

PROCEEDINGS OF THE SECOND INTERNATIONAL SYMPOSIUM ON THE MANAGEMENT OF LARGE RIVERS FOR FISHERIES

Sustaining Livelihoods and Biodiversity in the New Millennium
11th - 14th February 2003 in Phnom Penh, Kingdom of Cambodia
Edited by Robin L. Welcomme and T. Petr

Volume I



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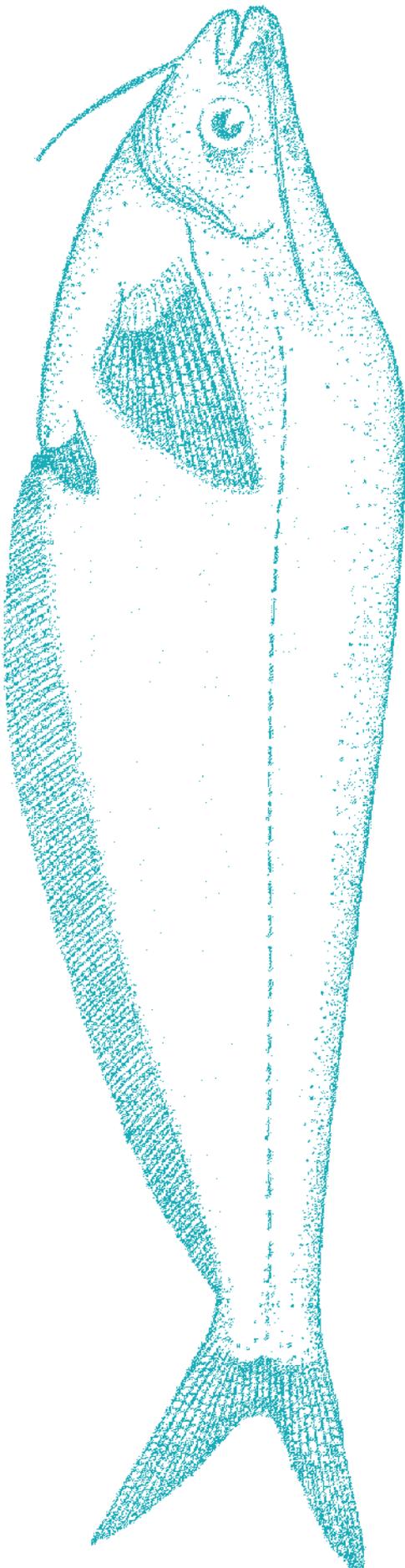
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ORIGINS of the SYMPOSIUM

The Second International Symposium on the Management of Large Rivers for Fisheries was held on 11 – 14 February 2003 in Phnom Penh, Kingdom of Cambodia. It had three primary objectives:

- to provide a forum to review and synthesise the latest information on large rivers;
- to raise the political, public and scientific awareness of the importance of river systems, the living aquatic resources they support and the people that depend on them; and
- to contribute to better management, conservation and restoration of the living aquatic resources of large rivers.

The Symposium was organised in six sessions:

Session 1 Status of rivers

Session 2 Value of river fisheries

Session 3 Fisheries ecology and conservation

Session 4 Management of river fisheries

Session 5 Statistics and information

Session 6 Synthesis

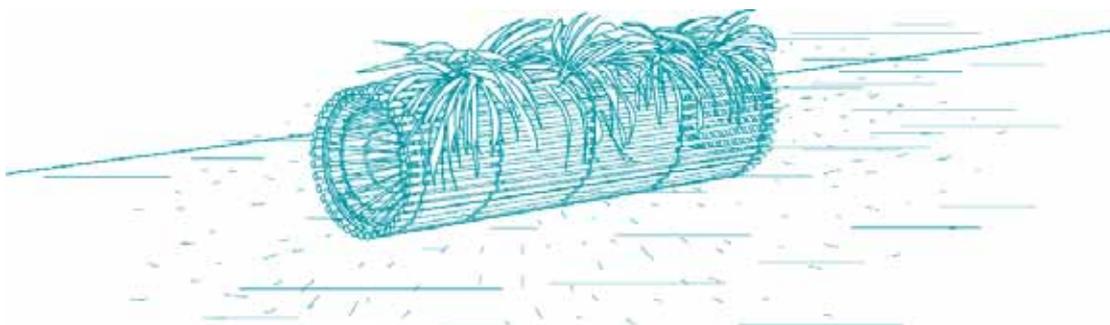
Over 220 river scientists and managers from around the world attended the Symposium. Contributed papers represented 96 rivers from 61 river basins from all continents and climatic zones.

