

UNDERSTANDING LIVELIHOODS
DEPENDENT ON INLAND FISHERIES
IN BANGLADESH AND
SOUTHEAST ASIA
(DFID/FMSP Project R8118)

LAO PDR SUMMARY REPORT

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TABLE OF CONTENTS

1. Poverty status and trends	3
1.1 Status	
1.2 Trends	4
2. Fisheries resource status and importance	5
2.1 Contribution of fisheries to income, food and trade	
2.2 Contributions by habitat and production system	
2.3 Status of resources and trends	6
3. Policies and institutions	7
3.1 Macro policy and governance	
3.2 Fisheries and wetland management	
4. Livelihood analysis	8
4.1 Livelihood strategies and assets	
4.2 Gender	9
4.3 Differentiation between households	10
4.4 Role of fishing in livelihoods	
5. Trends and changes	11
<i>Environment and human use</i>	
<u>Macro challenges</u>	
6. Problem analysis	12
6.1 General livelihood problems identified by stakeholders	
6.2 Fisheries-related problems identified by stakeholders and the review team	
Bibliography	14

Country Summary Report – Lao PDR

1. Poverty status and trends

1.1 Status

With an estimated GNP per capita of US\$280 in 1999 (World Bank 2000b), Lao PDR is one of the poorest and least developed countries in the East Asia region. Landlocked, the country covers 236,800 square kilometers with a population of 5.1 million growing at 2.4 percent per annum.

Social indicators in the Lao PDR are among the worst in the region, and closer to the average for Sub-Saharan Africa (Table 1).

Table 1. Social development indicators for Laos (World Bank)

Indicator (latest available year)	Lao PDR	East Asia & Pacific	Sub-Saharan Africa
Life expectancy at birth (years)	54	69	50
Infant mortality rate (per 1,000 live births)	96	35	92
Under 5 mortality rate (per 1,000 live births)	140	43	151
Adult illiteracy rate (percent)	53	17	41
Of which, females (percent)	70	24	53
Net primary enrollment ratio (percent)	77	99	...
Of which, girls	66	99	...
Access to safe water (percent of population)	39	84	45
Physicians (per 1,000 people)	0.2	1.5	0.1
Hospital beds (per 1,000 people)	2.6	2.6	1.1
Normalized road index	122	...	118
Paved roads (percent)	13.8	17.4	15.0

“Rural society is characterized by semi-independent villages engaged in semi-subsistence agricultural production. Ethnic, geographic, and ecological differences create variations in the pattern of livelihoods from one area to another, but the common threads of village self reliance, limited regional trade and communication, and identification with one's village and ethnic group persist regardless of the setting” (Randall Ireson 1995).

Lao PDR is officially a multi-ethnic nation with more than forty ethnic groups. These are classified into three general families: Lao Loum (lowland Lao), 66 percent of the population in 1993 and the dominant group (numerically, politically and economically); Lao Theung (midland Lao), 24 percent; and Lao Sung (upland Lao) 10 percent. Ethnicity differentiates villages but is usually not a source of conflict or antagonism. Most villages are ethnically homogeneous, although some include two or more distinct groups.

Lao Loum traditionally lives in stable independent villages situated near lowland rivers or streams. At higher elevations, villages are located in valley areas that give as much access as possible to land suitable for paddy rice cultivation. Villages are self-contained and range from around twenty to over 200 households, although they typically contain forty or fifty houses and 200 to 300 people.

Most Lao Theung villages are located on mountain slopes but not at the peaks or ridges. Since the 1950s, however, a growing number of villages have been established at lower elevations, particularly near rivers or roads. Migration during war, a desire to be closer to transportation, markets, and social services, and since the 1980s government encouragement to upland minorities to relocate to lowland areas in order to reduce upland *swidden* farming (shifting cultivation) and forest clearing have led to this. *Swidden* cultivation yields less than paddy rice, and high labor requirements to control weeds limit area expansion. As a consequence, Lao Theung is generally considered to be the poorest of the three ethnic groupings in Laos, and migration of men in search of employment is common.

