THE USE OF LOCAL KNOWLEDGE IN RIVER FISHERIES RESEARCH

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Introduction

River fisheries are extremely important for food security among the rural poor in many tropical countries. However, the growing populations and rapid industrialisation of these countries are continuously increasing the pressure on aquatic and other natural resources. In spite of riverine fish stocks being highly resilient to fishing pressure, they are extremely vulnerable to environmental degradation; the migratory habits of many riverine species, depending on both longitudinal and lateral connectivity among habitats, implies particular vulnerability to water management projects. The migratory nature of the fishes also means that any fisheries impact will have much more than local impact and may even extend beyond borders into neighboring countries. It is therefore of utmost importance that appropriate action be taken to sustain the fish resources for future generations.

However, the lack of detailed knowledge on the biology and sometimes even the taxonomy of many species combined with the dispersed nature of the fisheries in remote areas with difficult access and often lack of research funds make it difficult to get a manageable picture of the fisheries situation. For these nations to be able to manage their fisheries appropriately in the future, fundamental biological and ecological knowledge about the resource is crucial. In contrast the millions of people who live along the shores of the rivers and rely on the fishery for their daily survival, have a very intimate knowledge of the behaviour and biology of the fish. Gathering the fishers' knowledge can provide politicians or planners with baseline knowledge in a relatively quick and cheap way.

Basin-wide studies of the distributions, migrations and spawning habits of 50 commercial fish species in the Mekong River by the Mekong River Commission (MRC) from 1998 to 2000 (Poulsen & Valbo-Jørgensen, 2000; Valbo-Jørgensen & Poulsen, 2000) show the potential of this approach. These studies examined the knowledge of 355 fishers in 113 villages in four countries along 2 400 km of river from the estuary in the South China Sea in Viet Nam upstream to the border between Thailand and Myanmar. The stations were chosen based on a combination of the knowledge of experienced fisheries officers, information gathered during extensive pre-survey travelling in the region, review of scientific literature, and finally by spotting distinctive ecological reaches on detailed maps. An effort was made to cover all ecological reaches including upland as well as lowland parts of the basin and river segments above and below zoogeographical barriers. Sections where major tributaries join the mainstream were also given special attention. The surveys were carried out by teams of local

Box 1. The Mekong fisheries (Van Zalinge *et al*., 2004 and references)

The Mekong Basin in South East Asia sustains what are probably the largest freshwater fisheries in the world, with an annual yield in the range of 2.6 million tonnes. Most of the catch is harvested by small-scale fisheries and consumed locally. More than half of the daily protein is derived from fish with fish consumption rates averaging 57 kg per year and in certain areas as much as 98% of the population is involved in fishing. The fish fauna is extraordinarily rich with almost 1000 described species all of which to various degrees contribute to the catch. However, the taxonomic status of many species is still uncertain, with serious implications for studies of ecology and biodiversity; it is only in the last decade that fisheries research has gained momentum.

