Peter Edwards writes on

Rural Aquaculture

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Pilgrimage to traditional carp pond culture in Central Europe

Drs. Berka (left) and Varadi (right) who assisted my pilgrimage to the Czech Republic and Hungary.

Much has been written about contrasting philosophies of East and West concerning human interactions with nature. In Asia humans have been considered to be an integrated and relatively benign part of nature while in the West we have been stated to be in conflict with nature as we attempt to dominate the natural environment through science and science-based technology, including aquaculture. This view is written most eloquently by Elisabeth Mann Borgese in her 1980 book, "Seafarm, the Story of Aquaculture": "aquaculture has a philosophical base in the East and a scientific base in the West…in the East it is culture, it is life…it is embedded in the social and economic infrastructure…in the West, aquaculture is science and technology, embodied in industry and providing profits…it has no social infrastructure".

While there is some truth in these differences between Asian and Western philosophies and aquaculture practices, they are fast disappearing in rapidly developing Asia. Furthermore, they overlook a major European aquaculture system: carp pond culture in Central and Eastern Europe (CEE). Carp pond farming has an almost 1,000 year old history and cultural tradition and is an integral part of the physical landscape and social fabric of some CEE countries. Carp are currently farmed in nearly 0.7 million ha of ponds with an average annual production of 190,000 tonnes between 1999-2003.

I have been based for my entire professional life in aquaculture in Asia, carrying out research, teaching and promoting traditional Asian aquaculture practice, so I made a pilgrimage to the historic pond areas of the Czech Republic and Hungary to gain first hand experience of this traditional Western aquacultural practice. Laszlo Varadi of the Research Institute for Fisheries, Aquaculture and Irrigation (HAKI) in Szarvas, Hungary kindly guided me for one week in July across Hungary and through the southern part of the Czech Republic to visit the major historic fish farming areas. In the Czech Republic we were joined by Zdanek Adamek of the Research Institute of Fish Culture and Hydrobiology Vodnamy and the University of South Bohemia, Ceske Budejovice who has in-depth knowledge of traditional Czech aquaculture. We visited many farms and a fisheries museum in both countries. I also gained further insight into current issues facing carp pond culture in discussions following the lecture I gave at the above research institutions in the two countries on how application of some of the principles of traditional Asian aquaculture might lead to more environmentally friendly modern aquaculture. I was also very fortunate to meet R. Berka, a distinguished retired scientist from the Czech Republic who has a wealth of experience on both the historical and recent development of carp pond culture in Europe

Overview of carp pond farming

Carp culture comprises three sequential pond stages which have remained more or less unchanged since it was developed in the 14th century, nearly 700 years ago. Carp are raised sequentially in three groups of ponds which are drained annually: nursing ponds are up to 1 ha in area and 0.5 m deep (and are often used later in the season as wintering ponds with deeper water) and produce the first year's fish; summering ponds up to 10 ha in area are used to raise 2 year old fish; and

marketing ponds at least 50-100 ha in area are stocked with 2 year old fish which are raised until they are 3-4 years old and have attained a marketable size of 1.5-3 kg.

The typical polyculture is dominated by common carp (*Cyprinus carpio*) stocked at 50-90% of the total, followed by Chinese carps (bighead carp, grass carp and silver carp) at 10-30% with a few percent of predators (pike, *Esox lucius*; pikeperch, *Stizostedion lucioperca*; European catfish, *Siluris glanis*) and other species such as tench (*Tinca tinca*). About 70-75% of the nutrition for the fish is from protein-rich natural food (plankton and benthos) with 25-30% from supplementary feeding with energy-rich grain (barley, maize, wheat). Cattle manure is mainly used to fertilize ponds but pig and poultry manure is used in areas where these livestock are raised in feedlots. However, ponds in many areas are eutrophic from agricultural, industrial or urban effluents or run-off so fertilization may not be required.

Ducks were previously raised on some fishponds in Hungary but are now raised separately as duck farming is now highly intensive. However, in both the Czech Republic and Hungary semi-wild ducks are raised to stock on special fish ponds for hunters. In the past in Hungary, ponds were drained only every 3 years and were rotated with a plant crop such as lucerne, maize or soybean but this practice has been discontinued since state owned farms have been privatised. There was also a fish, lucerne, rice rotation in some areas in Hungary which has also been discontinued.

Fish are harvested by sein nets in summer and autumn but at final harvest at the end of the year the water level is lowered and sein nets are used to force fish to swim into harvesting basins usually located outside the pond. Pond yields are relatively low, ranging from 600-1,500 kg/ha. A large majority of common carp production is sold live at Christmas for the traditional Christmas Eve dinner.

Until recently fish farms were state owned but they have now been privatized with some companies owned by worker stakeholders. Although aquaculture's contribution to employment is relatively small, in some areas it is one of the few livelihood options and helps to sustain rural populations. Today

A typically large fish pond with grain used as supplementary feed and feeding boat. Aranyponty Fish Farm, Hungary.

A feed storage silo on a eutrophic fish pond with green water, Czech Republic.

there are 50,000 ha of fish ponds in the Czech republic and 25,000 ha of ponds in Hungary, the two countries I visited.