Lao Sung typically lives on mountaintops, upland ridges, or hillsides over 1,000 meters in elevation. Most groups are considered to be semi-migratory; villages tend to be moved to new locations when *swidden* farming resources in the old locale have been exhausted. Ethnic identity is never absolutely immutable. Some minority Laotians have adopted lowland Lao behavior, or intermarried with lowland Lao, and have effectively merged into lowland society.

Agriculture remains the major sector of the economy, contributing 53 percent of GDP and employing over 80 percent of the labor force. In the year 2000 rice accounted for about 84 percent of the total cultivated area of approximately 820,000 hectares per year, and about 16% of the rice area was an irrigated dry season crop. In addition to land under cultivation, about 800,000 hectares are used for pastureland or contain ponds for raising fish. Pastureland is rotated, and its use is not fixed over a long period of time.

Although there is inter-planting of upland crops and fish are found in fields, irrigated rice agriculture remains basically a monoculture system despite government efforts to encourage crop diversification. Usually characterized as an extensive but low productivity system, the agriculture sector has been unable to meet the needs of the growing population and to provide a reliable surplus for export and the food and feed processing industries. Generally, the low output character of Lao agriculture, and the low rural incomes that are its result, stem from both supply and demand side factors: for example, ineffective agriculture services to help farmers upgrade production techniques, and weakly developed marketing opportunities for poor rural farmers.

1.2 Trends

During the 1980s agriculture grew at an average annual rate of about 3.8 percent, almost double its growth rate in the preceding decade, while in the 1990s growth slowed to around 3 percent per annum. Increased production is a result in part of greater use of improved agricultural inputs. The area of land under irrigation remains a relatively small percentage, but any increase also helps to facilitate a continued rise in agricultural productivity. Small-scale village irrigation projects rather than large-scale systems predominate.

Since the introduction of reforms under the 'New' Economic Mechanism (NEM) in 1986, the Government has been transforming the economy from a centrally planned to a market-oriented system. The structural reforms and sound macroeconomic management initiated under the NEM fostered improved macroeconomic stability, production growth, the emergence of a small

private sector, and increased foreign direct investment and trade flows. GDP growth averaged 7 percent between 1992 and 1997.

However, given the rather isolated and semi-subsistence character of livelihoods in rural Lao PDR the influence of external structures and policies is weaker than is the case in other countries. For example, the initial impact of the regional financial crisis in 1997 was less dramatic than in other countries in the region, as the majority of the population is engaged in subsistence activities and was initially shielded. Nevertheless, in such a poor country even relatively small changes in social conditions and living standards are cause for concern. Effects have varied depending on the level of involvement of groups in the cash economy, their ability to produce sufficient food and other commodities for their own use, the degree of dependence on imported goods or inputs, and their ability to adjust their patterns of consumption or employment.

GDP growth appeared to recover in 1999 given continued strong agricultural growth and measures to stem the macroeconomic instability. The agricultural/rural sector continues to be the most important to the national economy, but poor rural infrastructure, access to markets and the limited network of all-weather feeder roads remain major constraints to rural diversification and development. Sustainable rural development will require correcting policy distortions, improving agricultural productivity, and ensuring appropriate natural resource management approaches that utilize the capacities of local communities.

The private sector is expanding but is constrained by low economies of scale, a small domestic market, few domestic suppliers, occasional restrictions on the imports of inputs, general difficulties with importing and exporting materials, bureaucratic red tape which confuses and slows investment approval and implementation procedures, little tradition of manufacturing, particularly to international standards and costs, credit unavailability, and poor infrastructure.

2. Fisheries resource status and importance

2.1 Contribution of fisheries to income, food and trade

Fisheries play an important role in rural livelihoods in virtually all regions of Lao PDR. Most fishing is carried out as part of a diverse rural livelihood strategy, typically ranked as the second or third most important activity (after rice farming and animal husbandry) and contributing on average about 20% to rural household income. The bulk of fish catch is consumed within the household, but surpluses may be sold and this accounts for about a quarter of total catches.

