Selection Criteria and Co-Management Guidelines for Harvest Reserves in Tropical River Fisheries

Regional Reserves Survey Report

UK Department for International Development
Fisheries Management Science Programme
Project R7043

Central Research Institute for Fisheries, Indonesia
Provincial Fisheries Services, Indonesia
MRAG Ltd, UK

April 1998

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Funding: UK Department for International Development (DFID)
Renewable Natural Resources Research Strategy (RNRRS)
Fisheries Management Science Programme (FMSP)
Project R7043

Collaborators:

Central Research Institute for Fisheries, Indonesia (**CRIFI**),
Jalan K.S. Tubun, Petamburan VI, P.O. Box 6650, Slipi, Jakarta 11410 A, Indonesia

Provincial Fisheries Services **(Dinas Perikanan)**
South Sumatra Province, Jalan Kapten A. Rivai II, Palembang, South Sumatra
Jambi Province, Jalan MT. Haryono No. 9, Jambi 36129, Jambi
West Kalimantan Province, Jalan Sutan Syahir No. 16, Pontianak 78116 A, West Kalimantan

MRAG Ltd, 47 Prince's Gate, London SW7 2QA, UK

Report Authors:

Aeron-Thomas, M; Garaway, C; Hoggarth, DD; Koeshendrajana, S; Nasution, Z & Sarnita, A

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Executive Summary

1. The aims of this project are to identify ecological and institutional criteria for the selection and beneficial use of harvest reserves in tropical, artisanal river fisheries; and develop guidelines for their co-management in Indonesia. The purpose of the guidelines will be the delivery of economic benefits to fishing communities, derived from enhanced recruitment to exploited fish stocks.

2. A 'reserve' is often understood to mean an area totally closed to exploitation for the purpose of nature conservation. In contrast, this project defines a *harvest reserve* as a spatially defined area of water, managed with any specified set of technical regulations, intended to sustain or increase the potential fish yield available from existing, natural fish stocks, for the benefit of fishers.

3. The project will run from November 1997 to March 2000, and involves collaborators from MRAG Ltd (UK), the Central Research Institute for Fisheries, Indonesia (CRIFI), and three provincial Dinas Perikanan (Fisheries Extension Service) offices in West Kalimantan (Kalbar), Jambi and South Sumatra (Sumsel) in Indonesia.

4. The project includes the following five main phases or activities:
   Inception and Legal Workshop (project inception and prospects)
   Regional Reserve Survey (reserve identification and fieldwork planning)
   Monitoring Programmes (biological, socio-economic and institutional surveys)
   Analysis of Reserve Benefits (estimation of reserve benefits, and their causes)
   Dissemination and Training (preparation and presentation of guidelines)

5. The Regional Reserve Survey (RRS) took place between 9 February and 27 March 1998. It was undertaken by six main collaborators from CRIFI and MRAG, with one biologist, one economist and one sociologist/institutional analyst from each institute. This team was supported by locally-experienced Dinas Perikanan fisheries officers in each province.

6. The objectives of the RRS were to study a selection of known 'reserves' in the three study provinces in terms of their ecology (their waterbody types and catchment positions etc) and their management institutions (the agencies responsible for management, and the regulations used). The information collected was used to develop a conceptual reserve categorisation system to enable a broad range of reserve types to be selected for further study in the following Monitoring Programme phase. Secondary objectives of the RRS were to involve local stakeholders in the project at this early stage, and to collaborate on the clear definition of remaining project activities.

7. The introduction to this report is followed by a conceptual framework of the mechanisms behind floodplain fisheries, showing the importance of interactions between spatial, ecological and institutional factors in determining the outcomes of management. This material is included as a prelude to the later proposals made for the Monitoring Programme.

8. In the field investigations, strong emphasis was placed on integrating information from the different collaborators to gain an inter-disciplinary perspective of the factors affecting reserves at each site. Initial activities in each province included discussions with Dinas Perikanan and other local experts on the characteristics of their reserves. A selection of these reserves were then visited to collect more detailed information on their ecology

and management. A standard checklist was used for interviewing village leaders and members of the fishing community. Two interviews were generally held in each village on each discipline to enable some cross-checking and integrated analysis (see section 3 for methodology). The data collected in each village are attached to this report as annexes. Comparative summaries of the village data and initial observations and proposals are were presented to the provincial stakeholders in Kalbar, Jambi and Sumsel at the end of each phase (see section 5 for observations on each province, and Annex B for itinerary).

9. Briefly, the field investigations showed that reserves were used quite differently in the three provinces. In Kalbar, community reserves were used by three of the forty fishing villages in the Danau Sentarum Wildlife Reserve (DSWR) to maintain their own local fish stocks. These reserves appeared to be effectively managed by strong, traditional institutions limiting certain gears or certain seasons, and local fish stocks still comprised many large, valuable fish species, compared to some other villages without reserves. In both Jambi and Sumsel, reserves were more often imposed 'top-down' by Dinas Perikanan: the regulations for these reserves usually prevented all fishing activities for the whole year, and were enforced by local guards. Both Jambi and Sumsel provinces have plans for developing many more river reserves in the near future. The Kalbar community reserves were intended to give benefits to fishermen within the village, while the Dinas Perikanan reserves were intended to distribute their benefits more widely among the villages of the whole catchment. Some of the reserves were not well designed, suggesting that there is an urgent need for the simple reserve selection criteria and management guidelines, to be produced by this project.

10. Reflecting the broad definition of harvest reserves adopted by the project, a reserve categorisation system was developed during the survey. The 22 harvest reserves identified in the three provinces were classified under the following headings:
- **!** Intended beneficiaries (local or catchment)
- **!** Catchment position (upland or floodplain)
- **!** Habitat type (river section or lake)
- **!** Management agencies (set up / managed mainly by government or community)
- **!** Management regulations (3 categories of partial reserves or full reserves).

11. This report includes preliminary plans for an interdisciplinary, integrated Monitoring Programme designed to investigate the above categories of harvest reserve. It is proposed that fieldwork activities should concentrate on reserves located wholly within the boundaries of single villages, with 4, 4 and 3 study sites in Kalbar, Jambi and Sumsel respectively. The monitoring should include a year-long sampling programme of both experimental fish catches and household economic data, adapted to local circumstances. These data will generate comparative indices on the state of the fish stocks within the reserves, and on the economic surplus generated by the fisheries within or around the reserves, and its distribution between village members and other stakeholders. A supporting programme of interviews and institutional analyses will give qualitative data on historical trends at each fishery and explore the mechanisms contributing to successes and failures of management. It is intended that the integrated, interdisciplinary analysis of these data sets will demonstrate (1) which types of reserves give the most benefits in given circumstances, and (2) what institutional arrangements are required for successful outcomes.

12. Further investigations were made during the RRS on the institutional arrangements for Indonesian inland capture fisheries to supplement the understanding gained in the December 1997 Legal Workshop (see Inception and Legal Workshop Report, March 1998). In collaboration with the fisheries agencies described earlier, it is now clear that

the Provincial Planning Agency (Bappeda), the Provincial Representative of the Ministry of Agriculture (Kanwil Pertanian) and the Local Agricultural Technology Institutes (BPTP/LPTP/IPPTP) each have a strong role in the extension of new agricultural management strategies, and should thus be given every opportunity to participate in the development of the project guidelines. Provisional proposals are made in section 8 of this report for the dissemination phase of the project.

13. The RRS phase ended with presentations of the survey investigations, results and proposals at the CRIFI offices in both Palembang and Jakarta. The Jakarta workshop was attended by the chief collaborators from the three Dinas Perikanan offices, and by key representatives of the Directorate Generals of Fisheries, Agriculture and the Environment. The Jakarta Workshop agreed that:

- An additional visit should be made to the upland reserves in Jambi province to consider their suitability for further study.
- CRIFI should establish an Indonesian Fishery Reserves Network to coordinate work on this issue.
- The Monitoring Programme should be undertaken as described in this report, within the period July 1998 to September 1999.
- The end-date of the project should be extended to March 2000.
- The project's Co-Management Guidelines should be written in collaboration with Ditjen Perikanan and with thorough consultation of the provincial collaborators and other stakeholders.
- A steering committee should be formed to ensure the successful and integrated uptake of project outputs.
- Legislation should be enacted to ensure a favourable environment for uptake of the project outputs.
- Pilot projects should be developed to begin after the project, using local funding, to demonstrate the potential benefits of the project recommendations.

1. Introduction

1.1 Project Aim

This project will identify ecological and institutional criteria for the selection and beneficial use of harvest reserves in tropical, artisanal river fisheries, and develop guidelines for their co-management in Indonesia. The purpose of the guidelines will be the delivery of economic benefits to fishing communities near to reserves, and ecological benefits, including broodstock maintenance and recruitment enhancement to the protected fish stocks.

1.2 Research Collaborators and Target Institutes

The project involves a collaboration between MRAG Ltd (UK), the Indonesian Central Research Institute for Fisheries (CRIFI) and three provincial Fisheries Service (Dinas Perikanan) offices in West Kalimantan, Jambi and South Sumatra. MRAG and CRIFI have worked together previously on two other FMSP projects, both mainly located in South Sumatra, and the second also briefly located in Jambi.

The provincial Dinas Perikanan are responsible for regional management and development of both capture and culture fisheries, under the national guidance of the Directorate General for Fisheries (Ditjen Perikanan). Dinas Perikanan are both research collaborators of the project (coordinating local activities and providing local knowledge) and 'target institutes', who it is hoped will use the outputs of the project. The Ditjen Perikanan is also considered a target institute due to its potential role in promoting the project guidelines to many more of Indonesia's 27 provinces.

1.3 Project Activities

The project includes the five following activities:

1. **Inception and Legal Workshop**
   To plan project activities and determine the scope for a locally-specific fisheries co-management strategy in Indonesia

2. **Regional Reserve Survey**
   To examine the types of fishery reserves currently used in Indonesia and plan a programme of investigations to determine the criteria for their success

3. **Monitoring Programmes**
   Data sampling and interview-based surveys of fish stock abundances and structures in selected categories of reserves and the economic surplus generated by fishing and its distribution in associated communities. Institutional analyses of the mechanisms whereby reserve benefits may be successfully gained, and those conditions leading to failure.

4. **Analysis of Reserve Benefits**
   Qualitative, interdisciplinary comparison of the ecological and socio-economic benefits from five different ecological and institutional categories of reserves.

5. **Dissemination and Training**
   Development of a set of participatory guidelines for the selection and co-management of reserves, set in the broad context of inland capture fisheries development, translated into Indonesian for use by Dinas Perikanan and associated agricultural extension agencies. Training of three Dinas Perikanan collaborating offices, and of Ditjen Perikanan trainers for wider promotion.

1.4 Regional Reserve Survey Objectives

Reserves of various sorts are already widely used in Indonesia, by various agencies and in many different habitats, including river systems. The Regional Reserve Survey (RRS) was undertaken to study those river reserves known to exist in three provinces having extensive river fishery resources.

The survey was designed to collect basic information on the ecology of each of the known reserves (their waterbody types and catchment positions etc) and on their management institutions (the agencies responsible for management and the regulations used). Such information was largely provided by the Dinas Perikanan collaborators, most often the main formal management agency. Further, more detailed information was collected during interdisciplinary village interviews on the local impacts of the reserves, on local or traditional participation in management, and on the perceived success of the management strategy. This information led to a reserve categorisation system, and the selection of representative study sites in each category for further work.

1.5 Regional Reserve Survey Field Study Sites

The project is investigating reserves in three Indonesian provinces, West Kalimantan, Jambi and South Sumatra. The first province, West Kalimantan (Kalbar) is dominated by the main Kapuas River flowing from the central mountain ranges of Borneo, to the sea at the provincial capital, Pontianak. The Kapuas catchment includes the Danau Sentarum system of lakes and floodplains in its middle reaches, which is managed by the Forestry and Conservation Department (PHPA) as a nature reserve and Ramsar site. Fishing has always been carried out in the reserve waters, and still continues, though conservation practices are encouraged. Traditional management practices are strong in this area and three villages had declared their own local reserve waterbodies within the wider Danau Sentarum lake system. These local reserves were particularly investigated by the project.

Jambi and South Sumatra lie adjacent to each other along the eastern side of Sumatra. In both provinces, major river systems flow down from Sumatra's Barisan mountain range towards the east coast. The main rivers studied were the Batanghari River in Jambi and the Musi and Ogan-Komering-Lempuing catchments in South Sumatra. River fishery reserves are being actively promoted by Dinas Perikanan in both these provinces with 8 reserves declared in Jambi since 1992, and 11 reserves in South Sumatra since 1982. More reserves are currently being considered. The selection criteria for these reserves are not clearly specified, and the institutional management structures used are generally oriented towards a top-down enforcement style.

1.6 Regional Reserve Survey Research Team

The RRS fieldwork was carried out by a multi-disciplinary team containing the following six permanent members from MRAG and CRIFI:

Dr Daniel Hoggarth, MRAG Biologist & Team Leader
Dr Achmad Sarnita, CRIFI Biologist
Mr Mark Aeron-Thomas, MRAG Socio-economist
Mr Sonny Koeshendrajana, CRIFI Resource economist
Ms Caroline Garaway, MRAG Institutional Analyst
Mr Zahri Nasution, CRIFI Socio-economist

In addition to this, 1-3 staff from the provincial Dinas Perikanan offices joined the team in each of the three study provinces to guide local fieldwork activities.

The survey was undertaken over a seven week period between 9 February and 27 March, 1998 (see Annex B).

2. Conceptual Framework for Floodplain Fisheries

2.1 Introduction

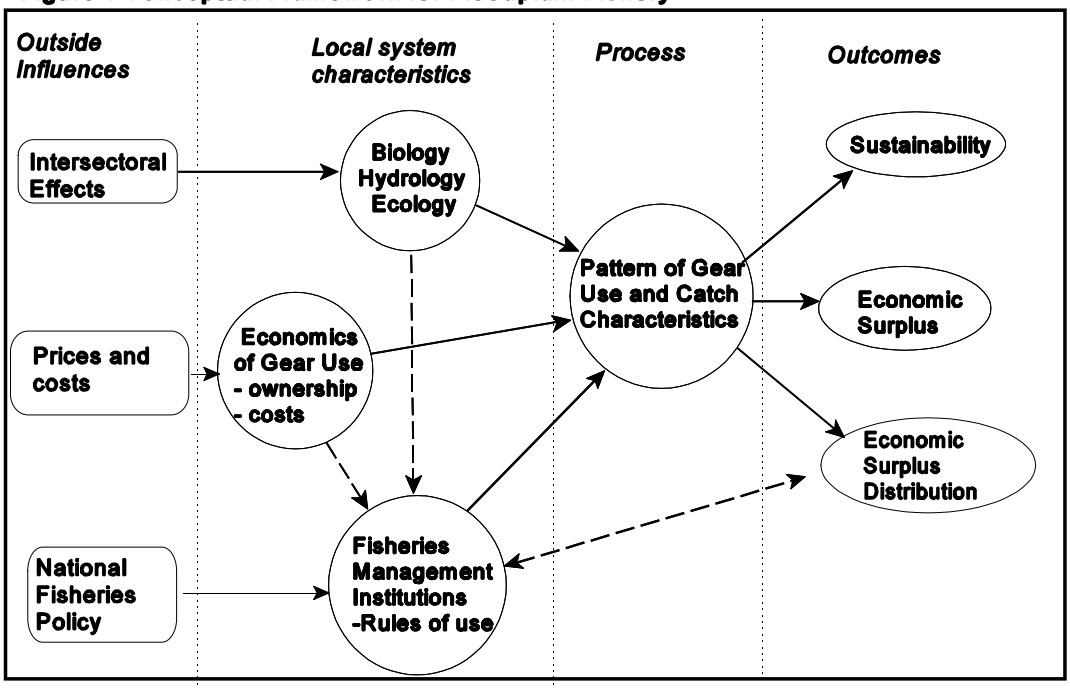
Reserves are one means of improving the management of floodplain fisheries. Criteria are needed for the selection of the waterbodies themselves, the rules that should apply to their use and the institutions to be involved in their management. These criteria need to be understood against the background of the sometimes competing objectives of floodplain fisheries management and the constraints that apply to it.

This section provides that background. The different components of a typical floodplain fisheries system are introduced within a framework that highlights their interactions and the effects these have on management objectives. The criteria for reserve choice and the management system necessary to make them effective is then discussed against this background.

2.2 The floodplain fisheries system: a framework for analysis

A conceptual model of floodplain fisheries is given in Figure 1 below. This shows the three main sets of *local system characteristics*: the natural resource (biology, ecology and hydrology), of technology (represented by the economics of gear use) and of fisheries management institutions (particularly rules of resource use and the factors that support their application). The interaction of these elements determines the patterns of gear use and the catch characteristics: what is caught , by whom, at what time and with what level of effort (or cost). This, in turn, determines the *outcomes* in relation to the three principal fisheries management objectives: sustainability, the level of economic surplus and its distribution between different stakeholder groups.

Figure 1 Conceptual Framework for Floodplain Fishery



This system does not operate in isolation. This is emphasised by the *outside influences* on the components of the local system: the intersectoral effects, such as changes of adjacent land use or pollution, that might affect hydrology or ecology; the influence of factor prices or alternative wage earning opportunities on the household's costs of gear operation; and the effect of changes in national/regional fisheries policy that may influence what rules can or can't be adopted at the local level.

2.3 System interactions

At the heart of this system is the pattern of gear use and catch composition. This is determined by the incentives to fish and the rules of use that influence which fishing opportunities can be taken up, and by whom.

The principal driving forces in affecting the incentives to fish are floodplain hydrology and, linked to it, fish ecology, which result in significant variations in the concentrations and therefore catchability of fish. As the floods rise the fish move out onto the floodplain from the dry season waterbodies. There they disperse and grow during the high water period, often in conditions that are not conducive to easy fishing. As the floods recede the fish become increasingly concentrated, either passively through the reduction in the area of water or as a result of a migrational impulse. They then become highly vulnerable to capture. CPUEs soar and the returns to fishing (the economic surplus[1]) are at their highest during this period.

Many rules developed for the management of floodplain fisheries deal with the problems that arise in these circumstances. Limited spaces for gears in the prime spots and the likelihood of interference between their operators, produce a situation in which conflict is best avoided by some accepted means for allocating fishing opportunities. Allocation rules include: gear space lotteries, restrictions on the number of gears that may be operated by any one household, ancestral precedent and auctions for discrete sections of waterbodies. Each has a different impact on who gets to fish; this significantly influences the distribution of the economic surplus. These rules, by affecting the pattern of gear use, may also have subsidiary effects on the level catch and the effort required. This affects the economic surplus attained. The level of catch (and its species composition) will also influence the sustainability of the fishery.

2.4 The influence of local system characteristics on outcomes

Within this system, local characteristics will play an important role in determining the impact of rules on outcomes.

In some circumstances, they will affect the balance of costs and benefits that arise from attempting to protect stocks. A ban on the use of certain gear operations may be appropriate if local stocks are particularly vulnerable to serious depletion due to the hydrological conditions in local overwintering grounds. Elsewhere, in different hydrological circumstances, the same operation may pose no threat and a ban would simply result in a reduction of the economic surplus generated by the fishery.

[1] Economic surplus is the difference between the value of output and the cost of its production from the economic perspective the household undertaking it. It is an index of the desirability of an activity relative to alternative activities that might be undertaken. It is analogous to profit.

Similarly, the use of a leasing system will often result in more efficient fish capture - due to differences in the mix or timing of gear use - but its effect on sustainability is indeterminate. In some circumstances, this may push catches beyond the level at which they are sustainable or it may not. It simply depends on the other local system characteristics.

2.5 Implications for floodplain fisheries management

Global rules can be useful: bans on taking broodstock or the use of poison or electricity, will improve the sustainability of the fishery in most circumstances that they are applied. But Global rules can not be expected to provide all the answers. If an appropriate balance between alternative management objectives is to be achieved, rules have to fit local ecological, hydrological and economic circumstances.

Local rules can not be determined from outside. Given both the scientific uncertainties that remain about the operation of floodplain fisheries systems, the number of variables that influence outcomes and the cost of obtaining data, specifying a definitive set of local rules from outside is not feasible.

Locally appropriate rules are best identified through a process of iteration or *adaptive management* , using all the available information on system characteristics, processes of interaction and the outcomes that result. The local community, if experienced in using the resource, will often be the best source of such information. Its participation in (or control of) management significantly increases the chance that the system will be appropriate, increases their sense of involvement and ownership and improves the chances they will monitor and enforce the rules. The many successful traditional management regimes for fisheries are based entirely upon these principles of adaptive management and community involvement.

Government can play a critical role in promoting or supporting such systems of management. Its support is particularly valuable when traditional systems are under stress (perhaps due to changes in outside influences) and when co-ordination is required between villages sharing a component of the fish stock.

2.6 Implications for the selection and management or reserves

Reserves may be an extremely valuable means of supporting the sustainability of a fishery. It should not however be assumed improvements in the fishery will justify the costs involved, particularly if fishing on the waterbody is stopped completely.

Reasons why fisheries benefits may be low compared to costs:

- ***stocks were not liable to be overfished***. If local waterbodies are too deep or full of snags for fishing operations or fishing pressure was low.
- *stocks protected do not connect with local fisheries.* If the reserve lacks good hydrological connections to fished waterbodies or stocks are not mobile.
- *stocks subject to high levels of natural mortality.* If the waterbody dries out or can be polluted.
- *restrictions on fishing extend beyond those needed to support sustainability.* Stopping the fishing of overwintering stocks may be sufficient.

Even if the reserve produces overall benefits that are high relative to costs, there may still be obstacles to successful local management if local costs exceed local benefits.

Reasons why local fisheries benefits may be low compared to local costs:

- ! *protected stocks migrate out of area fished by local community.* If reserve is to protect a mass breeding ground of a particular species.
- ! *reserve occupies a high proportion of waterbodies accessible to community.*

3. Regional Reserve Survey Methodology

3.1 Introduction

Regional Reserve Survey field activities were undertaken by the interdisciplinary team of collaborators over a seven week period, between Monday 9 February and Friday 27 March 1998.

Throughout the fieldwork, emphasis was placed on *integrating* information obtained from the different disciplines to gain an inter-disciplinary perspective of the most important issues relating to reserves in the three sites. Another important focus of the project was to involve and encourage participation of all those who may have a stake in the creation or management of reserves on completion of the project. This involved explanations of the research, dissemination of results, and requests for advice and suggestions from stakeholders both before and after the data collection exercises.

The activities in each of the three provinces thus followed a standard format with the following main steps:

- Initial meeting with provincial Dinas Perikanan (Diskan) collaborators, to introduce project
- Meeting with Diskan to determine initial categories of reserve, and choose initial study sites
- Visits to other stakeholder institutions, to introduce project and invite to workshop
- Visits to selected field study sites, for interdisciplinary investigations to clarify reserve categories and determine suitability for the detailed Monitoring Programme
- Team meetings about each study site to debrief, cross-check and record data collected
- Team meeting to discuss results and implications for province, and prepare for workshop
- Stakeholder workshop to present findings and proposals, and invite comment

In addition to the above fieldwork activities, many team sessions were spent in discussing the rationale and vision of the project, and in designing its monitoring, analysis and dissemination phases. To finalise this report by the end of the field trip, as part of the CRIFI-MRAG collaboration, additional days were spent writing up the various components of the report.

The detailed itineraries followed in each of the three study provinces are given in Annex B, along with the participants involved in each meeting. Details of the institutional relationships between the different stakeholders mentioned are given in the next main section. The rest of this section describes the research process, including the activities preceding and following the data collection.

3.2 Pre-fieldwork

Pre-fieldwork activities at each site included: identification of and meetings with stakeholders; collection of secondary data & interviews with key informants to aid selection of field study sites; selection of study sites; creation and subsequent modification of a checklist of questions/subject areas to be researched.

Local Dinas Perikanan collaborators arranged meetings with all parties who might have a future

role in implementing any policy recommendations following the project findings. These included government and non government institutions involved in relevant research and/or development activities. Apart from encouraging local involvement, these meetings provided useful secondary data for selection of study sites. Selection of study sites was based on the known presence of reserves, variability of biological, physical or institutional characteristics and logistics. When possible, sites where no reserves were known to be in operation were selected for comparative purposes. The checklist of question was developed by the team at the first site and modified throughout the first period of data collection and in subsequent provinces following field testing. Questions were sub-divided into four main sections: general village information; waterbody characteristics and fish biology; institutional arrangements for reserve or fisheries management; fishing activities and benefit distribution. A copy of the final checklist is included as Table 1.

3.3 Fieldwork

All team members had previously received training in the use of RRA/PRA techniques and the main techniques used in the field included semi-structured interviews, and the creation of maps and matrices. Interviews were held with both fishermen and resource managers at each village. The latter included head fishermen, traditional leaders at the village level, or local government. The actual interviewees varied between sites. Where possible, appointments to meet informants were arranged a day or more in advance. The team then split into three or four pairs and conducted between one to three interviews each at each site. Each interview was based around one of the sections of the checklist.

Information was cross-checked or triangulated in a number of ways. Firstly there was overlap between the sections within the checklist which gave at least three different replicates of some of the more basic information. For example, each interview started with the informant drawing a map showing the main fisheries resources and major features of the fishery. Other more general information may have been collected using different methods or approached from a different angle. Secondly, attempts were made to get at least two interviews (preferably three, though this was rarely achievable) relating to each section on the checklist. Interviews on each checklist section were usually conducted by the same team members within their own discipline. Lastly, if contradicting or interesting information emerged during the interviews, other team members were informed and, where possible, these subjects were integrated into other interviews at the site.

After each field site visit, the collected information was recorded by each interviewer and combined into a single data file (see annexes for each site). Time was then given over to reading the combined information and triangulating the various results. Information was discussed and integrated, making a particular note of any significantly different findings. At this point proposed modifications to the checklist were also discussed. This procedure was repeated at every site visited.

3.4 Post-fieldwork

After the data collection was finished in each Province, the data was analysed and presented to all stakeholders before leaving the Province. This served many purposes. Firstly it was an opportunity for those involved (including the Dinas Perikanan collaborators) to get more of an idea of what the research was about and what it hoped to achieve. Secondly it was another opportunity to cross check information with those with local experience and to present information which integrated a wide range of issues rather than focussing on one discipline as is more traditionally done. Thirdly, it was hoped that the involvement of the stakeholders would foster continued interest and possible participation in the project at later stages. To this end,

considerable time was given over to discussion of other issues which the stakeholders thought were important, and for suggestions and advice on how the project should proceed. This included information on how the research could be conducted or how research results could best be disseminated.

Table 1. Regional Reserves Survey - Fieldwork Checklist

VILLAGE BACKGROUND

- ! Total number of **households**; number whose main income is from fishing
- ! Village **homogeneity** (spatial, ethnic and occupational); village **permanence**

MAP OF WATERBODY CHARACTERISTICS

- ! Map of village **waterbodies**:
  Waterbody **names** & **types** (rivers, lakes, floodplains); **water flows**
  Minimum dry season **depths**
  Fishing areas
  Natural fish kills, due to **air bangar**? Which waterbodies?
- ! **Accessibility** in dry season (practicality of sampling)?

FISH ECOLOGY

- ! Main **fish species** caught nowadays by whole village, in each waterbody type?
  Average and maximum **sizes** caught nowadays of common species?
  Which species locally **extinct** now, or much **depleted**? Why?
- ! Location of **spawning** areas of main species?
- ! **Accessibility** of village fishing grounds to fish from main rivers (natural / fishing barriers)?
- ! Which waterbodies do fish **survive** the dry season in?
  Are local fish stocks fished out in the dry season? If not, why not?

INSTITUTIONAL ARRANGEMENTS AND OBJECTIVES

- ! *First, establish if there are any management arrangements*:
  Can anybody, from any where, use any gear, at any time, in any place? *If not, then....*

- ! What **regulations** are there? **Who** makes each one, and **why** (and for which **species**?)
  Species? Seasons? Gears? Access? Places? Allocation of fishing spots?
- ! **Relationships** between the rule making bodies? (**Formal** and **informal**...?)
- ! **Monitoring** of regulations
  Who does it? How is it done? In your opinion, how effective is the monitoring?
- ! **Enforcement** of regulations
  Who does it? How is it done? What are the penalties for breaking?
  How often are penalties applied?
- ! **How long** have the regulations been established? Any changes?
- ! Fishing **conflicts** or other problems?

FISHING ACTIVITIES AND BENEFIT DISTRIBUTION

- ! What type of fisherman are you? Where do you fish? (establish knowledge base)
- ! For the most significant waterbody:
  Matrix of **relative catch values** between 2-4 seasons (as recognised by the respondent) for 3-5 main gear types
- ! For the gear/season combinations (cells in the matrix) producing the largest catches:
  Which **species** caught?
  What **variability in timing**? (Identify sub-seasonal concentrations of economic surplus for particular gears)
  Access restrictions influencing allocation of surplus?
  Group or **individual** fishermen? **Immigrant** fishermen? Other categories?
  Details of **gear operation** (team composition, gear costs, share distribution/payment)?

4. Institutional Arrangements for Indonesian Inland Capture Fisheries

4.1 Introduction

Since Indonesia's independence, institutional arrangements have been strongly top-down in character, favouring the control of fisheries resources by government. Recent changes in emphasis now place considerably greater weight on the virtues of more local control. This gives scope both to build on traditional local fisheries management practices, where they exist, and to take advantage of local knowledge and well-developed procedures for local consultation and decision making.

Institutional arrangements in this context can be viewed as the procedures that establish the rights and rules that apply to the fishery and the mechanisms for their implementation. This may include top-down rule formation, by government, bottom-up rule formation, when local communities take the lead, or some form of 'co-management', when rules are devised through consultation between government and local communities. This section will consider the history of and prospects for institutional arrangements for inland capture fisheries in Indonesia and outline the processes by which policy/regulations may be formulated.

4.2 Legal Framework for Policy Formation and Implementation

The constitutional foundation for natural resource management in Indonesia is found in Article 33, paragraph 3, of the constitution of 1945 (*Undang-undang dasar 1945*). This states that: 'Land and water and the natural resource therein shall be controlled by the State and shall be utilized for the greatest benefits (welfare) of the people'. This provides the legal basis for the nation's control over its fisheries (Kusuma-Atmadja and Purwaka,1996). Basic fishery laws and regulations and the institutional arrangements for management of inland capture fisheries are based on the *Undang-undang No. 9/1985* (see Inception & Legal Workshop Report).

Policy can be formulated at a number of levels. At the national level, the Directorate General of Fisheries (Ditjen Perikanan), which is under the Ministry of Agriculture, is responsible for formulating and implementing fishery management policies. At provincial level, the formulation and implementation of fishery policies is carried out by the Fisheries Services (*Dinas Perikanan Tingkat Propinsi*) coordinated by the Provincial Agency of the Ministry of Agriculture (*Kanwil Pertanian*) and the Provincial Development Planning Board (*Bappeda Tingkat Propinsi*). At the *kabupaten* level, fishery policies formulation is the responsibility of *kabupaten*-level fishery services (*Dinas Perikanan Tingkat Kabupaten*), coordinated by the Development Planning Board level II (*Bappeda Tingkat Kabupaten*). Below *kabupaten* level, formal fishery institutions have not had the authority to formulate fishery management policy. The organisational structure for fisheries resource management in Indonesia can be seen in Figure 2.

Figure 3 shows that fisheries regulations at the National level could be either Ministry of Agriculture Decrees or Government Regulations (*Peraturan Pemerintah*). These regulations are extended by either Ditjen Perikanan Decision Letters or/and Implementation Guidelines *(Petunjuk Pelaksanaan* or *'juklak'* s). At the provincial level, regulations may originate either as local adoption of *Juklak* regulations, or as Governor Decision Letters or *Perda Tk I* regulations. The situation is analogous at the Kabupaten level.

4.3 Limitations of the top-down approach

A system of fishery regulation is a set of incentives (rights) and sanctions (rules) for influencing the individual behaviour of those who use and depend upon the resource (Bromley and Cernea,1989, and Pomeroy *et al,* 1994). It is appropriate when it produces a pattern of outcomes that is consistent with management objectives.

Government has been able to define some (near) universally appropriate rules of resource use: banning the use of electricity, poisons and explosives and the setting of minimum mesh-size and minimum harvested fish size. But, as indicated in Section 2 above, defining a comprehensive set of rules appropriate to all conditions of a floodplain fishery is impossible due to the contingency of outcomes on the local characteristics of the resource. Even with the limited set of rules in place, government agencies have also encountered significant problems with both their monitoring and enforcement.

In the previous five five-year national plans (Pelita I to V), in which the government maintained strong central control of the fishery resource, these problems were difficult to avoid. Prompted by the need to reduce administrative overlap and better distribute economic development, a recent policy shift toward decentralization of management of natural resources (including the fishery) to lower level authorities started in the Sixth Five-Year Plan (1994-1999). This change in policy has yet to find its full expression (Warren and Elston, 1994, and Koeshendrajana,1997). It does, however, create the opportunity for greater local participation and control in the longer term.

4.4 Foundations for local control of fisheries

A community-based approach giving fishermen the responsibility to manage their 'own resources' is an arrangement with a considerable tradition in Indonesia, dating back at least to the early period of Dutch colonial rule. It has been practised in marine capture fishery in some areas of Maluku, Irian Jaya, North Sulawesi and East Nusa Tenggara (Nikijuluw, 1997) and in inland fisheries in West Kalimantan, South Sumatra and Jambi (Pollnac and Malvestuto, 1992, Hoggarth *et al*, 199?). In many cases these systems have persisted either autonomously or with active support from local government. The existence of such traditions can provide a strong foundation for fisheries co-management.

In addition to this, there has been a long-established tradition in Indonesian culture for leaders to make decisions through a process of discussion (*musyawarah*) until unanimity *(sepakat*) is achieved. The intention is to formulate a solution in a way that ensures everyone is willing to accept the outcome. This is achieved either by altering the details of the proposal or by convincing reluctant members of their desirability. This can be applied to issues affecting the local fishery.

These decisions can become enshrined in local government fishery regulations through a process outlined in Figure 3. Bottom-up regulations may originate as a proposal from the village musyawarah; they can then be submitted to Dinas Perikanan Tk II. The proposal may subsequently become a Decision Letter from Diskan, the Bupati or Perda Tk II.

4.5 Institutional arrangements for application of project guidelines

The uptake of project guidelines will require extensive use of the bottom-up pathway shown in Figure 3. Support from Ditjen in Jakarta for the envisaged activities of lower levels of Diskan (Provincial, Kabupaten and Kecamatan) will also be necessary. Whether this support needs to be enshrined in legislation is not yet clear.

Dissemination procedures are elaborated upon at greater length in section 8 below.