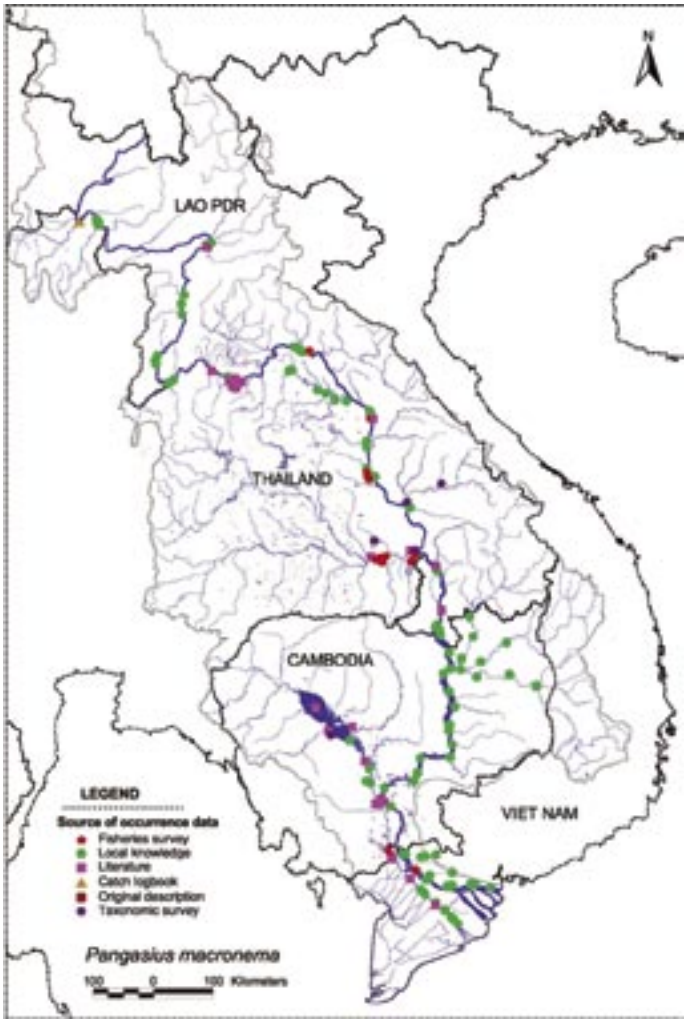
scientists working in their own countries. In order to ensure that reliable species-specific information was obtained, it was decided to use high quality photos of fishes as the main conversation objects during the surveys.

Species distributions

One of the areas where accessing local knowledge proved to be superior to any other methodology was in mapping the distribution of migratory fishes (Fig. 1). The method was especially useful in determining the range of endangered species, because rare species are not likely to show up in any sampling study of limited duration. On the other hand fishers, who set their gear in the same place day after day, will almost certainly know whether a particular species is there or not, and the fishers can also provide historical information about species that have disappeared within their lifetime.

However, the migratory nature of most fish species made the identification of stocks difficult. In order to get more detail it will be necessary to resort to supplementary methods such as sampling at fixed stations along the river, tagging (including electronic tags), and genetic population studies. Common for all these methods is that they are extremely expensive and nearly worthless without baseline data. Local knowledge data, therefore, will play a key-role in the formulation of hypotheses to be tested with these methods in the years to come.

Figure 1. Combining traditional taxonomic surveys with local knowledge. The map shows the distribution of the catfish *Pangasius macronema* in the Mekong Basin (Visser, Valbo-Jørgensen & Ratanachookmanee, 2003)



Spawning

The statement *"In June-July groups of the catfish Wallago attu larger than 2 kg gather in shallow water on flooded grassland to spawn. The eggs stick to the substrate and hatch within 3 days"* by a Thai fisherman at Chiang Khong illustrates the level of detail it is possible to obtain using this methodology.

Many fishers were able to provide information about the periods where the fish have eggs in the abdomen, which is an indication of the spawning period. However, the exact spawning grounds turned out to be much more difficult to identify than expected, probably because the Mekong is very turbid - especially during the flood season when most species are spawning. This also explains why the spawning grounds that were reported were mainly for species spawning in shallow water on the floodplain, i.e. the bronze featherback (*Notopterus notopterus*), cyprinids of the genus *Hypsibarbus*, the walking catfish (*Clarias batrachus*), large sheatfishes of the species *Wallago attu*, *W. leeri*, and the chevron snakehead (*Channa striata*).

Several spawning grounds could, however, be identified for the mainstream spawners sevenline barb (*Probarbus jullieni*) and thicklip barb (*P. labeamajor*), probably because these species are spawning in the dry season, when the water is clearer, and also because they make a lot of splashing during the spawning performance.

Dry season refuges

The question of deep pools was not specifically raised as an issue during the survey interviews, but fishermen still referred to deep pools as important habitats for certain fish species 230 times. Only a few species such as the smallscale croaker (*Boesemania microlepis*) are permanent residents in deep pools, while most species seem to use the deep pools in the dry season only.

Migrations

Although a detailed account of the migrations of individual species (see for example Poulsen & Valbo-Jørgensen (2000)) is outside the scope of this paper, some general patterns are provided below.