Tour of historic fish farms

Following visits to the Research Institute, and fish farms dating to the 1940's, in Szarvas, southeast Hungary, we visited Aranyponty Fish Farm in the west of the country.

It was built by a nobleman more than 100 years ago in 1896 on poor quality agricultural land prone to water logging. It was originally a wetland but was drained in 1825 for agriculture. More recently it was a state farm and was purchased by its present owner, Ferenc Levai from the State in 1994 who began to diversify activities in 2000 so that the farm is now the core of the Rétimajor – Ponds Nature Reserve which was established in 1996 and covers about 1,500 ha. The fish pond system consists of 12 large ponds (10-70 ha), 16 small

ponds (1-5 ha) and 21 wintering ponds, with a total farm water surface area of 739 ha. More than 220 species of birds are registered on the farm, almost 60% of those found in Hungary, the majority of which have protection status. The reserve was designated as a Wetland of International Importance under the Ramsar Convention on Wetlands in 1997. The farm is one of only seven organic fish farms in Hungary currently certified by Bio-Kontrol Hungaria. There are various tourist and recreational facilities such as a hotel and a restaurant, angling, bird watching and nature trails. A former stable houses Hungary's only fishing museum. A field laboratory has been established in cooperation with HAKI to monitor the environment, develop innovative aquaculture technologies and study multifunctionality of fish farms. The farm revenues of the multifunctional pond farm are 20-50% higher than those of a conventional pond farm with only aquaculture, and in addition the former has a more diversified income which increases its economic sustainability and social acceptance.

We then drove north to Tata near Budapest, Hungary and visited the Tata Agricultural Shareholding Company. The largest fish pond belonging to the company is 219 ha in area with an average depth of 2 m. It was developed as a fish pond from a wetland in the 18th century and when the pond is drained, the old river with flowing water reappears. The pond is linked to the moat of a 15th century castle which was used as a royal hunting lodge and is believed to have been stocked with fish centuries ago. Today the moat is used as fish harvesting and storage basins.

Visits were made to fish farms in south Moravia and in the Trebon area, the largest of the three fish pond areas in south Bohemia, in the Czech Republic. There are hundreds of fish ponds of varying sizes dominating the landscape in the Trebon area. The largest fish pond in the Czech Republic was visited, Rozmberk, which is 489 ha at present although it was more than 700 ha in the past. It was built by damming a river running through water logged agricultural fields in the second half of the 16th century. A visit was also made to Bosilecky, 190 ha, which is the oldest fish pond in the Czech Republic with reliable evidence for its existence in 1355, 650 years ago. The pond is in the Trebonsko Protected Landscape Area and Biosphere Reservation which

A traditional wooden drainage monk on a fish pond, Czech Republic.

Fish harvest, Czech Republic. Photo courtesy of Zdenek Adamek.

comprises the village and surrounding countryside. The fish pond has reeds and sedges which shelter rare animals and plants and the pond attracts large numbers of migrating water fowl during the spring and autumn passage. Some water fowl also nest locally. There are also colonies of night herons and common terns on islets in the pond.

Environmental issues

Fish ponds are an integral part of the rural economy as well as the landscape because of their large number and often large size. Ponds were built in low-lying wetlands or areas with soil conditions too poor to support productive agriculture, sometimes from water logged fields which had earlier been converted from wetlands. In some areas, in particular in parts of southern Bohemia in the Czech Republic, centuries old fish ponds are the major feature of the landscape. Although they are all artificial, they look like lakes because they are so big. There has also been a continuous programme through the centuries of draining wetlands in Hungary to develop agricultural land as well as large fish ponds.

Bill board for Aranyponty Fish Farm advertising its multifunctional nature, Hungary.

Fisheries Museum at Aranyponty Fish Farm, Hungary.

Carp sign above the restaurant door, Aranyponty Fish Farm, Hungary.

Ferenc Levai, owner of Aranyponty Fish Farm with a ceramic exhibit in the museum, Hungary.

Water birds on a fish pond, Aranyponty Fish Farm, Hungary.

Fish harvesting and storage basins in the moat of the castle at Tata, Hungary.

Many ponds are multipurpose. Besides producing fish they may serve for recreation and tourism such as bird watching, angling and hunting specially bred, semi-wild ducks; water storage and flood protection of surrounding areas; irrigation; as nature reserves; and to preserve the local cultural heritage of aquaculture and carp consumption. The major flood experienced by the Czech Republic in 2002 would have been much worse according to Dr. Berka without fish ponds which held more water than storage reservoirs, even though their water holding capacity has declined by 25% due to silting in recent years.

The current low yield of carp ponds in the CEE is partly due to their multiple use, and especially from strong pressure from nature conservancy and environmental groups. Aquaculture may take second or even third place behind biological treatment of water, water retention and nature conservation. According to Dr. Berka, aquaculture in the Czech Republic is "fighting for existence" with environmental groups who would be "happy without fish in the ponds" even though all fish ponds in the country are artificial. Fish ponds have been taken over by environmentalists in Germany with a 50% decline in carp production Dr Berka revealed. He pointed out further that building fish ponds made the landscape more useful for humans as well as for nature: without aquaculture, there would be no water bodies; had wetlands not been converted into fish ponds, they would have been developed into agricultural land.

