

Management Guidelines for Asian Floodplain River Fisheries
By D.D. Hoggarth

Floodplain river resources are both highly valuable and highly vulnerable. Their high biodiversity and natural productivity provide livelihoods in farming, fishing and other sectors, often critically important for the rural poor. Water flows from upstream bring the nutrients that make the resource so productive, but they also bring pollutants and other negative impacts from upstream parts of the river catchment. Increasing uses of the floodplain and competing demands for land and water have reduced the extent of these valuable resources and the benefits they provide in many parts of the world.

With their high human population densities, floodplain river fisheries are particularly heavily exploited in Bangladesh and elsewhere in South and South East Asia. According to FAO statistics, the Asian region produced over 65% of the total world inland fish catch in 2002. Development activities in this region initially focused on building massive flood control systems. These were generally beneficial for agriculture and in preventing localised flooding, but are now recognised as having had negative impacts on fish movements and fishing livelihoods. Although total catches remain high, FMSP and other studies have shown localised declines in both fish production and biodiversity, presumably leading to adverse impacts on the livelihoods of poor fishers. Large, valuable species such as the Indian major carps now comprise only a small proportion of the region's wild fish catch. In the 1990s, development projects spent millions of dollars on re-stocking these depleted carp species in Bangladesh, often to find that only a small part of the benefit was going to the poorest stakeholders. Current development projects in Bangladesh (e.g. the Fourth Fisheries Project, CBFM-2 and MACH) all now promote the use of co-management partnerships in designing and implementing local management arrangements and technical measures that give benefits to local people.

This policy paper briefly describes FMSP work on the management of floodplain river fisheries. This work focused initially on understanding the ecology of these complex resources and describing the impacts of flood control systems. It has since gone on to develop a series of guidelines for managing floodplain fisheries, taking into account the needs of the poor and the other users of this valuable but complex natural system.

FMSP and other DFID research on floodplain river fisheries

Floodplain river fisheries have been a major focus of the FMSP since its inception, with 'cluster 9' of the programme including 8 projects on this topic. Several other DFID projects, especially those in the NRSP Land-Water Interface programme, have also researched floodplain systems (see links in the FMSP project R8486 web page).

The biological foundations of the FMSP floodplains programme were laid by projects R5030, R5485 and particularly R5953. Between 1994 and 1997, project R5953 made detailed case studies of 'modified' floodplain fisheries inside flood control, drainage and/or irrigation (FCDI) schemes in Bangladesh. These were compared with control areas outside FCDI schemes in Bangladesh, and with un-modified river fisheries in Indonesia. The project found that fish catches per unit area were 60-104% higher outside the case study FCDI scheme than inside. Outside fish stocks also comprised more species than those inside, with the larger major carps among those most affected. Fish tagging studies showed that the FCDI schemes reduce the accessibility of modified floodplains to migratory species, but do not completely prevent their entry. The project also found, however, that fish diets, feeding rates, growth rates, sizes at maturity and other biological characteristics were similar inside and outside the FCDI schemes. This suggested that the modified floodplains *could* still

produce high fish catches, *if* the abundance of their fish stocks could somehow be increased. Finally the project showed that most fish in Bangladesh are caught before they reach an age of even one year old. A new 'year class' of fish is spawned at the start of each year's flood, but fishing is now so intense that less than 2% of these fish survive each year. Far more fish survive in Indonesia, where fishing is less intensive, but even there, some slow-growing fish species have already become locally extinct. The project concluded that the catches of the poorer landless fishers in Bangladesh could be substantially increased by restricting fishing effort in the dry season to allow more fish to survive and breed each year.

Two management approaches were proposed by project R5953 for increasing natural stocks in the impounded floodplains, particularly as cheap alternatives to fish stocking: the use of 'harvest reserves' to protect spawning stocks especially over the dry season; and the management of flood control sluice gates to maximise the entry of fish to FCDI schemes from waters outside. Detailed guidance on these two management measures were developed by projects R7043 and R8210, as described in the sections below.

The largely biological focus of the FMSP is complemented by the series of integrated systems-based projects undertaken by DFID's Natural Resources Systems Programme (NRSP – see www.nrsp.org). Among other things, these have looked at methods of maximising joint benefits from multiple resource use in such environments, such as where fish, rice and other crops all compete for the same water. Increases in the natural reproduction of small, self-recruiting species has also been sought by FMSP project R7917 by measures allowing their survival and production in small scale aquaculture ponds, without harming the target culture species.

