



MANAGEMENT OF RIVER AND RESERVOIR FISHERIES IN THE MEKONG BASIN

Data Collection and Sharing Mechanisms for Co-management

Report on Systems Requirements for National Management Institutions (“Level 2”) in Lao PDR



Vientiane, February 2004

Management of River and Reservoir Fisheries in the Mekong Basin (MRRF)

The aim of this Component of the MRC Fisheries Programme is to contribute to sustainable management and use of aquatic resources by strengthening reservoir fisheries co-management in the Mekong Basin. This will be achieved by developing improved river and reservoir management strategies, joint preparation of river and reservoir fisheries management plans by users and government agencies concerned and their implementation, and the strengthening of management capacity of all participating stakeholders. Major activities comprise the review of national fisheries management strategies, assessment of present and future river and reservoir fisheries potential, special studies on technical and institutional improvements in river and reservoir fisheries, participatory aquatic resource planning and management implementation, the training of resource users and Government staff in river and reservoir co-management and user community organization.

The Component maintains offices in all four riparian countries. Presently, its head office is at the Living Aquatic Resources Research Center (LARReC), Vientiane, Lao PDR. E-mail: fip@laopdr.com.

Title Illustration:

Staff of Lao fisheries agencies (Living Aquatic Resources research Center [LARReC] and Department of Livestock and Fisheries [DLF]) explore local knowledge of fishers on fisheries in deep pools of the Mekong, Khong island, Champassak Province. While 'local knowledge' is increasingly seen as a valuable source of information on fisheries, information collection still is extractive and not directly related to local management. Photo: Sommano Phounsavath).

**Level 2 System Requirement Report:
Information needs of national management
institutions in Thailand for the co-management of
fisheries**

This report was compiled by Wolf D. Hartmann on the basis of documents provided by Somphanh Champensay and others.

ACRONYMS

AIT	Asian Institute of Technology
ARI	Animal Health Research Institute
CBD	Convention on Biological Diversity
CBFM	Community-based Fisheries Management
CBNRM	Community Based Natural Resources Management
CITES	Convention on International Trade in Endangered Species
CPUE	Catch per Unit of Effort
DAFO	District Agriculture and Forestry Office
DANIDA	Danish International Development Assistance
DFID	Department for International Development
DLF	Department of Livestock and Fisheries
DOF	Department of Forestry
DOP	Department of Planning
EAP	Environmental Action Plan
FAO	Food and Agriculture Organization
GDP	General Domestic Product
GIS	Geographical Information System
IFMP	Indigenous Fisheries Management Project
IUCN	International Union for the Conservation of Nature
JFMP	Joint Forest Management Project
LARReC	Living Aquatic Resources Research Center
LMB	Lower Mekong Basin
LSFP	Lao-Swedish Forestry Programme
MAF	Ministry of Agriculture and Forestry
MLO	Multilateral Organization
MRAG	Marine Resources Assessment Group
MRC	Mekong River Commission
MRRF	Management of River and Reservoir Fisheries in the Mekong Basin
NACA	Network of Aquaculture Centers in Asia-Pacific
NAFES	National Agriculture and Forestry Extension System
NAFRI	National Agriculture and Forestry Research Institute
NEM	New Economic Mechanism
NGO	Non Governmental Organization
NSC	National Statistics Centre
OAA	Other Aquatic Animals
PAFO	Provincial Agriculture and Forestry Office
PFA	Plan for Action
RDC	Regional Development Coordination
SEAFDEC	South East Asian Fisheries Development Center

SIDA	Swedish International Development Agency
SRA	Sustainable Rural Aquaculture
SRR	Systems Requirements Report
STEA	Science, Technology and Environment Agency
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
USAID	US Agency for International Development
VFA	Village Forest Association
WRCC	Water Resources Coordination Committee
WWF	World-wide Fund for Nature

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Section A – Introduction

Preface

This report presents the findings from a number of regional meetings with staff from national fisheries line agencies in the Lower Mekong Basin (LMB), as well as consultations conducted with and materials collected from staff of the national agency in charge of fisheries in Lao PDR, i.e. the Department of Livestock and Fisheries (DLF) and the Living Aquatic Resources research Center (LARReC/NAFRI) of the Ministry of Agriculture and Forestry, by counterparts of MRRF who are also staff members of LARReC and DLF, in the period June 2003 – February 2004.

The information collected was compiled into a country-specific report. The main contributors are listed on the front page of the report.

Annex 4 of the report of Project Planning Workshop (Rome, April 2003), prescribes in detail the format of this Systems Requirement Report (SRR). Many of the line agency personnel, who provided the country-specific information, encountered problems with the requested contents of the reports, because it either overlapped considerably or indicated the need for information which was not readily available.

MRRF refrained from filling in information from literature or other secondary resources in order to make up for any gaps. Instead, the material contained in this report means to reflect the breadth and depth of information easily available with an important “co-management partner, that is, staff of the government agency concerned at national level.

1. Background

1.1 Purpose

Major pertinent documents prescribe the purpose of the project “Data collection and sharing mechanisms for (co-) management”, and, more specifically, the activity of writing up this report, as follows:

- To provide managers and advisors at all levels, but particularly local fisher communities and institutions, with appropriate cost-effective systems and mechanisms for the collection and sharing of data and information necessary to improve the sustainable co-management of their resources. [From the *RD1*];
- To develop guidelines for such data collection and sharing systems, based on a description, for local, national and regional levels, of (i) management institutions (ii) fisheries, (iii) data and information requirements for managers to meet their respective roles, responsibilities and mandates, (i) details of existing and planned data and information sharing and facilitation programmes, in the MRC’s area of operations (that is, the countries of the Lower Mekong Basin) [*Annex 2 of the Letter of Agreement between MRAG and MRC*];
- To write up this information in SRRs, which, subsequently, participants at the Guidelines Development Workshop will review, discuss and synthesize as the basis for developing a manual, in the form of an FAO Technical Paper, for designing and implementing data collection and sharing systems to support the co-management of aquatic resources.

1.2 Report Focus

It was agreed that the content of the SRRs should provide a broad picture of the (i) range of data and information requirements that exists, (ii) typically available manpower, resources and institutional capacity, (iii) structure and operations of co-managed fisheries, (iv) existing and potentially appropriate data collection tools, sources and methods, (v) existing data storage and processing methods (if any), (vi) requirements and opportunities for data and information sharing and (vii) lessons and experiences of previous or existing attempts to develop data collection and sharing mechanisms; this information should be provided for a range of geographic areas in the countries of the LMB, environmental regimes, and fisheries at different management levels. [From *Guidance Notes for Compiling System Requirements Reports*].

Section B – Methodologies

This document reports the information needs for co-management as felt and expressed by staff of the national management institutions DOF.

The compilers of this report collected pertinent information

- in workshops and other events with line agency staff presently involved in fisheries management, including the collection of management information;
- in consultations with line agency staff;
- in a literature survey carried out at DOF.

The schedule (including date and venue) is shown below.

Table 1: Main events for collection of information for SRRs

Date	Event
Regional	
June 2003	MRC/FIP Annual Meeting, Udon Thani
August 2003	Joint Management Committee (JMC) Meeting, Udon Thani
September 2003	3 rd Regional Training Course on Co-management in Inland Fisheries
November 2003	MRC/FIP Technical Symposium, Pakse
January 2004	JMC Meeting, Vientiane
In Thailand	
October – November 2003	Circulation of questionnaires at DLF, Vientiane
November 2003 – February 2004	Interviews with staff at LARReC and DLF, Vientiane
January – February 2004	Literature survey at LARReC and DLF, Vientiane

Section C - Results

1. Description of Department of Fisheries and its stakeholders

1.1 *National and sectoral policy environment*

The main objective of the Lao Government in the agriculture sector is to improve and increase the productivity of all types of agricultural commodities to achieve national food security. In Lao PDR, inland capture and culture fisheries involve wide range of participants in the rural areas. The catch from these fisheries plays an important role in food security as it is mostly consumed by local communities and is an important source of animal protein in people's diets. Apart from this, inland fisheries also provide employment and livelihood opportunities. Fisheries are believed to account for about 8% of National GDP.

The Fisheries Division was created only in 1995 as a distinct unit within the Department of Livestock and Fishery of the Ministry of Agriculture and Forestry. No information on national capture fisheries production has ever been collected in a systematic and comprehensive fashion. Some information has been collected for the fishery in the Nam Ngum reservoir, where collection is relatively easy since the local fishers are only allowed to sell their catches to one middleman. Despite this, information on the small-scale fishery in this reservoir, where the catch is consumed directly and not marketed through the middleman, has been lacking.

Fisheries Development in Lao PDR is confined to Inland fisheries development and management and sustainable freshwater aquaculture including the culture-enhanced capture fisheries and the fishery enhanced aquaculture. With the vast potential of water, wetland and aquatic resources and viewing the magnitude of the decline in fish catch from the Mekong River and its tributaries, the Government of Lao PDR, has given the priority on fisheries development with the strong concern on sustainable aquaculture. The overall policy framework is, therefore gearing towards "the sustainable use, appropriate management and protection of natural resources: forest, land and water resources including aquatic biodiversities".

The national goal for fisheries development during the last decade was to create conditions for increasing fish production from aquaculture and maintaining the capture fisheries, recognizing that about 50% of dietary protein of Lao people comes from living aquatic resources which are important for the food security of the nation.

In 1993, the government of the Lao PDR passed a national policy framework known as the Environmental Action Plan (EAP), which emphasizes that the utilization of natural resources should be consistent with the needs of environment protection and resource management. The EAP focuses on issues related to the management of key resources, namely, forests, biological diversity, land, water, tourism and fisheries.

On occasion of a Consultation Workshop organized by the Water resources Coordination Committee (WRCC 2002) and held in Xieng Khouang in 2002, it was found that the basic foundation for the Program for Action (PFA) of the water sector is the National Socio-Economic Development policy (WRCC 2002). The analysis of the National socio-economic policy indicates that its basic foundation includes the following elements:

- The ultimate aim is to alleviate poverty, minimize gap in the socio-economic status between urban and rural areas, and increase the harmony and understanding among ethnic groups.

- The national economic development is to be based on the wealth of natural resources, especially water and water resources, emphasizing on the improvement of the agricultural production and capability building in the service sector as to support commerce and economic cooperation in the region.
- The social policy focuses on developing the human resources, public health and social welfare with special emphasis on remote ethnic groups in remote areas.
- All people and every organization must protect the environment, natural resources: soil, groundwater and minerals, forests, wildlife, water sources, and air.
- Natural resources management is to be promoted through community ownership.

A specific PFA was developed for each of the 6 water sub-sectors, one of it being the inland sub-sector. The inland fishery PFA is based on the following assumptions of the situation in the sub-sector:

- Fish has been traditionally the main source of animal protein for the population in Lao PDR, especially in the rural community; the people of Lao PDR rely for more than 50% of their dietary protein from living aquatic resources.
- Capture fishery and aqua-culture are the second occupation of over 80% of the rural population.
- In 2001, fish accounted for about 7 to 8% of the GDP with the production of some 73000 tons of which 60% is the aqua-culture.
- Recent studies of fishery sector indicated that the demand for fingerlings in 2000 is about 500 millions while the supply is around 185 millions.

Therefore, the major targets and PFA of the fishery sector are:

- The requirement of aquatic animal products is expected to increase from 14kg/head/year in 2001 to 16kg/head/year in 2005 and 23kg/head/year in 2020 resulting in the total amount of 91,000 tons and 187,000 tons in 2005 and 2020 respectively;
- Increase in fish production through the aqua-culture and enhanced fisheries as capture fisheries have limited potential;
- Undertake the research and development works vis-à-vis the production of some Pangasius and ornamental for both domestic market and export.

The short-term PFA was described as:

- Continue the assessment of Mekong fisheries organized by the Mekong River Commission;
- Strengthening of fisheries information's systems;
- Promote the aqua-culture of indigenous fish species;
- Develop reservoir fisheries;
- Measures to eliminate the use of illegal and destructive fishing gear.

The long-term PFA is:

- Supplementary food supplies to the urban communities by promoting pen-urban semi-intensive aqua-culture with attention to aquatic animal health and good management practices;

- Gradual integration of sustainable aqua-culture farming into the agricultural mixed farming, generating new employment;
- Decentralization of fisheries management.

In 2002, the policy framework for fisheries development and management was set as follows (Phonvisay 2002):

- Holding the view that Lao PDR should adhere to the principle of equitable and fair utilization of the water Resources of the common River and that environmental consideration should be integrated into planning and implementation of major development Project in each catchments area to make sure that those project have no serious adverse environmental impact for the Basin;
- In the spirit of "sustainable use, appropriate management and protection of natural Resources including Aquatic biodiversities" and it is believed that increases in production from capture fisheries may not be possible, the increase in fish production has to come from aquaculture or enhanced fisheries;
- Recognizing the drastic increase in demand of dietary protein mostly from aquatic resources like fish, knowing the low fish protein intake status of the Lao people compared to its neighbors (the average consumption of fish per head per year in 2001: Thailand 25. kg, Viet Nam 20 kg and Cambodia 20 kg), The Lao Government has had executed many developmental plans and now attaches priority consideration to develop its fisheries resources;
- These Resources should be well managed by seeking funds and Know-how to develop technical manpower, fishery infrastructure, credit schemes, processing and cold chain including Marketing avenues and by bridging with regional and international Ventures for the sound exploitation and management of its resources under the umbrella of the "FAO Code of Conduct for Responsible Fisheries".

By the, application of the Government strategy concerning the gradual intensification of its agricultural production moving forwards to the long term diversification, the overall Government targets regarding fisheries products will center around:

- The contribution to food security with more emphasis in supplying more animal protein to the rural area particularly the rural farming communities.
- The contribution to a poverty reduction in the sense of getting a complementary source of income.
- Gradual integration of sustainable aquaculture farming into the agricultural mixed farming, generating new employment for the sub-sector.
- Supplementary food supplies to the urban growing by promoting peri-urban semi-intensive aquaculture (ponds, cages, pens) with attention to aquatic animal health and good management practices different ecosystems, Lao PDR can undertake the research and development works vis-à-vis the production of some Pangasius and ornamental fish designated for both commercial Domestic market and export.

The strategic framework for capture fisheries is the following: The fisheries management should refer to

- The code of conduct for responsible Fisheries (FAO 1995),
- The Convention on Biological Diversity and
- The Convention on Migratory Species.

