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Renewable natural resource-use in livelihoods at the Calcutta peri-urban interface

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Peri-urban

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Abbreviations and acronyms

ADB	Asian Development Bank
CBO	Community-Based Organisation
CEIP	Calcutta Environmental Improvement Project (ADB-DFID funded)
CPR	Common Property Resources
CUSP	Calcutta Urban Services for the Poor (DFID funded)
DFID	Department for International Development (UK Government)
DoF	Department of Fisheries (now Department of Fisheries, Aquaculture, Aquatic Resources, and Fishing Harbours), GoWB
DoE	Department of Environment, GoWB
DoIW	Department of Irrigation and Waterways, GoWB
DoLLR	Department of Land and Land Reform, GoWB
EKW	East Kolkata Wetlands
GNS	Gantantrik Nagarik Samiti - Democratic Citizens Society (NGO)
GoI	Government of India
GoWB	Government of West Bengal
HIDCO	Housing and Industrial Development Corporation
IoA	Institute of Aquaculture
IWMED	Institute of Wetland Management and Ecological Design
KMA	Kolkata Metropolitan Area
KMC	Kolkata Municipal Corporation
KMDA	Kolkata Municipal Development Authority
LWI	Land Water Interface
MIC	Minister-in-Charge
NGO	Non-government Organisation
NR	Natural Resources
PRA	Participatory Rural Appraisal
PS	Production System
PU	Peri-Urban
PUI	Peri-Urban Interface
PUBLIC	People United for Better Living in Calcutta (NGO)
SC	Scheduled Caste
SFDC	State Fisheries Development Corporation
ST	Scheduled Tribe
WB	World Bank
WBIDCO	West Bengal Industrial Development Corporation
WBSPCB	West Bengal State Pollution Control Board
WRR	Waste Recycling Region
WWF-India	World Wide Fund for Nature - Indian Branch

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1. Executive summary

Management of LWI PS in PU Kolkata has been described, as have various constraints to the system's continued operation covering such aspects as land acquisition, migration of skilled labour, limited investment in maintenance and pollution issues. Despite these constraints, the sustained use of this PS is considered desirable as it provides direct and indirect employment, supplies fresh produce to urban markets and a managed disposal route for domestic waste. However, the importance of employment, food supply and sanitary waste reuse associated with this PS in poor livelihoods has not been widely considered. This project addressed this knowledge gap and identified opportunities for NR-related enhancement of poor livelihoods dependent on LWI PS within Kolkata's PUI. The stated purpose of the project was to generate 'Knowledge on the Kolkata PUI, emphasising the contribution of LWI PS to the livelihoods of poor people and the role of institutions and actors'. Preliminary research activities included a comprehensive literature review, to highlight past research in the area and critical gaps in the knowledge base, and an initial stakeholder workshop where selected poor groups that depend on PUI farming, and stakeholders associated with managing the Kolkata PUI, were identified. New knowledge on poor groups benefiting from PU farming was used to target focus group and household interviews, while knowledge on stakeholders associated with managing PU Kolkata was used to guide the institutional analysis. Knowledge from the literature review and workshop was also used to guide a preliminary situation analysis in which knowledge was produced concerning the nature and extent of land, water and waste use in PU LWI PS. Further research activities included an assessment of fish seed trading networks in sustaining poor livelihoods and a study on the marketing channels for fish produced on PU farms. New knowledge from the project was made available to stakeholders and target institutions in appropriate formats; an activity in the first workshop helped identify appropriate communication pathways. Presentations at a second workshop, international conference and regional workshop were used to further disseminate key findings, whilst meetings with target institution representatives were conducted to promote the active dissemination of findings. Outcomes from the first workshop, situation analysis, focus groups and household interviews have provided NRSP Managers with new knowledge on the role LWI PS at the PUI play in livelihoods of poor people. Furthermore, the dissemination of these outputs, combined with findings from the institutional analysis and second workshop, have provided NRSP Managers and target institutions with new knowledge on development opportunities and researchable constraints for poor people at the LWI. The range and depth of research activities, combined with disseminating findings in reports, presentations and meetings means increased knowledge on the role LWI production systems at the PUI play in livelihoods of poor people has been made available to a range of stakeholders; publication of a series of working papers on the project website has further contributed to free and unrestricted access to key findings. Dissemination of project findings, particularly through workshops and meetings, has ensured planners and other key actors have had more exposure to features of the use of land, water and waste resources in LWI PS, including the importance of access to these resources in the livelihoods of poor people. Although, knowledge delivery has mainly been aimed at target institutions and planners, it is envisaged that resulting policy and development initiatives will help enable poor people who are largely dependent on the NR base to improve their livelihoods, therefore, contributing to the NRSP programme purpose.

Knowledge generated during the project suggests many poor people in PU Kolkata are vulnerable due to seasonal water shortages, declining access to solid organic waste and widespread insecurity of tenure. Furthermore, rising expectations combined with uncertainty regarding the prospects for LWI PS in PU Kolkata in the face of urban growth appear to be promoting the diversification of household livelihood strategies, both in agricultural and non-agricultural activities. Having consolidated existing knowledge and generated new knowledge to fill identified gaps, most notably on the livelihood strategies of groups and households dependent on access to PU NR, it is recommended that the comprehensive knowledge-base developed through the current project should be further exploited to facilitate collective decision-making, and to develop appropriate action plans to address those constraints and opportunities outlined in this report, and described in more detail in the annexed project documentation. Decision-making and action planning should involve collaboration between stakeholders and local institutions, however, further support from an external agency, such as DFID, may be required to facilitate such an approach.

2. Background

Aquaculture and horticulture practices exploiting wastewater resources in PU Kolkata were developed and refined by farmers; Bunting, Kundu and Mukherjee (2001a) present a review concerning the evolution and present status of these production systems. Currently, the pond area managed for wastewater aquaculture extends to nearly 3,500 ha divided into several hundred fisheries. Various historical reasons and government interventions have contributed to the scale and distribution of land holdings in the area, furthermore, landowners are commonly absentee landlords and management of the fisheries is largely undertaken by leaseholders; others are operated by fishermen's cooperatives and groups and a small number are under government control. Recently it was estimated that ponds managed for wastewater aquaculture produce $>18,000 \text{ t y}^{-1}$ of fish for sale in urban markets, many of which service poor communities. Estimates have also suggested that horticulture, commonly irrigated with wastewater, occupies an area of $\sim 320 \text{ ha}$, and that vegetable production from this area may be up to $370 \text{ t ha}^{-1} \text{ y}^{-1}$; many vegetable growers also exploit inputs of solid waste from the city to enhance production, maintain soil quality and inhibit weed growth.

Further to producing significant quantities of fresh produce for urban and PU markets, it is widely acknowledged that these farms provide direct and indirect employment for several thousand people, and that managed wastewater reuse provides a valuable service to society, reducing health risks from unregulated discharges and protecting downstream environments. Regardless, however, producers face several threats to the continued operation of their farms, whilst a limited willingness to invest time and money in maintaining and enhancing their farms due to growing insecurity makes them more vulnerable to emerging constraints. Considering the benefits, particularly to poor communities, and growing constraints facing producers, it was apparent that a primary objective of research in this region should be to generate new knowledge on both the direct and indirect benefits PU farming affords society, and to communicate this effectively to senior government officials and development agents. This could increase prospects for policies and development plans that ensure the continued operation of the various production systems and encourage initiatives to enhance the efficiency and quality of production on these largely traditional farms.

Failure of past research to address constraints facing producers and poor communities, or to communicate findings effectively to policy makers and development agencies, has caused widespread scepticism amongst certain stakeholder groups regarding further studies. Considering this legacy and the complex physical, institutional and social nature of PU areas, it was apparent that an effective research project would need to engage with a range of stakeholder groups, using appropriate research tools, to identify opportunities to enhance poor livelihoods, which are mutually acceptable, and ideally benefit all stakeholder groups. Consolidating the significant body of research concerning farming practices in PU Kolkata was the first step to identifying key knowledge gaps (Bunting et al., 2001a). Subsequent project activities focused on generating new knowledge on the contribution of PU farming, both directly and indirectly, to livelihoods in poor households and communities, and emerging constraints threatening the continued operation of the system. A key component in the research process was a workshop where the participation of representatives from several stakeholder groups was encouraged (Bunting, Kundu, Punch and Little, 2001b). Important outcomes from this meeting included new knowledge on poor groups that benefit from PU farming, leading to more targeted household interviews and focus groups, and information on the diverse stakeholder groups associated with PU Kolkata, which assisted greatly in facilitating the institutional assessment. The workshop also contributed to initiating a constructive dialogue with several stakeholder groups and target institutions.

In addition to working closely with respected local researchers, access to poor communities was facilitated partly through interviews undertaken with farm managers, where the number and background of people whose livelihoods depend either directly or indirectly on farming systems at the Kolkata PU interface was assessed. Outcomes from this work were used to guide a more focused assessment of the benefits poor people derive from PU farming. Based on knowledge from both the stakeholder workshop and farm manager interviews, selected poor groups were identified and representatives invited to participate in household interviews and focus groups to share perceptions of their livelihoods and discuss constraints and opportunities. Emerging constraints identified during this project phase are discussed further below. To ensure outcomes and recommendations are disseminated effectively a constructive dialogue with stakeholder has been fostered through workshops, participatory research approaches and a process of institutional analysis. Representatives from various stakeholder groups, including government agencies, producer associations, development agencies, NGOs and CBOs were interviewed to better understand their perceptions of PU farming, policies and agendas that govern PU natural resource management and constraints and opportunities they considered important. Other project activities included assessments of market networks in supporting poor livelihoods and the role of products from PU farming in the food security of poor households and communities; consumers were also interviewed to assess their perceptions of products from PU farms. In all activities particular emphasis has been given to the influence of the PU setting and role of age and gender in regulating access to different livelihood strategies. Formulation of an effective communication strategy for project outcomes, resulting in appropriate media for target institutions and key stakeholders was also regarded as crucial to project success, and increasing prospects for developing PU natural resource management strategies that benefit the poor.

Although largely successful in engaging with diverse stakeholder groups associated with farming in PU Kolkata, limitations were noted with identifying representatives from all groups and bringing together stakeholders with different backgrounds. During the project workshop it was obvious that a great deal of attention must be given to the timing and location of the meeting, the format of presentations and activities, including differences in language and terminology, and ensuring that less vocal or confident participants are able to express their opinions and concerns. The diverse nature of media considered useful by participants presents a dilemma as practical restrictions prohibit producing all the media requested. However, taking account of the project aims and an understanding of the likely contribution of particular stakeholder groups to achieving these, it was possible to prioritise and target outputs.

Having undertaken a literature review, stakeholder workshop, farm manager survey, institutional assessment and several household and focus group interviews, it is apparent that the PU Kolkata environment is characterised by complex physical, political and social arrangements, which are greatly influenced by processes of urbanisation, and changing access to natural resources, including wastewater and solid organic waste. Furthermore, emerging constraints, may seriously threaten the continued operation of traditional wastewater-reuse farming practices. Siltation of canals and ponds, decreasing access to wastewater (and solid organic waste) and declining quality, increased contamination, potential changes in wastewater treatment and distribution, urbanisation, changing consumer perceptions, excessive labour union demands and restrictive conservation measures all represent potential constraints. Furthermore, although potential management strategies to mitigate such factors may be proposed, the consequences of untested approaches are not always predictable and may in turn create problems. The limited capacity of most farmers and households in PU

Kolkata to pre-empt and plan for many of the emerging constraints means that traditional farming practices, and the poor that depend upon them, are increasingly vulnerable. Initiatives to increase the capacity of local communities and farmers to assess and manage emerging and unforeseen problems are therefore required.

Considering this background and proposed research activities, knowledge generated by the project not only addressed the project goal of 'Natural resources management strategies for peri-urban areas which benefit the poor developed and promoted' but in providing empowering knowledge to stakeholders and raising awareness of constraints and opportunities faced by producers and selected groups of the poor that depend on PU farming, also provides planners and target institutions with knowledge to implement policies and development initiatives to sustainably enhance production and productivity of RNR systems, thus improving the livelihoods of poor people, in essence contributing to the NRSP programme goal.