Fishing as a full time occupation is rare, and limited to locations near major rivers or reservoirs. Even in those locations, full time fishers rarely account for more than a few percent of the population. The commercial fishery in Nam Ngum reservoir, probably the country's largest, has developed as a result of the availability of a large and relatively non-seasonal resource combined with relative closeness to the market in the capital Vientiane. In other regions the commercialization of fisheries has traditionally been limited by the tendency for most households to meet their own subsistence requirements and the strongly seasonal nature of river and floodplain fisheries.

2.2 Contributions by habitat and production system

Approximate contributions of different aquatic habitats to total aquatic habitat and capture fisheries production are given in Table 2. Overall production is dominated by temporarily flooded

habitats, in particular rice paddies, followed by large rivers and perennial wetlands. The breakdown into habitats is indicative only, and it must be remembered that aquatic resource productivity in all habitats is closely linked. Production in rice paddies and other seasonally flooded habitats is dependent on recruitment from perennial water bodies. On the other hand, production in seasonal habitats “subsidizes” stocks and yields in perennial habitats. Perhaps the most important general pattern apparent from the distribution of production between habitats is that habitats other than large rivers account for over 70% of the total.

These estimates cover mostly the harvest of exclusively aquatic animals, in particular fish and shrimps. In addition to this, there is a significant harvest of amphibious animals such as frogs, snails and crabs.

Table 2: Estimates of capture fisheries and aquaculture production in Lao PDR, based on DLF (2001). Aquaculture and culture-based fisheries estimates given in brackets are based on fisheries survey estimates (Lorenzen et al 2000; Sjørølev 2000).

Description of the fisheries	Type of water resources	Area in (ha)	Productivity (kg/ha/year)	Total production (tons/year)	% of total capture	% of total production
Capture fisheries	Large rivers	254 150	70	17 790	28	
	Large reservoirs	57 025	60	3 421	5	
	Small reservoirs	34 460	150	5 169	8	
	Perennial wetlands	95 686	150	14 352	22	
	Rice paddies and floodplain	477 176	50	23 858	37	
	Total:			64 593	100	78 (95)
Aquaculture and culture-based fisheries	Aquaculture (pond)	10500 (2400)	1000 (650)	10500 (1560)		
	Culture-based fisheries	12 934 (5000)	570 (250)	7411 (1250)		
	Total:			17911 (2810)		22 (5)
	Grand Total			82504 (67403)		100

The contribution of aquaculture and culture-based fisheries to total fish production in Lao PDR is officially given as 22 % (Table 2), but this is likely to be a gross overestimate. Household surveys in different rural areas of Lao PDR have yielded a consistent estimate of about 2% of households engaging in private aquaculture, with an average pond size of 0.12 ha. Scaled up to about 1 million households, this gives a pond area estimate of just 2400 ha which, with a realistic average production estimate of 650 kg/ha/year gives a total production of no more 1560 t. Official production estimates for culture-based fisheries appear to be equally optimistic. While the precise contribution of aquaculture and culture-based fisheries is subject to debate, it is clear that capture fisheries account for the bulk of aquatic animal production in Lao PDR.

2.3 Status of resources and trends

Most living aquatic resources in Lao PDR are heavily exploited. Average catch per unit of effort is low (300g/hour fished), and catches comprise predominantly small species. Community and co-management schemes for aquatic resources are common and at least some have been

shown to be effective in conserving stocks. However, the strong reliance of much of the population on fishing makes widespread adoption of stringent effort controls impossible.

The degree to which aquatic habitats have been modified by water resources development and land use is comparatively low, but this is changing rapidly. Irrigation development, seen as the key to improving agricultural productivity, is progressing rapidly. A fisheries impact assessment of small to medium scale dam, weir and pump irrigation schemes has revealed only moderate impacts, mostly explained by changes in fishing effort likely to reflect increases opportunity costs of fishing in irrigated areas. Villagers perceived mostly positive impacts of irrigation development on fisheries, in particular increased dry season fishing opportunities. Two factors are likely to explain this unexpected result: the importance of rain fed paddies (the hydrology of which is not modified by dams or weirs) in fisheries production, and immigration of fish from surrounding non-impacted areas into the irrigation schemes. Land engineering of paddies and concomitant intensification of rice production may be more severe threats to aquatic resource production than isolated, small or medium size irrigation schemes. However, rapid proliferation of irrigation schemes is likely to lead to cumulative and synergistic impacts.