For the best management practices, some key factors should be considered, for example:

- The decentralization of fisheries management functions to empower local communities and call for its participation on co-management measures including the promotion on the use of good local knowledge and effective traditional management systems;
- Take measures to eliminate the use of illegal and destructive, fishing gears and practice by building awareness on adverse impacts, enforcing regulations and encouraging alternative means of livelihood;
- The introduction of right-based fisheries in some important reservoirs and fishing grounds;
- Promoting awareness of the importance of fresh-water fisheries for local food security (e.g. developing guidelines) rehabilitating and restoring habitats for migratory fish, restocking indigenous fish species and encouraging culture based fresh-water fisheries where appropriate,
- Build and maximize the use of National statistical systems by focusing on clear objectives and results directly related to fishery management decision-making and planning processes;
- Develop national statistical mechanisms and technical development framework on inland fisheries and aquaculture in order to provide a basis for the exchange in information with particular emphasis on the catchments approach, especially in international river basins.

The strategic framework for aquaculture is the following:

- For the development of aquaculture in Lao PDR, the basic principles adhered to poverty alleviation such as: "Social equity, gender equity, environmental sustainability, technical feasibility, economic viability and good governance" should be referred.
- Lao PDR should encourage to incorporate the following elements into the Government development strategies:
 - Investing in Aquaculture development;
 - Integrating aquaculture into rural development;
 - Improving culture-based fisheries and enhancements;
 - Managing Aquaculture Health;
 - Applying genetic to aquaculture;
 - Improving nutrition in aquaculture;
 - Improving food fish quality and safety;
 - Promoting market development and trade;
 - Strengthening institutional support and; and
 - Strong Linkage with regional and interregional cooperation.

1.2 Roles and responsibilities of DLF and other concerned institutions

At the national level living aquatic resources come under the direct control of the Ministry of Agriculture and Forestry (MAF). Within MAF there are three main sectors covering research, policy and extension under the National Agriculture and Forestry Research Institute (NAFRI), the various technical departments and finally the newly formed National Agriculture and Forestry Extension Service (NAFES). Research is

conducted by the Living Aquatic Resources Research Centre (LARReC), policy and planning comes under the Department of Livestock and Fisheries, and extension is the responsibility of NAFES. Enforcement of fishing regulations relating to endangered species comes under the jurisdiction of protected area management within the Department of Forestry.

The Fisheries Division was created in 1995 as a distinct unit within the Department of Livestock and Fishery of the Ministry of Agriculture and Forestry. This was subsequent to a reorganization of the Ministry of Agriculture and Forestry fitted to the New Economic Mechanism (NEM), during which the livestock and fisheries sub-sector was reviewed, and the Department of Livestock and Fisheries (previously named Department of Livestock and Veterinary Medicine) was created.

According to the order of the Minister of Agriculture and Forestry, the roles and responsibilities of the Department of Livestock and Fisheries are the following (MAF Order 1146/02):

- To transform guidance, policies, strategies and plans of Ministry of Agriculture and Forestry into action plan, projects to support development of livestock, veterinary and fisheries in entire country.
- To co-ordinate with relevant agencies (in the same and different ministries, organizations and local authorities) in surveying socio-economic situations, natural resources and their potential uses in livestock and fisheries areas. These will be used as base information for zoning development of livestock and fisheries for all over the country.
- Collecting and compiling information regarding livestock, veterinary and fisheries in the whole country. This includes establishment of statistic and its networking in these areas. The information will be used as guiding and directing for planning and disseminate to all concerned parties such as producers and villagers. For example, in case of disease outbreak, growth or declining rate of livestock and fisheries.
- Inspection, control and quarantine livestock and its products, animal and fisheries in entire country, including import and export from and to other countries.

At the provincial level, living aquatic resources come under the jurisdiction of Provincial Agriculture and Forestry Offices (PAFO), and delegated to its Fisheries Division. At present PAFO is responsible for planning, extension and research, however moves are currently underway to transfer extension to provincial divisions of the National Agriculture and Forestry Extension System (NAFES). The district level is the lowest level of government and all living aquatic resource extension is moved through the Livestock and Fisheries Section of the District Agriculture and Forestry Office (DAFO). There is a direct link between the district, provincial and national levels under the Ministry of Agriculture and Forestry along which planning flows up and technical expertise and operational funding flows down. In theory planning within agriculture and forestry is derived from the local level. Each year villages write and submit requests for assistance to a specific division in DAFO who in turn submits a district plan to PAFO who subsequently reports to the national level. Based on these plans funds and activities are allocated for the following 12 months.

However, with regard to natural resources management, there is one additional, even lower level of public administration, the village. Regarding the rights and duties of the Village Administrative Authorities the Forest Law (which is also applicable to aquatic resources management) states the following (Article 63 of The Forestry Law):

“In the administration of forests, forest land, and forestry activities village administrative authorities have the following principle rights and duties:

1. Organized the implementation of the district's directives regarding the forest, forest land and forestry activities;
2. Implement the assignment of village forests and forest land for individuals and inter village organizations, administer, preserve, rehabilitate, plant, propagate and make effective use according to contract, according to plan and approved regulations from the district Agriculture and forestry office.
3. Publicize, educate and train regarding the significance and benefits of forests, forest lands, marine animals, wildlife, water resources and the natural environment so that people in their villages actually understand [such significance].
4. Monitor and record the conditions of change in forests, the environment and the circumstances of the undertaking of forestry works in their villages, and there after report such to the district Agriculture and Forestry Office.
5. Appoint people to administer forests and forest lands within its village area.
6. Draft specific administrative regulations, for preservation of forests, water sources, marine animals, wildlife and the natural environment within the village for consistency with the actual conditions of that village.
7. Establish fixed occupations for people of its villages in order to restrict and progressively cease the cutting and destruction of forests and protection of the natural environment, making forests and forestry resources returns in abundance.
8. Consider approval for people cutting of wood within its own village according to regulations.
9. Monitor and inspect and prevent the hunting of game and the illegal buying and selling of wildlife.
10. Be enterprising in timely fighting bad activities impacting forest resources, water sources, and the environment such as; illegal logging; burning forests and restricting all acts which are detrimental to the forest resources, marine animals, wildlife and water sources.”

1.3 Institutional capacity and resources

DLF has a total of 74 staff in its headquarters in the Ministry of Agriculture and Forestry in Vientiane, and 819 staff in the district and provincial offices.

Table 2: Distribution of DLF Staff

Technical Expertise	Headquarters	Provincial/District Offices
Veterinary Medicine	30	178
Livestock	25	576
Fisheries	11	49
Total	74	819

Table 3: Educational Level of DLF Staff

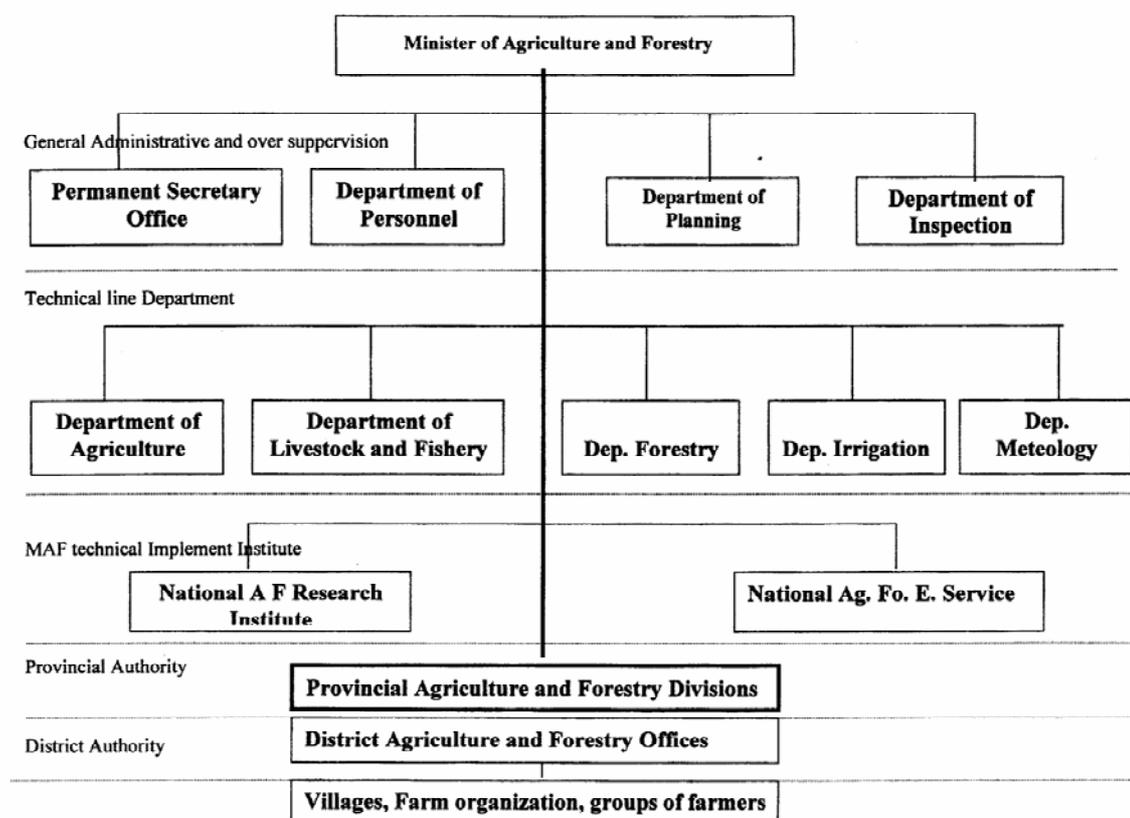
Educational Qualifications	Headquarters	Provincial/District Offices
Ph.D.	2	1
M.Sc.	7	1
B.Sc.	28	50

Educational Qualifications	Headquarters	Provincial/District Offices
Diploma	A7	84
Technician	17	522
Lower level	4	147
No certificate		14
Total	74	819

Fisheries staff is not distributed equally over the 18 provincial offices. For example, the offices at Sayaboury (6); Kammouanne (10); and Savannakhet (11) account for 55% of all provincial fisheries staff.

In 2003/2004, the annual budget (operating costs) of DLF was 650,000,000 Kip or approx. 60,000 US\$ (pers. comm. Somphanh Chanpengxay).

Figure 1: Organizational Chart of the Ministry of Agriculture and Forestry



1.4 Links and relationship with organizations and institutions

The four main groups of stakeholders identified are (i) government agencies (GOs), (ii) multilateral or international organizations (ML/IOs), non-government organizations (NGOs), and the user population ('villagers', 'communities'):

- Main GOs are: Basically the entire government and party apparatus and their mass organizations. However, more specifically, important links are maintained with the Science and Technology Agency (STEA), and the Department of Forestry (DOF), who is in charge of management of aquatic mammals, and the Lao National Mekong Committee (LNMC). Also, there are relationships with government agencies of neighboring countries (e.g. Aquatic and Animal Health Research Institute [ARI, Bangkok]);
- Main ML/IOs are: Food and Agriculture Organization of the United Nations (FAO), Mekong River Commission (MRC); Network of Aquaculture Centers in Asia and the Pacific (NACA); World Fish Center; Asian Institute of Technology (AIT); and Southeast Asian Fisheries Development Centre (SEAFDEC; in February 2003, Lao PDR has become the latest [10th] member of SEAFDEC).
- Main NGOs are: There are no national NGOs; relationships and links exist with international NGOs, such as IUCN and WWF.

Lao villages are well organised. The organisational set up usually in place comprises a village head and village committee (*khana baan*), who are elected by the community; council of elders (*naew hoom*); branches of mass organisations, such as the Party, the Women's Union, a youth group and a village security committee (Phounsavath 1998). The Village Committee takes on the responsibility for the

administration of traditional resource management rights and responsibilities. The Council of Elders provides advice to Village Committee and is often involved in conflict resolution and resource management disputes.

1.5 Description of co-management initiatives

Over the last decade, MRC member governments and line agencies responsible for the management of natural resources have increasingly involved end users in resource management. Users represent a significant resource for enforcement and regulation and defining operational rules. Their understanding and acceptance of rules ensures a high degree of compliance. There are long-standing traditions of fisheries management being undertaken by communities in many areas of the Lower Mekong Basin. Rules on fishing, often associated with spiritual beliefs, are established to sustain local resource levels and to ensure the equitable distribution of benefits. The rules established for traditional, community based fisheries management, whether documented or not, are often *de facto* recognized by provincial and national authorities and their enforcement is supported.

The growing political interest in promoting user participation in resource management has recently led to legislation favoring co-management arrangements whereby local fisheries are jointly managed by public authorities at various administrative levels, local fishers and other stakeholders. In Lao PDR there is constitutional support for local management and customary law. A new decentralization policy launched in 2000 represents a conscious effort to empower provincial and district authorities to actively manage local financial and natural resources to optimize the local development process. The province is the strategic unit, the district is the planning and budgeting unit and the village is the implementing unit. This decentralization process gives formal recognition and status to a process that has been underway for a number of years.

Hartmann (1999) pointed out that, since 1989, there is a growing trend of *decentralising* decision-making in natural resource management to provincial and district levels, and devolution of some management responsibilities to local communities. This is reflected in the Government's present policy strategies which include measures aiming at community management of natural resources, and a "bottom up" approach through the existing village participatory mechanisms. Thus, villages are allowed to make certain regulations regarding local issues, provided they do not conflict with national laws. Externally supported projects are expected to provide a context within which co-management approaches can be developed and demonstrated.

While in general the existing village *organisation* is deemed to be sufficient to deal with natural resource management issues, there are no qualms to establish ad hoc work groups and committees in co-management situations; similarly, villagers are free to collaborate beyond immediate village borders, all of which demonstrates high *flexibility* of user organisation.

Government *support* for fisheries co-management expresses itself in the close working relationships between district authorities and communities, which have been a factor for co-management success. Approval of locally established organisational structures by government staff has been important. External support is sought for training of village groups, as well as technical and organisational training of district level staff. Various co-management initiatives have shown that participatory resource management needs livelihood improvement and development, and technical innovations in fisheries have to be complemented by credit support. Furthermore, the rights and duties regarding resource management of authorities at national,

provincial, district and village level as well as of local communities have to be clarified.

Experiences have shown that not all fishers or fishing communities are able or willing to participate in fisher organizations. Attitudes of fishers towards organizing seem to be strongly and frequently negatively influenced by previous experiences with co-operative organization. Complicated procedures and lack of financial transparency within the administrative structure of co-operatives led to fisher's reluctance to participate in co-operatives. At the same time it was noted that experiences with co-operatives have contributed to a better level of (informal) organization at village level. Where fishers expressed an interest in organizing themselves formally, it was with a view to obtain credit support, protect common interests/legal rights, and exchange fishing experience.

