

This last issue of *Aquabyte* for 1995 comes to you with a mixed bag of articles on inland aquaculture systems and a broad overview of transgenic fish research. Over the years, *Aquabyte* has featured more articles on inland than on coastal aquaculture. This probably reflects the relative contributions to world fish supply from aquaculture and the rather more risky nature of farming in or adjacent to the sea: less control of the environment, invasive biota, red tides, severe weather, pollution, etc. It would be good to hear some views from NTAS members

on whether the balance between inland and coastal aquaculture might change in future. The transgenic fish review is packed with technical jargon that may be unfamiliar to many readers. However, transgenic technology cannot be ignored. This review and the references cited provide an entry point to the literature for those who want to explore it. For 1996, we hope for a larger crop of articles and of photos that tell a story. This issue lacks a photosection. Wishing all NTAS members a happy and successful new year. *R.S.V. Pullin*

## Aquaculture in the Mountains of the Northern Lao PDR and Northern Vietnam

LE THANH LUU, NGUYEN HUY DIEN,  
NICK INNES-TAYLOR and PETER EDWARDS

### Background

Except among national scientists, there is little awareness that traditional systems of aquaculture are practised in the mountainous areas of northern Lao PDR and northern Vietnam. Culture of fish in ricefields by Lao/Thai speaking people is centuries-old and is one of the few examples of indigenous systems of freshwater fish culture in Southeast Asia: inland aquaculture was introduced into most countries of the region by Chinese immigrants in the late 19th and early 20th centuries.

According to Chevey and Lemasson (1937), an indigenous rice-fish culture system involving a local strain of common carp (*Cyprinus carpio*), was carried out in valleys in the mountainous areas of northern Vietnam by a Thai ethnic minority, the largest minority group there. The self-contained, family-level system provided fish solely for household use, the excess fish were dried or made into fish sauce for consumption during the dry season. Two crops of rice were grown using traditional varieties, each for four to five months: from

Vietnamese New Year in early February to July/August, and from September to the following Vietnamese New Year. Fish were cultured only during the second, rainy rice crop season, when water was abundant. Broodstock of the local strain of common carp were overwintered in small ponds or cages and hatching, nursing and growout were carried out in ricefields, unmodified apart from some that had fish

refuges, 1.5-2.0 m diameter, 1 m deep in the center or corner.

Aquaculture staff at the Asian Institute of Technology (AIT), Bangkok, heard "rumors" of the current practice of such mountain aquaculture, during the implementation phase of an outreach program which assists in promoting aquaculture in these countries, in partnership with national institutions. This convinced them that efforts should be made to assess its status and possible future interventions. These are the results of the consequent missions.

### Northern Lao PDR

Singkhom Phonvisay, Director of the Department of Livestock, Veterinary Services and Fisheries and Somboon, an AIT alumnus, guided Nick Innes-Taylor and Peter Edwards on a nine-day field trip in November 1995 to six of the eight northern provinces of Laos (the Lao PDR) to assess the current status of aquaculture and the feasibility of an intervention through AIT's Outreach Program. Aquaculture was observed in all of the provinces visited.

In Hua Phan province, the party visited Ban Muang Vene, the home



*Small-scale fishponds in a rice-growing valley, Son La province, northern Vietnam.*  
ALL PHOTOS BY P. EDWARDS, AIT



*Small-scale fishponds, Mai Chau, Hoa Binh province, northern Vietnam. The surrounding mountains are deforested due to population pressure.*

village of the Director. In this remote village, electricity is provided by a generator, powered by the river flowing through the village. Only one crop of rice is grown, in the rainy season. Following land preparation, water is pumped into the ricefields in April by a large, water-driven wheel made of bamboo, to which bamboo cylinders are attached to scoop water from the river on the upturn and discharge it into an irrigation channel on the downturn.

Wild fish enter the ricefields and spawn naturally before the rice is planted in May. The main species are *pa nai* (indigenous common carp), *pa fek* (an unidentified carp species, which grows to as large as common carp) and three smaller species; all breed in the ricefield. The traditional rice variety is fertilized with buffalo manure and nutrients from the continuously flowing irrigation system. No pesticides are used.

Rice and fish are harvested together in September with yields of 2-3 t/ha and 40-60 kg/ha, respectively. The fish are collected from a sump in the center of the field. One farm in the village keeps broodstock in two small ponds, above the village level irrigation system.

Traditional rice-fish culture also occurs in Ban Hok in Mouang Kham district of Xieng

Khouang province, but exotic species and "modern" fish farming methods have recently been introduced (FAO/UNDP 1985; Singh 1994). Farmers traditionally keep broodstock in ponds for two to three years before replacing them with younger fish from the river. Broodstock are stocked in the ricefields for two to three days until they spawn; after which they are caught and returned to the broodstock pond. Fish yields here are relatively high, 80-150 kg/ha/year. That this traditional culture may still be widespread in the area was suggested by sale of common carp eggs attached to roots of water chestnut or *hai khai*, a plant growing along the river banks. This also occurs in the Xieng Khouang provincial market in April and May.