3. Policies and institutions

3.1 Macro policy and governance

Lao PDR has a devolved government structure where provinces enjoy a great deal of autonomy. Most government services including agriculture, fisheries and irrigation have a strong provincial base. Many decisions regarding natural resource management and local infrastructure (school, small-scale irrigation, electricity supply) are made at village level. This *de facto* autonomy is partly precipitated in an almost complete lack of resources on the side of higher levels of government to fund such developments or enforce rules.

While there is a decentralized government structure and many decisions are taken at local, district or provincial level, decisions regarding the development of large-scale infrastructure such as irrigation systems or roads are often made with very limited public participation. It is not unusual, for example, for farmers to be informed that an irrigation canal will be built across their land only at the moment the digger arrives. However, rural communities generally welcomed infrastructure development and surveys have revealed very little criticism of infrastructure projects even where local participation has been lacking at the planning stage.

3.2 Fisheries and wetland management

Formal responsibility for aquatic resources management in Lao PDR rests with the Livestock and Fisheries Department under the Ministry of Agriculture and Forestry. (The situation is somewhat unclear for protected areas, for which the Department of Forestry has overall responsibility).

In practice there is little active management of natural aquatic resources by the Department of Livestock and Fisheries. Although there are regulations, for example banning the use of destructive fishing gear and the capture of fish during the spawning season, these can not realistically be enforced by the government. This should not be taken to imply that destructive fishing is rampant. Rather, fishing is often regulated by local customary rules.

Communities carry out most active management of natural aquatic resources. The right of communities to manage these resources is recognized by the government, and community

management initiatives are encouraged and supported. However, as a result of the difficulties in sustaining such initiatives when several villages are involved, active management is largely restricted to small areas and individual water bodies.

While community management initiatives can be highly effective in regulating aquatic resource use locally, they are less effective in dealing with pressures on resources that arise outside the local area, such as cumulative effects of irrigation development. This is an important role for the government, which at present receives little attention.

Involvement of the Livestock and Fisheries Department in aquatic resources management is primarily focused on aquaculture and culture-enhanced fisheries. Natural aquatic resource issues are becoming increasingly integrated with aquaculture development. This is evident in tendencies such as the development of native species for aquaculture, or the development of rice-fish culture technology with explicit consideration of wild as well as cultured stocks.

4. Livelihood analysis

4.1 Livelihood strategies and assets

The lowland Lao PDR village economy is centered on paddy rice cultivation. In addition to paddy rice, some households may also have a small vegetable garden and some fruit trees, either in the house compound or near a stream or other water source. Other crops include cotton, tobacco, and sugarcane, but they are usually planted only in small quantities for personal use. Villagers also keep chickens, ducks, and pigs, as well as cattle and buffalo for ploughing and transportation, although these are quite rapidly being replaced by use of hand tractors in some areas.

Hunting, fishing, and gathering traditionally play an important role in the household economy, although as the population has increased and wild areas have been degraded, access to these resources may have deteriorated in some areas. Bamboo shoots, mushrooms, fruit, medicinal or culinary roots, and leaves are gathered in the forest according to the season.

Occupational specialization in villages is low. Some villagers may have skills in weaving, blacksmithing, religious knowledge or other crafts and industries, but these skills tend to be supplementary to growing enough rice and vegetables for the family. Household income may also be supplemented by part-time employment for government as teachers, health workers or agricultural extension agents, but wages are low and households usually combine this with the usual productive activities. This traditional picture is changing and examples were found among the households interviewed in the three selected villages of families who have begun to specialize in small-scale industry or commerce. However, such examples remain few, particular in more remote villages, and the diversification of the rural economy may be a slow process for the reasons discussed above.