3. Project purpose

The purpose of the project was to generate knowledge on the role of LWI PS in livelihoods of poor people at the Kolkata PUI, enabling actors and stakeholders to better understand benefits derived from these activities and facilitating institutional dialogue on developing PU NR management strategies that benefit the poor. It was intended that NRSP Managers and target institutions would be provided with new knowledge on the role that LWI PS at the PUI play in livelihoods of poor people, and specifically new knowledge on development opportunities and researchable constraints that could be addressed to enhance the livelihoods of poor people. It was envisaged that increased knowledge available to a range of stakeholders concerning the role LWI production systems at the PUI play in livelihoods of poor people, and more exposure of planners and other key actors to features of the use of land, water and waste resources of LWI production systems including the importance of access to these resources in the livelihoods of poor people, would contribute to the evolution of natural resources management strategies for PU areas which benefit the poor.

4. Outputs

Research results achieved by the project are summarised in Table 4.1, success in achieving anticipated outputs is discussed in terms of the outcome observed, and suggestions are given regarding what actions might be appropriate to take the research results forward. Considering the project purpose outlined above, a brief review of important knowledge generated by the project concerning the livelihoods of poor people and their dependence on PU LWI PS is given here, with particular emphasis given to new knowledge on the 'role of LWI production systems and associated activities in the livelihoods of selected groups of the poor generated'.

Focus group interviews with women, men, girls and boys engaged in agriculture and fish farming provided a valuable insight to benefits and limitations of occupation. For all groups the main benefit was the cash income generated, however, for many seasonal changes in productivity and labour demands resulted in vulnerability due to widespread temporary employment arrangements. Thus reflecting how poverty not only relates to economic resources, but also about expectations of a level of income in relation to issues of security and consistency (Punch et al. 2002). Women in focus groups expressed concerns over issues of family welfare and work related health problems, whilst men did not; for many women formal employment in fisheries meant there was less time for domestic chores and childcare, in some cases leading to informal childcare arrangements between local community members. For agricultural workers, the main difficulty related to the high cost of inputs, in particular seed for high yielding varieties, which they are forced to purchase owing to problems experienced with farm saved seed. Wastewater use for irrigation during the dry months was perceived as advantageous as less fertiliser is required, however, the cost of pumping this wastewater, which has increased due to siltation of the canals, combined with increased susceptibility to disease and a loss of taste constitute problems requiring further assessment. Due to seasonal lulls in agricultural employment, women and girls interviewed recounted how they engage in supplementary activities such as collecting edible plants and snails and ragpicking, however, these activities are dependent on access to CPR and continued use of solid municipal waste on agricultural land in PU Kolkata. Young people engaged in unpaid agricultural labour for their families recognised the contribution they make to sustaining the household, however, some suggested that being obligated to do unpaid work put them at a disadvantage as they are not free to earn money for their personal use.

For those engaged in fish farming related activities, decreasing yields due to siltation in the ponds, disease and fluctuations in the wastewater supply constitute a serious threat to their livelihoods. Both men and women regarded permanent employment on large fish farms as the greatest benefit, providing security and the added benefit of sick pay, soft loans and half pay during periods when there is no work on the farm. These arrangements have been negotiated between the labour unions and fish farm managers, and although providing a form of social security, the farm managers perceive them as an added burden, particularly as farm productivity is apparently in decline. Young people working on fish farms recognised their contribution to enhancing the family income, however, it is widely acknowledged that 'poverty and illiteracy combine to make child workers vulnerable' (Ramanathan, 2000). Amongst the groups engaged in fish farming related activities there was also fear that owing to pressures to develop PU land for residential and industrial purposes access to employment opportunities and land for rent may be lost. Enhanced planning regulation and

better enforcement might contribute to reduced vulnerability, as would ensuring security of land tenure for poor farmers.

In general people in the focus groups identified a number of major constraints including low incomes, problems with electricity and drinking water supplies, a lack of health care provision and alcohol abuse. Enhanced farming practices might be able to contribute to improved incomes, but risks and vulnerability associated with such enhancements may also be increased, improved service provision is a responsibility of the municipal authorities in much of PU Kolkata and this suggests better development planning and coordination is required. Food security was not considered a problem and perhaps reflects the productive nature of farms in PU Kolkata and their contribution to providing affordable produce to poor communities in both PU and urban Kolkata. However, potential health risks associated with PU PS, in particular, contamination owing to the exploitation of waste resources demands further consideration. Punch et al. (2002) give a fuller description of key findings from the focus group interviews.

Household interviews with families engaged primarily in fish farming related activities demonstrated that a lack of work during the winter resulted in seasonal vulnerability. Most households also farmed some agricultural land to produce rice and vegetables for subsistence, with any surplus being sold, and in some cases younger male household members have entered into off-farm employment in the construction, manufacturing and service sectors. Despite widespread diversification of household livelihood strategies, families are still forced sometimes to take loans from moneylenders. For households primarily engaged in agriculture input and transport costs apparently constitute a significant burden, whilst problems with the availability of solid municipal waste, commodity price fluctuations and the seasonal lack of irrigation water are also of concern. During periods when work on their own farms is not possible due to insufficient water supplies, household members look for employment opportunities on other farms in the region, women and girls working for other farmers generally receive lower wages than men; some women engage in scavenging over fields in the area, selling things of value they glean to supplement their income. However, declining use of solid municipal waste on agricultural land in the area, due largely to logistical problems, appears to threaten this coping strategy. Some farming families stated that due to the risks associated with the weather, disease and uncertain wastewater supplies they were no longer intending to lease land to farm, but instead would work for other farmers or try to engage in a new occupation. Training for family members in appropriate skills and crafts may assist in the transition from agriculture to non-farm employment, whilst improved credit facilities might assist some in establishing new businesses.

Households whose primary income is derived from nightguard duties regarded their salary, annual bonuses and weekly fish allowance as the most important benefits of this type of employment. Due to the nature of the work it is also possible for guards to engage in other work during the day, and in most cases this involves tending their own land, ponds or livestock or working in the local fish markets. Although households recognised that work as a nightguard provided secure and consistent employment for a reasonable salary there is always the threat of physical violence, and the risk of injury or death from tackling poachers. In one case a nightguard household had purchased a mechanical tiller to hire out to others in the area, and whilst this might prove to be a good investment, there are attendant risks requiring consideration. Households dependent on seed trading face a high degree of seasonal unemployment, and consequently often engage in other income generating activities, such as working in local auction markets for fish. The seed traders are also affected by periods of political instability that makes travel in the area difficult, delays due to unforeseen accidents or breakdowns also constitute a serious problem. Emergency measures such as carrying oxygenation or aeration equipment might help lessen the risk of fish mortalities, however, the cost of such measures is likely to be prohibitive. Sweepers and garbage collectors are highly vulnerable as they have limited physical assets upon which to draw; of those households interviewed, both had experienced significant upheavals and consequently the KMC had found employment for the head of the household, although, the mechanism by which this occurred is not clear. One household was set in a slum, where access to adequate drinking water was considered a serious problem. Despite appearing relatively better off the auctioneer household interviewed remains dependent on fish production in the region.

Households and individuals in PU Kolkata engaged in activities related to farming experience seasonal vulnerability, which appears most closely related to insufficient access to water during the dry winter months, this is despite the continuous discharge of wastewater from municipal Kolkata. Siltation in the primary and secondary feeder canals is compounding this problem and coordinated action on behalf of the local and municipal authorities is urgently required to address this constraint. Problems regarding delivery to farmers and diversion of solid municipal waste to a new composting plant are forcing producers in the area to switch to inorganic fertilisers, which not only has consequences for yields, soil condition and disease and financial risks, but also denies some of the poorest local people a valuable coping strategy, namely gleaning items of value from rubbish spread on the fields. Considering the vulnerability of poor people in PU Kolkata, particularly during periods of water scarcity or where traditional coping strategies such as scavenging are denied them, either action should be taken to address the underlying problem, or to support those at risk in accessing alternative employment or income generating activities, which due to opportunities presented by living in PU Kolkata may or may not be NR based. From both focus group and household interviews it was apparent that improved infrastructure and service provision by the municipal authorities contributed to improved livelihoods for many people in PU Kolkata, however, problems in benefiting from even basic service provision persist for many due to

poverty denying access and incomplete geographical coverage. Such problems might be addressed through improved planning and resource allocation, including pro-poor policy, however, the formulation and targeting of such initiatives would likely require better communication and coordination of activities by local government bodies. Studies of market networks undertaken show them to be highly organised and efficient, however, appropriate initiatives to help address concerns expressed by many regarding high input costs and possible human health and animal welfare issues associated with marketing appear warranted. Having attempted to outline above pertinent issues related to the possible enhancement of poor livelihoods, it is necessary to note here that the complex physical, social and institutional nature of PU Kolkata dictates that any attempt to address the constraints identified should be planned and implemented in consultation with a broad range of stakeholders.

Table 4.1. Anticipated outputs, planned results and outcomes observed

Outputs	Planned result	Outcome
1. Nature and extent of land, water and waste use in LWI production systems defined	By month 6, horticulture and livestock enterprises and wastewater usage activities, including aquaculture, characterised through consolidation of existing knowledge and initial situation analysis	Productive activities were characterised through consolidation of existing knowledge in the literature review (Bunting et al., 2001a) and production of proceedings from the first project workshop (Bunting et al., 2001b); the situation analysis report, although delayed beyond the intended completion date, presents a comprehensive assessment of farming practices in PU Kolkata based on interviews with a sample of NR and farm managers (Bunting et al., 2002). A report was also produced relating specifically to the assessment of livestock and horticultural production in poor livelihoods (Harris, 2001). Although alluded to in project outputs, it was not possible to characterise fully the operation and management of household ponds managed for wastewater aquaculture and downstream farms producing shrimp and rice in brackish water conditions.
	By month 6, main institutions and actors in LWI identified	The main institutions and actors linked to activities in the PU LWI were identified through consolidation of knowledge in the literature review (Bunting et al., 2001a) and a stakeholder analysis activity at the first workshop (Bunting et al., 2001b).
	By month 6, information on LWI production systems consolidated in form suitable for stakeholders	New knowledge on LWI PS from the literature review, first workshop and situation analysis was consolidated and presented to stakeholders in working papers. This communication pathway was considered suitable as in the first workshop a range of stakeholders, including NGOs, identified technical reports as one of their most valuable knowledge resources; possible reasons for this have been discussed in developing the project communication strategy (Bunting, 2002a).
	By month 6, survey data organised for subsequent use	Survey data collected as part of the situation analysis was organised in an Excel spreadsheet for subsequent use (Kundu, 2002); these data were utilised in preparing the situation analysis report (Bunting et al., 2002).
2. New knowledge on the role of LWI production systems and associated activities in the livelihoods of selected groups of the poor generated	By month 9, identify groups of the poor that engage in main LWI production activities	Through conducting a comprehensive literature review and workshop activity dealing specifically with the identification of poor people that depend on PU PS it was possible within the time specified to identify groups of the poor that engage in main LWI production activities. This knowledge, together with access negotiated during the situation analysis activity, was used to identify selected groups of the poor to invite to participate in subsequent focus group and household interview activities (Punch, 2001b).
	By month 24, livelihood strategies of target groups of poor men, women and young people characterised, particularly their use of natural resources in LWI production systems studied, and contribution to household food security and income generation assessed	Through focus group interviews it was possible to characterise some typical livelihood strategies of poor groups of men, women and children based on their main occupation. However, the participatory approaches employed made it difficult to draw out intra-group differences. Household interviews provided some additional insight concerning the different roles and responsibilities of men, women and children in poor families, although the complex and diverse nature of household livelihood strategies observed makes it difficult to formulate generalised conclusions. Responses obtained during focus group and household interview (Punch et al., 2002) must be considered in the context in which participants conduct their livelihoods. Due to resource constraints it proved unrealistic to cover all those groups of the poor identified in the preliminary sampling strategy (Punch, 2001b).
	By month 24, new knowledge on the contribution of produce from LWI production systems to local markets generated	New knowledge was generated on the role of produce (mainly fish) from PU Kolkata to both wholesale and retail markets in and around the city (Little et al., 2002). Estimates from this work suggest production from PU farms has increased over the past decade, whilst the type and size of fish produced make them particularly important in the food security of poor people. Interviews with consumers at retail markets also revealed a negative perception of products from farm in PU Kolkata culturing fish using wastewater.

