

**Fish cultivation can be one of the tools to help farmers manage uncertainty better. However, it is up to the farmer to decide when cultivating brings greater benefits than capturing. Many factors influence the farmer's choice, like rainfall and migration to cities (relieving the pressure on wild fish stock). In most cases, capturing wild fish remains an important strategy. The authors argue that field workers assisting lowland rice farming communities should focus on the real need for fish culture, rather than on the availability of suitable resources for aquaculture.**

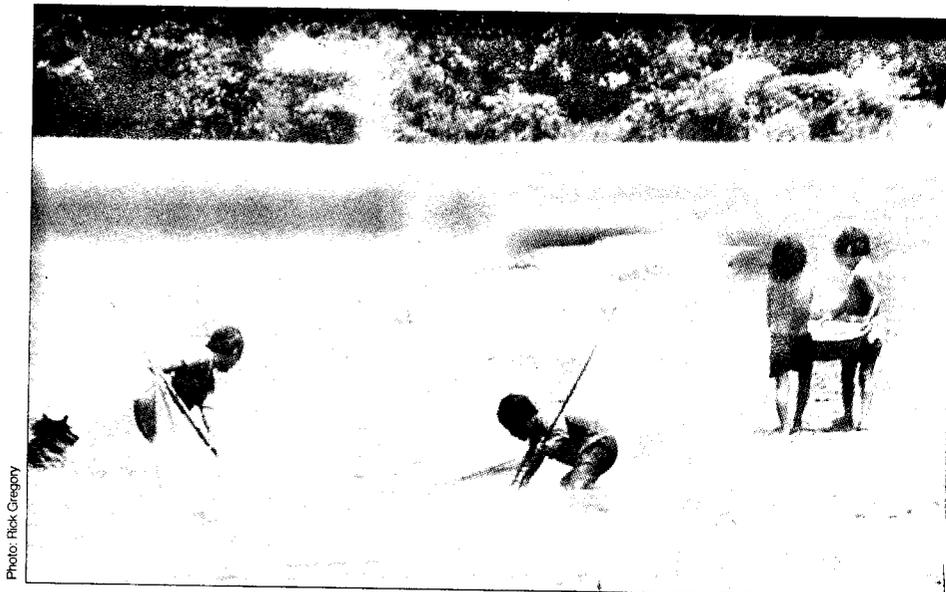


Photo: Rick Gregory

## Management of ricefield fisheries in South East Asia Capture or Culture?

**Rick Gregory and Hans Guttman**

**T**o many rice farming communities in lowland areas of Asia, wild fish and other aquatic produce such as crabs and frogs collected from ricefields are important sources of food. Appearing after the first heavy rains these aquatic animals are well adapted to the rice field environment where they breed and grow in great numbers during the wetter months. Where human populations are at low levels and rice farming practices remain extensive, aquatic animals can be easily collected by rice farming families providing them with free and highly nutritious sources of animal protein. Heckman (1978) documented 18 aquatic animal (10 fish) species regularly consumed by rice farmers in Udom Thani in North East Thailand and concluded that despite low per capita income at that time, villagers were able to manage an adequate diet, due, in no small part, to these free ricefield foods.

Increased pressure on the ricefield fishery, through population growth, the use of destructive fishing gears and techniques and the intensification of agriculture (particularly the use of pesticides and the use of dry season swamps for rice cultivation), are thought to result in the decline of ricefield fisheries to the point where farmers have to move from fishing to fish culture in order to retain previous levels of fish consumption in their diet. The experience of the AIT Aquaculture Outreach Programme in South East Cambodia and North East Thailand suggests that the success of extending aquaculture (where fishseed is introduced deliberately by the farmer) is closely linked to the present productivity of local ricefield fisheries.

### Anyone for aquaculture?

This can be illustrated by looking at two rice farmers in South East Cambodia, who live

some 20 kilometres from each other in Svay Rieng Province. Both are subsistence wet season rice farmers living in poor rural village communities and both collect aquatic produce from their rice fields. They are faced with a choice of whether to capture or culture fish from their ricefields, in effect, to change from ricefield hunter-gatherer to ricefield fish farmer.

The first farmer lives in a black soil, low pH (4-5) area of Svay Theap District, about 4m above sea level. Large areas of this district remain flooded throughout the wet season and there are some large permanent water bodies. Many homesteads have small ponds near to them and the water in the area is generally clear. Some forest areas remain including large areas of *Melaleuca leucadendron* from which the villagers extract Cajuputol oil for making balm. Rice yields are in the region of 1000 - 1500 kg/ha. The second farmer lives in a gray soil area of moderate pH (6) in Svay Chrum District at about 6m above sea level. Drought is common here and ricefields quickly dry out once the rains stop. There are few permanent water bodies in the area and few homesteads have ponds. What water bodies exist are extremely muddy and unproductive. There are few trees in the area aside from sugar palms. Rice yields are low, in the range of 800 - 1000 kg/ha.