The knowledge generated in these FMSP and other DFID-funded projects has already contributed to the design and evaluation of major development projects, including the Third and Fourth Fisheries Projects in Bangladesh. The participation of local collaborators in FMSP projects, often from government offices, has increased their capacity for management, especially in Bangladesh and Indonesia. New attitudes towards collaborative management and participation will be particularly useful at this time of increasing decentralisation of management authority in both of these countries. The new Open Water Capture Fisheries Strategy in Bangladesh, developed by the Department of Fisheries and the Fourth Fisheries Project includes many of the FMSP recommendations described below.

Support is still needed at the field level with the implementation of these new policies. Towards this end, the most recent FMSP project R8486 has packaged and promoted key guidelines from the programme in a range of forms. Electronic materials including PowerPoint presentations that may be used or developed for training purposes have been made available on the R8486 page of the FMSP web site (see www.fmsp.org.uk). Key messages from the projects were promoted in 2005, in Bangladesh, and in West Bengal, India, using a range of communication pathways and media, including seminars, leaflets, posters, drama and 'pot songs', as appropriate to different stakeholder groups.

Key messages on the integrated management of floodplain river fisheries

Results from the earlier FMSP projects up to 1997 were collated and published as FAO Fisheries Technical Paper 384 (Hoggarth et al, 1999). This provided a 'spatial, hierarchical and integrated strategy for adaptive co-management' of floodplain river fisheries. Key policy messages on the 'why, what, who and how' of managing these fisheries are given below. The recommendations are particularly applicable to Asian rivers, but are also generally relevant at a global level.

Why manage?

- Floodplains provide many benefits, both socio-economic and environmental, but are threatened by overuse from a range of competing sectors.
- Management plans need to be adapted to the priority objectives at each site, and must bear in mind the limits imposed by the natural productive capacity of the resource.

What to manage?

- In this multi-user environment, managers need to consider both the impact of fishing on fish stocks, and the influence of a range of other sectors that use or affect the aquatic environment.
- Floodplain river fish include both 'blackfish' species that survive in the floodplain and migrate only small distances, and more migratory 'whitefish' species. These species have different management ranges and different management needs.

Who should manage?

- Effective management of floodplain rivers requires a co-management approach, that takes advantage of the skills and capacities of different stakeholders.
- Management roles should be shared both 'hierarchically' between national, regional and local partners, and 'spatially' between different management units in each floodplain catchment.
- Some places will also have better prospects for co-management than others (see guidelines for a checklist of criteria).
- Local people should take the lead in designing management plans for their local blackfish resources, and in enforcing their local rules and monitoring the outcomes.
- Government partners need to co-ordinate the management of whitefish at a catchment level, and legitimize local plans with supporting legislation.
- NGOs may play critical roles both as facilitators and in developing capacity.

How to manage?

- Floodplain fishery resources should be divided up into manageable 'units' allowing local resource users to control activities within their area.
- Management units should be selected to achieve the maximum possible overlap between the range of authority of the local managers (e.g. a village boundary) and the distribution range of a fish stock (e.g. blackfish residing in a village pond and the surrounding floodplain area).
- Appropriate management measures will be needed in each unit, including measures managing the environment (e.g. restoring habitats, managing sluice gates); managing who can fish (e.g. by waterbody leasing), managing the amount and type of fishing (e.g. mesh size limits, reserves, closed seasons, gear bans) and managing the fish themselves (e.g. by stocking).

Selection and management guidelines for harvest reserves/sanctuaries

Protected areas, variously known as sanctuaries, reserves, closed areas etc, are valuable management tools in floodplain river fisheries for the following reasons:

- they conserve fish stocks and should sustain or increase local catches;
- their high visibility makes illegal fishing easy to detect;
- they are conceptually simple, with easily understood effects; and
- they are traditional approaches in many places, with proven local acceptability.

Working in Indonesia, FMSP project R7043 found that fish stocks in community-managed reserves were 5-21 times more abundant, comprised up to 31 more species and were 5-6 times larger by weight, than at a nearby comparison site that was fished with poison in the dry season (see Hoggarth et al, 2004, for details). The actual benefits at other sites will

depend on the specific ecological conditions and current levels of exploitation.

Sanctuaries or reserves may benefit fish stocks in a number of different ways, such as protecting fish over the dry season so that they can spawn at the start of the next flood. These benefits to fish stocks will only help *fishers* if the reserve is located in a water-body from which fish can migrate easily to fished areas (or if fish eggs or larvae can drift out), or if some fishing is allowed inside the reserve (e.g. in limited seasons, or with non-threatening gears). The term 'harvest reserve' emphasizes the need to design such protected areas for the benefit of *rural livelihoods*, ensuring that more fish are produced for capture in the fishery, and not just to conserve the stock. Key policy messages from the R7043 guidelines (Hoggarth, 2000) are given below.