Although it is Government policy to collaborate with local communities in resource management in practice there are few working examples of what is understood as co-management. External projects can provide a context within which co-management can be developed by creating and providing information for policy implementation, and by provision of advice to communities regarding the practical setting-up of co-management arrangements, assisting in conducting Village Aquatic Resource Co-Management Workshops, acting as mediators and similar.

There is a need for improvement of community involvement in resource planning at a wider (supra-community) level. Government support for community-based management has shown itself to be important for local people. Close working relationships with district authorities are a factor linked to success of co-management. Approval of new, locally established organizational structures by government staff has been important.

Villagers face material (in particular, financial) and technical limits in developing new management and production systems. Resources provided by state agencies (fingerlings and others) have been an incentive for villagers to become involved in co-management arrangements. Externally supported project provided funds for training of village technical group at various stages of the co-management process. As part of the introduction of community resource management, small revolving funds were established in some communities based on locally identified needs. This intervention was the catalyst for participatory land use planning and leadership formation. Participatory resource management needs livelihood development and improvement. Technical innovations in fisheries have to be complemented by credit support.

And finally, there is a general need for technical and organizational training of district level staff, in particular in community liaison.

Some co-management initiatives are (not exhaustive):

- *Sephandone Wetland Project*: Since 1996. Development and implementation of aquatic resource management plans drawn up by the community, supported by DAFO/PAFO; includes improvement of aquatic resource management regulation implementation and its enforcement. Creation of conservation zones. DfID/MRAG/RDC Community Fisheries Project, Savannakhet.
- *Community Fisheries, Southern Lao PDR (DLF/RDC)*: Since 1991, PAFO involved in community fisheries. Participating villages have grown from 1 to more than 40, and from 1 district to 13 districts in three Southern provinces. Many of these initiatives have involved stocking with cultured fish. Government's role crucial in providing technical advices, financial assistance and facilitating contact. RDC has been committed to improving

communication links between villages and between government and villages to allow sharing of information and experiences.

- *DfID/MRAG/RDC Adaptive Learning Project, Savannakhet*: A research project on community fisheries and their management in Southern Lao PDR since 1995 in general, and 1999 in particular. In cooperation with district staff of 8 districts in Savannakhet and 4 districts in Khammouane. Based on interest and effort of the 38 villages that are managing community fisheries.
- *Indigenous Fisheries Development and Management Project – SWIM (DLF/ACIAR/IDRC): Management of River and Reservoir Fisheries – MRRF (LARReC/DLF/MRC): 1997 to 2000 at Nam Ngum, Vientiane Province. Since 2000 at four waterbodies (irrigation reservoirs) in Vientiane Municipality and Bolikhamxay Province. Multidimensional (that is, institutional; organizational; technical; financial; communicative) capacity-building of co-managers (users and local government staff) for fisheries management planning and implementation.*
- *Nam Neun Integrated Watershed Management Project, Xiang Khouang (DOF/Danida)*: Survey on nature of community centered use and management of wild aquatic resources within a watershed perspective, driven by the belief that the protection of ecological and cultural integrity in a changing world is best achieved through a variable mix of local knowledge and national and international scientific perspectives (Dubois, Inthavong, & Barden 2002).
- *Joint Forest Management Project (JFMP)*: Started 1994 under the Lao-Swedish Forestry Programme (LSFP) with the development of two different models of Joint Forestry Management for partnership between villages surrounding the Dong Kapo State Production Forest (SPF) in Savannakhet Province. Village forestry has been implemented in about 100 villages involving over 5,000 families in Savannakhet and Khammouane provinces. Forests assigned to certain villages are sustainably managed by Village Forest Associations (VFA) in a partnership with forestry staff from the district and provincial authorities. The VFA have an active role in the decision-making process and determine also the use of benefits from forest management.
- *And others.*

2. The Fisheries

Lao PDR covers about 202 000 km² of the total Mekong catchment, which accounts for about 97 % of the total area of the country. It contributes some 35% of the average annual flow of the Mekong. However, the data on living aquatic animals are limited. Most fishing in Lao PDR is subsistence fishing, although there is significant commercial fishing in the Nam Ngum Reservoir.

2.1 Resources and Environment

2.1.1 Stocks/fisheries and area of operation

Inland Fisheries

Typically water bodies can be divided into streams, rivers, natural lakes or swamps, rice fields and irrigation reservoirs. Fishing activities are dependent on what types of water resources are available both temporally and methodologically.

Small water-bodies such as lakes and reservoirs, as presented above, have been the focus of a number of studies in Laos in the late 1990's. They form an extremely important source of fish for communities living in a flood plain environment. Bush (2002) analyzed fisheries in three districts in Savannakhet Province. The main species identified in water bodies are *Channa striata* (Pa Kor) and *Clarius macrocephalus* (Pa Duk). Also of note are *Chitala ornate*, *Chitala balnci* and *Chitala lopsis* (collectively known as Pa Tong), and *Hemibagrus* spp. (Pa Keng). These species are also known to be abundant in still water bodies. *C. striata*, *C. macrocephalus* and *Chitala* spp. appear to be most important in places like Chumphone where seasonal flooding and irrigation reservoirs, provide a large area of habitat in the wet season for these species.

Riverine fisheries: The species caught in the Mekong included *Cirrhinus microlepis* (Pa Phone), *Micronema micronemus* (Pa Nang), *Belodontichthys truncates* (Pa Kop), (Pa Ke), *Hemibagrus filamentus* (Pa Keung). All of these species are migratory some degree, either over large distances such as *C. microlepis* or between rice field and riverine environments such as *H. filamentus*. Riverine species identified as being most prevalent in the Chumphone river included *Chitala* spp. (Pa Tong), *Micronema micronemus* (Pa Nang), *Wallago attu* (Pa Khaw), *Belodontichthys truncates* (Pa Kop), and *Cyprinus carpio* (Pa Nay). All except *C. carpio* are high value native species.

Most of the communities interviewed caught fish in their rice fields. A greater proportion of villages interviewed used their rice field fisheries all year as a result of presence of irrigated dry season rice crops. However some communities only used their rice field fisheries in the wet season, as there is very little irrigation available.

Most fish species depend on different habitats at different stages of their life and at different seasons of the year. In general, seasonal floodplains are used as feeding and reproduction habitats by a large number of important Mekong fish. Outside the flood season, fish stay in dry-season refuge habitats, mainly in permanent lakes and pools or within the river channels. Certain stretches of the Mekong and its major tributaries contain deep pools, which are particularly important as dry-season refuges.

The separation of major fish habitats forces fish to migrate and is a conspicuous feature of the life cycle of most fishes. Some species migrate only short distances between permanent and seasonal water-bodies on the floodplain. These species are often referred to as 'blackfish'. Important examples of Mekong blackfish include snakeheads, gouramis and *Clarias* spp. catfishes, all of which breathe air and can survive in anoxic conditions as waters recede and stagnate.

Other species migrate long distances, often from dry-season pool habitats within river channels to flood-season feeding habitats on the floodplain. These species are often referred to as 'whitefish'. They tend to be more fragile and less tolerant of poor water conditions. Some whitefish migrate short distances within the river channels, whereas others migrate very long distances. Examples include most of the carps (cyprinids) and river catfishes (pangasiids).

The division of Mekong fish species into 'blackfish' and 'whitefish' is simplistic but useful for describing two dominant life cycle strategies. It is also useful for categorizing species according to their management requirements - blackfish require primarily local management, while whitefish are more trans-boundary in nature.

Kottelat (2001) identified 500 of the 1,200 fish species found in the Mekong Basin in Lao waters. Main threats to fish biodiversity are: Forest loss (lack, of detritus; increased temperature; turbidity; decrease in habitat diversity); Pollution (organic waste from domestic refuse and sewage, and from industries; agricultural pesticides

and herbicides); Species introductions (22 non-native fish species, 11 deliberately introduced, and more have been introduced accidentally); Flow alteration and water diversion; Fishing (signs of overfishing near populated areas; illegal gears).

Aquaculture

Aquaculture development in the Lao PDR has had a relatively short history beginning in the 1950's with assistance by the Japanese and United States governments. Subsequent effort has addressed increased food security and income through small-scale rural aquaculture extension (SRA) targeting a population considered one of the poorest in the world.

Later intervention in the country included three phases of a UNDP/FAO project that ran from 1980 to 2000. Over the 1990s the Asian Institute of Technology developed fish nursing and spawning networks which are now activities of the Regional Development Coordination (RDC) for Livestock and Fisheries in the Southern Lao PDR. In recent years the JICA funded Aquaculture Improvement Project (AQIP) has begun work in various parts of the country.

Bush (2003) analyzed fish farming in 3 districts in Savannakhet Province. He points out the following characteristics:

- *Stocking densities* - The highest stocking density was found in Khantabouli and the lowest in Outhomphone, possibly indicating a higher level of access to technical support and knowledge in Khantabouli (Table 1). Khantabouli also has the largest pond area indicating a higher level of investment in fish stocks. The low level of stocking in Outhomphone also indicates the lack of a reliable water supply for the entire growing season.
- *Species stocked* – *Hypophthalmichthys nobilis* (Richardson, 1845) and *Cirrhinus cirrhosus* (Bloch, 1795) are the most common species stocked in all three districts. In comparison, *Oreochromis niloticus* (Linnaeus, 1757) and *Clarius gariepinus* (Burchell, 1822) are the least stocked fish. In Chumphone, over half of the ponds (52.8%) have no stocked fish indicating either a reluctance to adopt fish culture or alternatively, the higher prevalence of wild fish caught in ponds. In comparison 81.3% of ponds in Outhomphone contain wild fish. *Tilapia* spp. (Pa Nin), *Puntius goniotus* (Pa Phak) and *Cyprinus carpio* (Pa Nay) appear to be the most frequently occurring.
- *Feed* - Locally sourced feeds are most common across all three districts including rice bran (58.3%, n = 2468), termites (12.1%) and buffalo manure (8.6%). Overall, 36.6% of ponds had no feed at all and no pond owners reported using commercially processed feed.
- *Use of Fish* - Fish production is predominantly for household consumption, a pattern consistent across all three districts. In Khantabouli however, one fifth of pond owners produce fish for sale only, a much higher proportion than the other districts. In Chumphone, around one quarter of pond owners neither sells nor eats stocked fish. Around the same proportion (26.9%) do not stock ponds with any fish showing a high degree of pond redundancy in that district.

Aquaculture has been estimated to make up 10% of the total fish catch in Laos, and in Southern Laos aquaculture is estimated at 2% of the total catch (Bush 2002).

2.1.2 The environment

The Mekong River Basin hosts one of the most diverse freshwater faunas in the world. There are 1,200 recorded fish species and the number will increase as new species are discovered and classified. Diversity among other groups of freshwater

animals (frogs, snakes, crustaceans, molluscs and insects) is also high. Diversity is based on a wide range of permanent and seasonal habitats, which are a result of the Mekong Basin's complex geological history.

The hydrological cycle is the main physical parameter influencing the river's ecology. The annual flood-pulse caused by the monsoon rains is responsible for the creation of vast floodplains in the Mekong Basin. These floodplains are highly productive for fish and other aquatic animals.

Most fish species depend on different habitats at different stages of their life and at different seasons of the year. During the flood season, most Mekong species take advantage of the floodplains for feeding, breeding and rearing their young. Outside the flood season, fish stay in dry-season refuge habitats, mainly in permanent lakes and pools or within river channels. Certain stretches of the Mekong and its major tributaries contain deep pools, which are particularly important as dry season refuges.

The separation of major fish habitats in time and space forces all Mekong fish to migrate. Some species migrate only short distances between permanent and seasonal water-bodies on the floodplain.

Important examples are snakeheads, gouramis and *Clarias* spp. catfishes. Other species migrate long distances from dry-season pool habitats within river channels, to flood-season feeding habitats on the floodplains. Examples include most of the carps (cyprinids) and river catfishes (pangasiids).

The Lower Mekong Basin has three major migration systems that are interconnected. The Lower system extends downstream from the Khone Falls, and includes the Tonle Sap River and lake system in Cambodia and the Mekong Delta in Viet Nam. The Middle Migration system runs from above Khone Falls to the Loei River. Within this system, floodplain habitats are connected with the large tributaries on both sides of the Mekong. The Upper Migration system stretches upstream from the Loei River. This system is characterized by upstream migration to spawning habitats near or in the Upper Mekong Basin. The Mekong giant catfish is a well-known member of this migration system.

The hydrological profile of the river environment also plays an important role in linking different ecological elements of the system. The same water flows between different river sections and habitats and is the integrating element of a large aquatic ecosystem. This holistic view is particularly important when considering fish migrations and water resources management.

The Middle Migration System runs from above the Khone Falls to the Loei River. Within this section, floodplain habitats are mainly connected with the large tributaries on both sides of the Mekong. Seasonal movements of migrating fish from mainstream dry-season habitats to floodplain Fisheries in the Lower Mekong Basin: Status and Perspectives feeding/rearing habitats are via these tributaries. In general, at the onset of the flood season, fish move upstream within the Mekong mainstream until they reach the mouth of one of these major tributaries from which they eventually reach the floodplain habitats. At the end of the monsoon the migrations reverse from the floodplains through the tributary rivers and back to the Mekong mainstream where fish spend the dry season in deep pools. There are complex interconnections to the lower migration system with many of the same species following both patterns, either as different, genetically distinct populations, or at different stages in the life cycle of the same population.

Most of the 25,000 reservoirs in the Lower Mekong Basin have been constructed for irrigation. The larger ones were built for flood control and electricity generation. Reservoirs are normally constructed by damming rivers or streams and they interfere

with the natural migration of fish to the point where some species eventually disappear. The reservoir fish fauna then becomes less diverse.

There are few fish species in the LMB well adapted to living in a lake environment. However, large reservoirs tend to be built on major tributaries and conditions upstream may provide riverine fish recruits. A good example is Nam Ngum reservoir in Lao PDR, where over 50 riverine fish species are thriving and where introduced exotics, including tilapia, have failed to proliferate. A few Mekong species are well adapted to the reservoir environment and can complete their whole life cycle within the reservoir.

In most small reservoirs, a variety of cyprinids and blackfish are exploited on a subsistence or semi-commercial basis using gill nets and traps. In larger reservoirs fishing operations include big lift nets. Small-scale operators living in communities surrounding reservoirs typically dominate reservoir fisheries. Frequently, the construction of a reservoir has given local people access to a new fish habitat and resources about which they have little knowledge. In Thailand, small reservoirs have been constructed and stocked with fish under community development projects by the Department of Fisheries. Fish are harvested on a specific fishing day, when tickets are sold to participants from inside and outside the village. Stocking of reservoirs by the Thai government is largely undertaken to serve social purposes rather than to optimize economic or biological yields.

