

CHAPTER 5

Outputs

5.1 Poverty Status

Poverty is multifaceted, and the different dimensions of poverty interact in important ways. So do interventions to improve the well-being of poor people. This section addresses the different facets of poverty in the four study countries. Attacking Poverty (World Bank 2000/2001) accepted the now established view of poverty as encompassing not only low income and consumption but also low achievement in education, health, nutrition, and other areas of human development. Based on what people say poverty means to them, it expands this definition to include lack of power and voice, and vulnerability and fear. These dimensions of human deprivation emerged forcefully from the *Voices of the Poor* study (World Bank 2000), which systematically sought the views of more than 60,000 men and women living in poverty in 60 countries.

The remainder of this section reviews the nature of 'poverty' at the national level. Overall, Bangladesh, ranked 144 on the UN's Human Development Index (HDI) (1999). Cambodia is one of the poorest countries in the region and has some of the worst HDIs in the world being ranked 153 out of 175 countries - the lowest in South East Asia. The average per capita income in 2002 was \$286 per annum. Almost 40% of households were below the poverty line, and about one-third of Cambodians did not have enough to eat. Laos ranked 136 on the UN's Human Development Index (HDI) (1999), while Vietnam ranked 121 on the UN's Human Development Index (HDI) (1999).

Table 5.1 summarises available information on some indicators of the extent of poverty in the countries and the involvement of people and poor people in fisheries, but it must be remembered that inland fisheries tend to be neglected in terms of poverty studies. In terms of national poverty lines the proportions of their populations below the poverty line also vary (depending on the year, from 50.9% for Vietnam to 39% for Cambodia).

Table 5.1 Summary of Poverty Indicators for Four Countries.

	Bangladesh	Cambodia	Lao PDR	Vietnam
Population (Million)	128	12	5.4	79.5
Growth rate (%)	1.6	2.9	2.6	1.8
Population density (pers/km sq)	981	67	22	238
% poor (national definitions)	<50 (overall) 90 (rural)	40% in rural (38% great lake)	40% rural (90% of all poor in rural areas)	57% in rural areas
% poor (under US\$1/day)	29%	na	na	na
% population involved in fisheries	90 mill live in floodplain, over 70% fish	85% engaged in forestry, crop, livestock and fisheries; 1.2 mill around Tonle Sap	80% agriculture, fishing not distinguished but 50-70% of people catch fish	14% of families work in fishery sector (includes marine)
GDP (US\$ per capita, 1999)	370	260	280	370
GDP per capita growth rate (% pa)	3.3%	2.2%	1.5%	2.9%
Agriculture as % of GDP	21%	51%	53%	23.6%

Source: various sources from Synthesis Report and Country Status Reports of this study, mainly World Bank (2000).

5.1.1 Bangladesh

With a population estimated at 125 million (and growth rate of around 2%), Bangladesh is one of the world's poorest countries. Over 50% of the population, 90% of which live in rural areas, is classified as poor, while BBS estimates 36% of all Bangladeshis are 'extremely poor' (including 40% of the rural population). Some 90 million people make a living on the floodplains, the majority from exploiting the NR base, while more than 50% are classed as functionally landless (owning less than 0.2 ha of land for cultivation.)

Bangladesh faces serious problems of natural resources management (NRM). There is relentless pressure on land from a growing population, while the stock of agricultural land is close to its natural limits. The extensive margin of cultivation was probably reached by the late 1950's, so increased agricultural output has to come from intensification. Current population density (averaging 900/km² in rural areas) is the highest in the world among countries of significant area. Resource use patterns are adapted to the temporally and spatially dynamic interface between terrestrial and aquatic natural resources. In consequence the rural population is extremely vulnerable to seasonality and to natural shocks and trends, while households build 'portfolios' of livelihood strategies to reduce vulnerability¹. Unable to be self-sufficient in food, the livelihoods of marginal rural families depend increasingly on a mixed portfolio of share-cropping, agricultural and non-agricultural wage labouring, fishing, migration to work elsewhere, and remittances from relatives abroad. Meanwhile for the whole population, land subdivision due to inheritance laws and crisis sales results in increasing landlessness and increasing pressure on Common Pool Resources (CPRs) (see Dixon 2000).

There are conflicting opinions as to whether Bangladesh is succeeding in reducing the proportion of its population in poverty. Recent studies (World Bank 1998b; Greeley 2000), based on BBS data, suggest Bangladesh has made outstanding progress over the last 20 years – the proportion of households below the poverty line falling from 80% to 37% in 1996 due to agriculturally-led growth, cheap food, strengthening domestic demand, and keeping labour in the countryside, while good management and reform at government level have also contributed. World Bank (1998b) – using BBS data - notes that the incidence of the 'very poor' declined from 43% of the population in 1991-1992 to 36% in 1995-1996 while the incidence of the 'poor' declined from 59% to 53%. Other authors (see Rahman and Hossain 1995), however, suggest the poverty reduction trend is downwards, despite some upward mobility and evidence of 'churning' between groups. BIDS figures indicate that while in 1994 the 'moderately poor' made up 29% of all households, between 1987 and 1994 30% of these fell into 'extreme poverty', while of 'tomorrow's poor' (21% of all households in 1994), 40% fell into poverty (24% into 'moderate poverty' and 16% into 'extreme poverty') by 1994.

Until the policy shift in 1996, the main driver of Bangladesh government policy in the natural resource sector since the 1950's had been the goal of national food security. Policy measures to achieve this goal primarily involved "extensification" (converting wetlands to agricultural production), and intensification of food-grain production through the introduction of High Yield Varieties (HYV) of rice, and investment in flood control, drainage and/or irrigation infrastructure (FCD/I) measures to support these (see Palmer-Jones 1999).

While agricultural production has kept abreast of the needs of a growing population, the trend has been for a reduction in the size of landholdings and increasing landlessness. In consequence poorer households are unable to meet their food security needs from their own or share-cropped land and have to diversify out of agriculture. While members of poor rural

¹ For the impact of seasonality and migration on rural livelihoods see Gill (1991). For the impact of seasonality more generally on livelihoods and the health of the poor see Chambers (1979), Chambers et al (1979), and Longhurst and Payne (1979). On livelihood 'portfolios' see Ellis (1998).

households may pursue a variety of livelihood strategies, including agricultural and migrant labouring, transportation, and petty trading, a very significant number turn to fishing as a part or even full-time occupation because of the low entry costs involved. This occupational trend, plus the trend in increased subsistence fishing is increasing pressure on the fisheries and leading to conflict between groups (see Barr et al 2000b, Dixon 2000). The World Bank sees the key to accelerating growth and reducing poverty in Bangladesh as being reform of the public sector. As World Bank (1999a) says 'development entails the need for an institutional transformation that improves information and creates incentives for effort.' In particular agrarian and institutional structures are constraints to achieving greater poverty reduction, while there is a need to address public sector inefficiencies and also institutional/ 'transforming' structures and processes at the local level.

This is the national picture from international agencies and researchers. The PRAs conducted under this study also offer a portrait of what poverty means for people dependent on inland fisheries. Table 5.2 shows how on average across the PRAs people defined relative poverty levels and the percentage of households in each wealth category.

Table 5.2 Wealth Category of Different Fisheries Stakeholders from PRAs (Bangladesh).

Stakeholder Type	Wealth Category with percentage	Criteria/wealth
Full time Fishers	1. Very poor; >50%	Landless, some have no homestead land or house. Some have small gear, some catch fish on share basis or as labours. Live hand to mouth, in debt
	2. Poor; 20%	Have homestead land no agricultural land. Have gear but no boat. No savings
	3. Average 20%	Have some agricultural Land, own gear, break even
	4. Better off; <10%	Have agricultural land, food surplus. Have fishing gear and boats. Have savings.
Part time Fishers	1. Poor; 50-70%	Some have no homestead or agricultural land (live on others' /khas land). Have gear, some fish on share basis as labourers
	2. Moderately poor; 25-30%	Have some agricultural land, homestead, house. Have poultry and livestock, have gear but no boat. Have diversified source of income
	3. Better off; 10-25%	Have agricultural land, boats & nets
Subsistence Fishers	1. Very Poor; 15-50%	Landless, most of them have no homestead land. Most depend also on labour, rickshaw, poultry, share cropping
	2. Poor; 25-50%	They do not have agricultural land, Mostly labour
	3. Moderately poor; 15-20%	Have some agricultural land but income is insufficient, no savings
	4. Rich; 10-15%	Have agricultural land and business, some have government job
Fish Trader Small Retailers	1. Very poor; 30-80%	Most do not have homestead land Live on others' land or khas land, some have no houses
	2. Poor; 30-50%	They some homestead land and houses. They can maintain family some how. Depend on others for running business
	3. Better off; 10-20%	Some have agricultural land (<1acre). Have capital to run business
Fish Trader Aratdar	1. Poor ; 25%	Have some agricultural land, livestock, and house. Mainly depend on loan to run business. 10-15 fishers attached with one's Arat.
	2. Moderately Poor; 50%	Have some agricultural land and house Dependent on credit to run business. 15-20 fishers attached.
	3. Better off; 50%	Have agricultural land, good houses and sufficient capital to run business. 20-30 fishers attached.
Fish Fry Catchers	1. Poor; 20%	Work as labour fry catcher, do not home agricultural land, depend on other.
	2. Moderately Poor; 50%	Have agricultural land, house and net and boat. Have other source of income
	3. Better off; 30%	Sufficient agricultural land, some of them are educated. Have net and boat to catch fry, and pond for nursery.
Fish Worker	1. Very poor	Most have no homestead land and house, live on others' land
	2. Poor	Have homestead land and house, some have small amount of agricultural land. Have other source of income like poultry.

The livelihood strategies of these, mainly poor, people dependent on inland fisheries are diverse according to the level of dependence on fishing and their opportunities, may still rely also on farming either on small plots of own land, through sharecropping, or most commonly as labourers on others land (Table 5.3).

Table 5.3 Livelihood Strategies of Different Stakeholder from PRAs (Bangladesh)

Stakeholder Type	Sources of Income	
	Main sources	Other sources
Full time Fisher	Fishing 70-95%	Agriculture, poultry business, wage labour poultry rearing shrimp fry collection, shrimp farmer 5-25%
Part time Fisher	Fishing 25 – 60%	Agriculture, wage labour, 15 – 50%
Subsistence Fishers	Agriculture - 50 – 80%	Poultry, business, Fishing, Wage labour, Shrimp fry collection 20 – 50%
Fish Traders	Fish trader 95%	Agriculture, livestock, poultry 10 – 20%
Fish Fry Catcher	Fry catching 70%	Agriculture, live stock 10 – 20%
Fry Raisers	Fry rearing & selling 60%	Fish farming, Agriculture 40%
Fish workers	Fish labour 25 – 80%	Agriculture, Fishing, Livestock, poultry 20 – 75%

5.1.2 Cambodia

According to the 1998 census, Cambodia's population was enumerated as 11.4 million, 82% live in rural areas, and about 36% of the Cambodian population lives below the poverty line. About 90% of rural households depend on agriculture as their primary source of income. However, large disparities in poverty distribution exist, with the coastal and mountainous regions having the lowest incidence of poverty (22%), the Tonle Sap Great Lake region having the highest incidences (38%), and the plain region with 29% of the population living below the poverty line (UNDP, 1999). The Tonle Sap and its floodplain alone are home to an estimated 1.2 million people of whom 25% live in floating villages or raised houses with little or no access to farmland (FACT, 2002).

Households headed by someone working in agriculture and fishing manifest the highest incidences of poverty (46%), followed by construction and mining (37%), transport (31%), and government workers (20%) (UNDP, 1997). Nearly 75% of poor people are engaged in fishing and farming occupations. Poverty incidences are also higher in households headed by someone with no schooling (47.1%) as compared to households headed by someone with secondary education (30.1%) and for those with college/ university degree (0 %).

5.1.3 Laos

Datt and Wang (2001) categorise the poor into the 'very poor' (or ultra poor) whose per capita consumption is below the food poverty line, and the 'moderately poor' whose per capita consumption falls between the food and the total poverty lines. On this definition, the very poor make up about 17% of the total population, while the moderately poor account for about 20%. Poor households are more likely to have an illiterate head, and tend to be larger and to have a higher dependency ratio than non-poor households.

5.1.4 Vietnam

Vietnam is among the most densely populated countries in Southeast Asia. The highest densities occur in the south (especially within the delta of the Mekong River) and the north (Red River delta) which represent the country's most important agricultural areas. The total population of Vietnam, by mid 2001 was 78.7 million, with an average annual growth (from 1995 to 2001) of 1.5%. Economic development has accelerated in recent years, but the

percentages of poor and hungry households in Vietnam remain relatively high. According to a Living Standards Measurement Survey (DFID), Vietnam’s poverty incidence was over 37% in 1998, and is estimated at about 32% in 2000 (based on average daily intake of 2,100 Kcal or total consumption of 20kg in the rural low/midland.

This study (see Vietnam PRA Report) found that there is a group of people, the “static poor”, who have become trapped in poverty which is difficult to reverse. These poor (Table 5.4 gives an example from one PRA) are landless, and it appears that returns to selling wage labor (the only viable income generating activity available beside fish capture) are so low that it is impossible to save enough to purchase assets, such as land. Most of these poor are in debt to both government lending programs and/or private moneylenders. If (and when) they default on government loans, they become ineligible for new loans, while if they borrow from private moneylenders, the interest rate is so high that they end up paying much more cumulative interest than they originally borrowed in loan principal. This group is also not showing any improvements in education, health, or income levels.

Table 5.4 Wealth ranking for full time fisher group: Vietnam canal environment PRA.

	Rich	Average	Poor
House style	Wall, having good facilities	Floor house, brick floor, and tone roof,	Temporary house (bamboo-leaf), Eucalyptus, tin roof.
Income level	High	Average	Low
Land	7-8 ha	1-2ha	Landless
Property	boat, machine, fishing-net, equipment, Japan motorcycle, color, cassette, etc	Small boat and machine (Kohler 4), china motorcycle, color TV	No facilities for catching, having bicycle, and white-black TV, etc.
Knowledge level	children coming school (100% family), high studying	40% family has children coming secondary school	1% family has children coming school (low level)
Debt	Borrow money to take business	To make farming	Cannot pay (private lender)
Capital	much	A little	No
No. of children	4-5 people	5-6 people	Depend on family
Job	Having facility to flow	Making farming, small business	Making employment, fishing

5.1.5 Social Differentiation

In **Bangladesh** inland fisheries the traditional fishers came from Hindu fishing castes, culturally and socially distinct from the surrounding communities of Muslim farmers and labourers. While these differences still exist and traditional fishing communities continue to exist, this minority group has had an unofficial trend of migration – to other occupations and to India. Meanwhile two categories of Muslim fishery stakeholders have developed. Among the poor are people who fish part time or for food, seasonally having no alternative income source. At the top are better off people who invest in fisheries. They range from local farmers who increasingly invest in brushpiles to control parts of river fisheries or who fence off areas of seasonal floodplain to culture fish, up through moneylenders who own or finance fishing gears and trading, to professional leaseholders and investors who are able to gain the fishing rights through the leasing system of *jalmohals* (physically defined state-owned waterbodies for which the fishing rights are auctioned out by government).