First of all there are two main migration periods (Fig. 2). The first is from May to July when the water is rising. During this period most fish are full of eggs, implying that this is a migration towards the spawning grounds. The second migration period is from October to December when the water level is falling rapidly thereby pushing the fish out of the nursery and feeding areas on the floodplain, from where they migrate to their dry season refuges.

It also became apparent that three different migration systems could be delineated, each with distinct ecological feature (Fig. 3). It is the relative position of the key habitats (spawning, nursery/feeding and dry season refuges) that governs the migratory patterns of the individual stocks or populations. For example, spawning areas and dry season refuges in the lower system are found in north eastern Cambodia and southern Laos, while the nursery areas are associated with the floodplains of the Great Lake. In the middle system spawning and growth takes place in tributaries with large floodplains while the fish spend the dry season in deep pools in the Mekong mainstream. In the third system, floodplains are scarce and lateral migrations therefore play a less prominent role. The most conspicuous feature here is, therefore, the movement between the dry season refuges in mainstream deep pools towards the spawning grounds. One example of such a migration is by the Mekong giant catfish (*Pangasianodon gigas*), one of the largest fishes in the world, which is the target of a traditional fishery during its spawning migration. Due to the rapidly declining stocks only a few individuals is caught every year and in some years none.

Experiences

From the above, it is obvious that large amounts of often surprisingly detailed life-cycle information can be obtained through semi-structured interviews with local fishermen. By combining results from a large number of species, it is possible to make conclusions about more general ecological parameters, such as determining the effect of hydrological factors on the fisheries ecology, or indicating the borders between different eco-regions. This would not have been possible through more conventional biological surveys such as sampling or tagging.

The critical issue here is that the survey is designed in a way that makes data collected from a number of sites comparable, so that each site act as one piece in the puzzle and when putting all pieces together, migration patterns for the species emerge.

Although a certain rigidity of the survey is important, in order to compare results from station to station, it is equally important to allow room to include other information, which the survey designers did not take into account during the design of the survey. The issue about deep pools, for instance, was not

Figure 2. The relationship between fish migration and hydrology (based on Bouakhamvongsa & Poulsen (2000)). Dotted line: Monthly discharge at Pakse, Southern Laos (m3/sec). Solid line: Number of migration reports all stations and species