2.2 The Fishery

Lao PDR is the only landlocked country covered in this report. The country is amongst the poorest in Southeast Asia. It comprises some 202 000 km² of the total Mekong catchment which accounts for about 97 percent of the total area of the country. It contributes some 35 percent of the average annual flow of the Mekong. Freshwater resources are dominated by rivers and the country includes some of the most pristine of all the Mekong tributaries. River fisheries dominate the sector. Floodplain/swamp fisheries occur in localised areas and are generally more common in the south of the country than in the north, although nowhere are they extensive. The country has one large reservoir, Nam Ngum, with modest production and a number of smaller reservoirs used for hydropower and mainly irrigation. Rice agriculture is widespread and is being intensified although pesticide use is currently less than elsewhere in Southeast Asia.

Lao PDR still has some impressive fisheries, mainly river-based. Population density is quite low and there is much potential for river capture fisheries to develop further. Aquaculture is poorly developed by Southeast Asian standards. This is likely partly due to the low level of marketing opportunities but also through competition from wild fisheries (including rice field fisheries). Information on trade is inaccurate but Lao PDR is likely a net exporter of fish. Considerable quantities of fish pass informally between Lao PDR and Thailand, especially in the south and along the Mekong River, which forms much of the 1,800 km international border between the two countries.

Table 1 shows the different water resource areas and their productivity in the year 2000 (Souvannaphanh, Chanpengxay, & Choulamany 2002). Previous studies of capture fisheries in southern Lao PDR were conducted in Kong falls area where there is a traditional fishery targeting migratory species. These studies produced useful data on catch effort for some fish species and can be used for managing the resource.

Table 3: Topology of national inland fisheries in 2000

Fisheries	Water resources	Total area	Productivity (kg/ha/yr)	Total production (tons/yr)	%
Capture	Mekong river and 14 tributaries	254,150	70	17,790	25
	Reservoirs	57,025	60	3,421	4
	Shallow irrigation and small reservoirs	34,460	150	5,169	7.4
	Swamps and wetlands	95,686	30	2,870	4
Aquaculture	Fish ponds	10,300	1,000	10,300	15
	Rice-fish	3,050	150	475	0.6
	Rainfed rice and irrigated rice-field	477,176	50	23,850	34
	Small natural ponds, oxbows and irrigation weirs	12,934	573	7,441	10
Total		944,781		71,316	100

The actual record does not determine the species, but it weighed separately scale-less and scale, small and large fish for selling purposes. The main species caught are listed in Appendix I at the end of this paper. According to 1999 studies by the Mekong River Commission's Assessment of Mekong Fisheries Component, fishers used more than 20 different types of fishing gear and methods. The most frequently used methods were stationary, drifting gill net, long-line, cast-net, traps, hook with line, small scoop net and other traps.

2.2.1 Status and trends

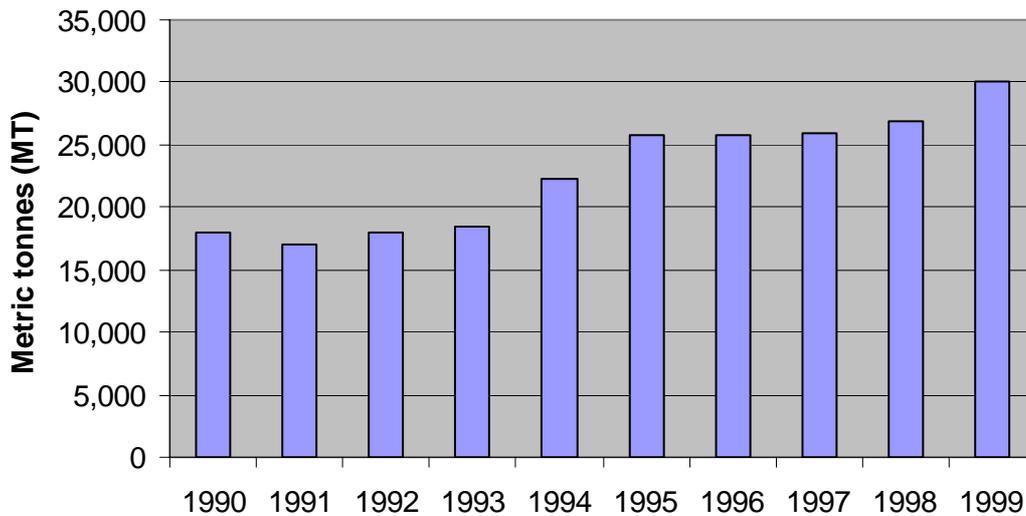
The following is based largely on Coates (2004). The official production figures, both for capture and culture fisheries, are based entirely on estimates. In some cases these are more accurately described as guesses. These may or may not include extrapolations using previous documented estimates and, needless to say, may not reflect actual production. Official estimates are derived from yields per unit area for reservoirs and rice/fish culture and a standard figure for river fisheries. The latter figure has not changed much over the years and originates from a study by the University of Michigan in 1973. Singh (1990) re-estimated total production and included more realistic estimates for reservoir fisheries. Again this was based on no sampling data from Lao PDR. This estimate has been used as the basis for recent statistics submitted to FAO.

Fish production

The recent official figures for total production from inland capture fisheries are shown in Figure 2 (Coates 2003). The reported increase in production since 1993, and variations between years, are assumed to be explained by re-estimates or perceived increased production from reservoirs. There is no sampling or statistical basis to the information reported in Figure 2.

A household survey was performed by NSC in 1992 comprising 3000 households in 147 villages in 18 provinces. The survey included a limited number of questions relevant to fisheries. The summary information suggests that nationally about 66 percent of the households interviewed own at least one fishing net. The NSC has also developed a "Village Book" for the regular reporting of various data.

Figure 2: Reported total production inland capture fisheries



There have been a number of localised studies of capture fisheries, notably in southern Lao PDR., e.g. in the area of Khone Falls, where there is a traditional fishery targeting migratory fishes. This work includes some excellent and extremely valuable time-series data for catch-effort for this fishery but is of limited use for estimating production.

Recently, research and survey work has enabled a reasonable re-evaluation of the likely capture fisheries production. Sjørsløv (2000) reported results of a sampling survey of fisheries in Luang Prabang province in the northern part of the country. This mountainous province has high terrain gradients and there are no significant lakes, reservoirs or swamps. There is an extensive network of rivers and streams, which is typical for such areas. A second major aquatic resource is rice-fields. Aquaculture is poorly developed. The area is regarded as one where capture fisheries production, on average, would be at the lower end of the range for the Mekong Basin. Even so, catches of individual fishers have a mean of 54 kg per year with a variance of 30-78 kg. Although not spectacular by capture fisheries standards the significance of the catches is considerable because participation in the fishery is very high. Final estimates were reached with some degree of confidence by combining a number of approaches. The use of fish consumption data injected considerable confidence into the overall estimates both as a way of calculating total production and as a check against catch-effort data. The survey concluded that total production from capture fisheries was between 10 000 and 15 000 MT per annum (as much as half of which is processed locally after being caught). Two main factors contribute to the under-reporting: First, it is understood that official reports cover only what is considered to be "proper" ("professional") fishing. Second, they only include finfish landed at regular marketing sites (the survey showed that most fish is not formally marketed and between 20-30 percent of the total catch is not fish but composed of a variety of other taxa – crustaceans, molluscs, insects, amphibians etc. taken especially from rice-fields).

Where imports and exports are known (either nationally or locally) then fish consumption figures can be used to estimate fishery production and are a very credible check for local statistics. As already noted, Lao PDR is unlikely to be a significant net importer of fish, and has no marine fishery. Therefore, most fish consumed will be produced domestically. Lao PDR undertook an Expenditure and Consumption Survey in 1997/8 based upon a nationwide household survey. The

resulting estimate of national fish consumption (= production) for Lao PDR is in the region of 200 000 MT (Sjørslev 2000). The largest potential source of error in the calculation arises from figures for processed fish (both consumption data and fresh-fish conversion factors). The survey data produced an estimate of consumption (production) of 100 000 MT per annum for fresh finfish alone. The estimate of 200 000 MT per annum is considered reasonable and equates to an average of about 36 kg per caput per annum which is realistic for a country in Southeast Asia with good water resources and a predominantly rural/agricultural population. The proportion of this arising from the various sub-sectors has yet to be calculated but aquaculture is known to represent only about 14 000 MT nationally in 1998, which was re-estimated at 30 000 MT for 1999 (7 to 15 percent of the total production). Production from rice-fields, however, is significant. A conservative estimate of capture fishery production of about 150 000 MT per annum is 5 times the officially reported annual figure.

Aquaculture

Rural areas in Lao PDR are typified by their self-reliant subsistence agriculture operations. Agricultural surplus is minimal and livestock production is still at a relatively undeveloped stage. Fish culture is constrained by the lack of seed, supplemental feed and manures. Technical information and extension services are hard to obtain, due partly to the low population density and poor communication between villages. Fish culture in ponds and rice fields is widely practiced and a variety of systems are used depending on the agro-climatic characteristics of the area. The attraction of aquaculture to rural farmers is most obvious in locations where capture fisheries are inaccessible or require excessive effort for a limited catch. There is a small amount of cage culture in reservoirs and rivers but this system presently makes only a small contribution to national production. Most ponds are hand constructed and shallow, with water depths less than 50 cm. Low productivity figures for aquaculture ponds reflect the limited amount of inputs applied, limited stocking of fish seed and a short grow-out season. A diverse number of species is cultured, including exotic carps and indigenous fish. Upland rain fed and irrigated rice fields with terracing are common in Lao PDR. This limits the size of individual paddy fields and farmers are reluctant to further reduce rice production area by cutting channels or constructing refuges for fish. In some areas water is supplied to the paddies from small diversion irrigation systems. Where these are present, the requirement for deep-water refuges is reduced as water is continually replenished in the paddy. Upland areas are also cooler so high water temperatures are less problematic. Where irrigation is used (usually from stream diversion), rice-fish culture is more successful. Typically, common carp is produced and spawn naturally in rice fields and adjoining ponds. This activity is extremely popular since farmers can produce fish seed themselves and no cash is required for stocking.

Aquaculture development in Lao PDR has been a tradition: lessons learned from the neighbors China, Vietnam and Thailand. Fish seed farms were built in many provincial capitals during the Indochina war period, especially during 1960 with USAID assistance in Vientiane, Savannakhet, Pakse, Sayaboury and Luang Prabang. In early 1970s hatcheries were constructed in Houaphanh, Xiengkhouang and Oudomxay with the assistance of China and Vietnam. From 1997 onwards a number of externally assistance donors particularly FAO/UNDP have been assisting continuously the Government in aquaculture development: Capacity building, extension, fish seed production demonstration, fish culture techniques, information on technologies, rehabilitation of some hatcheries etc. By the end of 2001, there were a large number of hatcheries scattered throughout the 18 provinces of Lao PDR, 30 existing hatcheries, of which 17 belong to provincial governments and 13 belong to private farms, and 9 new hatcheries are under construction. This will be the basic infrastructure for the expansion of aquaculture in the near future.

2.2.2 Numbers of fishers

No numbers of fishers or fish farmers are available. However, in Luang Prabang Province it was found that 66% of households have a net, and 83% are involved in fisheries, 41% of household members, 20% of which are children.

2.2.3 Gear types

Claridge et al. published a survey on techniques and issues of community fisheries in Lao PDR (Claridge, Sorangkoun, & I.G.Baird 1997). For them, the sheer diversity of fishing gear makes it difficult to classify them in any systematic way. They classified fishing gear into 20 major groups, from scoop nets and baskets to explosives. Dubois looked into gear use by gender and age in the North East of the country (Dubois, Inthavong, & Barden 2002).

Bush (2002) identified certain fishing techniques which were primarily used in certain habitats. Thus, the fishing techniques most prevalent across all villages exploiting stream fisheries were drift nets, throw nets and hooks. Fixed structures such as lift nets and those traps were not as prevalent. Driftnets, cast nets and hooks were the most utilized fishing gears for lakes and reservoirs; in addition to these spears were used, common to open water fishing areas. These methods with the exception of traps are easily accessible to the general population fishing a water body such as a lake or reservoir. In riverine fisheries, all fish are caught by throw nets, drift nets, traps and hooks. All with the exception of traps are either used from the shore or from boats. A lot of the fish caught in these fisheries were converted to *Pa Dek* and sold in market. This was one of the ways to account for the large amounts of fish that were caught, up to 150kg per day in Na Pho and Taa Seno during the wet season.

The capture fisheries of the Lower Mekong Basin have a centuries long history of catch technology, local resource knowledge, fish processing, marketing and social organization. The fishery is highly diversified and adapted to its variable and complex environment. Floodplains, swamps, rice fields, canals, streams, tributaries, main river, lakes, estuaries, and large and small reservoirs are exploited. A wide range of fishing methods are used to catch all types of fish and other aquatic animals. The methods include traps, hooks and lines, gill nets, drift nets, drift seines, drag seines, encircling seines, frame trawls, lift nets, cast nets, river barrages with associated trap systems and extended floodplain/lakeshore fences with trap systems. The methods have considerable design variations and size ranges. Much of the technology is indigenous to the Basin or has been extensively adapted to local conditions. Most of the fishing gear and boats used are of traditional design and are manufactured with extensive use of local materials. The major items of recent origin are twine, netting material and engines. An important aspect of catch technology is the ecological knowledge applied by local people in their fishing activities. Most fisheries activities are based on an intimate knowledge of fish response to seasonal environmental changes.

2.2.4 Seasonality

Different habitats are fished at different seasons (Bush 2002). The stream fisheries also exhibit seasonality. The main periods of fishing over the three districts are at the start and end of the wet season. This was described by fishers as the times when fish migrate into and out of the small streams.

Lakes and reservoirs: The seasonality of lake and reservoir fisheries is also indicative of the importance of these fisheries to communities in the three districts (Figure 10). Every respondent in Chumphone indicated that they utilized lakes and/or reservoirs

in all months of the year. Those in Khantabouli and Outhomphone however indicated a large degree of seasonality. Khantabouli communities appear to use the lakes and reservoirs in wet season whereas communities in Outhomphone fish them in the dry season. The three very different patterns of utilization may again be a function of differing access regimes. Water bodies in Chumphone such as Souie and Bac, being open access and holding water all year round, appear to attract fishers every month in some capacity. Khantabouli and Outhomphone water bodies experience very different hydrological regimes. The Mekong and small tributaries seasonally flood those in Khantabouli while those in Outhomphone are rain fed and provide a source of fish through the dry season while small streams provide fish throughout the wet season.

