

Foods from water bodies improve life for the very poor

RIU

Validated RNRRS Output.

Simple new ways of managing wild and cultured fish in paddy fields, ponds and lakes mean that people have more reliable supplies of food, better diets and better nutrition. For centuries, the rural poor have relied on wild fish, plants, snails and other foods. But these are fast disappearing because of over-exploitation, dwindling flood plains and more intensive farming. People-especially the poorest-in Northeast Thailand, lowland Cambodia and Bangladesh are already reaping the benefits of these systems and they are being strongly promoted in Vietnam, India, Indonesia and Lao PDR. There is also great potential in hilly agricultural and tropical forest systems where rainfall is seasonal.

Project Ref: **AFGP02:**

Topic: **3. Improving Fishers Livelihoods: Better Fishing Management & Aquaculture**

Lead Organisation: **University of Stirling, UK**

Source: **Aquaculture & Fish Genetics Research Programme**

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Description

AFGP02

Research into Use

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Geographical regions included:

[Bangladesh](#), [Cambodia](#), [India](#), [Indonesia](#), [Lao PDR](#), [Sri Lanka](#), [Thailand](#), [Vietnam](#),

Target Audiences for this content:

[Fishers](#),

A. Description of the research output(s)**1. Working title of output or cluster of outputs.**

In addition, you are free to suggest a shorter more imaginative working title/acronym of 20 words or less.

Introducing short-crop aquatic production into agro-aquatic farming systems to increase and diversify output, reduce vulnerability and improve livelihoods.

Short-crop Aquatic Production.

2. Name of relevant RNRRS Programme(s) commissioning supporting research and also indicate other funding sources, if applicable.

Aquaculture and Fish Genetics Research Programme

3. Provide relevant R numbers (and/or programme development/dissemination reference numbers covering supporting research) along with the institutional partners (with individual contact persons (if appropriate)) involved in the project activities. As with the question above, this is primarily to allow for the legacy of the RNRRS to be acknowledged during the RIUP activities.

R7064: Small-scale Farmer-managed Aquaculture in Engineered Water Systems: Critical Design and Management Approaches.

Institutional Partners: Sri Lanka - University of Peradeniya, India - Samuha, Bangalore,

R7917: Self Recruiting Species in Aquaculture, Their Role in Rural Livelihoods. Institutional Partners: Bangladesh Agricultural University, Intermediate Technology Development Group; India - CIFRI West Bengal, Vietnam – RIA No 1, Ministry of Fisheries, Cambodia – Department of Fisheries Aquaculture Division, Thailand -Department of Fisheries, Department of Vocational Education

R7100: Improved Management of Small Scale Tropical Cage Culture Systems in Asia. Institutional Partners: Bangladesh – CARE; Greater Noakhali Aquaculture Extension Project/ DANIDA; Bangladesh Fisheries Research Forum, Bangladesh Agricultural; Vietnam – RIA No 1; Ministry of Fisheries

AFGRP support also led to award of linked work in the EU INCODEV Production in Aquatic Peri-Urban Systems in Southeast Asia (PAPUSSA) project

4. Describe the RNRRS output or cluster of outputs being proposed and when was it produced? (max. 400 words).

This requires a clear and concise description of the output(s) and the problem the output(s) aimed to address. Please incorporate and highlight (in bold) key words that would/could be used to select your output when held in a database.

Supply of **aquatic products**, a key source of quality food to poor households, has been widely constrained by overexploitation of open water resources, reduction of floodplain areas and intensification of agriculture. In some regions semi-intensive aquaculture in perennial ponds has helped meet production needs but is primarily accessible to better resourced individuals. The poorest and most vulnerable are commonly excluded through

constraints such as lack of investment and operational capital, landlessness and insecure tenure. This approach to aquaculture is also increasingly sensitive to climate variability and its indirect effects on agriculture.

