and Lamag. See Annex 1 for detail.
- Sampling areas for 2005: Main Kinabatangan River (Four Zones), at Kampung Bukit Garam, Bilit, Sukau and Kuala Abai

5.2 Methods in Data Collection

5.2.1 Primary Data Collection

- Monthly collections of data from January 2004 to December 2005 (Two years)
- Data collected for 5 days per trip (Not including traveling days)
- Samples collected during two seasons (Dry season: Jan-April/May and Rainy season: June-December)
- Sampling to be carried out for one zone/season
- Each zone, 3 sampling stations
- Sampling gears; Stationary / Floating Gill Nets (7 mesh size: 2.5cm, 5.0cm, 6.5cm, 7.5cm, 8.5cm, 10cm and 12.5cm), portable trap (*for catching Macrobrachium rosenbergii*) and hook & line.
- Biological information of commercially important fish species
- Sampling for determining water quality and sediments
- Data collections for socio-economic data of fishers ((fulltime, part-time, sport) are based on questionnaires from enumerators (researches/state office personnel)

5.2.2 Secondary Data Collection

- Based on records of landing and total number of fishing efforts gathered by Kinabatangan Fisheries Department office

5.2.3 Data to be Collected

- Fishery-Type of fish caught, fishing gears, total fishing effort, total landings
- Biology-Size, maturity stages, stomach contents for some commercially important species

- Environmental condition-physical (water depth, water current, conductivity, turbidity, alkalinity, hardness, temperature, etc); chemical (Phosphate, Nitrate, Nitrite, Ammonia, Ferric, Dissolved Oxygen, Hydrocarbon, etc.) and biological parameter (chlorophyll, plankton, larvae, sediments, benthos, etc.)
- Socio-economic survey on fishers (fulltime, part-time, sport)-Information on household, population size, race, age groups, etc.). Covers at least 30% of total number of fishers (fulltime, part-time, sport) that exploiting the resources of Kinabatangan River.
- Monthly landing data and total fishing effort by fishing gears and district.

6.0 Envisaged Outputs

- List of species caught by sampling areas, fishing gears and seasons.
- Times series data on fishing operation (operation site, time, target species, number of fishing effort), catches data (catches by species and operation) and CPUE by sampling gears.
- Distribution and abundance of fish larvae by sampling areas and seasons.
- Details information on environmental conditions that influence abundance and distribution of fishes in Kinabatangan River.
- Information on socio-economic of fishers (fulltime, part-time, sport) along Kinabatangan River.
- Status of inland capture fisheries resources of Kinabatangan River.
- Database for inland capture fisheries of Kinabatangan River.

7.0 Proposed Activities and Budget requirement for 2004-2005

Source of Funding from Government of Malaysia: Eight Malaysia Plan, estimated to be RM128, 800,000 for each year.

No.	Proposed Activities	Budget (RM)
1.	Planning of Project	-
2.	Procurement of research materials and equipments	25,000
3.	Travel expenses and DSA for data collection of fishery, environmental condition and biology (5 days/trip/month)	40,000
4.	Procurement of Fish samples	15,000
5.	Renting of boats for monthly sampling	20,000
6.	Recruiting 1 Research Assistant RM1200/person/month	28,800
	Total	128,800

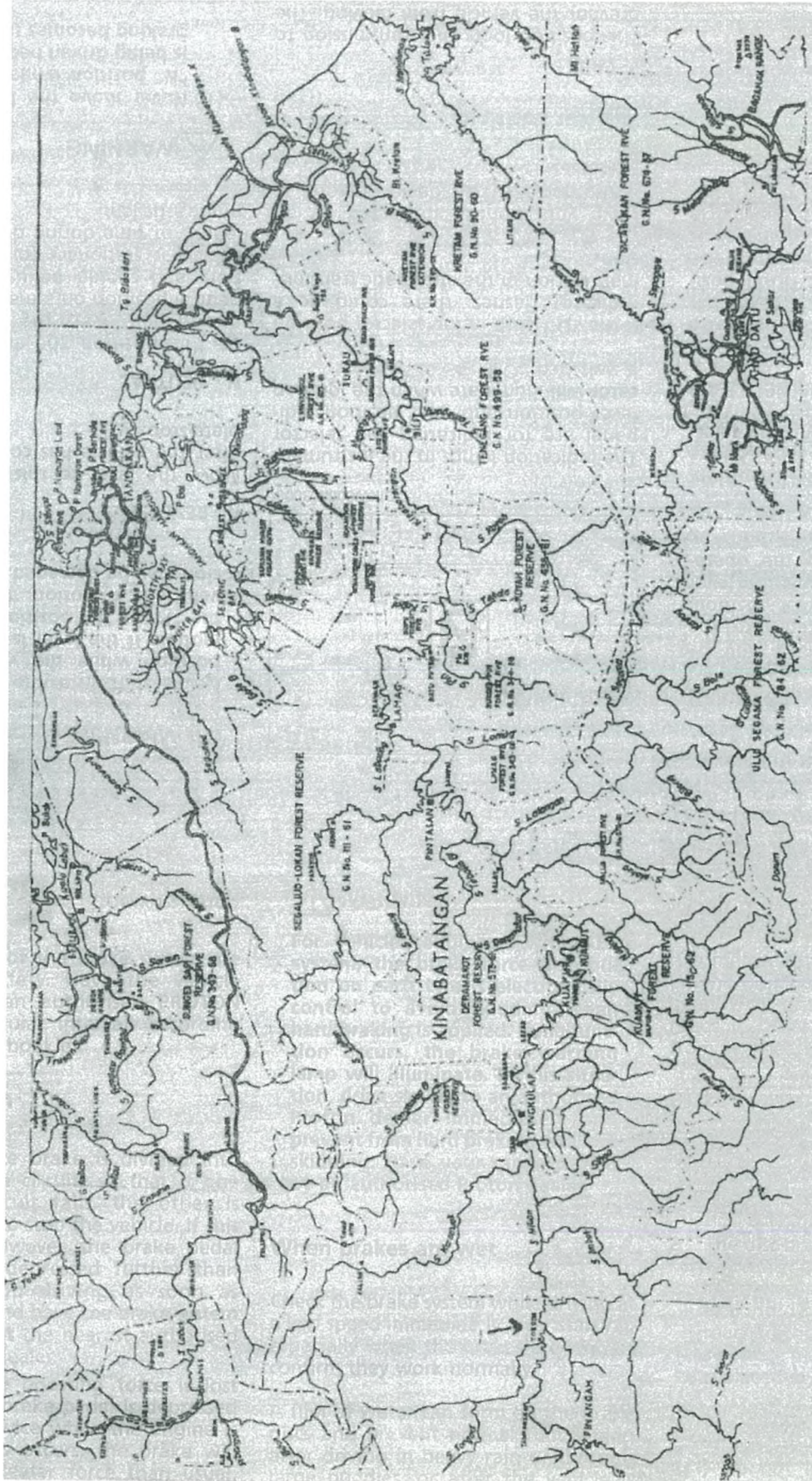
8.0 Project Team Members

No.	Researchers	Responsibilities
1.	Jephrin Wong	<ul style="list-style-type: none"> • Project Coordinator
2.	Dr. Ahmade Sade	<ul style="list-style-type: none"> • Project Leader
3.	Irman Isnain	<ul style="list-style-type: none"> • Deputy Project Leader • Fish Taxonomy • Fishing gear • RS & GIS component
4.	Benjamin Martin	<ul style="list-style-type: none"> • Fish Taxonomy • Fishing gear • RS & GIS component
5.	Primus Lukas	<ul style="list-style-type: none"> • Socio-economy
	Guraim Gueh	<ul style="list-style-type: none"> • Assistant Deputy Project Leader
	Kelvin Morris	<ul style="list-style-type: none"> • Assistant Deputy Project Leader
	Dionysius Laison	<ul style="list-style-type: none"> • Assistant Deputy Project Leader
6.	Kamal Hj. salleh	<ul style="list-style-type: none"> • Assistant Deputy Project Leader
7.	Kinabatangan Fisheries Office	<ul style="list-style-type: none"> • Secondary data on catch & effort, list of licenses, fishermen
8.	Sabah Economic Planning Unit	<ul style="list-style-type: none"> • Planning and endorsement of management plan
9.	Ministry of Agriculture & Food Production Sabah	<ul style="list-style-type: none"> • Planning and endorsement of management plan