The Czech Government has set a limit of a ratio of 50:50 fertilizers to feed to produce carps in ponds according to Dr Berka. It is prohibited by law to add inputs to a fish pond but permission may be granted based on analysis of pond water quality and pond history. The main point of conflict is the desire of environment groups to consider a fish pond only as a natural wetland which is hardly feasible.

Environmental groups have also prevented the stocking of grass carp in ponds in the Czech Republic as it is not a native fish even though it would help to reduce excessive growth of aquatic macrophytes in the shallow ponds. In Hungary grass carp can still be stocked in fish ponds but not in reservoirs or natural waters.

The majority of ponds do function as wetlands because of their large size vegetated margins. Three fish farms in the Czech Republic and four in Hungary have protected fauna, flora and habitats under the Ramsar Convention on Wetlands. Under the all European project Natura 2000, it is predicted that

A monument to common carp in Trebon, Southern Bohemia in the heart of the largest area of fish ponds in the Czech Republic.

A smaller, village-level fish pond, Czech Republic.

further additional protected fish pond areas will be designated in the Czech Republic in which fish production will be decreased in many ponds to almost an extensive level.

Fish predators such as cormorants, herons and otters cause high economic losses to fish farmers although in the Czech Republic they are compensated under law for losses caused by protected animal species. The number of cormorants has increased dramatically in recent years in the Czech Republic as migrating flocks of tens of thousands of birds spend a few weeks on the ponds in spring and autumn as they pass through the region. Farmers are not concerned about a few hundred locally nesting cormorants but huge migrating populations from Northern Europe consume huge amounts of fish as a cormorant eats 0.5 kg fish/day according to Dr. Adamek who is involved in assessing fish loses due to animal predation.

At present the most important concern in Czech aquaculture is shallow ponds caused by siltation. This has always been a problem with ponds but in the past ponds have been desilted when the mud layer exceeded 40cm in depth. In recent years the silt load of water has increased as greater overall management of water has slowed down the flow rate and therefore the flushing rate and increased the siltation rate in rivers as well as in ponds. In the Czech Republic the average pond depth is now only 0.6-0.9m compared to 0.8-1.1m previously. Ponds are currently being desilted to increase their depth but it is expensive and requires government subsidy. It was easier to desilt ponds in the 1950s and 1960s before the era of pesticides, and even through the 1970's and 1980's, as there was a large demand for nutrient-rich sediments to put on agricultural land but there is no demand today. Fish pond sediments sometimes have to be treated like hazardous wastes because of a high pesticide content from improper agricultural practices during the previous socialist era.

Carp farming is increasingly being seen as part of the solution to nature conservation and not as a problem. As well as producing more fish, deeper fish ponds can store more water as well as provide a more suitable habitat for water birds. Shallow carp ponds were observed in Hungary during the tour which had been left idle for a few years. They had become infested with dense stands of emergent macrophytes and had therefore become unsuitable for water birds attracted to open water. In fact, fish farming may be the only economic way to manage fish ponds to prevent them from disappearing through vegetational succession so that they can also serve as a suitable habitat for water birds. A balance needs to be struck between the various multiple functions. It is a major developmental goal of carp farming in the CEE countries to maintain the condition of existing fish ponds so that they may continue to function as wetlands with potential to preserve habitats for diverse fauna and flora as well as rural landscapes. Multiple functioning of fish ponds is now considered to be a strength of pond aquaculture by the aquaculture fraternity.

Marketing

There are also marketing issues which threaten the sustainability of carp farming. Carp production is still profitable with farm gate prices of Euro 2.2-2.4/kg for carp of at least 1.5 kg but annual fish consumption is very low

Above left: Water gate at Rozmberk the largest fish pond in the Czech Republic. Above right: Fish harvesting basin at Bosilecky, the oldest fish pond in the Czech Republic.

An unused fish pond filled with reeds and sedges, Szarvas, Hungary.

in the CEE e.g., in 2006 in the Czech Republic it was only 5 kg/person/year (and only 1.1 kg/person/year of freshwater fish) and only 3.7 kg/person/year (only 0.7 kg/person/year of freshwater fish) in Hungary in 2006. Carp prices have been stagnant over the last 10 years.

Most carp are eaten at the traditional Christmas Eve dinner, over 90% of the carp consumed in the Czech Republic although only 30% of the total annual sale is at Christmas in Hungary. Carp are also used to stock ponds for anglers and are exported for human consumption as well as for stocking ponds for angling. Very little fish is processed as the price of processed fish is much higher than that of processed pork and imported marine fish such as salmon. *Pangasius* catfish is now imported from Vietnam and as it is a high quality product that is cheaper than locally farmed fish, it is considered to be a major threat to the sustainability of local aquaculture. Advertising campaigns are being carried out to try to increase consumption of carp, a high quality fish with low fat content as natural high-protein food contributes 70-75% of the total food for the fish, but there is concern that the traditional carp polyculture might not be able to survive the increasing trend for importation of fish.