Policy and technical support has also tended to focus on this type of aquaculture, while the use of ephemeral water bodies in rainfed areas, most readily accessible to the rural poor, has been largely ignored. Strategies to promote aquaculture and enhance yields from water bodies have typically emphasised management practices that fail to recognise how the poor use these resources. They have also failed to address the increasing risks to conventional aquaculture of shifts in temperature and water balance during typically long production periods. Consequently, also, many interventions (e.g. stocking hatchery fry into communal irrigation systems) and management prescriptions (e.g. removal of wild and **self recruiting species** (SRS) from farmer's systems) have been misplaced and failed to reach poorest users.

AFGRP and linked research between 1998 and 2006 has shown that cultivation of short crop aquatic products can make important improvements to household **food security** and nutrition, **livelihood diversification**, income and employment among the poor in a variety of settings. Such diversification is also increasingly valuable in supporting more flexible strategies for conventional aquaculture. Advantages include; reduced financial and biological risk to growers, integration with and extraction of additional value from existing farming systems, high suitability for landless individuals and those with insecure land tenure, compatibility with seasonal variation in environmental conditions and resource availability, potential for collective action, and effective inclusion of the most marginalized and vulnerable societal groups.

The proposal offers a suite of technical approaches, capacity building and policy support, with great potential to extend benefits to a broad spectrum of end users across varied agro-ecologies. This would address issues including; household level food and income poverty, market entry and participation costs of alternative activities, landlessness, insecure tenure and limited water access **seasonality**, unsustainable or sub-optimal resource use and loss of biodiversity.

5. What is the type of output(s) being described here?

Please tick one or more of the following options.

Product	Technology	Service	Process or Methodology	Policy	Other Please specify
X			X	X	

Short-crop aquatic production generates products (fish etc), using simple processes. Implementation of new policies are needed to promote further uptake

6. What is the main commodity (ies) upon which the output(s) focussed? Could this output be applied to other commodities, if so, please comment

Short-crop aquatic production is applicable to conventional aquaculture commodities, particularly fish (e.g. tilapias, carps). Additionally it is suited to a range of indigenous and self-stocking fish species which are rarely cultured in a systematic manner. Aquatic vegetables, molluscs, crustaceans and amphibians, the dietary and economic importance of which is very frequently undervalued, and may all be produced directly or as by-products of short

crop aquatic systems.

7. What production system(s) does/could the output(s) focus upon?

Please tick one or more of the following options. Leave blank if not applicable

Semi-Arid	High potential	Hillside	Forest-Agriculture	Peri-urban	Land water	Tropical moist forest	Cross-cutting
X	X			X	X		X

There is potential for short-crop aquatic production wherever perennial or seasonal water bodies persist, the options indicated above reflect the production systems in which these condition are most likely to occur, but they may also exist in hillside, forest agriculture or tropical moist forest systems

8. What farming system(s) does the output(s) focus upon?

Please tick one or more of the following options (see Annex B for definitions).

Leave blank if not applicable

Smallholder rainfed humid	Irrigated	Wetland rice based	Smallholder rainfed highland	Smallholder rainfed dry/cold	Dualistic	Coastal artisanal fishing
X	X	X	X	X		

Short crop aquatic production is potentially applicable in all the farming systems listed above. It may be of particular importance where water supplies are seasonal, allowing for only a short growing season.

9. How could value be added to the output or additional constraints faced by poor people addressed by clustering this output with research outputs from other sources (RNRRS and non RNRRS)? (max. 300 words).

Please specify what other outputs your output(s) could be clustered. At this point you should make reference to the circulated list of RNRRS outputs for which proformas are currently being prepared.