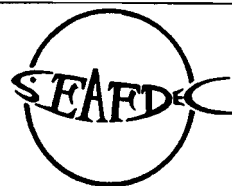
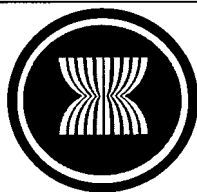
Note: Sabah Fisheries department is lacking in research officers, as such we would like to request for research officers from DoF Malaysia to assist Sabah in this project.

9.0 Project Schedule from 2003-2005

No.	Proposed Activities	2003				2004				2005			
				3	4	1	2	3	4	1	2	3	4
1.	Project proposal and planning project.												
2.	Procurement of research materials and equipments												
3a.	Implementation of scientific data collection at Kinabatangan River: Tongod-Tangkalap-Kuamut												
3b..	Implementation of scientific data collection at Kinabatangan River: Pitasan-Lamag-Bukit Garam												
3c.	Implementation of scientific data collection at Kinabatangan River: Bilit-Sukau-Kuala Abai												
4.	Database and RS/GIS: Development, data entry and dissemination of output through websites and national seminars												
5.	Dissemination of output through national seminars												
6.	Publications of reports												



Map of Kinabatangan District showing the Kinabatangan River



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

PROPOSAL FOR PILOT PROJECT

INLAND CAPTURE FISHERIES OF SARAWAK, MALAYSIA

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Sarawak, Malaysia

Title:

Diversity, ecology and utilisation of fish resources of Loagan Tujuh, Baram, Miri Division, Sarawak, Malaysia

Habitat: Ox-bow Lake

Duration: From mid 2003 to 2005 (Two-half years)

1.0 Background and Rationale

- Baram River is the second longest river in Sarawak and has the most number of oxbow lakes associated with the river system.
- Though connected to the main river, its ecology is quite unique.
- Information gained from study of the fish resources within the oxbow lake could help in our understanding of the fish resources in the other oxbow lake.
- Pattern of resource exploitation by the local communities could provide strategies for better management of the resources.
- Fisheries information collected could serve as baseline data as well as basis for justification to conserve this particular wetland or another suitable lake(s).
- Situated on the right bank side of the mighty Baram river, and about 30 minutes by boat from the Marudi Town, the lake may have the potential to be developed as a recreational or sports fishing (ecotourism).

2.0 Goals

- a) To gather as much information on the lake fishery.
- b) To assess the suitability of the oxbow lake for recommendation for conservation.

3.0 Objectives

- a) To compile information regarding the fish resources of the lake
- b) To monitor the water quality within the project period
- c) To study the impact of fishing and other activities on the fish abundance in the lake.

4.0 List of Projects / Activities:

- a) Fish stock assessment survey
- b) Study on the biology and foods of the fish caught
- c) Observation on fry availability and distribution

- d) Study on types of plankton present and distribution
- e) Determine lake topography and take readings of water parameters.
- f) Study on bankside vegetation around the lake
- g) Survey of longhouses/villages doing fishing in the lake

5.0 Materials and Methods

5.1 Proposed Projects Site

Oxbow lake (“Loagan”) Tujuh, situated on the right bank side of Baram River, about 30 minutes boat ride from Marudi Town.

5.2 Methods in Data Collection

5.2.1. Fish Stock Assessment survey

Fish sampling using different types of fishing gears (set gill nets, cast net)

- Record gear mesh size, date and setting time and duration
- Record species, size (weight, TL, FL) sex, catch location
- Preserve specimens

5.2.2 Study on the Biology and Foods of the Fish Caught

- Check stage of gonad development, egg weight, diameter, fecundity (for mature eggs)
- Analyze food taken components in the fish

5.2.3 Observation on Fry Availability and Distribution

- Sampling at different sites using nets of varying mesh sizes, electrofishing
- Attempts to identify species of fry.
- Preserve specimens
- Routine sampling (monthly, to check availability during different season)

5.2.4 Study in Types of Plankton Present and Distribution Within the Lake

- Collect water and plankton samples for analysis and identification
- Sampling during different time and locations

5.2.5 Determine Lake Topography and Water Parameters

- Make transects and mark out sampling-points
- Carry out echo-sounding to determine depth and bottom profile
- Routine sampling of water quality (parameters include temperature, pH, DO, turbidity, conductivity, ammonia, nitrate and others)
- Sample bottom substrate/soil for analysis

5.2.6 Study on Bankside Vegetation around the Lake

- Monitor flowering/fruited season of plants providing source of food for the fishes

5.2.7 Socio-economic Survey of Fishers/ Villagers within the Vicinity of Lake

- Interview the villagers and fishers regarding their fishing activities in the lake
- Fishing methods employed, fishing frequency, which time of the year, etc.

5.3 Data to be Collected

5.3.1 Ecology of Fish from the Oxbow Lake

- Fish species composition, sizes
- Section of lake where the fish are found, time of the day they are most caught and other ecological observations.
- Fry of fish species available at certain times of the year, abundance, habitat type where fry are found/caught, which time of the year

5.3.2 Biology

- Sex of fish, gonad conditions (stage of egg maturity), gonad weight, number of eggs in mature gonad, egg size/diameter
- May attempt artificial breeding if female fish caught is at right stage of maturity; other biological aspects
- Gut content compositions

5.3.3 Fishery

- Fishing gears used by local fishermen, part-time or full-time fishermen;
- Species caught which preferred by the fishermen
- Total landing for each day
- Amount of catch sold if any and market prices

5.3.4 Environmental Conditions

- Physical and chemical conditions of the lake, water parameters, plankton type, sites where they may occur in abundance
- Weather influence on lake conditions
- Vegetation type around the lake, flowering and fruiting season; trees providing natural sources of food for the fish, prominent species.

6.0 Envisaged Outputs

- a) List of fish species diversity and relative abundance
- b) Sex ratio, stages of maturity and patterns of gonado-somatic index
- c) Distribution and seasonal occurrence of fish larvae and fry
- d) Pattern of plankton distribution and occurrence
- e) Feeding habits of the fish and differences in food preference
- f) Time series data on water quality and level; fluctuations in entry and exit of water
- g) Importance of vegetation around the lake area in providing food for the fish population in a 'confined' environment and sustenance of water quality
- h) Information on fishing pressure on the resources

- i) Recommendations for enhancement of fish population and conservation of area for future R&D or for ecotourism

7.0 Proposed Activities and Budget Requirement for 2004-2005

Source of Funding:

Since project costs are to be shared, half of the fund required can be from the State Government and the other 50% from SEAFDEC. This proposed project is for about one year only.