The majority of those who fish as an occupation are men, with women and children fishing on a subsistence basis, and being involved in post-harvest activities such as fish trading, and drying fish. The contribution of children to the floodplain fishery is often overlooked,

though their fishing, using cheap simple gears such as push and scoop nets, can account for up to 50% of effort in subsistence fisheries (FAP 17, 1994). Hindu women, widows, very poor women and female heads of households, however, do fish in open-waters, ponds and ditches (FAP 17, 1994) when the economic costs of not fishing outweigh the social costs of fishing (Kabeer, 1998).

In **Cambodia** the PRAs and country status report indicate a relatively homogeneous society, but with a range of fishery dependence, that is predominantly rural based and combines fishing and farming. There are, however, defined fishing communes. The differentiation in the fishing sector comes, as in Bangladesh, between the rich investors in fisheries who can afford to buy the rights to fish in the lot system and to hire guards etc., compared with the many small scale fishers who use seasonally flooded areas outside of the high value *lots* (physically defined state-owned waterbodies for which the fishing rights are auctioned out by government). Nineteen percent of households in the fishing commune are headed by women, while national statistics indicate that 26% of households in the whole nation are headed by women.

In **Lao PDR** status in villages accrues to age, wealth, skill in specific tasks, and religious knowledge. Social and economic stratification has generally been low within villages, although villages may differ substantially one from another. However, stratification appears to be increasing as new market oriented economic opportunities have emerged under current policies

Wealth ranking exercises with both male and female respondent groups, revealed that access to land, adequate labour 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 also important indicators of wealth. Fishing as an activity is not gender specific though the choice of gear used tends to be. The 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, ricefield and pond fishing (Lorenzen 2000).

At the national level Laos 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.

In **Vietnam** the opening up of the economy to market forces after *doi moi* is leading to increased socio-economic differentiation. This is visible throughout the study as asset markets become more flexible and as successful fishers begin to benefit from larger-scale production and diversification. This differentiation is also strongly associated with landlessness and land agglomeration. Regionally upland areas tend to have a higher incidence of poverty and also are ethnically diverse.

There are differences between the genders in their involvement in the fisheries, with commercial fishing and fisheries related wage-labour being dominated by men. Women are more involved with smaller-scale household food production activities and with fish trading.

5.2 Fisheries Resource Status and Importance

The livelihood strategies of poor people using inland fisheries and aquatic resources can only be understood in the context of some background on the resources themselves. The study did not undertake biological investigations or undertake a fresh analysis of existing statistics, but has summarized available information and trends. Table 5.5 gives an overview of the fishery resources and their importance. Major points of comparison are that the type of fishery in each country is broadly similar, being dominated by major rivers and their floodplains and deltas. The strong seasonality of water areas and flows means that fish follow seasonal cycles and depend on a range of habitats whether these are at the local micro scale or involve long distance migrations.

However, existing information and emphasis in development in the countries to some extent follows two patterns: Bangladesh and Cambodia both with large areas of inland fisheries and consequently high total catches, and Lao PDR and Vietnam with relatively smaller areas and total catches. This is despite the apparent paradox of high species diversity in the last two countries, and in Lao PDR of course high dependence for fish on inland capture fisheries since this is the only land-locked country of the four studied. There are common threats and trends of high fishing pressure and loss of wetland and floodplain habitat to agriculture in the form of flood control and drainage, modification of river flows for hydro-electric power generation, and increasing use of agro-chemicals. However, there are few studies that quantify or demonstrate clear impacts from such trends. Moreover there are problems with availability, reliability and the overall coverage of fisheries data in all countries

Table 5.5 Summary of Inland Fishery Resources in Four Countries

Characteristic	Bangladesh	Cambodia	Lao PDR	Vietnam
No. freshwater fin-fish species (approximate)	273 (including exotics)	280 (swamp forest)	1,200 in Mekong (includes other countries)	145 in Mekong delta, 544 in whole country
Wetland areas (ha)	About 1.4 mill ha of jalmohals (permanent waters including estuary), 3 mill ha floodplain	Tonle Sap Lake 0.3-1 mill ha	About 0.4 mill ha of permanent waters, 0.47 mill ha of seasonal floodplains (ricefield)	Not known - under representation of this sector in official statistics and government policies
System	Seasonal cycle of movement between dry season water and floodplains in monsoon, some migrate to breed in floodplain, others breed in permanent waterbodies and the spawn/young move into the floodplain			
Inland fishery production	690,000 mt	295,000-420,000 tons	64,593 mt (but no reliable data)	About 70,000 mt
Inland fish catch trend	Recent revisions show declining trend (will average 0.9% pa). Official data need revised survey methods. Subsistence catches likely under recorded, fishers report declining CPUE	Not known but thought to be under pressure/declining, recent field studies greatly revised upward total catch estimates	Not known, culture fisheries in small dams have increased catches, but swamps converting to agriculture, most of catch subsistence and difficult to quantify	Declining during 1990s, likely due to conversion of remaining wetlands to intensive rice production, shrimp ponds, and agro-chemical use.
Fisheries sector as % of GDP	5.9%	8.8%-10.3%	52.6% in 1998 from agriculture (fisheries not separated)	3%
Inland capture fisheries as % of total fish produced	38.7%	89% (assuming recent inland catch estimates)	78%	About 4%
% people fishing	10% of the population have some dependence on the fisheries sector for income.			1.5 million people

Fisheries ecology of the Mekong River Basin and of Bangladesh is intimately linked to, and influenced by, the morphological and hydrological characteristics of the basin. The main driving force responsible for the fisheries productivity of floodplain river systems is the pulsing of the river flow, which produces periodic inundations of the floodplain.

The bulk of fish production is derived directly or indirectly from the floodplain, which is periodically replenished with inorganic nutrients derived from water and sediments transported from the main channel. These promote primary production from phytoplankton, grasses and higher plants. The ephemeral conditions also produce 'dynamic edge effects' or moving littoral zones where decomposition of organic material is promoted, thereby releasing nutrients back into the floodplain (Junk et al, 1989). This rapid increase in primary production and area available for colonization by aquatic organisms, supports a diverse community of highly productive fauna. Fish exploit this surge in production to grow rapidly. The floodplain also provides sheltered spawning grounds and refugia amongst submerged vegetation for the young and juvenile stages.

Various dry season waterbodies, replenished with water from the flood pulse, also provide important dry season refugia for floodplain resident fish species (Welcome, 1985). By contrast, conditions in the main channel are less favourable for primary and secondary production. Most species of fish that permanently occupy the main channel tend to be predators of fish and aquatic invertebrates which depend to a great extent directly or indirectly on the primary production of the floodplains. The main channel is used mainly as a migration route for gaining access to feeding and spawning grounds upon the floodplain or as a refuge during the dry season.

5.2.1 Bangladesh

The 1 million ha of perennial inland water-bodies (15% of Bangladesh's territorial area) and the over 3 million ha of floodplains provide an extensive opportunity for inland fisheries. Various types of seasonal and perennial water bodies exist on the Bangladesh floodplain, and include main rivers and their distributaries and tributaries, lakes, dead rivers and oxbow lakes, marshes and swamps, and mangrove and estuarine channels (up to 15 m depth of water in the coastal fringe is legally inland fisheries). During the flood period these water bodies merge with each other and with the main river channels. Many become isolated from one another or dry out during the dry season. In an average year c. 26,000 km² of the floodplain is submerged during June to October in response to monsoon rains (May to September) and snow melt. The upper limit in recent years has been 82,000 km², c. 57% of the whole country, although the unofficial value for 1998 was 95,000 km² (66% of the country). FAP17 (1994) assessed production from unregulated beel/floodplain/canal systems and found overall production to vary between 68 and 202 kg/ha with a mean of 119 kg/ha. In Tangail area (de Graaf et al 2001) found average production during 1992-2000 of 165 kg/ha/yr for deeper flooded land and 83 kg/ha/year for shallower flooded land. There was however tremendous variation between years. In dry years the catch was 20-80% of average; while in the two "big flood" years, production was 200-250% higher than average.

About 20-30 fish species, mostly so called "blackfish", which are resident in the floodplain and tolerant to low levels of oxygen, provide the majority of the national freshwater fish production. Cyprinidae, carps and minnows, and a large variety of catfishes predominate in the rivers and floodplains. The hilsha *Tenulosa ilisha* fishery is the largest single fishery in inland waters but now most of the catch comes from the estuarine and inshore areas. Much of the fish consumed by rural people comprise small species. With increased overall fish production in the country (from aquaculture) fish consumption has also increased during the last two decades. Per capita daily fish consumption has increased to 38 g in 2001 from 22 g

in 1981 (BBS 2001). Field surveys indicate higher consumption for pond owners and richer households, but that for the rural poor including full time fishers consumption in the late 1990s is closer to the 1982 national figure (Thompson et al. 2002). And these surveys indicate that overall the most commonly eaten fish by poor and rich alike in the rural floodplain areas are small *Puntius* sp.

During the last 50 years there has been a considerable loss and degradation of inland water bodies (fish habitat) due to man made and natural causes. Siltation is natural but abstraction of water for irrigation and fishing in the dry season reduces critical habitat. Flood Control, Drainage and/or Irrigation (FCD/I) projects and poorly planned roads constrain the high sediment loads. Some 8,888 km of embankments affecting 62% of cultivable land have helped increase agriculture production, but 0.814 million ha of floodplain wetland was lost up to 1985 and by the year of 2005 2 million ha of seasonal wetlands are expected to be lost (MPO 1988) with potential adverse consequence for fisheries. To counter this there has been a major emphasis on pond aquaculture development particularly from the mid-1980s which has resulted in rapid increases in production of carps from ponds, and there have also been several projects to support development of inland capture fisheries. The latter have tended to focus either on enhancement technologies or on institutional arrangements and community participation. The outcome to date is that stocking of carps is now widespread in closed lakes (for example ox-bow lakes and small beels) and is also increasingly practiced by landowners where they have small, well defined and bounded areas of floodplain; while in the remaining openwater systems community based management systems appear promising and have focused on fish sanctuaries, habitat restoration and closed seasons which are relatively easy for communities to adopt. Public stocking of floodplains has been promoted and some increases in catches have been attributed to it, but is controversial and has not been organisationally and financially sustainable due to the risks of elite capture and difficulty of organising financial contributions from many small scale fishers.

5.2.2 Cambodia

Inland fisheries occupy two major ecosystems: the Tonle Sap region consisting of the Great Lake and Tonle Sap River, (which accounts for approximately 60% of annual commercial fisheries production), and the Mekong-Bassac inundated region. In the dry season, the Great Lake occupies an area of 3,000 km² with an average water depth of around 0.8 -1m. During the rainy season, it expands to more than 10,000 km² covering the flooded forest to depth varying from 10-12 m. The Mekong-Bassac River system creates a vast inland water system, comprising numerous rivers and lakes, flooded forest, grassland, rice fields and swamps which is inundated during the wet season. Key factors are the seasonal reversal of flow between the Great Lake and Mekong River with attendant migrations of huge volumes of fish.

The annual freshwater fish catch is in the order of 295,000-420,000 tons, and fisheries contribute 8.8-10.3% of GDP. According to DOF (2000), the total inland fish production for the whole country ranges from 279,000 to 441,000 t of which 115,000-140,000 t is landed by small-scale fisheries, 45,000-110,000 t from rice field fisheries, 34,000-91,000 t from large scale fisheries and 85,000-100,000 t from middle scale fisheries. Fish consumption rates vary around the country. The highest consumption rates are found in or near fishing villages, particularly near the Great Lake (GL) and the Tonle Sap (TS) where rates may exceed 80 kg per capita per annum. In southeastern Cambodia annual fish consumption per capita is much lower (13.5 kg). The national average consumption per capita is estimated to be 25-30 kg per capita per year.

Fishery management is limited and has mostly been through the lot system of leasing out fishing rights, more recently from 2000 there has been a move to reserve about a third of

fisheries for community based management and DOF has set up a community management wing to support small scale fisher organization.

5.2.3 Lao PDR

Fish play an important role in the economy and diet of the people, particularly those living in the rural areas. For these people, fish and other aquatic animals such as frogs, snails, snakes and turtles are an easily accessible and inexpensive source of food. Most living aquatic resources in Laos are heavily exploited. Average catch per unit of effort is low (300 g/hour fished), and catches comprise predominantly small species. 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 labour.

According to sample surveys in 1995 the annual per capita fish consumption of rural and urban dwellers was 10 and 8 kg respectively. These figures indicate that a minimum of 30 percent of the total animal protein intake comes from aquatic resources. However, a recent fisheries survey in Luang Prabang Province carried out by the Living Aquatic Resources Research Center (LARReC), concluded that the average yearly per capita consumption of all fish and aquatic products is estimated to be 29 kg per person per year, with fresh fish accounting for between 16 and 22 kg. Fish and aquatic animals account for 43 % of the total animal product consumption

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

5.2.4 Vietnam

Inland capture fisheries have not been clearly separated in planning from aquaculture. The main focus of fisheries sector development policy has been on aquaculture extension and intensification. During the last few years (1994-1997) the contribution of the fisheries sector to national GDP was about 3%. The sector has performed well attaining a rapid growth in production from 890,590 t in 1990 to 1,969,100 t in 2000 (MOF, 2000). However, while culture fisheries showed a huge increase in production, inland capture fisheries have been declining from around 100,000 t pa to about 70,000 t pa during the 1990s (Fig 5.1).

Since Vietnamese households often keep pigs and poultry, fish is not the only supplier of animal protein in the diet. In fact wild and cultured fish contribute about 40% of the total animal protein intake of the population. However the per capita availability of fish has increased from 11.8 kg in 1993 to 13.5 kg in 1995 and is expected to reach 15.0 kg by year 2000, which probably reflects increasing incomes and levels of well-being as well as growing aquaculture production.

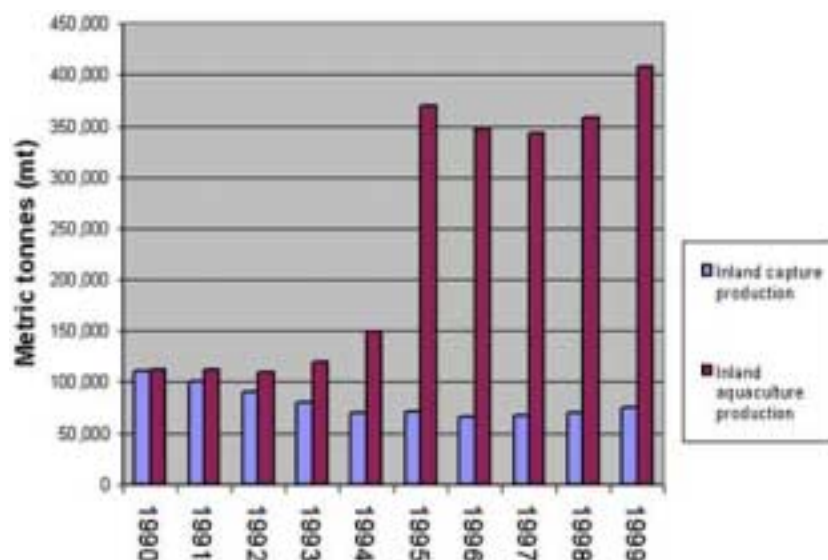


Figure 5.1. Vietnam - Inland capture fisheries and aquaculture production (national totals). Source: RIA 1, 2001

The major river fisheries are centred on the Red River and its delta in the north, which is now highly degraded, and more importantly the Mekong delta in the south. FAO studies from remote sensing flooding imagery show that up to 40 percent of the area of the Mekong delta in Vietnam is still flooded seasonally, mainly in the upper section. This is essentially an extension of the highly productive Tonle Sap floodplain system of the lower Mekong in Cambodia

5.3 Fisheries Management Policies and Institutions

Policies and institutions are to a great extent country specific, this section summarises the policy context and related transforming structures in each country as they relate to inland fisheries.