There is considerable potential for fish culture in the valleys of the mountainous

northern Lao PDR, which are well supplied with water. It is government policy to promote small-scale homestead aquaculture for domestic consumption in such rural areas. Conceivably, aquaculture development in the valleys could take pressure off the uplands, where the exist-

ing shifting cultivation system is becoming unsustainable. More ricefields could possibly be developed using village level as well as larger intervillage irrigation schemes. Rice-fish culture is clearly feasible as indicated by the evolution of the traditional system, which could have an increased role to play in mountain aquaculture.

The indigenous fish culture system, involving both indigenous species and local technology, should be assessed for its value, before further dissemination of exotic species and "modern" technology to remote areas. The local strain of common carp with its elongated body form may be better adapted for growth in shallow ricefields than deep-bodied, exotic strains of the species. However, continued reliance on supplies of wild seed from rivers flowing through villages may not be feasible as villagers have reported drastic declines in wild fish due to overfishing and environmental degradation (especially increased silt loads, which reduce the depth of rivers and diminished water flow). Decentralized systems of seed production will also need to be developed to permit aquaculture to fulfil its potential in these mountainous areas with limited infrastructure.

## Northern Vietnam

Le Thanh Luu, Nguyen Huy Dien and Peter Edwards made a four-day trip in May 1994 to the mountains and valleys of Hoa Binh and Son La provinces in search of the traditional rice-fish culture systems. The valley bottoms were planted to rice, with sweet cassava and maize on the slopes. Deforestation was severe with



*A bamboo waterwheel, now in disrepair after harvest time. This is used to irrigate the village rice-fish system each season.*



*The local (northern Vietnam) strain of common carp (Cyprinus carpio).*



*Nile tilapia (Oreochromis niloticus) and carps (Cyprinus carpio) for sale in the provincial market of Xieng Khouang, northern Laos.*

cultivation approaching the crests of mountain ranges. Many households had small ponds, most of which were provided with a continuous water supply through bamboo pipes tapping the river upstream. Cage culture was also prevalent along the Sap river but "red spot disease" had caused mass mortality of grass carp (*Ctenopharyngodon idella*). This was the preferred species because of the abundance of green fodder (grass and sweet cassava leaves). The disease probably arose from stress caused by too many cages in the river, stocked with fish at too high a density and with poor water exchange between the bamboo slats. Disease had also been transferred to ponds supplied with river water.

Traditional rice-fish culture has largely ceased, following the formation of cooperatives from 1963 to 1965 and their emphasis on rice. It may persist only in remote areas of the two provinces visited and in Thai Nguyen province. According to Mr. Nguyen Xuan Viem, the Director of Agriculture, Livestock and Forestry of Son La province, 6,000 ha of the 14,000 ha of arable land in the province now have double rice cropping. These were formerly stocked with fish during the second rainy season rice crop. Although the old rice varieties were low yielding, a fish harvest of 300-500 kg/ha was formerly obtained and

provided the major source of animal protein for ethnic Thais.

In-depth interviews were conducted in the ethnic Thai village of Chian Xom in Ban Hum community, where each family had a 100-250-m<sup>2</sup> pond located in a row along the upper side of the valley and supplied with water from a submersible pump, powered by a water-driven electrical generator. Fingerlings for stocking bamboo cages were nursed in the ponds, and were also used for domestic consumption. Some households had started rice-fish culture again, to nurse fingerlings for stocking cages.

Aquaculture is promoted through a fish seed station in Son La town, built in 1966, which produces mainly grass carp but also silver carp (*Hypophthalmichthys molitrix*), rohu (*Labeo rohita*) and hybrid common carp. The local strain of common carp, which used to be stocked in ricefields, has a reddish and rather elongated body.

Current levels of fish production in mountainous northern Vietnam are now insufficient to meet the growing demand for food and income, despite promotion of aquaculture. The local government perceives aquaculture to have great potential. For example, Son La has plentiful supplies of water which can be fed to the estimated 50,000 small-scale family level ponds either by gravity or by pumping from

locally developed, water-driven, submersible pumps. The major constraints are limited trained personnel and limited funds for poor households to invest in aquaculture. However, it may be difficult to reintroduce the traditional rice-fish system because modern rice varieties are now being grown.

## References

- Chevey, P. and J. Lemasson. 1937. Contribution à l'étude des poissons des eaux douces tonkinoises. Institut Océanographique de L'Indochine. 33<sup>e</sup> Note, Gouvernement Général de L'Indochine, Hanoi. 183 p.
- FAO/UNDP. 1985. Handbook on fish culture. Department of Livestock. FAO/UNDP Project Lao/82/014, Vientiane. 27 p.
- Singh, S.B. 1994. Fish culture in land-locked Lao P.D.R. FAO Aquaculture Newsl. 7 (August):16-18.

**LE THANH LUU** and **NGUYEN HUY DIEN** are from the Research Institute of Aquaculture No. 1, Ha Bac, Vietnam; **N. INNES-TAYLOR** is Country Program Manager, AIT Aquaculture Outreach Program, Savannakhet, Lao PDR; and **P. EDWARDS** is Professor of Aquaculture in the Agricultural and Aquatic Systems Program, School of Environment, Resources and Development, Asian Institute of Technology (AIT), GPO Box 2754, Bangkok 10501, Thailand. N. Innes-Taylor and P. Edwards are seconded to AIT by the Overseas Development Administration, UK.