

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



Imperial College
OF SCIENCE, TECHNOLOGY AND MEDICINE



**FINAL TECHNICAL
REPORT**

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PREFACE

The Department for International Development (DFID) through the Marine Resources Assessment Group (MRAG) has approved the project proposal for the Project Memorandum on “Understanding Livelihoods Dependent on Inland Fisheries in Bangladesh and South East Asia” based on an earlier concept note on the same topic. The project characterizes the poor, identifies their dependence upon aquatic resources, describes the nature and status of those resources, and emphasizes the vulnerability of the poor to loss or mismanagement of these resources. Constraints and possible research priorities were identified through consultations with poor people, other aquatic resource users, and various organizations (secondary stakeholders). The project helped fill information gaps and identified critical research problems and how they relate to the poor. Data generated made it possible to evaluate the impacts of potential research and interventions on different categories of the poor, their access to benefits, and any livelihood related risks.

The project was conducted during February 2002-January 2003 by the WorldFish Center (formerly ICLARM) in collaboration with CTU, Vietnam, An Giang University, Vietnam; DoF, Cambodia; LARReC, the Lao PDR; and BCAS, Bangladesh. The expected outputs from this project were (1) a set of national profiles compiled for the main categories of the inland aquatic-fishery resource system in each country (vol 4); (2) a set of case studies on livelihoods assessments and poverty profiles based on PRAs and covering the main stakeholder categories in representative sites in each country (Vol 5); (3) a set of summary reports consolidating the PRA and country profile (Vol 3); and (4) a report classifying and synthesizing these findings (Vol 6) to determine links or generalities among resource bases and trends, and livelihoods and needs/constraints that are available in summary form in local languages.

Volume		Authors
1	DFID Final Technical Report(FTR)	PS with PT& MA
2	Project Completion Report	PS with PT& MA
3	Country Summary Report	
3.1	Bangladesh	LA, PT With SSA, SAA & PS
3.2	Cambodia	KK, TS, NT with MA
3.3	Lao PDR	XC, KL with PS
3.4	Vietnam	PS, VTA and NHC
4	Country Status Report	
4.1	Bangladesh	LA, SSA,SAA With PD, ASH, PT & PS
4.2	Cambodia	SV, TS, KK, PJD & MA
4.3	Lao PDR	XC, KL with PS
4.4	Vietnam	VTA , NHC with PS
5	Country PRA Report	
5.1	Bangladesh	PS, SSA,SAA & PT
5.2	Cambodia	KK, TS, NT with MA
5.3	Lao PDR	XC, PS with DS
5.4	Vietnam	VTA, NNC, TTKH & PS
6	Synthesis Report	PJD

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The project was implemented on a partnership concept. Four different countries- Bangladesh, Cambodia, the Lao PDR and Vietnam were partner countries. Technical support was provided by four interdisciplinary international organizations. Basically country partners did the initial work and then through a regional workshop progress was reviewed. After review the country partners prepared reports and the institutional partners reviewed and updated them. Overall coordination and field level technical support were given by the WorldFish Center. All the reports were finalized by the Center. It is therefore fair to list all the partners who contributed at different stages of the research. Thanks are also due to other staff of the respective departments that helped in the field or in the collection of information.

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CHAPTER 1

Executive Summary

This report provides an assessment of the livelihoods strategies of the poor people dependent on inland fisheries in Bangladesh, Cambodia, the Lao PDR and Vietnam. Drawing upon the results of a one-year investigation under the Project entitled “Understanding Livelihoods Dependent on Inland Fisheries”, the report analyses current poverty status, fisheries resource status and its significance, policies and institutions for fisheries management and livelihoods assets of the stakeholders in inland fisheries in the four countries. The report also discusses the trends and changes in fisheries and wetland resources. It highlights the key challenges and prospects, threats and vulnerabilities of the poor stakeholders and problems and constraints in maintaining and enhancing the livelihoods of the poor stakeholders in inland fisheries. The following reports have been prepared and are included as annexes to this Final Technical Report (FTR): 1) Synthesis Analysis Report; 2) four Country Summary Reports; 3) four Country Status Reports; and 4) four Country PRA Reports.

Confronted with one of the most challenging development goals, i.e. eliminating extreme poverty in the World, DFID and many other governments and international bodies have now focused their strategy on understanding the context in which poor people make a living; ensuring the participation of the poor (“primary stakeholders”) in identifying their needs and priorities; and contributing to demand-led technology development and adoption. Likewise, the strategy seeks to integrate research and development, and ensure the full participation and ownership by partner governments and their extension agencies, and by all parties who have an interest and influence over improving livelihoods.

With international agencies and governments now focused on pro-poor growth and on the contribution that the fisheries sector can make to overall poverty reduction, there is an urgency to ensure that management solutions clearly address the needs of the poor. More detailed understanding of the dimensions of poverty and the needs of the poor is needed if more effective programs are to be developed to address poverty and its related consequences on the poor. The captioned project is an outcome of the felt need for more livelihoods oriented research and for information on the role of fisheries in the livelihoods of poor people. The results will feed into the design of livelihoods options within a common national and international strategy for eliminating poverty. In the Mekong region as well as in Bangladesh, there are changes that place a greater emphasis on redirecting and harnessing fisheries benefits to the poorer communities. A greater understanding of poor people’s interaction with aquatic resources for their livelihoods will be a very timely contribution to targeting the poor.

Although a considerable amount of work has been done under various Programs including FMSP, most of the previous analyses were fraught with “limited coverage”. They lacked information and understanding on the livelihoods strategies and capacities of local people, and failed to understand the socio-economic, institutional and regulatory environment as well as regional and global factors that impinge upon their livelihoods. Likewise, in the past too much emphasis on scientific information on the resources and their bio-ecology has failed to recognize the social complexities and the importance of

beneficiary targeting. Despite these shortcomings, in terms of the incidence of poverty and poverty impacts measurements, the information currently available, particularly in the four study countries, provide a broad basis for assessing the level of poverty. They point to the groups or communities that are invariably poor and vulnerable to shocks. They also suggest that farmers and fishers, including women, with limited or no access to natural resources, are amongst the poorest, while the risk associated with on-farm investment can deter the poor from expanding their economic base.

It is, however, clear that to make a clear contribution to improving livelihoods outcomes for poor people programs should be designed (a) to increasing the opportunities available to individuals, groups or communities by building up their asset base; and (b) by helping ensure that the structures, institutions and processes which define people's options are working in favor of the poor to further fishery specific livelihood analysis.

Keeping these in mind, the present project was designed to fill the gaps in information and analysis that would contribute to improving livelihoods outcomes of the poor. Specifically, the purpose of the project was to characterize the poor, identify their dependence upon aquatic resources, describe the nature and status of those resources, and emphasize the vulnerabilities of the poor in relation to loss or mismanagement. Facilitated through a series of PRA workshops and discussions, through coordination among government agencies and NGOs, the project's effort resulted in all stakeholders, including the poor people, other aquatic resources users, and representatives of organizations concerned identifying and prioritizing constraints and solutions for a better livelihoods outcome in inland fisheries.

The project methodology included a comprehensive review of literature on fisheries and livelihoods. An initial planning meeting, arranged with various national partners, UK partners and the WorldFish Center research team, provided PRA guidelines, and a country profile analysis framework, including orientation to national partners on stakeholder analysis methodology, Sustainable Livelihoods Framework and PRA methods. Using general guidelines on PRA and consistent with other locally significant criteria, each country identified the set of stakeholders involved in the inland fisheries sector.

Likewise, the partners characterized their specific countries' inland fisheries using their own definitions and classification of inland ecosystems. A number of PRA sites were covered in each country. The stakeholder and resource information took into account the wide diversity of both stakeholder groups and aquatic environments.

In each country, a major part of the research activities involved a review of information from secondary sources comprising previous studies, government documents and statistics. A literature review of previous rapid livelihoods assessments carried out by the national partners in each country, reported in the Country Status Report, helped identify and assess the following: 1) the main categories of the poor, their numbers and geographic locations within each country; 2) resource inventories comprising data on inland fisheries and aquatic resources, the status, trends and threats; 3) role of inland aquatic resources in the livelihoods of rural people, where possible, by poverty levels; 4) asset base and access to capital by rural people disaggregated by poverty levels; 5) institutional and legal profiles of fisheries and wetlands in terms of the status of access regimes; and 6) determination of information gaps in the existing literature. Evidently, the existing literature shows that there is very little depth in the coverage of information on

livelihoods which are dependent on inland fisheries in all four countries. At the same time the breadth of information varies widely between the countries. While Bangladesh has a large body of literature, the three Mekong countries have a paucity of documented information on the livelihoods and poverty analysis related to inland fisheries and aquatic resources.

In analyzing the rural poverty and fisheries livelihoods, it was revealed that fisheries as a CPR play a vital role in rural livelihoods. For example, Bangladesh faces a relentless pressure on land from a population of 131 million growing at 2.17% per annum. The role of CPRs, and particularly open-access fisheries, feature prominently as a contributor to expenditure-saving and survival livelihood strategies of the poor.

The potential for Bangladesh's vast inland aquatic resources for helping to meet the poor people's livelihood needs is under severe threat, requiring continued and increased targeting of landless, marginal and small-scale male and female producers who live in rural areas by DFID and other donors in their research and action Programs. For example, to deal with the complex issue of property rights and access support for speedier devolution of institutional governance of aquatic resources toward local communities should be a priority, for which continued donor support is crucial.

In Cambodia, the Lao PDR and Vietnam inland fisheries play an equally important role in rural livelihoods, despite poor visibility of the fisheries sector in the national plans and priorities in the latter two countries. The fact that some 2.3 million people are estimated to live in fishing communes and the rate of fish consumption is as high as 75 kg per caput per annum in Cambodia are clear evidence of the overwhelming role played by fisheries in Cambodia. Comparison of issues and trends in livelihoods dependent on fisheries in all four countries also suggest that there is scope for learning from Bangladesh by the Mekong countries.

The PRAs were a substantial part of the research activities under the project, which filled in the gaps in the existing literature significantly. Its main focus was on the primary stakeholders and their livelihood strategies. In addition to making the PRAs a rigorous and comprehensive exercise, such as inclusion of a full range of fisheries stakeholders and ecosystems, and application of a number of PRA tools, in order to capture information about most aspects of livelihoods of the stakeholder groups, key informant discussions and reports from secondary stakeholders were used prior and after the implementation of the PRAs. Discussions with the secondary stakeholders, such as the local authorities, provided an additional opportunity to build linkages with them, and to draw them into the uptake and dissemination process.

Recognizing that national partners had limited experience in conducting PRAs and little understanding of the "Sustainable Livelihoods Analysis Framework" prior to undertaking the project, the PRAs were used as a training forum to build up capacity in participatory research methods and livelihoods analysis framework. However, resources and time limited the scope to fully involve all partners and collaborators in a comparative analysis of livelihood strategies of different stakeholders in inland fisheries as had been hoped. Nevertheless, partners and collaborators were able to compare and discuss their PRA frameworks, results and analyses during regional workshops conducted under the project. National workshops (already conducted in Cambodia and Bangladesh) were intended to disseminate findings to target institutions in the respective countries. Distribution of summary reports (already prepared), including translation of major

findings and key recommendations into local languages, will provide a wider outreach of the project outputs, and promote further uptake and future use of the project methods and results through national and regional networks.

The characteristic features of livelihoods in inland fisheries in the four countries uncovered through this study show a number of similarities and distinctions in terms of overall poverty status as well as in terms of poor people's livelihood strategies across different stakeholder groups and aquatic ecosystems within each country and between countries. In Bangladesh, while members of poor rural 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 full-time occupation because of low entry costs involved. In Cambodia, nearly 75% of the poor people are engaged in fishing and farming occupations, whereas households headed by someone working in agriculture and fishing have the highest incidence of poverty (46%). The so called "static poor" groups in Vietnam, whose livelihood options are limited to fish capture and lowly paid wage employment hardly make a living with no means of acquiring any asset or capital.

Social differentiations amongst ethnic and occupational groups as well as gender differentiations have influenced livelihoods options and strategies of the poor stakeholder groups in the four countries. In Bangladesh, the three distinct stakeholder groups, namely fishing dependent people from traditional Hindu fishing castes; poor Muslim population who fish for food and subsistence; and wealthier fishery investors and financiers have a varying range of constraints and advantages in pursuing their livelihoods strategies. Likewise, the majority of those who fish as an occupation are men, with women and children fishing on a subsistence basis, as well as being involved in post-harvest activities such as drying, processing and trading of fish. On the other hand, despite being a relatively homogeneous society, Cambodia's fishing dependent population cluster around two distinct groups, such as those who combine fishing and farming or depend on fishing in the seasonally flooded areas; and those who can afford to buy fishing rights in the fishing lots, and employ poor people as workers in industrial-style fishing operations.

From the analysis of fishery resources status and importance, it appears that the types of fishery in all four countries are broadly similar, being dominated by major rivers and their floodplains and/or deltas. The seasonality in water areas and water 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 migration. However, nationally two distinct patterns are observed amongst the four countries: Bangladesh and Cambodia both with large areas of inland fisheries have high total catches, while the Lao PDR and Vietnam with relatively smaller inland areas have low total catches. Two common threats and trends were identified in the four countries: high fishing pressure and loss/degradation of wetlands and floodplain habitat to agriculture. These were, however, attributed to 1) flood control, drainage and irrigation structures; 2) modification of river-flows for hydroelectric power; and 3) effects of pollution and agro-chemicals. However, there are few studies to demonstrate clear impacts such as the quantity and value of the losses being incurred due these trends.

Policies and institutions are critical for poor people's access to resources and strategies to improve their livelihoods. Bangladesh's fisheries policy invariably supported the dominance of wealthier investors and financiers at the expense of the poor and

subsistence fishers, farmers and fish workers. Recent experiments through government organizations, (principally the Ministry of Fisheries and Livestock), NGOs and community partnerships have provided alternative institutional options and management models which can ensure poor people's access to fisheries, and consequently enhance their livelihoods. Likewise, recent policy shifts toward community management of fisheries in Cambodia presents a potential scope for enhancing the livelihoods of the poor people dependent on inland fisheries.