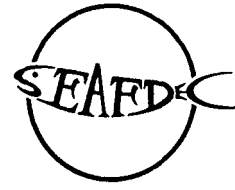
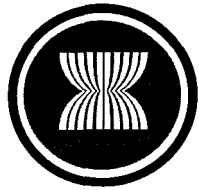
No.	Proposed Activities	Budget (RM)
1.	Planning of Project	-
2.	Procurement of research materials and equipments e.g Fishing gears, camping items, chemicals, containers	15,000
3.	Hiring of boats, outboard engine, driver and casual workers	17,000
4.	Transport and traveling expenses for routine trips to the lake, survey the longhouses/villages (up to 2 trips/month, initially to prepare the ground works, then once a month @ 5 days/trip- airfares, express boat fares, taxi fares, subsistence and lodging allowances	60,000
5.	Miscellaneous	5,000
	Total	97,000

8.0 Project Team Members

No.	Researchers	Responsibilities
1.	Stephen Sungam	• Project Coordinator /Project Leader
2.	Ken Edward	• Asst. Fisheries Officer
3.	Nigel Salam	• Fisheries Assistant
4.	Culbert Sadi	• Fisheries Assistant
5.	David Tinggi	• Fisheries Assistant
6.	Christopher Paran	• Fisheries Assistant

10.0 Project Schedule from Jan 2004- Dec. 2004

No.	Proposed Activities	1	2	3	4	5	6	7	8	9	10	11	12
1.	Fish stock assessment survey	x	x										
2.	Study on biology and food of the fish caught	x		x		x		x		x		x	
3.	Observation on fry availability and distribution	x	x	x	x	x	x	x	x	x	x	x	
4.	Study on plankton present and monitor water parameter	x		x		x		x		x		x	
5.	Determine lake topography and monitor water parameters	x	x	x	x	x	x	x	x	x	x	x	x
6.	Study vegetation		x		x		x		x		x	x	
7.	Survey on longhouses/ villages		x	x									
8.	Writing of final reports											x	x



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF MYANMAR**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Myanmar

Title:**Project 1:** Inland Fisheries Resources and Evaluation of the Fishery Management**Project 2:** Inland Fishing gears**Project 3:** Taxonomy of Inland Fishes**Habitat:** Riverine System**Duration:** From 2003 to 2005**1.0 Background and Rationale**

- Fast developing industry
- Potential

Union of Myanmar is the largest country in mainland Southeast Asia., comprising a land area of 676,577 km with a population of over 52 million in the year 200. Myanmar is a unique country in the region embarrassing cool and ice-capped mountain in the North and warm and sunny white beach in the Southern part of the country. No wonders various fauna and flora are abundant in such country with diverse climatic conditions.

Myanmar is endowed with four big rivers, 3,700 leasable fisheries, men made reservoirs and tanks covering 4 million acres and 1 million acres of swampland. In addition, one fifth of the country total areas are inundated during four to five months in monsoon period. Severe adverse effect by natural disaster such as flood, drought and cyclone arrives once in a century.

The major sources of freshwater food fish production are leasable fishery, open fishery and aquaculture. The leasable fisheries are unique type of fishing in ASEAN region. During rainy season, the fish come up to top of the riverlets or watershed adjacent to low land areas. Their main purpose is spawning. The young hatchlings are enjoying the ample natural food and reaching their juveniles stage. While the water level subsides after monsoon, they come down to big river with out flowing water. Then the fishermen are allowed to catch with prescribed fishing gear in allocated areas during limited time interval.

According to catch data production as tabulated in Table 1, the production from inland or freshwater fisheries showed a steady increase in production since late 1980's. Due to low price favorable natural condition, increasing demand, easy harvest and 100% consumer's choice, the share of inland fish production has increased more than 3 and half times from 143 metric ton in 1992 to 530 metric ton in 2002 as compared to an increase of one time for marine fisheries, from 530 metric ton in 1992 to 1,047 metric ton in 2002.

Table 2: Total productions of fish and prawn from both inland and marine fisheries in Myanmar.

Year	Inland Fisheries (Tones)	Marine Fisheries (Tones)	Total Fish Production (Tones)
1988-89	120	561	681
1989-90	143	586	729
1990-91	143	588	731
1991-92	167	590	757
1992-93	193	598	791
1993-94	214	602	816
1994-95	220	603	823
1995-96	218	455	673
1996-97	224	628	852
1997-98	246	676	922
1998-99	251	760	1,011
1999-2000	291	880	1,171
2000-2001	390	949	1,339
2001-2002	445	1,029	1,474

Regarding fast developing fishery sector, the State has set a clear cut policy mandating to produce the freshwater fish due to limited marine resources in order to supply national requirement and surplus to export. In addition to livelihood of half million of fishery related people and another half million of indirectly fishery related people, fishery sector contributes to the export earnings and provides source of affordable animal protein to rural people. In general, it is obvious that inland fishery is sustainable and profitable enterprise contributing significantly to rural food production and social-cultural aspects.

- Production is under estimate because of insufficient information and lack of statistic data.
- Though diversified fauna and flora are distributing from temperate region in the North to tropical region in the South, their biology, taxonomy and ecology are not fully understood.
- The fishing gears, mostly traditionally built and operated are not classified and recorded.
- The capture fishery has been replaced by culture based capture fishery currently with great success: i.e. more-production and income, more efficient management, more security in food production and sustainability, etc. But their significant contribution to inland fishery is not yet evaluated thoroughly and systematically.

2.0 Goals

- a) To ensure sustainable development of inland fisheries.
- b) To impart outcome, experiences and information to member countries.
- c) To utilize good outcome in formulation of development and expansion plan regarding inland fisheries development and management.

3.0 Objectives

- a) To strengthen the data and information collection system based on the project model and experiences.
- b) To promote and expand culture based capture inland fisheries coupled with self-awareness and participation by stakeholder introduced by demonstration under project.
- c) To facilitate management activities with comprehensive information on biodiversity, distribution, habitats and environmental conditions.
- d) To regulate more appropriate tactics based on expertise and experiences of the project.

4.0 Projects Activities

Project 1: Inland Fisheries Resources and evaluation of the Fishery Management Activities:

- a) Evaluation on replenishing of natural water bodies with hatchery bred fish seeds.
- b) Determination of improvement of habitats in project sites.

Project 2: Inland Fishing gears

Activities:

Constructions, materials, mode of operation, efficiency, catch, distribution are to be published with photographs, diagrams, drawings, etc.

Project 3: Taxonomy of Inland Fishes

Activities:

- a) Collection, identification and classification of inland fishes including their distribution and larval stages.
- b) Establishment of two-reference collection for inland fish species (one in Myanmar and the other in member countries).

5.0 Materials and Methods

5.1 Proposed Project Site

Project 1: Inland Fisheries Resources and evaluation of the Fishery Management

Project Sites:

- a. Kanwekabo Leasable Fishery (Wetland) - Delta region (Lower Myanmar)
- b. Taung Ta Mann leasable fishery (Tank) - Mandalay (Upper Mandalay)

Project 2: Inland Fishing gears

Project Sites:

All along the rivers, creek, lakes and delta region.