	By month 24, main constraints and opportunities for livelihood enhancement identified and ways in which these may be taken forward defined	Emphasis was given to identifying constraints and opportunities for livelihoods enhancement throughout the project; key findings are summarised in workshop proceedings, situation analysis and focus group and household interview reports. Ways in which opportunities may be taken forward and constraints addressed were discussed with stakeholders during the second workshop (Bunting and Mukherjee, 2002). Although, several promising strategies were identified it is likely that institutions identified as having key roles to play may require support to facilitate development of appropriate plans for action.
3.1. New knowledge on the role of institutions and key actors in regulating access to land, water and waste resources at the peri-urban LWI generated and influence on the use of natural resources and associated activities assessed	By month 6, target institutions, planners and other actors made aware of project objectives	Through participating in the first workshop and engaging with them in organising the institutional analysis activity, a range of target institutions, planners and actors were made aware of project objectives.
	By month 6, building on existing links, target institutions agree to attend project workshops and participate in a process of institutional assessment	Due to largely logistical problems it proved difficult for all target institutions to attend the first workshop. Punch (2001a) reported on specific problems, and lessons learnt were used to ensure better participation at the second workshop. Meetings with representatives from target institutions contributed greatly to knowledge on their role in managing PU LWI PS and NR (Edwards, 2001; Edwards, 2002a).
3.2. Target institutions more sensitised to constraints and opportunities of managing the peri-urban LWI	By month 18, structures and processes of institutions active in both urban and peri-urban areas that influence activities at the peri-urban LWI assessed	Knowledge consolidated during the literature review and generated during the institutional analysis activity contributed to the assessment of structures and processes of institutions that influence activities at the PU LWI. Based on this assessment it was possible to highlight areas of conflict between institutions and identify opportunities for mutually beneficial development and policy options (Edwards, 2002a).
3.3. Target institutions, planners and actors made more aware of features of the LWI in the PUI of Calcutta, particularly the livelihood strategies of the poor through various means of communicating the project's findings	By month 18, most appropriate communication materials for different stakeholders identified	Appropriate communication media for stakeholders were identified at the first workshop, the communication strategy developed for the project outlines further the rationale that guided the targeting of communication media
	By month 25, appropriate communication materials produced and disseminated to stakeholders	Communication materials, in particular, working papers were disseminated to target institutions, however, it was considered important to ensure stakeholders had unrestricted access to this knowledge, and therefore these outputs were also published on the project website (Institute of Aquaculture, 2002).
	By month 26, target institutions, planners and actors made aware of project findings through dissemination of appropriate communication materials, project reports and the second project workshop	Awareness of target institutions, planners and actors has been raised by the dissemination and web-based publication of appropriate communication materials; presentations to workshop participants also contributed to dissemination (Bunting and Mukherjee, 2002) as did meetings with individual target institution representatives (Edwards, 2002b). Discussion of findings at a regional workshop helped formulate the 'Hyderabad declaration on wastewater use in agriculture' (CGIAR, 2002), signed by partners from the DoF and DoE, GoWB.

Table 4.2 presents a summary of communication materials produced by the project and how they were disseminated to stakeholders and promoted with target institutions; behavioural change and policy action by stakeholders is also reviewed. A further record regarding the distribution and lodgement of communication materials produced by the project for stakeholders is presented as part of working paper describing the development, implementation and outcomes of the project communication strategy (Bunting, 2002).

Table 4.2. Stakeholder groups, the context in which they operate, perceived knowledge demands and dissemination activities undertaken and outcomes

Stakeholder	Context	Knowledge demand	Dissemination activity and outcome
Poor people	Poor people in PU Kolkata are largely employed in farming and related activities; vulnerable to rapid and unforeseen change; knowledge of threats and livelihood opportunities may therefore help them safeguard or improve their situation	Knowledge of emerging threats to help plan and evolve coping strategies; a summary of legislation and advocacy groups for empowerment; feedback to the community to meet expectations	Knowledge of the research objectives was communicated directly during participatory activities, and feedback provided to questions and concerns; based on outcomes from the first workshop, situation analysis and focus group and household interviews it was apparent that poor groups have limited capacity to cope with unforeseen and unexpected change, therefore, emphasis was given to providing information on constraints and opportunities to livelihoods enhancement to target institutions with the objective of helping promote development initiatives and policy change that enable poor people to improve their livelihoods. Participation of poor groups in the second workshop provided an opportunity to disseminate findings to local communities and seek their contribution to developing appropriate plans for action.
Advocates for the poor; CBOs, NGOs (CARE-India, WWF)	Involved in various aspects of trying to enhance poor livelihoods; mostly with limited resources for research and have demonstrated demand for knowledge outputs from the project	Knowledge of benefits to poor people of PU farming to help in advocacy and summary of constraints to help target future development initiatives	Knowledge of the research objectives and activities was communicated initially to CBOs and NGOs (PUBLIC & CIT) during the first project workshop, their feedback was used to guide the selection of groups of the poor and appropriate communication media. Constructive dialogue with various NGO and CBO groups was also fostered through meetings during the institutional analysis. Further, meetings with NGO and CBO groups were undertaken by various project team members, and meetings at the offices of CARE, WWF-India and CIT, and the provision of working papers, helped facilitate their participation in the second project workshop; their participation contributed to the identification of actions with potential to enhance poor livelihoods and lead to offers of training and micro-credit provision.
Fish, vegetable, rice and livestock producers KMC; KMDA; DoLLR; DoIW	Farmers aware of practical constraints yet lack assets and resources to cope with rapid change; training and advice restricted; some family members engaging in urban activities Generally aware of PU activities but perhaps give priority to urban issues; better awareness of benefits from PU farming may help evolution of more equitable development policy, including resources for PU socio-economic development	Knowledge of wider benefits to society from PU farming for empowerment, summary of constraints and emerging threats to help build consensus and inform decision making Knowledge of conflict and possible synergy between stakeholder positions to help build consensus and develop equitable policy initiatives; outputs of first project workshop and institutional analysis highly relevant	Knowledge of the research objectives was communicated directly during the first project workshop and situation analysis. A user-friendly leaflet was also produced for distribution to participants to reinforce this communication. Key findings were presented to producer representatives at the second workshop and their participation assisted in identifying promising actions to enhance poor livelihoods. Participation of this target group at the first workshop was limited, and highlighted by a stakeholder analysis activity with participants. The institutional analysis provided an opportunity to engage directly with various target institutions (KMC, KMDA & DoIW) and to provide knowledge of the project and its objectives. Dissemination of project findings to these institutions was achieved through presentations at the second workshop and international WEDC conference held in Kolkata, by distributing project reports and publishing them on the website and through targeted meetings as part of an active dissemination process. Attendance of the MIC, DoLLR at the second workshop demonstrated impact on this department. Collaboration on all project activities, including planning, helped ensure new knowledge on poor livelihoods and appropriate research approaches was taken into the institution. New knowledge on specific problems facing fish producers and of seed trading networks and fish marketing channels also highlighted opportunities to sustainably increase production and productivity, enhancing poor livelihoods. Following a specific request during a meeting all project working papers were lodged with the MIC, DoF, ensuring dissemination to the most senior level in the institution, and in turn led to the MIC participating in the second workshop. Outcomes from the workshop also indicated that DoF were keen to use the new knowledge provided to help coordinate appropriate actions in PU Kolkata and to guide the development of PU PS for other municipalities. As a consequence of collaborating on the project a DoF representative also signed the 'Hyderabad declaration of wastewater use in agriculture' (CGIAR, 2002).
DoF	Research on selected technical issues ongoing, however, training and advice needs of producers more oriented toward practical issues	Knowledge of constraints to fish production to help focus resources and develop appropriate policy response; knowledge of markets and seed supply networks critical to supporting quality enhancement	As a collaborator on the project all project outputs have been lodged with this target institution and new knowledge on poor livelihoods and appropriate research approaches was taken into the institution. Targeted meetings with senior members on the DoE and WBSPCB helped reinforce the communication of project findings. As a consequence of these activities the institution is using project findings to help develop a management plan for EKW for submission by GoI to the Ramsar Bureau. A DoE representative also acted as a signatory to the 'Hyderabad declaration of wastewater use in agriculture' (CGIAR, 2002).
DoE; WBSPCB; tannery operators and polluting activities	Threat of environmental degradation from industry recognised by all parties but non-co-operation of polluters and limited monitoring are constraining improvement	Knowledge of waste resource contamination to raise awareness amongst tanneries and assist DoE - WBSPCB develop enhanced environmental protection policy	Knowledge of new benefits to society of PU PS was communicated through mass media coverage of the second workshop, however, further work would be required to raise awareness of the full range of new knowledge generated and to assess the impact and change in awareness engendered.
Kolkata city (general society); tax payers	Awareness of PU farming and benefits to society limited, especially of subsidy afforded to society by managed waste reuse	Knowledge of benefits to society from PU farming and possible impact on environment and economy resulting from loss	

Bankers and credit institutions	Formal credit providers are reluctant to lend to PU farmers as they lack security, however, micro-finance, exposing lenders to low risks, could significantly enhance poor livelihoods	Knowledge of credit problems faced by farmers, particularly situation analysis report, to assist credit providers deliver more appropriate and flexible arrangements	During the situation analysis and focus group and household interviews, savings and credit arrangements were described. New knowledge on the limited access to credit and problem this caused for producers and poor people was presented at the second workshop. Two organisations involved specifically in providing loans (NABARD) and helping establish micro-credit schemes (CARE) who attended the meeting helped identify possible opportunities to provide credit in PU Kolkata, to sustainably enhance production and productivity, initially through desiltation, and to help poor families invest in livelihoods diversification. Knowledge of the project objectives was communicated directly to seed and wholesale and retail market traders during survey work. Findings from this work have been posted on the project website, but due to delays in reporting, new knowledge was not communicated effectively to traders and market associations. Further dissemination of key findings to traders could assist them in identifying opportunities to enhance product quality, food safety and their own competitiveness.
Wholesale markets, market owners, retail vendors; seed traders; processors	Large numbers of traders depend on servicing PU farms for their livelihood; individual traders must consider quality control to safeguard public health and increase competitiveness of PU farms	Knowledge of constraints and opportunities in market networks, to enhance functioning, competitiveness and quality	During the first round of meetings conducted as part of the institutional analysis senior representatives from WBIDC and HIDCO were presented with information on the project and its objectives. Feedback from these institutions highlighted the tension between urbanisation and preserving PU PS. It is anticipated that project reports published on the project website could constitute an important knowledge resource for these institutions although information on actual uptake and adoption is not available, further work would be required to assess this.
Developers & planners (WBIDC, HIDCO)	These institutions are primarily concerned with urban issues, however, failure to consider impact on PU activities threatens many poor livelihoods and continued supply of environmental goods and services currently supporting societal system	Knowledge of benefits to society from PU farming and possible impact on environment and economic development resulting from loss	The participation of local researchers in the first project workshop helped disseminate information of intended project activities and objectives. Presentations at the second workshop, regional workshop organised by IWMI and international WEDC conference contributed to disseminating findings to this group. Project reports posted on the website also constitute a valuable resource to help target future research work on PU PS in the region on critical knowledge gaps. However, outputs from the second workshop suggest researchers should concentrate resources more on addressing identified constraints through appropriate actions implemented in collaboration with local stakeholders.
Scientists - local, national and international	Activities must now focus on the transition from research to development, plans of action are required to translate findings into action	Knowledge of constraints that demand further research to help safeguard and enhance poor livelihoods	Information of project objectives was communicated to selected consumers during the retail market survey; dissemination of knowledge to this group has been limited and future initiatives to raise awareness of possible food safety issues etc. should be given careful consideration so as not to panic or confuse consumers. However, it must be noted that there are potential health risks associated with PU PS and these demand further assessment to safeguard producer, public and environmental health.
Consumers	Consumers in Kolkata are buying large quantities of produce from PU farms; providing advice on the safe storage and processing of products may be critical to ensuring health risks are minimised	Knowledge of benefits to society from PU farming (information on food safety has not been collected therefore not possible to comment on this aspect)	During the institutional assessment it emerged that international development agencies, including ADB and DFID-India were planning and implementing urban-based projects (CUSP & CEIP) with considerable scope to impact on poor livelihoods dependent on PU PS. Through email communication the Head of Urban Planning, ADB expressed a demand for project outputs and these were communicated in the form of working papers. Meetings with the DFID representative in Kolkata further highlighted the potential role of outputs in informing the CUSP project and during a meeting with engineering and rural livelihoods advisors at the offices of DFID-India in Delhi a request was received for project outputs, specifically relating to the institutional analysis. It was also agreed that the dialogue would be continued at the WEDC conference in Kolkata, however, due to communication difficulties this was not possible. It is anticipated that the full range of project outputs, and in particular working papers, constitutes an important knowledge resource for use by institutions such as ADB and DFID-India, although an evaluation of the impact of project outputs on planning and policy would require further assessment.
International development agencies (DFID-India, ADB)	- Development agencies are investing in services and infrastructure to enhance the livelihoods of the urban poor, however, possibly negative impacts on the PU poor do not appear to have been considered in full. - Considering the lack of wastewater treatment in West Bengal and India, knowledge from this study may be useful in guiding the development of wastewater reuse practices in other regions. - Development agencies may be well positioned to implement projects at the PUI that deal with the issue of how to enable poor people that depend on PU production to escape poverty, possibly by incorporating non-NR based activities in their livelihoods.	- Knowledge of the vulnerability of the PU poor to changing circumstances, particularly access to land and waste resources may assist in developing more equitable development initiatives that enhance the livelihoods of both the urban and PU poor. - Although not directly transferable due to the complex social and institutional setting in which the system has evolved, knowledge of such issues may help establish appropriate approaches elsewhere. - Knowledge of significant and varied threats to PU farming may suggest assistance is required for poor people to facilitate their transition from NR-based livelihoods to alternative, less vulnerable & more rewarding activities.	