Riverine fisheries: Both Na Pho and Taa Seno exploit the Mekong fishery at the start of the wet season, from May to July. During this time a number of migrations occur. Dong Khameun and Khengkok Dong differ considerably in their exploitation of the Chumphone River. Dong Khameun is 12 km away from the river and reported only fishing there from March – May while Khengkok Dong, on the banks of the river, fished there in some capacity all year round.

Rice fields: Most of the fishing in rice-fields occurs during the rise and fall of the seasonal flood. However, fish and other aquatic animals are exploited throughout the wet season.

2.2.5 Management and tenure

There are no exclusive *property rights* regarding natural resources. All natural resources are considered “national common property”, with overall management the responsibility of the state, but with the participation of individuals and communities. A promotion of a sense of local resource ownership is based not on legal title, but on the acceptance by the government of *de facto* rights of management by local people, which is based on the central state’s awareness of its limited capacity to manage at the local level. Most local management is based on traditional practices which are highly specific for different fishery environments and seasons. Thus, while property rights are diverse and well adapted to changing ecological and social conditions, they are no *secure*.

Fisheries management regimes differ according to the specific ecosystem exploited. In the case of ponds (*nong*), there is a tendency towards private ownership. Stocking of ponds or planting of lotus flowers may lead to (temporary) privatisation of aquatic resources. Fisheries in small water bodies (small tributaries, backswamps, oxbow lakes, natural depressions, reservoirs, etc.) are under *de facto* control of local communities, either for individual use by all community members, but not necessarily outsiders, or for exploitation by and for the community, as opposed to individual rights. In the latter, fish is sold to generate community income, and also consumed at village social occasions. Community fisheries may overlap with rights for individual subsistence use. Stocking plays an important part in the functioning of community fisheries. The communal investment appears to legitimise the communal control of resource exploitation. Ease of enforcing access restrictions is a key criterion in the selection of water bodies for community fisheries, located in the vicinity of villages report that small water bodies are also “rented out” to private individuals. Apparently this was a common practice before 1975, which later was banned up until 1990, when certain policies were relaxed. Today villages consider renting out on a yearly or seasonal basis stocked or unstocked village ponds to (groups of) individuals, frequently from the same village, an appropriate strategy to generate community income. In contrast (and not surprisingly), the open water of rivers like the Mekong and reservoirs such as Nam Ngum are open-access fisheries, which come under provincial and national management. While these waters are open-access,

temporary or permanent fish sanctuaries have been established by the concerned authorities with (Sepandhone Wetlands) or without (Nam Ngum Reservoir) consultation of fishers. In the latter case this (coupled with unclear demarcation of sanctuary boundaries) has led to frequent infractions of regulations by local fishers. Still, it was found that at Nam Ngum the majority of villagers agree to the idea of establishing a village management zone and fishing boundaries. Similarly, the majority agrees to the establishment of a (non-exclusionary?) license system. Furthermore, at Nam Ngum, a last important management function (and property right?), marketing, has changed over time from a state centralised to co-operative and finally leasing system.

In the districts analysed by Bush (2002), only one village, Khok Nyay in Outhomphone, had a form of management over their stream fishery. This consisted of restricted areas for fishing that were fished once a year at a village fishing day. This system appears to be possible in this case because Khok Nyay is the only community exploiting this particular fishery.

Lakes and reservoirs: The smaller less productive water bodies are more often close to the villages that are responsible for them and restrict fishing activities of other communities that come to fish them. The larger water bodies are too large for any control by single communities and as such are open access fisheries. Coupled with the high productivity of these water bodies fishers appear to be willing to travel up to 12 km to fish in them.

There were specific tenure regimes on some of the water bodies that affected their use. Two communities in Outhomphone, Non Dok Mai and Anhung Nyay, indicated that their small lakes were fished once a year at a fishing day (a *Pa Paa* in Lao). This is similar to systems found all over the country. Another system identified in Outhomphone was the use of the community fishpond when work was done or officials came to visit. Another management system was found in Dong Deng village. They rotate a fishing day of a local large Waterbody, Nong Lai Khon, with four other communities. The rotation is made on a yearly basis and funds from the day go to the village fund. Other systems of management of water bodies included Phon Sim village in Khantabouli where fishing was limited in Bung Kham to a designated fishing group.

Arthur and Garaway analyzed water tenure and management practices in small waterbodies in Savannakhet (Garaway & Arthur 2002). 'Group fishing' was the first system of management that got the DLF in Savannakhet excited about community fisheries back in the early 1990's. Promoted as 'ideal strategy', group fishing will only be beneficial in proportion to the amount of effort the village puts in to harvesting it. 'Renting': The most obvious benefit of renting a waterbody is that the village does not have any responsibility for monitoring the waterbody, enforcing regulations or harvesting fish. It therefore requires little effort on the part of the village.

'Fishing days', a tradition that in some cases goes back hundreds of years, have begun to re-establish themselves. Research suggests that, on average, more fish is harvested in this system than the others. Other benefits include;

- an inclusive system with men, women and children all participating on the fishing day.
- a social occasion where households and maintain and strengthen links.
- a transparent system of harvesting
- the villagers' catch is generally worth more than the ticket price, thus households benefit directly.

As stated by Claridge, Sorangkoun and Baird (1997), little is known of traditional fishery management in Laos. In many places elements of traditional practices survive, and these are being modified to meet changing situations. These local management measures can be grouped into: areas permanently or seasonally closed to certain activities; prohibitions or limitations on specific harvest techniques; and protection of particular fish species (Claridge, Sorangkoun and Baird 1997).

Lao PDR being a socialist country, all resources are considered “national “common property”, with overall management the responsibility of the state, but with the participation of individuals and communities. Before 1989 state farms, collectives and co-operatives took the place of individual ownership and production arrangements. In reality however, problems inherent to collectivisation and the state’s limited scope for management of natural resources meant that, on one hand, unsustainable resource use occurred, and on the other, local traditional systems of tenure and management persisted.

In general, fisheries are considered to be a fundamentally important commons resource that all Lao people should have access to for subsistence purposes. There are no exclusive property rights. It is basically open-access, but governed by gear and similar restrictions. So close attention has to be given to the impacts of any exclusionary measures on the poor or other groups who traditionally maintained access to various common property fishery environments. In fact use rights are in practice influenced by proximity to resource, kinship and social status (Baird 1999). Sometimes small streams and backswamps are associated with a particular village, and there is an association of the spirits of these natural features with the village in question. The promotion of a sense of local resource ownership is based not on legal title, but on the acceptance by the government of *de facto* rights of management by local people. This in turn is based on the central state’s awareness of its limited capacity to manage at the local level, leading to an approach that emphasises co-management in use and conservation of natural resources.

Community management of forest, land and water resources is longstanding and widespread and well founded on local knowledge. Local traditional practices and arrangements based on indigenous knowledge should be seen as the starting point for resource management initiatives and planning.

2.2.6 Socio-economic categories of fisherman

The great majority of inland fishers are small-scale. Fishing for subsistence plays a role in almost all cases. The importance fishing for income is highly variable, and family-specific.

Socially, the Mekong fisheries are as diverse as the ecological niches exploited. They range from individual seasonal fishers in the highlands of Lao PDR to fishing lot owners with large-scale operations in the Great Lake of Cambodia; from full-time specialized traditional fishers in the Khone Falls area to unemployed people returning from Bangkok to their native villages in Northeast Thailand who fish to support themselves in times of economic difficulties. Men, women and children of all ages are involved in the fisheries with roles influenced by both gender and age.

Participation in capture fisheries is high throughout the Basin, especially at the small-scale and household level. Virtually all farming households fish part time on a seasonal basis with captured fish making a significant contribution to food security. According to the Lao PDR 1998 agricultural census, 71 percent of all farm households were engaged in fishing. That equates to 2.9 million people dependent to varying degrees on fisheries as a livelihood strategy in Lao PDR alone. Northeast Thailand statistics show even higher levels of participation. Throughout the Lower Mainland Basin at least 40 million rural dwellers are active in the fishery. Surveys

show that for most rural households captured fish is important for family nutrition and income generation. Large-scale fishing operations are often based on exclusive access to sites obtained through purchase of government licenses. Capital expenses for fishing gear (barrages, fences, traps, nets, etc.) are relatively high and the individual operator is often dependent on a network that may also include sub-contractors for a part of the license fee. Large-scale fishing operations are generally based on hired labor. In the Mekong sub-system fisheries, some households and communities have developed specialized fishing as a full-time livelihood. The highest degree of commercial specialization is found in the large floodplains of central and southern Cambodia and the northern part of the Mekong Delta. Specialization is closely related to access to productive fish habitats and is also highly related to ethnicity. In many resource rich areas households and entire villages do not fish at all. All Mekong fisheries are highly seasonal and determined by the river flood-pulse system. Seasonal peaks result in a glut of fresh fish far beyond what local demand can absorb. This has stimulated the development of highly effective, low technology fish processing and marketing systems based on the production of fermented fish products, pastes and sauces. This large, mainly domestic industry provides seasonal employment and spreads the nutrition and economic benefits of seasonal fish production over the full year.

2.2.7 Socio-economic value of fisheries

Aquatic resources in the Lao PDR are an extremely important resource for the largely agrarian population. Estimates of aquatic resource consumption in Laos range from 7 kg/persons/yr to 42 kg/person/yr. Consumption in Savannakhet has been estimated at 17.5kg/person/yr. What is especially telling is the proportion that aquatic resources make up of total protein intake. Not surprisingly Vientiane, the national capital, consumes the most protein per capita in the country (kg.capita⁻¹.yr⁻¹) followed by Xieng Khouang, Oudomxay and Savannakhet. However, in terms of protein from overall aquatic resources Sekong and then Savannakhet follow Vientiane for the highest proportion. Both Oudomxay and Xieng Khouang are more mountainous than the southern provinces and do not have the same reliance on aquatic resources as the other provinces in Southern Laos. Sekong, one of the poorest provinces in the country, is most dependent of aquatic resources for protein. This indicates the importance of this resource for both poor communities, as a whole, as well as poorer households within communities.

There is considerable seasonal variation in aquatic resource use patterns in Laos. Bush (2002) describes the variation of aquatic products in all meals over 12 months in Sanasomboun district Champassak. The samples range from 43.3 to 78.3% of all meals. Fish are consumed more in October and May while the least amount of fish is consumed in February and September. Regarding percentage of income made up by aquatic products over 12 months, fish being most important during July and December-January. This closely follows the annual flooding cycle with most fish available on the rising and falling flood in July and October respectively. The large amount of fish consumed in May and February to September is most probably associated with harvesting of rice field fisheries and dry seasonal back swamps.

Bush (2003) analyzed the relative importance of capture and fish farming relative to each other within broader livelihood strategies. An equal number of families were selected from each of the wealth ranked groups identified by the communities. Some of the main qualitative findings of the study are as follows:

Neither fishing nor fish farming is regarded as a very important activity by communities in any of the districts. On average, communities ranked fishing as the fifth or sixth most important agricultural activity. Fish farming was ranked above fishing but still below other main activities. This is supported by (Dubois, Inthavong, &

Barden 2002), who observed that, though fishing is a primary economic activity, none of the villagers in his study in Xieng Khouang described fishing as their principal occupation, as the main activity for most of the year is rice farming. However, the frequency and time with which villagers spend fishing belies its importance. The income derived from fishing alone was estimated at around 13% of the total household income.

Bush (2002) reports that fish farming is usually the responsibility of the male head of the household. Women and children are very active in the capture fishery, operating in a number of habitats and using a variety of fishing gears. Poorer families are less likely to adopt fish farming as a result of the high cost of pond construction, lack of available land, and lack of access to technical assistance. In comparison, most families with ponds were identified as wealthy - fish culture is also used as a main indicator of wealth. None of the fish farming families or spawning farmers interviewed reported selling mature fish to local retail markets. The families sold within the community mostly during festivals or when guests arrived. Spawning families sold juveniles to a number of people from all over the province. The benefits of fish farming ponds included a source of water, less time spent fishing and ease of catching fish.

Sjørnslev (2000) reported from the Northern Luang Prabang Province that in 63% of surveyed villages, more than 95% of households depend on capture fisheries, with an additional 22% of villages having between 25-75% of household dependents. Fishing was ranked as the third most important household activity after rice-farming and livestock. Only two villages (7%) had "professional" fishers, each with about 10 percent of households involved. Overall, 83% of households are involved in fishing, and 41% percent of household members, 20% of which are children. The average yearly per caput consumption of fish and other aquatic animals was estimated at 29kg with fresh products accounting for between 16-22 kg. Fishery products accounted for about 43% of total animal products consumed but about 55-59% based upon animal protein equivalent. Margins of error using various methods to estimate total catch (based upon catch-effort data) were high (+ 30%).

In general, inland capture fisheries and rice are the basis of food security for the rural population. Fish is the single most important source of animal protein and rice, in the form of carbohydrates, the most important source of energy. With a total inland fisheries production from wild capture fisheries, reservoir and aquaculture of approximately two million tonnes (and given approximately 60 million inhabitants), the average per capita fish consumption surpasses 30 kg per year. Exports and import of marine fish into the Basin add to the ambiguity of this figure but hardly change its magnitude.

The role of fish as the most important source of animal protein in Southeast Asia goes undisputed. Many species have a high content of vitamin A. This is needed to prevent and treat a widespread deficiency causing eye infections and blindness among a high number of people in the region. Particularly, the eyes and entrails of certain species are high in vitamin A. Identification of species most suited as a source of vitamin A is still ongoing. Fish are also an important source of iron and zinc. Other wetland species including frogs, crabs and edible insects are less well known as a source of nutrition.

2.3 The Fisheries and other stakeholders

Besides capture, varying proportions of the population are involved with processing, sales, and related labor to support the fishery.

2.4 Management control measures

There is no specific fisheries law for the general regulation of capture fisheries in Lao PDR. However, both the 1996 Water Law and the recently adopted Environment Protection Law have clauses relating to wild fish resources management. The mandate of the DLF is determined in the Ministerial Decree on Fisheries. Capture fisheries management policy has concentrated on the development of regulations outlined in a decree of the councils of Ministers Number 118/PCM, on the management and protection of aquatic animals, wildlife and on hunting and fishing (5th October 1989), as well as a number of other legal instruments. These regulations are recognized throughout the country and enforced by the DLF by village committees. These regulations are:

1. Decree of the councils of Ministers Number 118/PCM, on the management and protection of aquatic animals, wildlife and on hunting and fishing (5th October 1989):

- Prohibits the use of military weapons, grenades, poison or other equipment of a “mass destruction” character.
- Prohibit catching of protected species, endangered species, pregnant or nursing animals or during the fish spawning season.
- Protected species may be caught in self defense but ownership reverts to the state.