Production of short-crop self recruiting fish species in rice field ecosystems and surrounding water bodies adds value to the following cluster of outputs; (From the Crop Protection Programme) 'Weed management in irrigated rice', 'Cost effective weed management packages for lowland rice in Bangladesh', and 'Weed management in seasonally inundated land'. It also correlates strongly with the 'Bangladesh: Integrated Floodplain Management' and 'Floodplain fisheries management' outputs from the Natural Resources Systems and Fisheries Management Science Programmes. Work on enhancing capture fisheries in irrigation systems in Sri Lanka overlaps with the 'East Africa: Rainwater harvesting' and 'Enhancement of inland fisheries' outputs from these same two programmes. From the AFGRP programme, short-crop aquatic production is complemented by the following clusters: 'Integrated aquatic production for rural livelihoods', 'Developing quality seed networks', 'Promoting healthy peri-urban aquatic food supply', and 'Developing market information systems within the marketing chain'. Many short-crop aquatic products and SRS are optimally cultured as part of integrated aquatic farming systems. Developing quality seed networks revolves around two self recruiting species; Nile tilapia and common carp. Production of fingerlings of these species in rice fields requires management practices similar to those used in enhancement of

SRS, and promotes increases in wild aquatic animal numbers. Peri-urban areas have become extremely significant in the supply of low cost agricultural products to cities and surrounding locales in the developing world, thereby playing a crucial role in the food security of the poor, and short-crop aquatic vegetables are particularly suited to production in these highly dynamic environments. Development of market information systems adds value to primary gains from short-crop aquatic production by generating knowledge for producers and marketing stakeholders. This, in addition to assisting communication between and amongst these groups in a manner which reduces risk, opens up new production and marketing opportunities, encourages innovation and optimises returns.

Validation

B. Validation of the research output(s)

10. How were the output(s) validated and who validated them?

Please provide brief description of method(s) used and consider application, replication, adaptation and/or adoption in the context of any partner organisation and user groups involved. In addressing the “who” component detail which group(s) did the validation e.g. end users, intermediary organisation, government department, aid organisation, private company etc... This section should also be used to detail, if applicable, to which social group, gender, income category the validation was applied and any increases in productivity observed during validation (max. 500 words).

Research and pilot projects were used to characterise the role of self-recruiting species in different aquaculture systems and to develop management approaches that enhanced the production of, and access to, such resources by the poor. Validation of the importance of SRS in the livelihoods of the rural poor was achieved during participatory field work in Cambodia, Northeast Thailand and Vietnam’s Red River Delta, Bangladesh and West Bengal (India). This established that consumption of wild aquatic animals from farmer managed systems (e.g. rice fields and seasonal ponds) plays a major role in the livelihoods of rural poor, and in many instances far exceeds that of cultured fish and those captured in open access water bodies. Consultation with stakeholders from each of the countries allowed development of a range of materials aimed at raising institutional awareness of the significance of SRS and farmer knowledge of management steps to enhance their production. Trials involving the initiation of local resource user groups (LRUGs) facilitated collective management of aquatic resources by farmers in order to extend their productivity. Participants in different locations adapted their management techniques contingent on local conditions and goals. Comparison of the perceptions of members and non-members of local resource user groups within the same communities over the two years following their establishment indicated the desirability of group management of natural resources for increased cropping productivity. Significant increases in subsistence harvests of aquatic animals were reported by end users, and the LRUG management model developed during the project has been adopted by Catholic Relief Services (CRS) in Cambodia for application to a variety of natural resource management situations. In Sri Lanka, participatory trials with community groups attached to small seasonal irrigation reservoirs (‘tanks’) enhanced the fisheries within them by stocking of wild fish seed collected in larger perennial reservoirs further down the watershed. Community appraisal found the fish subsequently captured from these small tanks to reduce the vulnerability of the lowest income groups during periods when the price of fish from other sources was elevated. Furthermore, interventions were most effective for the smallest, most marginalised communities, making this a particularly pro-poor project. End user impacts for

both projects were assessed and verified in three PhD Theses. Work in Bangladesh aimed at enhancing small-scale cage culture has also demonstrated the viability of nursing for fish fry and giant freshwater prawn post larvae in hapas (simple fine mesh net cages) in ponds and small water bodies for sale to farmers as a livelihood diversification strategy for the extreme vulnerable poor. Further expansion of this technique which generates rapid turnover has been constrained by undersupply of brood fish and post larvae in remote areas, but holds significant potential as these become more widely available. AFGRP associated research (PAPUSSA) has also verified the crucial role played by short-crop aquatic vegetables grown in peri-urban areas of Asian cities in sustaining livelihoods for the poor.