The PRAs have provided a good understanding of the major livelihood assets (human, financial, natural and social) of the stakeholders in inland fisheries in the four countries. In general poverty remains a major obstacle to poor people's ability to gain and maintain access to critical livelihood assets. Likewise, declining trends in the asset holdings have been observed by the poor stakeholders, reflected in the declining income from fishing, low rate of savings amongst poor households in inland fisheries, and high rate of degradation or loss of Common Pool Resources (CPR). Despite continued threats of access to CPR and displacement of the poor from natural resources, the poor invariably place a high premium on the water and aquatic resources to maintain their livelihoods. Fish becoming less and less abundant, higher market prices for fish have naturally placed fish stocks and natural resources high on the list of assets that poor people would like to have access to, although they have become increasingly inaccessible.

The challenges and threats that have besieged the inland fisheries have many sources and origins. They include: 1) competition and conflicts over fishery resources leading to over-fishing; 2) land conversion and degradation of natural water bodies causing loss of habitat for natural fish species; 3) deforestation and structural changes in land; 4) agricultural intensification, another factor causing habitat loss and degradation; and 5) privatization of CPRs for aquaculture development. PRA results show that all of the above challenges and threats to inland fisheries have already reduced the livelihoods base of the poor people, and made them more vulnerable to shocks such as drought and flooding, and the natural decline of the fish population, high population growth, and low prices for fish due to seasonality and problems of proper access to markets.

Although no separate effort was made through the project to develop an agenda for future research and action, the analysis of livelihood strategies of the poor people and their degree of dependence on inland fisheries clearly warrant urgent research and policy actions on a number of issues and concerns. It is also recognized that several international organizations (e.g., WorldFish Center and FAO) and donor countries/organizations and their implementing agencies (DFID-MRAG, ADB, World Bank) have already committed to undertaking research and action projects on institutional and legal frameworks; increased stakeholder involvement in the governance of aquatic resources; appropriate assessment mechanism of fisheries resources, including valuation of aquatic resources. It is important to link and feed the results of the present research into some of the above initiatives through follow-up research and actions. Immediate and most important among them are those that will: 1) increase the policy uptake of the livelihoods development and poverty elimination through integrating aquatic resources valuation and the policy development process with livelihood values and aquatic resources management; 2) assess the role of market and market forces, and impact of international trade on the fisheries livelihoods; and 3) provide further in-depth analysis of livelihood outcomes and impacts on ongoing and planned natural resources management projects.

CHAPTER 2

Background

In this chapter we summarise the context and external demand for the study based on donor priorities and past studies and also briefly review past literature. However, as a major part of the study activities was to review literature and make a comparative analysis between the three Southeast Asian countries and Bangladesh, this is summarised in more detail in the research activities and outputs chapters.

2.1 Demand for the Research in the Context of the Changing Development Agenda

Governments and international bodies have committed themselves to eliminating extreme poverty in the world, and have set themselves challenging targets to be achieved by 2015. Poverty here being defined as multidimensional both by reference to the Human Development Indices (HDIs) of UNDP, and by an income measure (less than a \$1 a day). The White Paper *Eliminating World Poverty: A Challenge for the 21st Century* was published in 1997 by the British government and commits it to meeting these targets. As a result all DFID funded activities -including research -have been reassessed to ensure a robust link with the department's poverty focus, and that they are 'fit for purpose' -that is deliver outputs which will contribute to achievement of the government's overall goal of poverty elimination.

Also the research programmes such as FMSP have reviewed their portfolios and developed a new strategic focus in order to increase their livelihoods and poverty focus. Fisheries research and development has been identified as an 'entry point' which can have a significant impact on poverty levels in those countries where there is a significant aquatic resource base and considerable numbers of poor people who are dependent upon the resource and who would be disproportionately disadvantaged by loss or mismanagement of the resource (Townsend, 1998). The project reported here has been commissioned under the new strategy and is intended to set a benchmark for further work that is commissioned under the programme.

Of course previous research and extension funded by DFID and other donor bodies has also had the goal of poverty elimination. However, experience in achieving this has been mixed. International indices indicate that there have been considerable advances in reducing the level of poverty in many countries as measured by the Human Development Indices (HDIs), but there remain a number which, for a complex combination of reasons, still have higher than average levels of poverty, including the nations covered by this study. Some of these do better on some HDIs (e.g. Vietnam on education and health indices), but still have large numbers who are on incomes below the poverty threshold.

While the reasons for poorer than expected impact of earlier research and development (r & d) initiatives are complex, international bodies, under the prompting of a host of individuals and civic bodies, have identified a number of areas which have been constraints to optimising impact. These constraints have primarily to do with the research and development process, and in particular a failure to develop partnerships between key players in the development process. The outcome of this assessment is that globally research and development processes and the organisations which deliver them are being restructured to address this failing.

In the research domain, partnership translates into two major areas, those upstream and those downstream of the research act. Thus the emphasis now is not on development

through a supply-side 'transfer of technology' model (e.g. of Green Revolution technologies) from richer to poorer countries, since this has frequently been inappropriate to the needs of the poor while being 'captured' by better resourced farmers. In short, 'trickle-down' has had disappointing impacts as regards poverty elimination.

By contrast, the emphasis now is on (a) understanding the context in which poor people make a living, and (b) ensuring the participation of the poor ('primary stakeholders') in identifying their needs and priorities, and contributing to demand-led technology development and adaptation. As DFID (1998) states, "the application of various participatory and associated approaches to research design can be an important contribution to enhancing the relevance of research interventions. Interaction with target groups and/or beneficiaries can help to ensure research "deliverables" are demand-led and can generate an empirical basis for the research programmes. This is in contrast to decisions being led by contemporary fashion or even the idiosyncrasies of scientists".

This knowledge-generation process requires the identification and targeting of the groups of poor ('primary stakeholders') on which one wishes to have a development impact, and the working in partnership with them to identify their needs and develop technologies and institutions, which they can adopt. Sustainable Livelihoods Approaches (SLA) and Participatory Rural Appraisal (PRA) tools have been developed to assist with this understanding and eliciting of demand.

The Sustainable Livelihoods Approach stresses the need to take a holistic approach, while in systems research 'everything is connected.' This point is well made in a DFID review of its Renewable Natural Resources Research Strategy (RNRRS) (DFID 1998) which notes that, until recently research was assumed to be of relevance to development simply because a development problem (e.g. an agricultural pest) was perceived as a constraint to production, while today most would agree that research should not be defined solely by the researcher's perceptions of constraints to development. 'In contrast to historic practice, most contemporary planning tools enable managers to consider the relevance of research' (DFID 1998).

In sum, while a holistic sustainable livelihoods analysis can be an invaluable basis for design, it should lead to focus 'entry points' for interventions. In commissioning this project, DFID has identified the inland fisheries sector as a valid entry point through which it can make a difference to the livelihoods and well-being of poor people in Bangladesh and Southeast Asia. To achieve this, what is sought is a better understanding of livelihoods associated with inland fisheries resources and an indication of the key constraints to improved livelihood development. We therefore have tried to be careful in establishing the boundaries for the research, while drawing out the relationships with other sectors - since livelihoods are made up of a range of strategies and people think holistically (Ellis 1998). In brief, we need to take a focused *systemic* (or holistic) approach rather than trying to model whole *systems* (DFID 2001).

On the upstream side, a similar lack of partnership with those bodies who might distribute the new technologies and provide support to enable their optimum uptake has been identified as a key constraint to overcoming scale issues - the constraints to scaling up the potential impact of technologies developed from site-specific research. "Without scaling up, any benefits for the poor will remain restricted to the few, may not be sustainable and may be insufficiently noticeable to register with policy-makers and donors" (DFID 2001).

Yet historically, and despite successes by localised civil society bodies, research and development have tended to be separated at a high level. Research might develop new demand-led technologies, but these were then handed over to other bodies to further adapt and distribute, and without these bodies being involved in the rationale for addressing the

needs of particular population groups, in identifying the needs of these groups, or in developing technologies for them. As such these bodies also failed to adopt research products for up-scaling, because, amongst other reasons, they did not see them as being relevant to their needs.

Thus a lack of ownership by governments and their extension agencies has been identified as a key constraint to the wider uptake of research products and the achievement of optimum impact, and measures are being taken to address these failings.

The new approach is most clearly demonstrated in what are known as Sector-Wide Approaches (SWAs) which have been developed as an alternative to the fragmented portfolios of projects historically favoured by donors but which are now recognised as having made it difficult for partner governments to manage aid flows effectively, prioritise spending and 'buy in' to the process. As Akroyd and Duncan note (1998) "Local commitment and ownership of the strategy process, as well as identification of beneficiary priorities are critical". The principles underlying SWAs have more recently been developed by the World Bank's through its development of Poverty Reduction Strategy Papers (PRSPs), where the stress is on partnership, participation, and ownership not only by partner governments by all parties to the country strategy. The origins of the PRSP initiative reflects a combination of (a) disappointment with poverty-reduction performance in the most aid-dependent countries in the last 20 years, and (b) growing recognition of the importance of the national policy context for aid effectiveness (ODI 2001).

In sum, the emphasis today is on working in partnership with those agencies ('secondary stakeholders'), who can have a significant influence on scaling up the delivery of appropriate technologies and enabling institutional frameworks to meet the needs of the poor - that is on working with government extension agencies, civil society and the private sector. Given the experience of market failure in service delivery to poor people, developing partnerships with government extension agencies and civil society is particularly important.

Given the international targets, donors are concerned to assess the impact of programmes and projects on poverty elimination. However, whereas a development intervention can normally be expected to have a determinate impact within a specified time-frame, it is unrealistic to expect this of research projects. Thus 'systems research must be evaluated not in terms of its immediate developmental impact but in terms of its impact on the thinking, policy and practice of development agencies at all levels (DFID 2001).

In terms of project and programme research the message is now very clear. We cannot just hand over research products to third parties. We now have to actively work with those whom we identify as major 'uptake pathways' in order to get them, as partners, to contribute to the research, develop a sense of ownership of the research products and 'buy-in' to their scaling-up. This is not just a matter of leveraging resources from other sectors, but of ensuring the longer term viability (or sustainability) of the research products as relevant and useful to poverty-reducing interventions. Otherwise, research products will remain gathering dust on the shelf.

2.2 Context of Research Demand in the Target Countries

Information on fisheries resources in Bangladesh and S.E. Asia is fragmented and has not taken account of poor people and their livelihoods. Research has been supply-led, resulting in limited uptake and gains for the non-poor. Often decisions are based on national level priorities overlooking the needs of local people, especially the poor, and thus posing a severe threat to local livelihood assets including fisheries. The development issues in the

two river basins are similar, and fisheries are a vital source of food and income for poor people. Comparative analysis offers the opportunity to learn from differences in institutional arrangements at local and regional levels, and from differences in dependence on fisheries as a source of livelihood, to help guide future development and research.

In this project, stakeholders prioritised constraints and identified possible research priorities through consultations with categories of poor people, other aquatic resource users, and with other organisations. This information matched against a classification and synthesis of fisheries resources and research and identified critical areas and researchable problems requiring further study. It evaluated the impact of relaxing key constraints for the poor.

The role of aquatic resources in rural livelihoods is characterised by diversity in the resource, habitat and environment, and in the resource users and the ways in which they exploit these resources (Townsend in Carney 1998). Yet historically, strategies to improve management of the fisheries sector have focused on the resources and on supply-side solutions. Understanding these natural resources is well advanced, but opportunities and constraints have largely been identified by fisheries experts. Difficulties with this approach have included variable uptake by target beneficiaries, the capture of benefits by non-poor with the resources to invest in new technologies, and an increasing gap between rich and poor.

With international agencies and governments now focused on pro-poor growth and on the contribution that the fisheries sector can make to overall poverty reduction, there is a need to ensure that management solutions clearly address the needs of the poor. Recent World Bank participatory poverty assessments (e.g. 'Vietnam: Voices of the Poor') have highlighted the livelihood problems, and their causes, that the poor face. However, the poor are not a homogeneous group, they follow diverse and varied strategies, so there is a need to more clearly identify stakeholders involved in the fisheries sector, to understand their needs and the socio-economic context in which they make a living, and to design solutions accordingly. This means consulting not only the poor involved in fisheries, but also secondary stakeholders.

Within all the focus countries, DFID is adopting a rural livelihoods strategy for the sector, which creates a demand for more livelihood oriented research and for information on the role of fisheries in the livelihoods of poor people (see Country Strategy Papers). In the Mekong region there are changes that give greater emphasis to fishing communities and the poor, for example the policy shift in Cambodia towards community based fisheries, to support this research needs to be based on the links between fisheries and the livelihoods of poor people.

There is a demand from donors for better information on the livelihoods of the rural poor and on the needs of the poor as articulated by themselves. Increasingly there is quantitative information on the dimensions of poverty in the countries of geographic focus, and also qualitative information (e.g. in The World Bank's *Voices of the Poor*) as the poor themselves articulate the dimensions of their poverty and their particular livelihood needs (see Section 3 Scientific Background of Project Memorandum). However, the *Country Strategy Paper: Bangladesh 1998*, for example, notes that DFID will 'continue to give priority to the livelihoods of the rural poor, enhancing their access to technologies and land and water resources', but that a more detailed understanding of poverty and the needs of the poor is needed if more effective programmes are to be developed. Much work has been done on understanding the dimensions of poverty and the livelihoods of the poor in Bangladesh since the *Country Strategy Paper 1998* was written and GoB, DFID and its partners are pushing ahead with a number of initiatives in the inland fisheries sector. However, a better targeting of these initiatives on the needs of the poor who have fishing as a significant livelihood strategy would be assisted by outputs from the current project

The *Country Strategy paper: Cambodia 2000* notes that increased investment in the rural areas rather than in the capital Phnom Penh is needed, and that, in order for this to be effective in eliminating poverty, better understanding of rural livelihoods is a priority, while poverty elimination means working with poor people. It further notes that there is a lack of information on rural Cambodia and that DFID will have to conduct its own strategic studies to help shape thinking and project identification.

The *Annual Plan and Performance Review 2001 (of the Vietnam Country Strategy Paper 1998)*, notes that the latter has 'a greater understanding of the causes, characteristics and consequences of poverty by government and donors' as one of its objectives, and that such understanding would have a significant input into the implementation of the Government of Vietnam's and donors' developing poverty reduction strategy. As in Bangladesh, there has been much work over the past few years in collecting quantitative and qualitative information on poverty and the livelihoods of the poor, but there still remains the need to relate this more effectively to the resource base and the identification of key constraints and opportunities.