2. Institutions on the execution of council of Ministers Decree No. 118/PCM on the management and protection of aquatic animals, wildlife and on hunting and fishing (5th October 1989), require registration of all weapons used for hunting and prohibit use of weapons modified from war.

3. Hunting and fishing ban during the Buddhist Lent (30 July 1993):

- Reiterates the need to enforce the provisions of Decree No. 118;
- Stop hunting, animals and fish cited in lists of prohibited and controlled species.
- Prohibit the selling, service in restaurants and consumption of wildlife meat.

Apart from enforcing a set of rather detailed operational rules for fishing in the Nam Ngum reservoir, the DLF is mainly practicing a hands-off policy on capture fisheries. This reflects the limited need for regulatory intervention at the national level (no major conflicts over access to fish resources, no report of overfishing etc.) and the lack of resources for such intervention.

In all four MRC member countries, provincial government offices have a high degree of autonomy. This affects how national legislation is interpreted at the operational level and the level of enforcement. On policy matters, provincial fisheries authorities normally report to the Provincial Government (in Viet Nam the Provincial People's Committee), whereas on technical matters reporting is to national line agencies.

2.5 Fish disposal

Bush (2003) analyzed fish marketing in three districts in Savannakhet province. Major findings were:

- The survey conducted over a 12-month period, provides a comparison of the weights and prices of both SRA and capture fish entering the market. The main findings of the survey were that exotic fish from SRA have a low market penetration compared to wild fish, and a lower, but more stable unit value. The following supports this:

- Between 13% and 53% of fish sold in markets come from SRA. Most is accounted for by exotic species with only 0.4 – 7.1% of fish from ponds reported as native. This indicates a low level of income from 'trap pond' activities.
- Overall, wild fish make up 65.5% of all fish entering the market. The highest proportion of capture fish was found in Chumphone (Table 5). Sex Reversed (SR) Tilapia from cage culture along the banks of the Mekong in Khantabouli is the most common species of aquaculture fish in each of the markets. In the largest urban market, Samakheysai, it is the most commonly sold species (17.1%) of all fish. In Seno and Khengkhek SR Tilapia is second to the wild species *Channa striata* (Bloch, 1793) and *Clarius macrocephalus* (Günther, 1864) respectively.
- Supply and demand of wild fish is inversely proportional (Figure 2). The supply of SRA fish is similar to capture fish, possibly indicating overall increases in demand during the dry season months from February to June. However, the amount of culture fish sold increases in July, the start of the rainy season and main capture fishing period.
- The overall average price of aquaculture species is US\$0.98, which is lower than the average capture species price at WC US\$1.14.

Bush (2002) began a survey of fish and other aquatic animals (OAA) consumption in September 2002, which ran for 12 months. The aim of the survey was to compare the consumption of farmed and capture fish as well as determine the relative contribution of fish and OAA to overall protein intake. It was found that farmed fish are eaten less frequently, however in larger portion sizes and, conversely, the average portion size of capture fish is smaller but overall more important for daily consumption. Preliminary results from the first 10-day survey period were as follows:

- The average daily per capita consumption was estimated at 54.7g of which 75% is fresh fish, 23% OAA and 3% processed fish.
- Capture fish and OAA are present in 85% of all meals.
- When farmed fish are consumed, the average amount eaten amounts to 60.2 g/person/day while the average amount of capture fish is 53.6 g/person/day.

The marketing potential in each of the districts varies according to season and source of fish. Communities close to Savannakhet town and the Mekong in Khantabouli have large opportunity to sell fish at high prices. Communities in Outhomphone have limited choice as they mainly produce aquaculture species of low value.

Aquaculture fish appear not to vary in price throughout the year. Respondents in all three districts indicated that these fish sold from 7000-10000 kip/kg. The low and high price differential was deemed to be a function of season and market location. Low prices are characteristic of the wet season when there is an abundance of wild capture fish and selling fish in the village has a lower price than when selling in the district market.

Most of the cultured fish was reported as being sold from April to June when ponds were harvested and for the main calendar s, Lao New Year, Pratu Lao and Khong Khaw. During these times pond owners sell fish by the side of the ponds where people then cook them.

Wild capture fish exhibit a different marketing regime. As with villages close to the Mekong such as Na Pho and Taa Seno, a lot of fish is sold to the main two markets in Savannakhet Town, Savansai and Samakheysai. These villages also have the opportunity to sell fish to Thailand across the Mekong for markedly higher prices. The

respondents in Naa Pho said that *Hemibagrus filamentus* (Pa Kheung) sold for around 150Baht (30000 kip) while it sold for 20000 kip in Savannakhet. Similar margins were seen in Chumphone where prices doubled according to season and market location. For example, *Clarius macrocephalus* (Pa Duk Na) ranged from 7000 kip/kg to 15000 kip/kg. The lower price was collected in villages during the wet season and the higher price in local markets during the dry season. Prices for *C. macrocephalus* were also seen to be as high as 35000 kip/kg in the Savannakhet markets. Communities in Outhomphone indicated they did not sell wild capture fish as they were primarily consumed in the villages. The decision to sell fish to market is made in consideration of the price offered by traders that come around to the villages to buy fish. If that price is high then they sell to these traders. If it is not so high they may sell fish themselves in market if they deem they have enough fish to make the trip worthwhile.

Fish and other aquatic animals are the most important source of animal protein for the approximately 60 million inhabitants of the Mekong Basin. Average fish consumption ranges from about 30 kg per capita in mountainous areas, to 70 kg in the Great Lake Tonle Sap area in Cambodia. In many parts of the Basin, fish is part of every meal. During lean seasons, fermented fish are used in place of fresh fish. Fish sauce is a staple used by most households all year round. Fish also have high levels of vitamin A and micronutrients essential to humans. The bulk of Mekong fish is consumed locally or traded fresh at village, district or provincial markets. There is considerable trade in fish within the Mekong Basin and its neighboring catchments. Exports out of the region are limited, but increasing.

The bulk of fish catches taken by small-scale farmers and fishers are consumed locally or traded fresh at village, district or provincial markets. Storage time from catch to consumption is short and usually little or no ice is used or needed. Some of the more robust species are marketed live. Ice is in widespread use in Thailand and southern Viet Nam for storage and for transport to large cities. With the growth of towns and the development of transport infrastructure, the use of ice is expected to expand.

Domestic markets are the most important. Fish species in the Mekong, as in other parts of the world, are often particular to a river basin and little known elsewhere. This limits their export potential. Other species, the sand goby for example, are widely known and highly priced in Asia and have a huge export market in Singapore and Hong Kong. Tilapia may, as an internationally known species, have market potential outside the region, but as it is not a highly priced species, the transport costs may be a limiting factor. River catfishes (*Pangasius* spp) from Viet Nam are one of the few local species groups to find an export market, mainly in countries where Vietnamese immigrants have settled. Recently, a considerable export market has developed in the USA where the marketing of catfish from the Mekong seems to have benefited from the already established market for the American catfish of the Ictaluridae family.

There is considerable trade in fish within the Mekong Basin and its neighboring catchments. Fresh fish from the Great Lake Tonle Sap in Cambodia is exported to Thailand in large quantities. River fish, including river catfish juveniles for cultured grow-out, are finding their way from Cambodia southwards into Viet Nam. A lively trade is taking place between Thailand and Lao PDR, with Lao traders sending high valued species over the river to Thailand, receiving in exchange tilapia and other species. *Pra hok*, the fermented fish product from Cambodia, is highly valued in large parts of Thailand and is exported together with some high quality dried fish products. The quantities traded across regional borders are not included in national statistics.

Although aquaculture has been identified as a future potential supplier of export items it is wild capture fish that at present provide the largest potential for export earnings as seen in Champassak province (Bush 1999; Phonvisay and Bush 2001). Trade to Thailand brings in a substantial income for local traders in the area estimated at up to US\$450000 a year (Phonvisay and Bush 2001). The challenge for the government in such cases is to ensure that adequate attention is given to wild fisheries within a broad aquatic resources management system so that local fisheries are maintained as a source of not only income but also of food for local communities (Bush 2002a).

Catch price at first sale varied according to the species and size of the fish and it was not recorded regularly. The average price across the country is estimated to range from 7 000 to 20 000 Kip/kg (Souvannaphanh 2003).

3. Identification of data and information requirements

3.1 Details of management plans

During the past, few information, policies and strategies, have been developed with respect to fisheries development and related matters. But guidance was directed towards the conservation of natural resources and the development of fish farming by decentralizing the fisheries management functions to local authorities, building awareness on the adverse impacts on the use of illegal and destructive fishing gears, promoting the sustainable exploitation and use of indigenous fish species, the establishment of fish breeding facilities, the use of non-carnivorous species in aquaculture, the careful use of exotic species in aquaculture etc. The fisheries management measures have been enforced by local authorities with many prejudices, conflicts and problems because of lack of scientific based information responding to the root causes of the situations. This was guided, later on by the Prime Minister Decree 118 on 5 October 1989 concerning the management and conservation of aquatic animals, wild animals, the hunting and fishing. The real fisheries management in Lao PDR was conducted in Nam Ngurn reservoir assisted successively by many donors through MRC since the beginning of the establishment of the hydro-power reservoir, mainly from Netherlands, Switzerland, Denmark, and the FAO.

Lao PDR clearly recognises the value of its living aquatic resources sector (fisheries). This is exhibited, for example, by the recent establishment of a separate division for fisheries and a significant research institute (LARReC). These developments show that, despite funding and human resource constraints, the country is willing to invest in the sector. This is a welcome and encouraging start. But a significant question is on what basis are sector and sub-sector policies set. This brief review has suggested that whilst Lao PDR appreciates its capture fishery, it seriously under-estimates its true quantitative value and extent. Recent surveys have helped reinforce the recent emphasis but the official figures remain.

There may be an opportunity for improved integrated planning between capture fisheries and other sectors, especially aquaculture. As natural resources come under stricter management control, the borders between culture and capture fisheries become blurred or non-existent. This is especially so as capture fisheries become enhanced through culture-based activities (stocking). It would be unproductive to sustain a continued and artificial division between these two sectors when joint planning could improve the circumstances under which various forms of aquaculture might be promoted in a region where capture based activities will remain dominant for the foreseeable future. One of the major threats to sustaining capture fisheries is

environmental degradation arising from the activities of other sectors. Better governance is the only solution and has to include better approaches to integrated planning for natural resources management. Achieving this goal will not be easy. Worldwide, those sectors (or indeed countries) have tended to separate resources in river basins, particularly water, through unilateral planning. This has generally left downstream users to deal with problems caused upstream, with fisheries being at the bottom of the hierarchy of influence. Until recently this has been the trend in the Mekong region but there are encouraging signs that things are changing and real opportunities are emerging.

3.2 Management objectives

3.3 Decision-making methods for each management objective

The district level is the lowest level of government and all living aquatic resource extension is moved through the Livestock and Fisheries Section of the District Agriculture and Forestry Office (DAFO). There is a direct link between the district, provincial and national levels under the Ministry of Agriculture and Forestry along which planning flows up and technical expertise and operational funding flows down. In theory planning within agriculture and forestry is derived from the local level. Each year villages write and submit requests for assistance to a specific division in DAFO who in turn submits a district plan to PLFO who subsequently reports to the national level. Based on these plans funds and activities are allocated for the following 12 months.

A number of novel decision-making mechanisms for natural resources management have been introduced through externally-funded assistance and development projects (Hartmann et al. 1999). While there are normally no attempts to create new levels of bureaucracy at village level, certain villages have established informal or ad hoc working groups. Thus, in villages covered by the Indigenous Fisheries and Management Project (IFMP) or MRRF, decision-making on all aspects of fishing activities lays with a (fishing) committee and its sub-groups. This committee stipulates duties and roles of the more specific fishing committee, which was set up as part of the co-management initiative. The fishing committee is organised as follows: committee head with overall responsibilities for fishing rules and activities; a deputy responsible for finances of fish catch at village level; a deputy responsible for technical aspects of fish catch; three groups, one each with responsible for fish culture, fish capture, and conservation. Income from sale of fish caught goes both to a common community fund and to consumption by members of the community. Usually, conflicts are solved, in their majority consensually, through the established conflict resolution mechanisms involving village head and committee. In one village at Nam Ngum, however, a local negotiation unit has been set up to solve conflicts, reportedly with total legal arbitrary functions.

Sometimes village headmen make decisions on issues such as natural resource management before the community has been consulted. In other cases, not only members of the immediate community are consulted, but those of neighbouring villages as well, in order to exchange experience regarding problems faced in each community and its possible solutions. Regular meetings, both at village and supra-village level, have been found to be an important ingredient in local resource management.

3.3.1 Currently established information systems for decision-making

It is not clear to what extent decision-making is based on currently established information systems. Coates (2002) points out a lack of confidence in national statistics. The usage of the current data on fishery production is extremely limited in Lao PDR and appears to be divorced from fishery planning exercises. Yet despite this, official figures do still have a major influence on national policies (e.g. the opinion that capture fisheries are in decline and aquaculture is of paramount socio-economic importance), especially amongst those less familiar with the sector. In particular, the figures have a major influence on donor perceptions and therefore their investment strategies.

3.3.2 Information requirements for DOF administrative purposes

The Lao-Swedish Forestry Programme sought to address weaknesses in regards to monitoring and evaluation/analysis, and in the area relating to training and training needs assessment in DAFO offices. Main reasons for these weaknesses were that DAFO staff do not always have a well-developed system (routines) for *how to document information*, and often limited skills in *how to manage information* in an efficient way. The objective of the system is to improve the managerial skills at DAFO offices by teaching the personnel how to 1) document information in a well organized and systematic way; and 2) manage information effectively (especially, *monitoring* of performance; *evaluation* (analyzing) and reporting; planning; *human resources development* [incl. training needs assessments etc]). The end users are the Head of DAFO and his staff. In reality, however, the system could be applied in any unit of an organization at the center as well as in the field. The beneficiaries are village people who get more efficient support and co-operation from the Government and the Government itself, who makes better use of its staff.

For more details see Chapter 6.