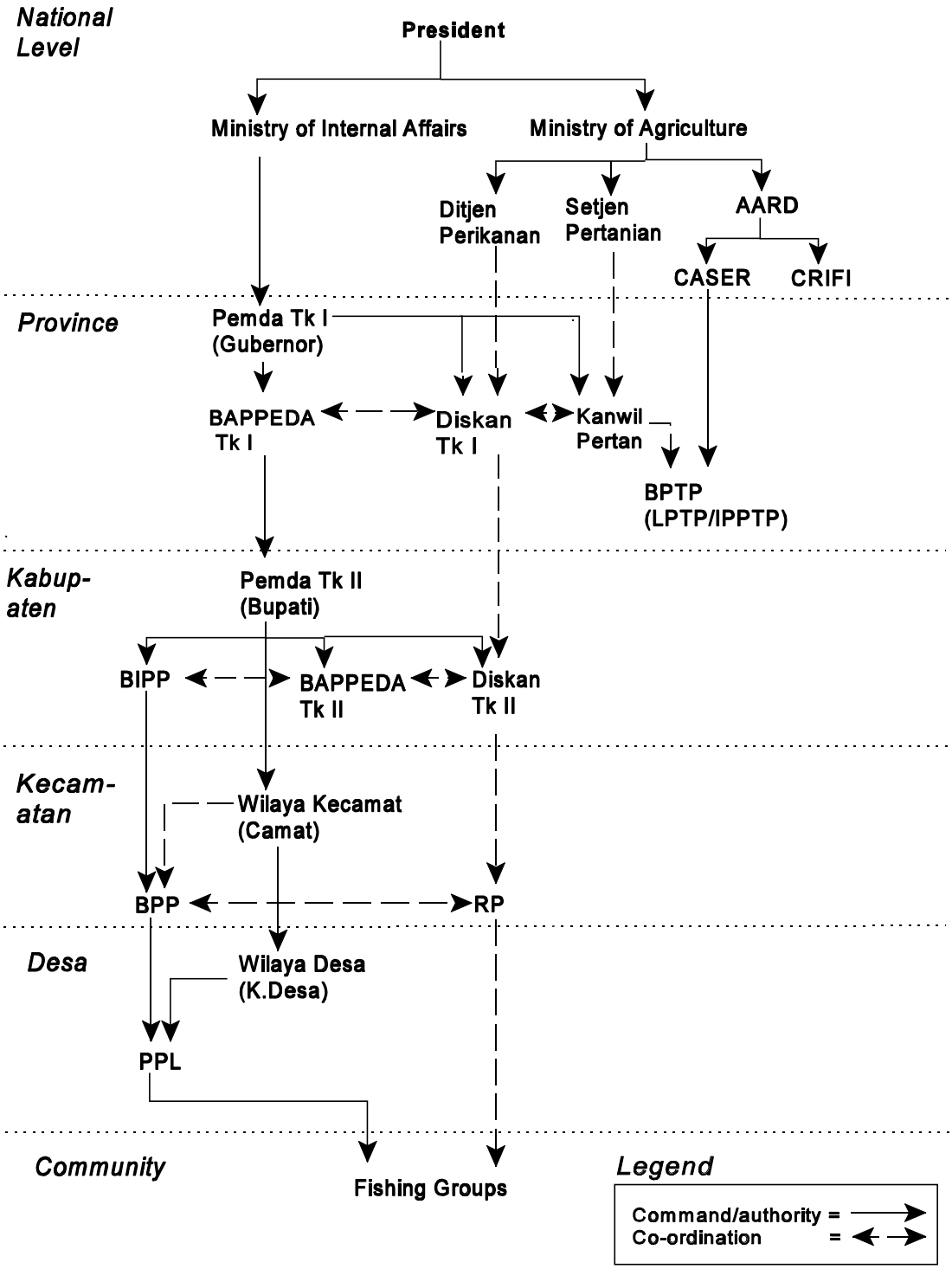


Figure 2. Organisational linkages between Indonesian institutions involved in fisheries (agricultural) management, research and extension

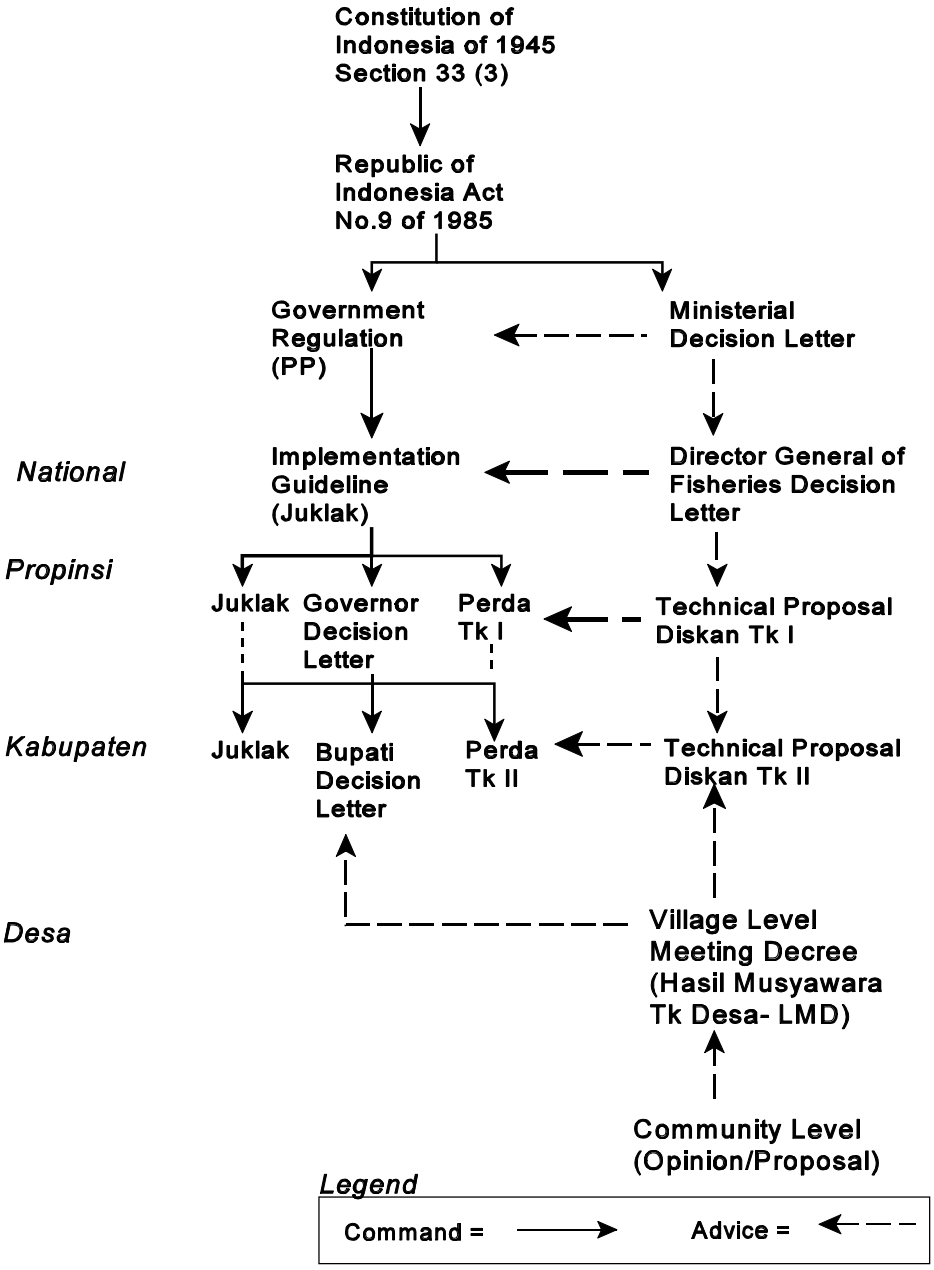


Figure 3. Pathways for creating legislation for Indonesian fisheries

5. Summary of Field Investigations

5.1 West Kalimantan

Danau Sentarum Wildlife Reserve (DSWR) is a low lying floodplain intersected by lakes and waterways, situated just north of the equator in the Kapuas Hulu Regency in West Kalimantan (Indonesian Borneo). There is an annual variation in water levels of around 10-12m, attributable to local topography and seasonal back-flows up the River Tawang from the River Kapuas; the peak is between December and March and the low usually between July and August.

DSWR has a unique ecosystem, evolved from its seasonal water variation, which supports a large number of terrestrial and aquatic species, including 220 species of fish. This has been recognised in its national status as a Wildlife Reserve, and by its recent adoption as a Ramsar site. At odds with its protected status, a large number of people (6-8,000) continue to live in the park, divided between around 40 village enclaves. Due to the age of the settlements, this situation is accepted in practice and no plans exist to change it.

Between 1992 and 1997 a conservation project of the Indonesia-UK Tropical Forest Management Programme developed management techniques for the reserve, with a focus in promoting local participation and community management. Due to the importance of fisheries to local livelihoods and of fish diversity to the conservation value of the reserve, the project placed considerable emphasis on building upon the extensive experience of communities in managing fisheries within their local areas. The objective of the MRAG-CRIFI-DP team was to investigate these local management practices and the efforts that had been made to integrate them on a wider scale.

The team visited five villages/settlements within DSWR. Tengkidap, a temporary fishing settlement, was at the lower end of the system on the R.Tawang towards its' junction with the Kapuas. Meliau, in contrast, was on the much smaller R.Leboyan that feeds into the lakes area from the East. Sambar, another temporary fishing settlement, is on the levee of the R.Belitung that protrudes into the largest and most central lake. Sekolat lies on the same river to the south. Finally, Pulau Majang lies on the western edge of the basin area.

Brief investigations covered the waterbodies falling within the 'wilayah kerja' (work area) of each village, their fisheries, their management institutions and their main socio-economic features. The results are given in Appendix C and summarised in Table 2 below. These indicate significant differences between these villages/settlements as well as a number of important similarities.

Given the differences in their position within the overall lakes area, there were significant differences in the size, permanence and number of different types of waterbody to which they had access. Previous studies had found the lakes underfished (early 1950s) and, later, as being not overfished as a whole (late 1980s). This initial survey indicated that there are significant differences between villages in the relative health of their fisheries: Pulau Majang had lost all its large species; in Meliau, in contrast, 40kg tapah were still caught regularly as well as seven other large species.

From an institutional perspective, all villages shared many features considered to be of assistance in local common-property resource management: all had the *de facto* right to manage themselves; they had local allocation rules (gear, space, time) that were flexible and

perceived to be fair; these were monitored and enforced by the community themselves, using graduated penalties. The commitment to maintaining systems were reinforced by the high degree of dependence on fishing at both the community and individual household level. There were differences in the degree of homogeneity and stability of the communities. Particular problems were being experienced in Pulau Majang where there were boundary and enforcement problems exacerbated by community heterogeneity. As a result, village fishermen felt unable to enforce the (national) regulations against the use of poison.

Secondary data on the economics of fishery exploitation is, like that concerning fish stocks, highly aggregated. The variety of gears reported in these studies and the seasonality of their catch was reflected in the findings of the survey. At the current level of study, the relative gear significance is difficult to assess reliably but there did appear to be distinct differences between villages. Competition for seasonal peaks in economic surplus was managed through the widespread use of lotteries for gear spaces (a clear contrast to the auction systems in use in South Sumatra and Jambi). The lottery results in an equality of opportunity that could be expected to reinforce fishermen's commitment to supporting the rules of their management system. One recent development was that of cage culture, principally of toman. Recent calculations suggest that the catch of smaller fish used as feed could now account for around 40% of the total and might pose a threat to the sustainability of the fishery.

Main Observations

(1) Fisheries resources *can* be well managed by village communities and are being in West Kalimantan villages

- good resource base and productivity still high
- good local regulations
- good cooperation within villages

(2) Fisheries resources *may not* be well managed due to:

- lack of sense of ownership
- inability to enforce regulations in own area
- lack of manageable resources in the dry season
- ineffective/inappropriate regulations (monitoring programme to assess this)
- increasing exploitation/pressure on fisheries resource

(3) Otherwise well managed fisheries may be unsuccessful due to:

- activities outside own area
- lack of co-ordination of fisheries management rules between villages

(4) There is a need for resolution of the status of DSWR (and the population within it) before an effective start can be made on addressing any of the problem areas identified above.

Table 2. Summary of Findings in DSWR Study Villages

	VILLAGE				
FACTORS	**SEKOLAT**	**SAMBAR**	**MELIAU**	**PULAU MAJANG**	**SELIBAN /SELIBAN**
Village					
Permanent/temporary	Village	Seasonal group	Village	Village	Seasonal
Mixed/homogeneous	Homog.	Homog.	Mixed	Mixed	Homog.
Size	167 kk	47 kk	28 kk	173 kk	40-60 kk
Waterbodies					
Size	Average	Average	Average	Large	Average
Permanence	2 lakes + river	0 lakes + 1 river	10 lakes + river	0 lakes + river	1 lake + river
Position in catchment	Middle	Middle	Upstream	Middle	Downstream
Fish					
Fish sizes/value	11 S/M 3L	9 S/M 8L	3 S/M 8L	4 S/M 0L	7 S/M 3L
Extinct/rare species	4	4	2	11	5
State of stock	Average	Good	Best	Worst	Average
Institutions/ Regulations					
Local boundary rules?	Y	Y	Y	Limited	Less
Rules simple, enforceable, well known?	Y	Y	Y	Y	Less
Stable/homogeneous community?	Y	Less stable	Y	Less homog.	Less stable
Rules easy to monitor?	Y	Y	Y	Less	Y
Enforcement happens?	Y	Y	Y	Not for poison	Limited
Local institutions strong?	Y	Less but good	Y	Y	No
Gear use & user regulations					
Restrictions on gears	Many	2	Many	Many	Few known
Restrictions on gear timing	4	-	Y	Y	Y
Restrictions on outsiders	Dry season	Some gears	Strong	Dry season	-
Lotteries for gear positions	Present	Present	-	Present	-

5.2 Jambi

Jambi Province is situated on the eastern side of Sumatra. It is divided into five Kabupaten and one municipal area (Kotamadya). Open waters (lakes, rivers and flood plains) cover an area of about 115,000 ha. Of the 46 significant lakes, Lake Kerinci is the largest, covering an area of 4,000 ha in the dry season and around 8,000 ha in wet season. The main river in the province is the Batanghari, which is 1,740 km long and flows from south-west to northeast. In Jambi City, which is located on its downstream reach, it has a depth of 4 m in the dry season and 11 m during the rainy season.

Around 130 fish species have been recorded in the province. These support a significant fisheries resource: production of fish for consumption was around 5,600 tonnes in 1996; also of economic importance is the catch of ornamental fish, with around 540,000 caught in 1996.

Four villages - Dano Lamo, Teluk Kenali, Arang-Arang and Jambi Kecil - were visited. All were located in the two downstream Kabupaten with the highest levels of fisheries production. One, Teluk Kenali, is in Kotamadya Jambi; the other three are in Kabupaten Batanghari. All are within a 30 km radius of Jambi town. Three have Diskan-supported reserves, though one of these (Arang-Arang) was a lake that had been traditionally managed. Jambi Kecil had a series of large lubuks that were subject to controlled fishing. All function as local rather than catchment reserves.

Jambi province is actively promoting the establishment of river fishery reserves, with 9 existing reserves and more planned. In addition to the floodplain reserves visited, Jambi also has reserves located in the upland areas, designed by Diskan and LIPI for the overall benefit of the Batanghari catchment. These reserves could not be visited within the time available, but a return visit to them by the CRIFI and Diskan collaborators is planned for May/June 1998.

Brief investigations in the four villages visited covered the water bodies falling within the wilayah kerja (work area) of each respective village, their fisheries, their management institutions and their main socio-economic features. The results of the studies are given in Appendix D and summarized in Table 3.

All the reserves studied were in the downstream Batanghari River Basin, and all have relatively small fishing grounds. The fishery reserves are all lubuks (deepest river pools), except Danau Arang-Arang reserve which is a lake. Fish stocks in the area of these reserves are considered to be average, except for Jambi Kecil which is currently poor after last year's very long dry season.

Compared to villages in Kalimantan, the socio-economic character of the fishery was more varied. The dependency on fishing by both communities and fishing households was less in all of the Jambi villages visited. This may have contributed to the use of lelang (auctions) and hari berkerang (ceremonial fishing days), which tend to distribute the economic surplus available away from fishermen and to skew the distribution of that which remains with them.

While fishing was a significant source of income in three villages (Arang-Arang, Teluk Kenali and Dano Lamo), only around 50% of household heads were classified as fishermen - compared to 90% plus in the DSWR villages. In the third village, Jambi Kecil, fishing was the main occupation of only around 10% of households. Agriculture was an important secondary source of income for fishing households and the primary source of income for non-fishing households in all villages except D.Teluk Kenali, where the proximity to Jambi town encouraged salaried employment. The availability of alternative livelihood strategies, as well as a significant proportion of each community having negligible/marginal involvement in the fishery may have been a contributory factor in the difference from the Kalimantan villages in attitudes towards the

fishery and its management. In Jambi, with the exception of Arang-Arang, there was lesser emphasis on rules that encouraged conservation and allocation rules tended to promote the distribution of the economic surplus beyond the confines of the fishing community.

The interaction of fish behaviour with local hydrology produced significant concentrations of fish during the drawdown. Where the connecting channels were large, conflict over the potential economic surplus was managed largely through lelang (Arang-Arang and Dano Lamo). On the channels in Jambi Kecil the use of barriers was banned. Lubuks and lebungs were managed through lelang in Arang-Arang. In Jambi Kecil the important lubuks were managed through hari berkerang; the lebungs were claimed by owners of the surrounding land. Arang-Arang also had a hari berkerang, though on the main lake.

In this context, lelang direct some of the economic surplus in the form of revenue for the community, while permitting the lelang winners to secure a disproportionate share of what remains. Hari berkerang provide an opportunity for a party and, by inviting local dignitaries, to enhance the status of the village. Their associated rules restricting earlier fishing on those waterbodies also ensure that potential economic surplus is at a maximum. This surplus is then made available to the wider community. In Jambi Kecil the use of ancestral precedent in allocating the prime spots for lift nets in the hari berkerang and the additional shares expected by local leaders, suggest that the spread of this surplus may not have been equal.

Main Observations

- The Jambi sites have a lower dependence on their fishery resources, at both the community and household levels.
- Lower priority is given to conservation rules than at the DSWR study sites.
- Some Jambi villages displayed a differential attitude to stocks of blackfish and whitefish, demonstrating a preference to preserving their own local stocks of blackfish.
- Rules favoured the distribution of economic surplus away from the fishing community.
- Jambi province's Dinas Perikanan has an active policy promoting the creation of reserves in its river catchments.

Table 3. Summary of results for village study sites in Jambi

FACTORS	DANO LAMO	TELUK KENALI	ARANG-ARANG	JAMBI KECIL	UPLAND RESERVES
Village					
Mixed/homogeneous	H	H	H	H/m	?
Size	178 kk	219 kk	173 kk	546 kk	?
% of kk mainly fishing	53%	46%	48%	10%	?
Waterbodies					
Position in catchment	Downstream	Downstream	Downstream	Downstream	Upstream
Floodplain size	Small	Small	Small	Small	Small
Reserve type	R	R	L	R	R
Fish stocks	Average	Average	Average	Poor	?
Fishing regulations					
..on gears/timing	1	2	6	4	All
..for reserves	Full proposed	Partial (spawning areas)	Partial (gears)	None (has snags)	Full
..controlling access	Auction	-	Auction	Tradition (ancestral)	-
Reserve objective	Local	Local	Local	Local	Catchment
Enforcement					
Simple rules	Y	Y	Y	Y	Y
Enforcement happens	Y	Y	Y	N	?
Local institutions strong	Average	Y	Average	Y	?

5.3 South Sumatra

The South Sumatra river fisheries have been much studied by previous projects of both CRIFI and MRAG (see eg. Hoggarth & Utomo, 1994; Hoggarth et al, 199?, and background material in Appendix E). Previous studies focussed on the exploited fishery areas, as managed by the traditional, local auction system.

Field investigations during this survey focussed on four reserves, within two provinces: Ulak Lia reserve in Musi Banyuasin (MuBa) province; and Lebung Karangan, Teluk Nilang and Teluk Gelam reserves in Ogan Komering Ilir (OKI) province. The results of these studies are given in Appendix E and summarized in Table 4.

All of South Sumatra's eleven current reserves were established by Dinas Perikanan, rather than by local communities. The benefits from the existing reserves are not well known, and yet, as in Jambi province, Dinas Perikanan have an active policy for the creation of further reserves. Dinas Perikanan aim eventually to declare 5% of the 1.5m ha of open water in the province as reserves (a more than 75-fold increase over the existing area of reserves!). All the existing reserves are of the fully-closed type, being intended for fish conservation and catchment-wide benefits (see Section 6). None of the reserves are exclusively associated with any single community, complicating the measurement of benefits from them.

In addition to the reserve programme, the inland fisheries of South Sumatra are managed by a 'lelang' auction system (see Appendix E, and previous studies). The system produces significant incomes for local government, especially at the Kabupaten level.

The auction system produces the most complex patterns of economic surplus distribution, due to the various arrangements of sub-leasing and sub-licensing. The system is complex, with considerable variation between different localities and even between lelang units. Even within the same unit, a series of overlapping arrangements can apply due to the sub-leasing of discrete sections of the leased area. Leaseholders will often retain one of the sections for exploitation by themselves or those employed by them. On these areas they may also licence individual fishermen for the use of defined gears. Though previous studies have looked at a range of socio-economic issues, none of have determined the detailed distribution of economic surplus that results from the lelang system. This complexity must be reflected in the socio-economic monitoring system chosen, which may be expected to be more complex here than at, say, West Kalimantan.

The annual leasing of the lelang units provides limited incentives for conservation. The sustainability of the fishery can be seen as a chance outcome of the pattern of gear use selected by the leaseholder in the hydrological conditions of the area. In some areas further rules supporting sustainability may therefore be necessary. The state of fish stocks in South Sumatra was not well determined by the brief investigations made. Knowledge from previous studies suggest that the fish stocks are probably more overexploited than at the West Kalimantan site.

Sustainable development of the South Sumatra fishery must work within the constraints set by the local system. In some places, such as the fishery on the Lempuing upstream from Pedamaran, the lack of permanent settlement next to potential reserve areas may limit the scope for full local management. The control of auction units by government does however provide an opportunity for reserve establishment or the introduction of supplementary rules for their use.

Main Observations

- The South Sumatra inland capture fisheries are managed by a traditional lelang (auction) system, supported by the use of government-managed reserves.

- The lelang system raises income for local governments and minimises conflicts between fishermen, but gives a skewed distribution of benefits, and does little to prevent the overexploitation of fish stocks.

- Fish stocks are now thought to be relatively depleted (eg compared to the West Kalimantan sites). River fishery reserves are now being actively promoted by the provincial Dinas Perikanan. Such reserves could be integrated relatively easily into the auction system. No examples were found of traditional (community-managed) reserves within this province.

- Sub-leasing (of whole waterbody areas) and sub-licensing (of fishing gears) within auction units under the lelang system creates many alternative patterns of distribution of economic benefits. This complexity must be reflected in the socio-economic monitoring system chosen.

Table 4. Summary of Field Investigations at Reserves in South Sumatra

Reserve	**Ulak Lia**	**Karangan**	**Teluk Nilang**	**Teluk Gelam**
Village	Sekayu II	Tanjung Sejaro	Benawa	(None nearby)
Kabupaten	MuBa	OKI	OKI	OKI
Social background				
Closeness of reserve to village	Close	Far	Far	Far
Number of households	1,060	491	654	? (6 at reserve!)
% of households fishing	30%	71% (fish/farm)	15%	?
Mixed / homogeneous	Homog.	Homog.	Homog.	?
Waterbodies				
Position of reserve in catchment	FP	FP (edge)	FP	FP
Reserve Habitat type	Lake	Lake	Lake	Lake
Reserve size	Large	Small	Large	Large
Fish				
No. of rare / extinct fish species	4	5	5	?
State of Stock	?	?	?	?
Management regulations				
Management agency	Govt.	Govt.	Govt.	Govt.
Management objectives	Fish Prod'n	Irrig'n (Dam)	Fish/Tourism	Fish/Tourism
Regulations on gear use	All banned	All banned	All banned	All banned
Reserve type	Full	Full	Local (snags)	Full
Access control mechanism	Auction	Auction	Auction	Auction
Factors affecting management prospects				
Local boundary rules?	Y	Y	Y	Y
Rules simple, enforceable, known?	Y	Y	Y	Less
Stable, homogenous community?	Y	Y	Y	No?
Rules easy to monitor?	Less	Y	Less	Less
Rules enforced?	Y	Y	No	?
Local institutions strong?	Y	Y	Y	?

6. Reserve Categorisation System

6.1 Introduction

A 'reserve' seems to be generally understood to mean a specified area completely closed to any form of exploitation. Broadening this general perception, this project recognises many different types and definitions of reserves, varying in both their objectives and their ecological and management characteristics. The project is designed to investigate the benefits of a specified sub-set of such reserves. Depending on the objectives, it is possible that the traditional type of reserve (permanently and completely closed) may not always give the maximum benefits.

The actual differences between waterbodies considered as 'reserves' (and proposed as such by the local Indonesian collaborators) are many and complicated - see Tables 5a and 5b. While recognising such complexity as important, it was also considered necessary to classify reserves in a relatively simple way that allowed for the sub-selection and comparison of the main types of management strategies.

This section describes the various different types of reserves found in Indonesia, within the following classifications: reserve objectives, their ecology and their management institutions. The start of the following section (on the Monitoring Programme) identifies those reserves subsequently selected during this project phase, for detailed examination in the remainder of the project.

6.2 Reserve Objectives and Definitions

The real objectives of reserves are often not clearly specified. Reserves may be declared for the purpose of 'fish conservation', for example, when the actual objective is to maintain the overall fish stock *for human exploitation*, and not for the fish themselves. The objective of a reserve thus needs to be defined in terms of *what* is to be protected, and *for whom*.

Reserves may be intended to maintain any of the following natural resources:

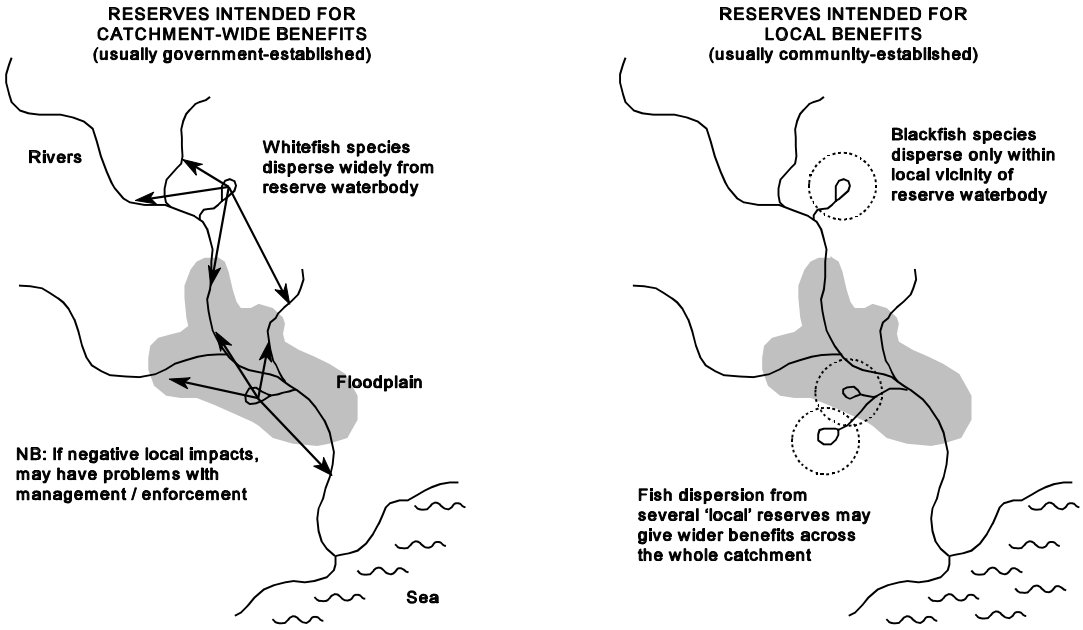
- the biodiversity of whole ecosystems
- the biodiversity of fish communities
- the survival of individual fish species

True 'conservation reserves', designed to maintain natural stocks for their own sake include various types of national parks and wildlife reserves. In Indonesia, such reserves are generally gazetted under the authority of the PHPA (ministry-level) and KSDA (province-level) Forest Conservation Agencies. Examples in the provinces studied include the Danau Sentarum Wildlife Reserve in Kalbar and the Berbak National Park in the mangrove forests of coastal Jambi. Danau Sentarum was initially established to protect the endangered red arowana, but is now a general wildlife reserve and recognised as a Ramsar site. Berbak National Park is primarily a bird sanctuary.

With its fisheries orientation, this project is more specifically concerned with '*harvest reserves*' or '*fishery production reserves*', which may be defined as follows:

***Definition**:* A **harvest reserve** is a spatially defined area of water, managed with a specified set of technical regulations, intended to sustain or increase the potential fish yield available from existing, natural fish stocks, for the benefit of fishers.

Such harvest reserves may be intended to benefit either the nation's people as a whole, or a specified group of fishermen. In spatial terms, riverine harvest reserves may be designed to benefit either catchment-wide or local users of fish resources. In general, it is understood that reserves established by the Fisheries Extension Service, Dinas Perikanan are meant to maintain fish stocks for the overall benefit of a whole catchment. In Jambi Province, for example, four upland fish reserves have been established during the 1990's to provide undisturbed spawning areas for fish species such as sampah (the barbel*, Tor douronensis*) whose fry then distribute throughout many downstream fishing grounds. In contrast, reserves are also sometimes established by local communities specifically to maintain their own local fish stocks. Such communities presumably hope that the extra fish produced by their management efforts will stay mainly within their own waters.



The *intended beneficiary* of a reserve is thus the first classification variable proposed for investigation by this project, with the following two categories for *harvest* reserves:

Intended Beneficiary Categories:

- **!** Local fishers (usually within a single village), or catchment-wide fishers

The categories of this variable for the reserves examined are given in Table 5a. As discussed in the following section, it would be far more difficult to estimate catchment-wide benefits of harvest reserves than local benefits, or dis-benefits. It may also be more difficult to predict the best places for catchment-focussed reserves (e.g. the spawning grounds) due to the lack of scientific information on the spatial life history patterns of the many different species involved.

A further category of reserves must also be mentioned in this section - those designed to give recreational benefits to sport fishermen and other tourists. Such 'reserves' are currently being actively promoted by the Indonesian Ministry of Agriculture in several provinces including Java, Jambi and South Sumatra. At least one of the 'reserves' examined (D. Kongar in Jambi) was

partially established as a 'put and take' fishery with stocking of fish being followed by their removal by paying sport fishermen. This enclosed and dammed reservoir does not interact with the remainder of the commercially fished stock, and is not considered a harvest reserve under the above definition.

6.3 Ecological Categories

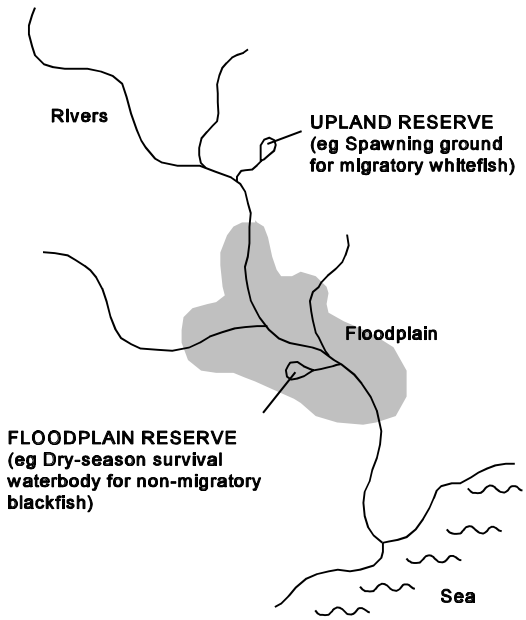
A river system is a complex mixture of many different habitats. Riverine habitats include the fast-flowing upland streams, often with waterfalls and rapids; middle reaches with riffles and glides (often called the 'barbel zone'), and the slow-flowing, meandering lowland rivers. Still-water habitats include various forms of lakes such as floodplain depressions and ox-bow lakes, and the extensive lateral floodplains around some lowland river reaches. Reserves may be created in any one of these habitats, or a combination of them, up to a full sub-catchment area or even a whole remote river system.

To simplify the potentially wide diversity of habitats, the ecological types of the reserves studied have been categorised under the following two classes (Table 5a):

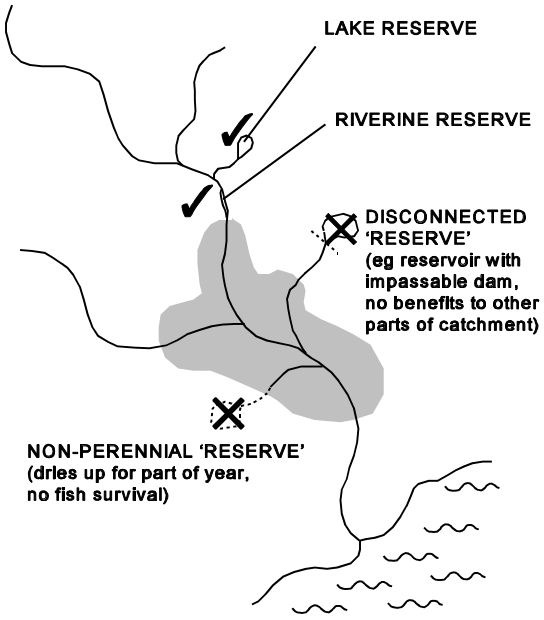
Ecological Categories:

- **!** Catchment Position Upland or Floodplain
- **!** Habitat Type Lake or River

As illustrated below, reserves in upland areas are mostly intended to protect spawning grounds for strongly migratory 'whitefish' species, whose fry benefit the overall stocks of the catchment. They may also have some local impacts depending on their institutional structure. Reserves in the floodplain areas may serve the same catchment purpose, or may be intended more to conserve local 'blackfish' stocks mainly caught close to the reserve. The species protected by the two types are likely to be quite different, though some interactions may occur.



Reserve Catchment Positions



Reserve Habitat Types

Riverine reserves generally comprise sub-sections of secondary river tributaries, often including (and sometimes limited to) the deepest pools known as '*lubuks*'. A given river catchment could

thus include many separate 'river' reserves scattered around the various tributaries. Riverine reserves may be located in either the upland or the floodplain parts of the catchment.

Harvest reserves in lakes are usually located within the floodplain region of the river. To be useful as a harvest reserve, such lakes must either be harvested at some time, or by some gears, or be connected to the surrounding exploited areas sufficiently for fish to emigrate from the reserve to the fished areas at some time during the year. Such emigration may include the movements of adult fish from the reserve, or the dispersion of eggs, fry or young fish spawned in the reserve, usually during the flood season.

An obvious but important ecological criteria for reserves in either lakes or river is that they must be 'perennial' waterbodies which keep reasonable depths of water over the whole year. In particular, water depths and water quality must remain high enough over the dry season period to enable fish to survive the high mortality rates experienced at this time, both from natural causes and from fishing. All the reserves investigated during this survey were in perennial waterbodies, though not always in the deepest local waterbodies.

The availability of local habitat types may constrain the choice of reserves within many local areas. Some of the villages visited, for example had only rivers within their local fishing grounds, and did not have the option of selecting a lake as a reserve.

6.4 Management Institution Categories

Management institutions are discussed here in the sense of the full system of rules and regulations by which a fishery is managed, including the relationships between the agencies involved.

The management institutions of the reserves investigated differed in many ways (see Table 5b). Different reserves were managed by different types of regulations, by different agencies and under different systems of authority. Some reserves were traditional institutions while others were newly imposed under the guidance of agencies such as Dinas Perikanan.

Of the various possible criteria for classifying these institutions, two main variables were chosen: the regulations used to manage the reserve, and the agencies involved in management.

Management Regulations

Regulations for the management of a fishery may be classed under two broad types: 'technical' rules which promote the sustainability of the fishery; and 'access' rules which allocate fishing rights.

Access rules include systems such as auctions (Sumsel and Jambi) and lotteries (Kalbar) which determine who may fish in which waterbodies. They may also include regulations on the use of barrier gears which could limit the accessibility of fish to fishermen on the downstream side of such gears.

Reserves are one component of a suite of alternative technical rules by which a fishery may be managed. Such technical rules, may include closed areas (reserves), closed seasons, and bans on those gear types felt (or known) to endanger the fishery. These types of rules may be combined in various ways to achieve the best possible outcome. However, due to the complexities of floodplain fisheries, it is difficult to predict exactly which combination may give the maximum sustainable benefits. The optimum solution for a given locality is also likely to be

highly dependent on its local hydrological and ecological characteristics.