2.3 Earlier Work under the FMSP

A considerable amount of work has been done under the FMSP to develop new knowledge which is relevant to both inland and marine fisheries management systems in various parts of the world (see FMSP Indicative Logical Framework 2001-2005). However, a number of comments can be made in relation to the current project with regard to the programme so far.

2.3.1 Limited coverage

The completed projects commissioned under the earlier FMSP (and under other NRSP and bilateral programmes) which are based on the target countries are limited in number. There are far more for Bangladesh than for the target SE Asian countries. New knowledge developed through earlier research in other countries may of course be relevant to the current geographic focus, but will need to be adapted to take account of these countries' socio-economic, institutional and regulatory environments, the existing knowledge, livelihood strategies and capacities of local people, and regional and global factors that impinge upon their livelihoods.

2.3.2 Science rather than livelihoods focus

Many of the earlier FMSP projects model the management of aquatic resources from the perspective of system's managers – that is from the perspective of secondary stakeholders – those who are situated at the macro- and meso-level and are particularly concerned with the making of policy and the regulation of fishing effort in order to ensure sustainability of the resources while achieving optimum economic value from them. In order to do this, there has been considerable investment in research to better understand the dynamics of what are complex biophysical and multi-species systems, and on developing management information systems, protocols and support to fisheries extension agencies for governing the exploitation of these resources. There has been little work so far in relation to inland fisheries that directly addresses the livelihood needs of identified groups of poor fishers. (There is more in relation to aquaculture than capture fisheries, but it may be asked whether those who can afford to invest in aquaculture are amongst the poorest in their communities, or whether the latter more frequently exploit open water-bodies).

Thus the emphasis under the earlier FMSP has been on the impact of fishing effort and the management (or not) of this impact on fish stocks and on species diversity, rather than on

the place of aquatic resources in the livelihoods of population groups with 'different portfolios of livelihood strategies' (to use Ellis' phrase, 1998). Two recent projects in Bangladesh (R6756 and R7562) under the LWI production system of the NRSP took greater account of the differences in livelihoods of groups exploiting a range of natural resources on the Bangladesh floodplains (see Box 2.1). Taking a systems approach, both projects characterised different livelihood portfolios, the interdependencies between livelihoods, and present the prioritised problems which representatives of different groups face in their livelihoods. Generally systems approaches have considered impacts at the ecosystems and production system level, rather than the household level. Consideration of poverty elimination as well as sustainability forces us to consider this at the household and intra-household level. (The Sustainable Livelihoods Framework is the most obvious manifestation of this systems approach at the household level).

Box 2.1

R6756 'Investigation of livelihood strategies and resource use patterns in floodplain production systems based on rice and fish in Bangladesh. Phase II.' 01/11/1996 - 01/02/2000. Country: Bangladesh.

The interactions in floodplain production systems are both ecological and socio-economic and neither feature as priority considerations in the majority of interventions on the floodplains. In relation to research, the problem is one of a strongly commodity-focused national research programme driven by top-down concerns and technology. The NARS thus largely neglects low resource-level producers and their livelihood systems and has made little progress on elucidating the knowledge base for farmers' decision making. Government planning has demonstrated a similarly poor comprehension of subsistence livelihood systems and cross-sectoral issues, and the evidence for this comes from the implementation of flood control measures. These have met their principal aim of increasing food-grain self-sufficiency, but only at the expense of impeding fish migration and reducing fish production, thereby particularly affecting the landless. That such technological interventions have succeeded in intensifying agriculture and increasing food grain production is recognised, however the concern is that they have done so without due consideration of the impact on small farmers and landless floodplain dwellers, who have thus been disadvantaged. The project addressed the lack of a holistic understanding of production strategies on floodplains in Bangladesh, and highlighted the need for, and benefits of, understanding the bio-physical and socio-cultural framework of production constraints.

R7562 'Methods for consensus building for management of common property resources.' 15/02/2000 - 31/03/2001. Country: Bangladesh

Approaches to help those households who depend heavily on inland open water (CPR) fisheries have traditionally focussed on increasing the productivity of the fishery, ie: raising the stock of natural capital. Thus, the Department of Fisheries presently has a strong focus on the biology and ecology of commercially and artisanally exploited species, while their extension service has primarily focussed on technical interventions. Floodplain stocking has been one approach used, but research shows that this is likely to affect poor fishers negatively, and aggravate their lack of access to the fishery. Other approaches included declaring fish sanctuaries, operating closed seasons and gear restrictions, but where directly imposed from above these measures have been difficult to enforce, and had low compliance. Targeting fishery leases at fishers failed in the past, as fisher co-operatives are often funded by moneylenders and de facto leaseholders. By contrast, local conservation measures taken up by fisher communities and habitat improvement have succeeded in improving productivity in a few pilot locations, but have not been possible in other locations, where there have been social tensions. Sustainable livelihoods analysis has shown that traditional fishers view poor access to the fishery as their key constraint, with trends in declining stocks as the next most important constraint. Sustainable change in management of open water CPR fisheries is therefore dependent upon building social capital to create greater cohesiveness, trust and common purpose between stakeholders, that is to bring about change in the local transforming processes (local rules/institutions) that influence access to the CPR, and to achieve sustainable fisheries. This project developed a method for participatory action plan development which identifies and builds on problems and solutions common to different stakeholders.

(From NARSIS database).

However, even these two projects, while they took a livelihoods approach and point the way forward for dealing with constraints to the livelihoods of the poor, only tangentially dealt with explicit problems raised by them. Indeed the Participatory Action Plan Development method developed and tested under R7562 takes a step back to consider what resource-use conflicts there might be between groups with different livelihood portfolios and to develop inclusive procedures for managing such conflicts at the community level. Since the research was generated by donor concern for the development of community-based natural resources

management and the global trend towards devolved governance, project outcomes can be seen as driven as much by the discourse on sustainability noted above, as by one on needs-based poverty elimination.

Two other recent projects, one under the LWI programme and the other under the FMSP sought (a) to develop a framework for evaluating the impacts on livelihoods of strategic policy measures concerning natural resources, and (b) develop a multivariate analysis tool to assist in the development of strategies for the management of capture fisheries important to poor people (see Box 2.2). Both these projects included Bangladesh as a country of geographic focus for the research, and were explicit in their use of a pro-poor and livelihoods approaches in guiding their analyses and development of methodologies. However, they have limited scope themselves to undertake a detailed characterisation of the different livelihoods and the vulnerability contexts for the poor in the countries under study. Both were also primarily concerned with developing models for assisting fisheries management agencies with benefits accruing to the poor as a consequence of pro-poor management actions by these agencies rather than targeting the poor directly

Box 2.2

R7868 Maximisation of joint benefits from multiple resource use in Bangladeshi floodplains: 15/11/2000 - 15/11/2001 Countries: Bangladesh

Traditional development planning, relating to Bangladeshi floodplain land use, has promoted agricultural production at the expense of floodplain fisheries. This strategy, manifest in the continued efforts to erect flood control structures to enable better crop production, has endangered the livelihoods of large numbers of poor households that depend on floodplain fisheries for income and nutrition. Doubtless, this strategy has led to the realisation of the agricultural self-sufficiency goal, inherent in the traditional planning approach. However, an estimated 73% of (predominantly poor) rural households in Bangladesh are at least partially dependent on fish capture from river floodplains and beels for their livelihoods and nutrition. The erosion of the floodplain as a fishing resource thus cuts away at their safety-net. The hydrological planning failure is one example of how narrowly focussed development activity can exacerbate the living conditions of poor households. This also extends to other developmental activities in floodplains. For instance, stocking floodplain waterbodies with a commercially attractive species of fish, often leads to decline in stocks of indigenous species that are typically harvested by poorer households.

Political, legal and socio-economic institutions in rural Bangladesh are often geared towards assisting households at the wealthier end of the spectrum, resulting in a continuous marginalisation of poorer households over time. This becomes especially critical where there is a direct conflict of interest between wealthier and poorer households on a floodplain. For instance, wealthier households may favour drainage of beel water to provide irrigation for crops, which affects the fish stock upon which poorer households are dependent. The study has modelled the potential gains from reducing irrigation abstraction to protect dry season water for overwintering fish, supported by crop diversification to maximise economic returns from water. The findings indicate that current project strategies of helping communities set aside fish sanctuaries are appropriate, and that in the order of 30% of normal dry season water areas should be maintained as fish sanctuaries and not drained out for agriculture.

R7834 Interdisciplinary multivariate analysis (IMA) for adaptive co-management 01/10/2000 - 30/09/2001. Countries: multiple including Bangladesh

Until recently, artisanal fisheries management has tended to focus upon maximising resource output using a suite of technical operational rules or regulations selected on the basis of deterministic (single-species) biological model-based predictions, set and enforced by a centralised (government) administrative authority. By largely ignoring important (dynamic) elements of livelihood assets, strategies, transforming structures, processes, the external environment, and other factors that affect livelihood outcomes, this paradigm has often failed to co-ordinate and restrain resource users, leading to depleted resources, inequity and conflict. This paradigm failure is particularly prevalent in the developing world; commonly exacerbated by the state's paucity of resources and institutional capacity to conduct (and interpret) formal assessments, and monitor and enforce rules and regulations among the widely dispersed resource users. Moreover, the technical management models employed to guide decision-making processes are usually inadequate to capture the dynamic complexity of the fisheries. Adaptive co-management is increasingly being seen as an effective strategy to redress these paradigm failures and thereby facilitate improved sustainable livelihoods.

ICLARM's institutional analysis research framework, which provides a useful model for studying fisheries-related livelihoods, was used and statistical analysis compared the outcomes of different co-management interventions and arrangements against a wide range of possible contributing factors.

From NARSIS database).

Despite earlier 'commodity-based' research of the FMSP not being placed in the context of poor people's livelihoods, it nevertheless remains of great value for the strategic management of natural resources. However, it needs to be understood within the context of a dominant discourse on natural resource conservation. Since the 1980's and especially since the 1992 Earth Summit in Rio, government agencies have primarily focused on environmental conservation and sustainable natural resource use due to worries about their depletion through over-exploitation. This focus on the environment has predominated despite the fact that the Agenda 21 section of the UNCED document stated that sustainable livelihoods could serve as an integrating factor that allows policies to address development, sustainable resource management and poverty eradication simultaneously. The concern with sustainability is laudable, but until recently this has meant that initiatives targeting the poorest Less Developed Countries (LDCs) have been overshadowed by initiatives to protect the environment. Only since the World Summit for Social Development at Copenhagen (1995), has there been a global consensus on the need to address poverty, and an acceptance that the depletion of natural resources can also be due to poverty and the lack of alternatives for poor people as well as to failures in the governance of natural resource use.

There is thus a need to understand the nature of poverty in the target geographical countries, and the socio-economic systems in which natural resource use is set. This requires the generation of new knowledge on where and to what extent people are dependant upon natural resources such as fisheries, their economic status, the important factors which impact upon their livelihoods, their vulnerability in relation to loss or mismanagement of these resources, and also information about their needs and goals as expressed by themselves (see in this respect un Nabi et al 1999, Narayan et al 2000).

2.3.3 Social complexity in fisheries

Projects under the earlier FMSP have paid insufficient attention to the complexity of the social – to the socio-economic characteristics of the human populations exploiting aquatic resources, and in particular to the different needs, perspectives and objectives of different population groups (as defined by age, gender, and socio-economic status) upon whom policy for the governance of resource exploitation impacts differentially. Historically, formal economic definitions of absolute poverty have led to whole populations being classified as poor or vulnerable, with development policy and interventions treating them as a homogeneous target group. Supply-side development policy and practice in particular have frequently assumed that all NR users in a country or region are basically alike and that one policy instrument/ technology will fit all. But as Chambers has pointed out (e.g. 1983, 1995, this can lead to biases in the development of policy instruments/ technology which, while they may suite the better-off, may be inappropriate to the needs of the resource-poor. Consequently, until quite recently, there has been a tendency to design and evaluate development interventions on the basis of net returns, many of which have been preferentially captured by, or accrued to, the wealthier members of communities. Only recently with the wide acceptance of the international development target on the eradication of poverty set forth in the 1995 Copenhagen Declaration, has there has been a shift in focus by governments to interventions that target the poorest. This has inherently led to the need for a socially differentiated approach - that is the disaggregation of populations according to a variety of indicators such as gender, economic status, food insecurity, etc., so that those who are deficient in respect of any may be identified and targeted.¹

¹ Defining and measuring poverty is difficult, and there is continuing debate about its meaning and measurement (see Ravallion 1992, UNDP 1997, Maxwell 1999). Historically definitions, measurements and policy recommendations which flow from them have focused on economic well-being. Increasingly composite measures have been constructed (e.g. the World Bank's Priority Poverty Indicators (PPI) and UNDP's Human Poverty Index (HPI)) by reason that 'poverty is too complex to be reduced to a single dimension' (UNDP 1997).

Current development initiatives accept that, while whole populations may be classified as poor according to formal income-based measures, there can nevertheless be large differences within populations when measured on relative as opposed to absolute scales. The one-dimensional measure of poverty which characterises people as poor according to a fixed point on an income scale (the poverty line), has largely been supplemented by country-specific poverty lines, and by criteria which identify 'quality of life', 'well-being', 'vulnerability' and/or 'social exclusion' according to a bundle of characteristics of both a formal and more informal/local nature (see de Haan 1999, Maxwell 1999, Ravallion 1992), and has led to a concern with livelihood security.

The design of interventions appropriate to their social context and client need is considerably helped by understanding the local character and determinants of poverty, well-being and vulnerability within populations and between social groups, and is a prime reason for the disaggregation of a population for data collection purposes. On the basis of the proposed research under the current project, technical outputs (including both policy instruments and extension packages) under the earlier and the current FMSP should make a better contribution to DFID's primary goal of poverty elimination.

2.3.4 Beneficiary targeting and poverty levels

Since earlier FMSP projects have paid insufficient attention to the complexity of the social, there has been insufficient understanding as to who the ultimate beneficiaries (primary stakeholders) of pro-poor research should be, and where they are to be found. While indices are a matter of debate, most analysts agree on common broad characteristics of the poor.