11. *Where and when* have the output(s) been validated?

Please indicate the places(s) and country(ies), any particular social group targeted and also indicate in which production system and farming system, using the options provided in questions 7 and 8 respectively, above (max 300 words).

Outputs fall relating to self recruiting species fall into three categories; 1) recognition of the importance of SRS and the potential to manage production systems to increase yields whilst enhancing stocks, 2) building capacity through dissemination of this knowledge to relevant institutions and individuals, and 3) community based interventions using the LRUG model developed during the project, and individual farmer trials. The first output was validated in the field through participatory rural appraisal exercises in 2001 and by mathematical modelling of the ecology of fish populations subject to both natural recruitment and artificial stocking. The knowledge acquired was put into practice during interventions between 2003 and 2004 in six villages in Southern Cambodia, five villages in Northeast Thailand and three in Vietnam's Red River Delta. This resulted in elevated levels of SRS production and consumption among participants. Poor farmers and other members of rural communities at sites located in irrigated, wetland rice, and smallholder rainfed highland farming components of land water production systems were the targets of these activities. In depth research on small-scale farmer-managed stock enhancement in irrigation systems was carried out in 14 watersheds containing 120 tanks, in North West Sri Lanka between 1999 and 2002. Preliminary farmer-managed trials took place with three communities (5 tanks) in 2000. A second phase of modified trials took place with three new communities and one old (5 tanks) in 2000/01.

Current Situation

C. *Current situation*

12. *How and by whom* are the outputs currently being used? Please give a brief description (max. 250 words).

Best practice guidelines developed during the project are currently being used by households in Cambodia and Northeast Thailand where community members continue to implement management practices agreed during LRUG meetings to enhance SRS productivity in their farming systems. Management activities put into practice include; deepening ponds, creating pathways between water bodies, maintenance of wild and stocked broodstock by avoiding total harvest and pond drainage, stocking of fish from captured in rice fields into ponds, and stocking

of hatchery seed. These activities facilitate migration of wild and stocked SRS between seasonally interconnected water bodies (rice fields, trap ponds, household ponds and perennial water sources), enhances stocks by creating refugia and other suitable habitat which encourage recruitment and survival, and allows for staggered harvesting, thereby extending the period over which they can be consumed. Pesticide use in these systems is also reduced to encourage the survival of animals in them. The interconnectedness of rice field/wetland ecosystems means that collective management is an extremely important if productivity is to be enhanced as part of this process since individual actions will create little impact. However, flooded rice fields are treated as common property resources meaning that non-participating community members are able to benefit from access to them. Farmers and communities with access to small managed areas of water, day labourers and their families, low-income purchasers and consumers with limited access to wider fish markets all benefited from management. Poorer households rely significantly more on SRS than better off households.

13. *Where* are the outputs currently being used? As with Question 11 please indicate place(s) and countries where the outputs are being used (max. 250 words).

Outputs are currently being employed by end users (farmers and other community members with access to interconnected water bodies) in Northeast Thailand, lowland Cambodia and drought prone and one flood prone area in Bangladesh. Disseminated knowledge products are being used institutionally in Bangladesh, Cambodia, Thailand and Vietnam. And information has also been distributed to relevant institutions in India, Indonesia and Lao PDR. Out of all the target countries, dissemination in Bangladesh was the most advanced due to good relationships with supporting institutions in the country. Institutions and organisations in the country are already aware of the importance of non-stocked aquatic animals and receptive to further information dissemination. CARE – Sri Lanka has adopted approaches to irrigation system management developed during AFGRP research in their programme planning for implementation across the country.