The possible combinations of technical management regulations involving reserves, closed seasons and gear bans are shown in the following Table 6:

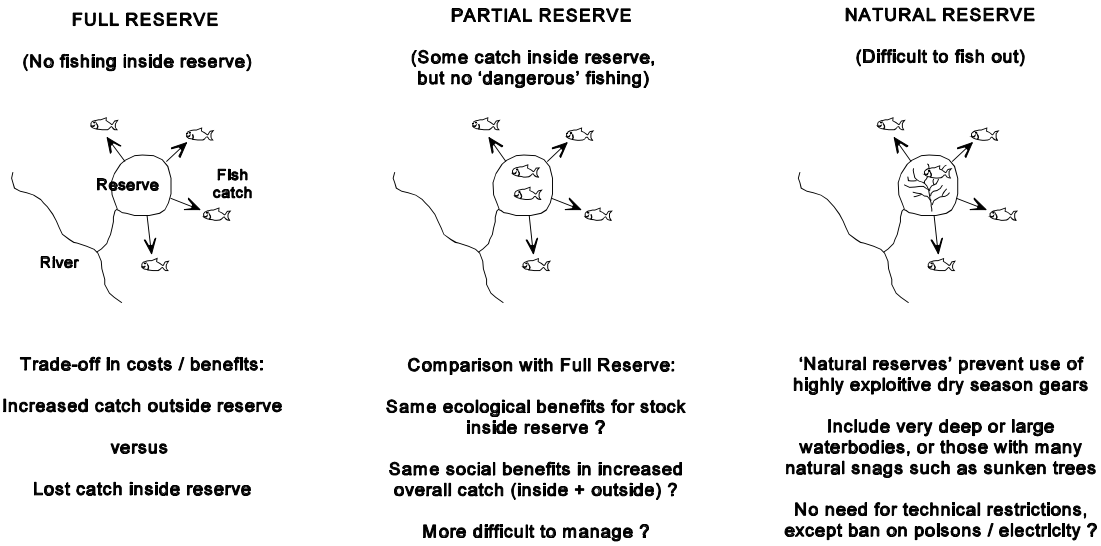
Table 6. Categories of Technical Management Regulations

Areas restricted	Seasons restricted	Gears restricted	Management Type	Code
None	None	None	Open access (no technical restrictions)	OA
None	None	Some	No reserve, some gear restrictions	g
None	Dry season	None	No reserve, closed season	s
None	Dry season	Some	No reserve, closed season and gear restrictions	sg
Reserve	Dry season	Some	Partial reserve, some seasons and gears	PR-sg
Reserve	Dry season	All	Partial reserve, some seasons, all gears	PR-sG
Reserve	All year	Some	Partial reserve, all seasons, some gears	PR-Sg
Reserve	All year	All	Fully closed reserve	FR
All	All year	All	Nature reserve, no benefits to fishery	NR

Of the above categories, the fisheries examined during the survey were managed either as one of the three Partial Reserve categories (PR-**), or as a Full Reserve (FR), or with no reserve and only some gear restrictions (category g) (see Table 5b). The Full Reserves were all promoted by the Fisheries Extension Service, Dinas Perikanan, while the Partial Reserves were more often chosen by local fishing communities for their own benefits. A key objective of this project will be to consider whether Full Reserves or Partial Reserves give the greater benefits. Though Partial Reserves may give less theoretical protection to the fish stock, they may also give some benefits to local communities by allowing some fishing at times when it would not threaten fish stocks. The less disadvantaged communities may then be less likely to compromise dry season fish survival by illegal fishing, which could reduce the *actual* benefits from the alternative Full Reserve.

As illustrated below, it is worth noting that some waterbodies may also be ‘natural reserves’, in which particular hydrological characteristics prevent the total capture of fish stocks. Usually, there should be no need for additional restrictive management regulations on such waters.

In addition to the types of management regulations associated with reserves, it would also have been interesting to investigate the importance of the relative sizes of reserves, for example as a percentage of the total fished area or the dry season water area. The lack of suitable replicate study sites and the difficulty of accurately estimating fished and reserved areas prevented this investigation.



Management Responsibilities

One of the major outputs of this project will be a set of guidelines for the co-management of harvest reserves, i.e. how government and local resource users could best co-ordinate to manage natural fishery resources as reserves. Given this focus it was decided that, of the many key features of management that could have been selected as criteria, the most appropriate was the level of local/government involvement in management.

When developing guidelines for the co-management of reserves, two of the fundamental institutional questions are firstly how reserves can be set up (i.e. how new institutions can be devised) and secondly how management of reserves can be maintained once they have been set up. The current and potential roles of local resource users and government will largely depend on the existing institutional arrangements for dealing with resource management, and the social, economic and institutional context in which they operate. To make sure that the widest range of these current arrangements was studied, the reserves were classified by the degree of local and government involvement in both their set up and ongoing management. It is hoped that studies on the current range of institutional arrangements and their outcomes will provide insights on the future opportunities and constraints for reserve management.

On the basis of this, reserve sites were classified on two criteria: (1) whether the creation of the reserve had been *mainly* initiated by government or by local resource users; and (2) whether management (particularly monitoring and enforcement) was *mainly* carried out by government or by local resource users. The possible categories were limited to two in each case for the sake of simplicity. As there were no cases where the reserve was created by local resource users and then managed by government, this led to the following three categories of management agency involvement:

Categories of Management Agencies

Category	Main force behind the creation of the reserve	Main agents responsible for reserve management
G-G	government	government
G-C	government	local resource users (community)
C-C	local resource users (community)	local resource users (community)

During the checklist interviews, it was found that the study sites differed greatly with respect to the perceived effectiveness of their management. The actual effectiveness of the management regulations attempted was also considered for inclusion as a classification variable. However,

given the objectives of the research, it was decided that such management effectiveness was too difficult to classify from the preliminary data available, and would be better studied as one of the outcomes of management, in the next Monitoring Phase.

6.5 Matrix of Main Categories of Harvest Reserves

From the full classification data presented in Tables 5a and 5b, each reserve has been simply categorised within the five summary classes discussed above. This matrix of possible combinations of reserve types is limited to those waterbodies intended as *harvest reserves*. It does not include the Danau Sentarum Wildlife Reserve intended primarily for nature conservation, though it does include the three villages within Danau Sentarum which use reserves for their own local benefits. The matrix also does not include the Danau Kongar dam in Jambi, managed as a 'put-and-take' sport fishery.

Reserve waterbodies in the study provinces in each category

		Intended for Local (Village) Benefits		Intended for Catchment Benefits		
		Floodplain		Upland	Floodplain	
Manage-ment Agencies	Manage-ment Regulations	Lake	River	River	Lake	River
C-C	PR-sg	D. Seliban D. Arang Arang D. Teluk Kenali	D. Teluk Kenali L. Jambi Kecil			
	PR-Sg	D. Belaram				
	PR-sG	D. Batuk				
G-C	FR		D. Mahligai	L. Sahap? L. Taman Ciri? L. Ngaol? L. Manik?		L. T.K. Puti? D. Mahligai
G-G	PR-Sg				D. Cala	
	FR			L. Sahap? L. Taman Ciri? L. Ngaol? L. Manik?	D. Teluk Rasau D. L. Karangan D. Teluk Gelam D. Teluk Nilam D. Air Hitam D. Ulak Lia D. Sidowali D. Gaslam	L. T.K. Puti?

The shaded areas in the above table indicate the (usually) incompatible combinations of management agencies and intended beneficiaries, since village agencies (C-C) do not use reserves for the benefit of the wider catchment, and government agencies (G-G) rarely focus exclusively on programmes to help single villages.

Within the other possible combinations, there are some regional concentrations of reserve types. For example, the C-C reserves are all found in Kalbar and Jambi, while all of the South Sumatra reserves are of the G-G type. The combined G-C category was only found in Jambi province, suggesting that Jambi's Dinas Perikanan may have the most consultative

management style. Upland reserves were only found in Jambi province, all of them intended for catchment beneficiaries. Such reserves were not visited during the Regional Reserve Survey, due to time constraints, hence the uncertainty in their categorisation shown above.

The selection of the reserves from those available, for the investigation of comparative benefits, is considered in the following section on the Monitoring Programmes.

Table 5a Reserve Categories - Village Background Information and Ecological Characteristics

Province	Reserve Name	Village Background						Reserve Ecology			
		Village Name	Kabupaten Name	Kecamatan Name	Village Homo-geneity	Village Size (House-holds - 'kk')	Village Perm-anence	Habitats Available	Habitats Reserved (Category)	Reserve Size (ha)	Catchment Position (Category)
Kalbar	D. Sentarum WR	40 villages			Variable			Multiple	3 as below		FP
Kalbar	D. Batuk	Sekolat			Melayu	167kk	Perm.	1R, 2L, 3SL	1L		FP
Kalbar	D. Belaram	Meliau			Mixed	28kk	Perm.	1R, 10L	1L(+C)		FP
Kalbar	D. Seliban	Tengkidap			Melayu	40-60kk	Temp.	2R, 4+L	1L		FP
Kalbar	NONE	Sambar			Melayu	47kk	Temp.	2R, 4L, 2SL	NONE		FP
Kalbar	NONE	P. Majang			Mixed	173kk	Perm.	1R, ManyL/SL	NONE		FP
Jambi	L. Sahap	P. Sangkar	Kerinci	Batang Merangin		?	?	?	R		Upland
Jambi	L. Taman Ciri	Telentam	Sarko	Pk. Tabir Hulu		?	?	?	R		Upland
Jambi	L. Ngaol	Ngaol	Sarko	Pk. Tabir Hulu		?	?	?	R		Upland
Jambi	L. Manik	Rantau Pandan	Bubo	Ratau Pandan		?	?	?	R		Upland
Jambi	L. Teluk Kayu Puti	Teluk Kayu Putih	Bubo	Pk. Tujuh Koto		?	?	?	R		FP
Jambi	D. Arang Arang	Arang Arang	B'Hari	Kumpeh Hulu		173kk	Perm.	2R, 1L	½L		FP
Jambi	D. Mahligai	Dano Lamo	B'Hari	Maro Sebo Hilir	Muslim	178kk	Perm.	1R	R	2km long	FP
Jambi	D. Teluk Kenali	Teluk Kenali	Kota Jambi	Telanaipura	?	219kk	Perm.	2R, 1L	2R, 1L	margins	FP
Jambi	L. Jambi Kecil?	Jambi Kecil	B'Hari	Maro Sebo Hilir		546kk	Perm.	1R	R		FP
Sumsel	D. Teluk Rasau	Pedamaran V	OKI	Pedamaran	Melayu	?	Perm.	?	1L	155	FP
Sumsel	D. Lbg. Karangan	Tanjung Sejaro	OKI	Indralaya	Melayu	491kk	Perm.	?	1L	22	FP
Sumsel	D. Teluk Gelam	Silape/Serapik	OKI	Tanjunglubuk	Malayu	?	Perm.	?	1L	50	FP
Sumsel	D. Teluk Nilam	Benawa	OKI	Tanjunglubuk		645kk	Perm.	?	1L	150	FP
Sumsel	D. Air Hitam	Benawa	OKI	Tanjunglubuk		645kk	Perm.	?	1L	100	FP
Sumsel	D. Ulak Lia	Sekayu II	MuBa	Sekayu		1,060kk	Perm.	2+R, 1L	1L (Ox-bow)	115	FP
Sumsel	D. Cala	D. Cala	MuBa	Sekayu		?	?	2?R, 1L	1L (Ox-bow)	120	FP
Sumsel	D. Kongar	Sungai II	MuBa	Pembantu Sungai		?	?	1 Reservoir	--	14	Upland
Sumsel	D. Sidowali	Bailangu	MuBa	Sekayu		?	?	2?R, 1L	1L (Ox-bow)	40	FP
Sumsel	D. Gaslam	Napal / Karangringin	MuBa	K. Babat Toman		?	?	2?R, 1L	1L	13	FP
Sumsel	D. Raya	?	MuRa	?		?	?	?	1L?	200	FP
Notes:	Habitats:	R=River (main river channels, + tributaries), L=Lake (wholly within village), SL=Lake shared with other village/s									
	Meliau village:	C=lakes protected by crocodiles/spirits									
	Catchment Pos'n:	FP=Floodplain									

Table 5b Reserve Categories - Management Institution Characteristics

Prov-ince	Reserve Name	Management Institutions												
		Closed Season in Reserve	Gears Banned in Reserve	Reserve Manag't Category	Barrier Rules	Access Rules	Regulating Authorities	Monitoring & Enforcement Agencies	Monitoring & Enforcement Effectiveness	Reserves per village	Reserve Origin	Reserve Intro-duced	Instit-utional Category	Intended Beneficiary Category
Kalbar	D. Sentarum WR	---------- Village specific----------					Desa	Desa/KSDA	Variable	1R:40V	KSDA	1982	G-C	Nature
Kalbar	D. Batuk	Dry season	All	PR-sG	Yes	Lotteries	Desa	Desa	V. Good	1R:1V	Desa	Trad.	C-C	Village
Kalbar	D. Belaram	None	Many	PR-Sg	Yes	None	Desa	Desa	V. Good	1R:1V	Desa	Trad.	C-C	Village
Kalbar	D. Seliban	Dry season	Few	PR-sg	Yes	None	Desa	Desa	Poor	1R:1V	Desa	Trad.	C-C	Village
Kalbar	NONE	--	--	g	No?	Lotteries	Desa	Desa	Good	NONE	--	--	C-C	--
Kalbar	NONE	--	--	g	Yes	Lotteries	Desa	Desa	Good except poison	NONE	--	--	C-C	--
Jambi	L. Sahap	All year	All	FR			Desa/DP/Pemda II	DP guard/Desa		1R:1V	DP/LIPI	1994	G-C/G?	Catchment
Jambi	L. Taman Ciri	All year	All	FR			Desa/DP/Pemda II	DP guard/Desa		1R:1V	DP/LIPI	1996	G-C/G?	Catchment
Jambi	L. Ngaol	All year	All	FR			Desa/DP	DP guard/Desa		1R:1V	DP	1992	G-C/G?	Catchment
Jambi	L. Manik	?	?	?			Desa/DP/Pemda II	DP guard/Desa		1R:1V	?	?	G-C/G?	Catchment
Jambi	L. Teluk Kayu Puti	All year	All	FR			Desa/DP/Pemda II	DP guard/Desa		1R:1V	DP/LIPI	1997	G-C/G?	Catchment
Jambi	D. Arang Arang	All year (HB)	Many	PR-sg	Yes	Auctions	Desa/DP/Pemda II	DP guard/Desa	Good	1R:1V	Desa/DP	1993	C-C	Village
Jambi	D. Mahligai	All year	All	FR	Yes	Auctions	Desa/DP	Desa	V. Good	1R:1V	DP/LIPI/Desa	Prop'd '97	G-C	Village
Jambi	D. Teluk Kenali	Dry/Spawning	Some	PR-sg	No?	None?	Desa/DP/Pemda II	DP guard/Desa	Poor + poison	1R:1V	DP/Desa	1993	G-G	Village
Jambi	L. Jambi Kecil?	All year (HB)	Many	PR-sg		None?	Desa	Desa		1R:1V	Desa	Trad.	C-C	Village
Sumsel	D. Teluk Rasau	All year	All	FR	No	Auctions	DP/Pemda I	DP guard + police	Fair	1R:1V	DP	1982	G-G	Catchment
Sumsel	D. Lbg. Karangan	All year	All	FR	No	Auctions	DP/Pemda I	DP guard + police	Good	1R:1V	DP	1982	G-G	Catchment
Sumsel	D. Teluk Gelam	All year	All	FR	No	Auctions	DP/Pemda II	DP + police	Good	3R:1V?	DP	1987	G-G	Catchment
Sumsel	D. Teluk Nilam	All year	All	FR	No	Auctions	DP/Pemda II	DP + police	Poor	3R:1V?	DP	1987	G-G	Catchment
Sumsel	D. Air Hitam	All year	All	FR	No	Auctions	DP/Pemda II	DP + police	Poor	3R:1V?	DP	1982	G-G	Catchment
Sumsel	D. Ulak Lia	All year	All	FR	No	Auctions	DP/Pemda I	DP guard + police	Poor?	1R:1V	DP	1990	G-G	Catchment
Sumsel	D. Cala	All year	Some	PR-Sg	No	Auctions	DP/Pemda II	DP + police	?	1R:1V	DP	1995	G-G	Catchment
Sumsel	D. Kongar	--	--	--	No	Put&Take	DP/Pemda II	DP + police	?	--	DP	1995	Private-G	Sport fishing
Sumsel	D. Sidowali	All year	All	FR	No	No fishing	DP/Pemda II	DP + police	?	1R:1V	DP	1995	G-G	Catchment
Sumsel	D. Gaslam	All year	All	FR	No	Auctions	DP/Pemda II	DP + police	?	1R:2V	DP	1995	G-G	Catchment
Sumsel	D. Raya	?	?	?	?	Auctions	DP/Pemda I	DP + police	?	?	DP?	?	?	?

Notes:
- Closed Seasons: HB=Hari Berkarang (ceremonial fishing day) permitted in reserve, otherwise closed/managed all year
- Reserve Management Categories: NR=No Reserved Area, FR=Full Reserve, PR=Partial Reserve, numbers indicate subcategories (see table 6)
- Agencies: DP=Dinas Perikanan, LIPI= Indonesian Institute of Sciences, Pemda=Local Government, KSDA=Forestry Conservation Authority
- Institutional Categories: Main agencies responsible for reserve creation (1st letter) and management (2nd letter); C=community, G=Government

7. Proposals for Monitoring Programmes and Data Analysis

7.1 Monitoring Programme Rationale

The Monitoring Programme is intended to provide guidance on two factors:

- Which types of reserves provide the greatest benefits in which circumstances (ie the reserve selection criteria)?
- What management institutions and arrangements are necessary to achieve a given objective or potentially available outcome (ie the co-management guidelines)?

Neither of these requirements can be answered by simple, short-term, experimental solutions. The rationale for practical and realistic approaches to answering these questions is provided in this section.

Qualitative comparisons between reserves

Comparisons between the different reserve types or between reserves and 'control' sites would be extremely difficult to make in any quantitative way due to the great local differences between study sites. Local river fisheries differ extensively in at least the following factors:

- Resource ecology (types of habitats and macrophytes available and their productivity)
- River hydrology (flooding patterns, including duration, depths, and areas and their variability between years)
- Fish ecology (fish species available, and their present abundance, potential productivity, distribution and migratory behaviour)
- Fishing practices (the intensity of fishing, the gear types used and their seasonality and effectiveness)
- Historical changes in all the above factors.

Though quantitative measures could be monitored for each of the reserves, local differences in the above factors would make it impossible to assign any given measured benefits to any one of the factors of interest.

The previous section developed a 'reserve categorisation system', which attempted to simplify some of this complexity and classify the known reserves on the basis of five variables. These variables were selected for their potential to give useful guidance on how to select or manage reserves:

- Intended beneficiaries (local or catchment)
- Catchment position (upland or floodplain)
- Habitat type (river section, or lake)
- Management agencies (established and managed mainly by government or community)
- Management regulations (partial reserves - with 3 sub-categories - or full reserves)

All of these classification variables are continuous measures, rather than discrete categories.

The categorisation system also does not cover most of the ecological and historical dimensions mentioned above. In light of these concerns, it was agreed that representative reserves should be selected for the study in as many of the category combinations as available, for the purpose of understanding what is important to make reserves beneficial, rather than for making quantitative comparisons. The monitoring programme is designed to generate indices of ecological and socio-economic benefits at study sites in each category. The analysis, however, must be done in such a way as to reveal *why* such an outcome is achieved in each case, rather than just allocating the result purely to any one category. For this reason, an integrated, interdisciplinary approach has been adopted for the monitoring programme, in which quantitative results are supported by more insightful interviews and institutional analyses using a case-study approach. The traditional 'control sites' are not included in the selection of study sites, though some non-reserve sites are included to illustrate the importance of certain key factors.

Investigation of local benefits

The monitoring programme is designed to investigate the impact of reserves on the status of fish stocks and on the actual benefits obtained by fishing communities from their overall management strategies. As mentioned earlier, reserves may be intended to give benefits to either local communities, or to whole river catchments. The impact of a reserve at a catchment level could only be investigated by comparing whole catchments, some with and some without reserves, and making allowances for the significant ecological differences between catchments. Such an approach is well beyond the scope of the present project. Instead, the monitoring programme focusses on *local* impacts of reserves, particularly as perceived by those communities most closely associated with them.

Many of the reserves examined fell entirely within the boundaries of a single village, which had some traditional or formal authority to control the fishing activities in their waters. The study sites selected all fell into this category.

The ecological benefits of reserves will be investigated by monitoring the state of fish stocks inside the reserve over a full yearly cycle. These will not be compared to 'control sites' outside reserves due to the difficulty of identifying sufficiently similar non-reserved waterbody conditions. However, the socio-economic benefits of reserves will simultaneously be estimated within the village as a whole, as obtained from all its fished waterbodies. This strategy supposes that fish protected within reserves give the maximum benefits to those waters most adjacent to them, as fished by the local village, and that such benefits may be detected in that community.

Though focussed on local impacts, this strategy also allows for the investigation of the *local* impacts of those reserves intended to give *catchment* benefits. Such reserves may be more successful at generating catchment benefits if they are also perceived to give some local benefits rather than strongly negative dis-benefits (which may prevent effective management).

7.2 Selection of Study Sites

From the 23 village reserves identified and investigated during the RRS, it was decided that 11 localities should be studied in the detailed monitoring programme. These include 4, 4 and 3 in Kalbar, and Jambi and Sumsel provinces, and exclude the following 10 sites for the reasons stated:

D. Sentarum	Kalbar	Benefits too widely distributed and local management too variable
Sambar	Kalbar	No particular features of interest
Teluk Kenali	Jambi	Overgrown by weeds and management regulations too complicated

D. Karangan	Sumsel	Reservoir, disconnected from floodplain by sluice gates
D. Cala	Sumsel	Security problem due to local bandits
D. Kongar	Sumsel	Reservoir, not floodplain river waterbody
D. Sidowali	Sumsel	No fishing grounds in village except reserve, so no local benefits
D. Gaslam	Sumsel	Waterbody shared between two villages
D. Ulak Lia	Sumsel	Overgrown by weeds; avoided for logistical advantage (last Sekayu site)
D. Raya	Sumsel	Too remote, avoided for logistical advantages

In addition to the villages with reserves, it was also decided that Pulau Majang village in Kalbar should be studied. This village does not have any reserve waterbodies, and many of its fishing areas are routinely fished by tuba and/or chemical poisons in the dry season. Studies in this village will determine the stock levels and benefits achieved in this locality from external recruitment sources only, when virtually all local sources of fish are destroyed in the dry season.

In total then, the following 11 reserves/villages were selected for the monitoring programme as representatives of the different categories. As discussed earlier (Section 5.2), the actual reserves to be included as representatives of the Jambi upland categories will be decided after the supporting field visits (Lubuk Taman Ciri and Danau Teluk Kayu Puti have been provisionally proposed as indicated below).

Reserves / villages selected for detailed study in the monitoring programme

		Reserve Intended for Local (Village) Benefits		Reserve Intended for Catchment Benefits			No Reserve
		Floodplain		Upland	Floodplain		
Management Agencies	Management Regulations	Lake	River	River	Lake	River	
C-C	g						P. Majang
	PR-sg	D. Seliban D. Arang Arang	Jambi Kecil				
	PR-Sg	D. Belaram					
	PR-sG	D. Batuk					
G-C	FR		D. Mahligai	L. Taman Ciri?		D. T.K. Puti? D. Mahligai	
G-G	FR			L. Taman Ciri?	D. Teluk Rasau D. Teluk Gelam D. Teluk Nilam	D. T.K. Puti?	

7.3 Biological Assessment

Introduction

The biological monitoring programme was designed to use the simplest possible approaches for generating useful, quantifiable indices on the states of fish stocks in reserves. Simple indices (eg fish abundances) were preferred over more complicated ones (eg current spawning stock biomass as a % of the unexploited biomass) to ensure that the results collected would be meaningful to artisanal fishermen with relatively little education.

The programme has two main components: a regular sampling survey covering a full 12-month cycle, and a series of supporting interviews to provide comparative data on historical conditions.

The routine sampling survey will collect quantitative data enabling the following indices to be calculated for the state of fish stocks, for the year of the survey:

- The abundance of fish
- The composition of fish stocks (by species and sizes of fish)

The supporting interviews will collect more qualitative data on the historical trends in the above indices over recent years, ie:

- Overall changes in fish abundances over time
- Any particular declines or extinctions of individual species

Seasonal variability in fish abundance

Fish abundance varies over time in an annual cycle linked to the seasonality of flooding. Most river fish species spawn at the beginning of the flood, and the overall abundance of the stock then rises during the flood season, and falls again as fish die off in the environmentally stressful conditions of the dry season. In fished rivers, catches are usually particularly high in the drawdown and dry seasons following the high water growth season. The long-term survival and productivity of river fish stocks is critically dependent on the survival of enough fish over the dry season to spawn at the beginning of each new flood season. The ecological benefit of a reserve may therefore be particularly measured in terms of the numbers or biomass of fish which it sustains over the dry season.

The actual timing of the dry season varies significantly between different localities and between years. This variability prevents the detailed advance planning of monitoring surveys intended to focus on dry season indices. To ensure that fish stocks are sampled over the unpredictable dry season period, it was decided that data should be collected over the full annual cycle.

Estimation of fish abundance using CPUE data

Indices of fish abundance may be obtained from catch-per-unit-effort (CPUE) data, since a given unit of fishing gear will generally catch fish in proportion to their availability. The main constraint to this approach is that the effectiveness (or 'catchability') of fishing gears varies in many different ways. Catchability varies enormously between different gear types, and is particularly variable in floodplain fisheries, with their very strong seasonal and spatial characteristics.

To maximise the comparability of abundance indices between the different study sites, CPUE data will be collected from standard fleets of variable-meshed gill nets to be bought by the project. Gill nets are most effective in relatively open waters at times when fish are relatively mobile, eg during the high water and drawdown seasons when fish are foraging for food and then attempting to emigrate from the drying floodplain. Gill net catchabilities may be lowest in the dry season when trapped fish are relatively sedentary. The high concentrations of fish at this time are usually caught by other, more active gear types. Recognising, then, that CPUE abundance indices may not be comparable between seasons, this approach is recommended on the assumption that changes in catchability may be relatively similar between the different waterbodies in the study, thereby allowing there comparison. If gill net CPUEs do decline to very low levels in the dry season, further sampling using more active cast nets may also be used to determine the actual presence of fish stocks. Consideration could be given to 'removal sampling' using such cast nets to give absolute estimates of fish abundance in some cases.

In addition to varying over the seasons, catchability also varies spatially: some fishing locations are simply better than others. To minimise bias due to different fishing practices between the study sites (each of which will be fished by different fishermen employed by the project), a

master fishermen will also be employed to compare study sites and provide guidance on the most appropriate fishing locations within the reserve.

Biological monitoring programme activities

In consideration of the above points, it is recommended that routine biological sampling activities should be undertaken in each of the selected waterbodies as follows:

- Two fleets of gill nets should be purchased by the project for each study location, each comprised of 5 sections of 50mx2m monofilament gill nets, with mesh sizes of 0.5", 1", 2", 3.5" and 5". To ensure comparability, all gill net materials should be purchased from the same supplier, and rigged in the same way. Depending on the rate of deterioration of the nets, additional nets may need to be supplied later in the programme. In this case, all sites should be supplied with identical, replacement nets at the same time.

- A weighing balance, weights and basket(s) should be purchased by the project for each village, of an appropriate size (eg to weigh up to 10-20kg in 0.05-0.1kg units)

- Since the sampling programme will deplete the fish stocks in each reserve, some compensation (say Rp500,000-1,000,000) should be paid to the village development funds, via the Kepala Desa. To avoid any misunderstandings about the legality of fishing, both verbal and written publicity should be distributed among village members, describing the scientific nature of the survey, the objectives of the project and the compensation paid to the village.

- After suitable training (see below), both gill nets should be set overnight, on 3-5 randomly selected days in each month, thereby generating 6-10 samples per month, from which to estimate a mean catch and its standard error.

- The programme should continue for at least a full 12-month cycle staring by 1 October 1998 at the latest, and should ensure coverage of at least one dry season period.

- The total catch from each night's sampling should be recorded as follows:
  the total weight of fish caught
  the number and weight of fish caught of each main species (or species group), in each of two size classes (above or below 30cm)
  Such data should be recorded on a standard data form, along the lines of that illustrated in Table 8a.

- The water level (in cm, above any constant datum) should be recorded every day at some convenient point close to, or in the reserve waterbody. The deepest water depth in the reserve should be measured on a specified day to calibrate the measured water levels as actual daily depths.

- The dates and severity of any occurrence of '*air bangar*' low water quality should be recorded, particularly when this results in fish deaths, either in the reserve or other village waterbodies. The likely cause of the *air bangar* should be recorded if this is known.

Biological monitoring programme staff and training requirements

To achieve the above routine fieldwork, the following staff should be recruited for employment:

- Two locally resident fishermen should be employed in each village for the full 12-month survey, and paid a daily salary (at an appropriate government-specified rate) to set and

retrieve nets 3-5 times a month, and land the fish caught.

- One locally-resident 'enumerator' or technician should be employed in each village for the full 12-month survey to meet the fishermen and assist them to weigh and record catches on data forms supplied by the project.

- One 'coordinator' should be employed in each province to provide a liaison between the village enumerators and the project, ensure that data is collected as required, to check data quality, and to send copies of data sheets to the CRIFI project coordinator by agreed deadlines.

- One master fisherman should be employed for approximately 4-6 weeks to train fishermen in each of the villages to use standard fishing techniques and identify those localities in the reserve likely to produce the best catches.

The village fishermen and enumerators, and the three provincial coordinators should be trained in the appropriate methods of data collection and recording during visits of the CRIFI/MRAG collaborators and the master fisherman during July and August 1998, in time for the surveys to begin by 1 October (preferably 1 September) 1998.

Supporting interviews on historical trends

The supporting historical data should be collected during the July/August 1998 training visits of the CRIFI/MRAG biologists, using the following short interview process. Each interview should not take longer than 10-15 minutes.

- A randomly selected subsample of at least 10 fishermen should be selected for interview in each village (eg with the help of the Kepala Desa and the Ketua Nelayan).

- Each respondent should be asked to state the number of years he/she has fished in the village waterbodies.

- The respondent should then be asked to estimate the change in *average* CPUE over a stated time period within his memory (*NB: this should be CPUE for a specified number of gear units of a specified, unchanged gear type, and NOT the change in total catch, or catch per fisherman*). Since fisherman often tend to overestimate the decline in their fish stocks, some questioning should be done to ensure that the respondent has compared present catches with the *average* historical catches, and not with, say, his *best day's catch in the best ever year* in that village. If fishermen can reliably recall data (or have kept records of their catches) for different years or gear types, then such catches should be recorded. The expectations of this approach should however be kept within reasonable bounds, and respondents not be pushed to provide data beyond their recall period.

- The respondent should finally be asked to state which fish species have either become extinct or have significantly declined within the period of his/her experience.

- All data should be recorded on a standard data form, with a basic structure along the lines of that illustrated in Table 8b:

Biological data analysis and fish stock indices

Data from the historical interview survey will be recorded by the CRIFI/MRAG staff, and should be kept by them for subsequent computer analysis. Data from the routine monitoring survey should initially be collected by the employed village enumerators. The enumerator should be

responsible for accurate and legible data collection and should be tested for such abilities during the training phase in each village. The provincial coordinator should collect the data sheets on a monthly basis from all the village enumerators, at pre-arranged times, and make two photocopies of each data sheet. The three copies should then be distributed, one to the village enumerator, one to the CRIFI coordinator, and one retained by the provincial coordinator.

Data entry should be undertaken in a suitable Microsoft Excel database by CRIFI staff. Data should be entered as soon as possible after collection to enable ongoing monitoring of results. An up-to-date copy of each month's database should be e-mailed to MRAG as soon as it is fully entered, and hard copies of the data sheets sent by post at the same time.

The historical trend interview data should be analysed to produce two visual, qualitative illustration of the changes in fish stocks:

- A plot of the ratio (historical catch / current catch) against the year of the historical catch (values consistently over 1, or a negative trend over time would indicate a decline in fish stocks).

- A frequency distribution of the number of times each fish species is reported by a respondent as being significantly declined or extinct (illustrating the degree of correspondence between the different respondents, and identifying those species most commonly agreed to have declined).

The following simple indices should also be calculated for each village from the monthly gill net survey data:

- Monthly average total weight of fish caught per 250m gill net, and its standard error (index of seasonal fish abundance)

- Yearly average % of total catch weight of large fish (>30cm), and its standard error (index of average fish sizes)

- Yearly average % of total catch weight of each species/group, and its standard error (species composition to illustrate abundance of preferred / valuable species)

- Yearly average sizes of fish (Σweight / Σnumbers) of most common species (index of fish mortality rates by species, assuming equal growth and emigration rates)

When the full year's data have been collected, the monthly fish abundance indices should be examined to determine the maximum and minimum fish levels achieved within the reserves, and the month at which they occurred, for comparison with the hydrological cycle.

When calculated, the above indices should be compared between the reserve categories, bearing in mind the caveats mentioned in the introduction about the ecological differences between the selected waterbodies. Explanation of the observed indices will required an integrated, qualitative analysis of the full suite of data collected. A key explanatory variable, not included as a reserve 'category' could be the level of fishing activities at each site. A rough index of fishing intensity (eg fishermen / km^2 of fishing grounds) will be produced by the socio-economic monitoring programme. If fishing intensity varies significantly between the study sites (as seems likely from the RRS survey results), this index should be used as a qualitative co-variate for the comparison of results between sites.

Table 8a Biological monitoring programme - gill net catch survey. Example of data entry form.

Date: _____, Village: _____, Waterbody: _____

Fish Species / Species Group	Fish caught (per night, per 2 x 250m of gill net)			
	Small fish (<30cm)		Large fish (>30cm)	
	Number	Weight (kg)	Number	Weight (kg)
Species 1				
Species 2				
Species 3 etc				
<insert more rows>				
Total				

Table 8b Biological monitoring programme - historical perspective interviews. Example of data entry form, with illustrative data.

Date: _____ , Village: _____

Fisherman name: _____, Years experience: _____

Geartype	Gear units	Current CPUE (kg / gear unit)	Previous CPUE (kg / gear unit)	Year compared
eg Gill net	eg 50m net fished overnight	eg 2kg this year	eg 4kg	eg 1996
eg Gill net	eg 50m net fished overnight	eg 2kg this year	eg 12kg	eg 1970s
eg Cast net	eg one hours casting in lubuks	eg 3kg this year	eg 8kg	eg 1990

List of species showing strong declines / extinction within years of personal experience:

_____

_____

_____

7.4 Institutional Analysis

The institutional analysis is designed to complement the assessment of the ecological and socio-economic benefits obtained from different types of reserves. Whilst these latter assessments focus on an evaluation of the *outcomes* (both biological and socio-economic) of the reserves, the institutional study investigates the *process* through which these outcomes have been achieved. This will be particularly useful when devising guidelines for the creation and management of reserves.

Lessons can be learned from both desirable and undesirable outcomes. Undesirable outcomes result from the implementation of management strategies which are either technically inappropriate (either biologically or in terms of allocation of benefit) or where the incentives generated are insufficient for resource users and other stakeholders to comply with the rules which would otherwise produce desirable biological and/or socio-economic benefits.

One of the objectives of the institutional study is to establish which of the two problems, under which circumstances, is more serious in producing less than desirable outcomes for reserve management in Indonesia. This is to be done by monitoring rule infractions and investigating perceptions of the effectiveness of monitoring and enforcement.

The second objective of the institutional study is give an assessment of the main criteria which have influenced the success (or failure) of achieving desirable outcomes, particularly of achieving co-operation and compliance with rules which have constrained individual action for the benefit of the group. This will be done by building on information already collected in the exploratory phase. The aim at each site will be to describe more fully the situational variables known to affect people's incentives to comply with sets of working rules and secondly to analyse which are the most significant in the study villages. Examples of groups of variables to be described include characteristics of the community of resource users and the types of institutional arrangements in place. This part of the research will draw heavily on theoretical work developed by scholars such as Ostrom, E; Gardiner, R; Schlager, E;Tang, S; Pinkerton, E. and others in the fields of institutional analysis and the community management of common pool resources.

The final objective of the study will be to gain some insight into the conditions necessary for the creation of reserves. This includes investigating how costs of setting up new institutional arrangements may be minimised, so as to encourage resource users and/or government agencies to make the effort to set up reserves. As well as a description of existing institutional arrangements at the local, regional and even national level, this will require an understanding of the evolution of institutional arrangements.

The institutional study will take place in the middle of the fieldwork phase approximately during February and March 1999, and will be based on a series of interviews with stakeholders in all selected sites. It is anticipated that the work will be carried out over a two month period. Monitoring of rule infractions will be carried out as part of the socio-economic monitoring described in the following section. All other information will be collected during the two month period. Emphasis will be placed on getting in depth, context specific knowledge to compliment the broader and more quantitative insights gained from the socio-economic and biological monitoring programmes. Further details on the proposals for the Institutional Analyses will be prepared in advance of the surveys.

7.5 Socio-economic Assessment

The objective of the socio-economic monitoring is to assess the socio-economic *outcomes* arising from different types of reserve and their associated management regimes. There are

a number of fisheries management objectives against which these outcomes may be assessed. These include total value of production, employment in fisheries, government revenue, profit etc. This study will focus on the level of economic surplus generated and its distribution between different categories of stakeholder (local government at different levels, fishermen of different types and leaseholders).