Regional and country analyses suggest that 39% of all people living on less than \$1 per day are in South Asia (DFID 1997). In 1999 36% of Cambodia's population of 11.8m, 37% of Vietnam's 77.5m, and 46% of Laos' 5.1m were below national poverty lines (World Bank 2000; DFID 2000). While Human Development Indicators (HDIs) are mixed for the individual countries, and while the proportion of national populations in poverty may be dropping, high annual average population growth rates mean that actual numbers of those who are poor are increasing. In Bangladesh, even though on some measures there has been a reduction in poverty over the past 20 years (see Greeley 2000)², on other measures around 50% of Bangladesh's 125 million people are poor (measured by calorific intake or cost of basic needs approaches), with over half of these in extreme poverty, while 95% of female-headed households are poor (Rahman and Hossain 1995; DFID 1998b). In Vietnam, World Bank figures suggest the number below the poverty line has dropped from 58% in 1992 to 37% in 1997, while the number below a 'food poverty line' (which is lower) has also declined from 25% to 15% (World Bank 2000). In Cambodia, while the rate of poverty has remained constant at 36%, indications are that access to land and common property resources are diminishing and that landlessness and indebtedness are rising (DFID 2001).

In all four countries the incidence of poverty and its rate of reduction varies considerably across regions within countries, while both quantitative and qualitative data indicate that the poverty status of households fluctuates over time due to their vulnerability to household-specific and community-wide shocks and crises and dependence on income sources which are highly variable (see for example Rahman and Hossain 1995; World Bank 1999).

The greater proportion of poor people are rural dwellers. In world terms, close to 1 billion people live in poverty in rural areas and, while urban poverty is a growing phenomenon, the

² Greeley (2000) suggests that over the past 20 years the proportion of households below the poverty line has fallen from 80% to 37% in 1996. However, the World Bank is not so sanguine about this progress continuing, noting that 'Bangladesh is trapped in a low growth cycle' and current trends hold out little hope of a brighter future.'

rural poor still account for over 80% of the total number of poor (see Jazairy *et al* 1995). In Bangladesh over 75% of the population live in the rural areas, with 90% those classified as poor living there. In Vietnam poverty remains largely a rural phenomenon, with 45% of the rural population of 70% of the total population below the poverty line. In Cambodia 84% of the population is rural, and in Laos 77%. In all four countries the rural poor are predominantly farmers and fishers, though as previously noted the poorest may in fact have limited access to natural resources. For those with access to natural resources, the risk of failure associated with on-farm investment can deter households from expanding their economic base.

The greater proportion of the poor are women. As Mikkelsen notes (1995: 152), historically 'indicative strategies on poverty have not been gender disaggregated and women's heavier exposure to poverty has been disguised'. Yet poverty studies which apply gender disaggregated analysis (as in intra-household studies) demonstrate that women more than men are subject to relative as well as absolute poverty (see e.g. Wignaraja 1990; Moser 1989; 1993). Rural women in developing countries are among the poorest and most vulnerable people in the world and the incidence of their poverty is increasing (Jazairy *et al* 1995). In Bangladesh alone there are over 45 million - almost doubling from 24 million in 1965. In all four countries, households which are female-headed are generally poorer than others.

2.4 Sustainable Livelihoods and the Role of the Study

These figures alone suggest that if interventions are to have any significant effect in reducing global poverty by the target date of 2015, then the above three factors must be prioritised in any research seeking an input to such interventions. Further, the 1997 UK Government White Paper on International Development commits DFID to promoting sustainable livelihoods and to protecting and improving the management of the natural and physical environment. Mechanisms for doing so are contained in the different DFID programmes, and through the common adoption of a sustainable livelihoods approach (see Carney 1998). Drawing on a number of influences (e.g. Cernea 1985, 1992), this approach takes peoples' own interpretations of and priorities for their livelihoods as its starting point, while the mapping of the different capital assets on which people draw to build their livelihoods, and investigation of how transforming structures, institutions and processes influence how endowments are (or are not) turned into entitlements (see Leach, Mearns and Scoones 1997), forces researchers 'to think holistically rather than sectorally about the basis of livelihoods' (Carney 1998:7). From this livelihoods analysis, it has been suggested that DFID can make a particularly positive contribution to improving livelihood outcomes for poor people by (a) contributing to the robustness of and increasing the opportunities available to individuals/ groups/ communities by building up their asset base; and by (b) helping ensure that the structures, institutions and processes which define people's options are working in favour of the poor (Carney 1998:12).

Sustainable rural livelihoods: What contribution can we make? (Carney 1998) includes chapters (including one on aquatic resources) which sketch out in a general way the role that different natural resources play in the livelihoods of different groups of poor, and the kinds of structures, institutions and processes which impact on their access to and exploitation of these resources. The implicit question here, and as contained in the revised FMSP, is what contribution can the programme make to improving livelihood outcomes for poor people dependent upon inland capture/ enhancement fisheries in the target countries. To answer this, as the current call identifies, it is necessary to develop a better understanding of livelihoods associated with inland fisheries resources in these countries, and identify the key constraints to improved livelihoods development, and the most critical researchable problems. Our initial review indicates that there is already a substantial literature in some

countries on poverty, and data exist with greater or lesser degrees of detail and reliability on fisheries resources. What is missing is an analysis that combines understanding of poor people, their livelihoods and their dependence on fisheries resources, while secondary data that meets this need may be limited. Some recent projects will be seen to be addressing this issue, and in others (such as DFID fisheries projects in Bangladesh) rapid livelihoods assessments have been made. However, these have focused more on aquaculture to date.

To fill these needs, this project will build upon work already done on understanding livelihoods and undertaking poverty analysis in the countries of geographic focus in order to draw out the main characteristics of livelihoods dependent upon inland capture and enhancement fisheries. Work already done includes both qualitative and quantitative approaches. In Bangladesh there is quantitative work by Bangladesh Institute for Development Studies (BIDS), e.g. Rahman and Hossain (1995) *Rethinking rural poverty: Bangladesh as a case study* and qualitative work by un Nabi et al. (1999) *Consultation with the poor: PPA in Bangladesh*.

In Vietnam there is quantitative work in the World Bank's Vietnam Living Standards Survey (1998), qualitative work in The World Bank's *Vietnam; Voices of the Poor*, and further data in *Vietnam. Attacking Poverty* (2000), by the World Bank. The *Attacking Poverty* report is the foundation for the analysis of poverty and its reproduction in Vietnam and for tackling it by creating opportunity, reducing vulnerability and ensuring equity. Additionally the report translates the perspectives of the poor on the structures, institutions and processes which impact on their livelihoods into a set of challenges which face the government.

2.5 The Nature of Poverty in Bangladesh

This section summarises in greater detail a profile of poverty in Bangladesh as the better studied of the four target countries. Bangladesh has an area of 143,000 km², of which about 15% is covered by permanent water bodies. The country is predominantly a flat floodplain/delta laid down by the three major rivers: the Ganges-Padma, Brahmaputra-Jamuna and the Meghna. This nearly flat topography is highly prone to drainage and flood problems with a third inundated during the annual monsoon period, and up to 60% flooded in unusual years depending on the distribution of rainfall and the coincidence and magnitude of river peaks and coastal tides.

Population in 2001 was estimated at 131 million, with an annual growth rate of around 2.17%. Bangladesh is one of the world's poorest countries with a GNP per capita in 1999 of \$370. Over 50% of the population is classified as poor (with 90% of them living in rural areas), while 36% of all Bangladeshis are extreme poor (including 40% of the rural population). Another 23% are classed as "tomorrow's poor". Over half of rural households and a greater proportion of female-headed households are functionally landless (owning less than 0.2 ha of land for cultivation), with 11% not even owning sufficient land for a homestead. Over 15% of rural households are headed by women. Bangladesh is in 144th place on the UNDP's Human Development Index (HDI) ranking, while its HDI has lagged behind GDP growth indicating that growth has not commensurately benefited the poorest sections of the population.³

Over 75% of the population, the greater proportion of whom are classified as poor, live in the rural areas, while the agricultural sector is the main source of employment. Agro-processing provides the core of industrial activity (jute, sugar, cotton, hides, tea and fish products), while

³ Fuller details are to be found in NRAC '97. For a more upbeat analysis concerning the overall poverty trend see Greeley (2000) who says 'Bangladesh has made outstanding progress in reducing poverty. In twenty years, the proportion of rural households below the poverty line has fallen from over 80% to 37% in 1996.'

other parts of industry supply agricultural inputs. Raw and processed agricultural products continue to generate the bulk of Bangladesh's foreign exchange earnings. In 1993/94, jute and jute products accounted for 12% of exports. Fishing contributes about 3% of GDP and is predominantly artisanal, although there is an industrial processing sector geared to export. It is estimated that 73% of the population engage in part-time fishing, while more than 8% depend upon it as their principal livelihood. More than 1 million ha of perennial inland waterbodies and over 3 million ha of floodplains provide an extensive area suitable for inland fisheries. Real annual growth in the fisheries sector has been rising steadily since the late 1980s registering 8.7% in 1993/94. However, the National Environmental Management Action Plan (1995) estimates that flood control has reduced floodplain fisheries by about 70%. A focus on aquaculture and culture fisheries projects aims to offset some of this loss, but it is probable that this will benefit wealthier farmers who can afford the capital investment, rather than poorer fishers who cannot.

Bangladesh faces serious problems of natural resources management (NRM). There is relentless pressure on land from a population growing at 2.17% per annum. Land available for agriculture is close to its natural limits, and increased agricultural output will have to come from intensification in the future. Population pressure is very high in all areas. Current population density (average $800/\text{km}^2$, cultivated area $1150/\text{km}^2$) is the highest in the world among countries of significant area, with the poor forced to become landless or to colonise very marginal areas including the transient islands (*chars*) which appear in rivers and river deltas and low-lying swamp areas. However these areas are particularly prone to the effects of the frequent climatic shocks (floods, drought and cyclones). Meanwhile land subdivision due to inheritance laws and crisis sales results in increasing landlessness. Critically Bangladeshi's resource use patterns are adapted to the temporally and spatially dynamic interface between terrestrial and aquatic natural resources. In consequence they are extremely vulnerable to seasonality and natural shocks and trends, and have to build 'portfolios' of livelihood strategies to cope. Unable to be self-sufficient in food, the livelihoods of marginal rural families depend increasingly on a mixed 'portfolio' of share-cropping, agricultural wage labour, fishing, non-agricultural labouring, migration to work elsewhere, and remittances from relatives abroad. The role of CPRs, and particularly open-access fisheries, feature prominently as expenditure-saving and survival strategies in the livelihood portfolios of the poor. Meanwhile, in keeping with the drive to improve the sustainability of the inland fisheries, government and donors are working to devolve their management from government organisations to resource users at the local level, a strategy identified as potentially having an impact upon rural poverty since it can enable the full utilisation of local technical and managerial knowledge. However, there have been questions as to how this local management is to be achieved.

Bangladesh's ever increasing population demands creative efforts to find new ways of producing more food from the country's finite resources. However the potential of Bangladesh's vast inland water resources for helping to meet these needs is threatened. DFID has a distinct aquatic sector strategy with a number of sizeable projects operational. Major projects include the Community Based Fisheries Management Project Phase 2 (CBFM-2) and the Fourth Fisheries Project (see list of significant projects later). DFID's fisheries sector programme is targeted towards landless, marginal and small-scale male and female producers who live in rural areas.

2.6 The Importance of Inland Fisheries in Bangladesh and SE Asia in People's Livelihoods

In this section we review briefly some of the issues and trends in livelihoods dependent on fisheries in these countries, but as this was part of the aims of the project more details are to be found in Chapter 5 and in the series of country reports and synthesis report.

While the role of the agricultural sector (inclusive of fishing) has declined in recent years in all four countries (to 20% and 27% of GDP in 1998 in Bangladesh and Vietnam, 42% in Cambodia, and 50% in Laos), agriculture and fishing are still very important in the livelihoods of rural people (who constitute 50% of the population in Bangladesh, 84% in Cambodia, 77% in Vietnam and Laos). Inland capture and enhancement fisheries are of considerable importance to the economies and rural livelihoods of the target regions not only in providing food (and in particular in providing animal protein (as already mentioned) to supplement the dominance of carbohydrate from rice in the diet.), but also in providing employment and income-generating opportunities. As the World Bank notes (2001), food insecurity means not just having insufficient access to food (either produced by the household or through having income to buy it), but also having insufficient to avoid malnutrition due to protein and micro-nutrient deficiency. Household food security is the prime concern of poor households. It determines production and investment choices.

2.6.1 Bangladesh

Property rights and access to aquatic resources are complicated. Inland open-waters are divided into over 12,000 *jalmahals* in which fishing is leased out by the government. Leases often go to locally powerful elites or moneylenders. In the last 15 years there have been experiments in licensing fishing rights by the Department of Fisheries, in open access in rivers, in floodplain stocking, and in community based fisheries management. The Third Fisheries Project focused on stock enhancement in large floodplains. The Fourth Fisheries Project currently has an enhancement orientation, but also seeks to improve on equity and institutional arrangements. The situation is complex, but in reality elites still 'own' most fishing rights and profit by collecting tolls from or employing professional fishers. However, when monsoon inundation joins waterbodies together they become *de facto* open to local villagers to fish and are then common property.

2.6.2 Cambodia and Lao PDR

The importance of fisheries in livelihoods has also been underestimated here. In Cambodia the Department of Fisheries reported an inland fish catch in 1995 of 72,500 t, but recent estimates indicate annual catches of about 400,000 t (Diep et al. 1998). Some 2.3 million people are estimated to live in fishing communes and fish dominates animal protein consumption - up to 75 kg/person/year (Ahmed et al 1998). Recent policy changes have reserved some fisheries for community management and there is scope to learn from Bangladesh. In Lao PDR the capture fisheries fall into two main categories – small reservoirs and riverine and floodplain fisheries. The latter are comparable to the other countries, for example in Khong District along the Mekong 94% of households fish with an average consumption of 43 kg/person/year (Baird 1999). There have been important experiments in community management and fish conservation that may provide lessons for the other countries.

2.6.3 Vietnam

In Vietnam the highest population densities are in the Red River and Mekong Deltas and the fisheries sector employed about 9% of the labour force in 1995 (IFEP undated). Inland fisheries comprise some 230 natural lakes, 2,470 reservoirs and 548,000 ha of floodplains. There is evidence of declining catches, but subsistence catches are not counted and inland fisheries only merited a few paragraphs in the master plan for fisheries to 2010.