Select and manage harvest reserves in collaboration with local people

- A participatory, co-management approach draws on the knowledge, skills and capacities of resource users, government officers, local development NGOs and other stakeholders, as appropriate in each location.
- Where conditions are suitable for 'co-management', local people should take the lead in the selection of reserves, using their local experience to identify the most suitable water-bodies.

Manage 'whitefish' at a catchment level and 'blackfish' at a local level

- Reserves for relatively non-migratory, local 'blackfish' species will mainly increase fish catches within a small local area.
- Reserves designed to protect more migratory, riverine 'whitefish' species may give benefits to the whole river catchment due to their wider dispersal patterns. These reserves may need to be managed by government to avoid local over-exploitation.

Select reserve locations carefully, considering who will benefit and how

- Reserve locations should be selected that will give the best possible benefits for *local* people.
- Select several small reserves rather than one large one.
- Include different habitat types to give protection to a range of different fish species and their various life stages.
- Select locations well away from potential sources of pollution (upstream).
- Where reserves are fully closed, leave enough alternative fishing grounds to maintain fishing opportunities for local people.
- Use a water-body that is close to the village(s) involved in its management, so as to reduce the chance of illegal fishing. Management should be easier where reserve water-bodies are fully inside a village boundary.

Use reserve management rules that are appropriate to local conditions and that will deliver the best overall benefits to stakeholders

- Harvest reserves in floodplain rivers may either be closed year-round or just for certain seasons or certain gears. What is best will depend on the objectives and the local situation.
- In blackfish reserves, the most dangerous dry-season gears (poison, electric fishing, fish drives and de-watering) should always be restricted to protect the spawning stock over the dry season.

Manage adaptively – monitor the results, compare with other places, and adapt as needed

- The best management rules for each location are hard to predict in advance, and need to be found by a process of learning and experience.
- Reserves will be more effective in some places than others, and the number of reserves needed or the relative area that should be set aside will vary.

- Use a long-term, 'adaptive' management style, monitoring your fishery to see if your goals are being met, and meeting regularly with stakeholders to discuss what to do if they are not.

Management guidelines for FCDI sluice gates for the benefit of fisheries

FMSP projects R5953 and R8210 both confirmed that fish can successfully migrate through 'undershot' varieties of sluice gates commonly used in FCDI schemes in Bangladesh. Such sluice gates should therefore be recognised as important structures for increasing the stocks of fish in modified floodplains. The following management guidelines, derived from projects R8210 and R8306 (see Halls, 2005 and Shanker *et al.*, 2004), provide ways of increasing the diversity and catches of fish inside FCDI schemes without requiring either the construction of costly fish passes or any structural changes to existing sluice gates. They are instead designed to be easily implemented with the help of local stakeholders and should have minimal impact on farming livelihoods.

Implementation of these guidelines would require sluice gate operators (often committees of local users) to give priority to fishers as well as farmers and landowners. Fishers' needs have often been ignored by gate operators in the past, but their recognition is now required in Bangladesh by the latest water legislation.

Operate sluice gates to maximise the flow of water (and therefore fish) into the flood control scheme during the rising flood period

- Very large numbers of juvenile and spawning adult fish can enter FCDI schemes via sluice gates with inflowing water.
- Maximising the inflow of water during the rising flood period will enable more fish to enter FCDI schemes and improve both catches and biodiversity.

Open sluice gates as frequently as possible and attempt to minimise the turbulence of water outside sluice gates during the rising flood period

- Both biodiversity and fish production will benefit from more frequent gate openings, particularly during the rising flood period.
- Turbulence in front of sluice gates can act as an obstacle to the induction and smooth passage of fish through the gate.

Control ebb flows from sluice gates to attract more fish into FCDI Schemes and to maximize passage success

- The chances of successful passage of fish through sluice gates during the falling water or ebb season could be increased where possible by ensuring that ebb flow velocities do not exceed the maximum sustainable swimming capacities of inwardly migrating fish and/or by creating ebb flows that attract the most fish towards the sluice gate.

Close sluice gates before the end of the ebb season in order to retain more water within FCDI schemes during the dry season

- Studies have shown that raising average dry season water levels by as little as 25cm can bring significant benefits to fisheries operating inside FCDIs by improving the survival of fish during the dry season, and spawning success at the start of the rainy season.

