

## **Fisheries management and information - a Mekong perspective**

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### Abstract

Conventional fisheries management has tended to emphasise predictions of the behaviour of fisheries resource systems to modify management according to short-term objectives, usually with the stated goal of optimizing specific outputs. Management relies on complex models with large-scale averages as inputs to predict the status of fish stocks. Associated top-down management interventions have poor support among fishers. Recent developments in the fisheries management discourse include increasing awareness of ecosystem complexity and adoption of the precautionary and ecosystem approaches to management.

The Mekong River supports the possibly largest inland fishery in the world, with an annual catch of more than two million tonnes. The fishery differs from large-scale marine fisheries in that it mainly consists of small-scale, diffuse fishing operations. However, the approach to management is by and large conventional and top-down. It is argued that a common cognitive basis for fisheries management, which is seen as legitimate by all stake holders, needs to be developed. Local knowledge contributed by fishers through co-management can be used to highlight slower, more predictable variables, including information on habitats and other basic biological and physical processes. Such information is essential for local management, but should also be used in larger scale assessment of the fisheries resources. The challenge will be to establish a process so that information from different sources, across scales and sectors, can be integrated with management models to form legitimate interventions.

### Introduction

It is increasingly clear that conventional fisheries management has failed to ensure sustainable use of fisheries resources. In marine fisheries, for which information is available, 47% of the resources are reported to be fully exploited and 28% are either overexploited or depleted, and more fisheries are likely to be added to the last category (FAO 2002). Although the status of inland fisheries resources is poorly known, an indication may be obtained from a recent UNEP report, which estimates that 50% of freshwater biodiversity has been lost globally since 1970 (UNEP 2002). Similarly, the IUCN Red List for bony fishes lists no marine species as extinct, compared with 96 freshwater species (Coates *et al.* 2003).

Inland fisheries are diverse and diffuse, and are carried out in an intricate socioecological setting, where the resource system is shared between a many users with miscellaneous needs and interests. Mostly, inland fisheries are small-scale, where individual fishers or small groups of fishers use a range of gears adapted to the local fish species and conditions. Despite these features of inland fisheries there has been a tendency to treat them as large scale marine fisheries, i.e. as consisting of fish stocks that can be controlled toward some form of optimum, for example maximum sustainable yield (Mattson *et al.* 2003a). Associated with this notion has been the promotion of fisheries specific management institutions by national and multilateral development agencies, often irrespective of the context of these fisheries.

Degnol (2003) gives an overview of how the fisheries management discourse has changed over the past century. He describes how fisheries biologists in the early 1900's were

concerned with the reasons for local variation in the catches. However, coinciding with increasing international cooperation and support to large-scale, top-down management, fisheries science gradually came to shift the focus from the study of local variation to estimating large-scale (100+ nautical miles) averages representing the status of fish stocks. This meant that local variation, rather than a subject for study, became a problem which had to be overcome by sampling design. This trend culminated in publication of “On the dynamics of exploited fish populations” by Beverton and Holt (1957). The main objective of management was rational exploitation and later ‘maximisation of long-term yield’. Fisheries management was based on the principle of deterministic predictability, i.e. it was assumed that the relevant parameters could be accurately predicted and the associated large-scale fisheries models employed in designing management interventions. Because local variation was not in the models, the users of the resource, the fishers, saw little credibility in the predictions and the derived management interventions.

This paper discusses emerging alternative approaches to management taking into account the cross-sector and multi-scale nature of fisheries. Examples of issues and ongoing activities from the Mekong River Basin are included.

#### Recent developments in the management discourse

The 1990’s saw increasing acceptance of the complexity of socioecological systems such as fisheries, implying that any prediction of system behaviour was associated with substantial uncertainty. An added requirement on fisheries management was to conform to the precautionary approach, as stated in Principle 15 of the 1992 Rio Declaration of the UN Conference on Environment and Development (FAO 1996): *“In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental damage.”*

The FAO Code of Conduct for Responsible Fisheries (FAO, 1995) further emphasised the need to consider the effects of the fishery on the environment, which increases the scope of management. Dengbol (2003) concludes that the *“...precautionary approach is fundamentally about accepting the fact that uncertainty is an integral part of management.”* Interestingly, McCormick Smith, Adviser in Fisheries to His Siamese Majesty’s Government, already in 1925 emphasised “safety first” for fisheries management (Smith 1925), which may be interpreted as an early notion of the precautionary approach.