Monitoring Programme

Scope of Study

The benefits of reserves may often be quite widely diffused - particularly when the stocks protected are of moderately to highly migratory species. Nevertheless, estimates of the reserve's impact will be restricted to the village to which it is attached and/or its directly connected waterbodies. This limitation on scope has two advantages:

- **!** it focusses attention on the rewards for both the community and fishers within it - issues of critical importance if the incentives to maintain and abide by a management regime are sufficient to outweigh the communal and individual costs involved;

- **!** it is practicable - measuring of impact becomes progressively more speculative (and so contentious) and expensive with the area covered increases.

Uniformity of Sample Design

It is normal in surveys of this sort for a uniform methodology to be adopted across all sites monitored. This will not be possible here. The variations in the features of the fishery and their management regimes, particularly between provinces, affects the distribution of economic surplus both between fishers and the wider local community and among fishers themselves. A sampling design that was blind to these differences would probably produce data that was both patchy and misleading. As a result a context sensitive sampling strategy is proposed.

West Kalimantan

In Indonesia all fisheries are technically owned by the state (Article 33 of UUD, Fishery Basic Law No.9/1985). However control over local resources by more local authorities is widely exercised and this is sanctioned by local regulations. In DSWR waterbodies were clearly recognised as belonging to particular villages and, though outsiders were permitted access during the wet season if they asked permission, their numbers were relatively small. Management rules and the characteristics of gears used lead to economic outcomes that appear to be comparatively equitable. There are clear fluctuations in the potential economic surplus from fishing, resulting from high concentrations of fish in certain locations during the flood cycle. But access rules here appear to be aimed primarily at ensuring equality of fishing opportunities within the community. A typical example is the use of lotteries to determine who is first to choose among the prime fishing spots for bubu (cylindrical rattan traps) on connecting channels during the drawdown, which was coupled with limitations on the number of traps that could be used by any one fisherman in the event that overall demand exceeded the spaces available. Secondary data sources indicate that gear ownership is not uniform across all communities but generally there appeared to be no major differences that would lead to a significant skewing of income from the fishery.

In the light of the above, the sample frame should be the fishing households within the village. Elaborate stratification is probably not necessary, though this might be considered if there appear to be significant differences in ownership of key gears. A uniform questionnaire should be applied to all households on a weekly basis. This should record the number of days fished and details from the most recent day of that week. Data should be collected: on the value of catch sold, used as an input into cage culture and that consumed; hours spent in catching, maintenance, travel etc.; marginal costs of fishing (fuel, materials etc.); any capital expenditures relating to fishing. Information should also be gathered on other sources of

income for the household, noting which they were and their ranking relative to fishing as an economic activity and as a source of cash income.

Possible complicating factors which may require further consideration during the survey include:

- ! ownership of jermal (partial barrier traps)
- ! cage culture and its associated fishing activities, particularly when time of sale may fall beyond the enumeration period
- ! estimation of fishing costs
- ! level of detail on catch by gear (desirable but leading to greater problems in enumeration and an escalation of data entry costs)

Jambi

The local villages at two of the reserves proposed for monitoring operate a lelang system on some of the adjacent channels or floodplain depressions. This auctions the rights to dry-season fishing to members of the village, with the revenue raised going largely to local development funds. It results in a very different distribution of the potential economic surplus from that found in DSWR as these waterbodies are often among the most valuable within the desa, producing a large catch very quickly sometimes from only one or two orchestrated fishing operations.

Village records indicate that control over waterbodies frequently changes as a result of the auction. There are also very significant differences between the auction values of different lelang areas - suggesting a high variance in expected economic surplus. Open access fishing continues on all waterbodies during the flood season and those not covered by the lelang during the dry season.

Detailed records on the proceeds from the lelang auction make the calculation of the economic surplus from the fishery going to the desa straightforward. The lelang does, however, complicate the estimation of total economic surplus and its distribution within the fishing community. If a simple household frame were used and no stratification took place the expected variance of estimates would be greatly amplified by the chance of a disproportionate representation of lelang winners in the sample. If the sample was stratified between lelang winners and other fishermen, there would be a significant chance of estimates being distorted by their switching categories during the course of the monitoring period.

In the light of the above, it is proposed that a detailed study of village lelang records be supplemented by two separate surveys, one of lelang areas, the other of household fishing in open access areas.

(I) Lelang Area Survey

If there are more lelang areas than can be covered by the survey, care has to be taken in selecting those that are to be monitored. The first stage would be to stratify waterbodies by type (connecting channel, floodplain depression). With the feasible sample size small, simple random sampling from a list of lelang of each type would result in an unbiased estimate with a high variance. An alternative might be to define alternative groups of 2 or 3 lelang (depending on desired sample size), that had a total auction value close to the average for all lelang. One of these groups could then be chosen at random.

Questionnaire design and the schedule of repeat surveys would have to be determined on the basis of the management pattern followed for each lelang type. For some this would require no more than one detailed interview with the lelang winner after the main fishing period. Others may require more extended survey. Issues covered would include total cost of lelang operation, reward systems (catch share etc.) for those operating under the lelang winner, value of catch.

Possible complications requiring further consideration:

- ! individual fishermen operating, subject to an agreement with the lelang winner, in the

lelang area during the dry season
- attitude of lelang winners to divulging sensitive information on profitability, particularly where identity of person controlling lelang was likely to change mid-survey
- differences in timing of dry season from one year to the next in relation to survey (danger of getting either two or no dry season catches)
- drop out of lelang units due to non-cooperation of new winners

(ii) Open Access Fishing by Households

This should conducted in a way similar to that described for West Kalimantan above, except fishing recorded should only cover that in open access waters.

Possible complications requiring further consideration:
- role and significance of subsistence fishing

South Sumatra

Due to the prevalence of lelang systems in the more valuable fishery areas, the main focus will be on lelang monitoring. Whether this will be supplemented will be determined by further investigations into the management patterns currently used and the feasibility of household surveys.

Data Analysis

Data Management and Manipulation

Data should first be thoroughly checked by the supervisor in each region before being sent on for entry. This should be done at the time of collection from the enumerator - not later in the office - to avoid delays due to queries and iron out problems quickly.

Data will be entered by CRIFI staff at a centralised location. CRIFI's preferred package for data entry is Microsoft Excel. This should be done concurrently with data collection with the objective that data be available for preliminary analysis no later than 6 weeks after enumeration, when a soft copy should be sent to MRAG in London. All necessary manipulation should also be done in Excel, making sure that it is maintained in a format readable as a database. Final analyses should be undertaken in SPSS for Windows and Microsoft Excel.

Form of Output Required

The objective is to provide information on the economic surplus from fishing activity and its distribution. The output will be in the form of an estimate of the overall distribution of economic surplus from fishing between government revenue, leaseholders and fishermen. The distribution between leaseholders and fishermen (perhaps of different types if disaggregation permits) will then be evaluated on a seasonal/monthly basis.

This will be set against an evaluation of the relative significance of fishing through the year for all fishermen types.

8. Proposals for Dissemination / Training

8.1 Introduction

The main output of this project will be the Co-Management Guidelines designed to enable improved management of Indonesian river fisheries using flexible 'reserves' in a locally appropriate institutional framework. These 'Guidelines' will be implemented by local agencies, largely without international support, probably using a 'pilot project' approach in the first instance. An enthusiastic uptake of such new technology is far more likely if the local agencies concerned have been involved in its development. To ensure success, it is therefore vitally important to facilitate the active participation of all of the relevant agencies in the project. This section briefly considers who needs to be involved in this process, and how they may participate.

8.2 Key Agencies Involved in Fisheries Development

The various agencies involved in the management of inland capture fisheries in Indonesia are described in detail in section 4 of this report. The current section briefly summarises the role each agency would need to play in the implementation of the project's Guidelines.

At the national level, the Directorate General for Fisheries would need to ensure that the Guidelines were compatible with current national policies. Provincial institutes may only undertake locally specific activities (such as a new pilot project) if these have the same basic goals as state policies. The Ditjen Perikanan's ratification or seal of approval for the Guidelines should therefore be sought before the end of the project to facilitate their subsequent uptake at local level.

At the provincial and kabupaten levels, three key agencies would be involved in the uptake of the project Guidelines. Firstly, the regional planning agency, Bappeda, would be responsible for allocating funds for any pilot projects from its agricultural development budget. Bappeda would also need to approve suggested locations for pilot projects based on their development priorities in the different agro-ecological zones of the province.

Secondly, technical components of the pilot projects and regional coordination of activities in different villages would need to be undertaken by Dinas Perikanan (the provincial Fisheries Services). Dinas Perikanan have good technical knowledge of their local natural resources and fisheries activities. In general, though, they are not well experienced in the type of 'bottom-up' community development work which would be required by the Guidelines to enable effective local participation in a co-management strategy. Support for such community-oriented work could be contributed by the BPTP system of Local Agricultural Technology Institutes and the BIPP/BPP Agricultural Extension Agencies at Kecamatan and Desa levels (see Figure 3 in section 4). Both these agencies are more oriented towards participatory development approaches, particularly using farmer groups.

Neither Bappeda nor the BPTP or BIPP/BPP services currently have any significant activities or extension projects in capture fisheries management in any of the three study provinces. The management of this sector is, however, within the remit of all these agencies and discussions with both Bappeda and BPTP in each province have given assurance of their commitment to this sector, if and when suitable guidance is provided by this project.

8.3 Key Agency Participation in Project

Dinas Perikanan are already formally involved in this project as local collaborators in three provinces. Their strong participation should be encouraged during the monitoring programme and dissemination phases.

The other key agencies, the Ditjen Perikanan, Bappeda and the BPTP/BIPP/BPP extension agencies are not formal collaborators of the project, though they are recognised as stakeholders and 'target institutes'. Their continued involvement should be encouraged by further direct consultations and regional workshops over the next two years.

To ensure local commitment to the Guidelines, significant time must be spent on explaining project activities at all stages, in such a way that the potential benefits of the project are revealed and understood by the collaborators. Without such effort, the project is more likely to be viewed simply as extra hard work for no personal or community benefit. Adequate opportunities must be given for local comment and ideas to be incorporated into the project and its eventual Guidelines. To facilitate focussed comments, a draft version of the project's Guidelines should be written before 31 December 1998 for distribution in Indonesian language to the stakeholder agencies during the 1999 fieldwork phases. A provisional structure for the Guidelines is given at the end of this section.

8.4 Final Dissemination and Training Activities

The project budget allows for translation of the Guidelines into Indonesian and their publication by CRIFI in a suitable format. A 14-day visit is then planned at the end of the project to disseminate the Guidelines to the collaborators, and for the 'training of trainers' on their use and application. In light of the insights gained during the RRS field visit and the comments above, it is recommended that this field visit should include the following components:

- **National Dissemination (2 days, Jakarta)**
  Presentation of the project results and Guidelines to the Ditjen Perikanan. Training of Ditjen Perikanan trainers on use of the guidelines, for their further dissemination to Dinas Perikanan offices in provinces not included by the project. Formal ratification of the Guidelines by Ditjen Perikanan for immediate national uptake by Dinas Perikanan agencies in Indonesia (it is recognised that such final ratification would require extensive formal consultations on draft Guidelines prior to this stage).

- **Provincial Dissemination (3.5 days per province)**
  Joint presentation of the project results and Guidelines to the Dinas Perikanan, Bappeda and BPTP agencies in Kalbar, Jambi and Sumsel provinces. Training of appropriate staff in the technologies required, including one day of practical fieldwork activities. Discussion of suitable field locations for pilot projects, and funding requirements for their implementation, and agreement on activities to be undertaken after completion of the project.

9. Stakeholder Workshop Recommendations

9.1 Introduction

As described in Section 3 and Annex B, RRS fieldwork activities included meetings with stakeholder agencies in each of the study provinces. Meetings with individual agences were first held at their own premises. A final joint workshop at the end of each provincial investigation then enabled the various stakeholders to discuss the survey results and contribute to the project planning.

Following these provincial meetings and workshops, a final stakeholder workshop was held at CRIFI's Jakarta office for discussions between the project collaborators (including the provincial Dinas Perikanan offices) and the national target institutes and other interested parties. Following presentations by the project team, this final meeting agreed the activities and responsibilities for the remainder of the project.

9.2 Workshop Participation

Name	Position	Institution
Dr. Fatuchri Sukadi	Director	Central Research Institute for Fisheries (CRIFI) (Pusat Penelitian dan Pengembangan Perikanan) Jl. K.S. Tubun Petamburan VI, PO Box 6650 Slipi, Jakarta 11410 A Telp : (021) 5709160, Fax : (021) 5709159
Dr. Achmad Poernomo, MappSc	Head of Reseach Supervision	Central Research Institute for Fisheries (CRIFI)
Dr. A. Rukyani	Director	Research Institute for Freshwater Fisheries (RIFF) (Balai Penelitian Perikanan Air Tawar) Jl. Raya 2 Sukamandi, Subang - Jawa Barat Telp : (0260) 520663, Fax : (0260) 520662
Dr. A. Sarnita	Researcher	Research Institute for Freshwater Fisheries (RIFF)
Ir. Zahri Nasution	Researcher	Research Station for Freshwater Fisheries (RSFF) (Loka Penelitian Perikanan Air Tawar) Jl. Beringin No. 308, Mariana, Palembang Telp/Fax : (0711) 367294
Ir. Agus Djoko Utomo	Researcher	Research Station for Freshwater Fisheries (RSFF)
Dr. Victor Nikijuluw	Researcher	Research Institute for Marine Fisheries (RIMF) (Balai Penelitian Perikanan Laut) Jl. Muara Baru Ujung, Komplek Pelabuhan Perikanan, Muara Baru - Jakarta Utara Telp (021) 6602044 Fax : (021) 6612137
Ir. Novenny A. Wahyudi, MDM	Head of Research Collaboration Division	Central Research Institute for Fisheries (CRIFI)

Ir. Sonny Koeshendrajana, Msc	Project Coordinator	Research Institute for Freshwater Fisheries (RIFF)
Ir. H. Iswahjudi	Head	Provincial Fisheries Service, West Kalimantan (Dinas Perikanan Propinsi Kalimantan Barat) Jl. Sutan Syahrir 12, Pontianak Telp : (0561) 34145, 32125 Fax : (0561) 66073
Ir. Ali Supardan, Msc	Head	Provincial Fisheries Service, Jambi (Dinas Perikanan Propinsi Jambi) Jl. MT Haryono No. 9 Telanai Pura, Jambi Telp : (0741) 61170, Fax : (0741) 65134
Drs. Rooslan Saleh	Head	Division of Aquatic Biological Resources Management (Sub Dinas Bina Sumberdaya Hayati) Provincial Fisheries Service, South Sumatera (Dinas Perikanan Propinsi Sumatera Selatan) Jl. Kapten A. Rivai 669/II, Palembang 30134 Telp : (0711) 352528, 351394, Fax : (0711) 352528
Drs.H.M. Ali Hasjim	Head	District Planning and Development Agency, OKI, South Sumatera (Badan Perencanaan Pembangunan Daerah /BAPPEDA Tk. II Ogan Komering Ilir, Sumatera Selatan) Jl. Letnan Darna Jambi, Kayuagung 30611 Telp : (0712) 321281
Drs. Sugeng Priyanto	Staff Assisstant for Control and Supervision State Minister for Environmental	The Office of the State Minister for Environment, Republic of Indonesia (Banaswasdal 2, Asisten IV, Lingkungan Hidup) Jl. DI Panjaitan Kebon Nanas Jakarta Timur Telp/Fax : (021) 8580066
Dr. I Nyoman Suryadiputra	Technical Director	Wetlans International Indonesia Programme Jl. Arzimar III/17, Bogor Telp : (0251) 312189, Fax : (0251) 325755
Ir. Bambang Wahyudi, MSc	Staff	Directorate of Programme (Direktorat Bina Program) Directorate General of Fisheries (Direktorat Jenderal Perikanan) Jl. Harsono RM No. 3, Ragunan - Jakarta Selatan Telp : (021) 7804116 ext 3507 Fax : (021) 7803196
Rifda Djam'an, SH	Head of Rule and Law Regulation	Secretariate Directorate General of Fisheries (Sekretatiat Direktorat Jenderal Perikanan) Jl. Harsono RM No. 3, Ragunan - Jakarta Selatan Telp : (021) 7828577 Fax : (021) 7803196
Drs. Sutardjo	Head	Conservation Division Directorate of Aquatic Biological Resources Management (Direktorat Bina Sumberdaya Hayati) Directorate General of Fisheries (Direktorat Jenderal Perikanan) Jl. Harsono RM No. 3, Ragunan - Jakarta Selatan Telp : (021) 7804116 ext 3604 Fax : (021) 7803196

Ir. Teguh Trimulyantoro	Staff	Directorate of Aquatic Biological Resources Management (Direktorat Bina Sumberdaya Hayati) Directorate General of Fisheries (Direktorat Jenderal Perikanan) Jl. Harsono RM No. 3, Ragunan - Jakarta Selatan Telp : (021) 7804116 ext 3604 Fax : (021) 7803196
Ir. Dede Irving Hartoto	Chief of Aquatic Dynamic Division, RDC for Limnology	Research & Development Centre for Limnology - Indonesia Institute of Science (Pusat Penelitian Limnologi - LIPI) Komp. LIPI Cibinong Jl. Raya Bogor - Jakarta, Cibinong Telp : (021) 8757071, Fax : (021) 8757076
Ir. Bambang Priono, SU	Head of Communication Division	Central Research Institute for Fisheries (CRIFI)
Drs. Eddy Setiabudi	Head of Research Planning Division	Central Research Institute for Fisheries (CRIFI)
Ir. Ijah Muljanah	Researcher	Central Research Institute for Fisheries (CRIFI)
Ir. Alie Poernomo, Msc	Researcher	Central Research Institute for Fisheries (CRIFI)
Dra. Suwidah, MS	Researcher	Central Research Institute for Fisheries (CRIFI)
Dra. Endang Pratiwi	Researcher	Central Research Institute for Fisheries (CRIFI)
Dr. Suprijono Eko Wardoyo	Researcher	Central Research Institute for Fisheries (CRIFI)
Drs. Nurbakti S	Staff of Communication Division	Central Research Institute for Fisheries (CRIFI)
Ir. Theresia Lolita N	Staff of Research Collaboration Division	Central Research Institute for Fisheries (CRIFI)

9.3 Workshop Activities

The stakeholder workshop included presentations on the following issues:

- Summary of project goal, purpose and activities.
- Definitions and categories of reserves (clarification of project purpose).
- Conceptual framework of floodplain fisheries (illustrating the importance of locally-based research and management).
- Summary of field investigations (comparison of study provinces - see Table 9).
- Proposals for monitoring programme activities and study sites.

Workshop discussions addressed the following main issues:

- How could the project outputs be integrated with existing programmes for fisheries development and management?
- How could the project design be strengthened or improved?
- Design, scheduling and responsibilities for future stages of the project.

9.4 Workshop Recommendations

The stakeholder workshop discussions produced the following recommendations:

General

- **!** Further **stakeholder workshops** should be held at each future phase of the project, to enable inputs on design and provide updates on project progress.

- **!** CRIFI staff should **revisit Jambi province** to undertake further RRS field investigations at the upland Dinas Perikanan / LIPI reserve locations. Following the visit, a report should be written providing 'checklist' data and recommendations on the suitability of the different reserves for inclusion in the Monitoring Programme studies.

- **!** The project should encourage continuation of the policy discussions on the legal status of the **Danau Sentarum Wildlife Reserve**, and the legalisation of fishing activities within the reserve, so as to enable the project Guidelines to be legally applied in that locality.

- **!** CRIFI should establish an **Indonesian Fishery Reserves Network** to publicise the activities of the project and coordinate research and development on this issue by CRIFI, Ditjen Perikanan, LIPI and others. The Indonesian Fisheries Society (ISPIKANI) could be approached to collaborate in this venture.

Monitoring Programme

- **!** The **monitoring programme activities** proposed in Section 7 were provisionally agreed, subject to more detailed discussion at the start of the next research phase.

- **!** Fieldwork activities should be undertaken at the following **study locations**:

Kalbar:	Meliau; Sekolat; Tengkidap and Pulau Majang
Jambi:	Arang Arang; Dano Lamo and two upland sites (to be decided)
	Summary investigations (no quantitative monitoring) in Jambi Kecil
Sumsel:	Biological studies in D. Teluk Rasau; D. Teluk Gelam and D. Teluk Nilang
	Socio-economic studies in Kecamatan Pedamaran and Desa Benawa
	Summary investigations in Upang Swamp Project study site.

- **!** Provincial coordination for the monitoring programme will be the responsibility of:

Kalbar:	Bk. Suasa (Dinas Perikanan); Andi Erman (WI-IP, DSWR)
Jambi:	Herman Suherman (Dinas Perikanan)
Sumsel:	Bk. Rooslan (Diskan Prop. Sumsel); Bk. Asmar (Diskan Kab. OKI)

- **!** The Monitoring Programme fieldwork should be undertaken within the period July 1998 to September 1999, as described in Section 7 and illustrated in Table 10. To accomodate the amended programme, the end-date of the project should be extended to 31 March 2000.

Co-Management Guidelines

- **!** The project's Co-Management Guidelines should be written in **collaboration** with Ditjen Perikanan's Living Resources Division, building on their existing guidelines for reserves and stocking (CRIFI staff to translate the main points from these). The provincial Dinas Perikanan collaborators and other stakeholders should also be given every opportunity

to contribute to draft versions of the Guidelines.

- The Guidelines should include a **matrix of responsibilities**, illustrating who would do what at each stage in the development of new management approaches.

Project Dissemination and Uptake

- An advisory group or **steering committee** should be formed to oversee the successful uptake and legislation of the project outputs. Membership of the steering committee should include representatives of CRIFI; Ditjen Perikanan's Living Resources Division; Ditjen Pertanian's Legal Secretariat; the Directorate General for the Environment and the three collaborating provincial Dinas Perikanan offices.

- Ditjen Pertanian's Legal Directorate should promote the drafting of a Decision Letter or Ministry Decree to create the **legislative environment** required for national uptake and use of the project guidelines.

- During the final training and dissemination phase, proposals should be developed for locally-funded **pilot projects** in each province, for implementation of the project Guidelines. Such pilot projects would require significant rural development activities, and should be designed in participation with the provincial Dinas Perikanan, BPTP and Bappeda offices. Successful outcomes from such pilot projects and their local adaptation by BPTP would be a necessary precursor for wider uptake.

Table 9. Comparison of fisheries management approaches in the study provinces

	West Kalimantan	Jambi	South Sumatra
Reserve Types			
Catchment position	Floodplain	FP / Upland	Floodplain
Habitat type	Lakes	Lakes / Rivers	Lakes
Reserves established by	Communities	Govt. / Comm.	Government
Reserves managed by	Communities	Govt. / Comm.	Government
Intended beneficiaries	Local (village)	Catchment / Local	Catchment
Management regulation type	Partial	Partial / Full	Full
Management of Access to Fishing			
Access control mechanism	Lottery	Auction	Auction
Availability of access to fishing	Within village	Within village	Open to all
Income raised by licensing access	Low	Moderate	High
Main recipient of licensing revenues	Village	Village	Kabupaten
Local Contribution to Management			
Sense of belonging (manage't incentive)	High	Moderate	Low
Use of bottom-up legislation system	Much used	Much used	Rarely used
Community involvement in enforcement	Strong	Moderate	Little
Flexibility of local regulations & penalties	Flexible	Flexible	More fixed
State of Fish Stocks?	To be investigated in Monitoring Programme		
Fishery Benefits and Distribution?	To be investigated in Monitoring Programme		

Table 10. Timetable of activities for remainder of the project

Activities	***1998*** A M J J A S O N D	***1999*** J F M A M J J A S O N D	***2000*** J F M
Completion of Regional Reserves Survey			
Additional visits to Jambi			
Preparation for Monitoring Programme			
Local staff recruitment etc			
Biological Data Collection			
Survey design & field staff training			
Interviews etc			
Gill net fish abundance survey			
Socio-economic Data Collection			
Survey design & field staff training			
Respondent interviews			
Interviews etc			
Institutional Analysis			
Interviews etc			
Data Analysis			
Data entry & analysis			
Joint MRAG / CRIFI Analysis			
Dissemination & Training			
Preparation of guidelines			
Translation of guidelines			
Dissemination / training activities			

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Annex A: Glossary of Indonesian/English terms

NB: * indicates a commonly-used contraction of the proper words

Agencies etc.

AARD	Agency for Agricultural Research and Development
Bappeda *	Planning Service
BIPP	Balai Informasi Penyuluhan Pertanian, Extension Service at Kabupaten level
Biro KLH	Biro Kelestarian dan Lingkungan Hidup, Environmental Bureau
BPP	Balai Penyuluhan Pertanian, Extension Service at Kecamatan level
BPTP / LPTP / IPPTP	Local Agricultural Technology Research Agency
CASER	Centre for Agro Socio Economic Research
CRIFI	Central Research Institute for Fisheries, Indonesia
Dinas Perikanan (Diskan *)	Fisheries Service
Ditjen (*) Perikanan	Directorate General for Fisheries
DSWR	Danau Sentarum Wildlife Reserve
Kantor Wilaya (Kanwil *)	Area Office
kehutanan	forestry
KSDA	Konservasi Sumber Daya Alam, Natural Resource Conservation at provincial level
lembaga adat	customary institution
LIPI	Indonesian Institute for Sciences
LKMD	village-level representative of Bappeda
pekerjaan umum	public works
pemda	local government
pemerintah	government
pemuka adat	traditional leader
pertanian	agriculture
PHPA	Perlindungan Hutan dan Pelestarian Alam, Natural Resource Protection and Conservation at national level
Pimpro (*) APBD	Pimpinan Proyek Anggaran Pendapatan dan Belanja Daerah, Project Manager of the local budget for regional development
Setjen (*) Perikanan	Secretary General for Fisheries
UPT UPPU	Unit Pelaksana Teknis Unit Pembenihan Perairan Umum, Seed production technical unit of the open water fishery
WI-IP	Wetlands International - Indonesia Programme (previously AWB)

Administrative levels and leaders

propinsi	province (highest level)
gubernor	head of province
kabupaten	regency
bupati	head of kabupaten
kotamadya	municipality
kecamatan	disctrict
camat	head of kecamatan
desa	village
kepala desa (kades *)	head of village
dusun / R.T.	village sub-groups
kampung	hamlet

Legislative Mechanisms etc.

LMD	Lembaga Masyarakat Desa
musyawarah desa	village discussion
PBB	Pajak (tax) Bumi dan Bangunan
pelita	five year national plan
peraturan	regulation
perda	decision letter
petunjuk pelaksanaan	implementation guideline
juklak *	implementation guideline
sepakat	unanimity
SIUP	commodity fishing license
undang-undang dasar	national regulation

Provinces

Sumatra Selatan (Sumsel *)	South Sumatra
Kalimantan Barat (Kalbar *)	West Kalimantan

Fishing terms

hari berkarang	ceremonial fishing day
ikan	fish
nelayan	fisherman
pengamin	leaseholder
pusako	fishing rights

Fishing gears

anco	cast net
bengkirai bilah	bamboo trap
bengkirai kawat	chicken wire trap
bubu	large portable trap
bumbun	vegetation 'FAD'
cauk	scoop net
corong	river flume barrier trap
empang	bamboo fence
jala	cast net
jaring	gill net
jermal	portable barrier trap / net
kilung	floodplain barrier trap
lapun	large-meshed portable trap
lukah	cylindrical portable trap
menteban	cylindrical trap
ngebur	fish drive with lift nets
ngesar	river fish drive
ngesek	lake fish drive
pancing	rod and line
paril	seine net
penetak	river barrier
pengilar rotan	rattan trap
pukat	drift gill net
putas	poison
rawai	long line
rumpon	brushpile trap
sangi	scoop net
serampang	multi-pointed spear
serok	lift net
sukam	river flume barrier trap
tabung	bamboo cylinder trap
tajur / tagang	individual hook
tangkul	lift net
tembilar	trap
terok	single-pointed spear
tuba	natural poison
tuguk	river trawl barrier trap

Hydrological features

danau	lake
lebak	floodplain
lebung	floodplain lake
lubuk	deep river pools
rawa / rawang	swamps
sungei	river

Seasons

air naik	rising water
air turun	falling water
musim kemaran/ing	dry season
musim hujan	rainy season
musim basah	wet season

General

adat	traditional
bebas	free (eg open access)
dukun	magician
hilir / ilir	lower / downstream
hulu / ulu	upper / upstream
jarak	distance
kecil	small
kelompok	group
kepala adat	traditional leader
kepala	head
ketua	chief
kk. (Kepala Keluarga)	household head
ladang	dryland seasonal crops
lelang	auction
marga	traditional administrative area
Melayu	of Malay origin
padi	rice
pondok	temporary house
pusaka	sacred
retribusi	commodity flow tax
sawah	rice field
siskamling	village security system
suku	tribe
tingkat / Tk.	level (administrative)
wilaya kerja	work area

Local names and characteristics of fish species reported as common (in bold) or rare/locally extinct (in brackets) at the study provinces. Un-named species may exist in each province, but were not reported as either common or rare.

Scientific name	English name	Local Indonesian names			Fish Type			
		Kalbar	Jambi	Sumsel				
?			**kelamak**	(lemak)				
?	cyprinid			**lemajang**				S
?			**buruk tulang**					
?		**bauk / bau**			?	?	?	S
?	ornamental spp.		(ridikangus)	**kujublang**				S
?			**timah timah**					
?			**lambak**					S
?				(tebangalan)				
?			(beterung)					
?				(ikan are)				
Anabas testudineus	climbing perch		**betok**		B	A	S	S
Arius ngyropleuron			**dalum**					
Balantiocheilos melanopterus		(ketutung)			?	?	?	S
Barbichthyes laevis			**mentulu**					
Barbodes schwanefeldi		(suain)	(lampam)	**lampam**	W	N	M?	M
Betta anabatoides?		(belantau)			?	N	?	S
Botia macracanthus		**ulang uli**	**lelangli**		W	N	L	M
Channa spp	snakehead	**runtuk**, (kerandang)	**bujuk** (serandang) (jale)	**bujuk** (serandang) (jalai)	B	A	?	L
Channa micropeltes	giant snakehead	**toman**	**toman**	**toman**	G	A	?	L
Channa striatus	striped snakehead	**delak**	**haruan**	**gabus / haruan**	B	A	M	L
Clarias batrachus	swamp catfish		**lele**	(lele)	B	A	?	M
Clarias leiacanthus			**lembat**					
Cryptopterus spp	knife fish?	**lais**	**lais**	**lais** (sengarat)	W	N	?	M/L
Hampala macrolepidota			(sebarau)					L
Helostoma temmincki	kissing gourami	**biawan**	**tembakan**	**tembakan / sapil**	B	A	S	M
Labeo chrysopekadion			**mital**					
Leptobarbus hoeveni		(jelawat)	(jelawat)	(jelawat)	G	N	?	L
Leptobarbus spp		(piam)			G	N	?	L
Macrobrachium rosenbergii	giant prawn			(udang galah)	W	N	L	M
Mastacembelus crythrotamia?			**tilan merah**					
Mastacembelus maculates?	spiny eel		**tilan kuning**					
Mystus spp		**patik**			W	N	?	L
Mystus nemurus	river catfish?	(buang)	**baung**	**baung**	W	N	L	L
Mystus migriceps			**sengiring**					
Mystus micracanthus		**rik**			B/G	N	?	M
Notopterus notopterus				(putak)	G	N	?	M
Notopterus chitala		**belida**	(belida)	(belida)	W	N	?	L
Osphronemus gorami	gouramy		(kaloi)	(kalui)				
Osteochilus hasselti			**palau**	**palau**	G	N	S	M
Osteochilus vittatus			**medik**					S
Osteochilus spp		**umpan / kelabau**			G/B	N	S	M
Oxyeleotris marmoratus	marbled goby	**betutu / ketutuk**		(betutu)	G/W	N	S?	L
Pangasius spp		**patin**		**patin**	W	N	L	L
Polycanthus hasselti	belontid perch			**selincah**				S
Pseudeutropius spp	schilbeid catfish	**nuayang**			G	N	?	S

Puntipletes bulu		**tengalan**			?	N	?	M
Rasbora spp				**seluang**				S
Rohteichthys microlepis	cyprinid	(kapas)	**kapras**	(kapas / kapras)	?	N	?	M
Scleropages formosus	arowana	(siluk)	(kelaso / chandana)	(arowana)	G	N	M?	L
Tor douronensis			**semah**					L
Trichogaster pectoralis			**sepat siam**	**sepat siam**	B	A	?	M
Trichogaster trichopterus				**sepat mera mata**	B	A	?	S
Wallago leeri / miostoma	giant catfish	**tapah**	(tapah)	(tapah)	W	N	L?	L

Fish Type codes:
Ist column: B: blackfish, W: whitefish, G: greyfish, P: pelagic (lake fish)
2nd column: A: air-breathing, N: non-air-breathing
3rd column: Migration distances: S: short, M: medium, L: long
4th column: Size: S: small, M: medium, L: large

Annex B: Field Itinerary and Workshop Participation

Jakarta (National Institutes)

Mon 9 Feb	Introductory **Meeting** with CRIFI collaborators, CRIFI HQ Initial briefing on project, and discussion of field activities and programme
	Multiple **bank** visits to exchange traveller's cheques (DH+SK)

West Kalimantan (Kalbar)

Mon 9 Feb	**Travel**: Jakarta to Pontianak, Kalbar (~4 hours)
Tue 10 Feb	Introductory **meeting** with Diskan collaborators, Diskan Provincial HQ, Pontianak
	Introductory **meeting** with KSDA (manager of Danau Sentarum Wildlife Reserve)
Wed 11 Feb	Introductory **meeting** with Bappeda
	Introductory **meeting** with LPTP
	Second **meeting** with KSDA, review and photocopying of reports
Thu 12 Feb	**Travel**: Pontianak to Danau Sentarum field site (~8 hours)
	Introductory **meeting** with Diskan, Kabupaten Sintang
	Team **discussion** of reporting responsibilities, and selection of study sites
Fri 13 Feb	Team **discussion** of checklist (see final version in Table 1)
	Initial visit to Sekolat village, general discussions
Sat 14 Feb	Checklist **interviews** at Sekolat village
	Checklist **interviews** at Sambar village
Sun 15 Feb	Team **discussion** of project design and reporting
	De-briefing and write-up of Sekolat village checklist results
Mon 16 Feb	Checklist **interviews** at Meliau village
	De-briefing and write-up of Sambar and Meliau villages checklist results
Tue 17 Feb	Checklist **interviews** at Pulau Majang village
	De-briefing and write-up of Pulau Majang village checklist results
Wed 18 Feb	Checklist **interviews** at Seliban/Tengkidap village
	Travel to Sintang (~4 hours)
	De-briefing and write-up of Seliban village checklist results
Thu 19 Feb	**Travel** to Pontianak (~4 hours)

	Team **discussion** and **write-up** of province results
Fri 20 Feb	**Write up** of province results and preparation for workshop
Sat 21 Feb	Kalbar **Stakeholder Workshop** Presentation of findings, invitation to comment and guide future stages **Participation**: Diskan (Kalbar); Yayasan Agromitra (NGO); Kanwil Pertanian; LPTP; KSDA; Kanwil Pekerjaan Umum; SBPN (Fisheries High School)

Jakarta (National Institutes)

Sun 22 Feb	**Travel** to Jakarta (~4 hours)
	Half day off
Mon 23 Feb	Update **Meeting** with CRIFI collaborators, CRIFI HQ Discussion of Kalbar results and planning of following stages
	Multiple **bank** visits to exchange traveller's cheques (DH+ZN)

South Sumatra (Sumsel)

Mon 23 Feb	**Travel** to Palembang (~3 hours)
Tue 24 Feb	Introductory **meeting** with Diskan collaborators, Diskan Provincial HQ, Palembang
	Team **discussion** of Sumsel requirements and plans
Wed 25 Feb	Diskan **meeting** to discuss survey planning, and select study sites
Thu 26 Feb	Introductory **meeting** with Bappeda
	Introductory **meeting** with LPTP
	Team **discussion** of institutional structures
Fri 27 Feb	**Write-up** of report sections / partial day off
Sat 28 Feb	Team **discussions**: implications of Kalbar results; redesign of checklist