5.3.1 Fisheries Policies in Bangladesh

In Bangladesh, all water bodies, except seasonally flooded private paddy fields and most of the man-made ponds, are owned by the Government. The Government owned inland water bodies (rivers, canals, beels, oxbow lakes, reservoir) are known as *jalmohals* and since 1950 have been controlled and managed by the Ministry of Land (MOL) with the aim of collecting Government revenue by leasing out fishing rights. While the Ministry of Fisheries and Livestock (MOFL) is responsible for management and development and conservation of fisheries resources for sustainable yield it only has authority over some *jalmohals* on MOL's terms and conditions. Since the 1960s there have been attempts to change policy in order to help fishing communities gain access to fisheries and improve their share of the benefits and to improve the sustainability of management either through limiting fishing in some way or through enhancement, but these have had limited effect.

Current administration of fisheries is complex. *Jalmohals* measuring up to 3 acres (1.2 ha) and with an annual lease value of up to Tk. 5,000 (about US\$ 80) have been open access resources since 1987, the local councils pay a nominal rent to central government for this. All closed/semi-closed water bodies (ponds and closed beels) measuring 3-20 acres (1.2-8 ha) are under sub-district administration and from 1997 they have been directed to lease

fishing rights to registered youth cooperatives to create income opportunities for the 15-30 year age group irrespective of their fishing involvement. Waterbodies larger than 20 acre (8 ha) are administered by the MOL through the districts and are leased by tender to the highest bidder (with a preference for fisher cooperatives). During 1986-1995 some 257 jalmohals were placed under the New Fisheries Management Policy (NFMP) implemented by MOFL, "genuine fishers" were licensed via the national fishers association, but revenue still had to increase at 10% pa, 31 jalmohals remain under this system. In 1995 flowing rivers were declared to be open access with no revenue collection, and fishing pressure has been increasing. In addition around 400 jalmohals have been transferred to the MOFL for management under different development projects of DOF, most have some form of community management. Lastly the brackish water fisheries within the Sundarbans reserved forest are managed by the Department of Forest.

The Ministry of Fisheries and Livestock is the lead agency responsible for formulating fisheries policy and strategies for proper management and development of fisheries resources for sustainable fish production. Finally after long delays a national fisheries policy was approved in 1998. Under it the Department of Fisheries has responsibility for development and management of inland fisheries, in general it sets out the aims for the sector:

1. Development of fisheries resources and increase of fish production.
2. Poverty alleviation through creation of employment opportunities and improvement of socio-economic condition of fisher community.
3. Meet the national demand for animal protein.
4. Increase foreign exchange earnings and economic growth through export of fish products.
5. Maintain environmental balance, protect biodiversity, and improve public health.

However, the implementation strategies for the policy have not yet been formulated.

Amongst other agencies involved in the fisheries sector, obviously the MOL has the key role as it controls all the public waterbodies. The Bangladesh Water Development Board and Local Government Engineering Department are mainly responsible for water management infrastructure; while the Ministry of Forest and Environment has responsibilities for the Sundarbans mangrove forest and for environmental protection including pollution control and some major wetlands in critical ecological areas

In the private sector, fisher cooperative societies and several NGOs are involved in the sector. Inland fisheries in practice are almost entirely in the hands of the private sector in the form of leaseholders (nominally fisher cooperatives but often powerful middlemen, professional leaseholders, and businessmen). The jalmohals under DOF administration are the exception and are for sustainable management through various extents of user (fisher) participation. In these there is co-management with DOF advising fisher communities and testing of systems such as fish sanctuaries and stock enhancement.

In the past the Government policy for land use, water resource and agriculture was exclusively focused to grow more rice through agricultural development and ignored other uses of wetlands and floodplains such as fisheries, aquatic plants, forests, grazing, navigation, etc. The resultant flood control and drainage negatively impacted on these other uses. Realising the consequences the Government has recognized the importance of fisheries and environment in the water resource, land use, and agriculture policies recently. The national policies are well formulated but very general and overlapping and are not fully translated into strategies and action plans. The actual fisheries policies in practice are scattered and a mix of traditional short-sighted revenue orientation and well intentioned but

ad hoc changes. But, the major problem is that the leaseholding interests at various levels are so entrenched in the system that they are able to overcome or manoeuvre around changes that threaten their income and power.

As a sample, the Ministry of Environment and Forestry's environment policy is summarised:

- 1) Environment congenial for fish should be ensured through:
 - a) control of discharge of industrial and domestic untreated effluent/waste into water,
 - b) prohibition of use of harmful insecticides and pesticides in agriculture, which may pollute water and harm aquatic organisms,
 - c) waterbodies cannot be dewatered for harvesting fish.
- 2) Arrangement will be made to halt reduction of area of water bodies and for their development/reclamation as source of fish production:
 - a) water holding capacity of rivers, beels etc. can be increased by excavation/dredging,
 - b) waterbodies to be reclaimed/developed and declared as national protected areas for fish production.
- 3) Flood control projects and other development activities which have already had a harmful effect on fish resources are to be evaluated and their environment improved for fish. Appropriate arrangements are to be made so that flow and current of natural waterbodies are not affected by roads, embankments, etc.
- 4) Ensure that fisheries development works do not create any effect on mangrove forest and other ecosystems.

5.3.2 Cambodia

In Cambodia there is no national policy directly related to management of aquatic resources. The National Program to Rehabilitate and Develop Cambodia sets a cohesive package, objectives of which include establishment of law, economic stabilization and implementation of structural reforms, strengthening capacity building, fostering rehabilitation and construction of physical infrastructures and facilities, integrating Cambodia's economy into the region and the world, promoting rural development and sound environmental management, and optimizing the use of natural resources.

Rapid, sustained and equitable agricultural growth; and empowerment of the poor are the two main strategies for agricultural development. The first strategy is the growth-mediated approach with its main thrust to invigorate and modernize the agricultural sector, generate employment, enhance household incomes and improve the access of the less privileged to food. The second strategy is the entitlement-mediated approach which empowers farmers, rural poor and other vulnerable groups to enhance their ability to participate in the growth process. It focuses on improving these groups' access to land, water and other production inputs for sustainable livelihood, food security and overall socio-economic development.

Since 1979, the main policy of the Cambodian Department of Fisheries has been to sustain landings. The national fisheries policy is still concerned with managing and conserving the natural aquatic resource in order to supply sufficient food to people. Yet this contrasted with policies in practice whereby fisheries were administered to generate revenue for the government from fishing lots (comparable to jalmohals in Bangladesh – areas of permanent wetlands that are state property and for which the fishing rights are auctioned out to earn revenue). However, fishing lot owners no longer respect the conservation clauses in their leases and do not take a long term perspective for sustainable management (the same is true in Bangladesh for jalmohals).

The fishing concession (lot) system remains the primary means by which DOF manages Cambodia's fisheries, but in 2000 it was reformed. The key elements of reform include the reduction of concession fishing lot areas and promotion of community fisheries management through the establishment of a community fisheries development office and sub-decree as the legal framework for this management approach. In early 2001, 56% of fishing lot areas were released to communities, which in conjunction with local authorities will manage, conserve, develop and sustainably use fisheries resources and will have their use rights and benefits protected. However, there is no guarantee of improved management without legislative structures, funding or training to support the establishment of community fisheries in these areas. They may otherwise effectively become open access areas, leading to confusion over access rights, alleged uncontrolled exploitation and illegal fishing. Concerns have been raised that there has been undue haste to develop community fisheries in order to fill the gap after removal of lot ownership. In the absence of immediate action this could lead to problems due to poor understanding of the concepts, and lack of vital information such as maps, fish catch and stock data, fisher's need assessment and understanding of environmental considerations, together with a failure to develop and implement in a participatory way effective regulations and structures.

5.3.3 Lao PDR

Laos 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 due to an almost complete lack of resources in central 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 welcome infrastructure development and surveys have revealed very little criticism of infrastructure projects even where local participation has been lacking at the planning stage. At the village and local level there is some successful experience of communities establishing their own fishery management systems.

5.3.4 Vietnam

In Vietnam, all significant policy debate is conducted within the confines of government and party. Some policy issues include:

- The 29 points to prevent damaging actions by fishers were promulgated on 25 April 1989 under the law on the Protection and Development of Aquatic Resources. The Environmental Law was pronounced in December 1993.
- The rules talk about the critical importance of maintaining good water quality, the size of the aquatic resources that can be harvested, and timing for catching.
- Using credit to help the fishers change to practices that are not damaging to aquatic resources, such as changing from fishing into cage culture in the rivers and lakes is also promoted.
- The impacts of public stocking of exotic fishes in rivers and lakes, for example grass carp and silver carp in the Red River appear not to have been discussed or assessed.
- Improvement in environmental education on aquatic resources in the universities and provinces being promoted.

- Promoting other sectors, such as industry, agriculture and forestry, to use limited amounts of chemicals and to adopt sustainable models for development, for example in agriculture integrated pest management and “VAC” (*vuong, ao, chuong* or garden, fish pond, animal house) system.

The Vietnamese government has taken a number of decisions and measures to support aquaculture development as it increasingly recognises the contribution of aquaculture to poverty alleviation and rural development; but has tended to ignore inland capture fisheries.

5.4 Livelihood Assets

The Sustainable Livelihoods framework can serve as a guide to thinking about issues that affect fisheries stakeholders at various different levels. That is, ‘capital’ assets and livelihood strategies, the vulnerability context, and the impact of policies, institutions and processes can be considered for individuals or households or larger communities. In this section, and in the study as a whole, the main focus in understanding livelihoods has been at the household level complemented by the viewpoint of individuals expressed through the PRAs in each country. The overall pattern for livelihoods dependent on inland fisheries, with common information for all the target countries, is shown in Fig. 5.2. While various examples of PRA outputs are given in this section.

5.4.1 Human Capital

Overall there is still considerable poverty in the four countries. High proportions of people are illiterate (except for Vietnam), although current reported school enrolment is high. Substantial incidence of child malnutrition, and low proportions of the population with access to clean water (except for Bangladesh) are taken not only as an indicator of the general well-being or otherwise of the population, but also as indicating the potential for each country to improve the lives of people through sustainable development and economic growth (Table 5.6).

Table 5.6 Human capital indicators at the national level.

Country	% of people 15yr and above who were illiterate in 1998		Life expectancy at birth (years)	Child Malnutrition (under 5 years)	Primary school enrolment (1997)	Access to improved water source (%population)	Sanitation (% population)
	Male	Female					
Bangladesh	49	71	58.9	56%	75%	84	35
Cambodia	43	80	56.4	NA	100%	30	NA
Laos	38	70	53.1	40%	73%	39	24
Vietnam	5	9	67.8	40%	100%	36	21

Source: World Bank 2000

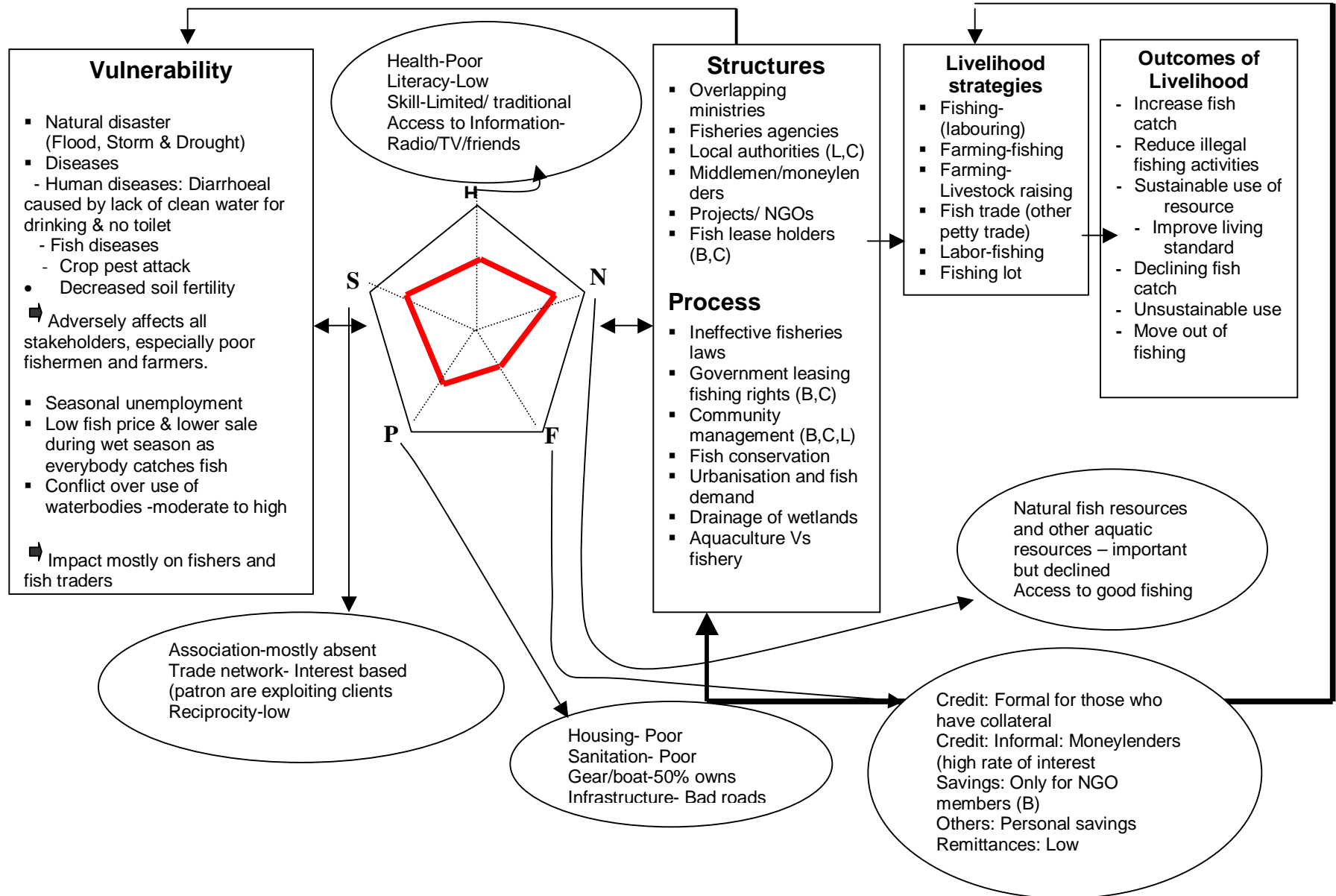
Gender differentiation in fish capture activities is an important issue for any future development plans for fisheries in the target countries. Already some comments have been made on this in the social differentiation section, but as an example of the PRA analysis Table 5.7 indicates that there is clear division of labour in the capture fisheries in Vietnam.