3.4 Requirements for policy and development planning

According to Phonvisay (2002), in the context of Lao PDR and Lower Mekong Basin, there still needs for a more in-depth understanding of the physical and socio-economical settings of present endowments in aquatic resources. Specific attention needs to put on riverine ecology, taxonomy, fish life cycle, fish habitats and breeding grounds. Aquatic plants, aquatic animals, the wetland values and community management dynamism need to be identified and reassessed.

As pointed out by Sverdrup (2002), in general researchers now have a reasonable understanding of the Mekong Basin ecology. However, there are certain gaps in our knowledge that remain to be filled. He mentions the following:

- Understanding the sub-populations and to what degree they overlap is crucial for the delineation of management units (stocks).
- Inter-connectivity of essential habitats is not well known especially for the long-distance migrants where spawning areas can be very distant from nursery areas. Knowledge of adult migrations is increasing, but larval and fry migration studies have begun only recently. Quantitative data on fisheries yield by species and by habitat is required.
- Economic valuation is still limited.

- Macro-habitat requirements are known for a few species in broad categories such as floodplain habitats and deep pools. However, micro-habitat requirements are unknown for most species.
- There is a need for detailed socio-economic studies on the functioning and resilience of traditional fisheries management systems, as well as the functioning of co-management fishery systems recently established by local initiatives.
- More information is needed on the trade of fish and fish products within the Basin and exports and imports to and from the Basin.
- More information on species interactions and inter-relationships is needed.

3.5 International reporting responsibilities

The Lao PDR is a member country of the FAO, and provides regularly (twice-yearly) data to this organization, on crops, livestock, irrigation, forestry and meteorology. With regard to fisheries, this data is mainly on fish disease; capture fisheries; and aquaculture.

Lao PDR has joined the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) in 2004, and has made a declaration to be bound to the provisions of CITES. Its status is that of a country in “accession”. As such, like any other member country, it is required to annual report data on the trade of species listed by CITES, such as the number and types of permits and certificates granted, the size and sex of specimens in questions, etc. However, the extent in which it is actually providing such data is not known.

The Lao PDR has the status of a country in “accession” to the Convention on Biological Diversity (CBD), which it joined in 1996. Concerning the data and information requirement in order to meet the objective of CBD, the following should be collected: Physical environment; Species lifecycles, abundance and distribution in time and space; Biological diversity abundance; Ecosystem aspects; How to manage in order to maintain biological diversity? How is the current biological diversity, including successes and failures? However, to what extent it actually provides this data is not known.

3.6 Support community-based fisheries

There is a need for definition of jurisdictional boundaries. The rights and duties regarding resource management of authorities at national, provincial, district and village level have to be clarified. Furthermore, support is needed in setting up licensing systems, as well as establishes legal conditions to promote fisher organizations. The demarcation and definition of resource tenure at village level need to be backed up at district and other levels.

A number of such enabling approaches exist, or are in the process of being developed in the four countries with the help of MRRF. Fishers in Viet Nam, who co-manage reservoir fisheries in the Central Highlands, have been authorized to levy taxes for aquatic resource use from members and non-members of their management organization, the Fishers’ Union. These, in addition to contributions from the Australian Government, have paid for management interventions such as stocking of water bodies. In Cambodia members of Community Fisheries, a unique form of user organization set-up in this country as a result of a recent fisheries management policy reform, collect contributions from community fishers for such activities as enforcement of community-formulated fishing rules and regulations. In Thailand, fisheries co-management is channeled through the Or-Bor-Tor, the sub-district administration. Here fisheries management plans become part of the Or-Bor-

Tor's plan, and management activities, such as stocking and establishing conservation zones are implemented with funding from this source. Reservoir Fisheries Management Committees in Lao PDR now receive funding into their own accounts, in order to spend it within the framework of their management plan. The benefits are many: It will, at least, enable "deep decision-making", based on funds actually within reach of community managers; the RFMCs administrative capacity is improved, as budgeting, accounting and financial reporting is now "for real"; and it will lead to increased transparency and accountability and "ownership" in the real sense of the word.

Yet government contributions may not be limited to the development of funding sources; technical inputs are equally essential. Though crucial in all stages, participation does not necessarily mean duplication of efforts. Co-managers may contribute in different roles to the same goal. Frequently, the overall design, fine planning and implementation of management activities requires 'expert' advice, available within MRRF's counterpart organizations. But such advice has to be client-oriented and demand-driven. In Lao PDR for example, a series of five research projects were identified to be conducted by staff from LARReC, FIP's counterpart organization in that country, in order to permit the implementation of management plans by RFMCs. According to needs identified by community managers, these research projects will deal with issues such as investments into cage- and pen-culture, stocking, eco-tourism and fish marketing, which, again, seek to raise income and operational capital for the local management organization. The latter study will be carried out to identify opportunities for participation of the RFMC in a presently monopolized fish marketing system.

Another critical service of government managers should be their 'expert' participation in monitoring and evaluation, and, in particular, the communication of management information across organization levels and geographical scales. Not least because fisheries line agencies are the management partners established on all levels and geographical scales. They are the 'missing link' in a two-directional information flow between mainly locally derived user knowledge and fisheries policy on higher, i.e. district, province, national and even regional management. Information has not only to be 'transported' between management levels, but also 'translated'. This is easier said than done! An ongoing project of FIP and other international fisheries development organizations on Data Collection and Sharing Mechanisms for Management initially aimed at recommending a generic, almost universally applicable management information system. It became quickly clear however, that there are different management information requirements at different levels. The crucial part in designing fisheries information systems therefore is the process of defining management objectives and resulting data needs. In other words, it is not so much the questions of 'what' to investigate, but the 'why' and the 'how', which have to be discussed and negotiated. Yet, a recent survey carried out in the respective line agencies found that there is still insufficient information on inland fisheries in each of the four riparian countries, and what exists does not inform fisheries management as such, but rather macro-economic policies. Adaptive learning therefore is an approach promoted by MRRF to be adopted not only in individual communities, but throughout fisheries management institutions in the region as a whole.

4. Data collection tools, sources and methods

Until quite recently no data were collected for fishery production on a regular basis and no other system for statistical data collection was in place in the Lao PDR. Fishery related socio-economic data are few, and the official production figures, both

for capture and culture fisheries, are mainly based estimates. However, the National Bureau of Statistics have been including fisheries data in their recent household survey in 1997, and has followed-up with adjustments since then. The total production figures deviate, however, still substantially from the figures created by the MRC Fisheries Programme, but coincidence is found in a recent study by both institutions in Luang Prabang Province.

4.1 Existing

Generally speaking, statistical data and information on the economic significance of the fisheries sector is difficult to obtain because of the limitation of financial support, limitation of human resources and knowledge of fishery scientists in statistics. A lack of information and statistical data on inland fisheries has undermined their importance and the subsequent management of the resources. With a growing population, it is important to maintain the contributions of inland fisheries to food security and to increase production. Concerted action is required in this regard. There is a need to improve the collection of statistical data that can be interpreted in economic, scientific and ecological terms for use in planning and development.

Although not currently functioning properly for providing fisheries information, a basic structure for data collection seems to be in place and is currently used to collect statistics on livestock, agriculture and forestry. Data collection at village level is performed by means of the village headman, a “model farmer” or the relevant veterinarian worker. Usually at least one, but more often, all three of these are present in each village. Each is responsible for data reporting to the Ministry of Agriculture and Forestry. These people submit completed questionnaires through the district and provincial authorities to the national line departments in Vientiane. However, it is reported that relationships between villagers and government officers are less than ideal and there is widespread under-reporting. The main problem appears to be the usual fear that statistics will be used for taxation purposes. The level of formal training in data collection and statistics, in general, is weak at both provincial and district level.

In Lao PDR, the fishery statistics system is a subsystem of the agricultural system, which in turn is a part of the different statistical agencies whose primary functions are the generation, processing, analysis and dissemination of official statistics. The government agencies directly involved in the generation of fishery statistics are:

- National Statistical Center under the Committee for Planning and Cooperation; the National Statistical Centre (NSC) has been developing methodologies and standards leading to a uniform system of data collection. The NSC policy is to work with a de-centralised structure where all line Ministries will be responsible for data collection in their own field;
- Department, Ministry of Agriculture and Forestry (MAF);
- Department of Livestock and Fisheries (MAF);
- Living Aquatic Resource Research Center of National Agriculture and Forestry Institute (MAF);
- Provincial Livestock and Fishery Sections;
- District Livestock and Fishery Units.

In the past, there were several types of information available that were relevant to the fishery at the National Statistic Center and the Ministry of Agriculture and Forestry such as:

- Lao Expenditure and Consumption Survey 1992/1993 (LECS 1);
- Collection of CPUE in Khong Island in 1993;

- Lao Expenditure and Consumption Survey 1997-1998 (LECS II);
- The Agriculture Survey Census 1998-1999;
- Meat and Fish Consumption in Xiengkhouang Province 1998;
- Foreign Trade Statistics;
- Consumer Price of Fish Index;
- Compilation of GDP;
- Baseline study in five provinces on aquaculture development projects supported by FAO (1998);
- Fisheries Surveys in Luang Prabang Province 1999.

The production figures of capture fisheries are based on the sampling data of the yields per unit area for several types of topology. However, the information on aquaculture was obtained from data collection. Data on capture fisheries were mainly taken from fish landing sites such as Nam Ngum Reservoir and Nakasang Village on Khong Island.

The Department of Planning (DOP) under the Ministry of Agriculture and Forestry (MAF) is responsible for disseminating basic statistical information on agriculture including crop production, crop area, crop yield, livestock population, animal production and fisheries. This information is prepared by technical departments and institutions such as the Department of Livestock and Fisheries (DLF), Department of Agriculture, Department of Forestry, Department of Irrigation and Living Aquatic Resource Research Center (LARReC). Technical fishery management information such as fishery production, topology of fisheries, number of fishing units, fishing gear, fish price, number of hatcheries, rate of fish consumption, rate of fry survival, fish feed production and type of fish farming is collected and compiled by the Department of Livestock and Fisheries in collaboration with LARReC, Provincial and District Livestock and Fisheries Units. This includes specific information (standard of fish stocking in pond, rate of raising in rice field, etc.), and aquatic animal health information. The trade data on fish and fish products are collated and reported by the National Statistical Center. Their data clients are decision-makers, scientists, planners and vendors.

Statistical data are not readily available or, if available, are scanty and not always accurate. There are only estimated data on inland fisheries such as estimates of fish production by sampling the yield per unit of a particular type of water body then multiplying by the water area. The main reasons for the poor knowledge of these fisheries are the large number, dispersion, variety and dynamic nature of inland water bodies and the diversity of their aquatic fauna. These account for the complex and numerous fisheries giving rise to a variety of distribution and marketing systems. This makes the collection of data costly, but when weighed against the contributions of the sector in the larger socio-economic context, it may be well worth undertaking.

A household expenditure and consumption survey was taken from March 1992 to the end of February 1993 by the National Statistic Center (NST). The sample was made up of 2 940 households from 147 villages. All household expenditure and income were recorded in a diary over a one month period. At that time the amount of expenditure on fish by household was similar to the estimated official fish production figures.

The second household expenditure and consumption survey was taken from March 1997 to the end of February 1998 by NST. This time the survey included household data on fish production in terms of value, rate of consumption from their own production and fish expenditure (Table 2).

In 1997, a field study on meat and fish consumption was conducted by Chanphengxay in Xiengkouang Province. The sample sites were taken in two districts (Pek and Phoukout) in one month of the dry season. One was representative of urban areas while the second was representative of rural areas. The figures show that the rate of fish and aquatic animals consumed was around 4.7 kg/head/year and 4.4 kg/head/ year respectively. In rural areas it was 2.5 kg/ head/year for fish and 2.8 kg/head/year.

The first Lao Agricultural Census was conducted from 1998 to 1999 by NSC in cooperation with the Ministry of Agriculture and Forestry. it covered all 141 districts in the country. The census was undertaken in two parts: a complete enumeration of all 798 000 households to collect basic data about agriculture, and a sample survey of the households to collect more detailed information mainly on crop production and livestock, including some data on the number of families involved in fishing and aquaculture and the area of fish ponds.

4.2 Potential improvements to existing systems

Coates (2002) pointed out that a major and immediate task for Lao PDR is to re-assess its current official figures for capture fisheries based upon a review of historical and recent information and data for the fishery. Much information is locally available and certainly more than enough to produce very realistic estimates. In this process, information based upon data from credible surveys should take precedent over all other information. Once survey data are accepted (within the normal margin of error) extrapolations based upon resource and population distribution are difficult to challenge. This must be done by the appropriate Lao authorities, not externally. The current report serves only to illustrate the need to do this. In common with many countries, Lao PDR needs to consolidate a more flexible, interactive and inclusive approach to the generation of national fishery statistics. There are encouraging signs that this is happening. It appears to have already been achieved recently with the figures for aquaculture. Only when this is achieved also for capture fisheries should the information be allowed to influence planning.

As mentioned by Souvannaphanh et al. (2003), because the resources required for the collection of these data have decreased, the quality, availability, reliability, accuracy and timeliness of data compilation at the national level is not satisfactory. The strengthening of the national fishery statistical systems as an integral part of a planning and decision-making process should be a major national fisheries objective in the drive towards sustainable fisheries and food security. The need to improve and strengthen data collection systems should not be limited to an individual country alone. The prospect of developing a harmonized fisheries statistics system among the countries in the region should be encouraged so that the region can share and use the data more readily to facilitate the management of their fisheries, especially in the case of shared stocks.

Since the collection and analysis of fisheries data is costly and time consuming, the needs and objectives for the statistical system must be clear and a thorough review of national statistical frameworks must be undertaken, including their linkage with priorities and objectives and the needs of respective data users. As management of the fisheries should be based on the best scientific information available, these data are critical to the sustainable management of fisheries resources.

Main issues and constraints to improving fishery information:

- Lack of feedback from users;
- Lack of objectives and incentives for enumerators and other staff to produce quality data

- Lack of awareness, especially by policymakers, of the importance of the sector in planning and development;
- The collected data is not always used which further contributes to the lack of motivation among enumerators;
- Low levels of capacity among personnel, especially at the local level, who are mandated to collect the raw data.

Fisheries statistics are not used effectively in the determination of national fisheries policy, the formulation of national management frameworks and actions or even as a basis for understanding the status and condition of fisheries resources. Since the production of effective and timely fishery statistics is a costly exercise, improvement in the use of statistics at the national level should be accorded high priority.

In the case of inland fisheries operating within an international river basin such as the Mekong Basin, these methodologies need to be harmonized with adjacent countries, and the catchment approach promoted in this regard. Once the minimum requirement for a national fishery statistical system is achieved, a gradual strengthening process can be conducted, taking into consideration the national capacity and priorities.