CHAPTER 3

Project Purpose

The new FMSP strategy aims to improve livelihood outcomes for poor people dependant upon fisheries resources. To achieve this, the strategy must clearly identify the needs of target beneficiaries.

Information on fisheries resources in Bangladesh and S.E. Asia is fragmented and has not taken account of poor people and their livelihoods. Research has been supply-led, resulting in limited uptake and gains for the non-poor. Often decisions are based on national level priorities overlooking the needs of local people, especially the poor, and thus posing a severe threat to local livelihood assets including fisheries.

The project's purpose was to characterise the poor, identify their dependence upon aquatic resources, the nature and status of those resources, and their vulnerabilities in relation to loss or mismanagement. Poor people, other aquatic resource users, and representatives of concerned organisations prioritised constraints and identified possible research priorities. Inland fishery environments were classified and some critical areas and researchable problems were identified. The number of poor people who could benefit from potential development and research initiatives were identified.

CHAPTER 4

Research Activities

4.1 Review of Literature on Fisheries and Livelihoods

A literature review of previous rapid livelihoods assessments and Participatory Rural Appraisals (PRAs) capturing ‘voices of the poor’ was done prior to the first planning workshop of the project in April 2002. Also the national partners collated available information for characterising the main inland aquatic environments in their respective countries. The main points from this have already been presented in Chapter 2 (Background), while the outcomes from the country reviews are summarized and compared in Chapter 5. The remainder of this chapter discusses the methods adopted in this study.

4.2 Planning Workshop

An initial planning meeting was arranged with all the partners to agree on a common framework of activities. The planning workshop agreed on roles and responsibilities, methods, sources of metadata, modalities for delivering outputs, a characterisation of freshwater fisheries. It identified representative environments and sites for PRA sites, finalised the PRA guidelines and country profile framework; and provided orientation to the partners on stakeholder analysis methodology, on the Sustainable Livelihoods framework and PRA methods.

4.2.1 *Process of stakeholder analysis*

Once field sites have been chosen for participatory rural appraisal (PRA) exercises, and any permissions to work there have been secured, researchers must decide whom in the community they are going to obtain information from.

In identifying primary stakeholder groups the key question is “Who has a stake – an interest – in the fisheries?” For categorization it is important to understand the issues that distinguish their involvement, role, dependence and relations with the fishery.

How was this categorisation done? Tentative definitions of different stakeholders were agreed in the workshop as follows.

- 1 **Primary stakeholders** – those who have full or partial dependence on the resource for their livelihood – e.g. fishers.
- 2 **Secondary stakeholders** – those who have influence over / an interest in the resource but do not directly depend on using it for a living – e.g. fisheries department.

Identification of categories can come from community itself or from outsiders/experts. Community stakeholder analysis results in many categories that are unique to each location, but when aggregated up into broader categories these usually show similarities/common features. Outsider categorization can ensure comparability.

For this project we needed to ensure broad categories for which secondary data would be available at national level, and that would allow comparison between countries, between regions within countries, and between fishery/wetland types within each country. Hence outsider categorization was necessary, although the participants in the PRAs also discussed how they characterised and classified themselves and other resource users. Hence this

approach still permits use of participant stakeholder analysis in PRAs, but in the workshop the partners undertook a stakeholder categorization/analysis to build in as part of the framework used in the research. An example considered in helping the partners from Bangladesh fisheries is shown in Table 4.1.

Table 4.1 Stakeholder Analysis from Bangladesh Community Based Fisheries Management Project.

Stakeholder	Involvement in project	Interests	Impact
Primary stakeholders – Communities			
Fishers (significant income source) (hindu and muslim)	Main participants	Long term fishing rights Sustainable catches Increased income Increased role in decision making	+ + + +
Spouses of fishers	May be secondary participants	Increased status and role in decision making Alternative income generating activities if excluded from the fishery in some seasons	+ +
Children of fishers	May be secondary participant or primary participants through the Ministry of Youth and Sport	Increased role in community decision making Alternative income generating activities if excluded from the fishery in the long term	+ +
Fisher leaders/middlemen	Secondary or main participants, aim is to limit their control	Controlling fisheries Maintain/increase share of fishery income Long term fishing rights Sustainable catches	- - +/- +
Landless (<0.2 ha)	Secondary or main participants	Access to fisheries More fish for food Additional income from fish and fish processing	+/- + +
Landowners (>.2 ha)	Consulted/represented, may be secondary participants	Access to fisheries More fish for food Increased supply fish in market	- + +
Richer/influential non-fishers (traders, moneylenders...)	Secondary participants, compromise agreements	Increase share of returns from fishery Power and prestige in community	- -
Secondary Stakeholders – Involved organisations and staff			
NGOs	Main implementors of CBFM activities	Expanding activities Increase incomes of fisher participants	+ +
DOF	Main implementors of CBFM activities	Increased role in fishery management Higher fish production	+ +
MOFL	Oversee project and policy	Influence policy Funds disbursed	+ +
MOL	Project partner also control fisheries	Maintain real revenue	=
ICLARM	Overall research responsibility (with other partners)	High quality research Influence on policy	+ +
Union Parishads	Influence over and represent local communities	Influence/role in resource management	+/-
Local administration (thana and district)	Administer fisheries	Control fisheries Mediate in disputes	+/- +/-
DFID	Donor - improving fishery management	Poverty reduction Improved food security Improved fisheries policies Disburse funds	+ + + +
External Stakeholders			
Fourth Fisheries Project	Lesson learning, sharing experience Joint influence on policy formulation	Effective institutional arrangements for local fishery management Information exchange Complementary ways and alliances to influence other stakeholders	+ + +
Other projects	Lesson learning, sharing experience	Information exchange Complementary influence on fishery management	+ +
Ministry of Youth and Sport	Lesson learning	Responsible for administration of waterbodies under 8 ha	+
Other donors	Lesson learning, sharing experience between projects	Disburse funds Informing and influencing policy	+/- +
Other NGOs	Lesson learning, sharing experience	Information exchange, promote new resource management methods	+

It was agreed in the workshop that the focus should be on household categorisation (fisher/farmer/landless/etc) and not on individuals (men/women/children), since the household is considered to be the main economic unit with a shared livelihood strategy and shared level of poverty, although this is not to ignore differences by gender and age. So the need was to for each primary stakeholder category to be able to summarise their livelihood asset structure, fishery dependence, vulnerabilities, role in transforming processes, etc.

4.2.2 Stakeholders Categorization

It was clear that each country had a different mix of stakeholders involved in the inland fisheries sector. It was therefore proposed that each partner should form their own stakeholder groups according to the general criteria of the PRA guideline together with locally-significant criteria. Additionally it was hoped that as far as possible stakeholder groups formed at research site locations could be linked to each country's national poverty indices. However, the primary criteria developed during the planning workshop are shown in Table 4.2.

Table 4.2 Primary criteria for categorising livelihoods dependent on inland fisheries

Categories	Characteristics
Bangladesh	
Fishers	Full time fishing and fishing related activities; fully dependent on income from fishing
Part-time fishers	Fishing for income seasonably or part-time
Subsistence fishers	Fishing for food
Fishing gear makers	Usually part-time; women and family members do this as supplementary income
Lease holders/ditch owner	High financial capital; influential; high management skill
Fish processor (mostly women)	Involved in fish processing seasonally; most of the family income comes from fish processing
Fish traders	Fully dependent on fish trading; borrow money to invest money in fish trading
Fishery workers	Wage earners assisting in landing, packing, transferring; poor and unskilled
Cambodia	
Full time Fishers	Depend on fisheries resources, fishing is their main occupation for their livelihoods and they fish almost every day all year round
Part time fishers	Depend on fisheries resource as well other income sources, but fishing is their part time job or secondary occupation. Part time fisher includes seasonal fishing (by time by fishing gear), subsistence fishing for household consumption, and those who do fishing when they have spare time from their first occupation
Fish traders	Those who sell fish either inside or outside the village. They buy fish from fishers and sell in the market. They earn income from this activity and consider it as their first occupation for livelihood.
Fish processors	Those who earn income from fish processing and consider it as their first occupation for livelihood.
Lao PDR	
Full time fishers	There are very few full time fishers. Full time fishing does not provide enough income for any stakeholder group. Those who fish during the peak fishing period are defined as full time fishers. These people are poor and they live on other means of income at other times.
Part time Fishers	Fish during their leisure for food and for income. They are mostly farmers and fish when they have time.
Labourer	Seasonal work; usually landless; may be paid with food (or low amount of money); low education level.
Middleman	Buys fish from village; may supply gear to the fishers; lend money to the fishers.
Vietnam	
Landless	No land; fishing for income (part-time)
Fulltime fishing – Delta	No land; fishing for income (full time); seasonal variation of fishing locations
Fulltime fishing – Highlands	No land; fishing for income (full time); fixed fishing locations
Part-time fishers	With land; large family size; fishing for income and others (part-time)
Fish trader	Involved in fish trading

Based on the initial stakeholder analysis in the planning workshop, the PRAs actually conducted resulted in a set of assessments of livelihood strategies and assets for actual stakeholder types found in the study sites. Over all the sites in each country the categories shown in Table 4.3 were found. Note that there was a greater diversity and sub-division of interests in the fishery in Bangladesh, with its very high population pressure, compared with the other countries. Also the definitions of full time, part time and subsistence fisher vary between countries, with few people in Lao PDR and Vietnam fully dependent on fishing for an income.

Table 4.3 Summary of the primary stakeholder groups across the countries.

Bangladesh	Cambodia	Lao PDR	Vietnam
Full Time fisher	Full Time fisher		Full Time fisher
Part Time fisher	Part Time fisher	Full Time fisher	Part Time fisher
Subsistence/Landless		Part Time fisher	Landless
Fish Traders	Fish Traders	Fish Traders	Fish Traders
Fish Processor	Fish Processor		
Ditch Owner			
Lease holder			
Poor women/ gear making			
Fishery worker			
Fry collectors			

4.2.3 Characterisation of Inland Fisheries

The country partners characterised their country's inland fisheries in terms of the different ecosystems that they believed pertained. Another exercise was undertaken to determine the number of sites, how representative these sites were, the likely number of stakeholder groups there might be for the PRA exercises and the number of persons in each group. Table 4.4 shows the range of environments covered by PRAs in each country, again the Bangladesh partner and WorldFish Center have done PRAs in a greater diversity of environments in Bangladesh, such as oxbow lake, estuary, mangrove forest (Sundarbans) and enhanced lake/floodplain fishery.

Table 4.4 Main inland fishery environments identified in the four countries.

Bangladesh	Cambodia	Lao PDR	Vietnam
Rivers	Main river	Main stream	Main stream
	Downstream river		
		Tributaries	Canal
Floodplain - Stocked (enhanced Beels)			
Floodplain - Deep flooded (Haor)	Great Lake	Back-swamp	Swamp forest
Floodplain - Seasonal		Floodplain/ Rice fields	Rice fields
Oxbow lake			
Reservoir			
Estuary			
Mangrove forests			

Note: beel is a floodplain depression; haor is a large depression that forms an inland sea; the great lake is Tonle Sap Lake and includes a vast area of permanent water, seasonally flooded forest, and seasonal floodplains; back-swamps combine seasonal floodplain with swamp forest

In the analysis workshop in November 2002 the partners jointly reviewed the actual PRAs undertaken and the common environments and stakeholder categories found during fieldwork, and the extent to which they were similar between countries. It was concluded that the common environments found in all four countries were those shown in Table 4.5, while the common stakeholder categories could be summarised as households who fish for an income (whether part time or full time), households fishing primarily for food, and fish traders. These stakeholder types can be found in each of the environments. However, it was

found that the PRAs in Cambodia and Lao PDR did not cover seasonal rice-field fisheries, and only in Bangladesh was a PRA undertaken in the reservoir environment (sole reservoir in the country). It was agreed that for the purpose of country summary reports information on livelihood strategies of these stakeholder categories would be summarised where available from secondary sources for these environments not covered in the PRAs. Nevertheless the PRAs in each country did cover at least a representative site from most of the main components of their inland fisheries.

Table 4.5 Common environments where livelihoods of those fishing for income, fishing for food and fish traders were assessed in all four countries.

Bangladesh	Cambodia	Lao PDR	Vietnam
Rivers	Main river	Main stream	Main stream
FP-Deep flooded Haor	G. Lake	Back-swamp	Swamp forest
FP -Seasonal	Rice fields** - seasonal	Rice fields** - seasonal	Rice fields
Reservoir	Reservoir**	Reservoir**	Reservoir**

** Information from Secondary sources

4.3 Secondary Data Analysis

In each country, a major part of the research activities was to review information collected from secondary sources, previous studies, government documents and other secondary sources. Literature review of previous rapid livelihoods assessments and PRAs capturing 'voices of the poor' were part of the review done by the national partners in order to compile information that included:

- The main categories of poor, their numbers, geographical locations.
- Data on inland fisheries and aquatic resources status, trends and threats, which were compiled into resource inventories.
- Where possible from past studies the role of inland aquatic resources in the livelihoods of rural people and their dependence was summarised by poverty levels.
- Assets and access to capital of rural people were summarised and disaggregated as far as possible.
- Institutional and legal profiles of fisheries and wetland status and access regimes were compiled.
- Gaps in information were identified.

Country status reports were prepared on the basis of all such collected information. The availability of information varied greatly. For Bangladesh a large and dispersed literature is available combining official sources and a range of specific studies and project reports. For the other countries data is much more limited and the range of studies is similarly limited, with most of those located produced in recent years. Overall the review of secondary information was less comprehensive than expected due to non-existence of information in some of the countries, and also due to the limited number of past studies which investigated in any detail poverty related to inland fisheries and aquatic resource use.

4.4 Participatory Rural Appraisal (PRA)

The PRAs were done in order to:

1. fill in gaps in national data and to focus on primary stakeholders and understand their livelihood strategies.

2. to obtain the opinions of primary stakeholders on problems and threats facing their livelihoods.

They were complemented with key informant discussions and secondary sources (reports) from secondary stakeholders.

For the PRA study, households having different primary socio-economic activities were selected deliberately and separate focus groups were held with representatives from each relevant stakeholder category. The households' incomes and livelihoods strategies based on water resources were the main criteria for selection of participants. Steps for PRA included:

- reconnaissance survey,
- secondary information from local authority, and
- PRA following a prepared checklist and set of tools.