Table 5.7 Gender role analysis in participating fish capture: Vietnam Rice field PRA.

Works	Men	Women	Both	Children	Time	Place
Catching fish	X	x	x	x	flood season	Catching in field
	X				Dry season	Catching in pool
Selling		X		x	Fish season	Market, neighbor,
Employing labour			X			

X-Main actor, x-secondary actor

Figure 5.2 Summary of Livelihood Analysis for Inland Fisheries
Livelihoods Assets



Bangladesh

The large and growing population of Bangladesh is seen as a problem rather than a blessing because of deficiencies in respect of literacy, skill and sound health. However, at the national level, human resource quality is gradually improving. The overall literacy rate has increased to 53% in 2001 as against 32% in 1991 and 18% in 1979. However, the literacy rate in female population has lagged behind that for men (BBS 2002).

In Bangladesh access to clean drinking water, sanitary latrine, electricity, improved communication etc. has improved over the past few decades. According to BBS (2001), 7% of people drink tap water and 90% drink tube-well water, which according to 1991 census were 4% and 75% respectively. These gains are reflected in improvements in other indicators: Child mortality has decreased to 51% in 2000 from 75% in 1973. Life expectancy increased from 56.6 years in 1997 to 61.0 years in 2001, indicating gains in health.

In Bangladesh, the incidence of poverty in households with agriculture, forestry, and fishing as major occupations is much higher than the overall national average (BBS 2000). About 40% of these households are below the poverty line (taking the lower poverty line). The highest percentage (49.5%) of households which are below the poverty line (using lower poverty line) is that of landless households. According to the 1995-96 HES (BBS 1997) 74.8% of landless agricultural workers and 45.4% of fishers were below the lower poverty line as against the national rural average of 39.8%. Professional fishers are usually poor, landless and illiterate. BRAC (2001) reported literacy rate to be 36% in eight open water fisheries areas under the Fourth Fisheries Project. People have access to tubewells for drinking water, but the majority lack a sanitary latrine. Table 5.8 compares the status of full time fishers in different environments.

Table 5.8 Human capital indicators for full time fishers from PRAs in Bangladesh.

	Reservoir	Oxbow lake	Enhanced Beel	Floodplain	Haor	River	Estuary	Sundarbans
Health	Poor	Good	Poor	Poor	Poor	Poor	Good	Poor
Literacy	10% (children)	No	10%	40%	30%	10%	10%	Illiterate
Fishery skill	Traditional	Yes	Yes	yes	Yes	Yes		DOF conservation training
Skill training		No	No		No	Fish cultivation	None	
Access to information			Radio, GO and NGO		Radio, neighbours	Radio, television	UFO (DOF)	Radio, TV, markets, NGOs, GO

Cambodia

Poverty incidences are higher in households headed by someone with no schooling (47%) as compared to households headed by someone with secondary education (30%) and for those with a college/university degree (0%). In general, male literacy rates are higher than those for females, while males have more chance to go to school than women. Twice as many women as men over 15 years of age have never attended school. Literacy rates are higher in urban than rural areas. A majority of the population aged 25 years and over have not completed primary level education: 70% of the rural population and 40% of the urban population. Only a tiny number have gone beyond secondary level. Cambodia also performs poorly as regards the proportion of children completing even primary education. While there is educational provision, three-quarters of the cost of primary education is met by households and communities. Education is thus too expensive for many families; girls and older children especially work rather than go to school or are withdrawn from school when the family falls into debt (DFID 2000).

Cambodia also does poorly on other social indicators. For example, half the children under five are malnourished, while for every 1000 live births 115 children die before the age of five. 42% of the population are under the age of 15. Average life expectancy is 54 years (DFID 2000).

Additionally 82% of rural households have no toilet, 96% cook with firewood, and less than 1% had access to electricity. The provision of safe drinking water, medical staff and health clinics in rural areas is poor, while most medicines have to be purchased in the local market. Yet the poorest quarter of the population spend on average 28% of their income on healthcare which may be inappropriate and ineffective (DFID 2000).

As in Bangladesh, individuals or household in Cambodia cannot look to their own human capital for salvation from shocks. Cambodia performs extremely poorly in terms of the UNDP's HDIs. The provision of safe drinking water, medical staff and health clinics in rural areas is poor, while most medicines have to be purchased in the local market.

Fishers largely categorise themselves as poor (49%) or very poor (30% of households in the river village). The very poor are the most vulnerable group because most of them are widows, old person or have many children. They are defined as those with neither farmland nor education. They usually work for others in farming, harvesting, seine net fishing or in fishing lots. They often lack food. Some households in this group had dry season rice land, but sold this to others as they had no ability to plow, irrigate or pay back the debt. If they are sick, they have to borrow money from others or they have to owe the doctor and pay back with interest after they earn income from fishing or from selling their family labor to other groups. Poor households 0 to 300 m² of agricultural land, producing up to 600 kg rice per year which only meets household needs for 2-3 months. Apart from farming, this group depends mainly on fishing. However, both fishing and farming are not enough for the household to survive, thus they need to sell labor in farming, harvesting, fishing, and working in fishing lot. This group also borrows money from local moneylender to buy fishing gears and other inputs but they have some ability to pay back the debt.

Lao PDR

On a number of social indicators Lao PDR performs better than Cambodia, but does more poorly than the World Bank's indices for other low-income countries, and significantly worse than the Bank's indices for East Asia and Pacific countries. Gross primary education enrolment compares well (at 112% of school age population) with that of low-income countries (96%) and East Asia and Pacific (at 119%). However, there is still a primary education enrolment gap between males (123%) and females (101%), and an illiteracy rate of 53% among the population aged 15+ as compared with 39% for Low-income countries and 15% for East Asia and Pacific. Datt and Wang (2001) note that households with an illiterate head are disproportionately poorer than those who can read and write in Lao. The severity of poverty for the illiterate group is more than double that for the literate group.

Life expectancy at birth (at 54 years) and infant mortality (at 96 deaths per 1000 live births) are worse than that for low-income countries (at 60 years and 77 per 1000), and markedly worse than that for East Asia and Pacific (at 60 years and 35 per 1000). Similarly the proportion of the population with access to a safe water source (39%) is also poorer than for Low-income countries (64%) and Asia and Pacific (84%) (World Bank 2000). There are considerable regional differences in all social indicators within the country, with the rural and particular mid- and upland areas performing more poorly. For example in 1989 the infant mortality rate in the capital, Vientiane, was 50 per 1000 live births, but in some mountain districts was as high as 299 per 1000 (WHO 1989:4).

Vietnam

A survey in 1993 showed that the population under the “overall poverty line” (annual per capita expenditure of VND 1,160,000), was as high as 58%, while as many as 25% were below the “food poverty line” of VND 750,000. Another key social indicator, that of child malnutrition, showed that 51% of children under the age of 5 were malnourished. Enrolment at lower secondary school level had fallen to 29% of eligible female children and 30% of male children by 1993 following economic restructuring during the 1980s.

By 1998, the situation had improved dramatically. A significant but much decreased 37% of population were then classified as poor in relation to the adjusted overall poverty line (US\$ 92). The incidence of child malnutrition had fallen to 34% and lower secondary school enrolment had rebounded to around 61%. However, 32% of the total population is still below the national poverty level (World Bank, 2002).

There are also regional disparities. In general educational level in the Mekong delta is low. Near the Cambodian border Khmer groups (refugees from the Pol Pot regime) have low education, lack of technical knowledge and live in poor conditions. Migrants (official and unofficial) lack knowledge of how to manage problem soils of the delta (which are severely acidic and old alluvial soils).

Life expectancy at birth is 69 years, and infant mortality is 37 per 1000 live births. Although many are living close to water resources, only 56% of the total population have access to an improved domestic water system. The percentages of rural population with access to clean water and electricity are as low as 17% and 48% respectively. The illiteracy rate is 6% (World Bank, 2002). On these figures Vietnam is performing very credibly in key social development sectors, while the economic sector has lagged behind.

5.4.2 Financial Capital

Financial indicators similarly indicate well-being or not, and the potential vulnerability of a population to seasonality, shocks and trends. This is ‘potential vulnerability’ since there may be sections of a population who do not rely on savings as a buffer against untoward livelihood events, but are able to call on a range of other non-financial coping strategies. Nevertheless, savings not only reduce vulnerability at household and country level, but also provide access to investment in emerging opportunities.

Bangladesh

About 70% of rural Bangladeshi households are dependent on some sort of credit, either institutional or private (BBS 1998). Collateral is the determining factor for access to institutional credit. The poor and those who have no resource for collateral are heavily depend on private sources of credit (moneylender, *Dadondar*, *Mohajan*) with a high rate of interest (8 % to 15 % per month). Fishermen, who are poor and virtually landless, in particular have to depend on private loan from *Dadondar* and *Mohajan* and *Aratdar* (fish trader).

Cambodia

Rural households rarely have many cash savings, while there are few formal options for obtaining credit. Most frequently rural people meet their medium-term need for finance by borrowing against their next rice harvest. According to UNDP (1999) ‘40% of rural households engaged in small-scale rice farming activities are using the harvest to pay back

loans.' When faced with an urgent need, people try to borrow from relatives or neighbours, but when that is not possible they borrow from money-lenders at high interest rates.

In the great lake PRA area fishing is the main occupation, 69% of people are engaged in fishing. Only 30 percent of the total traders are involved in fishing activities. The next livelihood activity is fish cage culture (38% of households). Most of them expressed that fish cage culture does not provide high income. In fact they sometimes did not made any profit in these investments. Even so, fish culture provides higher returns compare to daily income from fishing.

Laos

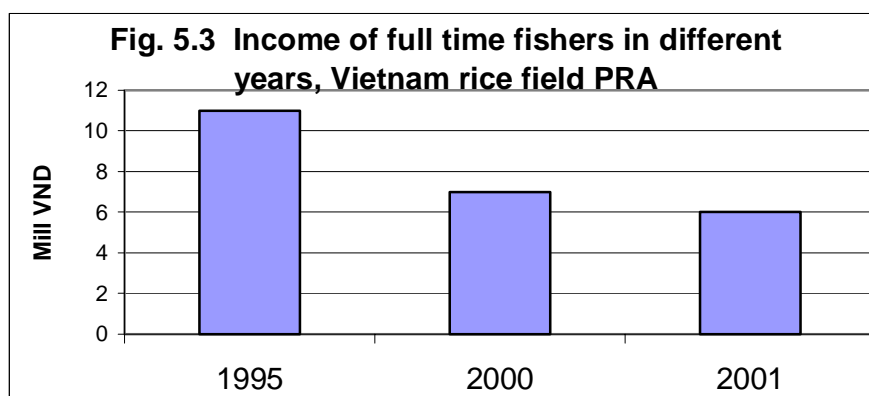
The PRAs indicate limited financial resources for fishing households, but some access to institutional credit sources, for example the Provincial Agricultural Bank provides loan with an interest rate of 12%. Most of the full time fishers earn between 3 to 7 million Kip a year, but their expenditure for fishing activities is about 50% of their income.

Vietnam

In Long An, 60% of households are on low incomes (22 million VND per household - 5.7 persons on average), or 321,637 VND per person per month.

However, as an example many of the full time fishers in the rice field environment PRA are, according to the People's Committee of Thoai Giang village, poor with an average income of 125,000 VND per person per month (below 100,000 VND per person per month is called the poorest and they have a certified book to get subsidy for medicine and education. Full-time fishers are poor and landless. On the basis of income sources, full time fishers can be divided into two groups: the first one relies entirely on fishing and the second one is living on capture fishery and agricultural labour (harvesting rice and carrying stones).

Their income level decreased over time (Fig 5.3). They said that fish resources are exhausted day by day due to dike construction for three rice crops production and applying intensive pesticide. Moreover, the number of fishers is also increasing day by day and they use modern gears (using electric devices for catching). Beside having income from fishing, they have extra income from working as agricultural labour.



5.4.3 Natural capital: food security and land

International bodies and country governments have been concerned for the food security of their populations. With the dismantling of the collective system of production in the SE Asian study countries, a prime strategy for achieving this has been through the promotion of enhanced cereal production by households. Given the overall agrarian nature of livelihoods, 'food security' has generally been translated into policies for ensuring that households have the basic prerequisites (in particular land, but also agricultural inputs such as seed) to ensure their own food security through cereal production for household consumption. While the same interventions have not occurred in all study countries, this policy driver has

underlain the historical emphasis on land redistribution, the introduction of rice HYVs and flood control and irrigation infrastructure, and agricultural extension.

The strategy has been effective in ensuring that, at the national level, populations are food secure, and has generated surpluses for export, but it has not made all households food secure. Interventions to ensure national food security may impact differentially on livelihood groups, benefiting some and negatively affecting others. Meanwhile, due to growing populations, inheritance laws, shocks and the natural vagaries of markets, land is not necessarily the only 'capital' on which poor people should rely to meet their household food security and other needs. Moreover it has systematically ignored and even undermined and reduced the inland fisheries which are a major livelihood source for many households and a combination of safety net and unpriced food for the poor during the monsoon.

Bangladesh

The overriding objective of GoB agricultural policy has been to achieve self-sufficiency in food grains (primarily rice) There have been large gains in output over the past 40 years and the country is approaching self-sufficiency in food grain production. Expansion in irrigation and the adoption of 'green revolution' technologies are the main factors behind this increase. There are worries as to whether this rate of growth in rice production can be maintained (see contributors to Rogaly *et al* 1999).

The World Bank and other donors are also not so sanguine about the contribution of cereal production increases to poverty reduction. Data indicate that cereal yields in Asia have tripled since 1955 to over 3 metric tons per ha as a result of Green Revolution technologies while, despite initial controversy over the impact of the latter on livelihoods of the poor, 'it is clear that poor people have benefited significantly through higher incomes, cheaper food, and increased demand for their labour' (World Bank 1999).² However, there have been social costs – in particular indebtedness and landless - within the traditional smallholder farming community, while there have also been negative environmental impacts (Dixon 2000). According to BBS (2000), 56% of all households own less than 0.5 acre (0.2 ha) land (homestead and cultivable land).

Because of the rapid increase in human population, the per capita availability of land has also dropped to 0.06 ha (1995-97 figure) as against 0.10 ha in 1979-1981 (World Development indicators 2000 - World Bank). Indeed about 9% of households have no land, 20% of households only have homestead land, 28% of households only have homestead land with cultivable land up to 0.5 acre, while 12% of households own cultivable land measuring 0.5 to 1.00 acre (MOF 2002). Net cropped area decreased over time due to urbanization and demand for homestead land in Bangladesh (Table 5.9). However, per hectare production increased due to shifting of land from local to HYV. Irrigated area also increased.

Table 5.9 Some food security related statistics from Bangladesh

	1981-82	1991-92	1999-2000
Net cropped area (000'acres)	21212	19716	20101
Irrigated area (000'acres)	-	7798	10345
Cropping intensity	-	168	175
Rice production (tons/ha)	1.45	1.71	2.15
Per capita rice availability (ton/yr)	132	153	198
Per capita fish availability (kg/yr)	8.31	7.89	13.49

² For example, a survey in India concluded that between 1973 and 1994 the average real income of small farmers increased by 90%, and that of the landless – among the poorest – by 125%, while calorie intake for small farmers and the landless rose 58% to 81% and protein intake rose 103% to 115% (World Bank 1999).