The field worker working in these areas might consider extending aquaculture but which of the two farmers would be most likely to adopt the practice?

### The capture fishery

At first glance, the environment of the farmer in Svay Theap seems to favour adoption. Many ponds full of good quality water for most of the year are usually a tempting sight for the aquaculture field worker. However, if they were to extend small scale fish culture in Svay Theap they would almost certainly fail to have farmers adopt the practice in the long term.

Per capita ricefield fish (and other aquatic animals) consumption in the area has been calculated at > 60 kg/year. A small trap pond dug to collect wild fish from ricefields will often yield in excess of 50 kg/year of predatory fish, Snakehead (*Channa striatus*) and Catfish, (*Clarias macrocephalus*) as well as 20 kg of smaller fish species such as Climbing Perch (*Anabas testinudeus*), Gouramis (*Trichogaster sp.*) and Danios (*Rasbora sp.*). Throughout the wet season, small fish can be easily collected from ricefield ditches for daily meals or preserved through fermentation as "brahok" (fermented fish paste) for the leaner times. Larger fish for consumption and sale can be speared at night, caught from jump traps, gill nets or baited lines.

Aquaculture might improve on the farmer's current pond or ricefield yields and possibly save the household effort in collecting fish. However, a number of factors exist which will make the farmer unlikely to be impressed by small-scale aquaculture when he compares the returns with the free alternative offered by the natural ricefield fishery. Natural fish are considered more tasty, kept alive after capture more easily and when sold fetch higher prices than most cultured species. Will the farmers in this area risk investing money and time on producing a lower value product? At the moment the answer is probably "No".

However, many farmers have expressed concern that the ricefield fishery in recent years is not as productive as it used to be and they are worried that in the future there will be no fish for the people. Farmers believe that the use of modern micro-mesh fishing gear and the pumping of dry season fish refuge areas are two reasons for this decline. Older farmers lament the change from communally managed resources, which ensured that some areas were not fished each year, to open exploitation by individual farmers under contract to wholesaler middlemen.

## The culture fishery

The present situation for the farmer in Svay Chrum is quite different. Here, typical trap pond catches are in the region of 5-10 kg/per year whereas per capita fish consumption is thought to be around 15 kg/year. Farmers still collect natural fish, frogs and crabs from their ricefields but these animals can only be caught in any quantity following periods of heavy rain and they are usually small in size. In Svay Chrum, the ricefields have probably always been less productive than in Svay Theap and cannot withstand much fishing pressure on them. So aquaculture may be one way that farmers can reduce their family fish deficit levels as well as easing pressure on the local ricefield fishery.

In this district, the AIT Aquaculture Outreach Programme working with the Cambodian Department of Fisheries and the Svay Rieng Agriculture Department have demonstrated that rice farmers can produce up to 200 kg of cultured fish (*Puntius gonionotus*, *Cyprinus carpio* and *Oreochromis niloticus* x *O. mossambicus*) from simple, extensive ricefield systems. Farmers have reported that fish culture is most useful for them at rice transplanting and harvesting time when the family doesn't have much time to forage for ricefield animals. However even here, farmers see fish culture as a supplement to the collection of aquatic animals from the ricefields not a replacement.

## Who needs small-scale aquaculture?

It is ironic then that in extending fish culture in non-irrigated lowland rice growing areas in Asia it may be better to look to the slightly higher, drier areas where soils and water conditions are usually poorer for fish. These are more likely to be fish deficit areas where a change from a capture to a culture system may make sense as culturing fish should ensure a more reliable and regular supply of fish than relying on the rain for a "good" year. It is suggested that field workers assisting lowland rice farming communities focus on the real need for fish culture, rather than on the availability of suitable resources for aquaculture. This would shift the whole emphasis of underlying research and extension effort to assisting the farmer decide "the best course of action" under any prevailing circumstances.

The effort required to collect ricefield fish and other aquatic animals must also be taken into account. It should also not be forgotten that children out fishing are not at school! At a certain degree of degradation of the ricefield ecology it may make sense for the farmer to switch to aquaculture once the effort to collect enough aquatic animals for the family is too time consuming. Unless this level of degradation exists, then aquaculture extension

effort will probably be wasted as farmers will still be able to satisfy their need for edible aquatic animals through fishing in the ricefields. However this is not a one way process either. Evidence from North East Thailand suggests that ricefield fisheries may be making a comeback following the extensification of rice cultivation, (as seen by the increasing popularity of broadcasting rice as opposed to transplanting) and the consequent recovery of the ricefield ecology. Many farmers in the region take up urban employment opportunities and may only stay in the villages during the periods when the ricefields are being prepared and transplanted/sowed and when the rice is harvested. Being away for most of the year means that they are not fishing. This has the effect of reducing pressure on fish stocks, particularly brood stock in dry season refuges and may mean more fish are available for those still fishing. This may mean that small-scale aquaculture in this part of Thailand is less relevant for small scale rice farmers than it was 10 years ago, before so many urban employment opportunities existed.