14. *What is the scale of current use? Indicating how quickly use was established and whether usage is still spreading (max 250 words).*

In Cambodia six villages, four in Svay Rieng province and two in Takeo province were targeted during the intervention. An additional six neighbouring villages in each province have since implemented similar management practices having observed their efficacy. Local resource user groups in all of these communities operate with the support of the Department of Fisheries. This amounts to use by 2435 households in Cambodia in a total of 18 villages. An NGO, Catholic Relief Services (CRS), has adopted the LRUG model as an effective tool for other forms of community based natural resource management in several locations. The five villages in Thailand where LRUGs were established continue to implement their management decisions, although the groups stopped meeting when institutional facilitation ceased. Dissemination of materials highlighting the significance of SRS and advocating management techniques which enhance their production continues. In Bangladesh and Cambodia, fisheries officials support this dissemination by directly involving their staff in the production of materials, and extension messages in Thailand and Cambodia have been altered to take into account the importance of SRS.

15. *In your experience what programmes, platforms, policy, institutional structures exist that have assisted with the promotion and/or adoption of the output(s) proposed here and in terms of capacity strengthening what do you see as the key facts of success? (max 350 words).*

The participation of multiple stakeholders in the project (i.e. policy makers, teachers, field extension workers, farmers, officers from agriculture and fisheries departments, NGOs and donors) and their key role in production of extension and dissemination materials has assisted greatly in their uptake and adoption. For instance dissemination activities in Cambodia were successful in part due to the involvement of the Director General of the Department of Fisheries who, in addition to supporting the production and distribution of dissemination materials, was also involved in their editing and translation. In the SE Asian sites LRUGs were the key platform from which promotion and adoption took place. Provincial fisheries stations operated by the Thai Department of Fisheries (DOF) operate projects for the promotion of rice-fish culture using approaches similar to the local resource user group model and overlap between the two has proven helpful. The decentralisation of power for natural resource management to the sub-district level which has occurred in Thailand in recent years is advantageous because it increases the flexibility of local government officials. As a result some Thai DOF officers have adopted participatory approaches to extension. In Vietnam government officials lack the autonomy to implement approaches such as these unless they are centrally sanctioned. Promoting resource management through LRUGs is effective in building local capacity at the grassroots level because it facilitates the establishment of informal institutions through farmer cooperation. Management of enhanced fisheries in Sri Lanka was implemented through the indigenous local institutions, 'death donation societies' that existed in each village. Because of their long history, broad membership, and regular meetings these proved an ideal conduit through which communal management could take place.

Current Promotion

D. Current promotion/uptake pathways

16. *Where is promotion currently taking place? Please indicate for each country specified detail what promotion is taking place, by whom and indicate the scale of current promotion (max 200 words).*

The Department of Fisheries in Cambodia currently acts as a facilitator for LRUGs managing SRS and the LRUG model has been adopted in Cambodia for promotion by CRS. Dissemination materials are being promoted in the seven Asian countries listed in Question 13 by the Support to Regional Aquatic Resources Management programme (an FAO, NACA and DFID partnership). These materials have been used to raise awareness of the importance of SRS among relevant institutions and policy making bodies in selected provinces of each country. Promotion has been nationwide in Bangladesh and Cambodia. Promotion of irrigation system management approaches by CARE – Sri Lanka based the results of AFGRP research has been implemented although it is not presently known on what scale.

17. *What are the current barriers preventing or slowing the adoption of the output(s)? Cover here institutional issues, those relating to policy, marketing, infrastructure, social exclusion etc. (max 200 words).*

Lack of institutional ability to support existing LRUGs and form new ones has prevented their continuation in Thailand and limited the scale of uptake in Cambodia. Institutional emphasis on commercial aquatic animal production in Vietnam runs contrary to promotion of management of SRS for largely subsistence purposes,

although the policy makers from the Ministry of Fisheries Aquaculture for Poverty Alleviation Strategy (SAPA) have expressed interest in further development of the concept given sufficient funding. In drier areas of Cambodia and NE Thailand a prolonged period of drought led to the cessation of two LRUGs. Neither marketing nor infrastructure issues pose a significant barrier to adoption of communal SRS and stock enhancement techniques since inputs (e.g. wild fry) are sourced locally from public water bodies and as the majority of consumption is of a subsistence nature.

