Monitoring Fish
GIS is helping to monitor floodplain fish biodiversity in Bangladesh

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Being a country of rivers and floodplains, fish play a very important role in the daily life of many people in Bangladesh. The Bengali expression Mache Bhate Bengali, or Fish and Rice make a Bengali, expresses this importance.

Bangladesh produces 1,400,000 tonnes of fish annually. Inland capture fisheries and aquaculture are the main contributors to this production. About 12 million people depend on fisheries; 1.2 million people are dependent full-time on fish and fishing activities.

However, natural fish production in Bangladesh, as in most Asian countries, is seriously threatened by human activities. Total riverine fisheries production declined 44% from 207,000 tonnes to 124,000 tonnes from 1983 to 1999. During the same period the annual riverine catch of major Indian carp (Labeo rohita, Catla catla and Cirrhinus mrigala) declined 77%, from 9000 to 2000 tonnes.

Fish production in Bangladesh, as in other floodplain areas in the world, cannot be properly considered without knowing something about the fish. The breeding and growth of fish and prawns in Bangladesh are strongly related to the sequence of flooding. The floodplains, which are inundated during the monsoon season, are rich in nutrients and play a significant role for four to five months of the year. Larvae, juveniles and adults grow in this habitat, after which they migrate back to rivers or depressions at the end of the monsoon, when the waters recede. Then they become concentrated in channels and small bodies of water, called beels, where they can easily be caught.

On the basis of their behaviour, mainly migration and reproduction, the fish species of Bangladesh can be divided into two groups: The so-called whitefish, such as Carp and Butterfish, migrate upstream and into the inundated oxbow lakes and floodplains adjacent to the river channels. They migrate in the late dry season or early rainy season in order to spawn in the sheltered and nutrient-rich waters of the beels.

The eggs and newborn larvae of these species are transported passively by the flood into the floodplain area, where they feed on the developed plankton. At the end of the rainy season, the adults and young of the year escape to the main channel and the deeper floodplains to avoid the harsh conditions of the floodplain during the dry season.

The so-called blackfish or beel residents are mainly omnivorous/carnivorous bottom dwellers such as Catfish and Snakeheads. They reproduce at the onset of the pre-monsoon season as the water level in the floodplain starts rising due to the accumulation of rainwater. At the end of the rainy season the young of the year and adults migrate back to, or get trapped in, the low-lying floodplains – they can survive the harsh conditions of these permanent water bodies during the dry season. They are adapted to resist low dissolved oxygen concentration and high water temperatures. The results of a number of research projects in Bangladesh indicate that the major causes of declining fish catch are the widespread destruction of fish habitats due to damming and draining in the floodplain and increased fishing pressure due to population growth.

A number of different stages in this process can be recognised (Chart 1). Phase 1 is a healthy flood plain system with no over-exploitation. This situation existed some 20 years ago and maybe still exists in the large floodplains in the north of the country.

In Phase 2, the floodplain is over-exploited, due to fish harvesting and the use of small mesh sizes. The Indian Carp stocks and other large fish come under pressure. They disappear quickly, as they reproduce only after several years. They are gradually replaced by fast-growing, small but quickly reproducing fish.

In Phase 3, controlled flooding and improved drainage is carried out. The total area of still water reduces somewhat, but resident species are still abundant.

In Phase 4, controlled flooding and drainage is further improved, and the large amounts of ground and surface water...
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In November–December 2000 all permanent floodplains in and outside the project were surveyed and the percentage of small prawns and belial resident fish species in the catch of the fishermen was measured.

From the results we see an increase of prawns in the northeastern part, just outside the project area. However, the results are difficult to interpret because the data are spatially distributed; further analysis in GIS was one of the options.

Plots like those in Figure 3 and Figure 4 show us that we have low percentages of belial fish in the northern part and
high percentages of prawns in the north and central part. Endangered areas are identified whenever the number of beel fish reaches 30% and the number of prawns goes over 25%.

The results are presented in Figure 5; the endangered areas in the eastern and northern parts of the project area became visible.

It is not clear why in these areas the species composition and biodiversity of the floodplains is deteriorating. Within the area, large-scale construction of roads and a railway connecting the Jamuna Bridge with Dhaka have been going on since 1997. It could be that this construction disrupted the hydrology in the area, but we do not know, as within the timeframe of the study this was not investigated.

The next stage of the work will be to move to a full project modelled on the CPP, which will look at the way fish stocks are declining around the whole country. Clearly, the work of controlling floods must proceed, since floods kill many Bengali people every year.

However, if the cost of this is to be the loss of the inland fisheries then the solution to one problem may simply be to create another one. The optimum solution would be to find ways of protecting the fisheries when designing flood mitigation methods, but first we need to understand exactly how.

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