Selected papers submitted to the Symposium appear in these proceedings, which consist of:

Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries: Volume 1

Proceedings of the Second International Symposium on the Management of Large Rivers for Fisheries: Volume 2

Papers appearing in these proceedings have been subject to the regular academic refereeing process. Additional selected papers will appear in the journal *Fisheries Management and Ecology*.





RECOMMENDATIONS for ACTION

- 1) Improve the valuation of living river resources in order to contribute to equitable and sustainable management of fishery resources and properly place the fishery in the context of the other uses of rivers.
- 2) Direct greater effort to better understanding the social and economic aspects of fisheries to support policy and management priorities; livelihood approaches will be a valuable tool.
- 3) Communicate and engage with environment and water resources managers within the context of multi-use of water in order to accurately assess impacts and to sustain the benefits of river fisheries in an equitable manner.
- 4) Develop processes that facilitate the users and beneficiaries of the fishery resource to assume greater control of its management.
- 5) Establish appropriate mechanisms at national and basin level to enable negotiation for the needs of communities dependent upon the living aquatic resources. In particular further regulations need to be elaborated to protect general ecosystem function and provide for environmental flows.
- 6) Use instruments such as the freshwater eco-regions approach, the Ramsar Convention and the guidelines for water allocation suggested by the World Commission on Dams, to enhance planning for conservation and sustainable use of river habitats.
- 7) Incorporate ecological flow requirements of river-floodplain systems into development plans and impact assessments that affect river flows, taking into account the seasonality of the system and the environmental cues needed by the fish for migration and reproduction.
- 8) Rehabilitate degraded ecosystems wherever possible. Prioritize schemes that ensure connectivity and protection of critical habitats.



SUMMARY CONCLUSIONS

IMPORTANCE OF RIVER FISHERIES AND BIODIVERSITY

Large rivers harbour a disproportionate share of the world's aquatic biodiversity, including over 50 percent of all freshwater fish species. Riverine biota are also among the most threatened components of biological diversity, with a much higher proportion of organisms classed as endangered or threatened than in most other ecosystems.

A significant proportion of the world's people use the living aquatic resources of rivers for food and recreation. Recent evidence indicates that the number of people dependent on these resources is far larger than previously thought. Studies further show fish to be particularly important in the livelihoods and diets of the poor, providing an inexpensive source of animal protein and essential nutrients not available from other sources.

VALUATION OF RIVER FISHERIES

Inland fisheries are generally undervalued in terms of their contribution to food security, income generation and ecosystem functioning. Conventional economic approaches aim to provide detailed quantification using a cost-benefit framework, which may not sufficiently value the role and function of rivers.

Socio-economic approaches and livelihood analysis can help to highlight the complex contributions of fisheries to rural livelihoods. Better valuation of living river resources is necessary to ensure the equitable sharing of benefits and for proper placing of the fishery in the context of the many other uses of rivers. It is important to recognise that fishers themselves have largely been excluded from valuation exercises.

STATE OF KNOWLEDGE

The first systematic expression of how rivers function dates from the first LARS in 1986 and many of the concepts arising from that meeting have proved extremely robust. The flood-pulse concept, the integral nature of the river-floodplain system, relationships between flood strength and catch, and the fishing down process in complex fisheries all continue to apply in many areas and conditions around the World. The general understanding of how river fish communities function is now sufficiently refined to permit broad management decisions concerning the river environment for fish and fisheries.

Despite a sound general understanding, detailed knowledge of the biology and ecology of individual species and ecosystems remains poor. Further studies on individual species, communities and ecosystems are urgently needed. However, in view of the

large number of species living in most rivers, management based on requirements for individual species is often impractical (except for flagship endangered species). General concepts of migration and food web structure are now emerging to allow for a better understanding of the impact of human interventions.

Research on flow-ecological relationships in large rivers is an urgent priority. However, sufficient knowledge exists to set interim conservation measures including environmental flow prescriptions, and the need for further research should not be used as an excuse to delay much needed action. Adaptive management will often be the most effective means of improving outcomes and knowledge.

Conventional methods for studying large rivers are generally inadequate and new approaches are being developed to gain understanding of the processes underlying fish ecology and fisheries. In particular, local knowledge held by traditional fishing communities has provided a wealth of information.

The effort put into the study and collection of data from rivers depends on national perceptions as to the value of rivers and their fisheries. Given the high cost of collecting data, programmes should concentrate on variables that are carefully selected to support desired research and management objectives.

SOCIAL, ECONOMIC AND INSTITUTIONAL ASPECTS

Study of the social, economic and institutional aspects of fisheries is a relatively recent development. However, the current global emphasis on rural poverty and sustainable livelihoods, together with deeper understanding of fisheries, has shown that knowledge of the human dimension of fisheries is essential for proper management. Understanding of the social organization of the fishery and the relationships between fisheries and other livelihood strategies is poor in most cases. However, the recent establishment of co-management arrangements for fisheries in some river basins and the involvement of users and other stakeholders in decision-making are forming the basis

for better recognition of the relationship between people's livelihoods and their aquatic resources.