18. What changes are needed to remove/reduce these barriers to adoption? This section could be used to identify perceived capacity related issues (max 200 words).

Limited institutional capacity at the provincial and district level is the major barrier to adoption of short-crop aquatic production techniques at present. Increased awareness amongst high level policy makers in fisheries departments regarding the importance of and benefits derived from SRS and their high potential for integration into farmer managed aquatic systems could lead to more widespread promotion of this knowledge in the field. Training and increased support for government extension staff and NGO workers in LRUG facilitation and participatory extension techniques would increase the scope and impact of community based management techniques.

19. What lessons have you learnt about the best ways to get the outputs used by the largest number of poor people? (max 300 words).

Cambodia and Bangladesh offer the best examples of positive impact on poor people. This is because greater awareness of the benefits associated with SRS has been achieved in these countries than elsewhere in the region. High level fisheries staff have taken on board and endorsed promotional messages here and this information has filtered down to local level extension officials and NGO workers. The involvement of an international coordinator (STREAM) has facilitated the dissemination of information internationally through its networking capabilities. It has also proven critical for any interventions to be appropriately targeted. Uncritical targeting and inappropriate development risks poor or negative impacts. This is critical in the context of common property resources where a broadening of focus from household to community is required to predict who might benefit and lose. Because of the fundamental role of inland fisheries in rural livelihood security, equitable distribution should be prioritised above macro-level economic growth. Conventional efforts to promote aquaculture in seasonal water-bodies have focused on technical innovations, i.e. identifying what species of fish to stock, how to produce the required fingerlings and the optimal stocking strategies. Unfortunately, such efforts have not been sustainable nor delivered benefits to the poorest groups. As both SRS management and fisheries enhancement as piloted in Sri Lanka are strongly pro-poor development tools they are most effectively applied to these social groups.

Impacts on Poverty

E. Impacts on poverty to date

20. Where have impact studies on poverty in relation to this output or cluster of outputs taken place? This should include any formal poverty impact studies (and it is appreciated that these will not be commonplace) and any less

formal studies including any poverty mapping-type or monitoring work which allow for some analysis on impact on poverty to be made. Details of any cost-benefit analyses may also be detailed at this point. Please list studies here.

No formal poverty impact studies have taken place to date, but a final technical report, dissemination impact assessment and two PhD theses have all documented the impacts of LRUGs on livelihoods

21. Based on the evidence in the studies listed above, for each country detail how the poor have benefited from the application and/or adoption of the output(s) (max. 500 words):

- What positive impacts on livelihoods have been recorded and over what time period have these impacts been observed? These impacts should be recorded against the capital assets (human, social, natural, physical and, financial) of the livelihoods framework;*

Positive livelihood impacts have been recorded in the four countries where SRS trials took place. In terms of natural capital, yields of aquatic animals were improved in each. This was also the case for financial capital, with a corresponding increase in earned income and reduced expenditure on food in each country. Physical capital increased for similar reasons due to more efficient water use and conservation, and improvements made to farmers' systems (e.g. deepening of trap ponds). Human capital was enhanced because farmers and consumed more aquatic animals, increased their knowledge of how to culture stocked fish and manage wild species together and learned group management techniques. Social learning was a key element of both projects resulting in enhancements of capital among LRUG members and small-tank communities which led to improved relationships. In Cambodia and Thailand harvested SRS were shared with other community members. In general the greatest benefits were derived through improvements to human and social assets

- For whom i.e. which type of person (gender, poverty group (see glossary for definitions) has there been a positive impact;*