Jambi

Sun 1 Mar	**Travel** to Jambi (~6 hours)
	Team **discussion**: conclude redesign of checklist
Mon 2 Mar	Introductory **meeting** with Diskan collaborators, Provincial HQ, Jambi
Tue 3 Mar	Introductory **meeting** with Bappeda, Provincial HQ, Jambi (DH & SK)
	Introductory **meeting** with ???? (Environ. Agency, Governor's HQ, Jambi (DH & SK)
	Introductory **meeting** with IPPTP, Provincial HQ, Jambi (DH & SK)
	Introductory **meeting** with Diskan Kotamadya Jambi (DH & SK)
	Write-up of report sections (rest of team)

Wed 4 Mar	Checklist **interviews** at Dano Lamo village
	De-briefing and write-up of Dano Lamo village checklist results
Thu 5 Mar	Checklist **interviews** at Teluk Kenali village
	De-briefing and write-up of Teluk Kenali village checklist results
Fri 6 Mar	**Write-up** of report sections / preparation for discussions / partial day off
Sat 7 Mar	Team **discussion** of Reserve Categories
Sun 8 Mar	Team **discussion** of plans for Monitoring Programmes and Analysis
Mon 9 Mar	**Budget analysis** of proposed amendments to Monitoring Programme (DH)
	Checklist **interviews** at Arang Arang village (rest of team)
	De-briefing and write-up of Arang Arang village checklist results
Tue 10 Mar	Preparation of FMSP **Annual Report** for DFID (DH)
	Checklist **interviews** at Jambi Kecil village (rest of team)
	De-briefing and write-up of Jambi Kecil village checklist results
Wed 11 Mar	Team **discussion** of province results and preparation for workshop
Thu 12 Mar	Jambi **Stakeholder Workshop**, Diskan Provincial HQ, Jambi Presentation of findings, invitation to comment and guide future stages **Participation**: Diskan (Jambi Province); Diskan (Batanghari Kabupaten); Berbak Nature Reserve; KSDA (Jambi); Kanwil Pertanian (Jambi); Kanwil Kehutanan (Jambi); Biro KLH (Jambi); Pimpro APBD; IPPTP (Jambi/Riau); UPT UPPU (Jambi); Kanwil Pekerjaan Umum (Jambi).
	Write-up of report sections
	Preparation of FMSP **Annual Report** for project (DH)
Fri 13 Mar	**Write-up** of report sections
	Team **discussion**: outcome of Jambi Stakeholder Workshop; redesign of checklist

South Sumatra (Sumsel)

Fri 13 Mar	**Travel** to Sekayu (~6 hours)
Sat 14 Mar	Introductory **meeting** with Diskan collaborators, Kabupaten Musi Banyasin, Sekayu Discussion of potential study sites and fieldwork plans
	First checklist **interviews** at Ulak Lia village
Sun 15 Mar	Second checklist **interviews** at Ulak Lia village
	Travel to Palembang (~2.5 hours)
Mon 16 Mar	**De-briefing** and write up of Ulak Lia checklist results
	Discussion and **write-up** of report sections

Tue 17 Mar — Final preparation and submission of FMSP **Annual Report** for project (DH)

Write-up of report sections

Wed 18 Mar — **Write-up** of report sections

Thu 19 Mar — **Write-up** and compilation of report sections (DH)

Introductory **meeting** with Diskan collaborators, Kabupaten Ogan Komering Ilir, Kayuagung
Discussion of potential study sites and fieldwork plans (MAT, SK, ZN)

Attendance at AARD **workshop** on agro-economic zones
Integration of project with 5-year AARD development plans (AS)

Fri 20 Mar — Coordination and finalisation of report sections

Sat 21 Mar — Checklist **interviews** at Tanjung Sejaro village

De-briefing and write-up of Tanjung Sejaro village checklist results

Sun 22 Mar — Checklist **interviews** at Benawa village

De-briefing and write-up of Benawa village checklist results

Mon 23 Mar — Team **discussion**: fieldwork results for Sumsel province; preparation for stakeholder workshop presentations

Tue 24 Mar — **Presentation** of results to CRIFI Mariana Inland Capture Fisheries Research Station
Dissemination of project concepts and RRS fieldwork conclusions

Wed 25 Mar — Sumsel **Stakeholder Workshop**, Diskan Provincial HQ, Palembang
Presentation of findings; invitation to comment and guide future stages
Participation: Dinas Perikanan (Sumsel Province & kabupaten OKI); LPTP (Sumsel Province); Bappeda (Kabupaten OKI); LIPI; Wetland International - Indonesia Programme; PHPA; CRIFI

Jakarta (National Institutes)

Wed 25 Mar — **Travel** to Jakarta (~3 hours)

Thu 26 Mar — National **Stakeholder Workshop**, CRIFI HQ, Jakarta
Presentation of findings; invitation to comment and guide future stages
Participation: Ditjen Perikanan; Dinas Perikanan (Kalbar, Jambi and Sumsel provinces); Ministry of Environment; Agriculture Department (Legal Section); Bappeda (Kabupaten OKI); LIPI; Wetland International - Indonesia Programme; PHPA; CRIFI

Finalisation of report sections, allowing for stakeholder comments

Fri 27 Mar — RRS field survey conclusion **meeting** with CRIFI collaborators

Annex C: Investigations at Danau Sentarum Wildlife Reserve, Kalbar Province

Danau Sentarum background

General Introduction

Danau Sentarum Wildlife Reserve (DSWR) is a low lying floodplain intersected by lakes and waterways, situated just north of the equator in the Kapuas Hulu Regency in West Kalimantan (Indonesian Borneo). There is an annual variation in water levels of around 10-12m, attributable to local topography and seasonal back-flows up the River Tawang from the River Kapuas; the peak is between December and March and the low usually between July and August (Dudley, 1996b) .

In the more deeply flooded basin areas, grasses replace the water as it recedes. On ridge crests and at the upper margins of the seasonally flooded areas, much of the vegetation is low shrub and swamp forest. On higher land, lowland dipterocarp forest is the climax vegetation, though some has been converted and is now used periodically within a cycle of shifting cultivation.

DSWR has a unique ecosystem, evolved from its seasonal water variation, which supports a large number of terrestrial and aquatic species, several of which are rare and endemic. This has been recognised nationally since 1982, when the area was gazetted as a Wildlife Reserve, and internationally since 1995, when its status as a Ramsar site was ratified (Koziell *et al*., 1997).

At odds with its protected status, a large number of people continue to live in the park, divided between around 40 village enclaves. Most are Malayu (Muslim and Christian) in origin and depend primarily on fisheries for their livelihoods. There are also a number of *Iban* and *Kantuk* Dayak groups (Christian and animist) that follow more diverse livelihood strategies, relying on shifting dryland cultivation and the exploitation of forest products to a greater degree (Soemarna and Giesen, 1993). Continued occupancy of the reserve has been accepted by the authorities, due to the age of the settlements. The permanent population is now around 6,000, which swells seasonally by a further 2,000. Over the last 10 years total population has increased by around 40% (Koziell *et al*., 1997).

Between 1992 and 1997 a conservation project of the Indonesia-UK Tropical Forest Management Programme developed management techniques for the reserve, with a focus on promoting local participation and community management. Due to the importance of fisheries to local livelihoods and of fish diversity to the conservation value of the reserve, the project placed considerable emphasis on building upon the extensive experience of communities in managing fisheries within their local areas. The objective of the MRAG-CRIFI-DP team was to investigate these local management practices and the efforts that had been made to integrate them on a wider scale. It was not to look at the wider issue of how DSWR might be operated to serve the objectives that prompted its establishment as a wildlife reserve and Ramsar site.

Fish Ecology

The fish fauna of the Kapuas Lakes is “spectacular and highly diverse - in fact probably one of the richest ichthyofaunal regions in Indonesia” (Jensen *et al.*, undated, p.9). This has been

ascribed to its association with the pleistocine Sunda-plat river system (Vaas, 1952). The final figure from DSWR project reports gave a total of 220 species, representing 64% of the fish fauna in Borneo (Jeans and Aglionby, 1997). Stock composition broadly varies between the swamps/hilly streams, with plenty of vegetation and decomposed matter, and the lake/river areas. Common large species that grow to 3kg or more include toman (*Channa micropeltes*), baung (*Mystus nemurus*), tapah (*Wallago leeri*) and belida (*Notopterus borneensis*) (Dudley, 1996b).

Within living memory the fishery was classified as being underfished - a stock with a preponderance of large predators (*Ophicephalus* spp.*, Notopterus* and *Wallago leeri*), giving rise to long and uneconomical food chains. This was, in part, attributed to dislocation both of the supply of hooks and yarn and of demand during World War II (Vaas, 1952). Studies of size structure of several species in markets in the 1980s indicated "that the fishery as a whole cannot be characterized as overexploited" (Pollnac and Malvestuto, 1992, p.28). However a number of species are now reported by fishers as being increasingly uncommon, presumably as a result of increased fishing pressure. These include: belantau (*Macrochorichthys macrochirus*); the ornamental species, arawana/siluk (*Sclerophages formosus*), ulang uli (*Botia macracanthus*), engkadik (*Botia hymenophsa*) and ringau (*Datnioides microlepsis*); and belida (*Chitala lopis*). It was also considered that possible problems might be indicated by the absense of large individuals of temunit (*Labeo chyrosphekadion*), kelabau (*Osteochilus* spp.), tengadak (*Barbodes schwanenfeldii*) and tengalan (*Puntioplites bulu*) (Dudley, 1996a). Of the large predators noted by Vaas (see above), no *Ophicephalus* spp. were found to be a significant component of catch in the statistics collected by Dudley (1996b).

Knowledge of the life history of most species appears to be limited. It has been asserted that most fish leave the reserve as the floods fall, to avoid the deoxygenated conditions in the much reduced areas of permanent water, and overwinter in the River Kapuas. Though air breathing "black fish", such as toman, are thought to remain (Dudley, 1996a).

Fisheries Management History

The history of fisheries management in the area appears incomplete. Until 1900 "native rulers possessed all fishing rights and enforced strict laws upon the population, thus preventing depletion of resources" (Vaas, 1952, p.206). By the 1980s this system had clearly evolved significantly: management of resources took place at the community level. Each community had "exclusive use rights to operate within a particular area", with the head fishermen, ketua nelayan, in each village taking the major decisions over access conditions. Rules adopted included those promoting the sustainability of the resource and equity in the distribution of its benefits (Bailey and Zerner, 1992, p.42). The DSWR project conducted more detailed investigations within the area of the park, revealing a number of areas of dispute between communities (DSWR project maps), and attempted to formalize the means of co-ordinating fisheries management between groups of adjacent villages (Dudley, 1996a).

Fisheries Economics and Benefit Distribution

The fishery is active through the year, with a peak in the months June-August towards the end of the drawdown. A variety of gears are used, many of which are both highly seasonal and specifically target particular species. In the months from June to September, bubu (cylindrical rattan traps) take 16% of the total annual catch of all gears, nearly half of which is biawan (*Helostoma temminckii*) and patik (*Mystus nemurus*). Small mesh gill nets, medium mesh cast nets, jermal (large funnel-like nets) and pengilar (rectangular rattan traps) all take around 10% of the total catch or more (Dudley, 1996b). In some areas a traditional poison, tuba, is used to harvest residual dry season waterbodies. Most of the catch is directly for sale, though some

is for bait and an increasing proportion is now used as feed for caged toman - this may now amount to 4,000 tons per annum (Aglionby, 1996) or 40% the most recent estimate of total catch from the fishery (Dudley, 199b).

Average annual income from the fishery was calculated as Rp.1,980,000, 74% of the total. This peaked, with catch, in the dry season months of July to September (Aglionby, 1996). Though data on the inter-household distribution of this income was not available, it is presumed to be comparatively equitable. Pollnac and Malvestuto (1992) noted the considerable degree of equity of gear distribution within the fishery and, of the gears noted by Dudley above, only the jermal requires substantial investment. Moreover, the exploitation of fishers by middlemen commented on in the 1950s (Vaas, 1952) appeared to be have eliminated by additional competition by the 1980s (Pollnac and Malvestuto, 1992). Disposing of the high dry season catch has continued to be a problem.

Sekalot Village, Danau Sentarum, Kalbar

1 Village Background

Village strongly dependent on fishing, with 156-167 fishermen.

Village visited as an example of a well-managed fishery, with one known reserve, located in central southern part of Danau Sentarum.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	Sungai Belitung		?, never dries
Exclusively owned lakes	Danau Sekolat Danau Batuk (reserve)		1m, sometimes dries 1.5m, never dries
Shared lakes	Danau Genali Danau Belida Danau Semangit		Usually dry Usually dry Usually dry

2.2 Water flows

Water floods in to the village waterbodies from S. Kapuas during the flood, bringing newly spawned fish caught in jermal traps. Water drains from lakes into S. Belitung, then via S. Tawang back to S. Kapuas.

2.3 Fishing grounds

All water bodies except Danau Batuk (reserve restrictions) in wet season. Fishing mainly in Danau Belitung in dry season; other waterbodies mostly dried up.

2.4 Air bangar fish kills

Sometimes at beginning of rainy season, especially after long dry seasons. Waterbodies affected not known.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Belitung (River)

Fish species	Relative abundance	Average current size	Maximum current size
nuayang,	Highest	10	10cm
bau,	2nd highest	8cm	10cm
ulang uli, *Botia .....*		3cm	5cm
belida, *Notopterus chitala*		3kg	5kg

rik,		8cm	10cm
pati		15cm	20cm
landin		8cm	10cm
umpan, *Osteochilus hasselti*		15cm	20cm

Danau Belida/Genali (non-permanent lakes)

Fish species	Relative abundance	Average current size	Maximum current size
lais, *Cryptopterus* spp	2nd highest	20cm	25cm
pati		20cm	25cm
umpan, *Osteochilus hasselti*	Highest	15cm	20cm
tengelan		25cm	30cm
kelebau		20cm	30cm
kapas	2nd highest	15cm	20cm

Danau Sekolat (semi-permanent lake)

Fish species	Relative abundance	Average current size	Maximum current size
biawan, *Helostoma temmincki*		12cm, 150g	16cm, 200g
toman, *Channa micropeltes*		40cm, 2kg	60cm, 8kg
bau,		8cm, 10g	10cm, 20g
nuayang,		5cm	7cm
rik,		5cm	7cm
pati		20cm	25cm
lais		20cm	25cm
umpan, *Osteochilus hasselti*		15cm	20cm

3.2 Declined / extinct species

Arowana, kerandang, belida, piam (valuable / large / tasty species)

3.3 Spawning grounds

Ulang-uli and belida in main rivers. Biawan and toman in Danau Batuk reserve and other lakes, especially shallow waters; bau, nuayang and rik in the deeper waters of lakes.

3.4 Perceived fish migrations

One respondent did not think that fish moved between the reserve and the exploited area or between the fishing grounds of different villages. A second respondent had no idea. No respondents made any distinction between non-migrant, local, 'blackfish' species and migratory, shared, 'whitefish' species.

3.5 Dry season fish survival locations

Fish mainly survive in S. Belitung and S.Tawang, and especially in D.Batuk reserve, the deepest lake owned by the village. Some fish return to S. Kapuas

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
D. Batuk	No fishing at all in the dry season	village	
D. Batuk	No gill nets in the wet season (since 1997)	village	
D. Batuk	No catching small fish (below consumption size)	village	
	No gill nets <2"	DP	
Rivers	No nets set across channel, or at overspills to lakes	village	Maintain fish migrations
Rivers	No barrier traps (empang) along river banks (especially at entrances to lakes) when water rising	village	Maintain fish migrations
Indonesia	No fishing at all for arowana (must return any captures), since 1996	PHPA	Species conservation
Rivers	No fishing by outsiders in the dry season (anybody can fish anywhere in the wet season)	village	
	Tabung cylinder traps to be set >5m from river bank	village	
	Lift nets to be placed >15m apart	village	
S. Belitung	Lift nets to be placed downstream of village	village	
	Lift net users must pay Rp2,000 per year to community development fund		
S. Belitung	Jermal drift traps to be placed upstream of village (two jermals in river within village used to raise funds for community development)	village	
S. Belitung	Not more than 32 jermal drift traps. Access to jermal fishing locations allocated by lottery, every 15 days (more fishermen would like to use jermals, but insufficient locations for all). Most upstream jermal position winner must pay Rp15,000 per 15 days, next downstream must pay Rp7,500, 3rd-6th pay Rp5,000, all others pay Rp1,500 to community development fund.	village	
Indonesia	No poisons	DP	
Indonesia	No electric fishing	DP	

Penalty regulations

Regulation	Authority	Objective
For 1st infringement, pay fine of value of fishing gear; for 2nd infringement, pay twice value of gear; for 3rd infringement, banished from village	village	

Purpose of Danau Batuk reserve to give security for future fishing, like 'money in the bank'. Fishermen have never yet fished in D. Batuk, but could do in future years if fishing declines too much in other

waterbodies. One respondent said this village and others with similar management had better fishing because of the reserve. Another respondent said fishing was no better there than elsewhere.

4.2 Relationships between rule-making bodies

Not known.

4.3 Monitoring of regulations

Fishermen monitor each other, and report rule-breakers to ketua nelayan (head fisherman). No-one from outside the village (ie KSDA or DP) comes to monitor regulations. Traders refuse to buy arowana, now trade illegal.

4.4 Enforcement

Enforcement is by ketua nelayan in the first instance, or referred to kepala desa (village leaders) if disputed. If fisherman claims ignorance of regulation, only given warning. If regulation known, receive punishment (fine). Previous head fisherman fined six people in eight years, current head fisherman fined two in the last six months (ie regulations are enforced). No fisherman ever yet banished from village for repeated rule-breaking (ie regulation enforcement is effective).

Monthly meetings held to discuss problems, develop new rules as necessary, and to publicly chastise rule-breakers.

4.5 History of arrangements

Regulations established since before living memory

5 Fishing activities

5.1 Relative catch values from different waterbodies

One respondent said total catch in S. Belitung twice that of D. Sekolat.

Other respondents ranked catches from waterbodies as: S. Belitung 1st, D. Genali / Belida 2nd, D. Sekolat 3rd, D. Genting / Semangit 4th.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

Danau Belida (also representative of other lakes)

Gear Type	Wet season (musim hujan) Includes rising water 8 Months: October-May	Dry season (musin kemarau) Starts from falling water 4 Months: June-Sept
Total	17	30
Jala	4 lais, mentokan Used by outsiders	11 lais, pati, bau
Pancing	5 gabus, belida	0
Jermal	8 ulang uli, bau Used by outsiders	0
Bubu	0	19 gabus, biawan, pati

Individual fishermen use all gears, no group fishermen.
Jermal and bubu fishermen may be assisted by family members.

Sungai Belitung

	Musim hujan	Musim kemarau
Total	33	17
Jala	10 ulang uli, bau Used by outsiders	6 bau kecil
Bubu	4 bau	4 gabus, biawan
Jermal	15 ulang uli, bau	2 barang, hulus
Jaring	4 bau	5 barang teugah

Jala fished usually by two people.
Jermals sometimes fished by groups, and catch split 2 to owner, 1 to other fishermen

6 Key features

- **!** Sekalot village 'owns' permanent waterbodies.
- **!** Management regulations protect both dry season fish survival and accessibility of migrant fish.

Sambar Village, Danau Sentarum, Kalbar

1 Village Background

This temporary fishing village comprises mainly houseboats and pondok fishing shacks. No adat leaders here live in the settlement. Presently 47 households, mostly fishing.

The village was randomly selected as a village without known reserves, but close to Sekolat village (with reserve) in the central part of Danau Sentarum lakes.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Batang Katam (downstream of S. Belitung)		3m maximum
Exclusively owned lakes	None		
Shared lakes	D. Genali		All dries out

2.2 Water flows

Central lake area, floods from Kapuas via S. Belitung and S. Tawang

2.3 Fishing grounds

Lake in wet season, and river all seasons. Danau Genali shared with several other villages including Sekolat village to south, and others to north.

2.4 Air bangar fish kills

No knowledge.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Batang Katam (River)

Fish species	Relative abundance	Average current size	Maximum current size
Patik		200g	500g
Lais		100g	300g
Ulang Uli	High water only	3cm	
Toman		500g	7kg
Kerandang		300g	500g
Biawan		100g	400g

Bauk	Low water only	15g	15g
Rik	Low water only	15g	15g
Nuayang		5g	5g

Danau Genali (non-permanent lake)

Fish species	Relative abundance	Average current size	Maximum current size
Tengalan		1.5kg	4kg
Kelabau		1.5kg	3kg
Belida		2kg	5kg
Baung		2kg	4kg
Tebirin		2.5kg	6kg
Bangah		3kg	5kg
Belis		5g	5g
Biawan	All same, except Biawan slightly less	100g	400g
Umpan		100g	100g

3.2 Declined / extinct species

Ketutung: ornamental species, overexploited.
Bubuk, kurau, paku: not especially large or expensive species, so maybe declined for reasons other than overexploitation.

3.3 Spawning grounds

No spawning grounds in Danau Genali, as virtually all becomes dry (except small channels). Ulang uli, toman and biawan thought to spawn in river, and betutu also.

3.4 Perceived fish migrations

Believe that fish migrate downstream from village in dry season, via S. Batung Katam to deeper S. Tawang.

3.5 Dry season fish survival locations

No fish survive in lakes, because virtually all dried up. Some fish survive in deeper pools of S. Batang Katam. They try to fish out in the dry season, but cannot because of large number of snags.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
Batang Katam / Tawang	Fishermen allowed to use bubu sebar (trap with small barrier) in this river, and must pay Rp2,500 for each bubu. Available positions decided by lottery twice each year.	Village (musa-warah)	Allocate positions and avoid gear conflicts.
Village	Outsider fishermen allowed to fish in this village, but must have permission from ketua nelayan (chief fisherman), specifying location and gear.	Village	Limit overexploitation by outsiders.
Village	Cast nets fishing prohibited at night during dry season.	Village	Avoid fish theft and disturbance of other set gears (gill net & bubu).
Village	Night-time capture of betutu with spears and lights prohibited.	Village	Avoid fish theft from other gears
Village	Outsider fishermen prohibited from using small-meshed jermal (drift traps).	Village	Keep jermal-caught fish for village members.
Village	Capture of toman less than 3cm prohibited.	Village	?
Indonesia	Use of poisons, electricity prohibited.	Govt.	Prevent bycatch losses of small, unsold fish
Indonesia	Capture and trade of siluk (arowana) prohibited.	Govt.	Prevent further decline of siluk stocks.

Penalty regulations

Regulation	Authority
Fine for catching small toman: Rp150,000	Village (ketua nelayan)
Fine for all other regulations: Rp75,000	Village (ketua nelayan)

4.2 Relationships between rule-making bodies

Not known.

4.3 Monitoring of regulations

Self-monitoring of fishermen within community, and by chief fisherman (ketua nelayan) especially, while working his own gear. Not visited by other authorities. Monitoring thought to be effective because fishermen aware of village-made regulations.

4.4 Enforcement

By ketua nelayan only (no ketua adat in this village). Unresolved problems taken to kepala desa in home villages, Desa Dalam, Desa Gudang Hulu and Desa Gudang Hilir in Kecematan (subdistrict) Selimbau.

Outsiders warned only on first infringements. Insiders get no warning: punished on first infringement.

Since 1995, have had four infringements and warnings of outsiders, but no fines for second offences. Warned outsiders from adjacent Sekolat village.

4.5 History of arrangements

No change of regulations since Sambar first settled (before memory), but if new regulations required, they could make by musyawarah (village meeting) process, led by ketua nelayan.

No change due to ODA project, which just documented and published/disseminated all regulations. No new regulations or increased incomes due to ODA project, but less conflicts due to wider knowledge of regulations and village boundaries. Another interviewee said there are now no gear conflicts but there are still boundary conflicts.

5 Fishing activities

5.1 Relative catch values from different waterbodies

There are water bodies, namely D. Genali, D. Belidak, D. Secawan, D. Sampar (inside) and the outsides are D. Japnila and D. Genting. Rivers are S. Tawang and S. Batang Ketam. First respondent could not rank. Second respondent ranked: Tawang (1), Batang Ketam (2), D. Genali (3) and D. Secawan (4).

During dry season, those lakes do not dry-out; however, D. Japnila is considered a reserve and nobody fishes there. Dry season specify at the falling water (Jun-Sep). Wet season is the rest of the year.

Fish catch rates high - currently 50-100kg/day in high water season, using 25 x 150m gill nets by one fisherman, and reportedly even higher in dry season.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

River Batang Ketam and Tawang (First Respondent)

Gear Type	Wet season (musim hujan) Includes rising water 8 Months: October-May	Dry season (musin kemarau) Starts from falling water 4 Months: June-Sept
Total	14	34
Pukat (Gill nets)	8, lais, patik, kapas, tengalan	17 betutu, patik, tengalan, biawan *
Bubu	0	7 patik, betutu
Jala	4 bauk kecil and bilis	6 Tengalan, lais, patik and biawan
Utas/Rawai	2 baung and belida	4 belida, baung and betutu

* outsider. The outsider is also operating ‘tabung’ for ‘ulang-uli’.

They operate their fishing gear individually, however, bubu and jermal some time require more than 1 person.

River Batang Ketam and Tawang (Second Respondent)

Gear Type	Wet season (musim hujan) Includes rising water78 Months: Nov-May	Dry season (musin kemarau) Starts from falling water Months: June-Oct
Total	16	35
Pukat (Gill nets)	7, lais, ikan umpan (bait)	11 tengalan, lais, patik kalabau and baung

Bubu	0	13 patik and lais
Jala	3 bilis	5 patik, lais, biawan and betutu *
Utas/Rawai		3 baung and belida
Jermal	6 bilis, ulang-uli	

In the dry season, jala catches a half value of bubu. Ratio of dry and wet seasons is 3 to 1 for all gears.

Group: in the dry season, jermal, bubu and jala are sometimes operated by more than 1 person.

Everybody uses all gears depending on how rich they are.

Meliau Village, Danau Sentarum, Kalbar

1 Village Background

Village in most remote part of Danau Sentarum, in traditional Dayak village. 28 families living in village, most of them in traditional long house. Fishing secondary priority of Dayak (around 25% of time, but producing 40% of income). Agricultural production main objective, mostly padi for own consumption, not for trading. Can produce enough for whole year, usually plus 30% extra as reserve supplies.

Village visited as an example of Dayak resource management, involving some use of reserves.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths (m)
Rivers	S. Lebuyan Channels linking lakes and rivers		4 - 8
Exclusively owned lakes	D. Balaiaram (reserve) D. Lukuk D. Merebung/Kemati D. Tujuh (7 lakes) Several smaller lebung		1 - 3 1.5 - 5 4 - 5 3 - 4
Shared lakes	None		

2.2 Water flows

Water comes from both local rainfall and flows back up the river from S.Kapuas when rainfall is very high.

2.3 Fishing grounds

Fishing in the three large lakes and S.Lebuyan. Fishing with some gears in the reserve. But not very much fishing is done in the D.Tujuh because of spirits, crocodiles and distance.

2.4 Air bangar fish kills

There can be fish kills at the beginning of the rainy season (not specific).

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Labuyan (River)

Fish species	Relative abundance	Average current size	Maximum current size
Lais		2 kg	10 kg
Baung borai	R2	2 kg	15 kg
Baung biasa		0.5 kg	3 kg
Belida	R1	1 kg	9 kg

Tapah	R2	3 - 5 kg/ 30 kg	45 - 50 kg
Kalabau	R1	0.7 kg	2 kg
Small fish	30 - 40 %	10 g	10 g

Danau (permanent lakes)

Fish species	Relative abundance	Average current size	Maximum current size
Toman	R1/2	3 kg	15 kg
Tapah		3 - 5 kg	45 kg
Piam	R2/1	0.5 kg	1 - 6 kg
Kerandang		300 g	500 g
Biawan	R1/2	100 - 300 g	300 - 500 g
Kalabau		1 kg	2 kg
Small fish	40%	10 g	10 g

3.2 Declined / extinct species
Belantau, ketutung (ornamental fish). Arowana/siluk still available here.

3.3 Spawning grounds
Some in the river some in the lakes.

3.4 Perceived fish migrations
Toman fry go downstream to Danau Luar. River spawn fry migrate into lakes. Fish do move from Kapuas & Tawang to this area (1 respondent)

3.5 Dry season fish survival locations
Fish survive in on local lakes & river. (Ie. Unlike others, this village has small but deep waterbodies). Most fish survive in reserve (of all lakes). Even fished lakes are never totally fished out - too deep and too many snags. Fish survive in Danau Tujuh because of remoteness, crocodiles & spirits.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
D. Belairam, D. Lukuk	Can only fish with hooks, bubu & jala (N.B contradictions in data - some said only hooks)	trad	equity in the society
All lakes	Cannot use gill nets	trad	disturb other fishing gears by frightening the fish away

River	Can only use gill nets for 1-3 weeks after harvesting rice (in water falling season),	trad	“ ”
Everywhere	Fishermen from outside can come for up to two days at a time using hooks, cant use gillnets.	trad	“ ”
Everywhere	No poison, electricity, tuba	govt	
Everywhere	Cannot catch/ trade siluk. (since 1996)	govt	protect arawana
	Can’t sell toman outside village or catch for sale (consumption or culture only)	trad	prevent decline in toman wild stocks
	Toman cage culture - no more than 500 fish per farmer (30% of villagers are toman farmers)	trad	prevent overfishing of toman fish fry & bait
River	Cannot use jermal	trad	catch too many fish & too small

Penalty regulations

Regulation	Authority	Objective
If use prohibited gear - fined. If no fish 20,000 - 30,000 Rp. If fish, maximum 500,000	trad	

4.2 Relationships between rule-making bodies
Don’t know

4.3 Monitoring of regulations
Monitor each other. Report to ketua nelayan who makes decision.

4.4 Enforcement
Warning given first time for outsiders (By Ketua Nelayan) - all other times direct fines. Fines have not been given frequently - only one time in the last five years.

4.5 History of arrangements
Arrangement been there past living memory and haven’t changed since then.

5 Fishing activities

5.1 Relative catch values from different waterbodies

Resp. 1: Balaiarum 10, Lukuk 5, Merebung 2, River 1, D. Tujuh 5, small lebung 1
Resp. 2: River most important
Resp. 3: Lakes overall most important (ie. Of all lakes combined)

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

Danau Belaiarum (similar in other lakes), first respondent

Gear Type	Wet season (musim hujan) includes rising and falling water, but don’t fish in high water	Dry season (musin kemarau) 4-5 months duration
Total	30	19

bubu	16, piam, tapa, biawan (important for value), lais, riu most in numbers	9: biawan, piam, gabus, kerandang (only for home consumption)
pancing	10: toman, tapa, kerandang, Baung	7: toman, tapa, kerandang, Baung
jala	4: riu, bantak (baitfish)	3: riu, bantak (baitfish)

No outsiders allowed to fish anywhere in Danau Belaiarum.
Families usually fish together.
In high water season, catch clarias (catfish) in rice fields.

Danau Belaiarum, second respondent

Gear Type	Wet season (musim hujan) includes rising water (Nov/Dec)	Dry season (musin kemarau) 4-5 months duration
Total	36	13
bubu	26	
rawai	4	7
pancing	4	6

Wet season catches mainly taken in 2 weeks of ngatan (setting) / ngabas (harvesting) of bubu, at time of migration and spawning (fishermen observe eggs falling from traps, and spent fish).
Outsiders cannot fish in lake.

Danau Kemati / Merebung

	Air Naik(rising water) November/Dec	Air turun (falling water) Feb-August
Total	29	19
bubu	10: piam, tapa, biawan	3: biawan, buruntok
pancing	4: toman, tapa, patik	7: toman, tapa
rawai	4: belida, toman, patik	4: belida, patik
tembilar (all types)	11: tapa, biawan, piam, toman	5: biawan, toman, tapa

No outsiders allowed; no conflicts observed.

Sungai Lebuya (main river)

	Wet season includes rising water	Air turun May-September includes falling water
Total	19	31
tembilar	13: belida, tapa, biawan	17: belida, tapa, tembalan, kelabau, kebali
pancing	3: toman, tapa, belida	7: belida, tapa, baung, toman
rawai	3: toman, tapa, belida	7: belida, tapa, baung, toman

Most fishermen have all three gears. Pancing and rawai used if bait available. Most fishermen have 10-15 tembilar traps, and 2-300 pancing/rawai hooks. Tembilar best fished by two people, other gears fished alone.

Pulau Majang Village, Danau Sentarum, Kalbar

1 Social Background

173 households in village, of which 155 are fishing households, mostly Melayu. Rest are farmers, teachers, administrators etc. Village boundary includes 22 Dayak families, who live in Empaik kampung (sub-village), in high ground, forest areas to west of area.

Village selected for study as a comparison for well-managed villages. Reported to be area with most depleted fish stocks.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Seriang		3-4m average, 8-11m lubuk pools
Exclusively owned lakes	Several, various areas		Mostly dry out
Shared lakes	D. Majang / Sempidan (P. Majang island in middle)		3-4m

S. Seriang, and channel from this, through D. Majang to S. Tawang/Kapuas never dry out completely. Sometimes get 0.5m deep low water sections in D. Majang dry season channel, separating deep lubuks. Access to village can be difficult in the dry season.

2.2 Water flows

Early flood rains give water from local areas via S. Seriang. Later get water from S. Kapuas also.

2.3 Fishing grounds

Extensive area of waterbodies, with fishing in large D. Majang, inflowing S. Seriang and other smaller, non-permanent waterbodies to NE of region.

2.4 Air bangar fish kills

Usually happens in falling water seasons, in variable locations. Causes fish kills in cage culture systems, but not usually in wild stocks.

3 Fish

3.1 Main fish species caught, by waterbody type

Danau Majang (permanent lake, but fish usually killed off by poison fishing), S. Seriang same

Fish species	Relative abundance	Average current size	Maximum current size
Lais		100g	300-400g
Umpan		33-50g	100-200g

Baung patik	Most common	33-50g	200-250g
Biawan		33-50g	300-400g

3.2 Declined / extinct species

Siluk, belantau, piam, suain, ketutung, kapas all now extinct in this region, since ~1980s.

Large fish species: baung, toman, tapa, kelabau, belida, betutu all now uncommon in this region.

Melayu fishermen respondents believed low numbers of fish due to use of poisons in this area by Dayak and others, and to increasing numbers of incoming Melayu fishermen.

3.3 Spawning grounds

No knowledge.

3.4 Perceived fish migrations

Believed main fish recruitment (arrival of young fish) comes from S. Kapuas, since most of fish in this area die off in dry season due to use of poisons.

3.5 Dry season fish survival locations

Most surviving fish return to Kapuas. Fish staying mostly killed off by poisons. A few fish only thought to survive in the deepest (11m) lubuks in S. Seriang. Head fishermen suggested annual fish stocking and/or strict enforcement of poison regulations necessary to rebuild fish stocks. Dominant Melayu villagers had tried to stop Dayak poisoning, but unable to, even after much conflict. Dayak claim traditional fishing method, only used once per year in dry season (Melayu dominate at all other times), and Melayu scared to dispute, due to ferocious reputation of Dayak.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
anywhere	New entrants to fishery (outsiders) not allowed in dry season. Outsiders traditionally fishing there (usually kin) can	trad	don't know rules, do wrong thing
anywhere	Nobody allowed to use jermal (this village). General regulation for many villages agreed 1994? - no jermal <2"	trad & KSDA inspired	catch too many fish & not everybody able to have one
anywhere	Gill nets can not be set in small channels where there are bubu / bubu & barrier	trad	gill nets stop fish getting to bubu
anywhere	no poison, no electricity	govt	
anywhere	no catching arawana	govt	
anywhere	Cant use gear "pengilar"	trad	too effective
outside main river channel	Can't use gill net in the dry season		

Penalty regulations

Regulation	Authority
Using jermal - after warning fine 300,000 - 400,000 Rp	trad
Using other restricted gears - after 2 warnings - fine ~ 60,000Rp “pati nyawa”	trad

Allocation regulations

Regulation	Authority	Objective
lottery for bubu & barrier. Twice per year (1 per season) More places than gear so lottery for best spaces	trad	equity

4.2 Relationships between rule-making bodies

Rules made by local people according to need and local custom. Will be open to suggestions from outside agencies e.g KSDA / Danau Sentarum project. Disputes generally settled at village level. If necessary (ie dispute between villages) attempts can be made to resolve at kabupaten level. This is by means of “musyawarah” (formal discussions between aggrieved parties) attended by them, the bupati (head of Kabupaten), Dinas Perikanan, Police. This in fact has only happened once. (see enforcement below)

4.3 Monitoring of regulations

Villagers monitor each other. Opinion is that it is very effective. There are not places where people can fish unseen (particularly since the advent of the motorized boat which makes movement easy) and gears are too big not to be noticed. Ie most rules are easy to monitor. Also there is a recognised system for reporting infractions

4.4 Enforcement

- If gear found without owner, gear confiscated and given to head fishermen. He informs fishermen and neighbouring villages that he has the gear. If they want it back - have to own up.
- If gear found with owner. Take names & inform them of rules & ask them to move. If don’t inform Ketua nelayan who informs the offenders Ketua nelayan and the warning/fine is processed through that channel.
- Last year 3/4 infractions from inside , ~ 10 outside. None required fines
  This year - 2 people fined last month for operating jermal. No other fines this year.
- 1 case ever taken to Kabupaten level - regarding the poison used by upstream villagers which are affecting downstream fish. At the meeting, offenders were informed there would be no more warnings and would be imprisoned if it wasn’t stopped. However, upstream peoples do not recognise the rules of those downstream & these rules are not enforceable. (1. Difficult to find actual evidence of poison, 2. difficult to get witnesses to come forward.)