Project 3: Taxonomy of Inland Fishes

Project Sites:

Countrywide: Northern Temperate region
Eastern hilly areas

Southern delta areas
Middle dry zone

5.2 Methods in Data Collection

5.2.1 Primary Data Collection

- Geographical and hydrological conditions at the project sites are to be taken on a monthly basis.
- Climatic conditions are to be noted daily.
- Fishing gear is to be collected and recorded with the help of camera.
- Ten commercially important species from two project sites are to be selected as main target species.
- Two technical staff and one biologist to be posted at the project site.
- Socio-economic situations are to be collected from time to time through verbal interviews.
- Previous data and information are to be collected in order to compare with the present collection of data and information.

5.2.2 Secondary Data Collection

- To be planned and implemented based on the results and experiences.

5.3 Data to be Collected

- Geography: Maps, topography, waterways and levels.
- Hydrography: Temperature, deposits, flow, turbidity, colors
- Chemical: Nitrate, phosphate, ammonia, DO, pH, hardness.
- Biology: Species contents, abundance, sexual maturity stages, season, fecundity, larvae, plankton, gut contents.
- Landings (catch): Number and percentage, species and sizes of stocked fishes.
- Growth, number and size (weight) of the undersized fingerlings or juveniles of commercially important fishes which are released back to water bodies at the project sites in rainy season after keeping them temporarily in ponds during dry season.
- Socio-economy survey: population, mainstay of the family income, amount of income, expenses, education, health.
- Number, species and sizes of hatchery bred fish seeds stocked into the project area.

5.4 Data Analysis

Data and information collected are to be analysed in accordance with regional or international methodology. Expertise and software are to be provided.

6.0 Envisaged Outputs

- a) Contribution to member countries with good experiences and sound data on replenishing of stock and restoration of habitats in freshwater fishery management.
- b) Through information on impact of environmental factors on biodiversity and their production. The result can be used as an example for neighboring countries.
- c) Two reference collection for local species.
- d) Documents on fishing gears.
- e) Distribution, route, growth and survival rate of larvae.
- f) Effectiveness of systematic management on culture based capture fisheries.
- g) Inspiration of fishery community with good farming and fishing practices.
- h) Classified lists and records of riverine and wetland fishes.
- i) Detail information on improvement of socio-economic of local communities reflected by replenishing of water bodies with fish seeds and conservation practices.
- j) Database for national development plan.

7.0 Proposed Activities and Budget Requirement for Three Years

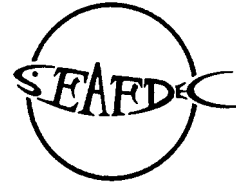
Source of Funding:

- Financial assistance from Japanese Trust Fund through SEAFDEC
- The local cost will be born by Department of Fisheries, Myanmar.

No.	Proposed Activities	Budget (USD)
1.	Planning of Project	-
2.	Training of project technical staff	7,000
3.	Procurement of materials, equipment, references, publications	50,000
4.	Establishment of reference collection	50,000
5.	Travel expenses and DoF for project experts and consultants	5,000
	Total	127,000

8.0 Project Team Member

No.	Researchers	Responsibilities
1.	U Hla Win: Deputy Director General	Project Team Leader
2.	U Aung Myint: Deputy Director	
3.	U Myint Thein: Information	Project staff
Project 1: Inland Fishery Resources and Evaluation of Fishery Management		
4.	U Myint Oo	National Coordinator Chief, Fisheries Management Division
5.	U Kyaw Myo Win	Deputy Director, Researcher
6.	Daw Aye Aye Zaw	Environment
7.	Daw Ma Ma Lay	Statistics
8.	Daw Tin Tin Oo	Socio-economic
Project 2: Inland Fishing Gears		
9.	U Khin Mg Aye	Head, Fisheries Training Institute Gear Technician
10.	U Win Thein Oo	Researcher (Gear)
11.	U Myint Soe	Researcher (Gear)
Project 3: Taxonomy of Inland Fishes		
12.	U Myint Pe	Head, Resource Division Taxonomy
13.	U Mya Than Tun	Taxonomic



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF PHILLIPPINES**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT Inland Capture Fisheries of Philippines

Title:

Fisheries Ecological Assessment of Lake Naujan, Oriental Mindoro, Philippines

Habitat: Lake (Inland freshwater body)

Duration: 2004 to December 2005

Proponent: Department of Agriculture
Bureau of Fisheries and Aquatic Resources (Central Office Manila)
Inland Fisheries and Aquaculture Division (IFAD) and
Capture Fisheries Technology Division (CFTD)

Cooperators: Local Government Units-Municipality of Naujan
BFAR-Regional Field Office NO. IV-B
Research Outreach Station-Naujan
Department of Environment and Natural Resources
PENRO-Naujan, Occidental Mindoro
Naujan Lake Fishermen's Association

1.0 Background and Rationale

- 1.1 Lake Naujan in Oriental Mindoro is the fifth biggest lake in the Philippines. It has an area of about 8,000 hectares, which is 20 meters above sea level with a maximum depth of 45 meters.
- 1.2 It is bounded by four (4) municipalities namely Naujan, Victoria, Soccoro and Pola. Its surrounding environs are characterized by marsh lands, swamps and mountain ranges.
- 1.3 The project addresses the importance and usage of data information; data gathering, analysis and interpretation to support the sustainable management of inland capture fisheries.
- 1.4 Important inland capture fisheries and migratory species such as "banak" (*Mugil sp.*); "simbad" (*Caranx sp.*); "maya-maya" (*Lutjanus sp.*); and "bangus" (*Chanos-chanos*) abound in the lake.
- 1.5 Inland fisheries play an important role in the socio-economy of the rural areas of Naujan and provide local food security and livelihoods for the people.
- 1.6 Declining diversity and production of major fish fauna and migratory species of the lake has been recorded.
- 1.7 Review of literature revealed scarcity of studies conducted on the state of lake's fishery, limnology, fish biology and migratory pattern.
- 1.8 Existing information on the current and existing fishing gear used and practices on capture fisheries are very limited, fragmented underestimated, if there are poorly reported.

- 1.9 Formulation of management policy needed in the sustainable resource use of the lake fisheries resources.

2.0 Literature Review

- 2.1 In the past years, a few studies had been made about the lake's ecology and fisheries.
- 2.2 A fishery survey was conducted by the Fisheries Integrated System Development Approach for Mindoro (FISDAM, 1979), which gave an estimated annual yield of the lake at 131,804 MT.
- 2.3 On the other hand, the 1976-78 record of the Bureau of Fisheries and Aquatic Resources (BFAR) showed an average annual production of 297,983 kgs. (Reyes, 1978) The inconsistent production data available, disallows an accurate biological status of the lake's resources.
- 2.4 There is a pressing need to establish sound limnological data on Naujan Lake because of its high economic potential.
- 2.5 The lake is the only inland water in Luzon where migratory species of marine fishes are still abundant in commercial scale.
- 2.6 It is considered a sanctuary area and potential reservoir of fish breed stock like milkfish, eel, red snapper, mullet, etc. Early researches on the lake started as early as 1916 by Pratt, Woltereck, *et. al* (1932), Blanco, *et. al* (1955), Delmendo and Angeles (1967) provided some information on the lake's characteristics.
- 2.7 The fisheries of the lake consists mostly of migratory fishes which include mullet, *Mugil dussumieri*; milkfish, *Chanos chanos*; snapper, *Lutjanus argentimaculatus*; tarpon, *Megalops cyprinoides*; eel, *Symbrachus bengalensis*; spade fish, *Scatophagus argus*; the non-migratory species or endemic fishes of the lakes include snakeheads, *Ophicephalus striatus*; freshwater catfish, *Clarias batrachus*; tilapia, *Tilapia mossambica*; goby, *Glossogobius giurus*; and shrimp, *Macrobrachium lanceform*.