Control fishing activities along channels connecting the sluice gates to the main rivers

- More than 50% of migrating fish can be caught before they even reach the entrance of sluice gates.
- Controlling fishing activities along channels connecting gates to main rivers is therefore very important, particularly in circumstances where gates remain permanently open.

Encourage cropping strategies with lower water needs, and the retirement of marginal low-lying agricultural land that is prone to early flood risk

- Switching to alternative dry season crops such as wheat or onions that require less irrigation water than the now-common, high-yielding boro rice crops would reduce pressure on dry season water resources that provide critical habitats for resident (non-migratory) floodplain blackfish.
- A greater emphasis on more flood-tolerant Aman rice would also allow for earlier, more frequent opening of sluice gates for longer periods during the rising flood.
- Such adaptive strategies are likely to become increasingly necessary in Bangladesh and other parts of South Asia where precipitation is predicted to increase during the flood season, but decrease during the dry season in response to climate change.

Contributors:

Dr Daniel Hoggarth (Scales Consulting Ltd, previously MRAG Ltd)
Dr Ashley Halls (Aquae Sulis Ltd, previously MRAG Ltd)
Caroline Garaway, Ian Payne, Mark Aeron-Thomas, Vicki Cowan (MRAG Ltd)
Saleemul Huq, Hannah Reid (IIED)
Ondara, Agus Djoko Utomo, Sonny Koeshenrjana, Zahri Nasution, Achmad Sarnita (CRIFI, Indonesia)
M.A. Wahab, Kanailal Debnath, Ranjan Kumar Dam (BAU Mymensingh, Bangladesh)
Atiq Rahman, Liaquat Ali, Sarder Shafiqul, Mahbub Alam (BCAS, Bangladesh)
Mokhlesur Rahman, Anisul Islam (CNRS, Bangladesh)

Sources:

- Halls, A. S. (2005). The Use of Sluice Gates for Stock Enhancement and Diversification of Livelihoods (R8210). Fisheries Assessment Report. London, MRAG, 75pp.
<http://www.fmsp.org.uk> – Project R8210.
- Hoggarth, D.D., Cowan, V.J., Halls, A.S., Aeron-Thomas, M., McGregor, A.J., Garaway, C.A., Payne, A.I. & Welcomme, R.L. (1999). Management Guidelines for Asian Floodplain River Fisheries. FAO Fisheries Technical Paper, 384/1 FAO, Rome.
Part 1. A Spatial, Hierarchical and Integrated Strategy for Adaptive Co-Management. (63pp) (<http://www.fao.org/DOCREP/006/X1357E/X1357E00.HTM>)
Part 2. Summary of DFID research (117pp).
(<http://www.fao.org/DOCREP/006/X1358E/X1358E00.HTM>)
- Hoggarth, D.D. (compiler) (2000) Selection Criteria and Co-Management Guidelines for Harvest Reserves in Tropical River Fisheries. Central Research Institute for Fisheries (CRIFI), Jakarta, Indonesia. (download from <http://www.fmsp.org.uk> – Project R7043)
- Hoggarth, D.D., Koeshendrajana, S., Aeron-Thomas, M., Garaway, C., Halls, A.S., Nasution, Z., Samuel, & Sarnita, A.. (2004) An integrated assessment of Indonesian river fishery reserves; Part 1 – Introduction and study design; Part 2 – Institutional analyses; Part 3 – Biological studies; Part 4 – Socio-economic studies and the distribution of fisheries costs and benefits. Indonesian Fisheries Research Journal. Vol. 9, No.1: 1-26. (download from <http://www.fmsp.org.uk> – Project R7043).
- Shankar, B., Halls, A.S., & Barr, J. (2004). Rice versus fish revisited: on the integrated management of floodplain resources in Bangladesh. *Natural Resources Forum*, **28**: 91-101.

For further information, contact:

Dr Daniel D. Hoggarth
Scales Consulting Ltd.
66b Creffield Road
London W3 9PS
UK
Tel/Fax: +44 (0) 208 992 0275
Email: dhoggarth@btinternet.com

Other related links

For downloads of FMSP communications materials on floodplain river fisheries management, including leaflets, PowerPoint presentations and management guidelines, please see the Project R8486 web page at www.fmsp.org.uk. Related outputs from preceding FMSP floodplains projects are also available on the R5953, R6494, R7043, R7834, R7917, and R8210 pages.

[DFID Natural Resources Systems Programme](#) – for systems-based research projects on floodplain production systems, see the Land-Water Interface sub-programme

[STREAM – Support to Regional Aquatic Resources Management](#)

[oneFish](#) – the internet portal for fisheries research