A general overview of livelihood assets in Lao PDR rural households is given in Table 3.

Table 3. Livelihoods assets of rural households in Lao PDR

Physical	• Generally access to infrastructure and public services is poor, but also highly variable in rural areas, for example: • Nationally only 19% of rural villages have electricity; only 10% have any kind of market, less than 50% are accessible by truck in the wet season. • Access to an improved water source, health volunteers (the most basic level of
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	health services), and a complete primary school is highly variable but generally low. • Irrigation impacted villages gain the benefits of the irrigation infrastructure, including any reservoir, as well as any potentially negative effects.
Human	• Levels of health and education are poor, particularly for women. • The rural literacy rate for those 15 years and older is 79% for men and 49% for women. • In rural areas the average number of years of schooling for those aged 15-49 is 5 for men and 4 for women. • Health indicators are poor as summarized in Table 1. Malaria and many other infectious diseases are prevalent in most provinces. • Women bear a significant burden of agricultural work as well as other household tasks. • There is significant indigenous technical knowledge of aquatic resource use, as well as of other wild foods and products from forest areas.
Social	• Households cooperate informally, especially within kinship groups and in agricultural work. Labor exchange may occur for almost every task associated with rice farming, although it is most common for transplanting, harvesting, and threshing. In central and southern Laos, villagers call on other households for help to complete a task. No specific repayment is required, but the family is obligated to help others on a future occasion • Kinship and social networks are also an important source of food security. Households may receive gifts of rice, vegetables or fish at a time of need and reciprocate when in surplus. Wealthier households may make unreciprocated gifts to those more frequently in need. Illness, death, or other household emergencies also elicit help from one's neighbors. • A relatively low level of socio-economic differentiation between households in villages, and a coincidence of interests in terms of reliance on and uses of communal resources such as fisheries, enhances the potential for effective local management of such resources. • An administrative committee headed by a village president and other persons with responsibilities for such areas as economic and population records, self-defense militia, agriculture, women's affairs, and youth affairs governs villages. Village leaders have little or no formal authority and govern through consensus and the use of social pressure to ensure conformity.
Financial	• Household savings are low and few options are available. • The majority of loans are obtained from relatives or neighbors. • Money lending was outlawed but some lenders may still exist. • Fertilizer can be obtained from the crop section of the Ministry of Agriculture and Forestry, with 50% of the cost paid in cash and 50% repaid to the Agricultural Promotion bank at the end of the season. Farmer's needs are usually coordinated by the village administration and a group application for fertilizer credit made. • Commercial banking capacity, in particular credit and risk assessment skills, is limited, and the financial health of state owned commercial banks is uncertain (World Bank 2000b). • Sale of fish surpluses is one of few sources of cash income for poor households.

4.2 Gender

Household tasks are typically divided according to gender, but the divisions are not rigid, and men and women often perform tasks interchangeably (Randall Ireson 1995). For example, both sexes cut and carry firewood. Women and children traditionally carry water for household use and to cultivate kitchen gardens. Women do most of the cooking, household cleaning and washing, and serve as primary care takers for small children. They are the main marketers of surplus household food and other petty production, and women are usually the commercial

marketers for vegetables, fruit, fish, poultry, and basic household dry goods. Men typically market cattle, buffalo or pigs, and are responsible for the purchase of any mechanical items. Intra-family decision-making usually requires discussions between husband and wife, but the husband normally acts as the family representative in village meetings or other official functions. In farming work, men traditionally plough and harrow the rice fields, while women uproot the seedlings before transplanting them. Both sexes transplant, harvest, thresh, and carry rice.

Women face a number of constraints, which deny them access to the means to optimize their labor productivity (e.g. the burden of housework, insufficient agricultural skills-training by extension services, lack of access to credit, lack of research and technology development appropriate to their activities), even though these have increased since the introduction of NEM in 1986.