In Vietnam landlessness increased over the years (Table 5.10). Average farm size also decreased over time indicating poverty and overall trend. Poor people who had some land before are selling land to cope with the household needs. Population pressure, rural unemployment, free market economy and globalization are the main causes.

Table 5.10 Percentages of rural households with no land in Vietnam.

Region	Percent households		Average farm size (m ²)
	1993	1998	
Northern Uplands	2.0	3.7	8890
Red River Delta	3.2	4.5	6491
North Central	3.8	7.7	5001
Central Coast	10.7	5.1	5180
Central Highlands	3.9	2.6	13746
Southeast Region	21.3	28.3	13712
Mekong River Delta	16.9	21.3	10650
All Vietnam	8.2	10.1	8148

Source: World Bank estimate based on VLSS93 and VLSS 98

However, given increases in productivity through HYVs of rice, double and often triple cropping through irrigation, and the production of cash crops to meet regional demand, size of landholding is perhaps not the constraint it is sometimes thought to be. Access, rather than ownership may be key here, and there are considerable opportunities to share-crop land in order to meet household need for a variety of land types for different crops. Certainly, landed households, and indeed entrepreneurial landless households, engage in complex in- and out-transfers of land under share-cropping and other leasing arrangements in order to meet household food security needs and take advantage of market opportunities. Additionally, landlessness and near-landlessness may now be less of a constraint to household food security than they once were, given that there is a wide range of alternative, though often agriculturally-related, employment opportunities (such as transport, petty trade, food processing and migrant agricultural labouring).

A major issue as far as the majority of landless and near-landless rural households are concerned, is what livelihood strategies to follow during the flood season when agricultural labouring jobs are at a premium. Of course many of the poor chose jobs in transport, petty trade, food processing and migrate to agricultural jobs in areas which have not been inundated, but significantly a considerable number of men and other members of their households (both women and children) turn to fishing both as a part-time occupation and for subsistence needs.

Cambodia

The availability of arable land is reasonable, at 0.34 ha per capita (1995-97 figure; World Development indicators 2000 - World Bank), and most families own land. However, only 7.1% of crop land is irrigated (unlike Bangladesh's 43.4%), precluding multiple cropping. Land pressure is more acute in more fertile areas, while there are indications that landlessness is growing. Most households do not produce enough to meet their needs, with the difference being made up by fishing and foraging. Many households, both rich and poor, depend on *prei* (forests/wildland) for basic household goods, foodstuff, and grazing land. However, one reason for food insecurity is that farm enterprises are under-capitalised and agricultural productivity is low. DFID's Country Strategy Paper (DFID 2000) suggests that 'increased investment in land productivity would make a big difference in increasing the rural poor's wealth and assets.' The Paper also suggests that 'the weakness of property rights (as well as lack of access to better inputs) has led many farmers to keep their investment in land very low,' with the consequence that national rice production has stagnated – in stark contrast to Bangladesh where growth in rice production has kept pace with population growth (see Palmer-Jones 1999), and to Vietnam which has become a major rice exporting country.

Farm households in upland **Laos** and **Vietnam** also tend not to have enough land to achieve food security and are similarly dependent on hunting and collecting forest products to make up the shortfall. Here the cause is low productivity, but this time due to poor soils, labour and other constraints.

Meanwhile on the floodplains of Laos and Vietnam where land is at a premium, most rural households with access to land are primarily dependent on their land-holding for food security. Besides rice production, their farming system may include small livestock (pigs), and pond aquaculture, while individual households may also fish for subsistence needs where the opportunity presents itself. In lowland Laos arable land availability is reasonable at 0.17 hectare per capita, but whereas Laos has a greater proportion of irrigated land (18.6%) than Cambodia (7.1%), and is seeking to extend this considerably, it is still low in comparison with Bangladesh.

A general conclusion concerning natural resource-based livelihoods in Laos is that the majority of farming systems are based on a combination of rice farming, animal husbandry and fishing. However, there are significant differences between the well-being of households. On the floodplain most richer households have >1 ha land, >5 cattle, a tractor, own a modest houses, and have a rice mill, and/or plantation. They fish on a part-time basis and are self sufficient in food. 'Middle-income' households own two or three buffaloes, two cattle, have simple houses made of wood, some household garden, some fishing gears and boat and they are also self sufficient in food. By contrast a substantial proportion of poorer people also live there but do not have land or other productive assets; they are either agricultural labourers or petty traders and also fish part time for subsistence needs. Poor people may possess a small house and some fishing gear. In order to secure household rice security they have to lease land and draft animals from others. The very poor categories on the floodplain are landless seasonal labour lacking professional skills (Country PRA Report Lao, 2003).

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. Nevertheless the fisheries do play an important role in rural livelihoods in virtually all regions of Laos, but fishing is 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.

The Lao PDR PRA Report indicates that there can be variations around this 20% mean in different agro-ecological zones on the floodplain as a consequence of the composition of livelihood portfolios, (from 5% of household income in rice-field agro-ecosystems to 20% in Mekong mainstream agro-ecosystems). The rice-field zone also has the highest number of poor and very poor people, while the Mekong mainstream zone livelihood strategies are focused on weaving (50%), farming (20%) and fishing (20%) – with fishing and weaving probably substituting for income generation from farming (which contributes between 40-63% elsewhere). In the Mekong mainstream zone, there may be less farming opportunities, while it is probable that the wealth of the zone has been built through the other strategies subsidising each other, while the surveyed communities probably also have good market access.³

³ The low figure for the rice-field agro-ecosystem, as an income measure, may mask the importance of living aquatic resources to the population of this zone, since evidence elsewhere suggests much of the production from ricefields is not sold but is consumed by households – particularly poor households (which constitute 52% of households of the survey sample).

The PRA report also suggests that the relative importance of fishing and agriculture has changed over the past 20 years or so. Thus as fish species, and particularly high value species have declined, so the yield (and probable value) from agriculture has increased due to the introduction of HYV rice and irrigation infrastructure allowing a second rice crop during the dry season. This trend is probably set to continue with a decreasing significance of the fisheries to rural dwellers livelihoods, particularly the wealthier, although an overall reduction in fishing pressure may lead to a recovery in the resource with benefits for the poorest who are likely to continue to exploit this CPR.

Vietnam

Historically good land on the Vietnam floodplains (particularly on the Red river floodplain) has been regarded as scarce, with the government being prompted to resettle landless households in the northern uplands. However, there have been periods when this has not been the case (e.g. when commodity and therefore land values have been low, and farmers have abandoned their land holdings). Again, under the stimulus of the *doi moi* reform policy, agricultural productivity has increased so dramatically that farmers' landholding, though small, have not only generated sufficient income to achieve household food security but have also generated a surplus for export. Average per capita arable landholding at 0.08 hectare is almost as small as in Bangladesh, but as in Bangladesh the proportion of irrigated crop land is considerable at 31% and enables multiple cropping through the year.

The poor tend to have less/no land and are most dependent on aquatic resources and have been impacted by agricultural intensification. In the Mekong delta region the key natural capitals are land, water and aquatic resources. The key issues are their quality and quantity. 28% of land is alluvial soils suitable for rice, 40% is acid sulphate (some are heavily acidic with dry season water pH value of as low as 1.5), 21% is saline, the rest is upland. Landlessness is increasing as a result of high provincial population and small land area. In the Ca Mau peninsula agriculture centres on a single, extensive, wet season crop of rice. As a result 83% of low-income families fish in rice fields, canals and rivers, catching on average 531 kg of fish per household per year, of which half is sold providing 14% of income, they eat on average 60kg of fish per person per year.

In all regions, but particularly in the Northern Uplands and Central Highlands, poor people living in or near wetland areas fish for income because they have no access to land and other productive resources. Moving into fishing is often a last resort for landless and displaced people. In inundated areas, areas prone to flooding and in flooded forest areas on the Mekong, people are often landless or land short, and lack capital and access to productive resources. These environments are vulnerable to storms and extreme floods. There are capture fisheries during flood/inundated periods and aquaculture in ponds. The Midlands and some coastal areas have poor soils as a result of deforestation, with high erosion, and poor access to fresh water. There are few opportunities for alternative livelihoods, and limited extension services. Wild (capture) fisheries have declined. This is partly attributable to the use of fertilisers and pesticides for rice cultivation due to government efforts to increase rice production. But there has also been a loss of dry season wild fish refuges in areas prone to saline intrusion.

Growing populations and the perceived need for food-grain security have historically led to the conversion of most suitable land to arable production in Bangladesh and Vietnam. While the process has lagged behind in Laos and Cambodia, it is continuing stimulated by government policy.

With most suitable agricultural land having been converted to arable production, but with populations still rising, there has been a falling per capita availability of land on the floodplains. With this, and marked seasonality of agricultural production on the floodplain,

and despite intensification and mitigation of seasonality through irrigation, flood control and other technologies, poorer households in the study countries have increasingly had to build portfolios of livelihood strategies beyond those based on land. These may be based on agricultural and other labouring, the seasonal exploitation of agricultural by-products, fisheries and forest (non-timber products), largely in the form of common pool resources, and a variety of other strategies ranging from transport, petty trade, post-harvest industries, and migration. However, as will be shown, an important component of the livelihoods of poorer, and particularly land-less or near-landless, households is exploitation of the fisheries in one form or another.

5.4.4 Social Capital

Social networks, relations of trust and cooperation, help poor people survive in times of stress, provide access to markets, resources, credit, and a chance to improve their status, yet also can often constrain any possible move out of poverty through relations of indebtedness and social power. There is limited available information from secondary sources on the social capital of fishing communities, and the PRAs provided an opportunity to understand their networks and organization. This is illustrated in Table 5.11 and Fig 5.4 for Vietnam, and in Table 5.12 for Cambodia.

Table 5.11 Ranking the relationship of three groups with institutions in the community in Vietnam.

Institutions	Part time fisher	Fulltime fisher	Fish trader
Sub-department of plant protection	1*		
Department of Agricultural and Rural development	3*	5*	
Sub-Department of Agricultural and Rural development	4*	4*	
Hamlet, commune	4*	1*	3*
Women union	5*		2*
Bank	2*	3*	
Charitable organization	6*	2*	
Youth union	7*		
Fish Fellow	2**	1**	
Rice trader	1**		
Private lender	3**	2**	2**
Fishers from other places	1***	3***	
Catch fish by electric		2***	
Fisher who draw a net (with electric gear)		1***	
Fisher			1*
Fish consumers			1*
Fish-depot			1**
Other fish traders			3***
Police			2***
Market board			1***

Note: *: cooperation; ***: conflict and **: both, 1=most important, 7=least important

Fig 5.4 Venn diagram of local Power structure in Vietnam (from PRA).

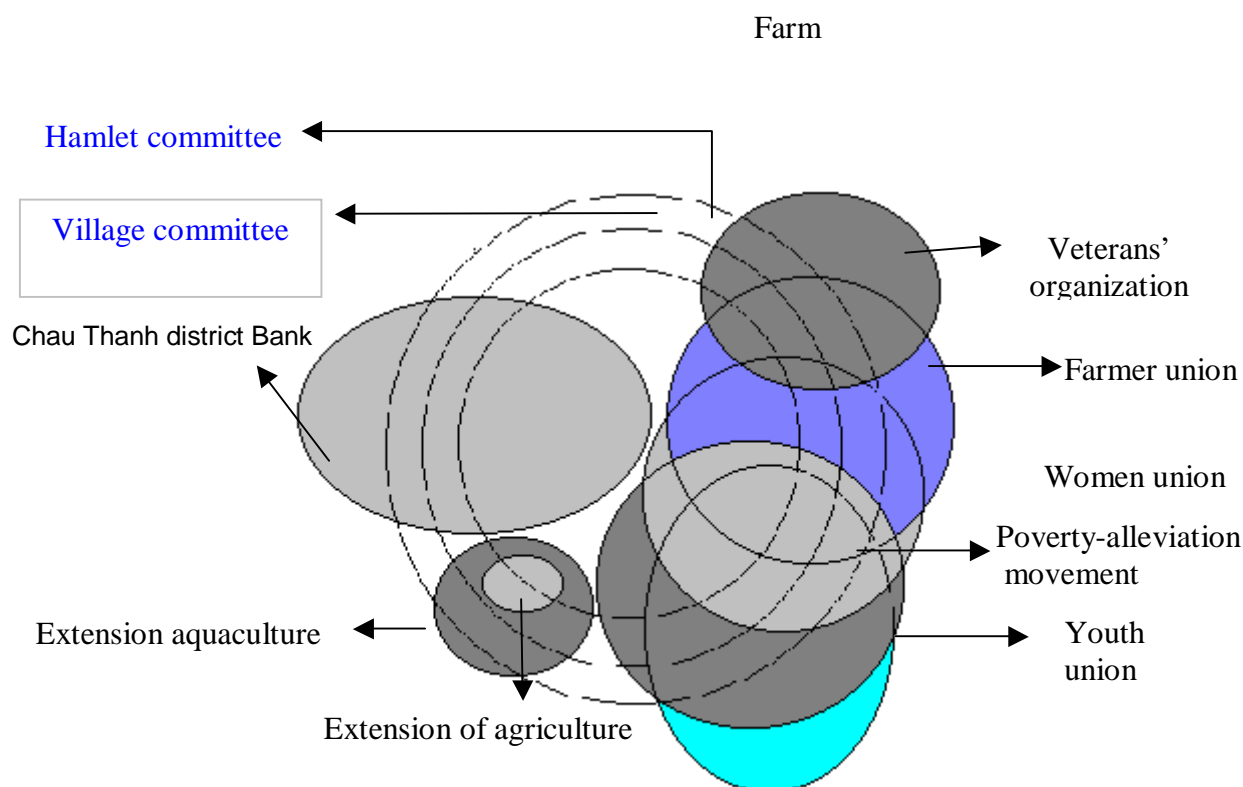


Table 5.12 Negative and Positive Impacts of Institutions on Rural Livelihoods in Cambodia (from PRA).