The team for each PRA comprised of more than one facilitator. Facilitators used primarily Participatory Rural Appraisal (PRA) tools to understand rural people whose livelihoods depend on inland fisheries and how they define their *well-being*, or what characterizes *good life* (rich) as opposed to a *bad life* (poor). The study also tried to find out the priorities and concerns of fishers and other stakeholders in order to understand how they identify and implement strategies for sustaining their own lives. In addition, it was important to learn about various support networks that the stakeholders depend or rely upon.

A proposed PRA framework (and the participatory tools that could be used) designed to capture the information sought from stakeholder groups as regards their livelihoods was discussed in the workshop in April 2002. It was noted that seasonal diagramming was an activity by which each group could bring out the main parameters of their livelihoods (giving a list of strategies they pursued, when they did it, what inputs they required, and so on). The seasonal diagram could then be used as the basis for further discussion and PRA exercises with each group both on their livelihood strategies, and on their vulnerability context. Other tools that could be used included ranking of strategies, timelines of major events impacting positively or negatively on their livelihoods, three-level cause-effect diagramming and an opportunity and constraint-solution census.

Finally the range of tools used for the PRAs were:

1. Timeline
2. Mapping
3. Venn diagram
4. Seasonal calendar
5. Daily activity
6. Gender analysis
7. Trend analysis
8. Matrix ranking and scoring
9. Flowchart
10. Strength weakness opportunity constraint analysis
11. Wealth ranking
12. Constrains/problems ranking
13. Problem tree

Activities to ensure the reliability of information included cross-checking the data given by individual informants. It was also ensured that the stakeholder categorisation criteria were linked where possible to some national indicators (for example in Bangladesh land as a proxy for wealth/poverty had been used), since this would enable external agencies to identify whether the groups described were similar to their target groups and the information

are applicable in their context. In each country the following process was adopted:

- Villages/sites to represent key aquatic environments for participatory livelihoods assessments were identified,
- Reconnaissance survey was done and some secondary stakeholders were consulted in order to identify fisheries stakeholders in appropriate villages,
- PRAs conducted to analyse resource use and dependence within livelihood strategies, and the influence of social capital, transforming structures, institutions and processes.
- Opportunity and constraint censuses with stakeholder groups and ranking and prioritisation of problems of which some qualify as issues for future research undertaken.
- National reports on PRAs for each country were prepared.

4.5 PRA Coverage

The PRAs were a substantial part of the overall research activities and form a set of participatory livelihood assessments covering in a systematic way major inland fishery environments and major fishery stakeholder categories, each having contributed their own analysis of their livelihood bundle of assets, trends, problems etc. In summary the stakeholder categories and environments actually covered in the PRAs in each country are shown in Tables 4.6-4.9.

Table 4.6 Stakeholders covered by environment in livelihood assessment PRAs in Bangladesh.

Ecosystem	No. of PRA sites	Poor full time	Poor part time	Subsistence	Fish traders	Women	Leaseholders/moneylenders	Kua Owner	Total
Main River-Jamuna-Ganges confluence	1	X	X	X	X		X		6
Estuarine-Bhola	1	X	X	X	X		X		6
Sundarbans-Khulna	1	X	X	X	X		X		6
Beel- (Enhanced) Naogaon	1	X	X	X	X				4
Haor-Floodplains (Sunamganj)*	1	X	X	X	X	X	X		6
Floodplain Beel-Narail*	1	X	X	X	X	X		X	5
Oxbow lake-Jessore (Enhanced)	1	X	X	X	X				4
Reservoir (Kaptai)	1	X	X		X				3
Total	8	8	8	7	8	5	4		40

Note: PRA carried out by BCAS - clear rows, PRA carried out by WorldFish Center – shaded rows.

Table 4.7 Stakeholders covered by environment in livelihood assessment PRAs in Cambodia.

Ecosystem	No. of PRA Sites	Fishers		Trader	Processor	Poor	Total
		FT	PT				
Main Stream	1	X	X				2
Downstream	1	X	X			X	3
Tonle Sap	1	X	X	X	X		4
Total	3	3	3	1	1	1	9

Table 4.8 Stakeholders covered by environment in livelihood assessment PRAs in Lao PDR.

Ecosystem	No. of PRA sites	Full time	Part time	Total
Tributaries	1		X	1
Main stream	1	X	X	2
Main stream	1	X	X	2
Tributaries	1		X	1
Back swamp	1		X	1
Rice field			X	1
Total	5	2	6	8

Table 4.9 Stakeholders covered by environment in livelihood assessment PRAs in Vietnam.

Ecosystem	Number of PRA sites	Full time	Land Owner	Landless	Part time	Fish trader	Total	Responsibility*
River (S)	1	x		x	x	x	4	AGU
Canal (S)	1	x		x	x	x	4	CTU
Swamp/forest (S)	1		X	x			2	AGU
Rice field/flood plain (S)	1			x	x	x	3	CTU
Total	4	2		4	4	4	14	

Note: AGU = An Giang University; CTU = Can Tho University

4.6 Secondary Stakeholder Analysis

The objectives, procedure and expected outputs from consultations and review of secondary data were agreed in the planning workshop in April 2002. It was also noted that, in terms of project outputs, information from these sources needed to be accessed, reviewed and reported by country partners to fill in gaps in secondary information and to obtain views on current threats and trends, opportunities and researchable constraints affecting the lives of poor people dependent on inland fisheries. Additionally, however, visits to secondary stakeholders also represented an opportunity to build linkages with them, and to draw them into the uptake and dissemination process.

4.7 Partnership and Capacity Building, Synthesis and Reporting

An important aspect of the project was to introduce the sustainable livelihoods analysis framework, develop with partners a simple way of building up such analysis through PRAs, and to then compile assessment for inland fisheries. The national partners had limited experience of conducting PRAs and very little experience of the sustainable livelihoods framework prior to this study. As the methods and study were built up in a participatory way with all the partners contributing, it gave a chance to develop skills within the national partners, particularly those in the Mekong region, which it is hoped will be used further by these organisations in guiding their future research and development activities. Resources and time limited the scope to fully involve all partners in comparative analysis of livelihood strategies, dependence, status and trends in inland fisheries and wetlands as had been hoped. But regional workshops were held with partners and collaborators to compare the progress and agree on analysis and reporting structures. There would, however, be benefits to follow up activities to draw together findings and raise awareness more broadly, particularly in the Mekong countries, or through regional forums.

Consultations were held as far as possible with collaborators and other organisations in the concerned countries on poverty and fisheries, including their assessments of researchable needs and priorities. National workshops were intended to be held to disseminate findings in

Bangladesh and the three Mekong countries to target institutions. They were held to disseminate findings in Bangladesh and in Cambodia, and in the other two countries will be held in May/June 2003. Summary reports have been prepared, but are still to be translated and distributed in national languages. The summary documents should then be distributed among the donors, other relevant projects, government and NGOs, and by the partners to grass roots levels during their own meetings and future research and development activities with fishing communities and local government. It is also expected that the partners will help take up dissemination of findings to grass roots levels through national and regional networks (e.g. STREAM).

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.

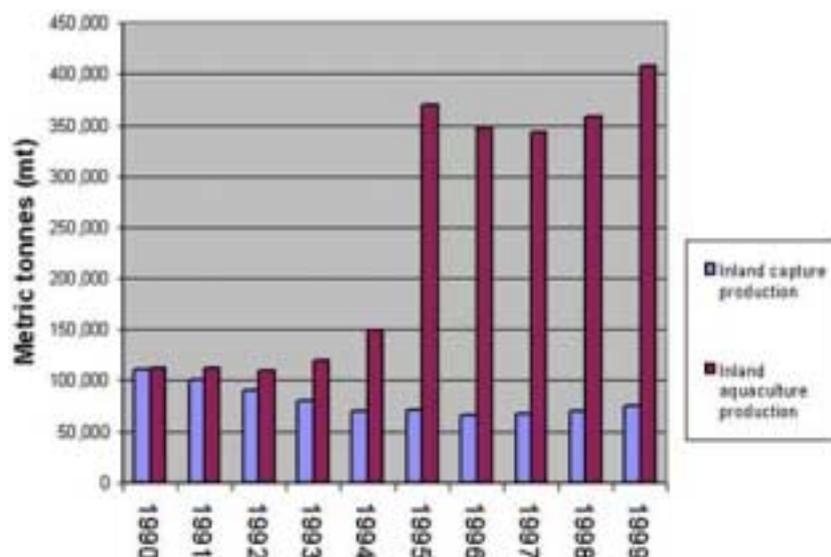


Figure 5.1. Vietnam - Inland capture fisheries and aquaculture production (national totals). Source: RIA 1, 2001

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

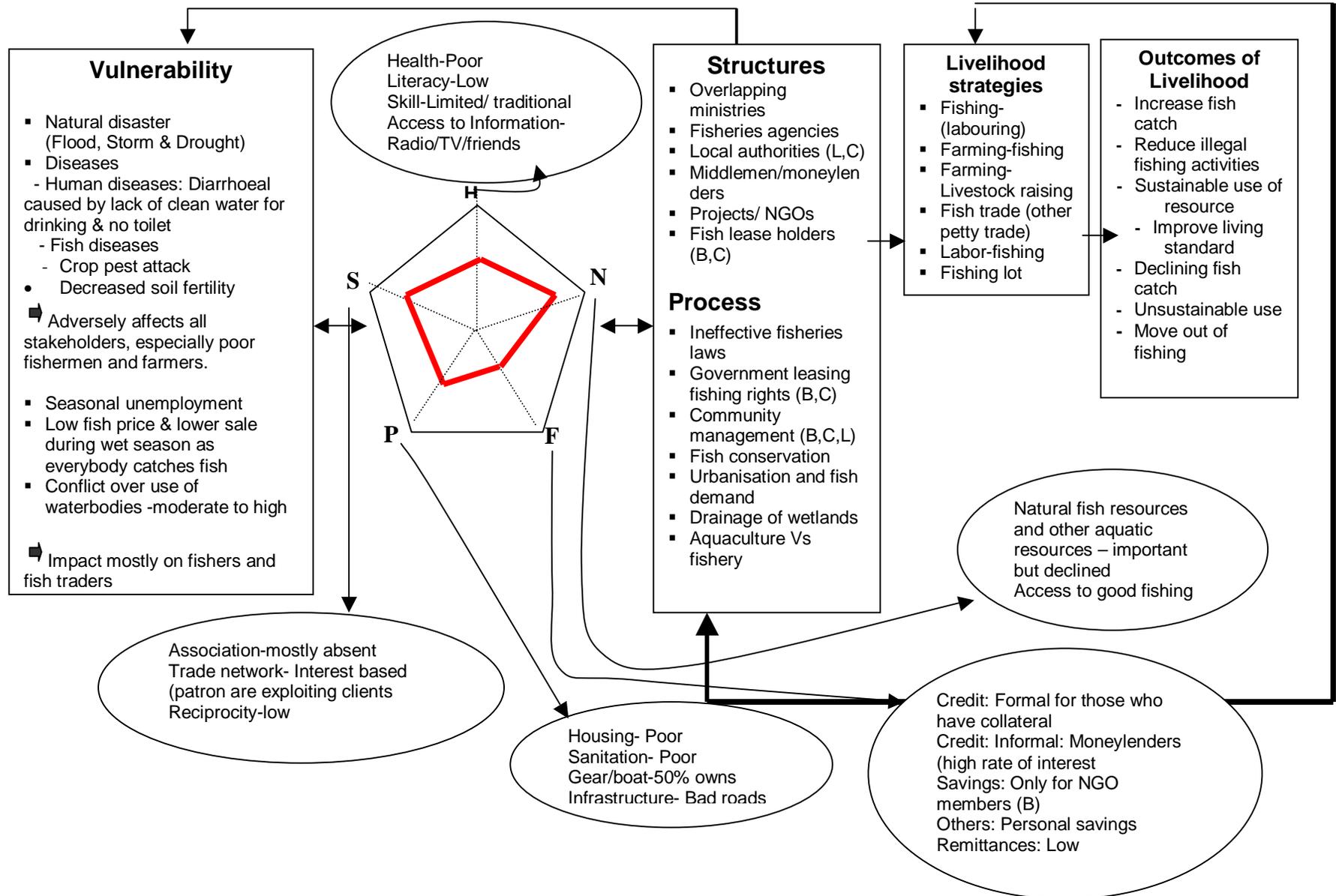
Gender differentiation in fish capture activities is an important issue for any future development plans for fisheries in the target countries. Already some comments have been made on this in the social differentiation section, but as an example of the PRA analysis Table 5.7 indicates that there is clear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

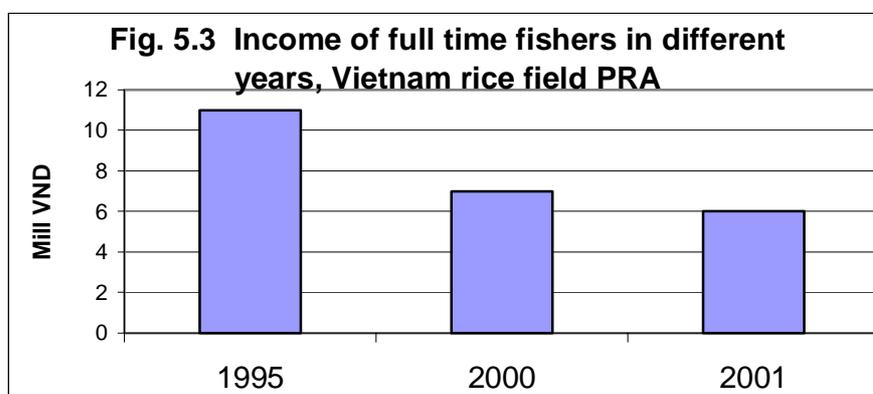
The PRAs indicate limited financial resources for fishing households, but some access to institutional credit sources, for example the Provincial Agricultural Bank provides loan with an interest rate of 12%. Most of the full time fishers earn between 3 to 7 million Kip a year, but their expenditure for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