4.3 Differentiation between households

Status in villages accrues to age, wealth, skill in specific tasks, and religious knowledge. Social and economic stratification has generally been believed to be low within villages, although villages may differ substantially one from another. However, stratification appears to be increasing as more market oriented economic policies have been introduced and new economic opportunities arise

Wealth ranking exercises with both male and female respondent groups, revealed that access to land, adequate labor to cultivate that land and achievement of a secure level of rice self-sufficiency or surplus were the most important determinants of 'wealth' and vulnerability as perceived by respondents. Ownership of other productive assets such as buffalo, cows and hand tractors were important indicators of wealth.

4.4 Role of fishing in livelihoods

Fishing is perhaps only second in importance to rice production as a livelihood strategy. Subsistence fishing is carried out by almost everyone who has convenient access to water; an observation confirmed by all survey findings. Freshwater fish are the principal source of protein for the rural population, and estimates of average annual per capita consumption range from 7 to 17.5 kilograms. Fermented fish (*pa daek*) is also a significant staple in all villages, particular during periods in the year when catches are poor or peak agricultural labor requirements reduce the time available for fishing.

A small but significant proportion of fish passing through each household is bought or given by relatives and neighbors, the latter confirming a significant role for kinship and social networks in food security. Income from fish sales is an erratic but potentially lucrative boost to cash income, with intra-village and intra-district trade taking place between fish-surplus and fish-deficit villages. On average seventy percent of household fish supply is caught by households themselves, less than twenty percent purchased, and the remainder received as gifts, reciprocal exchange, or payment in kind for labor. Approximately seventy-five percent of own catches was consumed by the households themselves as opposed to being sold or given away. Approximately nineteen percent of the total catch recorded in the survey was sold, but this by only eleven percent of recorded cases.

As discussed above socio-economic differentiation within villages is relatively low. However, poor individuals tend to catch more, and fishing more often, than individuals from other socio-economic groups. It appears that with fewer economic opportunities the poor had more time to

spend fishing, and caught more because of the extra time spent and skill gained. Reliance on fishing was very similar for all groups. Reliance on bought fish is highest for the richest socio-economic group and lowest for the poorest, and this is explained in terms of purchasing power. Poor groups receive more fish, as strong social norms encourage wealthier households to help the poorer, particularly within kinship groups (though observed differences were not statistically significant). The poorest groups that catch most are also selling the most, and therefore using the local fishery for income generation as well as household subsistence to a greater extent.

Fishing as an activity is not gender specific though the choice of gear used tends to be. As noted above selling of fish and immediate control of the cash income also tends to be in the hands of women. Children also play quite a significant role in fisheries, particularly in the smaller scale stream, rice field and pond fishing.

The time required for fishing clearly has implications for labor allocation decisions by households. Households tend to fish close to their own villages, and predominantly in water bodies over which they had *de facto* rights of ownership. This suggested that the availability and characteristics of resources within walking distance of the village, and/or restrictions on use, were important determining factors of total catches (and more important than socio-economic differences between groups). Villagers also tend to be constrained in their access to fisheries by what is available in their immediate vicinity because fishing (particular with 'passive' gear) is often combined with other activities that require household members to be in or near their village or rice-fields, thus limiting time to travel to water bodies (that may be open access or shared with other villages) further away.

5. Trends and changes

Aquatic resources, their use and role in livelihoods in Lao PDR are subject to two trends, which are likely to produce a highly non-linear change over the next 20 years. In the short term, rapid agricultural intensification combined with very low opportunities for off-farm work is likely to lead to extreme pressure on aquatic resources and livelihoods of marginal groups. In the medium term, industrialization and opportunities for employment in neighboring countries are likely to relieve pressures on both.

Environment and human use:

- In the short term, increasing population density combined with limited opportunities for off-farm employment are likely to increase pressure on fisheries resources.
- Water resources development for irrigation and hydropower will lead to widespread hydrological alterations and loss of habitat connectivity.
- Initially increasing, but eventually reduced use of marginal land.
- Land use change due to agricultural intensification may be more critical than irrigation development, given the key role of rain fed paddies in fisheries production.
- Agricultural intensification is likely to lead to concentration of land ownership and the emergence of marginalized landless group.
- A small and relatively poor group of full-time fishers is likely to emerge in the vicinity of major rivers or reservoirs.