3.0 Goals

- a) To establish fisheries ecological profiling of Lake Naujan in terms of physico-chemical features; biological diversities; fishery; fish biology and socio-economy of the resources.
- b) To formulate site-specific policy recommendation for the management, conservation, protection and sustainable resource use of the lake Naujan.

4.0 Objectives

- a) To conduct an inventory of the existing aquatic resources (fish fauna and migratory species), gear used and methods for capture fishing.
- b) To study the basic fertility of the lake (physico-chemical & biological) that may influence abundance and distribution of fish & fish larvae and determine potential for fish production.
- c) To determine the catch per unit effort (CPUE) and size composition of the dominant and migratory species in the lake.
- d) To evaluate the socio-economic profile of capture fishermen in the lake.

- e) To develop database information at the regional and localized level.

5.0 Materials and Methods

This will be a two-year research study, which is targeted to start in January 2004. As targeted Lake Naujan will be assessed to collect time series data on the following area:

- A. Capture Fisheries Profile**
- B. Fisheries Biology of Major Fauna**
- C. Lake Ecological Characteristics**

A. Capture Fisheries Profile

Fishing boats using different kinds of fishing gears will be inventoried, and boarded for at least five (5) fishing days per month to determine abundance and distribution of catch and species. Fishing data that will be collected, during actual boarding are name of vessel/gear; specifications of the net; location (coordinates); time setting; time hauling; species caught; volume by-catch (species, volume); operational expenses; price of fish; investments; crew data; sharing/wages system; etc.

The catch in terms of species and their volume will be computed based on the total landed catch and the catch per unit effort (CPEU) will be determined, Length and weight measurements of each species at random will be recorded.

B. Fisheries Biology of Major Fauna

Major and minor fish landing points for each lake will be identified. Fish landing stations will likewise be established from the identified landing points to monitor the volume of catch landed from dominant gear and identify catch composition by species and sizes; and individual length, weight and body depth measurement. Sex and gonad maturity of dominant and endemic species will be determined from the representative sample and gut content of some commercially important species will be analyzed.

Fish samples of major and migratory species to be utilize for biological study will be collected monthly from pre-determined fish landing points yielded from open water fishery or to be collected directly from the fish corral operating in the lake which ever is significant in catching migratory species understudy.

All samples obtained from the fish landing stations or fish corrals will be measured and weighted individually for length and weight frequency measurement using a measuring board and a triple beam balance. Catch composition by species and size will be recorded and computed monthly, plotted on to graph and presented into histogram. The total length-weight relationship for each migratory species will be computed using the parabolic formula $W=aLb$.

A representative samples collected from fish landing points will be purchased for each species understudy and will be dissected for the determination of sex ratio, maturity stage, spawning months. Theses methods may also assess factors that may be associated with the migration of the species.

C. Socio-economic Profile (Capture Fisheries)

Capture Fisheries is the major livelihood activities in the lake that include stationary fish structures locally known as “baklad”. The component study will assess the primary use of the lake resources with preference to the ongoing fishery activities around the lake environs. The objective is to establish a bench mark information on key development indicators, analyze the resource opportunities, constraints and potential of capture fisheries and describe the socio-economic and demographic conditions of the study sites and identify interventions which are necessary in the setting up of strategies that addresses the needs of the community around the lake.

Capture fisheries survey using structured questionnaires will be used to generate information from respondents. The selection of the respondent will be used on random sampling techniques. Twenty percent (20%) will be identified as key informants to represent the whole population.

6.0 Project Schedule (2004)

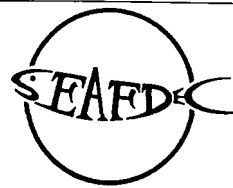
Activities	1	2	3	4	5	6	7	8	9	10	11	12
1. Planning/coordination and ocular survey of Lake Naujan.												
2. Design Program/plan, questionnaires dry-run and reproduction												
3. Inventory Fishing Boats, Fishing Gears Collection of Data on the common migratory species, its biology, conduct of limnological study.												
4. Preparation and Submission of Analyzed Monthly reports												
5. Submission of Scientific Paper												

7.0 Proposed Activities and Budget Requirement for One Year

No.	Activities	Amount (in pesos)	Amount (USD)
1.	Traveling expenses (for 1 year)	348,000	6,300
2.	Supplies and materials	84,000	1,600
3.	Equipments	780,00	14,200
4.	Boat rental	120,000	2,200
5.	Honoraria	168,000	3,000
	Over-all Total	1,500,000	27,300

8.0 Project Team Member

No.	Designation	Name	% Involvement
1.	Project Leaders	Abundio M. Galicia, Jr. (Fishery Biology and Limnology)	30
2.		Fileonor O. Eleserio (Capture Fisheries and socio-economics)	30
3.	Assistant Project Leaders	Emerita S. Lapasaran (Fishery Biology and Limnology)	25
4.		Lainie C. Tiongson (Capture Fisheries and socio-economics)	25
5.	Technical Staff	Benebert R. Fernando (Capture Fisheries and socio-economics)	20
6.		Renato Almonte (Capture Fisheries and socio-economics)	20
7.		James O. Villanueva (Fishery Biology and Limnology)	20
8.		Dennis F. Togonon (Fishery Biology and Limnology)	20
9.	Statistician (BAS)	Stella C. de Ocampo (Project Statistician)	25
10.		Reinalda P. Adriano (Statistician Staff)	25
11.	Support Staff	Myrna B. Ramos	20
		Angelina A. Padilla	10
		Rodolfo P. Tigue	10
12.	Administrative Staff	Lutgarda Sebastian	10
13.		Reynaldo Ronquillo	10



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF THAILAND**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Thailand

Title:

Management of Economically Important Fisheries Resource in Vachiralongkorn Reservoir, Kanchana Buri Province, Thailand

Habitat: Reservoir

Duration: May 2004 to May 2005

1.0 Background and Rationale

There are 25 major reservoirs, with surface area over 1,200 ha, in Thailand. The total surface area of 316,016 ha was ranging from 1,200 to 41,000 ha. Most of Thai reservoirs are multi-purpose reservoirs where about half were build priorities for power generation and the other for irrigation purposes. Some of the irrigation reservoirs were later also adapted for power generation. Fisheries is taken place in all of these reservoirs but as reservoir function comes in the third or the fourth place. However, reservoirs permit fisheries as a secondary or primary of activities for the people, especially the poor people, living in the vicinity of the reservoir. Catches are not only used for home consumption, making fish the cheapest animal protein source for such sectors of the populace, but are also the main and additional source of family income with required low capital input.

The reservoir fisheries in Thailand have increased substantially compared with production from the more riverine fisheries, which permit people to freely exploit in these resources. The average of fish yield in Thai reservoirs is 49 kg/ha/year and the estimated maximum sustained yield (MSY) and optimum fishing effort are 93 kg/ha/year and 10 fishers/km², respectively. It has been recognized that there are three main problems in Thai reservoirs fisheries, namely: i) heavy exploitation of fishery resource, ii) problems in planning, and iii) problems in management (Prompoj, 1994).