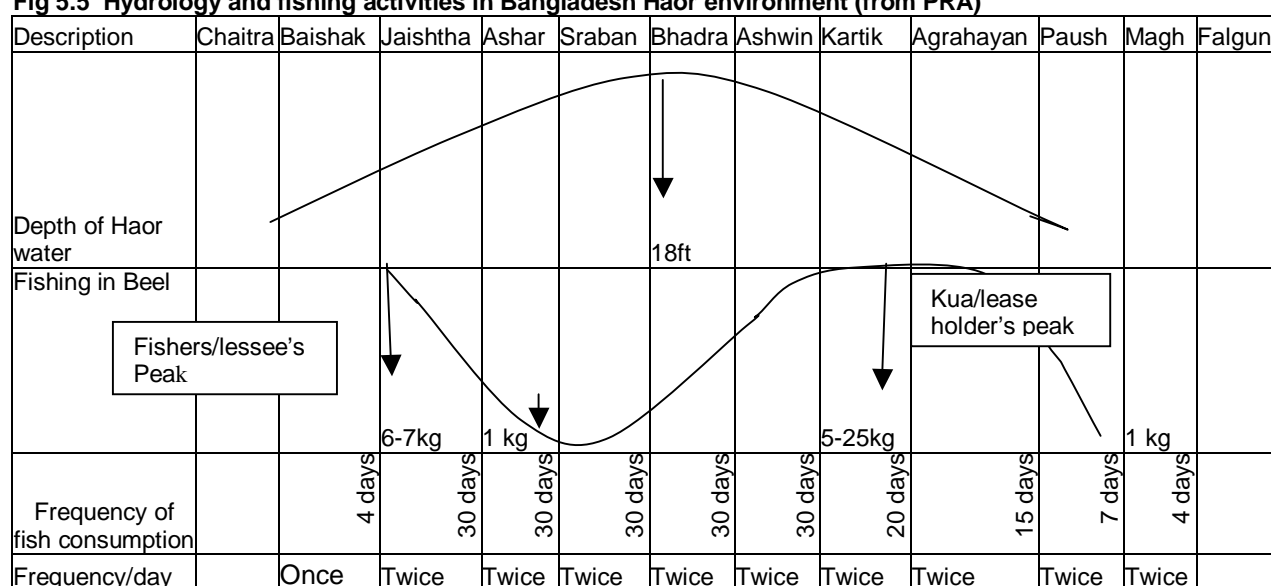
Positive Impact	Negative Impact
<p>Fisheries Agency:</p> <ul style="list-style-type: none"> ▪ Prevent and control against illegal fishing activities ▪ Plan to develop fishing community <p>Military Police:</p> <ul style="list-style-type: none"> ▪ Serve as social security agent and prevent illegal fishing by cooperation with fisheries institution <p>Inspector (Army):</p> <ul style="list-style-type: none"> ▪ Investigate on illegal fishers <p>Fishing lot:</p> <ul style="list-style-type: none"> ▪ Release 200 m fishing lot territory for local people use or public use. 	<p>Military Police:</p> <ul style="list-style-type: none"> ▪ Collect illegal fee from fish culture <p>Inspector (Army)</p> <ul style="list-style-type: none"> ▪ Collect illegal fee from fish culture <p>Fishing lot:</p> <ul style="list-style-type: none"> • Block the river mouth or down stream, to block fish migrate in (put barrage in February) • Prevent local people from fishing after final harvest of fishing lot. • Use fine mess size barrage fence that caused death of juvenile fish.

5.5 Seasonality in Environment and Human Use

Fishery depends on the level of water in the floodplains and waterbodies. This was a focus for understanding the seasonality of dependence on fishing in the PRAs, and this is illustrated and discussed here for one PRA (in the deeply flooded haor basin of north-east Bangladesh). Water stays in the beel for about 10 months but the flow is low during early months of monsoon (Fig. 5.5). However, the peak level does not go beyond 3m (12ft). The fishers complained that due to embankment building the beel never receives sufficient water. Water is only trapped in the ditches (Kua) but owners dewater each ditch every year 3 times

to catch all the fish they can get. Soil is fertile due to deposition of new silts every year but the beel basin is slowly silting up reducing the water level in the beel. Fishers start fishing in the beel as soon as the monsoon water starts to enter into the beel. Frequency of fishing increases with the water level although catch depends on the recession rate of the beel water. Fishers can fish in the beel every day for 4 months. The fishers reported highest amount of catch from the mid-November to mid-December. During that period each fisher can catch 5kg fish from the beel each day. However, peak fish catch for the kua owners is about 40 kg during the December/January. Fish consumption also depends on the fish catch. In the beel fishers don't usually catch big fishes. During peak fishing season they can eat fish everyday during all meals. Even the poor and assetless people catch fish by rod and line for consumption or if they get bigger amount, they can also sell. In other month's frequency of consumption is low and the number of days consumed also varies. During February to April frequency of fish consumption is low for all. During these months availability of fish in the market also low. Therefore, those who can afford to buy fish also cannot eat so much fish.

Fig 5.5 Hydrology and fishing activities in Bangladesh Haor environment (from PRA)



5.6 Trends and Changes in Fisheries and Wetland Resources

5.6.1 Bangladesh

With the increase in population, natural resources are becoming scarce day by day as was reported by participants in all the PRAs and summarized in Table 5.13. Overexploitation, habitat destruction and constant siltation of canals and rivers have a negative impact on the extent of the wetlands. Among all the natural resources stakeholder groups mentioned, water and land are the commonly important ones. To the better off farmers land is the most important natural resource as their income comes from farming. They need water for irrigation also to grow winter crops. This group has valued trees at the same level as water and land. For the part-time fishers grazing land along with water is important. To them livestock raising is important for their livelihoods. These people graze livestock in the open fallow land during beginning of winter and at the beginning of monsoon sell them. Therefore, it is important for them to have open grazing land. Fish is still their next important resource. They think it is hard to live on only fishing. For poor fishers still fish and water are important. Subsistence fishers put water at the top of their list of natural resources. They use water for irrigation, ply boat to earn money, and they do fish culture. The women's group, however, put water at the top of the list of resources for a range of reasons: domestic use to fish

culture. However, they also considered grasses at the top of the list as grasses are important for house building, to use as wave break for homesteads, and to feed livestock.

Table 5.13 Example of user analysis of natural resource status and contribution to livelihoods from Haor PRA in Bangladesh consolidated over stakeholders.

Type	Use	Access status (now)	Rank now	Access status (20 years ago)	Rank 20 yrs ago
Water	Irrigation, Bathing, Drinking, Household use, Water transport, Fish culture	No restriction to use water for irrigation, There is restriction for fish culture	10	No restriction	10
Fish	Eat, Sell/income	Restriction on fishing	10	less restriction	5
Tree	Rest underneath, Furniture making, Fuel, Boat making, Sell/ income, Eat fruit	No forest on public land. Restriction to cut trees from others' land, Restriction to eat fruits from others' trees, No restriction to cut trees from own land	10	Could collect fire wood, there were forests	6
Land	Agriculture/grow crop, Prevent flood, Road construction, Homestead work, Pottery (clay),	Less land available for agriculture, No restriction to road construction, Restriction to use khas land, Restriction to use others' land, No restriction in using own land	10	Less restriction in agriculture, No restriction on use of khas land,	10
Water hyacinth	Cattle feed, fuel, Compost	No restriction but less available, now used as compost	3	No restriction, plenty available, only used as cattle feed	2
Grass	Cattle feed, fuel, Sale/ income, house making	No restriction, less available as fallow land is restricted, less cattle	2	No restriction, grass available	2
Lily/ lotus	Food, cattle feed, Sale/ income	No restriction, less available but poor people sell	3	No restriction, only for food	1
Cane/ string	House/ mattress making, Sale/ income	Restriction	1	No restriction	1
Hogla plant	House/ mat making, Fuel	No restriction, less available, more competition for collection, can sell each mat at the rate of Tk. 25-35	1	No restriction, plenty available, only used for personal use	1
Birds	Food, Sale/ income	No restriction, now for sale	1	No restriction, only for food	1
Black soil	Fuel	No restriction	3	Was not available /people did not use	2
Arraila/ Chailla grass	Homestead fencing, fuel, livestock feed, protect homestead from erosion	Restricted, less available	6	No restriction, plenty available	0

Note: rank is importance for livelihoods out of maximum of 10 for each resource (Averaged over all stakeholders)

In the haor area everybody fishes for some part of the year either for food or for income. According to them fish were abundant 20 years back and other people (Muslim fishers) were fishing for food only. During that period importance of fish was less as there were no restrictions on access. Anybody could fish in any place. However, as the availability is now limited and the value is higher, and people fish for income, leaseholders do not allow people to fish in their territory or even in the private land as they claim fish to be their property and wherever fishes go lessees own them during late monsoon. During high flood period catching fish is difficult and one can only manage to catch a little even though access is easy, but when water starts to recede and fish get trapped in the beels and kuas (ditches), the lessees guard their fish. Fishers can only catch fish through poaching.

Some other natural resources, such as black earth (collected from the bottom of the beel, mixed with rotten aquatic plants) were either not available or people never used them. Now people collect those, dry and use as fuel. Grasses (chaila/arrailla) were used as fodder, fuel, fencing for protection of households from wave action. However, these grasses are rare and the landowners keep for their own use. General public has no access to those.

5.6.2 Cambodia

There has been a significant change in fishing technology during the last ten years with almost all fishers now using nylon monofilament gill-nets to replace bamboo frames and other bamboo materials. Furthermore, the use of small mesh netting to catch smaller and smaller fish has spread throughout the country as larger fish have declined.

Post-harvest handling practices in the Great Lake region have changed from storing fish in pens and cages through the dry season for live distribution, to chilling for year-round distribution to local and export markets. However, the quality of most fish now arriving at the markets is low, due to shortage of expensive crushed ice at the fishing areas.

The use of electrocution fishing, focusing on snakehead, is widespread throughout the remote wetland region, and is being practiced by all scales of fishing, especially small-scale. This situation is rampant, due to widespread poverty, fish stock decline, inequitable right of access to fishing grounds by small-scale fishers, and the surge in snakehead demand by the Thai market.

Ecological change, due to water infrastructure development in the upstream countries, has reduced the flood in the entire Cambodian inland wetland system, resulting in fish habitat loss. Further habitat loss is related to destruction of flooding forest for agricultural expansion.

The harvesting of new species, such as frogs, small shrimp, bivalve molluscs, combined with the harvesting of fry of *Pangasionodon hypophthalmus* catfish and *Channa microlepis* snakehead, is the result of over-fishing and further damages the ecological balance of the fishery.

Although there was critical reform in fisheries policy in regard to resource benefit redistribution in late 2000 — when over 56% of the concession fishing grounds were re-allocated to local communities — the process of strengthening the capacity of the fishing communities in able management of the fishing grounds is proceeding very slowly.

5.6.3 Lao PDR

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 Laos 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.

Most living aquatic resources in Laos are heavily exploited. Average catch per unit of effort is low (300 g/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

5.6.4 Vietnam

National data on trends in this sector is very limited, but the PRAs reveal serious decline in some fisheries. Although the fish traders do not often understand the trend in availability of fish, the fulltime and part time fishers have a common view that fish resources are declining remarkably (Table 5.14).

Popular fish species such as snakeheads, anabas, eel, loach etc. have a declining trend- only about 30-60% remained compared to 1975 and before (Table 5.14). The main cause of fish reducing is shift from mono-cropping of traditional rice to high yielding variety rice. Fishing ground narrowing down regularly, and intensive use of agricultural pesticides such as Decis, Sherpa, Thiodan, etc used for crop cultivation contributes to fish reduction. Besides, farmers capture larger quantity of fish every year with many modern gears such as electric gears. Yield of rare species such as fresh water prawn, snake, turtle, cá dầy, cá leo (*Walago attu*), thác lác (*Notopterus notopterus*) also reduced due to above reasons. These species have high economic value (export or consumed by restaurant customers at high price). This is one of the causes for high exploitation and the tendency is rapid decline. Similar trends were also reported for other aquatic resources which are also an important component of livelihood strategies in the delta (Table 5.15).

Table 5.14 Trend in fish resources reported by full time fishers in Vietnam PRA.

Fish species/ scientific name	Before 1975	75-80	80-85	85-90	90-95	95-2000	Now	Future
Anabas (<i>Anabas testudineus</i>)	100%	90%	↓	↓↓	↓↓↓	↓↓↓↓	30%	Gradually decrease
Snakehead fish	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	30%	Gradually decrease
Hito (<i>Clarias macrocephalus</i>)	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	1%	Gradually decrease
Mè vinh (<i>Puntius gonionotus</i>)	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	50%	Gradually decrease
Linh (<i>Cirrhinus jullieni</i>),	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	60%	Gradually decrease
Loach (<i>Cobitis taenia sp</i>)	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	30%	Gradually decrease
Fresh water prawn	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	Very rare	
Eel	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	30%	Gradually decrease
Small shrimp	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	50%	Gradually decrease
Thác lác (<i>Notopterus Notopterus</i>)	100%	↓	↓↓	50%	↓↓↓	↓↓↓↓	Rare	Extinct
Turtle, snake	100%	↓	↓↓	↓↓↓	↓↓↓↓	↓↓↓↓↓	Rare	Gradually decrease

Table 5.15 Status of other aquatic resources in Vietnam PRA.

Wild vegetables	In traditional rice field	In high yielding rice field
Water-lily	Abundant	Rare
Water spinach	Abundant	Rare
<i>Jussiaea repens</i>	Abundant	Rare
<i>Sesbania javanica</i>	Abundant	Common
<i>Monochoria hastata</i>	Common	Rare

Trends are not just negative, time lines were used in the PRAs to understand key events. In the Vietnam example it was found that in response to problems over the past decades (Table 5.16) in the study area, in 1997 farmers built a dam on a ditch around their agricultural field. This not only protected the fruit garden and rice field from flooding, but also improved conditions for fish by retaining water. Besides that, the local government promulgated a fish protection law and rules such as: forbidding fishing with electric gear, and duck baiting. The community reported that these are the reasons for improvement in wild fish in recent years.

Table 5.16 Trend in Natural fish from Vietnam PRA

Years	Events
Before 1975	Wild fish are plentiful
1975-1980:	All wild fish decreased by 30%-50% specially Snakeskin goumani
1980-1985	All wild fish decreased specially Snakehead decreased by 80% and hybrid catfish appeared
1985-1997	All wild fish decreased specially Snakehead keep decreasing further, Gray feather back decreased by 99%. <i>O.lucius</i> , <i>O.micropeltes</i> (Ophipcephaliformes) and Clarias catfish are disappearing.
1997-2002	Some initiative for fish conservation

In coastal areas the current use of aquatic resources is not sustainable. Exploitation pressure is increasing due to modernization of the fishing fleet (larger boats with better gear) and increasing coastal population density with its demand to maintain incomes through greater catches. The widespread use of illegal fishing methods also contributes to the degradation of the natural resource base.

The uncontrolled expansion of the brackish aquaculture sector into the coastal mangrove forest zone has led to depletion of the natural fishery stocks as the natural nursery grounds (mangrove forest area) have vanished. As shrimp culture is often based on natural shrimp recruitment, shrimp aquaculture yields have also been reduced, partly due to the depletion in the natural fishery stocks. The rapid conversion of mangrove forest into shrimp aquaculture has changed the entire ecosystem in the coastal area to such an extent that negative impacts have been experienced by the local communities in terms of reduced fish catches and shrimp disease outbreaks leading to harvest losses of up to 100%. The communities living in these regions are among the poorest in the Mekong Delta and therefore they have little or no other income opportunities than to cut the forest.

There is great concern about the direct discharge of effluents from factories in Mekong Delta provinces. Wastewater treatment systems seem to be non-existent in the production industry and the effluent discharge content ranges from organic waste to chemicals. The treatment of hospital wastewater is non-existent. Hospital effluent may carry waterborne pathogens that are endemic to humans and therefore represent a potential risk of epidemic outbreaks. Water contamination by pesticides was discovered recently in the rural areas of Can Tho Province. The problem will continue as long as pesticides are used in agricultural production. There is a need to inform people about the handling of pesticides (e.g. do not dilute them near your well).