5. Research Activities

Achievements relating to activities outlined in the project logframe are described below, where appropriate references are given for project reports and outputs that present a more detail account of methods employed and outcomes of activities undertaken. Figure 5.1 shows a schematic representation of the research activities undertaken during the project and highlights linkages where knowledge from a preceding activity was used to inform and target subsequent actions.

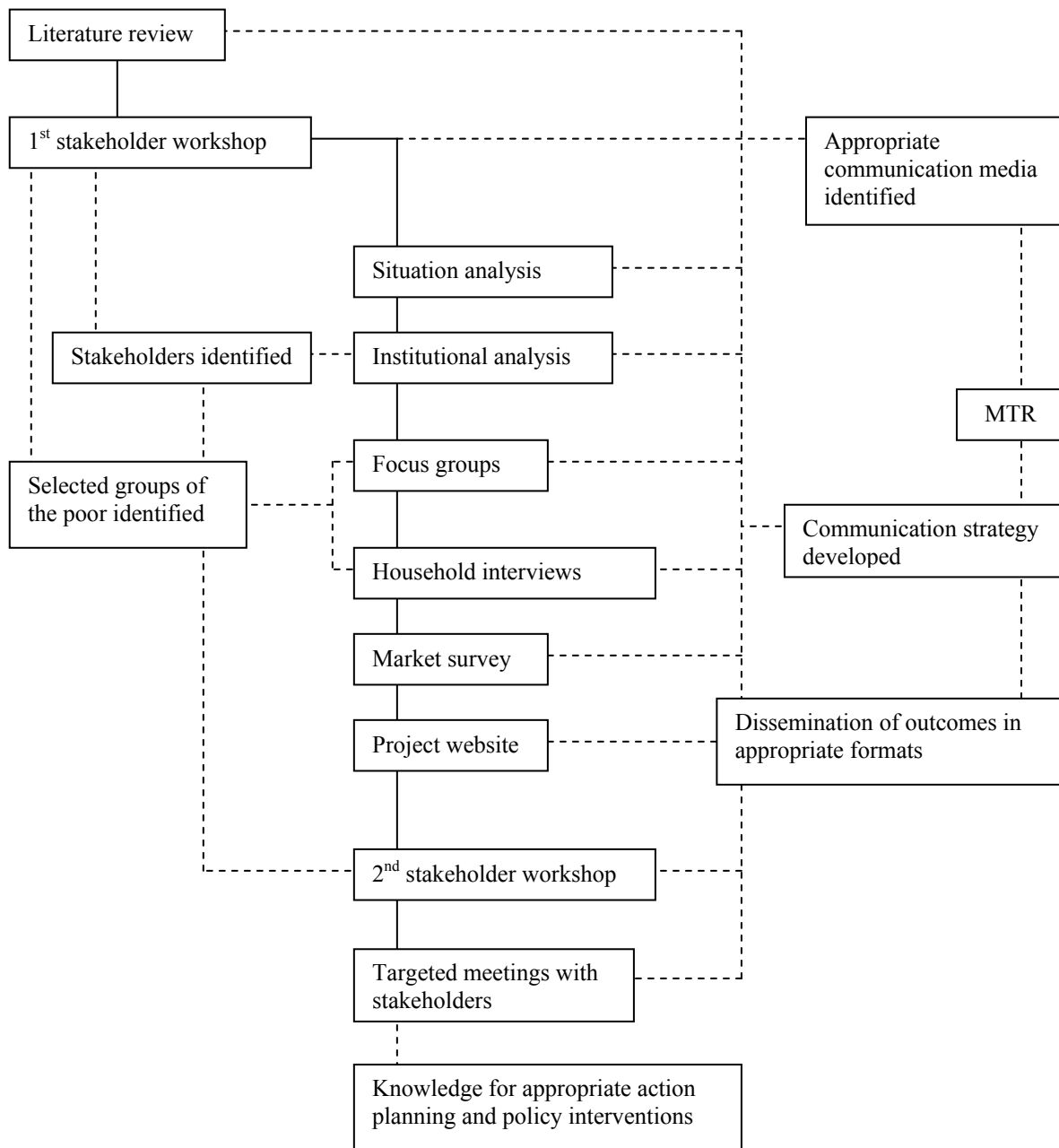


Figure 5.1. Overview of inter-linkage between research activities constituting the study of livelihoods dependent on PS in PU Kolkata (solid line links activities, dashed line shows knowledge flows)

1.1. Collaborative links developed, work plans written and RA's engaged

During month 6 a Memorandum of Understanding was drafted between the Systems Group, Institute of Aquaculture and IWMed, DoE, GoWB and the Systems Group and DoF, GoWB this activity was designed to better facilitate project management, and was carried out in addition to work plans and Terms of Reference drafted during month 3. As a consequence of the management approach adopted it was noted in the project MTR that 'The two Kolkata

collaborators of the project team are substantially involved in the project, and there is no doubt that they are taking the new knowledge into their organisations and will use it' (Mattingly, 2001).

1.2. RA's trained in participatory methods, database management and Sustainable Livelihoods Approaches

Further to training provided during month 4, local team members from collaborating institution were provided with training in various fieldwork techniques during month 6; this included work on building rapport, interviewing skills, observation, reporting, potential difficulties and the investigation of key areas of concern such as natural resources, seasonality, urbanisation, migration, gender and age (see Punch, 2001a). Further training on fieldwork techniques, particularly approaches for the focus group and household studies was also carried out, and activities undertaken focused on selecting and interacting with household and community members (Bunting, 2001a; Punch, 2001b). During the course of the project it was apparent that training requirements of the local team members were ongoing and required identification and addressing at regular intervals. However, despite previous training, during the mid-term review it emerged that research assistants were encountering problems conducting fieldwork, as participants were reportedly disinterested and frustrated (Mattingly, 2001). These problems were subsequently discussed with the local team leaders who agreed to work with their researchers to develop appropriate strategies for engaging with participants and building rapport.

1.3. Database established to collate project data and monitor publications and media coverage

Coordination of reports and publications relevant to the project was facilitated through the establishment of a ProCite database; a word document was used to record reports, publications and media communications emanating from the project. During the course of the project these databases were consulted by team members to help inform a DFID AFGRP programme development activity concerning the sustainability of fish seed trading networks in West Bengal and to develop a successful proposal regarding 'Production in aquatic peri-urban systems in southeast Asia' for the FP5 EU-INCO DEV programme. Most recently the databases have been used to help develop an annotated bibliography on urban aquaculture for publication by RUAF as part of their online and CD-ROM based compendium on Urban Agriculture (Bunting and Little, forthcoming).

1.4. Relevant literature, reports and studies by partner institutions reviewed

Collation of materials and production of the initial literature review in collaboration with local team leaders resulted in a comprehensive assessment of past research activities in PU Kolkata, as well as critical gaps in the knowledge base. The review also helped identify selected groups of the poor that depend on PU farming to support part or all of their livelihood and contributed to identifying the broad range of stakeholders associated with managing the PUI. Broader issues raised by the review were also considered useful in guiding research and development initiatives in other situations and as a result the review has been modified and will contribute to the forthcoming RUAF compendium on Urban Agriculture.

1.5. Situation analysis facilitated using RRA and PRA techniques including transect walks, stakeholder analysis, resource mapping, timelines, income and activity calendars and the development of wealth indicators to characterise the nature, extent and timing of LWI production systems

During the initial phase of the situation analysis training was provided to project team members concerning fieldwork, a semi-structured questionnaire incorporating participatory tools developed and tested, and a survey framework established to guide the research (Bunting, 2001b). Based on outcomes from the literature review it was apparent that farming activities in PU Kolkata were concentrated to the east of the city, and therefore interviews with NR managers producing fish, rice and vegetables were focused in this area. Following the production of a summary report of data collected during the situation analysis and separate review of crop and livestock production by Harris (2001) the content and format of the situation analysis report was discussed and refined. The final situation analysis report, produced in collaboration with both local project team leaders, constitutes a comprehensive appraisal of the current status of farming activity at the Kolkata PUI based on survey work with a representative sample of fish, vegetable and rice farmers (Bunting, Kundu and Mukherjee, 2002). To facilitate free and unrestricted access to the final situation analysis report it has been posted on the project website.

1.6. Summary of the role of LWI production systems in livelihoods at the peri-urban interface in user-friendly documents

Based on expressions of demand for communication materials outlined by participants in the first project workshop, it was noted that well prepared project reports would constitute a valuable and appropriate communication medium for disseminating knowledge on the varied livelihood activities of people dependent on LWI production systems in PU Kolkata. Initially it had been thought that more concise outputs may have been requested, but various stakeholder groups expressed a preference for more detailed technical reports, possibly as such reports have the advantage of communicating more information regarding the context in which poor people live and work, as opposed to brief summaries. In the past there has also been only limited and restricted distribution of project reports dealing with issues in PU Kolkata and as a consequence stakeholders appear keen to access as much information as possible. The role of

LWI production systems in livelihoods at the Kolkata PUI has therefore been summarised in a project working paper (Punch, Bunting and Kundu, 2002). To facilitate widespread, free and easy access to this report it has been posted on the project website. Although briefing documents were not requested by stakeholders for main project outputs, the project team considered it useful to prepare a summary leaflet for the project to assist in communicating the nature, aims and objective of the project to participants and other interested stakeholders (Institute of Aquaculture, 2001).

1.7. Target groups of the poor identified based on findings from the initial situation analysis and discussions with stakeholders and actors facilitated through the first multidisciplinary project workshop

The first project workshop, planned for month 5, was held in the training room at the offices of the WBSPCB, DoE on April 15th 2001 and attended by ~30 stakeholders. Representatives were invited from target institutions, government departments, NGOs, CBOs, farmer associations, media organisations and research community. Following registration and an opening address from the Director, IW MED, the project and workshop objectives were introduced and participants requested to complete a simple mapping exercise to formalise their personal perspective of constraints and opportunities for PS at the Kolkata PUI. Then in groups with largely similar backgrounds i.e. producers, NGOs, researchers and government officials, participants were asked to list and rank these problems and benefits and present their findings to the workshop. The focus of the workshop then changed and participants were asked to identify groups of the poor present at the PUI, to rank the relative poverty of these groups and for the four poorest, suggest what factors contribute to their poverty and how they benefit from the PUI. Following the presentation of this group work, a short brainstorming exercise was facilitated to identify stakeholders, other than the poor, associated with the Kolkata PUI. Participants were then asked to prepare a short sketch for a role-playing exercise *Anyer Chokhe Dekha* 'seeing through the eyes of another' and to present this to the workshop. Project activities planned for the future were then discussed and participants asked to identify which communication media they would find most valuable. Finally, outcomes from activities during the day were synthesised in a short presentation and participants asked to evaluate the workshop. Proceedings from the workshop were compiled (Bunting et al., 2001b) and outcomes used to guide the initial institutional analysis and inform the selection of poor groups at the PUI for further investigation. Proceedings were disseminated to participants and other stakeholders that could potentially benefit from knowledge of the outcomes, and published on the project website to permit unrestricted access.