Vachiralongkorn reservoir located in the western of Thailand where about 250 km far from Bangkok and 161.8 m above mean sea level. The reservoir established in 1985 with the maximum water surface area, mean depth and water volume of 353 km², 24.0 m and 8,860 million cubic meter, respectively.

2.0 Goals

To make management recommendations of fishery resource in Vachiralongkorn reservoir with could be manage in a sustainable way using fishery biology and catch information.

3.0 Objectives

- a) To estimate yield of the reservoir in term of yearly catch,
- b) To study fishery, gear efficiency, and gear variability used in the reservoir,

- c) To estimate population parameters of economically important species: growth, mortality, recruitment, and
- d) To predict and assess the optimum fishing level and maximum sustainable yield from population parameters and catches.

4.0 Projects Activities

- a) Evaluate fish yield of total catch by monitoring fish landing at monthly interval by direct interview and logbook,
- b) Evaluate fishing gear efficiency and fishing activity
- c) Population dynamic study
- d) Predict and assess the optimum fishing level and maximum sustainable yield from population parameters and catches

5.0 Materials and Methods

5.1 Proposed Project Site

All activities will be sampling and survey at nine landing sites and its adjacent area (Fig 1.). Five dominant catch species as *Mystus nemurus*, *Hampala macrolepidota*, *Osphronemus gorami*, *Channa micropeltes* and *Pristolepis fasciatus* will also be evaluated in one year round.

5.2 Methods in Data Collection

During the fishing season, 20-30 fishers of each main type fishing gears will select randomly for yield and effort estimated. Catch per unit of effort of each gear will be estimated as kg/unit of gear/day or night.

Monthly interviewing, sampling and survey of the total catch and five target species catch, gear efficiency and fishing effort, and the data of length frequency distribution of those target species will be collected at all nine fish landing sites.

5.3 Data Analysis

Various methods such as Ford-Walford, Gulland and Holt will be used for estimation of growth parameters by FiSAT programme. The initial condition parameter (t_0) will estimate using the von Bertalanffy method. Natural mortality coefficient, M , will estimate from the empirical linear relationship model of Pauly. The Wetherall method will apply to estimate the total mortality coefficient, Z . The fishing mortality will calculate as $Z-M$. Recruitment patterns will be analyzed through LFD and von Bertalanffy's growth parameter. Beverton and Holt's relative yield per recruitment model will use to explain the optimum exploitation rate and Thomson and Bell predictive length-based model will apply to study sustainable yield model.

6.0 Envisaged Output

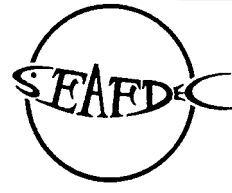
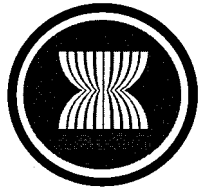
The recommendations option for Vachiralongkorn reservoir fisheries management will be obtained from the study.

7.0 Proposed Activities and Budget Requirement

No.	Proposed Activities	Budget (Baht)	Budget (USD)
1.	Travel cost for monthly field sampling	149,100	3,550
2.	Consumable cost	10,500	250
3.	Fuel cost	43,680	1,040
4.	Documentation cost	21,000	500
	Total	224,280	5,340

8.0 Project Team Members

1. Mr.Boonsong Sricharoendham Senior fishery biologist, Inland Fisheries Resource Research and Development Institute, Department of Fisheries.
2. Miss Jintana Damrongtripob, Fishery biologist at Kanchana buri Fisheries Research and Development Center, Department of Fisheries.
3. Mr. Amporn Sakset, Fishery biologist at Kanchana buri Fisheries Research and Development Center, Department of Fisheries.
4. Mr. Jinda Sookcharoen, Driver



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**PROPOSAL FOR PILOT PROJECT
INLAND CAPTURE FISHERIES OF VIET NAM**

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

PROPOSAL FOR PILOT PROJECT

Inland Capture Fisheries of Viet Nam

Title:

Data Collection and Information of Inland Capture Fisheries for Management in the Mekong Delta

Habitat: River and Floodplain

Duration: Two years

1.0 Background and Rationale

Natural fisheries resources in the Mekong Delta are very abundant in fish species composition. More than 250 species, consisting of various ecological groups: swamp fish or “black fish”, riverine fish or “white fish”, brackish water fish, anadromous fish, migrating fish to upstream for spawning have been identified. Among them about 50 species are considered as commercial fish due to big catch or large size or high selling price.

The inland fisheries have an important role in mainly providing animal protein source to the people’s diet in the Mekong Delta. Data from household surveys in An Giang and Tra Vinh provinces showed that the average fish consumption is about 59 kg fish per capita per year, accounting for 62 - 75% of total animal protein food in their diet.

However, the studies on history of inland fisheries and fisheries description in the Mekong Delta were scattered and have not been updated for a long time. In 1980s, there were a few surveys and studies related to the fish species composition, biology of some fish species and catalogues of main fishing gears. In 1992, the MRC Fisheries Program produced a report on fisheries description in the Lower Mekong Basin in which the inland fisheries in the Mekong Delta were reviewed. Since then the fisheries resources and fisheries have been greatly changed due to development, change of land uses and diversity of agricultural production. At present no survey or review has been done for reviewing information of the inland fisheries in the Mekong Delta.

On the other hand, the previous surveys also gave different figures of inland fish production in the Mekong Delta, varying from 50,000 tones (MRC, 1992) to more than 200,000 tones (MRC, 2001) due to different approaches. The statistic data on fisheries are not reliable and quite different between the provincial Statistic Department and the Fisheries Department or Department of Agriculture and Rural Development. Additionally, due to small scale and unprofessional fisheries, it is very difficult and unrealistic to correctly assess fisheries resources. However, in term of fisheries management, the monitoring of trends of resources is more important than estimation of fish production and can be indirectly observed through the monitoring of catch, fish species composition, fish size at some fishing gears or local markets in time series. In this context, it is necessary to

improve monitoring system to be able to collect reliable data on fisheries statistics that can be more effective for management of the inland fisheries in the Mekong Delta.

2.0 Goal

To improve information of inland capture fisheries for management and sustainable development of fisheries resources in the in the Mekong Delta, Viet Nam.

3.0 Objective

To establish a sustainable system for collecting and monitoring data on inland capture fisheries necessary for effective and sound management of inland fisheries in the Mekong Delta.

4.0 Project Activities

- a) Setting up strategies for field surveys and data collecting
- b) Designing survey framework and monitoring systems.
- c) Training stakeholders involved in data surveys and monitoring systems.
- d) Data collection
- e) Data entry and analysis
- f) Producing information on inland fisheries to target users.

5.0 Materials and Methods

5.1 Proposed Project Sites

An Giang and Dong Thap provinces (inland provinces) in the Mekong Delta of Viet Nam.

5.2 Methods in Data Collection

- Fisheries household interview.
- Local officer interviews for secondary data on inland fisheries in provinces.
- Monitoring stations.
- Market surveys/monitoring.

5.3 Data to be Collected

- Data on fishing effort (gears/boats)
- Fish catch.
- Fish markets

5.4 Data Analysis

SPSS, Statistical software.

6.0 Envisaged Outputs

- a) Monitoring/collecting systems for data on inland capture fisheries.