Contemporary models of fisheries still depend heavily on increasingly complicated predictive models, which now include stochastic elements and wider ecosystem considerations. The models therefore require increasing amounts of real time data. The limited predictability of ecosystems coupled with the rising cost of getting the required data and information means that the marginal benefits of investment in data and information collection is decreasing. For the US, Singleton (1998) pointed out that fisheries management costs in the 3 to 200 mile Exclusive Economic Zone are equal or nearly equal to the value of the catch. In addition, contemporary fisheries models tend to be even further removed from the users’ understanding of the system, and the legitimacy of management interventions therefore remains low. Thus, the awareness of the complexity of socioecological systems has increased, but it would seem that this has not yet improved the ability of fisheries agencies to effectively deal with management issues.

A recent trend in fisheries management is support for the Ecosystem Approach to Fisheries (EAF) (Garcia *et al.* 2003). FAO (2003) states that *“Generally speaking, the purpose of an*

*ecosystem approach to fisheries is to plan, develop and manage fisheries in a manner that addresses the multiple needs and desires of societies, without jeopardizing the options for future generations to benefit from the full range of goods and services provided by marine ecosystems.*”, and that “*an ecosystem approach to fisheries (EAF) strives to balance diverse societal objectives, by taking account of the knowledge and uncertainties of biotic, abiotic and human components of ecosystems and their interactions and applying an integrated approach to fisheries within ecologically meaningful boundaries.*” The EAF thus encompasses the precautionary approach and the need to consider the wider ecosystem issues and interactions. An international workshop in Penang in January 2004 endorsed the implementation of the EAF to inland fisheries to serve as a bridge between fisheries and other sectors<sup>1</sup>.

### Mekong fisheries

The fisheries resources of the Lower Mekong Basin (LMB, including parts of Cambodia, Lao PDR, Thailand and Viet Nam, see Fig 1) are exceptionally rich and diverse. The fish species alone is estimated to be more than 1,200, and possibly as many as 1,700 (Coates *et al.* 2003). Only the Amazon has more species, although the Mekong has more families of fishes (91) than any other river. The catches from the LMB have been estimated at more than 2 million tonnes annually (Sverdrup-Jensen 2002, Hortle and Bush 2003). This amounts to an average consumption of at least 36 kg/year for each of the 60 million people living in the Basin. FAO (2002) gives the world inland capture fisheries production as 8.8 million tonnes, and although this is certainly an underestimate, it gives an idea of the importance of the Mekong fisheries. The variety of fishing activities and gears used is large, with more than 150 types of fishing gear identified in Cambodia alone (Deap *et al.* 2003). Although there are some large-scale fishing operations, especially on the Tonle Sap (the Great Lake) in Cambodia and in the Mekong Delta in Vietnam, most fishing activities are small-scale and subsistence-oriented. Often fishing is only one of several livelihood activities. Yet, it is particularly important for food security, as fish is a staple in the local diet.

The fisheries of the LMB are perceived to be in a good state (MRC 2003). However, there is a tendency that fish from capture fisheries are getting smaller and some large species, such as the Giant Mekong Catfish (*Pangasianodon gigas*), are threatened (Mattson *et al.* 2002). Many important commercial fish species of the Mekong Basin are migratory, i.e. fish will spend the stages of their life cycle at different and often distant locations. Fisheries or other activities in one area, that influence abundance at particular life stage, may affect fish abundance at another life stage in other areas. Fish production is driven by the annual rise and fall of water levels. Flooded areas provide rich feeding habitats and protection for fish and other aquatic animals. In the dry season, when waters recede, many fish seek refuge in deep pools of the river.

Although threats to the fisheries come from the sector itself in the form of excessive fishing pressure, destructive fishing methods and introducing alien species, major hazards arise from activities in other sectors, for example constructing weirs and dams, changes to rivers for improvement of navigation and pollution (Coates *et al.* 2003). Destruction or blocking of migration routes prevents the fish from reaching critical habitats, including spawning grounds.

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<sup>1</sup> [http://www.worldfishcenter.org/news/PDF/PR\\_16Jan04.pdf](http://www.worldfishcenter.org/news/PDF/PR_16Jan04.pdf)

The fishery of the LMB thus requires management interventions on various levels. In some cases this may be on national level. In cases where migration routes cross national borders, international collaboration is required. But in most cases management is best addressed at the local level, involving fishers and local government staff. The fishery has a long history of catch and post-harvest technology, marketing and social organisation. Local management systems are widespread in the Basin and have been so for centuries. They are based on detailed local knowledge about the fisheries and the ecosystem (Bao *et al.* 2001).

#### Co-management and local knowledge

Co-management implies participation of users and concerned government agencies in resource management, in particular, but not exclusively, at local level. To enable co-management there is a need to build the capacity of both users and government officers in knowledge and skills (Box 1).