2.1. Target groups of the poor selected, based on the contribution of LWI production systems to livelihood strategies and numbers engaged in particular activities, and report produced

Knowledge generated during the first project workshop was critical in guiding the selection of groups of the poor for further investigation. Within the workshop addressing the question of "Who are the poor?" gave a reasonable insight in to the types of poor livelihoods at the Kolkata PUI and where the focus of future investigation should lie. However, some of the poor groups identified may benefit less from enhancing management strategies for PU natural resources than other groups. Therefore, where possible, information on livelihoods less dependent on the natural resource base will be communicated to other organisations with the capacity and objective to assist such groups. A key opportunity identified was the potential role of new knowledge from the project to inform forthcoming initiatives such as the ADB and DFID funded CIEP and CUSP initiatives. Although the workshop outputs were useful in identifying selected groups of the poor for a detailed livelihoods assessment, further consultation with local partners and exploratory field visits were required to further focus the final sampling framework (Punch, 2001b).

2.2. Project annual report(s) compiled

Annual and quarterly reports have been compiled and submitted in a timely fashion to the NRSP Managers to help communicate recent progress with project activities, where possible outputs were submitted with these interim reports. The reporting procedure was viewed by the project management team as a useful exercise in assessing the progress of the project against its stated objective.

2.3. Interviews with different household members including men, women and young people from target groups employing PRA techniques, including semi-structured interviews, resource mapping, timelines, income and activity calendars and preference ranking to assess the role of LWI production systems in their livelihoods

Preparatory work for focus groups and household interviews involved the development of appropriate PRA tools to permit participants to relate knowledge of their experience of depending on farming in PU Kolkata. This process involved proposing and testing selected tools and training research staff in their application and reporting (see Punch, 2001b). The development and application of PRA oriented tools was considered vital as it was hoped less extractive methods would assist in overcoming the apparently widespread research fatigue that has been encountered at the Kolkata PUI. Progress with the implementation of both focus group and household interviews was assessed during an interim review and as a result several suggestions were proposed to help in refining the interview and reporting process (Punch and Kundu, 2001). Although targeting of focus groups and household interviews with selected poor groups was well defined, and the number of interviews relatively small, the depth of enquiry resulted in a comprehensive dataset which demanded a great deal of manipulation and assessment in order to produce the final working paper (Punch et al., 2002).

2.4. Market analysis and consumer surveys to assess the contribution of products from peri-urban LWI farming to supplying the needs of the poor

Initial market visits were used to inform the market analysis; surveys forms for both auction markets and retail markets were developed, as were interview frameworks for individual auctioneers, retailers and consumers (Bunting, 2001a). Preliminary survey forms for both auction markets and retail markets were tested and refined with individual auctioneers and retailers. During the course of the study, interviews were taken on a monthly basis to collect data concerning the fish-trading network supplying urban markets and giving insight to seasonal trends in production and price. Although planned for completion by month 20, it was considered that seasonal variations in marketing may have serious consequences for poor communities, and therefore monitoring work was extended to cover a full year. From this work it is apparent that despite facing several different constraints, based on the number of traders active in the regions auction markets, production of fish in PU Kolkata appears to be increasing (see Little, Kundu, Mukherjee and Barman, 2002). Estimates from the study suggest that in excess of 18,000 t of fish is traded through the four auction markets surveyed. This indicates production from PU fish farms is significantly higher than previously thought, especially as only four of the eight main auction markets in PU Kolkata were surveyed. Higher estimates for the production of fish from PU Kolkata also suggest the system is more important than previously thought in the food security of poor people. Regarding the retail markets it was found that the location and customer-base influenced the type of vendor likely to be present, vendors selling small live carp and tilapia originating from PU Kolkata tended to trade alone and have relatively small amounts of fish for sale, as compared with vendors selling large iced IMC from other states and marine fish. Of the consumers interviewed roughly 50% had a negative opinion regarding the use of wastewater to produce fish. A preliminary assessment of table-fish market networks was undertaken as part of the joint project with the DFID AFGRP programme development exercise investigating seed trader networks in West Bengal (see Milwain, 2001). Aspects concerning the role of fish seed trading and supply networks in supporting production and livelihoods at the Kolkata PUI were also comprehensively reviewed during this study and further information concerning livelihoods impacts was assimilated to develop the academic thesis into a project working paper (Milwain, Little, Kundu and Immink, 2002). This output gives an important insight to the extent to which PU fish production supports poor livelihoods, even in areas quite distant from Kolkata city.

2.5. Issues relevant to gender and generation summarised and reported

The community level investigation of livelihood strategies with selected groups of poor people was largely facilitated through focus groups and household interviews. Focus groups permitted the influence of age and gender on livelihood activities to be assessed and compared between various groups, based on their predominant occupation. The household interviews gave an insight to the diversity of activities undertaken by different household members, the division within households, and the role of age and gender in decision-making and participation in social networks. The outcomes of these interviews were assessed and summarised in a combined working paper (Punch et al., 2002) and this has been posted on the project website and distributed to selected target institutions, including DoF, DoE, CARE and DFID-India. Preliminary findings on issues relating to gender were also presented at a regional workshop on the role of wastewater agriculture in poor livelihoods organised by IWMI (Mukherjee, Datta, Mookherjee, Punch and Bunting, 2002).

2.6. Compilation of a publication for peer review

Currently a summary of key findings from the project is being prepared and will form a chapter entitled 'Aquaculture, wastewater reuse and poor livelihoods in peri-urban Kolkata, India' in the forthcoming book on Urban Aquaculture to be published by CABI; it is expected publication will occur early in 2003.

2.7. Constraints and opportunities for livelihood enhancement recorded and described during the project, summarised and reported

During the course of the project, constraints and opportunities for livelihood enhancement have been assessed and summarised in a number of reports and outputs. Documents summarising particular areas of note include the: situation analysis report that deals with constraints and opportunities at the farming systems level, as many poor livelihoods in and around Kolkata depend on these activities; report on focus groups and household interviews which details constraints and opportunities facing specific groups and households based on their primary occupation; second project workshop proceedings in which local stakeholders discuss possible plans of action to address some of the constraints and opportunities to livelihoods enhancement identified. Project outputs produced in an attempt to further summarise key livelihood constraints and opportunities identified during the project include papers presented at the second project workshop (Bunting and Mukherjee, 2002) and 28th WEDC Conference (Bunting, 2002b).

3.1. Building on existing contacts and dialogue initiated at the first project workshop, target institutions, planners and actors made aware of project objectives

Several key actors and representatives from various stakeholder groups attended the first project workshop, however, due to several problems (see Punch, 2001a) it was not possible to involve the range of senior stakeholders and target institutions intended. The absence of representatives from these organisations was highlighted by the stakeholder

analysis exercise during the workshop. Having acknowledged the limitations of the first workshop this provided an added impetus to engage with those key stakeholders not able to participate and to modify arrangements for future project workshops to achieve a more representative and equitable forum for debate. However, as a direct result of outcomes from the workshop it was possible to identify specific target institutions, planners and actors to engage with in the subsequent institutional analysis, and this more target approach appeared relatively useful in eliciting the perceptions of specific institutions regarding PU farming and in informing them of the intended project objectives (see Edwards, 2001).

3.2. Institutional assessment planned

Knowledge generated from the first project workshop was used to inform the planning of the institutional analysis exercise, ensuring the project engaged directly with key actors, target institutions and planners and leading to a more comprehensive assessment of the institutional and policy setting in which NR management and exploitation in PU Kolkata occurs. Based on the identification of stakeholders during the workshop a comprehensive programme of meetings was arranged for the first phase of the institutional assessment.

3.3. Institutional assessment undertaken, key actors interviewed and legislation and policy documents reviewed, enabling an assessment of structures and processes that influence the adoption and sustainability of peri-urban LWI production systems and associated activities

As part of the institutional analysis, senior representatives from target institutions, including KMC, KMDA, DFID-India, WBIDC, HIDCO, DoIW, DoF and DoE were interviewed regarding the organisations' perspectives and motivations concerning the management and planning of the Kolkata PUI; a comprehensive assessment of outcomes from the meetings was subsequently undertaken and key areas requiring further consideration identified (Edwards, 2001). Following from this activity, the need to interact further with target institutions and senior stakeholders and enable access to project outputs was highlighted during the MTR. To permit further interaction a second project workshop was organised and this was attended by ministers from the DoF and DoLLR, GoWB a number of international and local NGOs, CBOs, producer representatives and other stakeholders; key project findings were described and outline plans to initiate action planning discussed (Bunting and Mukherjee, 2002). A second round of interviews with senior stakeholders from target institutions (KMC, DoIW, DoE and DoF) also permitted the discussion of specific project outputs and discussion of likely future actions (Edwards, 2002b). Regarding the wider dissemination of project outputs, in addition to passing reports directly to senior stakeholders, the publication of reports on the project website was undertaken to facilitate unrestricted access. Outputs from the project have also been highlighted through online articles, conference papers and presentations at regional workshops.

3.4. Project findings summarised in communication materials appropriate for dissemination of project findings selected through stakeholder consultation

Research on identifying which communication media various stakeholder groups regarded as most useful and therefore appropriate began during the first project workshop. During the MTR the need to better engage with target institutions was identified and following this work was undertaken to formulate an effective communication strategy for the project (Bunting, 2002a). Based on outputs from the first workshop, it was noted that various stakeholder groups including government and NGO representatives, expressed a preference for project technical reports. This finding was largely attributed to the fact that access to reports from past research and development initiatives in the region has often been restricted. To permit stakeholders, particularly from target institutions (KMC, KMDA, DFID-India, DFID-NRSP, DoIW, DoF, DoE and NGOs) free and easy access to the range of project outputs, in particular technical reports which deal with a variety of issues that affect the livelihoods of poor people in PU Kolkata, it was decided to publish these documents on the project website (Institute of Aquaculture, 2002). Furthermore, publicity for the website from an article in the *New Agriculturist* online journal (New Agriculturist, 2002) resulted in interest for further project outputs from DFID-India, IWMI (Country Director, India) and ADB (Head of Urban Planning). Two of these constitute important target institutions that are currently planning major development projects in Kolkata (CEIP and CUSP), outcomes of which may significantly affect the livelihoods of poor people at the PUI. A meeting with representatives of DFID-India in Delhi also provided a valuable opportunity by which to disseminate project outputs to a key target institution and assess prospects for enhancing future outputs to meet the needs of such development orientated institutions. The meeting also led to a direct request for the project report detailing outcomes from the stakeholder analysis activity as it was regarded as a useful resource to help implement forthcoming development plans. The *New Agriculturist* article also led, in part, to an invitation by IWMI to present a paper at a regional workshop on wastewater reuse in poor livelihoods, and as a consequence led to project team members from the DoE and DoF signing 'The Hyderabad Declaration on Wastewater Use in Agriculture'. Presentation of a paper 'Wastewater-reuse and poor livelihoods in peri-urban Kolkata' (Bunting, 2002b) at the 28th WEDC Conference on 'Sustainable environmental sanitation and water services' also contributed to further raising awareness of the project amongst international delegates and local stakeholders that attended the conference. Engagement with local communities during fieldwork enabled direct knowledge transfer concerning the project objectives and permitted immediate feedback to questions and requests for further knowledge and contacts. However, the wider dissemination of key project findings to local

communities and primary stakeholders remains a priority, which has been achieved in part through the second project workshop, and local coverage of this activity in local newspaper articles and television broadcasts (see Bunting and Mukherjee, 2002).

3.5. Productive institutional dialogue encouraged at second workshop with partners, target institutions, planners and actors to review project findings and disseminate new knowledge in appropriate formats

Where possible preparations for the second project workshop took account of limitations experienced with the first. Attendance at the second workshop was higher with a wider range of stakeholders being represented. Presentations during the first half of the workshop helped disseminate project findings, whilst open discussions in the second half allowed stakeholders to debate the actions they perceived as being most appropriate to address some of the key livelihood constraints and opportunities identified by the project. However, despite significant effort it proved difficult to arrange for senior participants from target institutions such as KMC, DoIW and DoE to attend, consequently a second round of targeted knowledge interventions in the form of meetings were arranged with these institutions (see Edwards, 2002b).