- b) Information of inland capture fisheries in the Mekong Delta updated.
- c) Trained staff for data collection and information generating

7.0 Proposed activities and Budget Requirement for 2 years

External contribution:	USD 100,000
Government contribution (in kind):	USD 50,000
Total:	USD 150,000

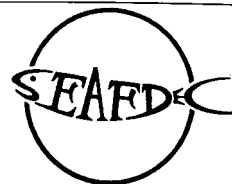
No.	Proposed activities	Budget (USD)
1.	Household surveys/interviews	25,000
2.	Gathering secondary information and data	15,000
3.	Monitoring at field stations	15,000
4.	Market surveys and monitoring	15,000
5.	Data entry to database & analysis	25,000
6.	Generating information for target users	5,000
7.	Training staff and governmental officers	20,000
8.	Consultancy	20,000
9.	Contingencies	10,000
	Total	150,000

8. Project Team Members

- Staff from Research Institute for Aquaculture No. 2
- Officers from provincial/district fisheries authorities
- Commune officials
- Interviewers mobilized from Fisheries University

9.0 Project Schedule

No.	Activities	Year 1	Year 2
1.	Setting up strategies for field surveys and data collecting	—	
2.	Designing survey framework and monitoring systems	—	
3.	Training stakeholders involved in data surveys and monitoring systems	—	
4.	Data collection: interview campaign/ monitoring	—	—
5.	Data entry and analysis	—	—
6.	Producing information on inland fisheries to target users		—



**REGIONAL TECHNICAL CONSULTATION
ON INFORMATION GATHERING FOR
INLAND CAPTURE FISHERIES IN ASEAN
COUNTRIES**

**Kuala Lumpur, Malaysia
4-6 August 2003**

**WORK PLAN OF PROJECT: INFORMATION
GATHERING FOR INLAND CAPTURE
FISHERIES FROM 2002 TO 2005**

MAHYAM MOHAMMAD ISA

**Marine Fishery Resources Development and
Management Department
Fisheries Garden, Chendering
21080 Kuala Terengganu
Malaysia**

WORK PLAN OF PROJECT: INFORMATION GATHERING FOR INLAND CAPTURE FISHERIES FROM 2002 TO 2005

Program Title

Follow-up Program of the Special 5-year Program on the contribution of Sustainable Fisheries to Food Security in the ASEAN region

Project Title

Information Gathering for Inland Capture Fisheries in the ASEAN countries

Lead Department: MFRDMD

Lead Country: Cambodia

Team Members

- a) Resource persons/core expert from each ASEAN member countries except for Singapore.
- b) Researchers of MFRDMD
- c) SEAFDEC Secretariat, Bangkok
- d) SEAFDEC Training Department, Bangkok
- e) Researchers of FRI, Penang, MACRES and KUSTEM

Duration: 2002 - 2005

1.0 Definition

a) Inland Waters

A body of water confined to freshwater only such as lakes, rivers, reservoirs / dam, floodplains, swamps, marshes, lagoon, irrigation canal, channel, tributaries, spring, stream, drainage, ex-mining pools.

b) Inland Fisheries

Fishing operation in inland waters

c) Capture Fisheries

Use of fishing gears for catching fish (excluding aquaculture)

d) Information

Knowledge that includes data on fishery, biology, environment and socio-economy of the community concerned.

Try to collect information on what, where, how and who

2.0 Background and Rationale

Inland capture fisheries are characterised by great varieties of fishing gears and methods used, types of environments, social and culturally complex societies. Due to these complexities, it has been difficult in establishing and compiling good quality information that is very beneficial for policy makers and administrators in managing sustainable development of inland fisheries resources. Presently, most information on inland capture fisheries in Southeast Asia are still scanty, fragmented, poorly reported and of insignificant importance as compared to the established system in the data collection of

marine capture fisheries. The estimates of production from inland capture fisheries are not based upon direct observations, report verification and elaborate sampling procedure of catch or landings. Fishing activities are mostly dispersed and this further elevates difficulty in obtaining accurate estimates of production. Moreover, the current information collected on inland capture fisheries does not provide adequate information for addressing, monitoring or managing issues that related to rural livelihoods. The rural communities heavily depended upon inland fisheries resources in sustaining their livelihoods. Therefore, more effort needs to be addressed in compiling and gathering accurate information on inland capture fisheries as basis for sustainable management of the resources.

3.0 Project Objectives

- a) To strengthen collection and compilation of information for inland capture fisheries in ASEAN member countries
- b) To gather as much information on inland capture fisheries and act as basis for future plan on sustainable management of inland fisheries resources.
- c) To promote information exchange among ASEAN member countries through networking
- d) To establish standard format of data entry and collection of data

4.0 Proposed Projects

- a) Regional Projects
- b) Pilot Projects

A conceptual plan of this project is outlined in Figure 1.

5.0 Regional Projects: Four projects (2003-2005)

- a) Compilation on Fishing Gears and Methods used in inland capture fisheries of ASEAN member countries.
- b) Compilation on list of species and scientific biological information on commercial species caught in the inland waters of ASEAN member countries.
- c) Compilation on environmental conditions on inland areas of ASEAN member countries.
- d) Compilations on socio-economic information of inland capture fisheries in ASEAN member countries.

6.0 Pilot Projects: Five projects

Habitat Basis: Riverine System, Reservoirs and Floodplains

- a) Status and Trend of Fishery and Species distribution.
- b) Scientific biological information on commercial species.
- c) Larval identification and distribution.
- d) Role of environmental factors to the abundance and distribution of indigenous species/ community.
- e) Compilation on socio-economic activities of communities in inland fisheries.