Throughout the Lower Mekong Delta there are problems with acid sulphate soils. Acid sulphate soil or potential acid sulphate soil (PASS) is seen as a constraint to agricultural development. Exposure of PASS to air leads to oxidation of pyrite and the formation of sulphuric acid, which acidifies soil and water. The consequences of an acute pH reduction in aquaculture ponds in the early monsoon, by acidic surface water, can in severe cases cause an entire harvest failure. In less severe cases, the shrimp may just be stressed which makes them more susceptible to disease outbreaks. Growth of vegetation is inhibited by exposure to acidic conditions. Only a limited number of plant species are tolerant of low pH.

Sustainable management of the natural fisheries is needed. It is not sustainable to increase production by building a bigger fleet of larger boats that can simply go offshore. Measures to reduce exploitation of the coastal (near-shore) and inland fisheries are essential in order to allow the commercial species to reproduce and thereby maintain sustainable fishery stocks.

Increasing brackish aquaculture production by increasing the area is not an optimal solution. At the moment the production of shrimp is extensive, yet the yields are far below (150

kg/ha/year) the yield of similar systems in other SE Asian countries (500-800 kg/ha/year). It would be more useful to introduce improved extensive or semi-intensive production systems. That would in theory increase production whilst keeping the area stable allowing for mangrove to be forested.

A number of illegal fishing methods are common in the inland fishery such as: electric fishing, fishing with mosquito nets, and chemical poisoning. These pose a direct threat to the suitability of the ecosystems because they are non-selective fishing methods.

In conclusion some of the issues that need to be addressed through legislation and policy provisions include:

- Fish production from natural sources is falling gradually due to over-fishing and use of damaging fishing methods such as electrical shock, nets with small mesh size, chemicals, and explosives. These damaging practices need to be prevented.
- Natural fish habitats and niches have been reduced in area by expanding the rice cultivation areas and intensifying farm activities.
- Almost all the freshwater production is consumed in local markets, this is a major income for the poor farmers with small landholding and the landless but is not considered in policies.
- It is necessary to develop and extend sustainable agriculture models such as VAC and rice-fish integrated farming systems. This can increase fish production and hence incomes of farmers.
- Establishing fish sanctuaries to protect valuable genetic resources.

5.7 Key Challenges, Threats and Prospects including Macro/Exogenous Factors

5.7.1 Overfishing

Bangladesh

The National Environmental Management Action Plan (NEMAP, 1995) estimated that floodplain fisheries have been reduced by about 70% in recent years. Fishers frequently report that catches are declining, as is the size of the fish caught. Given growing populations and increasing numbers of fishers, the pressure on the resource is certainly increasing, and individual fishers' catches may be declining. However, overall production from the fisheries is still increasing in response to demand for fish, while the trend in the fisheries is for further commercialisation. One suggested scenario is that at some stage, if not already, the fisheries could collapse.

Cambodia

The country study and PRAs reported serious declines in catch per fisher day and changes in gear use. In 1982, with small fisher population, the average household catch was reportedly 300 kg/day by using traditional fishing gears. In 1985 the catch dropped to 150 kg/day/household by traditional fishing gears with higher fisher population. However, the household catch could be 80 kg/day more than previous year with modern fishing gear (fisher population increased, more fishing gear used, and fishing lot owners invaded into the public fishing ground).

In 1995 fish catch had decreased by 30 kg/day/household. The decrease of catch was caused by the use of modern fishing equipment such as, one-engine boat trawl 'yang kav', brush park 'somras', scissors pushing net 'chheup', and, electrocuting 'chork' (only a small

number using this method). In 2000, electrocuting was widely used by all fishers. This fishing equipment was developed when wetland forest encroachment was abundant. This has resulted in the catch falling by 10 kg/day/household.

The catch in 2002 has reportedly declined to only 2-4 kg/day/household. This is due to increased demand, therefore led to more intensive extraction with modern fishing gears. High population growth resulting in more clearing of inundated forest have caused the loss of fish habitat. This situation is worsened by exploitation using electric fishing gear and fine mesh size net (mosquito net).

Lao PDR

Lao respondents in the current project's PRA exercises state that the number of fish species, and particularly high value species, has declined in the last 20 years. 'According to the part time fishers, big fishes have now almost disappeared from the rivers. Number of cultured fishes in the waterbodies have increased. These fishes are occupying the niches of the other rare or extinct fishes. The overall earning of the fishers have been decreased. Some of these part time fishers were full time fishers before.' Causes of fish decline cited include the use of pesticides, harmful gears and the catching of brood fish during the breeding period.

It is important to note that the pressures bearing on the fisheries have changed. Traditionally, fishing was conducted almost entirely for subsistence purposes, with the exception of a small amount of barter trade for certain high quality preserved fish like "*som pa eun*" and "*pa chao*" (Baird *et al.* 1998a). However, the NEM reform programme, the increased availability of new technology (such as mono-filament gill-nets, motorised boats and ice-coolers), and particularly the opening up of market-links to the provincial capital and to Thailand, have led to a shift from subsistence to commercial fishing. A significant number of Lao households, particularly Lowland Lao close to the Mekong and its tributaries, now depend on fish sales for a considerable proportion of their income. As Baird (1999) notes, in southern Laos 'changes were occurring rapidly, and while most villagers were becoming aware of the over harvesting problems facing their fisheries, only limited action had been taken to reverse the perceived downward trend in aquatic animal populations.'

Commentators note that the level of fisheries exploitation is generally very high, although there is a great deal of local variation (driven largely by population density relative to the extent of local water resources). As elsewhere, the fishery is inherently multi-species and multi-gear, exploiting virtually all fish species as well as various invertebrates. Garaway (1999) and Lorenzen *et al* (2002) have demonstrated that relationships between catch and effort show the asymptotic pattern typical of aggregated catch-effort relationships in multi-species fisheries, where a constant level of catch is maintained over a wide range of high effort levels. However, both suggest that the constant catch is likely to mask a change in species composition from larger and higher value species to smaller, low value species with increasing effort.

Thus aggregate natural fish stocks may be declining due to a range of unfavourable human-induced disturbances including deforestation in the upland, water pollution and dam construction (Phonvisay 1994). Cavas (1994) suggests riverine fisheries have declined by up to 20%, while Phonvisay (1994) suggests production in lakes and reservoirs declined by about 60% between 1980 and 1994. However, there are no convincing data to support the widespread assumption of an overall decline (see Lorenzen *et al* 2002). Catch per fisher may have declined as the result of increased numbers of fishers exploiting the resource, but overall catch has been maintained or has increased (which may suggest that optimum off-take levels have not yet been reached). However, since fishery statistics do not record the catch landed by species, it is not possible to say whether fishing effort is changing the composition of species in the fishery.

Vietnam

National statistics indicate that fish production from natural sources is falling gradually, and this may indicate that there is over-exploitation of the resource. Indeed many writers suggest that this is so while also cataloguing the harmful fishing methods (gill nets, explosives and the like) which they take to be responsible. However, biophysical factors such as land conversion, irrigation infrastructure and the like may have a greater impact. Additionally, national production figures may mask changes in fishing effort that may be taking place. Thus as Vietnamese households becomes wealthier and can afford the technology, there may be a trend by households to switch from exploiting the wild fisheries to aquaculture which can give higher returns for less effort. Certainly as production from the inland capture fisheries has declined, so production from aquaculture has soared

5.7.2 Loss of habitats: land conversion and degradation of waterbodies

As noted above, habitats have been changing along with fishing pressure. Over the longer term, with growing populations - and growing urban non-food producing populations - all four countries have been concerned with ensuring national food security.

Food security has in particular meant self-sufficiency in cereal production and particularly in rice production. While there is rainfed (dry-rice) production in the upland areas of SE Asia, the major effort has been in developing wet-rice production, both extending the area devoted to wet rice through converting land from other usage to crop land (e.g. flooded forest and swamp), through multiple cropping (by means of irrigation), and by lifting yields through introducing new cultivars (High Yielding Varieties) and technology (High External Inputs).

In Bangladesh this has led to the conversion of most available wetland to wet-rice production, to huge investment in irrigation infrastructure (including public sector deep tube-wells and private sector shallow tube-wells for dry season agricultural water supply) and continuing investment in FCD/I infrastructure (see Dixon 2000). Similarly in Vietnam most land suitable for wet-rice cultivation (most of which is to be found in the Red river and Mekong delta regions) has already been converted, irrigation infrastructure is quite extensive, and there is growing investment in FCD/I infrastructure. As a consequence of these developments, together with 'doi moi' socio-economic reform, Vietnam is now a major rice exporting country, second only to Thailand in the region. Similar trends in the conversion of 'waste-lands' suitable for wet-rice production to arable land are proceeding in Laos and Cambodia. For example Lao has ambitions to boost economic growth by becoming a major rice exporting country like its neighbours Vietnam and Thailand.

The Lao Country Summary Report suggests the following rather bleak impact of agricultural intensification on livelihoods based on the fisheries:

'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 rainfed paddies in fisheries production. Agricultural intensification is likely to lead to concentration of land ownership and the emergence of a 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.'

There are, however, a number of reasons for being more cautious about such a prognosis. Firstly water resources development for irrigation (and the drive for increased agricultural

output through this, improved infrastructure, extension services and the like) should lift rural incomes and may provide opportunities for investment in aquaculture and generate a demand for agricultural labour as has happened in Vietnam). Irrigated paddy may be as or more productive of fish than rain-fed paddy, though the Bangladesh experience is that water bodies may be drawn down for dry season irrigation with impacts on the fisheries, while intensification may involve greater water pollution from high external inputs. The concentration of land ownership is likely to be a medium to longer term affair rather than short term, by which time there should not only be the development of demand for agricultural labour, but also for other rural non-farm services, both of which are likely to be met by marginal farmers withdrawing from agricultural production (and perhaps land ownership), while some may leave to the growing opportunities in urban areas. Increasing rural wealth may produce a greater local demand for fish which, together with urban and export-led growth in demand, may lead to growth in the fishing community as trade specialisation develops, and may also lead to greater production from a variety of sources (both wild and cultured).

In the remainder of this section we summarise some of the cases of habitat loss trends revealed in the country studies and which may be repeated in other countries.

5.7.3 Deforestation and structural changes in land

Cambodia: Flooded forest and declining fishing grounds

The area of inundated forest in the Kampong Samnanh village in Cambodia changed over 3 main stages. From 1990 to 1993 the area of flooded forest was reduced because people converted this area into dry season rice field; from 1993 to 1996 the inundated forest increased because some villagers gave up their rice field as their crop was completely destroyed by rats and insects; and in the last stage from 1996 to 2002 these areas decreased again as the inundated forests were cleared to plant rice. So far the inundated forest area that remains is only 10 ha and is managed by the Kampong Samnanh community.

The flooded forest plays an important role in household food production and income generation through the different goods and services which it provides. It is exploited for food, trade and other products and provides charcoal, firewood, land for agriculture, materials for constructing shelters and fishing gear, food and medicine. Flooded forest wildlife includes crocodiles, snakes, turtles, frogs and waterfowl. However, a large proportion of Cambodia's flooded forests and wetlands have already been converted to agricultural land and the remainder is under threat. Flooded forest areas decreased from 937,900 ha in 1973 to about 370,000 ha in 1997. This forest would seem to be under especial threat because it allows for the possibility of two/three livelihood strategies (fishing, farming and hunter-gathering in the forest). There is a population of very poor people around the Great Lake whose sole occupation is fishing but who, given the forest's *de facto* CPR status, would seek to clear some for rice cultivation when the opportunity arises and thus secure greater livelihood security to the detriment of the common fishery.

Fishing areas are very important for households in Kampong Samnanh village because their livelihoods depend mainly on fisheries resource. Due to the small sizes of fishing areas, problems such as conflict between fishers and conflict between fishers and fishing lot owners arise. These conflicts sometimes end up in violence. In addition, the villagers need to go fishing far away from the village, so they need to spend a lot of time and money. Thus their income will be lower and their whole livelihood pattern will decline (not enough food to eat, cannot send children to school, borrow money to fulfill the gap). In other words increasing poverty.

The two main root problems are: cutting of inundated forest and installing brush parks that cause erosion and siltation and hence make the lake shallower; and the increase of fishing efforts due to increasing population.

Change in rural sector and natural resources management (forest)

The impact of changes in the structure of the rural economy has not been overwhelmingly positive. It is clear that on a general level rural livelihoods have benefited from the development of linkages between urban and rural economies. Rates of poverty in rural areas have been reducing through access to wider markets. However, not everyone has benefited. Location, and access to markets are critical in enabling people to lift themselves out of poverty. Where communities have remained isolated, so they have generally remained poor (e.g. isolated communities in the uplands of Vietnam, Cambodia and Laos, and the *charlands* in Bangladesh). Additionally, the stimulus of demand from the wider economy for rural products (overwhelmingly in the natural resource sector), raises questions as to the sustainability of these livelihood strategies.

The pressure of growing populations, of growing opportunities for diverse commercial agricultural production, and the limited availability of land in those areas best suited to wet-rice cultivation has meant that there is a continuing pressure on natural resources and a continuing conversion of land from other uses to agricultural use. Of the four countries, this process has gone furthest in Bangladesh, where almost all the floodplains have been converted to agricultural use over the past 100 years. In SE Asia, the same process is continuing and is most graphically illustrated by the loss of forest cover from the three countries

Siltation and loss of habitat in the Lower Mekong

The impact of forest removal has been blamed for a number of negative downstream impacts on fish habitat. In particular a commonly voiced view is that removal of forest cover increases run-off from upper catchments, and increases siltation and flood risk in lower catchments. For example in **Cambodia** it has been reported that siltation of the Tonle Sap is a serious problem as deforestation in the basin is believed to have caused accelerating soil erosion. However, the lack of reliable long-term data prevents the development of firm conclusions. A planned study forming part of the Mekong River Commission's Water Utilization Program should aim to investigate this further (Country status report: Cambodia, 2003). DFID's Country Strategy Paper (DFID 2000) also notes that many forests have been logged illegally and are seriously degraded.

In **Laos** with deforestation proceeding at a quite alarming rate there is soil loss and siltation. Deforestation was also blamed to be a contributory factor to extreme flooding. It was argued by experts that increasing discharge rates and silt loading leads to shallower rivers which combine to make the rivers more prone to flooding.

While the latter part of this statement is true, and is a natural function of floodplain development, evidence from elsewhere suggests that deforestation in itself is but a minor contributory factor in extreme flooding. Indeed some hydrological scientists suggest that the difference in run-off and sediment volume between forested and non-forested (grassland) catchments is small, and that there are other factors which contribute far more to flood risk in lower catchments than the type of vegetation cover in upper ones.

Siltation in Bangladesh

During the last 50 years there has been a considerable loss and degradation of inland water bodies in Bangladesh due to man-made factors such as siltation, water pollution, caused by

the impact of FCD/I projects, unplanned construction of embankments, dams and roads, and the diversion of waterflow in major rivers in the neighbouring countries.

Since population pressure on land is intense, and all available land that can be tends to be converted to cropland, there are declining waterbodies which can act as natural refugia in which non-migratory wild fish can shelter though the dry season. This problem is compounded by the fact that the number of perennial waterbodies may also be being reduced by natural siltation, by improved drainage designed to convert these wetlands. The problems for some species of fish are also compounded by the common practice of dewatering natural and man-made depressions in order to capture the fish concentrated there as flood waters recede.