3.6. Database interrogated to assess the extent to which new knowledge emanating from the project has been disseminated

Although a database of project communications was established, the extent to which knowledge emanating from the project has been disseminated has formally been documented in the proceedings of the second project workshop (Bunting and Mukherjee, 2002), which contains a list of participants present and their comments, and report detailing meetings with target institutions in which key findings were discussed (Edwards, 2002b). A number of less formal dissemination activities have also been documented in project annual and quarterly reports and working paper outlining the communication strategy developed for the project (Bunting, 2002a).

3.7. Project findings summarised and presented in the project Final Technical Report

Due to the range and depth of research activities undertaken during the project it was only possible to present a brief summary of project findings in the FTR, however, where possible references to specific reports constituting a more detailed knowledge resource have been included.

6. Environmental Assessment

6.1. Significant environmental impacts

In line with the environmental assessment submitted in the project memorandum it is believed that project activities had no direct impacts, either positive or negative, on the environment.

6.2. What will be the potentially significant environmental impacts (both positive and negative) of widespread dissemination and application of research findings?

During the project-planning phase it was proposed that recognition of the value associated with PU LWI production systems, the opportunities for income generation they present and their contribution to the food security of poor people provides an incentive for operators to manage solid and liquid waste resources. Furthermore, it was suggested that the managed reuse of waste resources makes a significant contribution to environmental protection, and that therefore, the continuation of these practices may contribute to ensuring that negative impacts associated with the unregulated waste disposal are minimised. While, the area occupied by waste reuse practices represents an important refuge for wildlife at the margins of one of the largest cities in Asia.

Based on the range of outcomes produced by the project, especially new knowledge produced for local PU NR managers, it appears reasonable to assume this should constitute a valuable resource to help promote improved NR management strategies for PU Kolkata, both to enhance poor livelihoods and to safeguard the environmental protection functions attributed to waste resource exploitation in PU farming. It is also anticipated that knowledge concerning the management, functioning, constraints and opportunities associated with the various farming activities in PU Kolkata will be useful for other urban authorities, particularly in West Bengal and India, that wish to develop appropriate approach for the productive exploitation of waste resources in PUI areas surrounding other towns and cities, thus contributing to greater environmental protection.

6.3. Has there been evidence during the project's life of what is described in Section 6.2 and how were these impacts detected and monitored?

A recent initiative that could have significant consequences for environmental management in PU Kolkata has been the declaration of the EKW as a listed site under the Ramsar Convention. As a consequence the DoE, GoWB is preparing a management plan for the wetlands for submission to the Ramsar Bureau through the GoI, and in doing so is using project outputs to assist in the process (Kundu, personal communication). Furthermore, during the project, the DoF, GoWB was contacted by two other municipalities in West Bengal that have an interest in replicating the Kolkata model

of waste resource exploitation through PU farming (Mukherjee, personal communication), and it is anticipated that knowledge from the project will be useful in developing appropriate PU farming approaches for these cities.

6.4. What follow up action, if any, is recommended?

Having compiled a significant body of knowledge relating to PS in PU Kolkata it is recommended that support should be provided to enable institutions such as DFID-India and KMC, in implementing the planned CUSP and CEIP projects, and DoE, GoWB, in developing the management plan for EKW, to fully exploit this knowledge so that access to environmental goods and services underpinning many poor livelihoods in PU Kolkata is not lost, but instead enhanced.

7. Contribution of Outputs

Through better characterising the dependence of selected groups of the poor on LWI PS in PU Kolkata and identifying constraints and possible opportunities the current project has produced knowledge with the potential to contribute toward the NRSP PU goal of 'Livelihoods of poor people improved through sustainably enhanced production and productivity of RNR systems.' However, the consolidation, creation and dissemination of knowledge to better inform stakeholders, planners and target institutions, constitutes only a first step to the achievement of sustainably enhanced production and productivity. It is anticipated that target institution may require further support to facilitate the assimilation of new knowledge into appropriate management interventions and policy change. The production of new knowledge regarding the role of PUI NR in poor livelihoods also has the potential to contribute to the NRSP programme goal of 'Benefits for poor people generated by application of new knowledge to NR systems.' However, providing a frank assessment of the project's achievements, it is only possible to say that target institutions have recently begun to adopt products from the research process, and that the impact of this adoption on policy and development planning remains to be seen. The impact of project outputs is assessed further below, firstly a robust assessment is made of the extent to which OVI-1 at the purpose level were attained, and secondly an assessment of the project on the thinking of research partners and stakeholders and the impact on policy approaches and techniques is presented.

OVI-1: It was intended that the project would provide NRSP Managers 'with new knowledge on the role that land-water interface (LWI) production systems at the peri-urban interface (PUI) play in livelihoods of poor people'. From the interim assessment carried out during the MTR it was noted that for some aspects, such as the characterisation of productive activities through consolidation of existing knowledge and initial situation analysis and identification of poor groups dependent on activities in the LWI, this had been achieved. For others, where progress suggested that activities such as the characterisation of livelihood strategies of target groups of the poor that depend on LWI PS would be achieved, and work was ongoing regarding the consolidation of information on LWI PS in appropriate forms for stakeholders and organisation of survey data, outputs suggest that these objectives have been obtained. Furthermore, although stated in the NRSP PUI logframe that separate activities 1.2.1.c) 'Existing knowledge of livelihoods and major production systems using land and renewable natural resources in the PUI consolidated and assessed' and 1.3.1.c) 'New knowledge created to fill any critical gaps in existing knowledge bases' would be linked with and follow R7872, it is believed the comprehensive assessment of the existing knowledge base and wide ranging research undertaken during R7872 has helped address the intended purpose of these activities.

Knowledge of key research findings has been described in the various project outputs, however, some particular issues warrant further attention here. Although many poor people in PU Kolkata depend largely on LWI PS for a significant part of their livelihood, inconsistency and seasonality of water supplies for filling ponds and irrigation, combined with declining access to solid municipal waste mean traditional farming practices and coping strategies such as scavenging are under threat. Due to problems with water and waste supplies, limited returns from traditional farming practices and increasing insecurity of tenure, households living in PU Kolkata have developed diversified livelihood strategies, however, the degree of diversification is often limited to NR based activities. Infrastructure development and service provision in PU Kolkata has enhanced the livelihoods of many, although it remains difficult for the very poor to benefit from such developments; for many education, training and skills provision combined with assistance in accessing off-farm employment opportunities would provide a valuable opportunity to lessen the vulnerability they experience in the face of encroaching urban development and uncertainty concerning the prospects for NR based livelihood strategies.

OVI-2: The second OVI at purpose level stated that 'NRSP Managers and target institutions would be provided with new knowledge on development opportunities and researchable constraints for poor people at the LWI'. Throughout the project constraints to the livelihoods of poor people and farming systems upon which they depend either directly or indirectly have been described and assessed, opportunities to address several key constraints have also been identified (Edwards, 2001; Bunting, 2002b; Bunting and Mukherjee, 2002). The dissemination of outputs to target institutions and their participation in the second project workshop also provided an opportunity to ensure the provision of new knowledge was achieved. This activity was advanced further through meetings with individuals from selected target institutions to discuss the likely impact of project findings.

Technical constraints to sustained or enhanced production from LWI PS in PU Kolkata have been highlighted, in particular problems in accessing reliable wastewater and solid organic waste inputs, dependence on externally sourced high cost inputs, in particular seed, recurring disease problems and limited access to formal credit arrangements. However, it would be dangerous to assume that increased productivity or profitability for PU PS would contribute directly to enhanced livelihoods for poor people. Findings from the research demonstrated that poor people were often keen primarily to enhance their cash income, and that with adequate support this might be obtained from non-NR, and indeed more urban oriented activities. Indeed whilst enhanced agricultural production might contribute to sustaining poor livelihoods, to move out of poverty people in PU Kolkata require access to alternative livelihood options, and for young people, the chance of a quality education appears to constitute the best route to accessing such opportunities. The provision of infrastructure and services seemingly plays an important role in enhancing the livelihoods of poor people living in PU Kolkata, however, provision is not complete or seemingly equitable. Better communication and coordination by local bodies and municipal authorities appear to have a role to play in ensuring the demands and expectations of all community members are addressed. In summary it appears that the main technical issues constraining production in PU Kolkata have been identified and that targeted development projects to address these problems may help sustain and enhance yields and in doing so contribute to the continued support of many poor livelihoods, both directly and indirectly, however, action is also required to enable poor people to further diversify their livelihood strategies, and where necessary or prudent remove their reliance on insecure returns from NR-based activities. Critical issues such as ensuring the safety of food produced in the LWI PS around Kolkata also deserve attention, as possible health hazards may not only affect consumer confidence, but may also result in detrimental health affects for producers, consumers and local residence, the very people reportedly benefiting most from continued production in the various LWI PS in PU Kolkata.

OVI-3: It was intended that increased knowledge would be ‘available to a range of stakeholders concerning the role LWI production systems at the PUI play in livelihoods of poor people’. Through consolidation of existing knowledge and the various research activities undertaken during the project it is possible to say that critical gaps in the knowledge base have been identified and to a large extent addressed. The identification of appropriate communication media and production and dissemination of project reports has also made this knowledge more available and accessible to stakeholders. Publication of key reports (i.e. Bunting et al., 2001b; Bunting et al., 2002; Punch et al., 2002) on the project website has further increased access to knowledge regarding the role LWI production systems at the PUI play in livelihoods of poor people to a range of stakeholders and target institutions.

OVI-4: Finally, it was expected that there would be ‘more exposure of planners and other key actors to features of the use of land, water and waste resources of LWI production systems including the importance of access to these resources in the livelihoods of poor people’. The use of land, water and waste resources in PU LWI PS was described during the situation analysis, and constraints experienced by NR managers were also discussed (Bunting et al., 2002). The importance of access to PUI NR in the livelihoods of poor people was described in more detail following the focus group and household interviews with selected groups of the poor (Punch et al., 2002). The exposure of planners and key actors to this knowledge was increased through the dissemination of reports, including publication on the project website, presentations at the second project workshop, an international conference (Bunting, 2002b) and regional workshop (Mukherjee et al., 2002) and meetings with representatives from selected target institutions (Edwards, 2002b).

Impact on the thinking of research partners and stakeholders

Based on findings from the MTR it was noted that ‘The two Kolkata collaborators of the project team are substantially involved in the project, and there is no doubt that they are taking the new knowledge into their organisations and will use it’. In addition to knowledge concerning research outputs, it is believed that knowledge concerning the research process and activities, much of which was new to the two Kolkata research teams, has also been assimilated into these organisations, and may well help guide future research activities. There is also evidence that project outputs may have a role to play in influencing the implementation of development projects in the region. Although focused on urban issues the DFID supported CUSP and CEIP programmes have the potential to significantly influence activities and poor livelihoods at the PUI, and following a meeting at the DFID-India office in Delhi, project outputs, specifically concerning the institutional analysis, were requested by engineering and rural livelihoods advisers to help inform the implementation process.

Impact on policy approaches

During his address to the second project workshop the MIC, DoF, GoWB noted that the collaborative project involving his department and IW MED, DoE constituted an important development activity for the state (Bunting and Mukherjee, 2002). Furthermore, his department is now looking to use project outputs to help formulate plans for appropriate PUI LWI production systems exploiting waste resources for other municipalities in the state (Mukherjee, personal communication). In preparing a management plan regarding the EKW for submission to the Ramsar Bureau through the

GoI, the DoE, GoWB is using project outputs to assist in the process (Kundu, personal communication). Having collaborated on the project and contributed significantly to generating new knowledge regarding the role of LWI PS in poor livelihoods at the Kolkata PUI, the local team leaders, representing DoF and DoE, GoWB, acted as signatories and adopted the recent 'Hyderabad Declaration on Wastewater Use in Agriculture', facilitation of which was carried out by IWMI (CGIAR, 2002). The declaration marks a significant step forward in recognising the role PU LWI production systems play in poor livelihoods, and that research to address knowledge gaps, greater institutional coordination and livelihoods-based assessments are required to address the most significant constraints facing producers and poor communities depending on such activities.

Impact on techniques

With appropriate adaptations, the approaches to focus group and household interviews developed by the research team, may well be useful in assessing the role of NR based activities in the livelihoods of poor people in other settings. Furthermore, development, testing and refinement of PRA-based tools, for both focus groups and household interviews, in collaboration with local researchers contributed to their knowledge on the use and application of such approaches. Prior to this project the research teams had little experience of research approaches with the capacity to disaggregate the views of men, women and children and allow differences and similarities to be assessed and evaluated. The overall approach to research, including activities such as the literature review and stakeholder workshop to help identify stakeholders and selected groups of the poor also has potential to help the two Kolkata collaborators better target resources. Whilst, emphasis on using more participatory approaches and providing feedback to participants, may help them overcome problems of engaging with poorer groups, especially in PU Kolkata where a legacy of inappropriate and fruitless research has led to widespread fatigue.