MANAGEMENT OF RIVER FISHERIES

A number of issues have emerged as particular concerns at this stage in our attempts to manage river fish, fisheries and their environment. A tension continues to exist between use and conservation. It is impossible to catch fish without influencing the composition of the fish community. However, the goal of fishery management should be to maintain or establish conditions consistent with the continued survival of all species.

It has become increasingly clear that most river fisheries are not managed effectively. This is largely due to the old pattern of centralized Government agencies applying a one-size-fits-all approach. This pattern has failed worldwide, largely due to inflexibility, insufficient funding for agencies, and lack of stakeholder collaboration. In some cases this failure has led to a *laissez faire* approach to policy and enforcement. Sometimes state-owned river resources are in practice treated as open access systems and are vulnerable to overexploitation. Where systems of limiting access are being contemplated they have to take into consideration the needs of community members who might be excluded.

Management alternatives are being developed that attempt to bridge the gap between centralized government and traditional, locally enduring participatory management systems. Such strategies are being tried in most climatic zones and continents and are compatible with a livelihoods focused approach that considers other stakeholder activities. Participatory approaches depend strongly on cultural, social and political environments. After more than a decade of innovative schemes and experiments, there are many international examples of how to enable users and other beneficiaries of resources to assume more significant control. It would be appropriate to make greater use of these experiences in policy formulation.

Major conflicts between the various users of river systems can only be resolved if there are appropriate mechanisms at national and basin levels to enable negotiation for the needs of the living aquatic resources. River basin organizations are an essential instrument for managing such conflicts, especially for rivers flowing through more than one nation or province.

Appropriate legislation must be formulated to encourage more equitable treatment of living aquatic resources and the fisheries that depend on them. In some areas water quality, quantity and mechanisms for fish passage around obstacles are already the subject of legislation. But further regulations are needed to protect general ecosystem diversity and provide for environmental flows. In addition, the involvement of user groups in management decision-making should be legally supported and/or mandated.

GENERAL DEGRADATION OF THE RESOURCE

Most river basins support intensive fisheries and yields in some basins are still increasing. River fisheries continue to provide large catches, even in the face of intensive exploitation, although changes in species composition and size are occurring and some large and late-in-life maturing species have become rare as a result of fishing pressure. In contrast to marine and lake fisheries, there are no proven cases of a river fishery as a whole having collapsed from fishing pressure alone. Where collapses have occurred, they have always been linked to degradation in environmental quality.

Indicators on all continents show that there is a general decline in the physical, chemical and ecological quality of rivers from source to mouth. This decline is typically associated with rising population pressures. The form and function of rivers have changed in response to dams and channelization, and changing land use practices and marginal agriculture have resulted in deforestation leading to increased siltation.

The increasing demand for water is altering the timing and magnitude of flow regimes in many rivers. There is a need for improved understanding of the ecological flow requirements of river-floodplain systems, taking into account the seasonality of the system and the environmental cues needed by fishes for migration and reproduction. This will allow definition of the timing and amount of water that should be reserved for fish in the context of other developments in the river basin.

Strategic assessments, such as the ecosystems-based approaches, freshwater eco-regions approach, and the guidelines for water allocation suggested by the World Commission on Dams provide some possible mechanisms for the conservation of river habitats. A number of conventions provide additional supporting frameworks including, in particular, the Ramsar Convention and the Convention on Biological Diversity. Frameworks for making decisions on water management should include assessment of options and environmental and social impacts, and involve full public participation.

MITIGATION, REHABILITATION AND ENHANCEMENT

There is an urgent need to rehabilitate degraded ecosystems. Technical options do exist for amelioration and mitigation of adverse impacts. Several examples of successful rehabilitation are already emerging, but they are often expensive and time consuming. The eventual cost of rehabilitating a resource is likely to far exceed the benefit derived from its destruction and it is clear that conservation is better than rehabilitation.

There have been attempts on all continents to mitigate problems caused by dams, levees and polders which bar fish migrations. The success of these mitigating structures is extremely variable since they cannot cope with the numbers of fish migrating or be used by all fish species, and they generally focus only on facilitating upstream movements, ignoring the downstream drifting of fry and juveniles. Research is needed to develop ways to allow less obstruction to fish

movement that are significantly broader in their application.