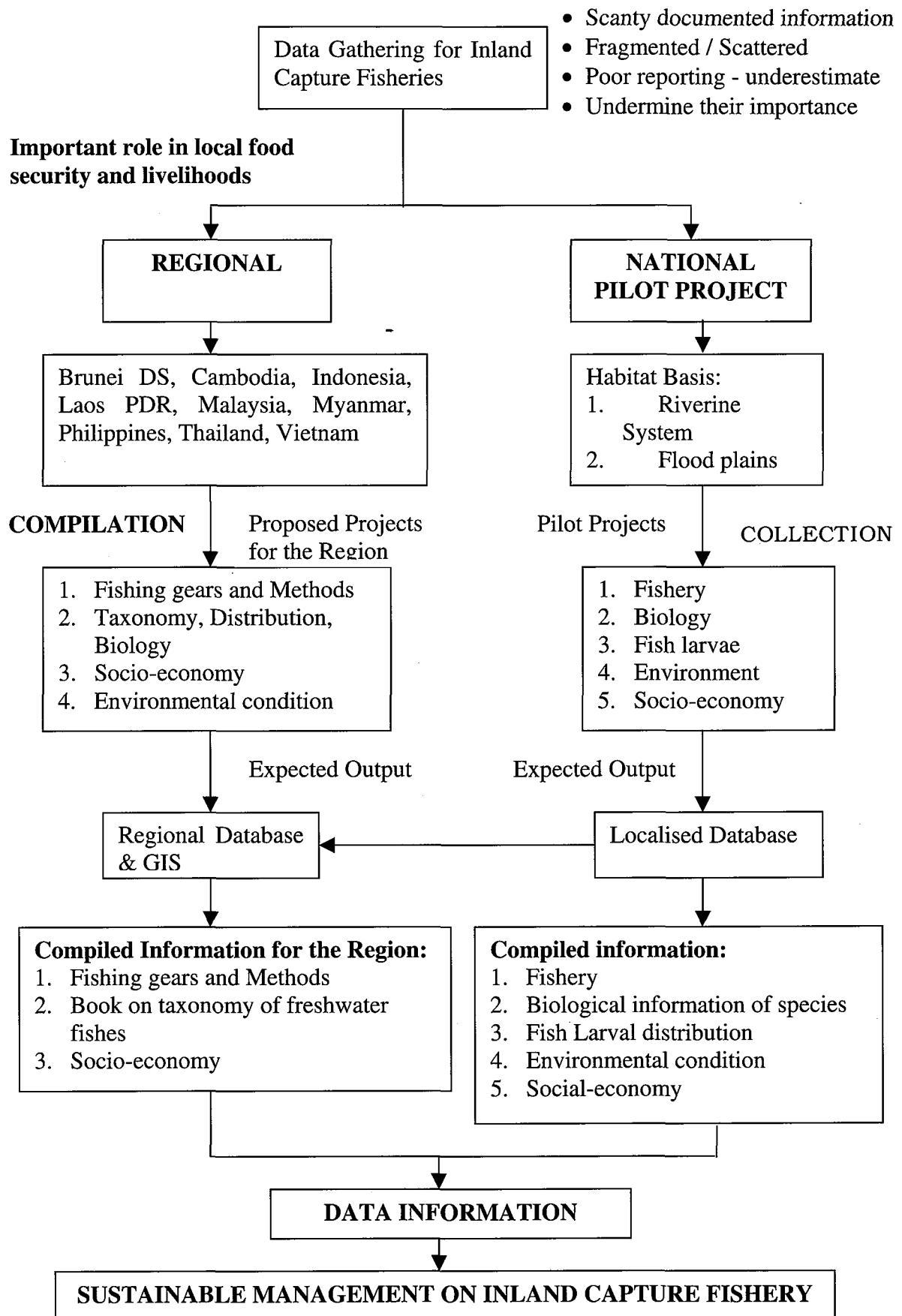


Figure1: Conceptual Plan for Information Gathering on Inland Capture Fisheries

REGIONAL PROJECTS

Proposed project sites: All ASEAN member countries

Duration: 2003 to 2005 (Three Years)

1.0 Objectives

- a) To collaborate with resource persons from each ASEAN member countries in strengthening collection and compilation of information on inland capture fisheries.
- b) To gather as much information on inland capture fisheries and act as basis for future plan on sustainable management of inland fisheries resources.
- c) To promote information exchange among ASEAN member countries through networking
- d) To establish standard format of data entry and collection of data

2.0 List of Projects

- a) Compilation of Fishing Gears and Methods used in inland capture fisheries of ASEAN member countries.
- b) Compilation of list of species, distribution and scientific biological information including migratory pattern on commercial species caught in the inland waters of ASEAN member countries.
- c) Compilation of environmental conditions on inland areas of ASEAN member countries.
- d) Compilations of socio-economic information on the communities of inland capture fisheries in ASEAN member countries.

3.0 Project Activities

3.1 Organize Three Regional Meetings

a) First Regional Technical Consultation (4-6 August 2003)

- i. To identify core expert and resource persons from all ASEAN member countries.
- ii. To gather information on fishing gears and methods, species composition, biological information on commercial species, environmental conditions and socio-economic information of inland capture fisheries for each ASEAN member countries.
- iii. To identify and implement pilot project
- iv. To establish Standard Operating Procedure and format in data collection, gathering and analysis on inland fisheries resources.

b) Progress Meeting on Project (Tentatively February 2005)

To evaluate progress of the implementations of pilot projects by participating countries

c) Final Regional Technical Consultation (Tentatively November 2003)

- i. To present outputs of project
- ii. To recommend for Follow-up actions on inland capture fisheries that benefits for all ASEAN member countries.

3.2 Implementation of Regional Project

Compilation of information on fishing gears and methods, fish species, environmental conditions and socio-economy with the help of core expert/ resource persons that had been identified/ agreed during the first RTC in Kuala Lumpur.

3.3 Implementation of Scientific Data Collection (Pilot Projects)

The proposed projects will be conducted in three different habitats: Riverine system, reservoirs/ lakes and floodplains

3.4 Establishment of Database

For data entry, listing and archiving of information on inland capture fisheries. Compilation and dissemination of all relevant data set will be presented in the form of GIS, which is an indispensable tool. The GIS outputs will be able to show spatial distribution of inland fisheries resources in the studied areas and to be distributed through websites/ CDs

3.5 Establishment of Websites on Information Gathering for Inland Capture Fisheries in ASEAN Countries

A website on this project will be initiated to provide some information on the progress of the project. Similarly a website on inland database will also be developed to act as a platform to gather and compile information on inland water bodies and support for the gathering of information on inland capture fisheries in ASEAN countries. The websites will be regularly updated with information gathered from pilot studies as well as from reports submitted from member countries. The websites are also link to other websites containing information about the background of the country, weather conditions and fishing industries that are related to inland capture fisheries.

3.6 Organize Two Regional Trainings

- a) Short term course on data collection, entry and analysis for member countries
- b) Short term course on freshwater fish classification/ verification and fish larvae

3.7 Consultation Visits

Consultation visits to all ASEAN member countries for information evaluation and rectifications and photographing on materials/subjects will be conducted from time

to time. This will be carried out at selected sites for observation on inland capture fisheries in different habitat systems.

4.0 Expected Outputs

- a) Book on fishing gears and methods used in inland capture fisheries in ASEAN countries.
- b) Book on list of freshwater species and biological information for commercial important species of inland capture fisheries in ASEAN countries.
- c) Book on social and economic information on inland capture fisheries in ASEAN countries.
- d) Database and GIS on lists of freshwater fishes, fishing gears and methods.
- e) Reports of Regional workshops.
- f) Standard Operating Procedure and format for data collection and analysis.
- g) Network among ASEAN member countries on inland capture fisheries.

5.0 Project Schedule and Proposed Activities from 2002 to 2005

No.	Proposed Activities	2002	2003				2004				2005			
		4	1	2	3	4	1	2	3	4	1	2	3	4
1.	Project proposal and reviewing existence scientific information on inland fisheries in ASEAN countries.	■												
2.	Preparation on organizing First Regional Technical Consultation	■	■											
3.	Organize First RTC meeting to: a) Identify resource person b) Gather and compile Information c) Endorse and adopt regional and pilot projects			■										
4.	Implementation of regional projects: Compilation of information on fishing gears and methods, fish species, environmental conditions and socio-economy.			■	■	■	■	■	■	■	■	■	■	■
5.	Consultation visits to selected sites for observation of fisheries in different systems						■				■			
6.	Implementation of scientific data collection (pilot projects): Three habitats - Riverine system, reservoirs/ lakes and floodplains		■	■	■	■	■	■	■	■	■	■		
7.	Capacity building: Regional Trainings / participate in research seminars or symposium: a) Participate in LARS2 Symposium b) Short term course on data entry for information on capture inland fishery c) Short term course on freshwater fish classification/ verification and fish larvae		■								■			
8.	Websites: Development and updating information			■	■	■	■	■	■	■	■	■		
9.	Database and RS/GIS: Development and data entry			■	■	■	■	■	■	■	■	■		
10.	Organize Progress Meeting										■			
11.	Organize Final RTC													■
12.	Publications of reports								■					■

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