Promotion of knowledge

Appropriate communication media and pathways to stakeholders and target institutions were partially defined during the first project workshop, whilst knowledge needs were subsequently assessed during the formulation of a communication strategy for the project (see Bunting, 2002a). As outlined in the project logframe, findings from the project were disseminated in appropriate communication materials, project reports and the second project workshop, in addition an active process of dissemination was initiated through meetings to discuss project findings with selected target institutions i.e. KMC, DoIW, DoE and DoF (Edwards, 2002b). However, considering the range of issues addressed during the current project, and depth of investigation undertaken, further work on disseminating findings to target institutions and critically helping them assimilate this knowledge into policy and development planning may considerably enhance the impact of the project on enhancing poor livelihoods dependent on the NR base of PU Kolkata.

8. Publications and other communication materials

8.1 Books and book chapters

Bunting, S.W. (forthcoming). Aquaculture, wastewater reuse and poor livelihoods in peri-urban Kolkata, India. In: *Urban Aquaculture*. Wallingford, UK: CABI Publishing.

8.2 Journal articles

8.2.1 Peer reviewed and published

8.2.2 Pending publication (in press)

8.2.3 Drafted

8.3 Institutional Report Series

8.4 Symposium, conference, workshop papers and posters

Bunting, S.W., 2001. Project summary sheet and presentation for Aquaculture and Fish Genetics Research Programme (AFGRP) programme meeting, 18th December 2001. Stirling, UK: Institute of Aquaculture [unpublished report].

Bunting, S.W., 2002. Wastewater-reuse and poor livelihoods in peri-urban Kolkata. Paper presented at the 28th WEDC Conference on Sustainable Environmental Sanitation and Water Services, 18-22 November 2002. Science City Conference Centre, Kolkata, India.

Kundu, N., Konar, P. and Basu, A., 2001. Peri-urban Agriculture and Environmental Management: Kolkata Experience. Paper presented at the International Conference on Rural-Urban Encounters: Managing the Environment of the Peri-Urban Interface, 9-10th November 2001. Development Planning Unit, University College London.

Mukherjee, M., Nath, U., Kashem, S.A. and Chattopadhyay, M., 2001. The Sewage Fed Fisheries in Kolkata. Paper submitted for the International Conference on Rural-Urban Encounters: Managing the

Environment of the Peri-Urban Interface, 9-10th November 2001. Development Planning Unit, University College London.

Mukherjee, M., Datta, A., Mookherjee, M., Punch, S. and Bunting, S.W., 2002. Female livelihood strategies in peri-urban Kolkata: nature, constraints and opportunities. Abstract prepared for the forthcoming workshop on Wastewater Reuse in Poor Livelihoods, 11-14 November 2002, IWMI, Hyderabad.

8.5 Newsletter articles

8.6 Academic theses

Milwain, G.K., 2001. Investigation into sustainable development and livelihood issues of the fish seed distribution network in West Bengal, India. Stirling, UK: University of Stirling [MSc thesis]

8.7 Extension-oriented leaflets, brochures and posters

Institute of Aquaculture, 2001. DFID peri-urban farming and livelihoods project for Kolkata. Stirling, UK: Institute of Aquaculture [Project leaflet].

8.8 Manuals and guidelines

8.9 Media presentations (videos, web sited papers, TV, radio, interviews etc)

Aberdeen Press & Journal, 2001. Funding for Calcutta study. Aberdeen Press & Journal, 7th April 2001, p25.

Channel DD7, 2002. TV broadcast in Bengali. Channel DD7 (*Khash Khabor*), 23rd November 2002.

New Agriculturist, 2002. In Focus: East Kolkata Wetlands. New Agriculturist, 02(4). <http://www.new-agri.co.uk>

Stirling Observer, 2001. Helping to feed the world. Stirling Observer, 6th April 2001, p 4.

Stirling News, 2001. Calcutta study has boost of £126,900. Stirling News, 21st April 2001, p 4.

Times of India, 2002. Project to help city wetlands. Times of India, Kolkata Edition, 27th November 2002.

University of Stirling, 2001. Calcutta farming. hear:say, UoS staff-quarterly, p 9.

8.10 Project reports and data records

8.10.1 Citation for the project Final Technical Report (FTR)

Bunting, S.W., 2002. Final Technical Report: Renewable natural resource-use in livelihoods at the Calcutta peri-urban interface. Stirling, UK: Institute of Aquaculture [unpublished report].

8.10.2 Project technical reports including project internal workshop papers and proceedings

Bunting, S.W., 2002. Communication strategy. Stirling, UK: Institute of Aquaculture [Working Paper].

Bunting, S.W., Kundu, N., Punch, S. and Little, D.C., 2001. East Kolkata Wetlands and Livelihoods: Workshop Proceedings. Stirling, UK: Institute of Aquaculture [Working Paper].

Bunting, S.W. and Mukherjee, M., 2002. Peri-urban farming and poor livelihoods: developing plans for action. Workshop Proceedings. Stirling, UK: Institute of Aquaculture [Working Paper].

Edwards, P., 2002. Institutional assessment: reviewing policies, processes and stakeholder positions at the Kolkata peri-urban interface. Bangkok, Thailand: Asian Institute of Technology [Working Paper].

Little, D.C., Kundu, N., Mukherjee, M. and Barman, B.K., 2002. Marketing of fish from peri-urban Kolkata. Stirling, UK: University of Stirling [Working Paper].

Milwain, G.K., Little, D.C., Kundu, N. and Immink, A.J., 2002. Overview of fish seed production and distribution in West Bengal, India. Stirling, UK: Institute of Aquaculture, University of Stirling and Kolkata. India: Institute of Wetland Management and Ecological Design [Working Paper].

Punch, S. and Kundu, N., 2001. Review of progress with focus group interviews. Stirling, UK: University of Stirling [unpublished report].

Punch, S., Bunting S.W. and Kundu, N., 2002. Poor livelihoods in peri-urban Kolkata: focus group and household interviews. Stirling, UK: University of Stirling [unpublished report].

8.10.3 Literature reviews

Bunting, S.W., Kundu, N. and Mukherjee, M., 2001. Renewable natural resource-use in livelihoods at the Calcutta peri-urban interface: a literature review. Stirling, UK: Institute of Aquaculture [Working Paper].

Bunting, S.W. and Little, D., (forthcoming). Urban Aquaculture. An Annotated Bibliography on Urban agriculture. Leusden, The Netherlands: RUAFA [CD-Rom & Web-based paper].

8.10.4 Scoping studies

Bunting, S.W., Kundu, N. and Mukherjee, M., 2002. Situation analysis: production systems and natural resource management in PU Kolkata. Stirling, UK: Institute of Aquaculture [Working Paper].

8.10.5 Datasets, software applications

Bunting, S.W., 2002. R7872 reviewed literature. Stirling, UK: Institute of Aquaculture. [ProCite database].

Bunting, S.W., 2002. R7872 media communications. Stirling, UK: Institute of Aquaculture. [MS Word document].

Kundu, N., 2002. Situation analysis dataset. Kolkata, India: IW MED [Excel spreadsheet].

8.10.6 Project web site and/or other project related web addresses

Institute of Aquaculture, 2002. Land-water interface production systems in peri-urban Kolkata. [Project website for R7872: <http://www.dfid.stir.ac.uk/dfid/nrsp/kolkata.htm>]

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- Bunting, S.W., 2001b.** *Calcutta trip including the initial project workshop for R7872.* Stirling, UK: Institute of Aquaculture [unpublished Back to Office report].
- Bunting, S.W., 2002a.** *Communication strategy.* Stirling, UK: Institute of Aquaculture [Working Paper].
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10. Project logframe

LOGICAL FRAMEWORK FOR THE PROJECT

Narrative Summary	Measurable Indicators	Means of Verification	Important Assumptions
GOAL			
1. Natural resources management strategies for peri-urban areas which benefit the poor developed and promoted	By 2003 in at least one other city-region, key stakeholders (including at least two target institutions) regularly participating in the formulation of plans of action for at least two aspects of natural resource management for peri-urban areas which will benefit the poor.	<p>Reviews by programme Manager.</p> <p>Reports of research team and collaborating/target institutes.</p> <p>Appropriate dissemination products</p> <p>Local, national and international statistical data.</p> <p>Data collected and collated by programme manager</p>	<p>Target beneficiaries adopt and use strategies and practices.</p> <p>Enabling environment exists.</p> <p>Budgets and programmes of target institutions are sufficient and well managed</p>
PURPOSE			
1.1. Knowledge on the Calcutta peri-urban interface generated, emphasising the contribution of land-water interface production systems to the livelihoods of poor people and the role of institutions and actors	<p>NRSP Managers provided with new knowledge on the role that land-water interface (LWI) production systems at the peri-urban interface (PUI) play in livelihoods of poor people (by Month 26)</p> <p>NRSP Managers and target institutions provided with new knowledge on development opportunities and researchable constraints for poor people at the LWI (by Month 26)</p> <p>Increased knowledge available to a range of stakeholders concerning the role LWI production systems at the PUI play in livelihoods of poor people (by Month 26)</p> <p>More exposure of planners and other key actors to features of the use of land, water and waste resources of LWI production systems including the importance of access to these resources in the livelihoods of poor people (by Month 24)</p>	<p>NRSP Mid-term review report and Project final technical report</p> <p>NRSP research calls after project completion</p> <p>Mass media communication materials emanating from the project</p> <p>Published peer reviewed paper</p> <p>Workshop proceedings</p> <p>Minutes of meetings from apex committees of target institutions</p>	<p>Continued public acceptance of products from practices using waste resources</p> <p>Cost-benefit continues to favour the use of waste resources as production enhancing inputs</p> <p>Management of peri-urban waste disposal systems continues to permit access to operators of production systems</p>
OUTPUTS			
1. Nature and extent of land, water and waste use in LWI production systems defined	<p>By month 6, horticulture and livestock enterprises and wastewater usage activities, including aquaculture, characterised through consolidation of existing knowledge and initial situation analysis</p> <p>By month 6, main institutions and actors in LWI identified</p> <p>By month 6, information on LWI production systems consolidated in form suitable for stakeholders</p> <p>By month 6, survey data organised for subsequent use</p>	<p>Literature review</p> <p>LWI production systems situation analysis report</p> <p>User-friendly summary documents</p> <p>Project database</p>	

OUTPUTS continued			
<p>2. New knowledge on the role of LWI production systems and associated activities in the livelihoods of selected groups of the poor generated</p>	<p>By month 9, identify groups of the poor that engage in main LWI production activities</p> <p>By month 24, livelihood strategies of target groups of poor men, women and young people characterised, particularly their use of natural resources in LWI production systems studied, and contribution to household food security and income generation assessed</p> <p>By month 24, new knowledge on the contribution of produce from LWI production systems to local markets generated</p> <p>By month 24, main constraints and opportunities for livelihood enhancement identified and ways in which these may be taken forward defined</p>	<p>Project report on target group identification</p> <p>Project annual report</p> <p>Project report on target groups of the poor</p> <p>Project report on market analysis</p> <p>Project report on gender and generation issues</p> <p>Peer reviewed publication</p> <p>Project final technical report</p>	
<p>3.1. New knowledge on the role of institutions and key actors in regulating access to land, water and waste resources at the peri-urban LWI generated and influence on the use of natural resources and associated activities assessed</p> <p>3.2. Target institutions more sensitised to constraints and opportunities of managing the peri-urban LWI</p> <p>3.3. Target institutions, planners and actors made more aware of features of the LWI in the PUI of Calcutta, particularly the livelihood strategies of the poor through various means of communicating the project's findings</p>	<p>By month 6, target institutions, planners and other actors made aware of project objectives</p> <p>By month 6, building on existing links, target institutions agree to attend project workshops and participate in a process of institutional assessment</p> <p>By month 18, structures and processes of institutions active in both urban and peri-urban areas that influence activities at the peri-urban LWI assessed</p> <p>By month 18, most appropriate communication materials for different stakeholders identified</p> <p>By month 25, appropriate communication materials produced and disseminated to stakeholders</p> <p>By month 26, target institutions, planners and actors made aware of project findings through dissemination of appropriate communication materials, project reports and the second project workshop</p>	<p>Project report on institutional assessment</p> <p>First project workshop proceedings</p> <p>Report on identification of communication materials</p> <p>Media products</p> <p>Minutes of meetings from target institutions</p> <p>Second project workshop proceedings</p> <p>Project final technical report</p>	<p>Planner and key actors have a threshold of interest in project objectives and activities</p> <p>Interest of target institutions in the peri-urban LWI at least continues at level existing at project commencement</p>