In the three SE Asian countries LRUG members were the major beneficiaries. Community members who did not participate in the groups also obtained some benefits since the increasing abundance of aquatic animals was not spatially limited to the systems of group members. Qualitative surveys of 120 participants in Bangladesh indicated the potential of SRS to reduce gender disparity in fish consumption. Deliberate inclusion of SRS in aquaculture also expands niche benefits for non-pond owners and vulnerable professional groups such as fishers during the 'lean season' since fish from ponds are available during dry months when SRS from open access waters are less plentiful. SRS also play an important role in producing social capital in Bangladesh where they are often offered as gifts to neighbours and relatives. Small fish from aquaculture systems are also frequently part of payment in kind for workers or are sold at low prices, thereby contributing to the livelihoods of poor non-fish farmers in rural and urban areas. In Sri Lanka, the poorest, most marginalised communities were found to gain more from stock enhancement of tanks than richer communities, and so practiced communal management more effectively. Within individual communities, the poorest households were found to consume the greatest quantities of fish stocked during trials.

- Indicate the number of people who have realised a positive impact on their livelihood;*

As research findings trialled through interventions to promote SRS production and enhance tank fisheries were

of an experimental nature absolute numbers of people impacted are relatively small at present, and exact number are not known. 2435 households in Cambodia in a total of 18 villages currently manage SRS through LRUGs. In Bangladesh year round participatory trials in which entry of wild SRS into carp ponds was encouraged were carried out with 29 farmers. 108 households participated in trials in Thailand and Vietnam. Six communities participated in stock enhancement activities in Sri Lanka

- *Using whatever appropriate indicator was used detail what was the average percentage increase recorded*

In Bangladesh SRS yields more than doubled with no measurable negative impact on carp production. Furthermore, SRS accounted for 24% of total household fish consumed from trial ponds. In the three SE Asian countries it was not possible to disaggregate consumption of purchased fish or those harvested in open water bodies from that of SRS since they were often of the same species. However, LRUG members in all three countries reported increased yields from their systems. Variability between sites in Sri Lanka makes it difficult to provide an overall measure of increases in production and consumption of fish resulting from stock enhancement. However, to give an example, of the type of impact achievable, 65% of fish consumption among poor households in one village was derived from a tank which had previously contained no fish.

Environmental Impact

H. *Environmental impact*

24. *What are the direct and indirect environmental benefits related to the output(s) and their outcome(s)? (max 300 words)*

This could include direct benefits from the application of the technology or policy action with local governments or multinational agencies to create environmentally sound policies or programmes. Any supporting and appropriate evidence can be provided in the form of an annex.

The major environmental benefit associated with enhanced management of SRS is the increased abundance of wild aquatic animals in farmers managed systems. Unsustainable practices such as total harvest of trap ponds are discouraged in favour of brood stock maintenance. Stocks of juvenile fish were also protected, and in some cases captured and restocked in nearby water bodies to enhance production. Pesticide application was reduced in order to improve the productivity and biodiversity of rice fields and surrounding ecosystems. Habitat improvements such as the deepening of trap ponds, opening up of corridors between the different components of wetland systems and habitat creation. In Cambodia indiscriminate harvesting practices such as electrofishing and trapping of migrating fish with certain fishing gears have been banned. This complements proactive management by LRUGS, and reduced harvest by these methods is compensated for by the higher yields obtained from farmer managed systems. The total amount of SRS consumed over the year is strongly correlated with diversity of SRS species consumed and emphasising the significance of maintaining biodiversity.

25. *Are there any adverse environmental impacts related to the output(s) and their outcome(s)? (max 100 words)*

There are no recorded adverse environmental impacts.

26. Do the outputs increase the capacity of poor people to cope with the effects of climate change, reduce the risks of natural disasters and increase their resilience? (max 200 words)

Enhanced management of SRS extends the period over which they can be harvested. In traditional systems the bulk of fishing/capture activities are highly seasonal. Consumption is highest during the late wet and dry seasons. Management practices instituted by LRUGs such as conservation of brood fish mean that stocks are maintained throughout the year and harvesting is staggered. This makes beneficiaries more resilient to food shortages than they would otherwise be. Preservation of fish from these systems by basic processing (e.g. drying, fermenting) also enhances food security in the face of climatic events (e.g. drought, flooding), and