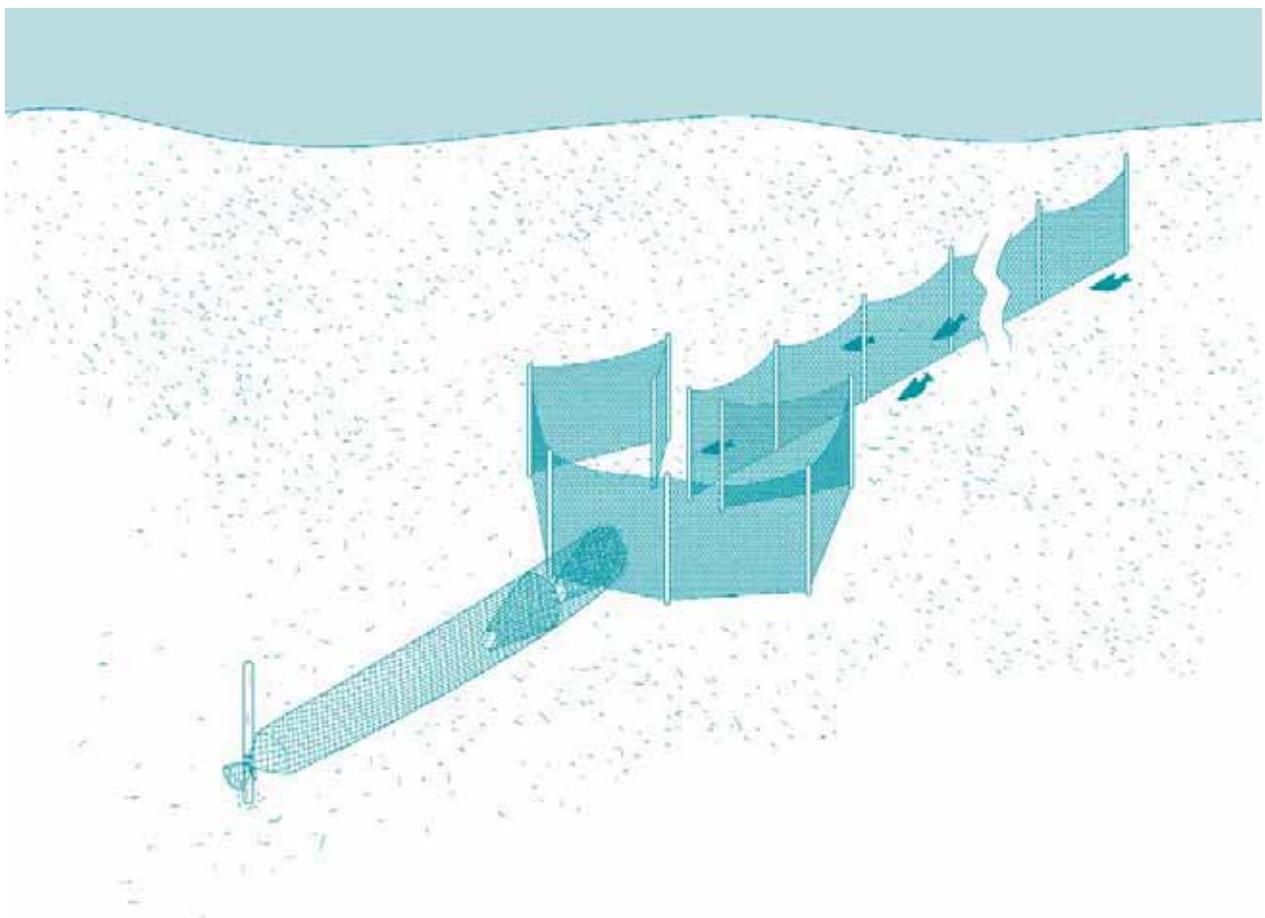
Aquaculture is frequently seen as mitigation for declines in wild fisheries or as providing an alternate activity. Although stocking of juvenile fish and fish farming have shown promise in some areas, there is often a policy conflict where the benefits of enhancement do not accrue to those formerly dependent on wild fisheries, and their access to land, water and feed resources may be jeopardized by enhancements.

PROSPECTS

Maintenance of healthy rivers and restoration of degraded rivers and their fisheries will only be achieved if there is political will at all levels of society to do so. Those responsible for managing riverine resources need a collective approach that is sensitive to the needs of resource users and society at large. Adequate and accurate information on the value and

the functioning of rivers, as well as on the impacts of other users on the resource, is required. The fisheries sector must not continue in isolation but must communicate clearly with the public and other users of inland water resources in order to arrive at equitable solutions for sustaining the fishery.

There are some encouraging developments. The international community is slowly becoming aware of the value of living inland aquatic resources as evidenced by the European Union Water Directive, the World Water Forum, the high priority awarded to it by the Convention on Biodiversity, the decommissioning of dams in North America and Europe, and the reestablishment of keystone species such as salmon through large scale rehabilitation of some damaged rivers. It is unfortunate that inland fisheries received such a low profile from the World Summit on Sustainable Development and this situation needs urgent redress.



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