ACTIVITIES		
<ul style="list-style-type: none"> 1.1. Collaborative links developed, work plans written and RA's engaged 1.2. RA's trained in participatory methods, database management and Sustainable Livelihoods Approaches 1.3. Database established to collate project data and monitor publications and media coverage 1.4. Relevant literature, reports and studies by partner institutions reviewed 1.5. Situation analysis facilitated using RRA and PRA techniques including transect walks, stakeholder analysis, resource mapping, timelines, income and activity calendars and the development of wealth indicators to characterise the nature, extent and timing of LWI production systems 1.6. Summary of the role of LWI production systems in livelihoods at the peri-urban interface in user-friendly documents 1.7. Target groups of the poor identified based on findings from the initial situation analysis and discussions with stakeholders and actors facilitated through the first multidisciplinary project workshop 	<p>Budget: £126 974</p> <ul style="list-style-type: none"> 1.1. Work plans, project staff contracts and Terms of Reference established (Month 1) 1.2. Training sessions provided to RA's (Month 2) 1.3. Database established (Month 2) 1.4. Production of initial literature review (Month 3) 1.5. LWI production systems survey report produced (Month 6) 1.6. User-friendly summaries of LWI production systems in the livelihoods of poor people produced and disseminated (Month 6) 1.7. Multidisciplinary review workshop held and well attended, suitable target groups of the poor proposed and proceedings produced (Month 6) 	<p>Clear lines of communication developed; access to reports and studies possible; access to peri-urban areas and groups of the poor involved with LWI production systems possible; identification and agreement on target groups of the poor possible</p> <p>Enabling environment exists; access to case study groups possible and individuals and households willing to participate; identification of products from peri-urban LWI production systems possible</p> <p>Access to key institutions possible and willingness of actors to participate in the process; suitable venue for workshop available, key stakeholders and actors willing to participate and consensus on new knowledge possible; key actors and stakeholders willing to participate in and sustain institutional dialogue</p>
<ul style="list-style-type: none"> 2.1. Target groups of the poor selected, based on the contribution of LWI production systems to livelihood strategies and numbers engaged in particular activities, and report produced 2.2. Project annual report compiled 2.3. Interviews with different household members including men, women and young people from target groups employing PRA techniques, including semi-structured interviews, resource mapping, timelines, income and activity calendars and preference ranking to assess the role of LWI production systems in their livelihoods 2.4. Market analysis and consumer surveys to assess the contribution of products from peri-urban LWI farming to supplying the needs of the poor 2.5. Issues relevant to gender and generation summarised and reported 2.6. Compilation of a publication for peer review 2.7. Constraints and opportunities for livelihood enhancement recorded and described during the project, summarised and reported 	<ul style="list-style-type: none"> 2.1. Target groups of the poor selected and explanatory report produced (Month 9) 2.2. Assessment of target groups engaged in LWI production systems and associated activities completed and report produced: detailing the role that assets and access to resources has on influencing the LWI production systems and associated activities in which poor people engage; issues relating to gender and generation; the extent of competition for land, water and waste resources with other user groups and alternative livelihood strategies and the relative contribution, with respect to other livelihood components to income generation and household food security (Month 18) 2.3. Project annual report produced (Month 12) 2.4. Market analysis on the contribution of produce from peri-urban LWI production systems to local and regional markets, including a profile of consumers, completed and report produced (Month 26) 2.5. Project report on gender and generational issues produced (Month 18) 2.6. Paper produced and submitted for peer review (Month 20) 2.7. Report produced summarising the main constraints and opportunities for livelihood enhancement (Month 26) 	<p>Suitable materials and routes for disseminating new knowledge exist or may be developed; possible to identify constraints and opportunities; access to publications and media possible for monitoring</p>

ACTIVITIES continued		
<p>3.1. Building on existing contacts and dialogue initiated at the first project workshop, target institutions, planners and actors made aware of project objectives</p> <p>3.2. Institutional assessment planned</p> <p>3.3. Institutional assessment undertaken, key actors interviewed and legislation and policy documents reviewed, enabling an assessment of structures and processes that influence the adoption and sustainability of peri-urban LWI production systems and associated activities</p> <p>3.4. Project findings summarised in communication materials appropriate for dissemination of project findings selected through stakeholder consultation</p> <p>3.5. Productive institutional dialogue encouraged at second workshop with partners, target institutions, planners and actors to review project findings and disseminate new knowledge in appropriate formats</p> <p>3.6. Database interrogated to assess the extent to which new knowledge emanating from the project has been disseminated</p> <p>3.7. Project findings summarised and presented in the Project final technical report</p>	<p>3.1. First project workshop attended by target institutions and proceedings produced (Month 6)</p> <p>3.2. Institutional assessment completed (Month 18)</p> <p>3.3. Report on institutional assessment produced (Month 18)</p> <p>3.4. Appropriate communication materials for stakeholder groups produced and disseminated (Month 25)</p> <p>3.5. Second project workshop held and proceedings produced (Month 25)</p> <p>3.6. Data on publications, media coverage and minutes from meetings of target institutions assessed and reported (Month 26)</p> <p>3.7. Project final technical report produced and submitted (Month 27)</p>	

11. Keywords

Aquaculture, horticulture, rice, wastewater-reuse, livelihoods, institutions, stakeholders, urbanisation, constraints, Kolkata

12. Annexes

Annex A Scientific Annex

Symposium, conference, workshop papers and posters

Bunting, S.W., 2001. Project summary sheet and presentation for Aquaculture and Fish Genetics Research Programme (AFGRP) programme meeting, 18th December 2001. Stirling, UK: Institute of Aquaculture [unpublished report].

Bunting, S.W., 2002. Wastewater-reuse and poor livelihoods in peri-urban Kolkata. Paper presented at the 28th WEDC Conference on Sustainable Environmental Sanitation and Water Services, 18-22 November 2002. Science City Conference Centre, Kolkata, India.

***Kundu, N., Konar, P. and Basu, A., 2001.** Peri-urban Agriculture and Environmental Management: Kolkata Experience. Paper presented at the International Conference on Rural-Urban Encounters: Managing the Environment of the Peri-Urban Interface, 9-10th November 2001. Development Planning Unit, University College London.

***Mukherjee, M., Nath, U., Kashem, S.A. and Chattopadhyay, M., 2001.** The Sewage Fed Fisheries in Kolkata. Paper submitted for the International Conference on Rural-Urban Encounters: Managing the Environment of the Peri-Urban Interface, 9-10th November 2001. Development Planning Unit, University College London.

Mukherjee, M., Datta, A., Mookherjee, M., Punch, S. and Bunting, S.W., 2002. Female livelihood strategies in peri-urban Kolkata: nature, constraints and opportunities. Paper presented at the workshop on Wastewater Reuse in Poor Livelihoods, 11-14 November 2002, IWMI, Hyderabad.

Academic theses

Milwain, G., 2001. Investigation into sustainable development and livelihood issues of the fish seed distribution network in West Bengal, India. Stirling, UK: University of Stirling [MSc thesis]

Extension-oriented leaflets, brochures and posters

***Institute of Aquaculture, 2001.** DFID peri-urban farming and livelihoods project for Kolkata. Stirling, UK: Institute of Aquaculture [Project leaflet].

Media presentations (videos, web sited papers, TV, radio, interviews etc)

***Aberdeen Press & Journal, 2001.** Funding for Calcutta study. Aberdeen Press & Journal, 7th April 2001, p25.

Channel DD7, 2002. TV broadcast in Bengali. Channel DD7 (*Khash Khabor*), 23rd November 2002.

***New Agriculturist, 2002.** In Focus: East Kolkata Wetlands. New Agriculturist, 02(4). <http://www.new-agri.co.uk>

***Stirling Observer, 2001.** Helping to feed the world. Stirling Observer, 6th April 2001, p 4.

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Times of India, 2002. Project to help city wetlands. Times of India, Kolkata Edition, 27th November 2002.

***University of Stirling, 2001.** Calcutta farming. hear:say, UoS staff-quarterly, p 9.

Annex B Project Technical Reports

Citation for the project Final Technical Report (FTR)

Bunting, S.W., 2002. Final Technical Report: Renewable natural resource-use in livelihoods at the Calcutta peri-urban interface. Stirling, UK: Institute of Aquaculture [unpublished report].

Project technical reports including project internal workshop papers and proceedings

Bunting, S.W., 2002. Communication strategy. Stirling, UK: Institute of Aquaculture [Working Paper].

Bunting, S.W., Kundu, N., Punch, S. and Little, D.C., 2001. East Kolkata Wetlands and Livelihoods: Workshop Proceedings. Stirling, UK: Institute of Aquaculture [Working Paper].

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- Edwards, P., 2002.** Institutional assessment: reviewing policies, processes and stakeholder positions at the Kolkata peri-urban interface. Bangkok, Thailand: Asian Institute of Technology [Working Paper].
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- Punch, S. and Kundu, N., 2001.** Review of progress with focus group interviews. Stirling, UK: University of Stirling [unpublished report].
- Punch, S., Bunting S.W. and Kundu, N., 2002.** Poor livelihoods in peri-urban Kolkata: focus group and household interviews. Stirling, UK: University of Stirling [Working Paper].

Annex C Literature Reviews and Scoping Studies

Literature reviews

- Bunting, S.W., Kundu, N. and Mukherjee, M., 2001.** Renewable natural resource-use in livelihoods at the Calcutta peri-urban interface: a literature review. Stirling, UK: Institute of Aquaculture [Working Paper].
- Bunting, S.W. and Little, D., (forthcoming).** Urban Aquaculture. In: *An Annotated Bibliography on Urban Agriculture*. Leusden, The Netherlands: RUAFA [CD-Rom & Web-based paper].

Scoping studies

- Bunting, S.W., Kundu, N. and Mukherjee, M., 2002.** Situation analysis: production systems and natural resource management in PU Kolkata. Stirling, UK: Institute of Aquaculture [Working Paper].

Annex D Back to Office reports

- Bunting, S.W., 2001.** Back to Office report: 3-17th February. Stirling, UK: Institute of Aquaculture [unpublished Back to Office report].
- Bunting, S.W., 2001.** Calcutta trip including the initial project workshop for R7872. Stirling, UK: Institute of Aquaculture [unpublished Back to Office report].
- Bunting, S.W., 2001.** Stakeholder analysis trip for R7872, including planning, programme and summary of outcomes. Stirling, UK: Institute of Aquaculture [unpublished Back to Office report].
- Bunting, S.W., 2001.** Forward planning trip for R7872, including initiation of household level livelihoods case studies and market survey. Stirling, UK: Institute of Aquaculture [unpublished Back to Office report].
- Edwards, P., 2001.** Senior stakeholder meetings, Calcutta – 30 July to 6 August 2001. Bangkok, Thailand: Asian Institute of Technology [unpublished Back to Office report].
- Edwards, P., 2002.** Second senior stakeholder meetings, Kolkata – 2 to 10 December 2002. Bangkok, Thailand: Asian Institute of Technology [unpublished Back to Office report].
- Harris, P.J.C., 2001.** Development of a work programme to assess the role of livestock and horticultural production systems in poor livelihoods at the peri-urban LWI in Calcutta. Report of visit 11-19 August 2001. Coventry, UK: Henry Doubleday Research Association [unpublished Back to Office report].
- Punch, S., 2001.** Back to Office report. Field trip 1: 4-19 April 2001. Stirling, UK: Department of Applied Social Science [unpublished Back to Office report].
- Punch, S., 2001.** Designing, piloting and refining participatory interview techniques. Stirling, UK: Department of Applied Social Science [unpublished Back to Office report].

Annex E Final Project Inventory

- Institute of Aquaculture, 2002.** R7872: Final project inventory. Stirling, UK: Institute of Aquaculture [unpublished report].

*lodged previously with NRSP Office