3.5 *Conflicts*

Major conflict between downstream villages (this village and neighbouring village) and the upstream villages regarding their use of poisons (see section on enforcement also). Have always used poison, but now they are using chemical rather than natural poisons which the downstream villages have no defence against. (Previously they used salt to mitigate the effects). The problem of chemical poison has existed since 1990 - but has been getting progressively worse. Last year they estimated that poison had flowed down 15 times (probably from 15 separate villages) in the dry season. At present the problem is unresolvable.

4.5 History of arrangements

The traditional arrangements have been in place for a long time. Rules are added to if it seems appropriate within the village. This is decided by the ketua nelayan and fishermen.

5 Fishing activities

5.1 Relative catch values from different waterbodies

The first respondent, a fisherman called Paris, divided the area used by the village into four fishing grounds. The NW quadrant, containing S. Manyatai, S.Sejakor, S. Tangit and two unnamed danau was thought to be the most valuable to the village. The area S of S. Sriyang and to the E of the Desa, containing one unnamed danau was second. The area to the W of the village was third. Lastly, the S.Sebadin and another unnamed danau was fourth.

In the wet season (December to April) the entire area was covered by water. The dry season started from the drawdown in May and included the rising flood. During the dry season only the S.Sriyand and S. Manyatai still contained water.

The second respondent, an illiterate fishermen accompanied by Kepala Desa, divided the area used by the village into 17 small rivers and 10 lakes.

During wet season (Nov-Apr), all the specified water bodies become a single water body, however, during dry season (May-Oct, peak at August), the water body exists only S. Tawang, S. Seriang, S. Menyatai, S. Tangit and Sungai Senunuk. The permanent lakes are Kerianan (D.) Sejakar, D. Benah and kerinan in the upper stream of S. Tangit.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

First Respondent
NW quadrant area (ranked 1)

Gear Type	Wet season (musim hujan) 5 Months: Dec-Apr	Dry season (musin kemarau) Starts from falling water ends after rising water 7 Months: May-Nov
Total	27	19
Pukat (gill nets)	22 lais, mixed (barang)	7 patik, biawan and barang
Jala (cast nets)	- bait fish only	6 patik, biawan, barang
Bubu (traps)	-	6 patik, kerendang, biawan
Pancing/rawai (hooks and lines)	5 tapah, tebirin and gabus Some outside fishers	-

Catching during wet season is reasonably continuous, however, catch in the dry season particularly on bubu is highly concentrated in the period at the beginning of the drawdown. There are 75 fishermen in the villages operating bubu, 10 traps/fishermen, and they have spaces to operate these during this period. The best space, however, are determined by a lottery. The winner of this get first choice of fishing spot on the NW. After the high initial bubu catches catch rates in the dry season decline significantly.

Most fishermen have all three types fishing gear and will use them in rotation. Some, however, do not have jala (cast nets) or bubu trap as their home-made and they may not have the necessary skill.

Second respondent (experienced since 1965)

	Musim hujan (Wet: Nop-Apr)	Musim kemarau (Dry: May-Aug)
Total	19	27
Pukat (gill net)	16, patik and lais	

Jala (Cast nets)		25, patik, biawan and gabus
Pancing/Rawai (Hook and lines)	3, gabus and tapah	
Bubu trap		2, patik, biawan and gabus

Kepala Desa said that Up stream people may not do 'tuba' if the Malay people do not cultured 'toman-fish'. This is because toman needs a lot of life small fish for feeding.

A third respondent fisherman reported that Melayu usually only fish in high and falling water season until Dayak arrive to poison fish, usually in July/August, the early dry season. Iban then take large catches, sometimes too much to eat or sell all, and leave fish rotten at site. In worst years with long dry seasons, Melayu may have virtually no fish for 6 months of the dry season, but usually less than this.

6 Key features

- **!** Local stocks mostly killed off in dry season, by use of poisons. Malayu villagers unable to prevent use of poison by Dayak residents, but ensure access of fish from outside (S. Kapuas) by regulations preventing use of jermal barriers.

Seliban Village, Danau Sentarum, Kalbar

1 Village Background

Seliban is a relatively small and temporary fishing village located on the Tawang River, close to the main Kapuas River, in the south-west corner of Danau Sentarum. The former fishing group leader gave the number of KK as 60 (200 people). The fishing community stayed in Nanga Tengkidap during the dry season.

The village was visited to investigate its reported use of reserves in its nearby waterbody Danau Seliban. Due to the lack of respondents available, only one interview was conducted for each discipline.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Tawang S. Tengkidap several small tributaries and channels		12m 2m in lubuks some 0.5m, some dry
Exclusively owned lakes	D. Seliban Small lakes		5m in lebungs mostly dry out

2.2 Water flows

Water in this area mainly derives from the seasonal floods of the very nearby S. Kapuas. In the high water season, all the waterbodies become connected by channels of various width. In the dry season, the main lake D. Seliban becomes disconnected from the river channels, and is only accessible by a 20-60 minute walk. Water flows permanently in the deep S. Tawang, the main river linking the Danau Sentarum lakes to the Kapuas River.

2.3 Fishing grounds

All waterbodies are fished during the flood season. In the dry season, fishing is only available in the deep Tawang River, the small lubuk pools in S. Tengkidap, and the deeper lebung pools in D. Seliban. Certain types of fishing are restricted in D. Seliban in the dry season.

2.4 Air bangar fish kills

Air bangar is common, usually during the falling water season. Only cage-culture fish and wild caught fish in storage are affected, especially tapa, baung, patik, kedebu and jelawat. Toman and belida are more resistant to air bangar.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Tawang/Tengkidap (Rivers)

Fish species	Relative abundance	Average current size	Maximum current size

Same species as danau, plus...			
Belida		2.5kg	7-8kg
Baung		0.5kg	2-3kg

Danau Seliban (permanent lake)

Fish species	Relative abundance	Average current size	Maximum current size
Lais		100g	1kg
Biawan, *H. temmincki*	Most common	100g	200g
Baung patik		100g	300g
Toman, *C. micropeltes*		400g	4-5kg
Rantuk	2nd most common	2-300g	500g
Delak		2-300g	500g
Bauk		10-20g	10-20g
Ikan ritak (mixed small fish)	Main high water catch	10-20g	10-20g

3.2 Declined / extinct species

Extinct species: ketutung (ornamental), kapas, belantau
Much declined species: kerandang, piam

3.3 Spawning grounds

Belida (*N. chitala*) believed to spawn in main River Tawang, and baung, lais and patik in smaller secondary rivers. Biawan, toman, rantuk, delak and bauk thought to spawn in Danau Seliban at start of wet season.

3.4 Perceived fish migrations

Fish perceived to return to deep River Tawang during dry season, and into Danau Seliban. Fish clearly could migrate to nearby River Kapuas, but fisherman did not know about this.

3.5 Dry season fish survival locations

Fish mainly thought to survive in S. Tawang and in local lebung and lubuks. Survival in D. Seliban lebung lakes guaranteed by village regulations preventing use of gill nets and ngesar fish drives (only jala and bubu pengilar permitted). Gill nets *are* used in the riverine lubuks in the dry season, which are much more fished out. No perceived problems with fish survival or overall abundance levels: catches thought to be good, and local rules effective.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Interview with two temporary fishermen. Interviewees did not have knowledge of many of the regulations, only a temporary gill net fishers who also worked as loggers.

Fishing regulations

Location	Regulation	Authority	Objective
D.Penyepang, D.Sepapan, D.Bursmpai	No gill nets in dry season	trad	too easy to catch fish
anywhere	No gill nets<1.5" in the dry season	trad	" " "
anywhere	No poison, no electricity *(see conflicts)	govt	
D.Penyepang, D.Sepapan, D.Bursmpai	No jermal allowed in dry season	trad	
all Danau	Can't use mesh size < 1"		
anywhere	Can fish for arawana but not for the broodstock	govt	

Penalty regulations

Regulation	Authority	Objective
Unknown, but see enforcement below		

Allocation of fishing spots

The former fishing group leader indicated that there was a lottery for fishing spots on S.Seliban for bubu for the rising flood. The lottery allocated spaces among all members of the fishing community wishing to participate. In the event that the number of traps would exceed the spaces available, fishermen were required to reduce the number that they used. Any remaining traps could be used on any of the other, less valuable, sungai. (Mark/Sonny)

4.2 Relationships between rule-making bodies

Unknown

4.3 Monitoring of regulations

People monitor each other and are aware of what is being done in the area. However, not everyone is aware of the regulations and due to lack of enforcement (see below) it seems that people sometimes don't bother to report. There is no government or other type of monitoring. This fisherman hadn't seen any official from any organisation in their area in the lat 5 years. Monitoring therefore is somewhat perceived to be in effective. (only one interview)

4.4 Enforcement

Enforcement is perceived to be poor. This is reported to be due to an ineffective Ketua nelayan who is also not always present in the area. Respondent kept repeating "Members of the society here are difficult to manage". In general he believed people are never fined when they break the law. If a report is made to the ketua nelayan, the accused just denies it. This fishermen reports to see fishermen coming with a speedboat every night and fishing in their area with electricity. He has told the ketua nelayan but nothing happens (boat thought to be owned by rich people in Suhaid). The gill net ban was enforced by the kepala desa two years ago (bypassing ketua nelayan) and he believed that's why this rule is respected.

There are no ketua adat in this area either.

4.5 History of arrangements

Not known.

5 Fishing activities

5.1 Relative catch values from different waterbodies

Not collected due to the time taken to locate the respondent and the fact that D. Seliban was the reserve area and so the automatic first choice.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

Danau Seliban (reserve area)

Gear Type	Wet season (musim hujan) Includes rising water 5 Months: January-May	Dry season (musim kemarau) Starts from falling water 7 Months: June-December
Total	14	34
Pukat (gill net)	7 lais, patik, barang	5 biawan, patik
Jala (cast nets)	- + umpan toman (UT)[1]	16 biawan, toman + UT
Bubu (traps)	-	6 biawan, toman, patik
Jermal (funnel trap)	4 ulang uli + UT	5 lais, bauk (s)
Rawai/Pancing (hooks & lines)	3 tapah, toman, baung, belida	2 tapah, toman, baung, belida

The dominant season was the dry season, when those from outside the community were not allowed to fish anywhere in the area of the community.

Allocation of spaces for traps during the falling flood is described above. Their catch, though a relatively minor proportion of the dry season total, was concentrated in a very short period - 3 to 4 days, as the water rose. If rising water was accompanied by rainfall catches were usually large (30-40 kg/bubu/day) and they were harvested daily. If it was not raining, harvest would not take place for 3 days. Managing such catches was not thought to be a problem, as they could be dried or salted, as required by market demand. Salting was the more problematic of the two operations.

The respondent believed that harvests had declined in the area due to the numbers of fishers now competing.

Annex D: Investigations in Jambi Province

Jambi Background

General Background

Jambi Province has an area of around 53,000 sq km and is located in the longitude range of 101o10' to 104o55'E, and in the latitude range of 0o40'to 2o45'S. The province consists of 5 districts (kabupaten) and 1 municipal area (kotamadya): Kerinci, Sarolangun Bangko (Sarko), Tanjung Gabung, Batang Hari and Bungo Tebo Districts, and Jambi Municipal. In 1996 the total population was around 2.25 million (Dinas Perikanan Jambi, 1997).

The Province of Jambi has a vast open water area, consisting of rivers, lakes and flood plains. The area covered by this water bodies is estimated to be 92,487 ha (Dinas Perikanan Jambi, 1997). The Batang Hari River, 1740 km long, is the main river flowing from Southwest to Northeast. In the upper part of the river a number of tributaries feed the river, including Batang Tebo, Batang Tabir and Batang Tembesi. The number of lakes in the province is reported to be 46, Lake Kerinci is the largest, having an area of 4,000 ha in the dry season and about 8,000 ha during the rainy season (Dinas Perikanan Jambi, 1997).

Open waters in Jambi are very important for the development of the economy of the province, since the fisheries potential of the waters is quiet big, and at least 50,000 people depend their life on it. The open waters produce consumable fishes and ornamental fishes as well.

Fish Community and Fisheries potential

Open waters in Jambi have a wide range of fish species diversity. It is recorded that the water bodies contained more than 106 fish species belonging to 24 families and 14 orders. Fish communities in the waters was dominated by Family Cyprinidae, followed by Family Bagridae. Other families found were Siluridae, Ariidae, Cobitidae, Clariidae, Pangasidae, Luciocephalidae, Anabantidae, Gobioidae, Channidae, Soleidae, Flutidae, Hemirhamphidae, Mastacembellidae, Nandidae, Kurtidae, Notopteridae, Osteoglossidae, Polynemidae, Poecillidae, Trygonidae and Tetrodontidae.

The potential fish production of lakes and rivers in the province were estimated to be 120 kg/ha/yr, with its maximum sustainable yield (MSY) of 5,100 tonnes per year. However, in 1997 open waters in Jambi Province produced 5,606t of fish for consumption as well as around 540,000 ornamental fish (Dinas Perikanan Jambi, 1997).

Species distributions of catch vary between Kabupaten. In the western and more upland Kabupaten Kerinci the catch is dominated by barau, medik, kulari, gurame, lampam and lele. In four more downstream Kabupaten the most common species are belida, betutu, udang galah, lampam, gabus, lais, toman, sepat siam and tembakang. Statistics for the period from 1989 to 1997 from Dinas Perikanan indicate a significant variation in catch from year to year in all Kabupaten. Kabupaten Kerinci varies the least, with a maximum of 506 tonnes in 1997 and a minimum of 262 tonnes in 1993. The more lowland Kabupaten vary significantly more. Highs were experienced at one or two year intervals, in 1989, 1992, 1995 and 1997. Catches in intervening years were routinely 15% or less than the subsequent highs. While the reliability of such statistics is unknown, they show no indication of a decline in the overall catch, with all Kabupaten attaining their highest or near highest catch in 1997. Kabupaten Batanghari had the highest catch, at just over 2,000 t, followed by Kotamadya Jambi, at 1,925 t.

Fishery Management Strategy and History

Government initiatives
Dinas Perikanan Jambi have undertaken a number of measures to support the sustainability of the fishery. Open waters have been restocked with Nile tilapia (*Oreochromis niloticus*), common carp (*Cyprinus carpio*), kelemak (*Tor douronensis*) and lampam (*Puntius* sp). In 1995 and again in 1996, 30,000 fingerlings were released into lakes, rivers and floodplains. Establishment of fishery reserves has been done since 1993. Danau Arang-Arang and Danau Teluk Kenali were established in 1993. In 1994 Lubuk Sahab was declared as a fish reserve area, and Lubuk Taman Ciri Fishery Reserve was established in 1996. Another fishery reserve area, Lubuk Teluk Kenali, was established in 1997. Lubuk Ngaol was proposed in 1992, though it has not yet been approved. All these reserves, except Danau Teluk Kenali fish reserve area, were established after being proposed by respective villagers (after musyawarah desa). Management criteria, such as core and buffer zones, have been proposed by LIPI. It is not clear how scientifically they have been applied.

To control fish captures in open waters, the Local Government issued several regulations; among others are:

- Perda (Regional regulation) No. 6 / 1971 prohibits fishing using gill net having a mesh size less than 1 inch.
- Perda No. 4/1974 prohibits fishing using gears or methods (including poisons) which may destroy fishery resources.

Local traditions
From case studies at individual villages it is believed that local management of fisheries has existed from before the Dutch period. A lelang system for leasing individual waterbodies by local communities operated in conjunction with a number of locally determined rules. Detailed information on the evolution of such management or current extent was not however available.

Fishery Economics and Benefit Distribution

In 1996 there were nearly 11,000 fisherman households in Jambi. Since the fish catch of 1996 was 5,641t, the average catch for inland fisherman in Jambi, therefor, would be 515 kg/household. Detailed background information on the operation of the fishery was not available. Dinas Perikanan data suggest that the catch is taken exclusively with artisanal gears.

Dano Lamo Village, Kabupaten Batanghari, Jambi Province

1 Village Background

Dano Lamo village has an area of 9500ha and lies to the north of Jambi town and the Batanghari river, and downstream of the previously studied Jambi Kecil village. Dano Lamo village had a population of 791 people in 1996/97, in 178 households, all of them Muslim. Fishing is a major employer in the village and provides the main source of income: 95 of 152 households were classified as farmers/fishermen, and 95% of all people reported to engage in some fishing activities, at least for subsistence.

The village was reportedly well known for its good catches in past years, but fish stocks have declined in recent times. The village was selected for investigation as Dinas Perikanan have recently (Oct. '97?) decided with the village committee to designate a major part of the dry season waterbodies as a permanent reserve. The legislation for the new reserve is presently being reviewed prior to implementation. Fishermen agreed to the new reserve, but are presently concerned at the potential loss in catches when the reserve is implemented, given the uncertainty of long term benefits.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Berembang 7 tributaries	Main river length 11.5-17km, total desa area 9500ha	3-6m in reserve area lubuks 3-7m in lubuks outside reserve, but narrower 1m minimum in main river, but many snags prevent fishing
Exclusively owned lakes	None		
Shared lakes	None		

The reserve area includes four of the largest *lubuk* river pools, spread over a 2km stretch of river downstream from the village bridge.

2.2 Water flows

The S. Berembang lies in a broad meander of the Batanghari River, being permanently connected to the main river at its downstream (eastern end), and temporarily connected via shallow floodplain lands at its upstream (western end). Water flows into the S. Berembang from the main river from both ends during the flood season, then drains during the dry season through its deeper channels to the east.

2.3 Fishing grounds

All waters in the village are fished. The main S. Berembang channel has traditionally been openly available to all village members, including the deepest lubuks now selected as the reserve area. The seven main tributaries within the desa are leased for fishing at an annual auction currently for Rp0.27-2m each, and several smaller tributaries are available for free fishing.

2.4 Air bangar fish kills

Not known in this area.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Berembang (River), including surrounding floodplains

Fish species	Relative abundance	Average current size	Maximum current size
toman	Not investigated	1.5-3kg	7-9kg
tembakan		100g	170g
beterung		100g	170g
haruan (gabus)		330-500g	2kg
bujuk		330-500g	2kg
kapras		35g	50g
baung gantang		500g	2-3kg
lais		35-100g	50-170g
betok		35g	50g
sepat siam		35g	50g
buruk tulang		2.5kg	6kg
timah timah		1kg	2kg
sengarat		500g	6kg
ringo		10-20g	70g
lambak		10-20g	70g

3.2 Declined / extinct species

Locally extinct: serandang, kelaso (arowana), betutu, kaloi (gorami), ridikangus (ornamental).
Locally depleted / rare: tapa (2-20kg, but now v. uncommon), kaloi (2.5-5kg).

3.3 Spawning grounds

Not clearly known by respondents. Snakehead species observed protecting broods in nests in swamp areas.

3.4 Perceived fish migrations

Certain fish species thought to migrate in to the village area from the main S. Batanghari then to return with the drawdown: first respondent suggested these included baung, toman, tembakan, ikan panjan (tilan), bau tulang and patin; second respondent named only three different species: buruk tulan, timah timah and sengarat. Majority of other fish species thought to be more local, going upstream with flood for feeding etc, but not migrating downstream to the Batanghari during the dry season.

3.5 Dry season fish survival locations

Majority of fish thought to survive in four large lubuks now proposed for reserve area. Many fish also thought to survive in lubuks in other parts of villages rivers. Difficult to fully exploit all fish in the dry season even without reserves due to the large number of snags in the rivers.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations
Information came from the kepala desa, his secretary, the ketua adat, and two fishermen.

Location	Regulation	Authority	Objective
reserve (core zone)	No fishing allowed by anybody at any time (since 1997)	musyawarah desa	conserve area for spawning, increase fish availability outside the reserve area in the wet season
selected small canals	Yearly closed auction. Opening bidding price decided by LMD (council of village representatives) one month before auction based on earnings from previous year (word of mouth). No of people bidding for 12 sites (8 streams, 4 lebak) varies from 40-60. (The higher the water in January, the more people bid). Only villagers from inside the village can join auction. Auction unit prices recently Rp0.27-2m.	musyawarah desa	equity, avoid conflict. Money for community development fund
anywhere	outsiders not allowed to fish unless given permission by kepala desa - usually only relatives of villagers who ask	trad	keep resources for villagers
anywhere	no poison, tuba,"putas" - pesticide, electricity	govt	
anywhere	can't catch small kissing gourami (tembakan)	trad	allow to reach more marketable sizes
anywhere	can't catch spawning toman, bujuk or ruan	trad	conservation of brood stock
Sungai Berembang	No permanent barriers allowed in either Desa D. Lamo or in the downstream Desa Dusun Mudo	inter-village agreement	maintain accessibility of fish to fishing grounds of all villages

Additional information on auctions - Sometimes a group of fishermen will buy a unit together (up to 5 fishermen). Sometimes one will buy and will get other fishermen to work with/for him. Common ratio owner : rest of fishermen = 1:1. Period auctioned April - April. Most intensive fishing April - October. About 25% fishermen never involved in auctioned areas - either because they prefer to fish for free or don't have the money to rent.

Penalty regulations

Regulation	Authority	Objective
core zone rule infraction - village representatives (LMD)plan to have musyawarah desa to authorize specific sanctions. Not happened as yet	musyawa-rah desa	
general rule infraction - social sanction is high "Much shame - people will remember for 10 years". Fine can be issued, dependent on size of infraction but has never happened	trad	

Additional activities - Have a "Hari Berkarang" further down stream from the core zone when there is a particularly dry season. The condition of the river is monitored by the fishermen who then tell the Ketua adat when time is right and Ketua adat decides a day. Fishing allowed immediately preceding and after the two days. One day drive the fish into the lebungs. Second day communal fishing. Objective to raise community income. All participants give community 500-2000 Rp. Average profit per fishermen (before this) 6000Rp.

Ngesar fish drives used occasionally by groups of 6-7 fishermen in the dry season (last time in 1996),

but strongly frowned upon by other village members who do not receive any share of the catches.

4.2 Monitoring of regulations

Self monitoring in auctioned canals. Reserve area close to centre of village and easily monitorable.

4.3 Enforcement

Have been very few cases where people are given warnings. Nobody ever been fined. Impression that this is due to lack of infractions rather than bad enforcement. Social sanctioning, shared values seems an effective deterrent in such a close knit community. Impression of strong leadership and strong organisation

4.4 History of arrangements

Auction system been around for a very long time. Reserve only started on recommendation of Dinas Perikanan, last year. The LMD (village representatives ~30 people) had a meeting where they agreed the proposal for reserve. Villagers members were informed of decision. There was apparently little disagreement because there are “plenty of other places to fish”. Some fishermen interviewed also gave this impression, though some others were more concerned that the best fishing grounds were being restricted. Reasons it was perceived as good included: (1) place for fish to spawn, (2) in wet season, more fish will spread out from the core zone.

4.5 Conflicts known about

Only two mentioned:
1988 - conflict between lift net fishermen over fishing spot. Kepala desa solved with a warning.
1972 - Poison caused large fish kill - possibly from village upstream. No-one caught.

5 Fishing activities and benefit distribution

Two interviews were conducted to assess the socio-economic features of the fishery and the impact of the reserve. Both were with two fishermen and started with drawing a map of the fisheries resources important to the village. In both cases the interview started with an assessment of the different waterbodies important to the village, drawn by the respondents on a map, and an attempt to assess their relative significance. Both maps showed the same principal features : a main river, the Sungai Dano Lamo, on which the village was located, and a series of minor tributaries/channels that drained the surrounding floodplain that consisted of a patchwork of **sawah** and swamp forest. S. Dano Lamo was perennial, the tributaries were all seasonal, drying up usually in August or September.

In terms of the fishery, the tributaries seemed to the more significant, particularly since a large section of the main river had been established as a reserve in the previous year (a fact not explicitly recognised by the first pair of respondents). The tributaries were all auctioned off as part of a **lelang** system. The highest bidder obtained the right to manage the tributary for the year at all times when it was distinct from the surrounding floodplain, this was defined as the point when water levels dropped sufficiently for the banks of the tributary to be visible. When water levels were above this the fishery was considered to be **bebas**, or open access. The auction was arranged by the **kepala desa** each April, with all the funds collected going towards village development.

There were around 9 distinct **lelang** areas, which varied in value. Last year these ranged from Rp0.27 to Rp2 million. The winners were always small groups of 2 to 4 individuals, who tended to contribute equally to the cost. They then decided on the management strategy followed. Details were obtained from respondents on the management of different waterbodies in 1991and 1997. In both cases the main gears operated by the **lelang** winners were **tangkul** (lift-net), **lukah** (cylindrical rattan traps) and **tembilar** (rectangular wire traps) in conjunction with a bamboo **empang** (barrier) that was erected at the mouth of the channel.

Gear name	Gear type	Size (m)	Life (yrs)	No. of KK owning	No. Used per group	Cost (Rp.)
Tangkul	Lift net		5	+/- 30	1	200000
Lukah	Rattan trap		1	+/- 50	5-6	<15,000
Tembilar	Wire trap		1	60-70 kk	10-15	4000
Empang	Rattan barrier	5 x 2	?	-	1	20000

For the larger group (4 individuals), these were supplemented by **jaring** (gill net) and **tajur** (hook and line). The smaller group (2) gave individuals access to their **lelang** area, for variable periods subject to negotiation. These operated **tembilar**, **lukah**, and **pancing** (hooks), and worked on a 50% catch share basis. **Tangkul**, the only gear operated exclusively by the **lelang** winners, was considered to take around half the catch.

Catch rates varied significantly through the year. These were highest during the falling flood and generated returns of up to Rp.20,000/day to the **lelang** leaseholders in the period between May and July. Returns during the wet season were hard to estimate, but catch rates varied between 0 to 5 kg.

It proved impossible to get an estimate of the relative catch of individual fishers and the **lelang** winners. But it was clear that within a **desa** of 178 households, in which 90% were estimated as deriving most of their cash income was from fishing, that the distribution of fishing opportunities was not even. The **lelang** system gives priority access to between 20-30 households. The gears taking the biggest catches, the **tangkul,** were owned by only 30 households (though many of these must have been used in the non-leased fishing areas). The only gear owned by all households were hooks.

The reserve restrictions had only recently been introduced. The subject proved a difficult one to pursue. Two fishermen, who were not current **lelang** holders, did respond. They were not yet convinced that it would be of clear benefit to them and felt that older members of the community unable to travel far would be affected most. The species composition of catch in the river and the **lelang** areas suggested a significant overlap, with only **patin** clearly staying in the river itself.

Observations (socio-economics)

- Difficulty of obtaining even approximate information on fish catches in a system characterised by high variability.
- Impact of reserve will depend on relative significance of longitudinal and lateral movement/migration of stock components: if it is longitudinal, the village may loose out; if it is primarily lateral, there will be a redistribution within the community between poorer fishers reliant on the river and **lelang** owners. In the longer term the increased value of **lelang** control should increase the revenues collected by the village.

Teluk Kenali Village, Kotamadya Jambi, Jambi Province

1 Village Background

Desa Teluk Kenali lies within the municipality (*kotamadya*) of Jambi town, along the south bank of the main Batanghari River. The desa area includes a waterbody, Danau Teluk Kenali, which Dinas Perikanan adopted 5 years ago as a harvest reserve. Fishing is still allowed in the 'reserve' waterbody, but certain practices are now more strongly restricted by a guard employed by Dinas Perikanan in the desa.

The village has 219 households, of which around 100 mainly fish for income and 69 were farmers/fishers. 50 households were 'salaried', 30 of them government officers. All households were Muslim.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Beluran (in/outlet) S. Kenali (inlet) S. Sapelang (to rawa) S. Kaligaire (creek to river)		4-8m 1m avg., 3-5m lubuk dry dry
Exclusively owned lakes	Danau Teluk Kenali		1-2m
Shared lakes	None		

Danau Teluk Kenali, the main fishing ground of the village, has recently become infested by a virtually complete covering of duckweed (species?). This is thought to be due to the long dry season being experienced at present and the resulting increase in nutrient levels. Eutrophication caused by sewage/fertiliser pollution is not thought to be the main cause. The vegetation mat strongly restricts fishing opportunities, but is not thought to have significantly reduced fish stocks. Cage-cultured tilapia, however, now take 4 months to reach marketable size compared to only 2.5 months before the invasion (possibly due to the reduction in natural planktonic food sources).

2.2 Water flows

Water flows into Danau Teluk Kenali all year round through the small S. Kenali tributary. Significant inputs of water are also received from the main Batanghari River during the flood season, via the small but short channel S. Kaligaire (within the desa) and also via the longer S. Belurum. The latter river passes through the large D. Sipin and several other desa in-between D. Teluk Kenali and the Batanghari. Water flows in this river are said to be reduced nowadays by siltation around the piles of a drinking water pipe built across the river, close to its confluence with the main Batanghari.

2.3 Fishing grounds

Danau Teluk Kenali is the main fishing ground for the village, with additional fishing in both the inlet and exit rivers, and also in the main Batanghari river.

2.4 Air bangar fish kills

Not known in this area.

3 Fish

3.1 Main fish species caught, by waterbody type

Danau Teluk Kenali (permanent lake), and including other village waters

Fish species	Relative abundance	Average current size	Maximum current size
lambak	Most common	25-30g	50-70g
baung		0.25-1kg	1.5-2.5kg
kalamak		1-2kg	2.5-3kg
toman		2-2.5kg	4-6kg
tembakan / biawan		125-330g	500-750g
lais		30g	50g
haruan / gabus		170g	1.5kg
ringo		50g	500g

3.2 Declined / extinct species

Ornamental ridikangus fish now almost extinct, and thought to be overexploited due to high value. Serandang now much depleted, but cause unknown. Lelangi (botia) stocks still strong. All species much declined in average size nowadays compared to previous years, indicating high exploitation.

3.3 Spawning grounds

Not well understood, but thought to be on vegetation in rawang areas around island and other shorelines, now preserved under new reserve regulations. Spawning season known to be start of flood.

3.4 Perceived fish migrations

The main fish species are thought to stay in the permanent lake Teluk Kenali. A smaller number of species such as belida and sengaran (?) are believed to migrate in from the Batanghari River with the flood, and to return to the main river with the drawdown. Fishermen in the adjacent, downstream Desa Buluran Kenali use many barrier traps which may prevent fish reaching D. Teluk Kenali, but this is not perceived to be a problem due to the effectiveness of the lake as a local source of fish recruitment. The cool waters of Danau Teluk Kenali are also believed to attract local fish to remain there over the dry season, rather than returning to the Batanghari via the warmer river channels, thus limiting the effectiveness of the once-used barrier traps at the exit from the lake.

3.5 Dry season fish survival locations

Fish survive the dry season in the shallow (1-2m deep) but broad D. Teluk Kenali, and also in the narrow but deep (4-6m) lubuks in the inlet and outlet rivers. Fishermen do try to catch fish during the dry season, but are unable to fish out the lake (even by poison) due to its large size, or the river *lubuks* due to bans on *ngesar* fish drives, *paril* seine nets and poison etc. The village waterbody guard (previously the *ketua nelayan*, now employed by Dinas Perikanan) indicated that the S. Kenali *lubuks* were previously fished by poison, but that this practice has now stopped due to his presence and authority. Other interviewees strongly disputed this position (see later).

4 Institutional Arrangements and Objectives

Information was collected in two interviews. One with member of Lembaga adat (customary institution) and a civil servant with family planning extension services, the other with two fishermen. In general their information was similar. One exception was rule infractions (see enforcement section)

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
anywhere	No Paril . Rule has been around for a long time but only really enforced since 1982/1983	trad	too efficient
anywhere	No "Ngebur" - (fish drive with large lift net)	trad	avoid conflict, equity, disturbs other gears, not everybody can do cos expensive
anywhere	no poison, electricity, putas	govt	
anywhere in village	No fishing by outsiders without permission (two adjacent villages had good relationships with Teluk Kenali and often requested access).	trad	
Soar Pelang & others (4 marshy areas cultivated in dry season	No fishing once connected channel to D. Kenali dried up - even if there are still plenty of fish in the area. Becomes the property of the rice farmers who own the land		
S. Kenali lubuks	No poison or barrier or ngebur fishing	New (1993)	
spawning grounds (around island etc)	no fishing during start of flood season	New (1993)	protect breeding stocks

Observe that regulations defined in the legislation for the new 'reserve' were really only known by the DP-employed 'guard'. Other fishermen were completely unaware of their existence.

According to local BPP extension worker, a closed season would be impossible to enforce because fishermen use lake and have done so for a long time.

Penalty regulations

Regulation	Authority	Objective
"Ngebur" - Warning, then fine 5000rp for second infraction	trad	

No other specific penalties known

4.2 Monitoring of regulations

In the daytime, fishermen monitor each other - relatively easy & inexpensive form of monitoring. In the nighttime, use the general security system set up in this village & all others in Indonesia ("*Siskamling*"). Village households split into groups (in this case 4) and households rotate guard duty on a nightly basis (5 members form each group of households). Again no special monitoring systems required to be set up - relatively inexpensive.

The member of lembaga adat thought the *siskamling* guard system was quite effective - with most people turning up for duty at some point. (Small fine for not doing so). He also thought the monitoring of the lake area was effective. Particularly for the gear regulations - but they weren't able to monitor poisonings.

4.3 Enforcement

Differing opinions on breaking of "Ngebur Regulations":

1) Warnings given every year to people breaking "Ngebur" regulations. "2-3 groups per year. No fines ever given. Fines weren't needed because no group did it more than once, and they only did it out of necessity to get food for family.
2) However, the fishermen said that it was the same groups who did it every year, that they were relatives of the kepala desa, that they used intimidation and that they have not been warned since 1985 ! Before this time the *camat* (head of Kecamatan) warned these groups

Unable to enforce poison rule breaking - probably from upstream villages (see conflicts below).

4.4 History of arrangements

Rules appear to have been present for a long time but been more enforced in the last 15 years

4.5 Conflicts/Problems known about

Poisoning or "*putas*" from upstream villages: one interview said it happens every year, usually in September/October & up to 10 times per year. One group said two years ago, meeting was held between villages in all the kecamatan to try to solve problem (led by camat), but has made no difference. Other respondent said local police have been informed but there has been no follow up.

5 Fishing activities and benefit distribution

one empang fished before reserve established at exit from lake, but never very profitable location due to permanence of lake, and not leased under auction.

5.1 Scope of Interviews

Two interviews were conducted to assess the socio-economic characteristics of the fishery; each involved two respondents. Both interviews started with a map of the main fishing grounds used by fishers from the village. Despite the proximity of the village to the large S. Batang Hari, the only fishing area of significance was the Danau Teluk Kenali. Due to the invasion of the lake by aquatic weeds in the last year, much of the usual fishing activity had been suspended. Accordingly, the information gathered was generalized from their experience of fishing this lake in previous years.

5.2 Principal gears/activities

A gear-season matrix was generated in each interview. Due to differences in the definition of the seasons chosen by the fishers, the results of the two interviews are not directly comparable. In each case, three gears were identified as economically significant: the **tangkul** (a large (7m x 7m) lift-net mounted on a bamboo pivot) and **jaring** (monofilament gill net) were used in both wet and dry seasons. The **rumpon** is a permanent brush pile, fished out using a small meshed gill net at two week intervals during the dry season. **Serampang**, a 2m long multi-pointed spear, were also said to be widely used/owned. These were employed at night and used in conjunction with a torch.