Macro challenges:

- Urbanization and industrialization, although limited at present, are likely to change the face of rural Lao PDR dramatically in the medium term. Following an initial rise in rural socio-economic stratification, the poor and marginal households are likely to relocate into towns or seek employment even further afield. An agricultural “middle class” may dominate rural areas, albeit reliant in part on remittances from family members employed off-farm.
- An ambitious road-building programme will increase market access considerably.

An overview of the likely changes:

Table 4. Summary of projected short and long-term trends

	Short-term (next 5-10 years)	Long-term (over 10 years)
Rural population	Increase overall, increased social stratification	Decrease overall, emergence of rural “middle class” as dominant group as poor migrate to urban centres
Environment	Increasing hydrological modification and agricultural intensification	Further agricultural intensification in prime areas, extensification with potential for ecological restoration in marginal areas
Role of fishing	Increasingly important for poor/marginal people	Domain of new rural “middle class”, combined subsistence and recreational function
Status of fisheries resources	Under extreme pressure, likelihood of some irreversible changes	Pressure reduced, conservation and restoration

6. Problem analysis

6.1 General livelihood problems identified by stakeholders

Invariably, the most important livelihood problems identified by stakeholders were of a general nature and unrelated to fisheries. This is not surprising given that fishing played an important, but rarely dominant role in the livelihoods of people interviewed.

In the lowland areas, flooding was perceived to be the single most important problem, followed by a range of problems deemed to be of similar importance: bad road access, lack of electricity and clean drinking water, agricultural pests and animal diseases, and low availability of aquatic resources. It is worth noting here that any solutions to the most important problem (flooding) are likely to carry significant fisheries costs.

In the upland areas, low availability and quality of agricultural land were deemed the most important problems, followed by low availability of aquatic resources. This ranking seems to imply that fisheries problems are seen as more important in upland than in lowland areas, confirming the impression that make a greater relative contribution to upland livelihoods, even though absolute catch levels are lower.

Low availability of aquatic resources was generally believed to be a consequence of high fishing pressure, and fishing restrictions were seen as the solution to this problem.

6.2 Fisheries-related problems identified by stakeholders and the review team

The following problems can be identified from the wider review of fisheries related issues conducted here:

- (1) Most living aquatic resources are heavily exploited. Average catch per unit of effort is low, and catches comprise predominantly small species. Community and co-management schemes for aquatic resources are common and at least some have been shown to be effective in conserving stocks. However, the strong reliance of much of the population on fishing makes widespread adoption of stringent effort controls impossible. Initiatives to control exploitation for the benefit of livelihoods and biodiversity should be further promoted, but only the development of livelihood alternatives will bring significant relief for aquatic resources.
- (2) Rapidly expanding irrigation development and the future likelihood of further large hydropower dams make significant hydrological modifications all but inevitable. This will impact on the productivity and biodiversity of the river and floodplain fisheries, but also create new opportunities for fishing. Careful consideration and management of fisheries impacts at the individual scheme and catchments/basin level are essential to minimize degradation of aquatic resources and maximize opportunities.
- (3) Land use change, particularly in the large areas currently under rain fed paddy cultivation, may have very dramatic impacts on fisheries. Land engineering to reduce water retention in irrigated paddies or heavy pesticide usage could virtually eliminate fisheries production from paddies, which currently accounts for 37% of the national total. This tradeoff is well understood by farmers. Developing intensive rice farming practices that conserve aquatic resources remains an important challenge.
- (4) Socio-economic stratification in rural areas is likely to increase substantially over the next few years. Fishing is likely to gain in importance as a livelihood option for the poorest and most marginalized groups. It will be crucial to maintain access to aquatic resources for these groups. Aquaculture-based fisheries could provide significant opportunities for these resource poor groups where potential problems of access can be resolved.

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