##### Box 1

#### **Bridging the local and the global - Regional Training Course on Co-management in the Lower Mekong Basin**

The MRC Fisheries Program has in recent years increased emphasis on spatially and functionally integrated systems (catchments, cross-sector and multiple-level stakeholders). In achieving this FP has facilitated Regional Training Courses (RTCs) on Fisheries Co-management. The course emphasises bridging ‘the local’ with ‘the regional’ and *visa versa*. During the RTCs fisheries officers from the LMB are brought together to share experiences and ideas concerning fisheries co-management.

The methodology of the RTC is based on sharing rather than teaching. It is assumed that all participants, regardless of type or level of expertise, have experiences from which other participants can learn. The RTCs emphasise training in a field situation and during the 9-10 day course participants spend 3-4 days in the field. Most of the participants work at provincial or district level, and in their normal duties rarely deal with issues on a regional scale. Bringing together people that work in different countries but within the same interlinked system, provide an opportunity to scale local management issues into a regional framework. These experiences are then analysed in both local and regional context. Linkages of importance for LMB fisheries identified by participants are numerous, including biological, economic, social and institutional connections between sub-systems.

The MRC Fisheries Programme has used the following ‘working definition’ of co-management: “A formalised process of sharing of authority and responsibility by government and organised user groups in decentralised decision making”(Hartman, 2000). The phrase “sharing of responsibility” is understood as the sharing of obligation and ability to act. Co-management will persist only when there is a perceived need for sharing of management responsibility coupled with willingness and capability, from both sides, to do so. The capacities of co-managers can be developed through a process of joint management planning, implementation, monitoring and evaluation. Thus it is an adaptive process where skills are gradually developed “by doing”. When applied to the collection and analysis of information for fisheries management, the legitimacy of such information is likely to increase (Augustinus and Hartmann, in press).

Fishers rely on daily observations about ecological and environmental conditions in their fishing areas. These observations are interpreted by the fishers and used to predict what, where, when and with what, to fish. Daily observations are pooled over long periods and

often passed on from one generation to the next. Thus, local ecosystem knowledge is constantly refined.

Many LMB fisheries are based on the capture of migratory fishes during their seasonal migrations to, and from, seasonal floodplain habitats. Local fishers have often developed detailed knowledge about the life cycles of fishes, the timing and nature of their migrations and the critical habitats they need to survive and reproduce (Box 2).

### Box 2

#### **Local ecological knowledge in the Mekong**

In recent years, the Mekong River Commission, through its Fisheries Programme, has based a large proportion of its fisheries research on the compilation and pooling of local ecological knowledge. For instance, a basin-wide study on migration patterns and critical habitats was based on local knowledge. A large number of semi-structured interviews with expert fishers throughout the lower basin were carried out. The study focussed on spatial and temporal aspects of life cycle events, such as migration patterns, spawning habits and critical habitats (the what-, when- and where-questions), whereas no attempts were made to quantify the fishery resources (the how much-question). In addition, the multi-species and multiple-sites approach resulted in the identification of multi-species migration waves and eco-regions within which these waves occur (Poulsen *et al.* 2002).

Following the above study, some of the key expert fishers agreed to participate in the formulation and implementation of a one-year daily monitoring study to identify fish migration waves in further detail, including the ecosystem 'triggers' of migration. Most of the involved fishers stayed with this programme for the entire year and enthusiastically participated both in the planning, implementation of data collection and in the discussions of the results.

The strength of local knowledge is that it reaches beyond spatial and temporal scales. At the spatial level, local-scale information from different areas, when merged, can illuminate larger-scale spatial characteristics, not only about distribution ranges for individual species, but also about multi-species migration patterns and of different eco-regions in the basin. At the temporal scale, inter-annual variations are surpassed, since the information is based on knowledge accumulated over long time periods, often across generations.

This information can then be used to identify critical priority areas or habitats for management purposes. Management implementation in the end takes place at local level and the involvement of local communities and local government, in not only implementation but also decision-making, planning, monitoring and evaluation is increasingly seen as a precondition for successful management.

#### Information for fisheries management or management of fisheries information?

Rational management relies on appropriate information to show direction of management activities and the systems response to these. Since fisheries management mainly takes place at the local level, the information must obviously first of all be relevant at the local scale. However, the status of local resources is intimately linked to the integrity and functioning of the ecosystem as a whole, so it is also necessary to generate ecosystem information and knowledge at national and regional scales. At larger scales information is mainly used to formulate policies, and the requirements thus differ from the local scale.