Natural processes such as siltation, and man-made FCD/I infrastructure are reducing the overall area of water bodies on the Bangladesh floodplains, while the pressure of an increasing population and increased landlessness is swelling the numbers of those exploiting the inland fisheries. It is uncertain what the impact of this on livelihoods is likely to be. However, the overall impact may be to lead to a reduction in catch per unit effort for all fishers, and the withdrawal of some from the industry, or at least diversification into other activities by those who were previously primarily dependent on the resource. That is, in order to meet household needs, the majority of poorer floodplain households may need to diversify from necessity, flexibly exploiting resources as they become seasonally available, with only a limited number of richer households using capital investment to specialise.

That siltation as a natural process is occurring is not in doubt. Bangladesh water bodies on the floodplains (beels, haor and river) are gradually being silted up due to increased soil erosion ,by intensification of agriculture activities and deforestation both in the country and outside of the country. According to Millman and Heade (1983) some 2.00 to 2.4 billion metric tons of sediment are carried out by the three major river systems with their tributaries and distributaries every year. About 5% of this is deposited in the river bed, floodplain and beels, and the rest is discharged into the Bay of Bengal (Hossain 1992). Soil erosion due to agricultural intensification and deforestation is pronounced on the hills surrounding the northeast region of Bangladesh, with huge amounts of sediment being deposited every year in the haor basins, gradually reducing their water holding capacity. These perennial water bodies are rapidly being converted into seasonal ones and the dry season water area is gradually being reduced. ISPAN (1992) reported a reduction of about 70% in the water area in a beel (Jugnidaha beel) in the district of Tangail in 15 years (1977 to 1992) as measured by satellite imaging. According to MACH (2000) about 7.6 cm of sediments have been deposited in Hail Haor with maximum of 15 cm/yr during the last 12 years. FAP-6 (1994) reported that the piedmont rivers rising in the Indian catchment area carry a large quantity of sediment, most of which is deposited in the beels, floodplains and rivers. As a result many of the perennial water bodies are converted into seasonal water bodies, while reduction in surface area and depth of water bodies are negatively impacting fish production.

Similar concerns about deforestation, soil loss from the uplands, and potential negative impacts on downstream resource users, are voiced by different observers of Vietnam.

5.7.4 Agricultural intensification and habitat loss and degradation

Agrochemical use

In **Bangladesh** the shift to the use of High External Input technologies (chemical fertilisers and pesticides), accompanying the adoption of HYV rice, has been identified as a potential problem for water quality and as leading to unacceptable levels of harmful contaminants in fish caught for human consumption. There is widespread, popular belief that rice cultivation, especially intensive production of HYV rice is the cause of much wetland pollution due to

run-off of agro-chemicals that adversely affect fish and fish habitats (Sadeque and Islam, 1993). For example ISPAN (1992) reported that pollution due to use of chemical fertilizers and pesticides / insecticides in agriculture for production of HYV rice and other crops has affected fish production. BCAS and NCM (1994) reported that the commonly-used fertilizer, urea, which is soluble in water, is washed into water bodies under irrigated conditions and flood and causes luxuriant growth of hydrophytes which after death and decomposition give rise to anoxia conditions which result in fish mortality. Ali (1994) reported the occurrence of pesticides in the *khas* and ponds within the Meghna- Dhonagoda Irrigation Project area and resultant mortality of fish there.

About 70% of all pesticide use is on rice, most of which are insecticides and over 50% of which are used in the dry season on the boro (dry season) rice crop (Pagiola, 1995). Usage per unit area is, however, low, and the three main insecticides (carbofuran, diazinon and phosphamidon) are relatively short lived, though moderately to highly hazardous. A limited study by FAP 17 (FAP 17, 1994b) found no organo-phosphate residues although low levels of organo-chlorine residues were detected in fish collected near Tangail. In the north-east region the annual application of chemical fertilisers was conservatively estimated at 95 kg ha⁻¹ in 1987-1988; case studies have shown that fertiliser runoff from these areas is capable of causing eutrophication, especially in areas where FCD/I projects result in stagnant waters. Also, there are occasional fish kills which have been attributed to the 4,000-5,000 t of pesticides used annually in Bangladesh (Craig et al in press).

Similarly, given the low industrial base and the extent of sheet flooding, it might be thought that surface-water pollution is not a serious problem within the Bangladesh floodplains. However, there can be quite dramatic localised downstream impacts by, for example, effluent from fertiliser plants, paper mills and the like (FAP 6, 1993; Ahmad and Reazuddin, 1990). The World Resources Institute reported that 'the direct contamination of aquatic systems by industry in Bangladesh is widespread and of concern' (WRI, 1990). Aside from water-borne pollution reducing the productivity of floodplain fisheries, there are also concerns over the deleterious impacts to human health of consuming contaminated fish (Ali, 1997) (Craig et al in press)

In Cambodia it is reported that agricultural chemical run-off may affect nearby fisheries and directly impact rice paddy fish productivity (Thuok and Sina 1997). Due to a lack of research on this subject in Cambodia, it is impossible to determine whether the levels of agricultural chemical run-off have significant impact on the health of fisheries. However, anecdotal evidence suggests that high pesticide use in some areas affects fish productivity in rice paddies and nearby ponds. **Vietnam** also has very extensive rice cultivation and has recently challenged Thailand as the world's top exporter. However, production is intensive with very high pesticide use and fishers in the PRAs reported impacts on ricefield fish catches, rice-shrimp production has no doubt also suffered as a result. Other factors are pesticide use for HYV rice production, and low pH in canals during the early rainy season.

Irrigation

Despite the fact that the extent of water bodies acting as fish refugia through the dry season may be reducing due to their draw-down for irrigation purposes, most observer comment has been reserved for the potential negative impacts on the fisheries of hydraulic engineering. The main contention is that where polders have been built to protect low-lying crop lands from flooding and there is poor maintenance and operation of sluice gates, not only are crops at risk of damage through water-logging but migratory fish species are prevented from entering the seasonally flooded lowlands from perennial rivers in order to breed. The extent of the problem is, however, contentious, while the gains to agriculture and other sectors may more than offset the loss to the fisheries. However, which households this is likely to benefit and which may lose out is unclear.

Aquaculture and privatization of CPRs in Bangladesh

The majority of those who make a living on the floodplains depend on a combination of aquatic and terrestrial production. Nevertheless, since the landless poor are normally dependent on aquatic resources for at least part of the year, they need to have access to these at that time. However, in Bangladesh, being poor (and perhaps Hindu) full- and part-time fishers normally lack the political and social capital to stand up to the dominant land-owning (Muslim) majority. Thus, there is the threat of the loss of access to CPRs by the poor as more powerful rent-seeking groups appropriate them for their own use.

In Bangladesh, agricultural land is privately owned and access is in the hands of the owner while it is above the flood, but when it is submerged to a depth of more than knee-height use of wild aquatic resources (other than crops) typically becomes a CPR in which anyone can fish. Additionally, even on shallow-flooded land that remains private property but where the owner is not utilising the aquatic resources, poor people can harvest these resources. However, as the value of the fisheries rises, land-owners often use *kuas* (ditches) to concentrate fish on their land for harvesting when the flood-waters recede, or increasingly may fence off areas in what is customarily a CPR in order to stock carps. In both instances they deny access to others – and frequently back this with force.

Such constraints on access to CPRs (a de facto ‘privatisation’ of the resource) may be flouted by individual subsistence fishers, or may be more actively resisted by fisher groups and even whole communities (see Dixon 2000). However, given the value of the resource, the low entry costs to their exploitation, and uncertainties over access rights, there is considerable potential for conflict between different groups of fishers, between groups from different social and occupational strata, and particularly between groups with different perspectives on land and water use on the floodplains. As Craig et al (in press) note, FCD/I projects in which the benefits of flood control have accrued mainly to those farming inside embankment schemes have been responsible for exacerbating social tensions between different groups, and particularly between farmers and fishers over the timing of sluice gate opening to allow fish and fry into the floodplain (FAP 12, 1992; Sultana and Thompson, 1997).

5.8 Vulnerability

5.8.1 Cambodia

There are several problems that have led to livelihoods vulnerability and that impact upon livelihood strategies of the stakeholders in the PRA study area and which highlight the concerns of fishing communities. These include:

- Drought: people in Sreycheuk area faced natural calamity in 1998 such as drought and rodent, which caused decrease in rice production.
- Flood: in 1995 villagers faced one natural calamity (flood) and abundance of *Mimosa pigra*. These two cases caused loss of land for rice cultivation. As a consequence, the floating rice production reduced considerably, for example there was no rice production in 2001. It caused shortage of food for household consumption.
- Population growth: the population has increased from 50 households in 1982 to 120 in 2002. The increase is due to migration from Kandeang, Kanthor, and Kampong Lourn. These people are now residents, but the population in fishing season is even higher. Fishers come from Chikreng, Rangtil, Kandeang, and Kampong Lourn to catch fish and

for fishery related business. The population at this time of the year can be as high as 400 households (in 2002).

- Natural fish decline: fish catch decreased considerably each year. This is reflected in the catch in 1982, which was 300 kg/day/household, and fish catch in 2002, which was only 4 kg/day/household. Reasons of fish decline given are, increase in fishers and modern fishing gears (such as one engine boat trawl 'yang kav', bush park 'somras', electrocuting 'chork', scissors push net 'chheup'), and, decrease in flooded forest.
- Low fish price: in 1982 fish price was high (up to 5000 riels/kg for class 1, 2 and 3) but the price of fresh fish currently (2002) is only 500 riels/kg. As for processing fish, one household could produce 10,000 skewers of smoked fish a season and 200 kg of fermented fish (prohok) a year. In contrast, the processed fish production has, recently decreased, for example, only 1,500 skewers of smoked fish are produced and 10 kg of fermented fish being produced per household in a year. This has affected the household income of those who are involved in these activities.

Local people of Sreycheuk area have encountered other problems such as unlawful payment for fish culture to police and inspectors, encroachment by fishing lot owner into common area, fishing lot owner blocks the fish way which can disturb the fish migration from lake and stream, the shallow stream mouth, and lack of human resources. All of these problems have impacts on the livelihoods of the people in Sreycheuk.

5.8.2 Vietnam

In PRA sessions, respondents mentioned some vulnerability issues (Table 5.17). Due to sudden shock from these different events and hazards and given their overall vulnerable situations, poor people to cope with their loss of income and food have to lose through sale or mortgage their fixed assets.

Table 5.17 Vulnerability summarized from PRAs in Vietnam.

Vulnerability	Extent of damage
Decreased soil fertility-increased production cost	Soil fertility decreased gradually because the dyke prevents sediment to accumulate on rice fields in flood seasons. Crops demand high doses of fertilizers increasingly in the area
Crop pests	Due to shift from single to triple crop and mono-crop culture causes high incidence of crop pests. To prevent crop loss farmers have to use high doses of pesticides. Application of high doses of pesticides increases vulnerability to fish loss every year in dike protected area, hence increase in production cost, crop loss and decrease income.
Natural fish declined	Natural fish decreased gradually because of limited surface water area in the dyked area and use of harmful causing declined fish catch as well as less dependency on fishing. More out-migration, change of profession and competition, insecurity and low income and higher rate of unemployment.
Water pollution	Farmers use more and more pesticides and fertilizers, so water is polluted and harms fish. Dyked area has no flushing of water as well as water logging. This condition makes people vulnerable to different diseases and loss of income.
Disease	Yearly outbreak due to unhealthy living condition and polluted water usages

5.9 Problems and Constraints

During PRA sessions in all the target countries, participants identified different problems affecting their livelihoods, their causes and effects, and in some cases also identified possible solutions. To some extent these identify areas for possible research, although they also relate to development issues and often highlight the complex livelihood patterns of fishery dependent households and that fishery and wetland management are only one area of concern. The country reports detail problem analysis for different fisheries stakeholders and environment in the four countries. Problems common to all countries are listed in Table

5.18 along with their typical consolidated causes, consequences and probable solutions based on the views of the fishers.

Table 5.18 Common problems identified by all stakeholders across environments and countries compiled from PRAs in Bangladesh, Cambodia, Lao PDR and Vietnam.

Problem	Causes	Consequences	Solutions
Fish and other aquatic resources decreasing	<ul style="list-style-type: none"> - Overexploitation - Use of agro-chemicals - Catching brood fishes and fish fries - Use of harmful gears - Infrastructure development (B,C,L,V) - complete dewatering of ditches for fish harvest 	Loss of livelihoods of the fishers	<ul style="list-style-type: none"> - Alternate livelihoods for fishers (training and credit) - Awareness campaign - Strict enforcement of fisheries laws - Restrictions on harmful activities
No/limited/restricted access to fishery for poor fishers	Lessee/rich people restrict catching fish in the good fishing ground (V, L,C) /leased in waterbodies/ fishing lots (B,C)	Poor income or less/no fish for consumption for poor fishers	<ul style="list-style-type: none"> - Community based management - Lease of waterbodies to fishers
Lack of fishing ground	<ul style="list-style-type: none"> - Building brushpiles in the open waters (B) - Cages in the open water (L,V) - Enclosure in the flooded area (B,V) 	Poor income or less/no fish for consumption for poor fishers	<ul style="list-style-type: none"> - Ensure access of the poor fishers to good fishing grounds - No private brushpiles allowed in the open waterbodies for fish aggregation and harvest
Lack of capital	No collateral for the poor (B), no land as security for formal loan (V), high rate of interest for informal loan (B,C,L,V)	Poor income or less/no fish for consumption for poor fishers	<ul style="list-style-type: none"> -Income Generating Activities -Credit at low interest rates
Low price of fish	No price security, no cooperative (B,C,L,V)	Poor income or less/no fish for consumption for poor fishers	<ul style="list-style-type: none"> - Market monitoring, fixed price and safety procedure for fishers - Fishers cooperative
Conflict over surface water use for irrigation and fishery	Usually rich farmers have more land and they control water sources/structures. Farmers do not care more about the fish habitat as they only fish for food/as a hobby or buy fish from the market	Fish fry recruitment and brood fish entry in the floodplain hampers. Poor income or less/no fish for consumption for poor fishers	<ul style="list-style-type: none"> - Community based management of water resources - Fish sanctuary - Using early variety
Change in land use pattern-habitat loss	Food grain production/food security has been given priority	More food grain but low fish consumption and low income for fishers	<ul style="list-style-type: none"> - No conversion of wetlands - Ensure minimum water area for each district
Relaxed enforcement of fishery laws	Corruption (C,B), Lack of manpower and facilities of the law enforcing authority (V,C,B,L), Implementing of fisheries laws remain with DoF but DoF has no law enforcing authority (B).	More fish exploitation, little access of the poor fishers to waterbodies	<ul style="list-style-type: none"> - Strict law enforcement

Key: B - Bangladesh, C - Cambodia, L - Lao PDR and V - Vietnam

As an illustration of the kinds of analysis made by fishers in the four countries, Fig 5.6 shows a problem tree from Cambodia. An important output from the project has been the presentation of the views and ideas of fishers and other users – landless or landed – of inland fisheries and aquatic resources as to their problems and possible measures that can be taken by government and by local communities. The aim was to help these views along

with analysis of past experience and expert opinion reach a wider audience in the target countries and this is discussed in the next chapter.

Fig. 5.6 Problem tree from PRA in a Cambodian Fishery