## Uncertain management versus management of uncertainty

Natural factors affecting the availability and productivity of aquatic animals from the ricefield are usually well-known to rice farmers and appear to be related to land topography, the proximity to natural water bodies, (Tana 1993) and perhaps most importantly, the amount of rain which falls during a wet season and the duration that the ricefields are flooded. As rainfall varies considerably from year to year farmers might want to culture fish in a dry year but rely on wild fish in a wet year. This is complicated by the farmers' need to stock cultured fish fingerlings before the peak of the rains. So the farmer, as with many of the other farming activities needs to be able to predict the weather. A possible strategy to manage this uncertainty could be for farmers to use fish culture as insurance against poor rains and thus poor wild fish availability. Whilst the farmer might stock fingerlings each year, in a year of poor rains the farmer could invest more resources into the cultured fish system whereas in a year of good rains, the cultured fish, after an initial period could be largely forgotten and the farmer concentrate on wild fish instead. As with any insurance the rewards only pay when something goes wrong, in this case the rain fails.

One indicator of the productivity of ricefields is the amount of natural fish which can be trapped in a farmers pond connected via a broken embankment to a rice field. The AIT Aquaculture Outreach Project in Cambodia is developing a tool which will enable field workers to collect, compile and map data from trap ponds and thus identify areas of low ricefield productivity, which may be the most suitable areas for extending fish culture, (Bunra and Gregory 1995). A more detailed explanation on how to use and interpret results from this tool will feature in a later article.

## Conclusions

In terms of maintaining family fish supplies in lowland rice areas it seems that farmers need to develop the same degree of skill on when/when not/how to do aquaculture as they now routinely do with rice culture and other crops. Richards (1989) describes farmers in Northern Nigeria making rolling adjustments to drought situations, using different seed mixes to the changing circumstances. This included the planting of back up and insurance crops. It is suggested in this article that aquaculture can fill a similar role in some lowland rice growing areas.

Field workers trying to help farmers acquire this type of performance skill for aquatic animal production are likely to be more successful than those offering an "aquaculture or nothing" package approach. This calls into question the meaningfulness of project evaluations which might measure farmer adoption rates a year after an extension effort to determine success. A farmer who chooses to culture fish one year in every five is still "an adopter".

The promotion of aquaculture to lowland rice farming communities is, therefore, not as simple as introducing a superior technology to replace the natural ricefield production. Exactly how and when farmers choose or choose not to use aquaculture as a means to supplement household nutrition and income depends on a range of factors affecting the availability of naturally occurring alternatives.

Finally, this article calls for more work to be done on the subject of managing ricefield capture fisheries in Asia. With so many rural families dependent upon this resource, it is astonishing that so few studies have been conducted. Heckman in his study 20 years ago, hoped that his work was a point of departure for more detailed studies into managing the entire ricefield ecosystem but little subsequent work appears to have been done. One thing is for certain: through neglect, natural ricefield fisheries can quite quickly become degraded to the point where farmers have little choice but to turn to a cultured solution to the problems of household fish supplies.

## References

- Bunra, S. and R. Gregory. 1995. **Trap Pond Mapping as a Survey Tool in Aquaculture Development Planning**. Paper presented at PADEK Seminar on Aquaculture Development in SE Cambodia, 1995.
- Heckman CW. 1979. **Ricefield Ecology in Northeastern Thailand**. Dr. W Junk Publishers, The Hague.
- Richards P. 1989. **Agriculture as a performance in Farmer First**. Intermediate Technology Publishers, London.
- Tana TS, H Demaine and P Edwards. 1994. **Fish Consumption Patterns in a Deficit Area: A case Study of Svay Rieng Province, Cambodia**. AIT Aquaculture Outreach Working Paper No C1.

**Rick Gregory and Hans Guttman**. AIT Aquaculture Outreach, PO Box 835, Phnom Penh, Cambodia. Fax: +662 524 6200. E-mail: [aitaqua@pactok.peg.apc.org](mailto:aitaqua@pactok.peg.apc.org)

A (PAL) video in English and Khmer, filmed in Cambodia on this subject entitled "More than just Rice" is available for US\$15, (postage included) from Information Unit, The AIT Aquaculture Outreach Programme, Asian Institute of Technology, PO Box 2754, Bangkok, Thailand. Fax no