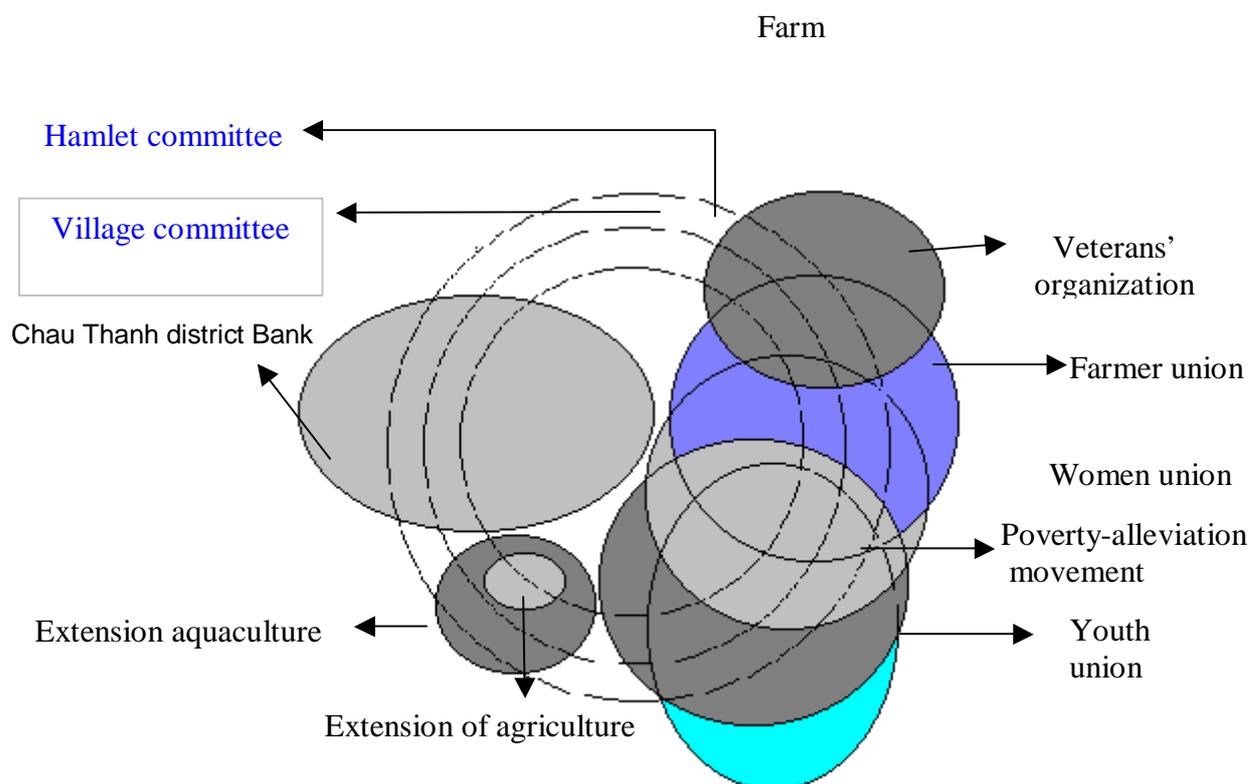


Table 5.12 Negative and Positive Impacts of Institutions on Rural Livelihoods in Cambodia (from PRA).

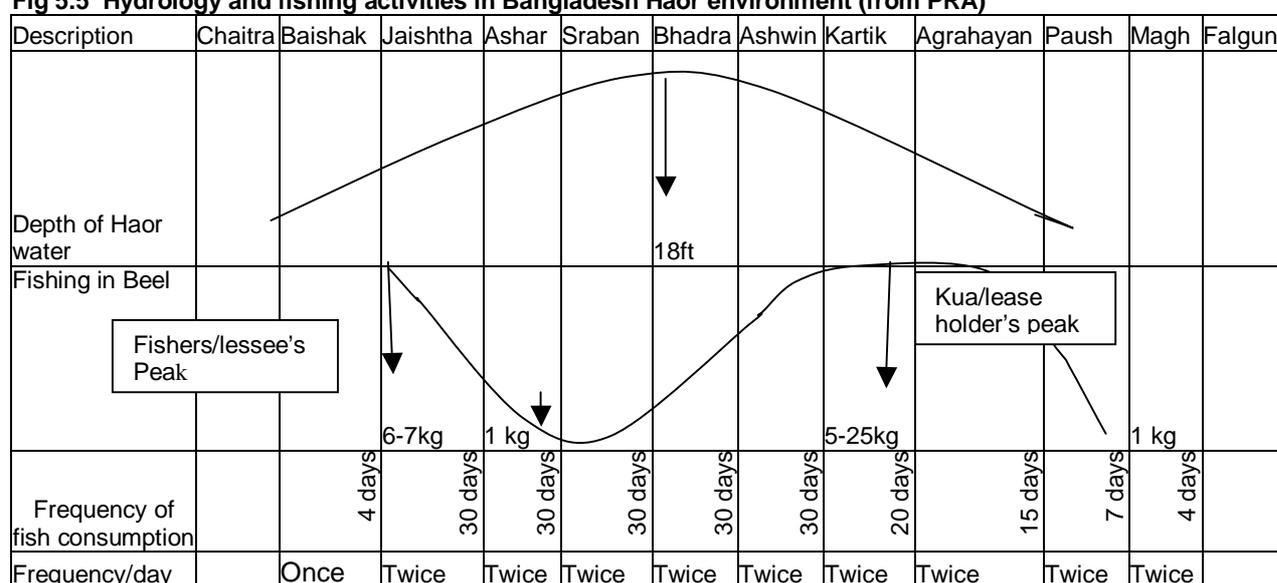
Positive Impact	Negative Impact
<p>Fisheries Agency:</p> <ul style="list-style-type: none"> ▪ Prevent and control against illegal fishing activities ▪ Plan to develop fishing community <p>Military Police:</p> <ul style="list-style-type: none"> ▪ Serve as social security agent and prevent illegal fishing 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.

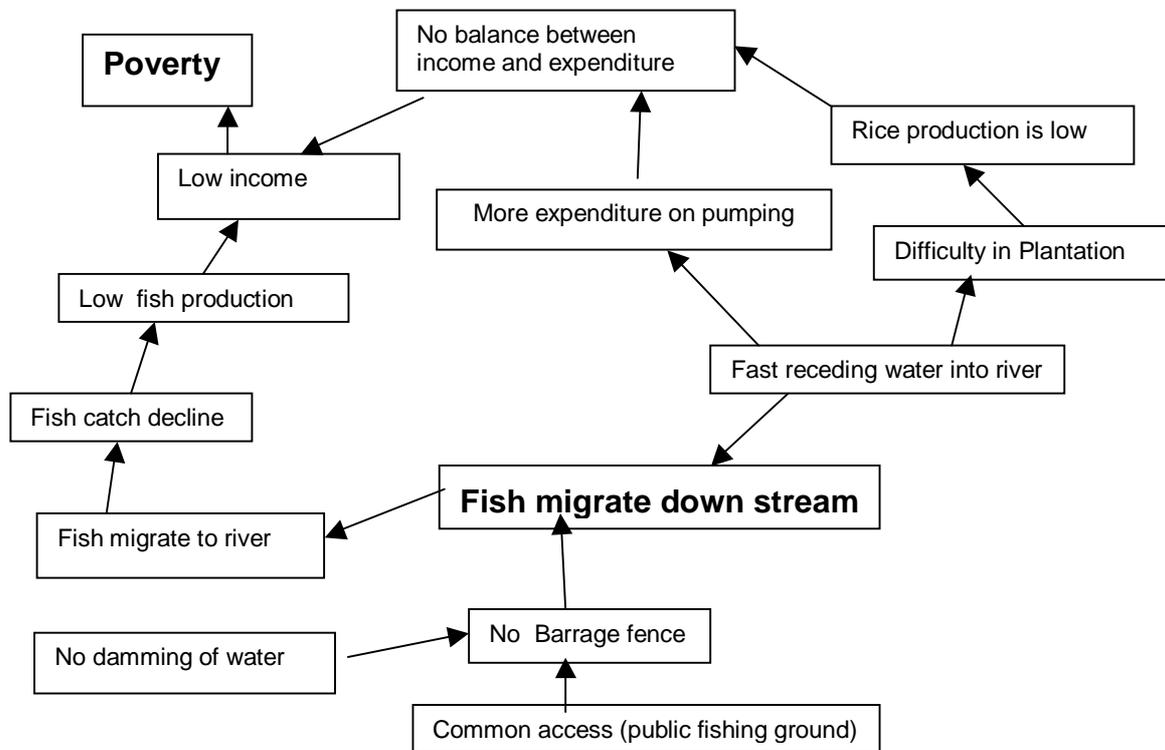
Problem	Causes	Consequences	Solutions
Fish and other aquatic resources decreasing	<ul style="list-style-type: none"> - Overexploitation - Use of agro-chemicals - Catching brood fishes and fish fries - Use of harmful gears - Infrastructure development (B,C,L,V) - complete dewatering of ditches for fish 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



CHAPTER 6

Contribution of Outputs

6.1 Contribution of Outputs to DFID Development Goals

The overall goal of the programme and this component of it is that the livelihoods of poor people be improved through sustainable enhancement of production and productivity of land/water interface systems. However, the project was not intended to do this directly and nor was not designed to develop new technologies. Instead its intended contribution was to provide insights into the livelihood strategies and priorities of people, particularly poor people, dependent on inland fisheries in Bangladesh and Southeast Asia which could then be used to help guide development activities including other projects, and to be used to guide the development of potential research projects to ensure that they take better account of the wider livelihood context in inland fisheries and the problems and needs of poor people.

In summary the achievement of output indicators is shown in Box 6.1

Box 6.1: Achievement of Output Indicators	
Target	Achievement
By project month 2 a framework and guideline developed and agreed for preparing representative livelihoods assessments through secondary sources and PRA.	Prepared in internal workshop in April 2002
By project month 6 classifications, and profiles of fisheries and associated livelihoods for 4 countries prepared from secondary sources covering: location; capital pentagon including role and dependence on fisheries particularly for resource poor stakeholders; legal, institutional and policy framework; threats, trends, and prospects; gaps in information; past research; and constraints.	Presented in internal workshop in November 2002
By project month 8 representative livelihoods assessments disaggregated by stakeholder group, poverty profiles, rankings of constraints and associated researchable issues prepared through PRA for example sites in the main inland fishery systems in 4 countries.	Presented in internal workshop in November 2002 but actually completed in January 2003
By project completion dissemination of a comparative assessment of the levels of poverty, dependence on aquatic resources, livelihood strategies, vulnerability and needs of key stakeholders using inland fisheries in 4 countries and the relationship between these aspects and the resource base, institutions and property rights that govern access to aquatic resources in particular	Comparative assessment not yet distributed. National reports completed for distribution to secondary stakeholders. National partners working on translations of the respective summary volumes for printing and wider circulation. In Bangladesh and Cambodia national workshops were held in March 2003 to disseminate the findings to key stakeholders.

The context in terms of DFID's specific poverty focus and country aims has been already detailed in Chapter 2 (Background). However, the contribution should be seen as fitting within a wider context of informing research and development policy formulation in the target nations and for regional and international researchers and development partners.

WorldFish Center has and will continue to use its existing links and collaboration, for example with the Departments of Fisheries in Bangladesh and Cambodia (where it has respectively been working to develop and test community based management of inland

fisheries for over 7 years and just recently), and with provincial authorities and research agencies in Vietnam and Lao PDR to help take up the results.

In Bangladesh this fits into wider debate on policy in fisheries, particularly inland fisheries, and on research priorities, where the WorldFish Center with national partners has an active role and will make use of the findings. In Cambodia too it fits into recent moves towards people centered fishery management through community fisheries and helps strengthen the capacity of the Department of Fisheries which again will be taken up through further projects with WorldFish Center. However, in Lao PDR and Vietnam there is probably the greater potential impact since inland fisheries have been relatively neglected in terms of fishery science and most importantly the high dependence of many poor subsistence and part-time fishers on these resources. Unfortunately these are the two partner countries where dissemination is more difficult due to their more decentralized administration which lacks ready made focal points in government and donor assisted projects for ready uptake of the findings.

6.2 Promotion of Outputs

6.2.1 List of project reports

The following reports have been prepared and are included as annexes to this FTR

1. Synthesis Analysis Report
2. Bangladesh Country Summary Report
3. Bangladesh Country Status Report
4. Bangladesh Country PRA Report
5. Cambodia Country Summary Report
6. Cambodia Country Status Report
7. Cambodia Country PRA Report
8. Lao Country Summary Report
9. Lao Country Status Report
10. Lao Country PRA Report
11. Vietnam Country Summary Report
12. Vietnam Country Status Report
13. Vietnam Country PRA Report

In addition an Internal Planning Workshop Report was prepared for the initial workshop in April 2002 to guide the project partners.

6.2.2 Workshops and other dissemination

Under the agreements for the project, the national partners (Can Tho University (CTU) and An Giang University, Vietnam; Department of Fisheries (DoF), Cambodia; Living Aquatic Resources Research Center (LARReC), Lao PDR; and Bangladesh Center for Advance Studies (BCAS), Bangladesh) are responsible for holding national workshops to disseminate the findings to target institutions in their respective countries and for preparing translated versions of the country summary report and project executive summary to be printed locally and distributed to policy makers and implementers at different levels.

Further target organizations were relevant international agencies such as FAO and SIFAR, regional agencies (Mekong River Commission (MRC), NACA/STREAM), international NGOs working in the region (Oxfam, Save the Children), and development partners. These were included in the initial planning workshop in Phnom Penh and have been updated on the

study, but it has not proven possible to hold an event to inform them collectively. There is a need for the national partners, the UK based partners and WorldFish to seek outlets for non-formal dissemination with these agencies through their newsletters, seminars, etc.

National workshops were arranged in two countries within the project period - in Cambodia and in Bangladesh. The participants included government agencies, other donors, fisheries sector projects, NGOs, academics, and Departments of Fisheries. In Bangladesh the Secretary Ministry of Fisheries and Livestock and Director General Department of Fisheries were the main guests in the workshop, which was also attended by representatives of Ministry of Land and Bangladesh Water Development Board. The national partners and WorldFish Center here presented the national summary report of the project, and gave an overview of the project as a whole. Participants gave their comments on the summary report and the summary report was revised accordingly, they also identified key issues and future research needs. In addition this was preceded by a consultation meeting with a panel from relevant projects and NGOs which helped to shape the national summary report.