Relative distribution of catch values (%) - Interview 1

Gear	Gear type	Dry Season Sep-Nov	Wet season Dec-July
Tangkul	Lift-net	8	43
Jaring	Gill-net	8	17
Rumpon	Brush pile	24	-

Relative distribution of catch values (%) - Interview 2

Gear	Gear type	Dry Season May-Nov	Wet season Dec-April
Tangkul	Lift-net	20	21
Jaring	Gill-net	7	14
Rumpon	Brush pile	40	-

The respondents were thus agreed that the **rumpon** was the single most valuable gear, followed by the **tangkul** with the **jaring** coming last. **Serampang** were said to used for catching fish for household consumption only (perhaps because of the damage inflicted on the fish during capture).

The unit value of catch did not seem to vary significantly between seasons. Though there was a greater intensity of catch in the dry season, the larger sizes of individuals and the presence of **baung** in the catch of both **rumpon** and **jaring** in this season compensated for the seasonal tendency towards lower prices. The fact that the village is so close to Jambi town means that all the catch can be sold wet and at a relatively high price may also contribute to this.

Cage culture had also had a recent, and brief, role in the fishing activities of the village. Introduced in 1995, cages had spread rapidly before their use had become uneconomic due to the rise in the price of feed. It was stated that the use of **rumpon** caused problems by stirring up sediment and reducing water quality. It had been suggested that this practice was stopped.

5.3 Distribution of benefits

There were some significant differences in the estimates of the number of gears used by the community. At one interview the respondents suggested that around 30 kk owned **tangkul,** the other thought the figure was 52. Estimates for **jaring** varied even more widely (one interview said that all households owned, the other said only 20kk owned). **Rumpon** were used by nearly all fishing households.

No particular access restrictions were reported for any gear, with **rumpon** owners using the same spots for season after season. The better spots were said to be around the edge of the lake. **Tangkul** ownership may have been limited by their costs, estimates for which varied between Rp. 400-500,000. **Jaring** cost Rp.75-100,000 for 40m x 2m. Estimates of **rumpon** costs for the net also varied significantly, though this may have reflected differences in the length of net used. The wood used for the brush-pile was collected within a day from the forest; no particular type of wood was preferred.

Fishing households tended to consume around 1kg of fish per day during the dry season and half that in the wet season.

Observations
a rather messy village with both aquatic and socio-economic features that would make it hard to compare to others.

Arang Arang Village, Kabupaten Batanghari, Jambi Province

1 Village Background

The village has 173 households, with 985 people. All are Melayu in origin and Muslim. Fishing was the primary source of cash income for 75% of households, though most of these also farmed as well. The remaining households were full time farmers, traders and government employees (including teachers). Despite the large number of fishing households there was no established Kelompok Nelayan.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Kumpeh (shared) S. Danau (river to lake) S. Bakung (trib.) S. Parit (trib.) S. Gelam (main trib.)	4km in desa	>10m 1-1.5 (no lubuks) Dry 1-2m (in lubuks) 0.5-2m (in lubuks)
Exclusively owned lakes	D. Arang Arang 5 lebung lakes	30ha High W. 10ha Low W.	1-1.5m (no lubuks)
Shared lakes	None		

Most of the channels were seasonal, drying out in August-September apart from the lubuks. S. Danau, the channel linking D. Arang-Arang and the S.Kumpeh, was perennial. The lake is difficult to access even by small boat in the dry season though, due the large number of snags in S. Danau; the lake can be reached over land though. D. Arang Arang (the reserve lake) is surrounded by large areas of rawang on all sides.

2.2 Water flows

Water flows into D. Arang Arang from the S. Kumpeh during the flood, and from the three smaller tributaries also. Water drains back from the lake to the river. No water flows in dry season.

2.3 Fishing grounds

Fishing is mainly undertaken in the three tributaries flowing in to D. Arang Arang. (which are leased at auction), in the lake channel S. Danau, and the surrounding rawang areas. Not much fishing in the deeper S. Kumpeh. The lake is fished as a Hari Berkarang during the dry season, and after that is available for fishing on payment of Rp10,000 per boat (or Rp40,000 per boat for outsiders) up until March when the water starts falling. The shallowest tributary Sungai Bakung not auctioned any more because catch usually lower than price!

2.4 Air bangar fish kills

Do have air bangar, but does not affect blackfish in lake, only whitefish in sungai.

3 Fish

3.1 Main fish species caught, by waterbody type

Danau Arang Arang (permanent lake, including tributaries)

Fish species	Relative abundance	Average current size	Maximum current size
tembakan	Most abundant	50-90g	100g
sepat siam	abundant	35-70g	35-70g
haruan	abundant	350g	500g-1kg
bujuk		350g	500g-1kg
lambak		20-70g	20-70g
lais		50-70g	100g-2kg
lele		350g	500g
baung		500g	1.5kg
toman	Most abundant	1kg	6kg
tapah		1kg	20kg

3.2 Declined / extinct species

Ridikangus & jale (snakehead spp) now extinct. Sebarau, chandana (arowana) and belida very rare. Cause of decline not known. Size of fish also declined. Believed declines maybe linked to increasing fishing activity of fishermen in other villages downstream and in own village, so less fish migrate up to village, and don't have time to grow to good size.

3.3 Spawning grounds

Both in rawang areas and in lubuks in lake tributaries at start of rainy season. Spawning thought by one respondent to be prevented nowadays by palm oil plantation development and destruction of local rawang forests and draining of swamps especially in vicinity of S. Gelam (other respondent not so concerned, except that some fish may now escape via the new drainage canals).

3.4 Perceived fish migrations

Distinguish between whitefish (actually use name ikan putih) from river (eg some lais species) and blackfish in lake (eg sepat siam, other lais species).

3.5 Dry season fish survival locations

Fish mainly thought to survive in lubuks of the tributaries, in the deeper parts of D. Arang Arang, and many to escape back to S. Kumpeh. Try to catch all fish in dry season, but cannot (reason uncertain). Fish thought to survive due to guarding by lake gods.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Information provided by respondents including *pemuka adat* and two fishermen.

Fishing regulations

Location	Regulation	Authority	Objective
S. Kumpeh S. Danau	Permanent empang barrier not allowed across full width of river (only allowed across river in leased tributaries, or along banks in other rivers).	M. desa	Maintain for fish migration
D. A. Arang	Cast net only allowed during Hari Berkarang		
D. A. Arang	Not allowed fishing with rumpon (FAD)		
	No fishing with big size of lift net (10 x 10 m)	M. Desa	Prevent excess capture of fish by individuals
	No fishing allowed by anybody at dry season with any gears until the “Hari Berkarang” were determined.	M. Desa	To allow fish to grow bigger
	No fishing with gill-net at any size	M. desa	Too effective
S. A. Arang	Must have 50 m space between lift nets	M. desa	To give space for fishing
Anywhere	Not allowed fishing with “serkap” (unknown geartype)	M. desa	Prevent fish disturbance
National	No poison, tuba, putas, pesticide, electricity	Govt	
	Can’t catch small size of toman and serandang (snake head)	M. desa	To allow fish to grow
Selected small canals	Yearly closed auction, opening bidding price decided by LMD one week before auction based on previous year’s price. Number of people bidding varies from 15 - 20. Only fishers from inside the village can join auction. Example for previous year prices between Rp.400.000 and 2 million. Period of fishing in these areas from March to December.	M. desa	Avoid conflicts; raise money for community development fund, equity
Anywhere	Outsiders not allowed to fish unless given permission by Kepala Desa - usually only Desa Sipin, Desa Pemetung, Desa Sei. Terap, permitted, not for other villages except on “Hari Berkarang” but must be pay for licence	M. desa	To preserve resources for their community

Additional information on auction

Usually a group of fishermen will buy a unit together (up to 5 fishermen). They have only for unit of auction object namely part of Kumpeh main stream border to desa Sipin, S. Gelam, S. Parit, S. Buluran Cino. Auctioning held in the desa office led by Kepala Desa (LMD) and the Camat as a witness. One fishermen in last year bought S. Parit together with 5 brothers got Rp.800.000 net profit for all fishing time along the year. None some one were fixed at the same place for many years. The ones our respondent never bought waterbody are sold in this village. It is because he have no money and his think that many places available his can go fishing. Waterbodies were got by the fishermen never use to be sub leasing.

Penalty regulations

Regulation	Authority
For D. Arang Arang rule infractions, have musyawarah desa to authorize specific sanctions. Standard sanctions for: Rumpon (FAD) - fined Rp250.000 Cast net , gill net, serkap - fined Rp50.000	Ketua Danau*

Electricity, poison, tuba, pesticide: For the first time, warning from Ketua Danau/Kepala Desa For second time, reported to the Police (never yet happened)	Police

* Ketua Danau are chosen each year by LMD through 'musyawarah', selecting for honesty, bravery and consequence. There are presently two Ketua Danau; Ketua I and Ketua II, they receive salary of 20% of the danau income per year. For example in 1997, they received 20% of Rp 3m Danau income and the rest of 80% money went to the desa for community development (1996 ; Rp. 2 million; 1995 about only 1,2 million).

Additional activities

Have a "*hari berkarang*" in Danau Arang-Arang in the dry season. The first time of hari berkarang is determined by the Kepala Desa through "musyawarah" with LMD one week before. Usually in August when the water mostly dry every where. Licence fee of Rp5.000 payable for access on that day for village members, while outsiders pay Rp. 40.000/person. Licences expire at the end of year (December). For the first two days almost 100 people are actively fishing and usually during 2 month were finish, but at the third they only about 30 people were fishing. (CLARIFY THIS LAST SENTENCE)

4.2 Relationships between rule-making bodies

Each regulation usually made through the Musyawarah led by Kepala Desa within LMD institution - 30 people member of Pemuka Adat, informal leader and the other key person within the desa. WHAT RELATIONSHIP WITH DP, NOW THEY HAVE ADOPTED D. ARANG ARANG AS A DP RESERVE?

4.3 Monitoring of regulations

Self monitoring in auctioned tributaries (does this mean no monitoring? no specific regulations for lease units anyway). For the other regulations in either D. Arang-Arang or other non-leased places, monitoring is by every member of the community. Especially for D. Arang-Arang, someone reports to the Ketua Danau based on the Pemuka Adat and two fishermen monitor the effectiveness of the regulations.

4.4 Enforcement

Even though much fishing in downstream area and concern about competition over migratory whitefish, no conflicts yet between adjacent fishing villages on S. Kumpeh. Also never had any infractions in the auction waterbodies - social sanction due to "shame" if caught.

For fishers breaking rules within D. Arang-Arang, Ketua Danau holds "musyawarah - LMD" to make appropriate sanction based on fine guidelines. First warning usually strong enough to prevent reoccurrence. For example warnings were given every year to people breaking cast net, gill net, serkap regulation. In 1997, Rp20,000 fines were given to 2-3 fishers breaking the rumpon regulation within D. Arang-Arang.

Enforcement is less strong for outsiders breaking the electric fishing rules in S. Kumpeh upstream of the village. Though problem reported to the local police, no follow up resulted.

4.5 History of arrangements

Rules appear to have been present for a long time but been more enforced every year in the last 30 years.

The lebaks on either end of the S.Kumpeh had only been incorporated into the lelang system in 1977. These were introduced to avoid the conflicts that were developing due to increased pressure on resources. They were auctioned in June when the likelihood of dry season fishing was easier to assess. They were not auctioned every year. The other lelang areas were considerably older (origins unknown).

4.6 Conflicts/problem know about

One interviewee said that his community have a big problem with the development of a new estate on oil palm in upstream of the D. Arang-Arang secondary communal forest, thought to be a spawning areas of fish species. Respondent said that the community have lost their right to their resources due to the

significant decline in local fish populations.

4.7 Additional Information on lelang system

Lelang auctions conducted using a sealed bid system against a reserve price. Whether the reserve price is known to those making bids is not clear. It was reported though that the lelangs were never left unleased. Bids can only come from residents of the village. Sometimes this is done individually, sometimes by groups. Village residents sometimes allowed outsiders to join them in a joint bid.

A quick survey of available village records gave some indication of the relative significance of different lelang areas. Tabulated below are the actual prices for the main lelang areas of 1994 and reserve prices for two years later. It was noted that the reserve prices are substantially lower, despite being later.

Lelang Name	Reserve Price 1996 (Rp.)	Actual Price 1994 (Rp.)
S.Gelam	600000	1555000
S.Parit	750000	2225000
S.Buluran (=Bakung?)	150000	315000
Lebak Ptg.Kayu	75000	135000
Lebak Besar	75000	110000
Lebak Panjang	25000	
Lebak Lumpur (??)	100000	100000
Lebak Getal	50000	75000
Lebak D?? Sipi	15000	
Lebak Par??	20000	

5 Fishing activities

Two interviews were conducted. The first with the Desa Secretary and the LKMD (village level representative of BAPPEDA), both of whom were also fishermen (11 and 14 years experience respectively). The second was with two fishermen (each of 16 years experience). Both pairs gave considered and detailed responses to the questions asked. The LKMD was also able to provide access to desa records of the lelang (reserve prices, auction prices in recent years and the identities of those bidding and winning the auction for different lelang). Each interview started with the drawing of a map of local waterbodies. The first map was considerably more detailed than the second and showed the main waterbodies and the lelang areas.

5.1 Relative catch values from different waterbodies

The waterbody contributing the most important proportion of catch was D. Arang-Arang. The two lelang channels, S. Parit and S. Gelam, were the next most important. S. Danau, the channel connecting D. Arang-Arang and S. Kumpeh, was the fourth most important. The remaining lelang channels were ranked in line with their auction prices. The lebak and lebung areas then followed.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

The second interview provided detailed information on the seasonality of gear use. This indicated that nearly all gears could be used throughout the year. Exceptions to this were the tangkul, which could not be used during the start of the drawdown, due to water speed. The jaring was banned during the

period June to August, as were pancing. Jala was only usable during the dry season, when the water was shallow enough.

Danau Arang-Arang (from first interview)

Gear Type	Musim Kering (Dry Season) May-Nov	Musim Basah (Wet Season) Dec-Apr
Total	19	6
Tangkul (lift-net)	5 baung, lais, toman	1 patin, lais, baung
Tembilar (rectangular trap)	4 tembakan, sepat, lembat	2 tembakan, lembat
Bubu (cylindrical trap)	2 baung, lais	-
Jaring/pukat (gill net)	3 toman, robus, tembakan	2 lambak, ringo
Jala (cast nets)	4 all spp.	-
Pancing (hook & line)	1 gabus, lembat, baung	1 lembat, gabus

A separate respondent gave the main gears as tembilar, lukah (bubu) and pukat, with other common gears including tajur, pancing, tangkul, rawai. In rising water season, fishermen also use tabung trap for bajubang (ulang uli). Pukat minimum mesh size 1.5".

In the dry season, a considerable proportion of the catch was taken in the hari berkarang. This communal fishing operation occurs in mid-August over a 3 day period. Only two gears are used, tangkul and jala. The hari berkarang accounts for most of the dry season tangkul catch (ratio given for HB to non-HB was 5:2) and all the catch of the jala, which is only used at this time. The HB is divided into two stages: an ceremonial/festive day with perhaps up to 300 participants, to which outside dignitaries such as the Bupati, his staff and the staff of Dinas Perikanan are invited; and two days of fishing involving the professional fishermen from the desa and a much smaller number of outsiders, who pay an access fee of Rp.15,000/boat (2 fishers). Catch rates for the outside participants, who all used jala, on the ceremonial day were estimated at 15-20 kg/ fisher (Rp.40-50,000). Professional fishers, using both tangkul and jala, took catch valued at around Rp.300,000 each over the whole period.

In the second interview the operation of the lelang on the channels leading into D. Arang-Arang was discussed. One of the respondents had, in 1993, held the lease for S.Gelam, the second most important of these channels; both indicated that they also had more current information.

Most channels were thought to be operated in a similar way. Following the auction in March-April the lelang winner assumes complete control over the fishery. A pukat is placed across the mouth of the channel in August and then progressively moved up-stream until the fish become concentrated in a limited area of shallow water. The fish are then captured using two different types of scoop net, called sangi. The first is a 1.5" meshed net mounted on an oval wire frame attached to a wooden handle, which is operated by a single individual. The second is a 2.5m x 1.5m rectangle attached to two ropes, which is operated by a team of two. This is repeated within the month. The catch is mixed, with tembakan, toman, serandang and gabus providing the more highly valued species. A team of 4 people could expect to take a catch valued at between Rp1.5-3m. (Values were based on previous years. The recent escalation of prices - a kg of toman rose from Rp2,000 to Rp6,000 in the last year - makes this data of limited value as a basis for comparison with monitoring data.)

Jambi Kecil Village, Kabupaten Batanghari, Jambi Province

1 Village Background

The village is a mixed community of Melayu (70%) and the descendants of Javanese (30%) who settled there in the distant past. There are 546 kk (2512 people), divided into six Dusun and beneath that 12 R.T. of 40-60 kk. The area of the village was 5,627 ha. The primary source of income for most households is agriculture, with rubber tapping the most important, followed by livestock rearing and rice cultivation. 175 kk own the 215 ha of sawah (50 ha double cropped), a similar number also had upland rice fields. In a good year the rice consumption needs of the village are met; if there are problems (drought, pests etc.) production may only be enough for 7 months.

There were no full time fishermen, but 70% of population fishes, either for consumption or sale. Around 10% of households (50 kk) relied on fishing for half their income or more. Of these, only around 15 households own their own empang barrier traps. Generally, the catch was said to be high enough to survive on in previous years, but fishing is very poor now due to the drought conditions.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Berembang (largest river, 4-5km within the desa, with reserved lubuks) S. Melintang S. Saku S. Kiero S. Balayar S. Jambi Kecil S. Jerni	6x50m 25x100m	Lubuk Simpang, u/s, 4m Lubuk Panjang, u/s, 2-3m Lubuk Tampang, mid, 4-5m Lubuk Bungur, d/s, 3-4m 0-1m (may dry out) 1m 1m (2-3m in 1 lubuk) 0.5m (1.5m in lubuk) Dries out
Exclusively owned lakes	None		
Shared lakes	None		

Adjacent villages along S. Berembang are Desa Tanjung Katung then Desa Dano Lamo (downstream) and Desa Sekernan (upstream).

2.2 Water flows

Water flows along the S. Berembang in both directions through the village, depending on the relative water levels in the S. Batanghari. Dry season mainly from April to October, with peak drought in June to August.

2.3 Fishing grounds

Fishing mainly in S. Berembang, but also in all the other rivers. No leasing system, so all rivers are open access to village members. Fishing activities controlled by *hari berkarang* regulations: no fishing in 3/4 reserved lubuks in S. Berembang for 4-5 weeks prior to *hari berkarang* (to let fish assemble there?), then one fishing day, then free fishing for rest of year without gear restrictions (except poison and electricity).

2.4 Air bangar fish kills

Only occurs in S. Berembang during dry season and only in certain years, particularly affecting 'whitefish' species such as baung, lais, sebarau and kelamak. Does not kill the fish completely, but only disorientates them.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Berembang (and generally for other rivers)

Fish species	Relative abundance	Average current size	Maximum current size
toman	Abundant (B)	1.5-3kg	4-5kg
baung		300g	2kg
kelamak	Abundant (B)	350g	1kg
lais	Most abundant (B)	50-70g	70-200g
bujuk		750-1000g	2kg
tembakan	Most abundant (A)	70-160g	200-500g
sebarau		1kg	2kg
haruan	Abundant (A)	2kg	3kg
betok	Abundant (A)	100g	100g
sepat siam		50g	70g

NB: Abundances marked (A) and (B) indicate views of different respondents, one fishing in the main S. Berembang, the other more often fishing in the rawang and small rivers.

Ikan patin catfish never caught in this area.

3.2 Declined / extinct species

One respondent said no declined or extinct species (until this year). Second respondent said serandang (snakehead) extinct, and beterung (unknown species) depleted. One 70 year old respondent said fish had declined generally in numbers (used to catch too many fish to eat and had to give away to neighbours), and mentioned that the rawang forest is now much reduced from former times, so fish have much degraded spawning grounds now.

Last dry season was very dry (lasted right up to November 1997), and very good for fishing. Before that used to get at least 5kg per week average over the year. In 1998, now getting only less than 1kg for two months. All respondents now requesting restocking of depleted river fish.

3.3 Spawning grounds

Spawning at start of rainy season, especially in rawang areas. Few differences known about different species: toman, haruan and bujuk known to be nest spawners; lais, baung and sebarau (whitefish) seen to be mature at end of dry season ready for spawning, but in unknown locations. Tembakan and sepat siam seen laying eggs in shallow channels of rawang: spawning fish thrash against the bank, or '*mengempas*' to expel their eggs.

3.4 Perceived fish migrations

In wet season fish migrate in from S. Batanghari (main river). One respondent thought these same fish migrated back to the main river at the end of the year. The other respondent thought these fish stayed in the local rivers when they were grown up, as the empang barriers prevented their emigration to the Batanghari.

3.5 Dry season fish survival locations

Fish mainly thought to survive in the deeper lubuks, and some maybe to escape back to the deep Batanghari River. Lebak and Rawang areas all dry out in the dry season. No real restraints on dry season fishing after the *hari berkarang*, but impossible to fish out the lubuks due to the large numbers of snags. In 1997 dry season however, fish survival seemed to be very low even in the deeper lubuks (unclear whether fishing or natural deaths caused main losses of fish - or whether a reserve would have helped in such environmental conditions).

4 Institutional Arrangements and Objectives

4.1 Regulations:

Information was obtained from the *pemuka adat* and two fishermen.

Fishing regulations

Location	Regulation	Authority	Objective
Anywhere	No poison, tuba, putas, pesticide and electricity	Gov't	To sustain fish production and fishery resources conservation
S. Berembang in two pools allocated for *Hari Berkarang*	Not allowed to fish by anybody using any gear one week - one month before the village annual party at the Lubuk Panjang and Lubuk Tampang of the Berembang river	Kades through LMD	To keep fish stay at these lubuk until fishing in the day of party
Anywhere	Outsiders are not allowed to fish unless permission has been given by Kepala Desa	Kades	To inform outsiders that the desa have a party at dry season
S. Berembang (2 pools)	Not allowed to fish using cast net, trap and gill net	Kades through LMD	Avoid conflict within community and provide more equity (not individual benefit)
At the river and small canals	Not allowed to set up barrier across the river' canals with opposite position	Kades	provide equal income generation opportunity for all community not for individual

Additional information on "Hari Berkarang" (HB). The " HB " will determined through "musyawarah" in LMD led by *Kepala Desa* one week - one month prior the HB (usually in August of the year). The adat ceremony will be led by the *Ketua adat* by which first fish would be harvested by using un-prohibited fishing g ears. This activity is to keep fishing more and more and to avoid conflict at the beginning of the party. They have 30 places where "rumpon" could be set up and 200 places where liftnet could be set up and those places became family right all the time by the same kinship generation. No body can replace these spot fishing unless permission by the owner of the right (Pusako). Outsiders could be joined in this party with permission from Kepala Desa; however, they have to follow the rule made by the Desa. Fishing with liftnet and spears are only allowed in this party. Almost all the fishing community joins in this occasion accounted about 500 people at the first day of event and sometime families who join in the party are only 'for pleasure'.

Penalty regulations

Regulation	Authority	Objective
Disobedience of the HB will be given a 'social sanction'	Kepala Desa through Ketua Adat	Keep providing an equal opportunity among fishermen in that village.
Disobedience of general regulation came from government (tuba, poison, pesticide and electricity will be treated as follow formal procedure, e.g., at first at the LKMD, then follow formal procedure	Kades through LMD	To avoid conflict within the community

4.2 Relationships between rule-making bodies

Each regulation is usually made through the Musyawarah led by Kepala Desa, that is, LMD institution member of Ketua Adat, informal leader and the other key person within the desa. When necessary, new regulations may be proposed by the LMD through the musyawarah desa.

4.3 Monitoring of regulations

Self monitoring is conducted by the owner of the 'pusako' (DOES THIS MEAN NO REAL MONITORING?). The "Hari Berkarang" fishing is also monitored by each-other, especially in the "lubuk" prepared for "Hari Berkarang" party in dry season.

4.4 Enforcement

Few cases have been given to the people since the last 28 years. No body have ever been fined. The Ketua Adat's impression was due to lack of infractions rather than bad enforcement. This is because of the existence of social sanction and relatively close each others in that community. In addition, the role of informal leader, Ketua Adat, is still strong. For example, in 1992/1993, There was a group of 4 people used gill net before "Hari berkerang" in that area. This is considered breaking the HB regulation. Sanction was given by taken-away all their harvested fish amounted of about 30 kg (species of lampam, lais, sengarat and jelawat). Respondent also informs that problems exist due to a lot of snags in that river and pool areas.

4.5 History of arrangements

Annual community party (*hari berkarang*) has been practised for a very long time. Since then, the HB regulation has never been changed. This is because full time fisherman are not exist in this village. The main occupation in this village is a 'rubber tapping' and 'growing rice' either in the sawah or dry land rice and horticulture (duku and durian).

4.6 Conflicts/problem know about

Since 1970, bigger size of liftnet (more than 2,5 m) of 7 x 7 m have been set up by fishermen. This change became a problem among fishermen, however, such problem has only never became a serious problem. This is because a close relationship among the fishermen based on their kinship either grand-father or -mother. In 1997, in the dry season, there were many local people (3 people) with 4 people from outside fished using "paril" and they got about 500 kg of fish. This may disturb sustainability of the fish in that area of fishing. Due to this, respondent proposed to the Kepala Desa to prohibit that the fishing gear (paril). The reason is such fishing gear catch a lot of fish and undersized fish. But he mentions that the people who were use that fishing gear has a close relationship to the Kepala Desa. This fact brought him difficult in advising or informing the Kepala Desa.

5 Fishing activities

Two interviews were conducted. The first was with the Kepala Desa and the Desa Secretary; the second

with two older fishermen who habitually worked together.

The official village map was used as a reference in the first interview. This showed all the waterbodies and main rivers. The location of 3 or 4 major river Lubuks - all on Sungai Berembang - was indicated. The existence and fisheries significance of around 4-5 lebungs in the rice fields was noted, though their precise location was not.

5.1 Relative catch values from different waterbodies

The Desa Secretary was able to give estimates of the total catch from different rivers. S.Berembang was the most important (5-6t/year), followed by S. Jambi Kecil (3t/year) and S. Kiaro (1t/year). These were all rivers that had their source outside the Desa. The marked rivers arising in the Desa itself were not considered of major fisheries significance. The catch of the individual lebaks on the S.Berembang were not differentiated. The lebung were said to catch up to 0.5t/year each.

5.2 Relative catch values by season, gear type, fish species, fisherman type and waterbody

While the Desa secretary was able to provide overall catch estimates of some seeming accuracy for different waterbodies, he was unable or unwilling to differentiate this by gear or season. The two professional fishermen were able to give some estimates of the range of catch rates for the gears that they used but not an overall indication for any particular waterbody. It was therefore not possible to compile a complete matrix. A certain amount of indicative information was gathered, particularly about the hari berkerang - the ceremonial fish-outs of the lebaks of the S.Berembang - and the personal experience of the informants in the second interview.

Hari berkerang were held in August at three locations on the S.Berembang and lasted between 1 and 3 days. The exact timing was decided by consensus among village leaders and the day announced at prayers. The Camat and the Bupati were both invited but their permission was not needed.

At the main lubuk, L. Bungur, preparations started two days before with the fish being driven some distance upstream and an empang put in place at the downstream end of the lubuk to prevent their return. The next day the same process was repeated with a downstream drive from above the lubuk. By this stage the fish were penned into the lubuk. Most of the catch was taken by tangkul, cauk (a scoop net) and different types of spear used in conjunction with a floating FAD called a bumbun. Of these the most important were the tangkul which took the majority of the catch, which was made up of toman, sebaroh, lais, ringo, tepras.

At each lubuk there were said to be 100 spaces for tangkul, which were determined through ancestral lineage. Given that there were only 50 semi-professional fishing households in the desa, most of these were presumably owned by other members of the community. The low cost for tangkul (Rp.100,000) and life span (3 years) quoted indicates that these may be smaller and of less durable construction than the tangkul seen elsewhere. Tangkul operators were able to take home their entire landed catch (10-15 kg).

The rest of the catch was taken by spears, the terok (single point, up to 6m) and the serampang (three points, 3-5m), used in conjunction with bumbun. The bumbun was constructed from a wooden frame covered with various types of leaf (banana, coconut) in which a hole had been left. In the melee of the hari berkerang, fish sought refuge in the dark under the bumbun, only to be speared when their heads became visible through the hole. In contrast to the tangkul operators, individuals operating in the lubuks with spears and the cauk scoop nets were required to pool and share their catch both between themselves and with the desa dignitaries. These shares were also said to be around 10-15kg.

The two fishermen indicated that despite the generally higher catches taken in the dry season (May-October), their own income was no greater in this period, due to the problems of gaining access to the best fishing spots. They used lukah, menteban (a cylindrical trap), pancing and tembilar in the dry season. Of these the pancing was the most important. In the wet season, the same gears were used plus pukat, which was particularly productive for them in the period of high flood from January/February (catches up to 20kg/day). In this period their income averaged around Rp.4,000/day. Fishing in the river was limited by owners of tangkul.

Observations (economics)

- fisheries said to be in decline but of relatively minor importance to the village
- some management measures (restrictions on gill nets) were aimed at promoting sustainability
- conflict over valuable fishing spots had been avoided by making them hereditable
- the issues of equity and the generation of desa income did not seem important to key respondents, though there was clearly some considerable pride attached to presence of important guests at the hari berkerang
- the professional fishermen interviewed appeared to have very limited means of access to the dry season fishery.

Annex E: Investigations in South Sumatra Province

South Sumatra Background

General Background

South Sumatra province, Indonesia, is located in the southern latitude range of 1^{o} to 4^{o} and the eastern longitude range of 102^{o} to 108^{o}. On the northern, western and southern part of the region, it is bordered by the province of Jambi, Lampung and Bengkulu respectively. On the eastern side, the region is adjacent to Karimata Strait and the Java Sea. The province covers an area of 109,254 km^{2} and is divided into 10 regencies (BPS, 1997).

In 1996, the total population of the province was recorded at 7.25 million. The Gross Domestic Product (GDP) of the province at current market price was 14,532 billion rupiah. During 1986-1997, the region achieved a continuous increase in GDP with the agricultural sector contributing 19.35 per cent of total GDP in 1967. In 1996, only 2.40 per cent of total GDP was derived from fisheries. However, fisheries is an important sector for the region because of its contribution to rural people in terms of income, employment opportunity and relatively cheap animal protein.

The province of South Sumatra has several important rivers, including the Musi, Ogan and Komering. The rivers spring from the Barisan mountain and flow over low hills in the vicinity of the capital city Palembang. This hydrological condition creates an extensive, swampy and constricted river basin. Temperature is about 21.5 - 32.7^{o}C. Rain falls throughout the year with the exception of a short dry period of 2-4 dry months, with an average of 213 mm per month (1,500 - 3,200 mm per year) of rainfall. Humidity ranges from 82-91 per cent.

Given the above physiographic characteristics, the inland fishery in South Sumatra may be termed a typical 'floodplain fishery resource'. The resource is basically form by the main river, the Musi, and its major tributaries. The floodplain of the river is considered a more general feature of the river basin and includes the tributaries flowing into the main channel along the entire length of the river. Often the rivers cut through their own embankment, creating direct connection with the extensive floodplains. Some parts of the floodplain are shallow depressions with no links or permanent drainage to the surrounding river system and are fed by their own minor tributaries.

The floodplain and the river system are controlled by the hydrological cycle. During the rainy season, the river basins flood and water levels in the rivers are high, whereas during the dry season, the river basin drains and water levels in the rivers fall. Water bodies on the floodplain lose water by evaporation and to a lesser degree by filtration during the dry season. In the cycle of seasons, there are intermediate periods of rising and falling water levels.

Previous studies indicate that environmental degradation has become a major public issue in the inland fishery resources of South Sumatra. The continued growth in the number of fishermen and fishing units entering the fisheries is unlikely to be accompanied by further increases in fishery resource productivity. The two most important regions for the inland water capture fishery in South Sumatra are located in Ogan Komering Ilir (OKI) and Musi Banyuasin (MUBA) kabupatens.

Fish Community and Fisheries Potential

The inland fishery resource consists of the main river itself, seasonally flooded lands (floodplains), permanently swampy area, and small lakes. Swamp and lake resources are usually distinct geological entities; however, ecologically they are integrated into the main river

and floodplain system. The river and small lakes contain water throughout the year while the swamp areas tend to lose water during the dry season. Fishing is traditionally considered an important occupation for many rural people living in the area. Fishing patterns in the area are significantly affected by fluctuations in water levels. The fishing seasons can be distinguished as high water (December-February), receding water (March-May), low water (June-August) and rising water (September-November). The types of fishing gear operated depend on both area and season.

Fishing increases during periods of low flow with greatest catch per unit of effort associated with falling or rising water levels. Fish are more concentrated in low water and tend become migrationally active during rising and falling water. Hence, they are more susceptible to capture during these times. In this regards, the structure and functional composition, as well as abundance of fish stock, are reflected in the types and intensities of fishing effort operated during this time of the year. Fish stocks typically recover from intense low water exploitation during the high water season, when fishing efficiency is low due to the dispersion of fish in newly inundated areas. However, there is still a tendency for inland capture fisheries production to gradually decrease in terms of both the total numbers of fish caught and their average sizes.

Fishing gears used on the floodplain fisheries of South Sumatra may be classified into 7 groups: (1) gillnets, including drift and fixed gill net; (2) cast nets, *anco*; (3) lift nets, *serok;* (4) hooks and lines, including *rawai* and *pancing;* (5) filtering barriers, including static barriers such as *kilung, tuguk, empang* and *corong,* and active barriers; (6) portable traps, including *pengilar rotan, bengkirai bilah, bengkirai kawat, lapun, menteban* and *sero*, and; (7) other gears. These gears are operated by fishermen according to seasons and area of fishing.

Over one hundred species of fish are currently harvested from the fishery; though official records of the Fishery Service differentiate catches into only 17 species or species groups. These harvested species may be classified as either 'whitefish' or 'blackfish' (Welcomme, 1985). According to this classification, whitefish migrate spatially and seasonally, from the river to the floodplain area every year to feed, after which they must return to the river due to their intolerance of low oxygen in the dry season. Blackfish may spend their whole lives in the standing waters of the floodplain. Recognition of these alternative strategies may help to determine where and when fish harvest reserves should be set up.

Fisheries Management Strategy and History

In South Sumatra, most inland fishery resources, comprising rivers, lakes and swamps, are naturally sub-divided into defined physical units. Fishing management rights to these units are allocated through an open auction, held every year in November/December. The management system has a long tradition, and has probably influenced the present organisation of the fishing community. The system has two principal effects:

- by allocating specified units of fishing ground among fishermen before the start of season, it reduces the possibility of disputes;
- it raises revenue for the local government.

This system provides no guarantee that fishermen will be able to re-lease the same site next year. This may encourage them to exploit the site to the maximum before the end of the period of the lease.

Initially, under the old *'marga'* system of local government, the annual auctions were apparently a fair and equitable means of regulating access to valuable fishery and reducing conflict in the fishing community. Most of the revenues from the auctions were paid directly to the community who actually owned the resources. In 1983, however, the local *'marga'* system was replaced by a national system of local government with a strongly hierarchical structure. Under this new

system, the role of ‘marga’ is replaced by the district government *(Kecamatan)*, which is representative of the auction authority (regional government). The revenues are paid to the officials authorised for that purpose at the regional level which returns some moneys to the district government which, in turn, redistributes some moneys to village administrations. Under such system, the government imposes an additional charge on the winning bidders of 15 per cent direct tax on the price paid for a resource unit at auction.

Danau Ulak Lia Reserve, Kabupaten MuBa, Sumsel Province

1 Village Background

Danau Ulak Lia reserve is located in Kelurahan Sekayu II, a large municipality of Sekayu, with 1,060 households and 5,169 people. 30% of households mainly fishing, 35% mainly rubber tapping, 30% mainly farming and 5% other occupations and mixed agriculture. 80% of the village originated from Sekayu, the other 20% from Java, Medan and Jambi etc.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Musi 4 small tributaries 2 minor tributaries		Very deep 2-6m in lubuks Dries out
Exclusively owned lakes	D. Ulak Lia (reserve) D. Burung		1-2m 1m
Shared lakes			

The Ulak Lia reserve is difficult to access during the dry season, as the river channels dry out completely.