Fisheries statistics are a key component of a fisheries information system required for policy, planning, monitoring and management of fisheries. Improvements to national and regional fisheries statistical systems including data collection, analysis and reporting are required to maximize the utility, timeliness, accuracy and reliability of fisheries statistics.

A review and reassessment of current statistics for the capture fishery is needed to obtain accurate and reliable information. The compilation and exchange of fishery statistics for the region is required to provide a wider view of the importance and status of fisheries in the economies of basin countries. Clearly, the collection and analysis of data should be standardized to facilitate this exchange. Comparable information technology and databases will assist in this regard.

Souvannaphanh et al. (2003) make the following recommendations for improvements of fisheries statistics:

National Level

Strengthen national fisheries statistics systems as part of a national decision framework for policymaking, planning and monitoring to achieve sustainable fisheries by:

- Determining the objectives and minimum requirements of fishery statistics data and information with particular reference to national and local requirements;
- Coordinating collection and use of fisheries statistics data between the national fisheries authorities and other authorities including those responsible for trade, vessel registration, freshwater aquaculture and rural development;
- Building capacity at both national and local levels to collect, compile, analyze and disseminate quality statistical data and information in a timely manner as an empirical basis for formulating policies and decisions for fisheries management;
- Prioritizing statistical data and information needs with particular reference to practical indicators for fishery management and the specific requirements of the region's fisheries;

- Applying internationally or regionally standardized methodologies for statistical data to facilitate regional compilation and data exchange where appropriate; and
- Reviewing the national fishery statistics systems to identify areas needing improvement.

Regional Level

- Supporting, upgrading and expanding regional fisheries statistical systems by developing regionally compatible methodologies for national statistical data to facilitate regional fisheries assessment and data exchange; and
- Promoting technical cooperation between national agencies responsible for fisheries statistics to improve national systems, including development of guidelines and handbooks.

4.3 Alternative sources, and data collection tools

The following alternative sources and tools for data collection have been identified:

- Consumption data as a source for yield (Bush 2002; Bush 2003a; Bush 2003b);
- Local Ecological Knowledge (Poulsen & Valbo-Jorgensen 2001);
- Co-management (Hartmann, Degen, Logarta, Phounsavath, & Tuok 1999; Mattson, Hartmann, & Augustinus 2003).
- Population genetics research (Sverdrup 2002);
- GIS (Sverdrup 2002).

4.5 Use and potential of traditional knowledge

Mekong communities have always depended on the fisheries resources in the river. As a result, they have accumulated a large body of ecological and biological knowledge about these resources. In many places along the Mekong, communities have established management practices, including limitations on fishing gear types, seasonal limitations and conservation zones in order to ensure that fish are harvested sustainably.

Since 1997, the Fisheries Programme of the Mekong River Commission has been accessing local knowledge in some of its basin-wide ecological research activities. The objective of this research was to obtain life-cycle information about important Mekong fish species, particularly in relation to migration and spawning. Local 'expert' fishers were interviewed and have provided a large amount of information on the nature, location and timing of fish migrations and spawning behavior. By merging information from different areas along the river, migration routes and essential habitats have been identified.

This research demonstrated that by accessing local knowledge it is possible to obtain vital information that could not be obtained using conventional biological research techniques. Although local knowledge on its own cannot provide all the answers about the functioning of a large and complex ecological system such as the Mekong, it can provide a solid foundation for basin-wide planning and decision-making. Furthermore, information obtained through local knowledge can help focus future research, management and monitoring activities.

Future development and resource management in the Mekong River basin will be successful only if local communities are involved in the planning and management

process. As part of this process, the knowledge that exists within these communities must be taken into account.

6. Existing/or previous activities to develop data collection and sharing systems

Lao-Swedish Forestry Program:

According to Alounsavath and Andersson (2003), the Lao-Swedish Forestry Programme sought to address weaknesses in regards to monitoring and evaluation/analysis, and in the area relating to training and training needs assessment in DAFO offices. Main reasons for these weaknesses were that DAFO staff do not always have a well-developed system (routines) for *how to document information*, and often limited skills in *how to manage information* in an efficient way.

The team has worked according to the principles that the development process has to be *participatory* (be developed together with the people who are going to use the system). The system has to be *easy to use* (well adapted to the realities of working in a district office) and finally, *easy to expand* to other DAFOs in any province.

The objective of the system is to improve the managerial skills at DAFO offices by teaching the personnel how to 1) document information in a well organized and systematic way; and 2) manage information effectively (especially, *monitoring* of performance; *evaluation* (analyzing) and reporting; planning; *human resources development* [incl. training needs assessments etc]).

The end users are the Head of DAFO and his staff. In reality, however, the system could be applied in any unit of an organization at the center as well as in the field. The beneficiaries are village people who get more efficient support and co-operation from the Government and the Government itself, who makes better use of its staff.

In the first part of the system, routines are constructed for *how to document different kinds of information*. When the documentation routines have been constructed each unit will have clearly defined *goals* (e.g. 5 years) and *objectives* (1 year), describing what the unit is trying to accomplish.

Each unit and all its individual staff will have clearly defined *job descriptions*, describing the area (or tasks) that they are responsible for, including (if needed) written instructions for how to carry out these tasks.

The planning process will be closely linked to the goal setting process. After the unit has set its goals and objectives they have to describe *how* they plan to attain them. They need to define what kind of outputs they think are required in order for the unit to reach set goals and objectives. The outlined *output requirements* will guide them in their work of designing the activities that they believe will produce the desired result.

Each unit will have to write a *monitoring plan* describing how the unit plans to monitor progress of activities and performance of staff. Part of the monitoring plan will be for each unit to have '*weekly meetings*' with all staff. The purpose of having these meetings will be for the Head of the unit to monitor the progress of work, give support and advice, and to inform and plan for the week ahead.

In the unit's *evaluation plan*, the Heads of the unit have to describe how they plan to evaluate the effectiveness of the work that is carried out by the unit. The suggestion is that each unit has '*evaluation meetings*' every six months, whereby an analysis is made of the unit's performance in relation to plans and goals. The conclusions will be summarized in '*Evaluation/Action Plan Reports*'.

With the right support on how to write these reports they will become a valuable source of information for the planning of activities and the training needs assessment process.

In the last section of the *Unit File* a *staff development plan* should be developed. Here the Heads of the unit should work together with the deputy Heads of DAFO to produce a plan for how to improve the performance of the unit and its' staff. Together they should review the work performance of different staff in relation to the needs of the organization, and thereafter decide in what areas skills need to be developed.

The end product of this assessment process should be the unit's '*Staff Development Plan*'. This plan will describe how the Unit can develop its performance by improving different skills of the staff in areas that have documented weaknesses (as concluded in the *Evaluation Reports*).

In the second part of the system, training is given on how to make good use of the available information (see above).

Regional Development Coordination (RDC)

The Livestock and Fisheries Section in Savannakhet is responsible for the development of livestock and fisheries in all 15 districts in Savannakhet province. Access to good data from the districts is an important tool for development, but in 'he past it has generally been difficult to find data at the district office level. Although district offices regularly collect data for reporting to the provincial office, there is no system available for storing data at the district level. Data is therefore normally kept with various staff in the office responsible for collecting the data (fisheries, livestock, etc.), and it is often difficult to find the data if it is required again in the future.

The Savannakhet Livestock and Fisheries Section developed the Book System in 1995 for the livestock and fisheries officers in Savannakhet province in order to improve the data collection and storage at the district level, and to help improve the province's ability to monitor district level development. The Book System was initially tried in 6 districts in Savannakhet and then it was gradually expanded to all 15 districts by the end of 1998.

All of the district officers who participated in the workshops feel that the Book System is useful and that it is an improvement on their previous data collection and storage systems. In fact, several of the districts have increased the number of books that they use which is a good indication that they find the system useful. It also indicates that the districts are starting to develop some ownership of the system.

During a workshops the participants exchanged their experiences using the book system and discussed what they feel are the strengths and weaknesses of the system. The main points from the workshops are listed below:

Strengths

1. The books are useful for the DLF, the district and the province.
2. The books are convenient for summarizing data, writing reports and for planning.
3. Data is located in one place and it can be stored for a long time.
4. People at the district and provincial level can easily see and understand the data.
5. The books can be used to easily compare data from different years. 6. The books are convenient for when people change their positions because responsibility for the data input can easily be transferred to another person.

Weaknesses:

1. There has not been a workshop on how to use the Book System for the people who enter data into the books.
2. There are no standard input forms for each book.
3. There is no appropriate place to store the books in the district offices.
4. The handbook is not detailed enough and it should include standard input forms for each book.
5. Some districts want to collect data that is not included in the original 12 books but the current system does not take this into account.

During the workshops district staff discussed methods to improve the book system for future use. Additional recommendations for improving the Book System were developed through inspections of the books in several districts and through discussions with the livestock and fisheries staff responsible for developing and monitoring the Book System. The recommendations are as follows:

1. Each district should have a separate filing cabinet for the Book System. All books should be stored together in the filing cabinet; however, several people may be responsible for managing the books.
2. Each book should have a standard number, title and input table that are used by all districts. This will make it easier to compare data between districts.
3. Each book should have Lao and English titles and column headings so that more people can understand the data.
4. The RDC should hold a workshop to design standard input tables for each of the books and train district staff on data input and the Book System use in general. All 15 districts in Savannakhet province should be represented at the workshop by the district DLF office head plus one staff who is responsible for data input. Savannakhet provincial DLF staff (livestock, veterinary, fisheries and administration) should also attend the workshop to assist with the input form design, and to understand the use of the Book System. Summary formats at the provincial level should also be developed during this workshop.
5. The handbook should be improved by adding more detailed information on how to use the book system. The handbook should include the standard number, name and input table for each book.
6. A procedure should be developed that enables the districts to increase the number of books that they use. The district office should work directly with the provincial office to request an increase in the number of books. The procedure should allow the province to stay up to date with the data being collected at the district level. It should also allow the province to have some input into the data format to ensure that the data can be easily summarized and computerized in the future. The province should keep a record of the books and standard input tables used by each district.
7. A system should be developed at the provincial level to summarize and store the district level data. Depending on the resources available at the provincial level, the data should be summarized in books or by computer. Standard summary formats should be developed during the, input table design workshop mentioned in recommendation number 4. The RDC should then develop a database for the provincial level summary data. A summary schedule will have to be agreed upon, but from the workshop discussions it appears that for most data annual summaries would be appropriate.
8. Data collection at the village level was discussed during the workshops and it was determined that generally the district staff collect data by producing forms that they distribute to sub-district staff and to village leaders. The sub-district staff and village

leaders then collect the data and return the forms to the district office. In some cases the district staff collect the data directly. This system appears adequate and no improvements are recommended at this time. It should be noted that developing standard input forms for each book will assist the district staff when they produce their own forms for collecting data at the village level.

9. A second review of the Book System should be performed six months after the completion of the workshop on input table design and Book System use. The objective of the review should be to confirm that the above recommendations have been successfully implemented and that the system is working as planned.

A meeting was held with the Khamouane provincial Livestock and Fisheries Section office to understand their current data collection system and to try to determine if the Book System would be appropriate for expansion to other ROC provinces. Khamouane province seems to be using a data collection system similar to Savannakhet before the development of the Book System. District offices collect data required for provincial reporting and then send reports to the province, generally on a monthly, quarterly or yearly basis, depending on the provincial requirements. Although data is summarized by computer in the provincial Livestock and Fisheries office, there is no formal system for storing data or reports in the district offices.

Assuming that other provinces within the RDC are similar to Khamouane, it appears that the Book System is appropriate for expansion to other RIDC provinces. However, the recommended improvements to the Book System in Savannakhet should be implemented and evaluated before expanding the system to other provinces.

If the RCC decides to expand the Book System to other provinces then workshops should be held with the provincial and district DLF staff in order to train them on the use of the system. The standard book formats developed in Savannakhet should be used for other provinces, but as mentioned in the recommendations, provision should be made for districts to increase the books that they use.

7. Details of involvement in related research and studies

Activities executed by Department of Livestock and Fisheries (DLF)

- Policy Framework for Fisheries and Aquatic Resources sub-sector in Lao PDR.
- A vision for sustainable operation and management of policy, programs and projects of The Living Aquatic Resources Research Institute (LARRI) of Lao PDR.
- Aquatic Life Survey in Nam Mang 3 Hydropower Development Project.
- Pre-impoundment Survey and Post-impoundment Management of Fishery in the Theun Hinboun Hydropower Project in Lao PDR.
- Participatory Fishery Management Program. A case study of Theun Hinboun Hydropower Project.
- Study of Aquatic Resources of Theun 2 Hydropower Development Project.
- Study of the Nam Song Aquatic Resources and Development Potentials.
- Post-impoundment Survey of Aquatic Life in Houi Ho Hydropower Project.

Activities collaborated by DLF and other Organizations

- Study of fish species in the upper Meng Khan Mekong river (from Houi Say upto Phamong Dam).
- Analysis of water quality in the upper Meng Khan Mekong river from Houi Say upto Phamong Dam.
- Study of Aquatic Resources of Down and Up streams of Theun 2 Hydropower Development Project.
- Aquatic Life Survey in Nam Ngum 2 Hydropower Development Project.
- Aquatic Life Survey in Nam Ngum 3 Hydropower Development Project.
- 3. Activities executed through bilateral assistance.
 - Fish species collection by catch per unit of effort in Khong District, Champassak Province.
 - Analysis of Water quality in the Mekong River at Khong District, Champassak Province.
 - Analysis of water quality in Mekhong and Nam Khan rivers in Luang Prabang Province.
 - Induced Breeding and Raising of Principal Lao-Mekhong Indigenous Fish Species for Restocking in Lao PDR.

Activities executed through multilateral/ regional cooperation

- Fish species data collection by catch per unit of effort in Nam Ngum Reservoir.
- Social Mobilization for Eradication of Ghost nets and for community Management of Nam Ngum Reservoir Fishery.
- Restocking of Indigenous Fish species in Nam Ngum Reservoir.
- Biodiversity of Lao Fisheries.
- Migration, spawning and harvest of Mekong fish species.
- Fish Species data collection by catch per unit of effort at Khong District, Champassak Province, Phase 2.
- Induced Breeding and Raising of Principal Lao-Mekhong Indigenous Fish species for Restocking in Lao PDR, Phase 2.
- Rapid Rural Appraisal Survey in 3 District: Sanasomboun, Phonthong and Pathoumphone,
- Fish Species data collection by catch per unit of effort in the downstream and upstream of Selabam Dam.

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