In Bangladesh further uptake has come through a national research planning workshop in April 2003 jointly organized by WorldFish Center and Bangladesh Fisheries Research Institute, here the national partner to this project presented one of the resource papers, and while the scope was the whole of the fisheries sector, one of the key areas was inland fisheries research and policies. This workshop attended by senior policy makers and a wide range of research stakeholders confirmed several of the research priorities identified in the earlier workshop.

6.3 Future Actions and Research

The partners in Lao PDR and Vietnam are due to hold national workshops in the coming months (delayed due to new year festivals and other commitments). Also from the project provision all four national partners have agreed to translate their respective country summary reports into the national language, it is hoped that this can be combined with the key findings from the comparative study and the resulting short reports will be distributed widely to decision makers, practitioners, local government and researchers.

Further dissemination is expected to include short articles in newsletters, web pages and CD distribution. The PRA methods and tools used for the local livelihood assessments are already being incorporated within participatory planning and assessment in our ongoing projects, and hopefully will also be used by the partners in their research programmes.

A major outcome from the project is identification of potential research topics for the future and of issues that are common between the Mekong and Ganges-Brahmaputra-Meghna river basins. Some of the latter are likely to be taken up through the CGIAR global challenge program on water and food.

6.3.1 Example from Bangladesh

In the National research planning workshop on 3-4 April 2003 the two working groups on inland fisheries identified the following possible priorities considering respectively primarily research areas, and secondly more generally development, policy and research:

Inland fisheries

1. Institutional linkages

- Environment

- Water management; water sharing, conflict, Integrated Floodplain Management options
 - Fish and agricultural management
 - Opportunity and constraints
- 2. Existing leasing and access**
 - Assess existing policy and recommended conservation policy
 - Impact on poor
 - Impact on fisheries
 - Distribution of benefits under different situations
 - 3. Impact of habitat restoration and conservation**
 - Economic and social benefit
 - Biodiversity
 - Habitat destruction/impact of flood control works
 - Seasonal dimension
 - 4. Alternative income generation methods to reduce fishing pressure**
 - 5. Appropriate assessment mechanism of fisheries resources**
 - 6. Population dynamics of important species**

Open water fisheries

- 1. Development of an action plan**
 - Rationalise and harmonise with other related policies
 - Process & rationalisation can be simultaneously run with development of action plans
 - High powered council with the concerned ministries
 - Consultation with all concerned (national to grassroot level)
 - Study on policy impact and the possible conflicts
- 2. Jalmahal Policy**
 - Better access and management
 - Administrative systems that are not for revenue generation only
 - Community based management
 - Can contribute in poverty alleviation
 - PRSP - how it fits with the fisheries sector
 - Reinvestment of lease money for improvement of fisheries (social fund)
 - Change of jalmahal management over period
 - Court cases
 - Open access - benefit goes to the rich
 - One jalmahal leased out two purposes in a time (farming & fisheries)
 - Improve/simplify the leasing process
- 3. Governance and enabling legislation with respect to openwater fisheries**
 - Water sharing/use
 - Improvement of land use
 - Degradation of wetlands and loss of habitats (degree and extent) and their restoration
 - Encroachment of water bodies
 - Conservation of water bodies
 - Preference of base line

- Capacity of enforcement of various regulation
- Sustainability of sanctuaries

4. Strengthening of capacity of Department of Fisheries

- Would have the ability to assess fisheries Environmental Impact Assessment
- Multidisciplinary professionals

5. Impact of stocking

- Knowledge gap
- Local versus exotic species

6. Responsibilities of research

- Adequacy of mandate
- Capacity to conduct research on policy issues

Finally the participants developed short outlines of the rationale for 48 possible researchable topics in the whole fisheries sector, 19 were placed in the high priority category (Table 6.1). Out of these 10 were on inland fishery and livelihood issues (although some spread also into aquaculture or marine fisheries).

Table 6.1 Highest priority research topics for medium term from a Bangladesh national workshop held in April 2003 (topics which half the participants ranked as high priority).

Research topic	High	Med	Low	Don't know
Management of shared stocks (hilsa) and assessment of the likely effects on biodiversity by the release of exotic species	27	14	1	0
Fish health management - diagnosis, prevention, control & care	27	13	2	0
Dissemination of aquaculture technologies	27	10	2	3
Assessment of the impact of aquaculture technologies and fisheries management regimes on the poor	25	15	2	0
Constraints to the effective implementation of government fisheries policies	25	11	4	0
Conservation and rehabilitation of hilsa breeding grounds	25	9	7	1
Conflicting water use in aquaculture	24	18	0	0
Genetic stock improvement of commercially important aquaculture fish species	24	12	4	2
Impact and sustainability of the use of invasive exotics in aquaculture	24	14	3	1
Livelihood strategies of fisheries and aquaculture dependant households	24	14	1	3
Assessment of the impact of aquaculture technologies and fisheries management regimes on the poor	25	15	2	0
Alternative income generation options to reduce fishing pressure on open-water bodies	23	15	3	1
Studies on the population dynamics of important fish species (wild, stocked, inland & marine)	22	18	1	1
Impact of habitat restoration in open-water fisheries	22	18	2	0
Governance & enabling legislation affecting open-water bodies and wetlands	22	16	3	1
Analysis of the constraints of current water body leasing policies	22	15	4	1
Gender empowerment in fisheries and aquaculture	21	17	4	0
Impact of coastal aquaculture (shrimp farming) on the soil quality of paddy fields	21	17	3	1
Development of low cost, quality feeds for commercially important cultured fish (esp. broodstock and early rearing)	21	14	6	1

Bold indicates topics relating to inland fisheries

References

Ahmad and Reazuddin, 1990.

Ali, M.Y. (1994) Fisheries and Environment. In A.A. Rahman, S. Huq, R. Haider, and E.G. Jansen (eds.) Environment and Development in Bangladesh. University Press Ltd, Dhaka.

Ali, M.Y. (1997) *Fish, Water and People*, University Publishers Limited, Dhaka, Bangladesh.

Baird, I.G. 1999 The Co-management of Mekong river inland aquatic resources in southern Lao PDR. CESVI, Pakse, Lao PDR.

Baird, I.G., V. Inthaphaisy, B. Phylavanh and P. Kisouvannalath 1998a. A Rapid Fisheries Survey in Khong District, Champasak Province, Southern Lao PDR, Unpublished technical report prepared for the Environmental Protection and Community Development in Siphandone Wetland Project, CESVI, Pakse, Lao PDR, 31 pp.

Barr, J.J.F., Dixon, P-J., Rahman, M.M., Islam, A., Zuberi, M.I., McGlynn, A.A., and Ghosh G.P., (2000b) Report on a participatory, systems-based, process for identification of improved natural resources management for better floodplain livelihoods. London: DFID, NRSP.

BBS (1984) *National Population Census-1981*, Bangladesh Bureau of Statistics, Dhaka, Bangladesh

BBS (1994) *National Population Census-1991*, Bangladesh Bureau of Statistics, Dhaka, Bangladesh

BBS (1998) Household Expenditure Survey 1995–96, Bangladesh Bureau of Statistics, Bangladesh.

BBS (1998) *Household Expenditure Survey 1995–96*, Bangladesh Bureau of Statistics, Bangladesh.

BBS (2001) *Household Income and Expenditure Survey 2000*, Bangladesh Bureau of Statistics, Bangladesh.

BBS (2002) *National Population Census- 2001*, Bangladesh Bureau of Statistics, Dhaka, Bangladesh

BBS, (2001) Statistical Year Book of Bangladesh 2000. Bangladesh Bureau of Statistics, Bangladesh.

BBS,2000. Statistical Year Book of Bangladesh 2000. Bangladesh Bureau of Statistics, Bangladesh.

BCAS and NCM (1994)

BRAC (2001) Socio – Economic Baseline Survey at eight open Water Fisheries Under FFP, BRAC, Dhaka, Bangladesh.

Cavas (1994)

Chambers (1979),

Chambers et al (1979),

Chambers, R., 1983 *Rural development: putting the last first*. London: Longmans

Chambers, R., 1995 'Poverty and livelihoods: whose reality counts?' *Environment and Urbanization*. Vol.7 No.1.

Craig, J.F., Halls, A.S., Barr, J.J.F. and Bean, C.W. (*submitted*). The Bangladesh Floodplain Fisheries – A Review. *Fisheries Management*.

Datt, G., and Wang, L., *Poverty in Lao PDR: 1992/3-1997/8*. World Bank, Washington D.C.

de Graaf et al .(2001)

DFID, (2000) *Cambodia Country Strategy Paper 2000-2002*. London:DFID.

Dixon, P-J. (2000) Farmers, Fishers and Complex Systems: Securing sustainable livelihoods for the rural poor in Bangladesh through consensus management of floodplain natural resources. MA thesis, University of Durham, UK.

DOF, (2000) The Department of Fisheries, Fisheries Data Collection and statistics, 1980 – 1999, Phnom Penh, Cambodia.

Ellis, F., 1998 'Household strategies and rural livelihood diversification. *Journal of Development Studies*. Vol. 35 No.1, pp. 1-29.

FACT, (2002) *Feast or Famine, solution to Cambodia's freshwater fisheries conflict*. A report by the Fisheries Action Coalition Team in collaboration with the Environmental Justice Foundation.

FAP 12 (1992) *Bangladesh Flood Action Plan FCD/I Agricultural Study Final Report* Dhaka: Flood Plan Coordination Organisation, Ministry of Irrigation Water Development and Flood Control (prepared by Hunting Technical Services).

FAP 17 (1994) *Main Volume. FAP 17 Fisheries studies and pilot project, final report*. Government of Bangladesh Flood Action Plan. Ministry of Irrigation, Water Development and Flood Control, Government of Bangladesh, Dhaka.

Flood Action Plan 6. 1993. *Northeast Regional Water Management Project Fisheries Specialist Study*. Flood Plan Coordination Organisation and Bangladesh Water Development Board, Dhaka (Report prepared by Shawnigan Lavalin (1991) Inc. and Northwest Hydraulic Consultants). 291p.

Garaway, C.J. 1999. Small waterbody fisheries and the potential for community-led enhancement: case studies in Lao PDR. PhD Thesis, Imperial College, London.

Gill (1991)

Greeley, M., 2000 'The road to recovery. Are new policies driving down poverty in Bangladesh?' www.ids.ac.uk/id212/static/7amg1.htm

- Hossain M.M. (1992). Total sediment load in the lower Ganges and Jamuna, *Journal of IEB*, Vol. 20, No. 1&2.
- ISPAN (1992). Environmental Impact Assessment (Case Study), Compartmentalization Pilot Project (CPP), FAP-16, Report prepared for USAID and Ministry of Irrigation, Water Development and Flood Control, Government of Bangladesh, Dhaka.
- (Junk et al, 1989). Lao
- Kabeer, 1998). – gender BG
- Kabir Azmal et al (2000) Impacts of Community Based Fisheries Project. Policy Research Report, Proshika, Dhaka.
- Longhurst and Payne (1979
- Lorenzen, K., Nguyen Khoa, S., Garaway, C.J., Arthur, R.I., Chamsingh, B., Litdamlong, D., Siebert, D. & Innes-Taylor, N. (2000) Impacts of irrigation and aquaculture development on small-scale aquatic resources. Final report to the DFID Environment Research Programme.
- Lorenzen, K., Smith, L., Nguyen Khoa, S., Burton, M., Garaway, C.J. (2002) Management of irrigation development impacts on fisheries. Final Technical Report to the DFID Knowledge and Research in Engineering Sectors Programme.
- MACH (2000) First Annual Report. Management of Aquatic Resources through Community Husbandry, Dhaka (Report prepared by Winrock International).
- Millman and Heade (1983).
- Ministry of Fisheries. (2000). Report on the fisheries development status and activities relating to CPG since the 2nd CPG meeting. Ministry of Fisheries, Hanoi, Vietnam pp.6.
- MPO (1987) *Fisheries and flood control, drainage and irrigation development*. Master Plan Organisation Technical Report 17, Ministry of Irrigation Water Development and Flood Control, Dhaka. (Report prepared by Harza Engineering Company Int., Chicago). 54p.
- NEMAP, (1995). *National environmental management action plan*. Ministry of Environment & Forests, Dhaka.
- Pagiola, 1995
- Palmer-Jones, R., (1999). 'Slowdown in agricultural growth in Bangladesh: neither a good description nor a description good to give' (in Rogaly B., Harriss-White, B., and Bose, S (eds) *Sonar Bangla: agricultural growth and agrarian change in West Bengal and Bangladesh*. London.Sage.
- Phonvisay, S., 1994 Inland fisheries development policies and strategies in the Lao PDR with special emphasis on the Mekong Basin. Director General of the Department of Livestock and Veterinary Services. Ministry of Agriculture and Forestry.
- Rahman, H.Z., and Hossain, M., (1995). Rethinking rural poverty: Bangladesh as a case study. Dhaka :UPL

Rogaly B., Harriss-White, B., and Bose, S., (eds.) (1999) *Sonar Bangla: agricultural growth and agrarian change in West Bengal and Bangladesh*. London: Sage.

Sadeque and Islam, 1993

Sultana, P and P.M. Thompson. 1997. Impact of Flood Control and Drainage on Fisheries in Bangladesh and Design of Mitigating Measures. *Regulated Rivers* 13: 43-55

Thuok, N and Sina, L., (1997) *Review of the fisheries and aquaculture sector in Cambodia*. CMB/95/003: Natural resource base development for the Tonle Sap Area.

UN's Human Development Index (HDI) (1999).

UNDP (1997). UNDP. Cambodia Human Development Report 1997.

UNDP- Cambodia Human Development Report 1999.

Welcomme, R.L. (2001) (ed.) *Inland Fisheries: Ecology and Management*. Oxford: Blackwell Science.

WHO, (1989) World health Organization, Environmental Health criteria. DDT and its derivatives; Environmental effects.

World Bank (1999a)

World Bank (2001) *Voices of the Poor*. Washington: World Bank.

World Bank (2000). Lao People's Democratic Republic (in *The World Bank Participation Sourcebook*. World Bank:Washington. (also on the internet).

World Bank 1998b

World Bank, 1999/2000, *Voices of the Poor*. Washington; The World Bank

World Bank, 2000, *Vietnam - Attacking Poverty. Vietnam Development Report 2000*. Washington; The World Bank.

World Resources Institute (1990) Bangladesh environment and natural resources assessment. Center for International Development and Environment, World Resources Institute, Washington.