2.2 Water flows

Water flows in to the area as overspill from the main River Musi, and down the tributaries following local rainfall. D. Ulak Lia fills with water from the Musi across the lebak/rawang areas, and also up a network of river channels, especially via the S. Langarang. Both these routes dry out in the dry season, disconnecting the reserve from the surrounding waters.

2.3 Fishing grounds

D. Ulak Lia is closed as a DP reserve. S. Musi is open access. All the smaller rivers and tributaries are auctioned annually in several units. Barriers and dry season gears (usually FADs) are operated by the leaseholder usually, while other smaller gears are sub-leased (area-specific) or sub-licensed to individual fishermen (eg Rp50,000 per boat per year, or Rp50,000 per 150m of tabung fishing spots on the S. Langarang).

2.4 Air bangar fish kills

Air bangar is found in all rivers, every year, but not usually bad enough to cause fish kills. Also have in reserve Ulak Lia, particularly for species such as tapah.

3 Fish

3.1 Main fish species caught, by waterbody type

Sungai Langarang (eg of river tributaries)

Fish species	Relative abundance	Average current size	Maximum current size

tembakan	** (R1)	50g	500g
kujublang (ornamental)	* (R1)	small (2cm)	small (5cm)
gabus/haruan	** (R1)	250-500g	2-3kg
seluang	** (R1/2)	25g / 6cm	25g / 10cm
baung	** (R2)	350-700g	2-4kg
lais	** (R2)	100-125g	200-350g
toman		1-3kg	6-7kg
patin		3-5kg	35kg
lemajang (cyprinid)		500g	3kg
bulu tulang (lais spp)		500g	4kg
kelamak (jelawat)		70g	3kg

R1 & R2 indicate different respondents, who may have given different rankings based on their own experiences (eg R1 in lebak, R2 more in river).

Fish species in D. Ulak Lia reserve thought to be much the same as above, but not fished nowadays so respondents not sure.

3.2 Declined / extinct species

Declined species include belido, putak, betutu, udang galah, sengarat (lais spp), and palau. Extinct species now serandang, lalai (lele), kapas (kapras) and arowana. Fish thought to be extinct due to ease of capture of these species and high fishing effort.

One respondent with 25 years experience of fishing this area thought that, in general, both fish abundances and fish sizes had declined very much over this time. In comparison, a younger respondent with 7 years experience felt that fish catches were still good in this area, especially in years with large floods (eg 1997).

3.3 Spawning grounds

Spawning known to be in rising water season, usually around November. Tembakan, gabus and toman said to spawn in stagnant water, in shallow rawang habitats, baung and tapah in flowing water in small rivers. Riverine patin thought to spawn in main River Musi.

3.4 Perceived fish migrations

Fish thought largely to recruit locally from Musi and D. Ulak Lia.

3.5 Dry season fish survival locations

In leased rivers, survival thought to be very low, due to extensive use of barriers and poisons by auction winners. Some fish still thought to survive in the deepest S. Langarang lubuks. Dry season fishing does not include (legal) ngesar fish drives due to many snags, but (illegal) poison may be far more destructive, and FADs also take many fish. Recruitment benefit of Ulak Lia reserve thought to be limited now by extensive growth of surface macrophytes.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Information provided by two respondents: the Kepala Kelurahan (lurah) and the Pemuka Desa (informal leader, member of LMD committee).

Fishing regulations

Location	Regulation	Authority	Objective
S. Musi	Open access 'bebas', to anybody, including outsiders.	govt	
All areas	Poison, electric fishing, explosives banned	govt	fish conservation
D. Ulak Lia	All fishing banned, all year	Dinas P.	tourism, conserve stocks
Other areas	Lelang (auction) system, waterbodies leased annually in December. Bidding open to anybody, including outsiders. Standard (starting) prices set at 50% of previous years' sale price. Auction organised for all Kecamatan Sekayu waterbodies together (not by each village), controlled by committee of DP Kabupaten MuBa; Camat Sekayu; Pemerintahan Desa (village govt coordinating division of Pemda); Bagian Keuangan Pemda (accounts division). Revenue to Pemda Tingkat II (70%) for community development, and to 3 Sekayu Kelurahan (10% each) for committee members, not for community development.	Pemda Kabupa-ten, and originally from marga	Avoid conflicts within community. Generate local government income for development (previously all income to marga).
All areas	Gap in empang/corong barriers must exceed 0.5".	Dinas P.	Avoid capture of small fish
All areas	Gill net mesh sizes must exceed 0.5" (seems doubtful)	Dinas P.	Avoid capture of small fish
Auction areas	Auction winners must pay for SIUP (Surat Isin Usaha Perikanan = license for commercial fishing), cost 1.5% of auction price; and additional PBB (Pajak Bumi dan Bangunan) tax of 1%. (overall total 102.5% of auction price split 70:30 as mentioned above).	Dinas P.	Raise revenue

Penalty regulations

Regulation	Authority
Fine for fishing in Ulak Lia reserve or fishing with poison/electricity up to Rp100,000,000	govt

4.2 Relationships between rule-making bodies

No regulations yet made by village committees (musyawarah), so authority always top-down from Dinas Perikanan, without support of village.

4.3 Monitoring of regulations

Monitoring by DP-employed guard in Ulak Lia, paid Rp100,000/month from provincial level DP. Guard is a Sekayu local villager, and lives in DP house built next to reserve.

Outside reserve, no monitoring in the free-fishing (bebas) areas, while auction winners monitor their own leased waterbodies. Lurah suggested that, in bebas part of S. Musi, community members monitor each other and may report infringements to him or to head of RT (village sub-unit).

4.4 Enforcement

Poison and electricity rules regularly broken in the dry season in the Musi River, by outsiders but no-one ever caught. Village leaseholders also use poison in auction units, but reporting of offences by other local fishermen never resulted in formal penalties. Outsiders come with 70hp speedboat from other villages. Used to have some poaching in Ulak Lia when first declared reserve, but no-one ever fined. Now difficult to fish due to overgrowth of weed. Told that poison not used in Ulak Lia as ineffective in non-flowing water (?).

Local government (Pemda) contracted Satgas Security Service (includes members of police and army, coordinated by Kabid Sospol / Bupati), to control fishing throughout Kabupaten Muba. Tried to capture law-breakers, after observations of many fish deaths in 1997, but most of team only used slow river boats, so unable to capture speedboats!

Told that, in another desa of Kecamatan Sekayu (Desa Teladan), one man was caught for poison fishing and jailed for 3 months in April 1997.

4.5 History of arrangements

Ulak Lia reserve introduced in 1990 by Bupati, without consulting village, as a tourist resort/attraction. Lake stocked with patin and nilam to improve local stocks. Locals reportedly unconcerned at loss in fishing opportunities, as hope to gain from new tourist industry (though none seen yet!).

5 Fishing activities and benefit distribution

Two interviews were conducted. The first with the Diskan guard at the lake, covering waterbodies and leaseholding patterns. The second was with an individual fisherman who undertook bebas fishing in the area between the lake and the S.Musi and was a licencee on the main leaseholding.

The lake was very thickly matted with floating vegetation. This included water hyacinth, various grasses and *Salvinia molesta*. A map was drawn showing the lake and the channels through which it connected to the S.Musi. The most direct channel was open for only part of the year. Running off this channel between the longer side of the lake and the S.Musi was the S. Lenggaran. Off this was a series of seasonal connections to the S.Musi.

The number of lelang units was unclear. The first section of the channel connecting to the lake was under the control of Diskan. The S. LENGGARAN, which was the most important lelang unit, had been controlled by the same leaseholder, a resident of Sekayu II, for the past 10 years. The reserve price went up 10% per year, with the income going to the Desa. Last year the price had been Rp.1.5m.

Fishing in the area was particularly influenced by the abundance of jublang (Botia). It was reported that the pengamin of S. LENGGARAN authorised up to 45 fishermen to fish individually for jublang, for a fee of Rp.50,000/year and on condition that they sold their catch to him - at the same price as the independent fish traders. Catch was taken using small traps made from sections of bamboo with a hole at one end, in which the fish liked to hide. It was not clear whether this was a licencing system, where the fishermen were allowed to fish wherever they wanted, or a sub leasing system, where each was allocated a defined stretch of the river. Catch of other species was taken by fishermen working for the pengamin, mainly using various forms of barrier (wet season - corong; dry season - empang). Though no figures were available on the catch of these gears it was apparent that the leaseholder was likely to make a substantial profit on his lease, since the estimated revenue from licencing alone would have been Rp.2.25m, a 50% return on his investment.

The individual fisherman indicated that he used a variety of gears during the year, including pancing, serampang, tajur, tangkul (different sizes), jala and jaring. The single most important in terms of income generated (50% of annual total) was the bamboo traps used for botia. Each fisherman was thought to operate between 70 and 300 of these. Returns to this were highly seasonal, taking around Rp.1m in a three week period in December (?). Catch with other gears was both for sale and consumption and at its peak (due to access restrictions) during the months January to May.

Tanjung Sejaro Village, Kabupaten OKI, Sumsel Province

1 Village Background

Dinas Perikanan's Lebung Karangan 'reserve' is located wholly within the area of Desa Tanjung Sejaro, in Kecamatan Indralaya, Kabupaten OKI, of Sumsel Province. The village lies alongside a side channel of the Ogan River in a complex system of floodplain lakes and channels. Much of the local lands are used for growing rice, and for fishing in the high water season. The village has 491 households and 2,658 people, spread between 7 dusun (RT). Of these, 350 were reported to be primarily farmer / fishers. The village inhabitants mostly originate from the Melayu pegagan tribe or marga.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Ogan (canal) S. Kelakar		1m >1m
Exclusively owned lakes	L. Karangan (reserve) D. Teluk Seruo L. Kalian L. Gabus L. Pauzi	155ha	2m Dry 0.5m Dry 0.5m
Shared lakes	None		

Water depth in L. Karangan declines to 2m in the dry season when the sluice gate is used to maintain water levels. For the last 2-3 years, the sluice gate has been broken and water has drained from the lake to leave a depth of only 0.5m. The gate has recently been repaired and is now operational again this year.

2.2 Water flows

Water flows into the village waterbodies mainly down the broad S. Ogan, then via the smaller Ogan side channel reputedly built by the Dutch to drain/irrigate the area and finally along the S. Kelakar which feeds the local sawah and those of other villages beyond Desa Tanjung Sejaro. L. Karangan reserve is an irrigation reservoir, also dammed by the Dutch several decades ago. The sluice gate is still operational and the waters are still used to irrigate the downstream sawah during the dry season.

2.3 Fishing grounds

All waters in the desa are auctioned annually for fishing except the L. Karangan reserve, D. Teluk Seruo, and some parts of the main river channels Ogan and Kelakar. Fishing is controlled by leaseholders in the auctioned areas, is freely available in the rivers, and prohibited completely in L. Karangan. Danau Teluk Seruo was withdrawn from the auction system in 1984 by its leaseholder Bk Ruspih, claiming that his ancestors had originally dredged the lake, and that he had since dammed its waters.

2.4 Air bangar fish kills

Not investigated.

3 Fish

3.1 Main fish species caught, by waterbody type

Lebak-Lebung (Floodplain & lakes)

Fish species	Relative abundance	Average current size	Maximum current size
rucah (mixed small cyprinids)		35g	35g
palau		50g	100g
sapil (small tembakan)		20g	350g
sepat siam	Most common	20g	?
gabus		350g	1.5kg

3.2 Declined / extinct species

Lais, serandang and gabus were reported as being declined, and jelawat, betutu and baung as being locally extinct.

3.3 Spawning grounds

Not investigated.

3.4 Perceived fish migrations

Not investigated.

3.5 Dry season fish survival locations

Fish were believed mainly to survive in L. Karangan reserve, in S. Kelekar and in some of the auctioned lebungs. Fish survival was thought to be low in all waterbodies, however. In L. Karangan, up to 100 otters were believed to come in the dry season to eat the conserved fish: subsistence fishing was also permitted for the guard and other locals. The unleased S. Kelekar retained few fish due to the open access fishing in the dry season and the fact that most leaseholders on the upstream tributaries used barrier traps to prevent fish returning to the S. Kelekar. The auctioned lebungs retained few fish due to the traditional use of ngesar fish drives in the dry season.

Though the most fish may survive in the reserved L. Karangan, the respondents thought that such stocks gave no benefit to the fishery due to the hydrological management. The respondents owned the sub-lease unit directly below the sluice gate of L. Karangan. They reportedly caught fish migrating into the lake, but never to catch fish coming back out of the reserve. Due to the sluice gate, the reserve maintains relatively high water levels all year. Fish thus attempt to migrate into L. Karangan both during the flood, and also during the dry season due to the attraction of flowing water. L. Karangan fish reputedly did not try to leave the lake due to its good water levels, and could not emigrate anyway due to the sluice gate structure and the use of empang barricades positioned by the Dinas Perikanan guard. With such a management pattern, L. Karangan may function effectively as a conservation reserve for those fish able to maintain their full life cycle within the lake. It does not seem able to function as a *harvest reserve*, however, due to its lack of interaction with the exploited stocks of the village.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
Anywhere	No poison, tuba, putas, pesticide and electricity	Government	To sustain fish production and to conserve fish spawner
Waterbody auction units within the village	Not allowed to be fished by anybody using any gear unless given permission by the 'pengamin', except for daily fish consumption only (by hook and limited gill net only)	Formal procedure through 'pengamin' and Kepala Desa	To provide more fishes available for 'pengamin' because the price of the auctioned waterbody is high.
Anywhere	Not allowed to catch small size snake head (toman and gabus)	DP Kabupaten OKI	To keep spawners for the near future
Lebung Karangan Reserve Area	Nobody allows to fish using any gear except for daily fish consumption (using limited gears such as hooks and a piece of gill net)	Formal procedure through the reserve guard	To keep fish spawners in the reserve for maintaining high fish production

Additional information on the auction system as follows:

1. Nine waterbodies in Tanjung Sejaro village were auctioned in the Ex Marga Pegagan Ilir Suku I (PIS I). Auction was held in the Tanjung Sejaro village by an organizing committee (Camat is the head of the OC). Auction was conducted in an open bidding system. Auction occasion is announced to the community through the village office, 10 - 14 days in advance. The auction was usually held in November or December every year, but the period of leasing begins from the first of January to 31th of December of the same year.

2. Outsiders who have money to buy auction objects are allowed to bid in the auction of water bodies within Tanjung Sejaro village. The list of the participants at the auction is not necessary to be made. The 'Lebung Waris' is included as auction units where the 'pengamin' will have rights to fish even in the rice fields. Any gear is not prohibited to be used in auction units including small mesh sized gill net or barrier traps ('empang').

3. The revenue obtained from the auction are delivered to Kabupaten (Pemda) as soon as the auction closed. About 60% of the auction revenue then received by the village and is used for Kepala Desa travel cost, administration cost, incentives for Kepala Desa, Secretary of the Desa, Kepala Dusun, and Kepala Urusan in the village office.

4. The waters available in limited areas like in ‘lebung' during dry season are belonged to the auction winner, and he has the rights for fishing even within the rice fields of other person.

5. The procedure for setting the reserve price had undermined the whole purpose of open auctions for lelang. Making the reserve price the previous highest price plus 10% had, inevitably, pushed this beyond its economic value. At the last auction none of the reserve prices had been met in the open bidding. As a result all had been allocated by the Camat, with authorisation from the Bupati, on the basis of private negotiations for unpublished sums.

Penalty regulations

Regulation	Authority
Disobedience to the government general regulations (tuba etc) will be treated following the formal procedure; e.g. at first warning by Kepala Dusun, and then by Kepala Desa.	Formal procedure through the reserve guard for the reserve area. Formal procedure through the 'pengamin' for the leased waterbodies.

4.2 Relationships between rule-making bodies

Each regulation usually announced by Kabupaten Fishery Extension Service at the auction occasion held in the village. The villagers have no idea for fisheries regulation at the present time. It is because

the villagers have no attention since the auction system was changed from the old 'Marga System' to recent auction system conducted by the government.

4.3 Monitoring of regulations

Monitoring was done by the winners of the auction where they get authority to fishing. Some time the winners have guards for their waterbody who monitor fishing during dry season when the fish concentrate in the limited areas such as in 'lebung'. The guard monitors the reserve especially in the dry season when fishermen fishing in other areas. However, fishing for daily consumption is still allowed for everybody using limited gear.

4.4 Enforcement

For the last 2 years, very few cases where people are given warnings, either at the reserve area or at the waterbodies auctioned. So far no body has ever been fined. The Secretary of Desa gets impression that this is due to the lack of law enforcement. There is an impression that leadership of 'the Pengamin' is strong and he has a strong security organisation. An example happened in two years ago where a group of 4 people used gill net (40 pieces) in the reserve area. After being caught they only get advices delivered by Dinas Perikanan Kabupaten OKI. Respondent also informed that there are still a lot of water hyacinth covering the reserve.

4.5 History of arrangements

Annual auction has been doing for a very long time under the 'Marga System'. The auction system now is controlled by Pemda Tingkat I (Governor authority) through the 'Perda Propinsi Sumatera Selatan' No.8/Perda Sumatera Selatan/1973/1974 dated 14 July 1974. Since 1982 that authority for conducting auction has been given to Kabupaten (Bupati) through the Governor Decision Letter No. 705/KPTS/II/1982 dated 5 November 982. The first 'Perda' in Kabupaten OKI namely 'Perda Kabupaten Dati II OKI No.3/1984 was established in 1984. The regulation now changes a lot. The last regulation was established in 1996 was 'Perda Kabupaten Dati II OKI No. 3/1996'. The organizing committee controls the auction, and the schudule for auction was decided by Bupati, usually within the month of November.

5 Fisheries economics and benefit distribution

Two interviews were conducted, both with fishermen involved in the operation of the lelang area immediately outside the sluice gate on the reserve. This lelang area was divided by the pengamin (lelang winner) into four areas. One of these was operated by fishermen working on his behalf under a catch share arrangement. The other three were sub-leased for a flat fee. The first respondent was the head fisherman working for the pengamin. The second was a sub-lessee.

Given the spatial exclusivity of the operations in both areas the principal focus was on the fishing operations as a whole, rather than looking at the catch and ownership characteristics of individual gears - the main focus of these interviews at many of the other sites. The principal objectives were to understand more about benefit distribution from the fishery and to identify appropriate procedures for socio-economic monitoring.

The head fisherman indicated that he ran all fishing operations. The pengamin (who in this case was the Kepala Desa) paid the lease fee (Rp.5m) and met all the operating costs of the fishery. These included Rp.2-3m for fishing gears (empang, jaring, pengilar, jala, bubu, bengkirai, pancing) and Rp10,000 a day to cover subsistence costs (lunch plus cigarettes) of the four fishermen in the unit, who were all related to the respondent. This expenditure was set against fishing revenue. At the end of the year the net profit from fishing was divided of a 50:50 basis between the pengamin and the fishing group.

The living costs of the fishermen's families were met by seasonal interest-free loans from the pengamin.

Preparations for fishing operations in March. Fishing started in April . Revenue was limited in the initial period to around Rp.1m per month. It rose significantly in September/October when two ngesar

operations were undertaken. The first typically took Rp.10m, the second Rp.5m.

The respondent said that he kept records during the year, detailing revenues and expenditure. Records from previous years had been discarded after final reconciliation with the pengamin. He was willing to make such records available for the purposes of the MRAG-CRIFI monitoring programme.

The sub-lessee had the more westward portion of the lelang area. Its area was unspecified. He had operated this area for the last 7 years. This year he had paid Rp.500,000. Apart from a small area, lubuk gabus, of around 100 m square it all dried out by June. His rights to the area were limited to the period when it was flooded, as all the land was owned. Much was used for sawah (including a portion that he himself owned). For the rest of the year he was a rice farmer, producing around 6t of padi per year.

Though he was uncertain about the details of the operation of the area operated by the pengamin's fishing unit, he indicated that this was the area that dried out last and that it benefited from significant concentrations of fish.

On his own area he operated jaring, pancing and pengilar for the early part of the year. At this time he would check all the gears once per day, taking around 5 hours to complete the process. His expected revenue during the period February-March was Rp.150,000 per month, rising to around Rp.200,000 in April. His peak months were when the area dried out in May-June. During this period he would check his static gears twice per day as well as using jala. He expected to make around Rp.1m in these two months. The small lubuk was harvested towards the end of the year, at the same time as the sawah. Catch was not specified.

He sold most of the fish himself to traders in Indralaya during the early part of the season. The round trip took around one hour and cost Rp.250 each way. All was sold live or wet. During the peak season he would sell to traders visiting the area, salting perhaps 50% of the catch himself (all the dead fish).

He said that he permitted fishing for consumption by other households but stopped those fishing for sale. He had no problems with enforcement. Catch for consumption was limited.

Danau Teluk Gelam Reserve, Kabupaten OKI, South Sumatra Province

1 Village Background

Danau Teluk Gelam reserve is located in a remote part of Silape/Serapik village. The temporary dusun (settlement) adjacent to the reserve currently has only 6 households. All residents were local people, mostly from Pedamaran. Mostly rubber tapping employees, collect fire woods for sale and make mats from sedges.

The reserve is considered eco-tourism fishery reserve. There is one reserve's guard paid monthly by the Diskan. The guard is allowed to fish in the reserve area for his daily consumption. During observation, three people which is a relative of the guard stay in the area. They help the guard managing the reserve. In fact, they also fish for their daily consumption in the reserve area. According to the reserve guard, his main duty is to keep cleaning the waterbodies from weed and protecting the water bodies from illegal fishing since commercial fishing is not allowed in that area.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	Sungai Kalup (Outlet of the reserve)	Not known	1 m
Exclusively owned lakes	Danau Teluk Gelam	?	4-6 m
Shared lakes	Non	-	-

2.2 Water flows

Teluk Gelam lake is in a peripheral part of the Lempuing catchment, but was reported to be at too high an altitude to receive floodwaters from Sungai Lempuing, receiving water only from local rains. One respondent said the lake received no water from Sungai Komering while another said it was possible to travel by boat all the way from the Komering to the Lempuing via the three reserved lakes Nilang, Air Hitam, Teluk Gelam and their connecting channels, mainly Sungai Kalup.

2.3 Fishing grounds

Fishing is done only for daily consumption, using tajur and small bubu. The guard of Danau Teluk Gelam reserve used kilung set in the outlet of the reserve all year around.

2.4 Air bangar fish kills

Not known

3 Fish

3.1 Main fish species caught, by waterbody type

The fish species of the reserve lake were not well known. One local fisher caught only small fish, as tabulated below, though he used only cheap, inefficient gears for subsistence. Another respondent said that the Dinas Perikanan guard also catches small fish, and he believes that there is no big fish in the reserve. In contrast, various endangered species such as belida and arawana were also thought to exist in the Teluk Gelam Reserve.

Sungai (River) Kalup.

Fish species	Relative abundance	Average current size	Maximum current size
Sepat siam (young ones)	?	5 cm	5 cm
Riu	?	5-6 cm	5-6 cm
Selincah	?	5 cm	5 cm
Gabus/Haruan	?	<100 g	100 g
Sepat merah mato	?	<5 cm	5 cm

3.2 Declined / extinct species

Not known.

3.3 Spawning grounds

Not known

3.4 Perceived fish migrations

Not known.

3.5 Dry season fish survival locations

Not known.

4 Institutional Arrangements and Objectives

The lake was believed to be operated as a full, permanently closed reserve by Dinas Perikanan. There was insufficient time to further clarify any institutional arrangements or fisheries economics.

Benawa Village, Kabupaten OKI, South Sumatra Province

1 Village Background

In the desa there are 645 households (3,259 people), 20-25% of which were fishermen.

The main part of the village was homogeneous in its origins. Most households are dependent on agriculture or on work on oil palm estates that are close to the village. At some distance to the north of the desa was an oil palm estate. 50 households lived there in a separate dusun, Dusun Margo Mulio. These were a mixture of migrants from Java and locals from the village.

2 Environment

2.1 Waterbodies

Waterbodies	Names	Flooded areas	Dry season depths
Rivers	S. Komering Desa Canal	? ?	1 m 0.5 m
Exclusively owned lakes or lebaks	1. Lb. Nilang 2. Air Hitam 3. Anak Jele 4. Ank Kemang 5. Lb. Canduy 6. Tl. Netani 7. Lb. Kalup 8. Muaro Duo	? ? ? ? ? ? ? ?	2.5-10 m 8 m 2-3 m 2-3 m 1 m ? ? ?
Shared lakes			

Four waterbodies were classified as “reserves”. These were Lebak Nilang (which was the closest to the village, the largest and deepest), Anak Jeuleh, Anak Kemang and Air Hitam.

2.2 Water flows

Waters flow from the Komering into the lake system via a canal dug many years ago. From the lakes, water drains down via Danau Teluk Gelam to the Lempuing catchment.

2.3 Fishing grounds

Fishing grounds of the village are : Lebak Nilang Lebak Air Hitam, Lebak Anak Jele, Lebak Anak Kemang (the four largest ones), Lebak Canduy, Lebak Teluk Netani, Lebak Kalup, Sungai Komering, and Desa Canal. A ’Special auction’ system has been applied since 1990. There are only two auction units, e.g. Lebak Nilang, Lebak Kalup, Lebak Teluk Netali, Lebak Canduy and Lebak Muaro Duo are considered as one unit, and other lebak as another unit. The River Komering is a free fishing ground (not leased).

2.4 Air bangar fish kills

Air bangar occurs every year during the dry season due to aquatic weed decomposition. However, mass mortality of fish does not occur every year. In recent years more pollution comes from palm oil plantations. Sometimes in Lebak Muaro Duo outsiders catch fish using poison (insecticide).

3 Fish

3.1 Main fish species caught, by waterbody type

There was much disagreement between respondents on the state of current fish stocks. One respondent said the largest fish now caught in the 'reserve' area was only 0.5kg, and that it was no longer worth paying the auction fees. Another respondent suggested that fishing was still good, and gave the average fish sizes below:

Sungai Komering (River)

Fish species	Relative abundance	Average current size	Maximum current size
Lampam	?	150 g	1.5 kg
Baung	?	500 g	2 kg
Sihitam	?	350 g	1.5 kg
Kalui	?	1-2 kg	6 kg

Danau Lebak Nilang, Air Hitam, Anak Jele and Anak Kemang (permanent lakes)

Fish species	Relative abundance	Average current size	Maximum current size
Haruan	Abundant	< 1 kg	6 kg
Bujuk	Abundant	<500 g	1.5 kg
Serandang	Abundant	300-500 g	2 kg
Toman		< 3 kg	10 kg
Belida		< 3 kg	9 kg
Tembakang		300 g	1 kg
Sepat siam		100 g	350 g
Buing		30/kg	30/kg
Palau		30/kg	30/kg
Tapah		4-5 kg	30 kg

3.2 Declined / extinct species

Extinct fish species : Jalai (similar to gabus), tebangalan, lemak, and ikan are.
Depleted fish population: ikan betutu.

3.3 Spawning grounds

Fishes spawn in lebaks during the beginning of rainy season. Arawana (keleso) is believed to spawn in lebaks, too.

3.4 Perceived fish migrations

Some fishes migrate from Sungai Komering during rainy season, and some of them go back to the River Komering during the dry season. In the River Komering there is no penetak.

3.5 Dry season fish survival locations

Fish mainly survive in lebungs of the above lebaks. Fishermen try to catch out all fish, but they can not fish out due to aquatic weeds and snags, and also because some lebungs are very deep. During dry season fishermen fish using gill net, pengilar, tajur, bubu and jala.

4 Institutional Arrangements and Objectives

4.1 Regulations:

Fishing regulations

Location	Regulation	Authority	Objective
Anywhere	No poison, tuba, putas, pesticide and electricity	Governme nt	To sustain fish production
Leased waterbodies within the village	Nobody is allowed to do commercial fishing using any gear, unless given permission from the 'pengamin'. Fishing for daily consumption (using hook and limited gill net only) is allowed.	Formal procedure through 'pengamin' and Kepala Desa	To provide more fish available for 'pengamin' since the lease price for a water body is expensive

The status of the reserves was not clear. While these had been designated as official reserves by Diskan, they had been operated for some years by appointed individuals. It was not clear on what basis these appointments had been made but their methods of management were indistinguishable from normal auction winners (pengamin). There were no particular restrictions on the gears that might be used (as long as the appropriate fees were paid). Ngesar were used, when the capital of the fishermen and hydrology allowed. There were no closed seasons.

The area of Lebak Nilang accounted for 10 sq. km. Previously, the area was to be an auction unit. Since 1987, the status is changed to be fishery reserve. It is so-called ‘fishery reserve’ because the area is not for auction unit but will be given to the appropriate person to manage the waterbodies in such away. Such waterbody is usually negotiated by one pemuka masyarakat to Diskan, then it is given to the local fishermen to manage it. However, it was found that the current fisherman operated in that area is not considered ‘local fishermen’. The fisherman has usually pay some amount of money which is considered a form of ‘annual tax’. Similar case of Lebak Nilang are Lebaks Anak Jeleuh, Anak Kemang and Air Hitam.

The four lakes were divided into three lelang units, with Anak Jeuleh and Anak Kemang being operated together. Air Hitam was operated by someone from Pedamaran, the other two units by locals from the Desa. In addition there were 6 lebung within the lelang system. Three were to the west of the road along which the desa was located. The remainder were on the same side as the lakes. There was also one lebak that was leased separately.

In the whole area, four kilung were operated by leaseholders on the connecting channels. Three of these were on inflow or outflow channels from Lebak Nilang. On the inflow to L. Nilang (S. Muaro Duo) the kilung was operated on a separate sub-lease (valued Rp.600,000). It was not clear whether the other kilung were independent lelang units or sub-leases. The values of the kilung on its two outflows were over Rp.1m each. The sub-lease on the final kilung, on the outflow channel from Anak Jeuleh, had an price of Rp.0.5m.

Penalty regulations

Regulation	Authority
Disobedience to the Government general regulations (tuba etc) will be treated following formal procedure; e.g. first he/she gets warning from Kepala Dusun, then warning is given by Kepala Desa, and then followed by formal procedure.	Formal procedure through the 'pengamin' for the waterbodies which were auctioned. Warning usually is given by Kepala Desa before the case is brought to the police office. It may be solving by 'musyawarah' if unanimity is achieved.

4.2 Relationships between rule-making bodies

Every regulation is informed by the Kabupaten Fishery Service at auction occasion. At the present time, Head of the village has no power to enforce the fishing regulation for the reserve area. The village authority has no attention to the water body since they are given to someone for fishing area. They did not know wether the waterbody is a reserve or an auction unit likes other waterbodies in this village.

4.3 Monitoring of regulations

Monitoring was done by the winner of the auction where he gets authority for fishing. Sometime the winner hires a guard to monitor illegal fishing in his waterbody especially during the dry season when the fish concentrate in limited areas such as in 'lebungs'.

4.4 Enforcement

For the last 10 years there were very few cases where people are given warn either in free fishing area (the River Komering) or in the leased waterbodies. Everyone did electric fishing was caught, but our respondent did not know what further actions taken by government in this case. The Kepala Desa get impression that this is due to the lack of law enforcement. It is impressed that 'pengamin' has a strong leadership and strong security organisation.

4.5 History of arrangements

Annual auction system in South Sumatra begun since long time ago under 'Marga Government System' . The objective of the system is to reduce social conflicts and to provide fair and equal access to a valuable natural resource which is belonged to marga area. The marga also have revenue from the auction. Another important benefit of the auction is once the fishing rights is allocated fishermen are warrantied to have employment for the entire year. Kepala Desa specifically say that the community want to work in an auction units to avoid friction within the community and to avoid thieves which commonly happened in the free-fishing area as the River Komering.

4.6 Known conflicts / problems

Letter of Decision issued by 'Bupati'', the Head of Ogan Komering Ilir Regency (No. 180/SK/Bappeda/1987; dated October 1987) declared that Lebak Teluk Gelam, Lebak Teluk Purun, Lebak Air Hitam and Lebak Nilang including their surrounding waterbodies as tourism and fishery reserve areas. Based on this letter of decision is mention forest deterioration is restricted. However, actually those fishery reserves were used as fishing areas by four chosen persons of the village . The waterbodies holder obtain the rights for fishing in the waterbodies from the persons who get authority at the regency level. Because of these activities, those waterbodies are not different from other waterbodies which were auctioned. The waterbodies then can be sub leased and sub-sub leased to other persons. The Kepala Desa also mention that if these waterbodies are really declared as reserves, he can make fishing arrangements for those reserves such as allowing to use specific fishing gears, establishing close season or other regulations needed.

5 Fisheries economics and benefit distribution

The fishery was operated by a complex mixture of leasing, sub-leasing, licencing and open-access fishing.

Most information was gathered on Lebak Nilang. The size (10 km^2), dry season depth (5m) and vegetative cover on the lake made this difficult to fish out by any co-ordinated operation. Fishing on the lake itself was undertaken by licence holders. These paid a fee for the right to fish for the year, with the amount paid dependent on the gears used. One boat (with a crew of one or two) paid Rp100,000 for a year if they were using tajur (hooks) and/or serampang (spears). There were around 25 such boats this year. A further six boats had paid an unspecified but higher amount to use jala (cast net) and jaring. Fishermen were not required to sell their fish to the pengamin - a feature of a number of lelang arrangements on the Lempuing. Fish traders were however required to pay a flat fee of Rp125,000 per

year to operate on his lake.

An additional interview with a former leaseholder indicated the relative significance of different gears in different months during the period when he was responsible:

Gear Type	Wet season (musim hujan)						Dry season (musin kemarau)					
Month	10	11	12	1	2	3	4	5	6	7	8	9
Empang/Penetak	XX	XX	XX	X	X	X	X	X	X	X	X	XX
Kilung	XX	XX	XX	X	X							
Bengkirai rotan	XX	XX	XX	X	X							
Jala							X	X	X	X	X	
Jaring (Pukat)	X	X	X	X	X	X	X	X	X			X
Pancing	X	X	X	X	X	X	X	X	X	X	X	X

XX : For penetak catches 300-400 kg/month, while kilung and bengkirai less than 50 kg/month.

Fishing gear allowed to be used is pancing; however, corong, jaring, pengilar and jala were also found in the nearby reserve area.

According to respondents, fishing activity is carried out through the year. However, a significant fish caught is obtained during rising water, that is, from August to December. It was accounted that during September-December, the monthly total fish caught was about 300-400 kg. Other than that period the fishery is not important because the daily harvested fish is only enough for their daily consumption. Fishermen usually operate their fishing gear in the morning (06-10) and the afternoon (17.00-19.00). Fishermen have to spend about 0.5 to 1 hour to reach the Lebak Nilang, from the Desa to the fishing ground.

In the absence of any information about lease costs (and so about local government revenue from leasing), distribution of this portion of the benefit from the fishery was impossible to assess.
Bebas (open access) fishing took place along the S. Komering and on the floodplain that surrounded the lake area during the period of high floods. The involvement of fishermen from the dusun in the oil palm estate was emphasised.

Implications for socio-economic monitoring
The complexity of the conditions under which the fishery is operated will make estimation of the distribution of benefits difficult. The operations on Lebak Nilang are clearly unusual and the monitoring system needed to capture them accurately would need careful design. Much would depend on whether the pengamin operated a kilung. If not, and his revenue was all derived from licences, he would not have to be involved: a sample of licence holders would be sufficient. Not enough information was gathered on the operation of the other three lakes to judge what would be needed there.

The unusual status of the leaseholders on the Diskan reserves may make them nervous of investigations into their income flows. There is a particular danger of an illusion of cooperation combined with systematic understatement of their own benefits.

Some form of survey of bebas fishing is clearly needed. The need to separately monitor the lebungs should also be investigated.

Observations

Status of the waterbodies
From a technical perspective it did not seem obvious that a closed reserve was needed: Lebak Nilang remained deeply flooded (5m) in the dry season and was full of snags and floating vegetative mats. It was thought to be impossible to fish out. Reports on the status of stocks supported the belief that a full reserve would have been unnecessary.

From an administrative perspective the situation seemed less than desirable. If the water bodies were to be operated as lelang units and there was no technical justification for a reserve, these waterbodies might, in the interests of consistency, have been best kept within the lelang system.

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