There is a disparity between what Mekong fisheries line agencies and fishers regard as legitimate information for policy and management purposes. The fisheries line agencies, like in most parts of the world, are charged not only with fisheries management but also with generating information on which to base the government fisheries policy. The line agencies generally take a conventional stance by assuming that by increasing data and information generation, the effects of management interventions can be accurately predicted. This tends to focus efforts and resources on information management rather than on management information. In many cases what may be termed 'data-less' (not knowledge-less) management would be a better guiding principle (Mattson *et al.* 2003b).

### The way forward

There are already impressive examples of how co-management can improve local management of fisheries resources. As co-management becomes more widespread, it is expected that its role at national and regional level will increase. An integral part of co-management is local research to generate information for management decisions and monitoring. As a result, the local knowledge base is consolidated and strengthened. The process by which the information is generated will have direct bearing on legitimacy. There are indications that central government policy makers of the LMB see the need to ensure legitimacy of information on which policy is based. Box 3 and Box 4 are examples of recent Mekong events where local user interests and knowledge have been at least partly considered.

#### Box 3

##### **Cambodia's fishing lot system**

Parts of the fishing-lot system in Cambodia, which is giving private persons exclusive rights to exploit the fisheries resources in specific fishing grounds, was recently abolished in a policy reform. The decision came as a response to an open crisis in fisheries management, with rising tension among stakeholders and was supported by the drafting of a sub-decree on community fisheries (Degen *et al.* 2002, FACT 2001). However, fisheries co-management institutions were weak or not present when the decision was put into action, and activities to develop these are ongoing.

#### Box 4

##### **The Pak Mun Dam**

The Pak Mun 'run-of-the-river' dam, constructed on the Mun River (a major tributary to the Mekong) for hydropower in 1994, was underperforming and severely affected the local fisheries. A lengthy conflict between several actors finally, in January 2003, led to the compromise to open the sluice gates for four months each year. The decision was based on several reports, including research by scientists, local users and a case study by the World Commission of Dams (Amornsakchai 2000), which generated new knowledge and alternative options. The protests and the communication of local knowledge, influenced the decision to open the gates. However, Foran (in press) conclude that elite state actors in the end mattered more in shaping this decision than well-organised villagers appealing for compensation for their lost fisheries.

Fishers and other users are likely to possess knowledge on the functional aspects of the ecosystem, particularly slower, more predictable variables and processes. Combining local knowledge with scientific knowledge will contribute to a common cognitive basis for understanding ecosystem processes and establishing fisheries management that is valid and effective from local to regional scale. Fisheries line agencies need to recognise that co-management institutions have the capacity to generate valid information also for policy decisions. The information required for local management will be of higher resolution than what is useful at national or regional levels, and it will be crucial to ensure that the meta-information derived for policy decisions is legitimate from local to regional scales. Moreover, local management institutions need to understand the larger scale implications of local fisheries management, and also the impact on local resources from larger scale activities, in and outside the fisheries sector. To achieve this, a directed and structured process, comprising organisations, institutions and functions, across scales will be required.

One promising development is indicators for fisheries management. Such indicators would act as substitutes or proxies for reference points used in fisheries management. The challenge will be to identify indicators that are measurable by users, while valid and acceptable at larger scales (Degnbol, 2003). Examples of possible approaches to indicators include the assessment of the dry-season spawning stock in the deep pools of the river (Poulsen *et al.* 2002). In Cambodia, the “dai” fisheries, a big stationary bagnet (Deap 2003), of the Tonle Sap River may serve as an indicator of the status of the migratory stocks (Van Zalinge, 2003). Another possible indicator would be fish size or proportion of mature fish in the catches.

The events described in Box 4 were largely driven by non-fisheries sectors, in particular EGAT (Electricity Generating Authority of Thailand). This illustrates a common dilemma; fisheries line agencies and fisheries managers may embrace the ecosystem approach, but if other powerful sectors do not, EAF objectives are unlikely to be achieved. This problem must be overcome by strengthening the linkages between sectors and by working toward a common cross-sector knowledge base for policy decisions. We suggest that this should be the main role for national and regional fisheries agencies, i.e. they should delegate management to lower level co-management institutions and shift the focus to cross-sector linkages.

The governments of the LMB countries increasingly recognise the value of local knowledge and efforts are under way to use this in management (Sverdrup-Jensen 2002). Because the LMB fishery is affected by and affects people on a variety of scales and levels, management by multiple stakeholders and sectors is an important condition for a sustainable fishery. Co-management is perceived to provide some of these ingredients, that is, local knowledge and stakeholder involvement in management decision-making. It is expected that this will contribute to the maintenance, or improvement, of productive inland capture fisheries in the LMB, by building awareness on resource use and conservation leading to better management decisions by fisheries communities and government agencies concerned.

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Figure 1. The Lower Mekong Basin