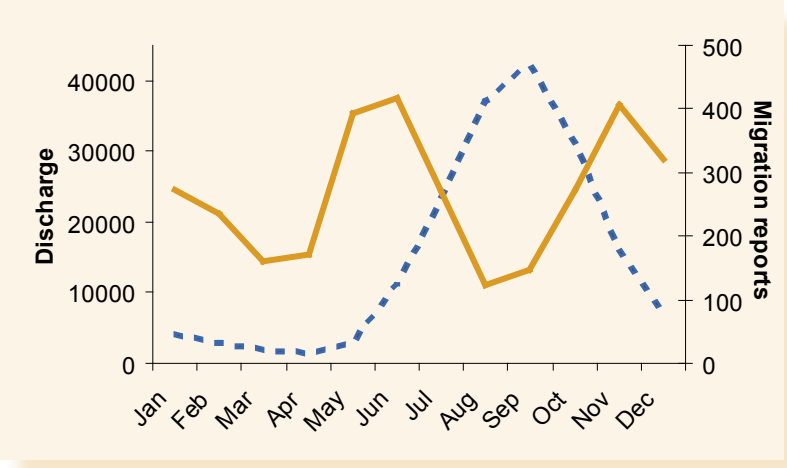
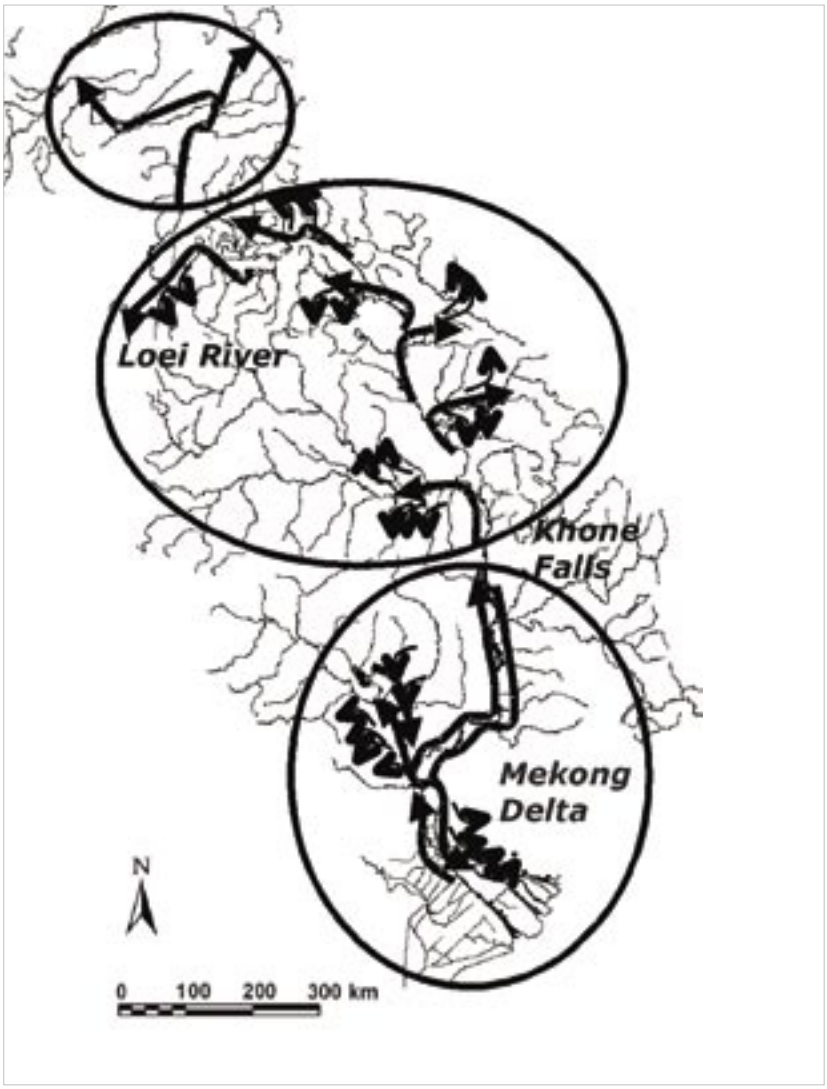


Figure 3. The movements of migratory fish stocks can be divided into three migration systems with distinct ecological features (based on Coates, Poulsen & Viravong, 2000). Large arrows represent longitudinal migrations small arrows lateral movements



considered specifically when designing the survey. However, the development of co-management systems for deep pool habitats may be a priority for future fisheries management in the Mekong Basin, and the survey provided an unexpected opportunity to map out important deep-pool areas and indicate which species are using deep pool habitats.

It is nevertheless essential to emphasize that the method cannot, and should not, stand alone, but should rather be used as the first step in a process enabling researchers to ask more specific questions, which can be answered through more focused studies. In the Mekong, local knowledge surveys have been followed up by studies using other methodologies such as tagging, hydroacoustics, sampling of individuals, and genetic population studies in order to test hypotheses formulated based on information gathered using local knowledge.

Conclusions

Collecting local knowledge is an inexpensive method to quickly obtain detailed biological information about riverine fish, especially when information about a large number of species is needed from a large area with difficult access. It also enables the researcher to get data on seasonal events such as fish migrations or spawning in a one-time visit.

The distribution of rare species that are extremely unlikely to be caught during a short-term sampling programme can be confirmed, and historical information about already extinct species can be gathered.

In the Mekong, local knowledge will be at the centre of future fisheries research, monitoring, management and impact assessments. Other methods will obviously be used to answer more specific questions, but will rely on local knowledge in order to formulate testable hypotheses.

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LIST OF FORTHCOMING MEETINGS

3-4 February 2005
11th Annual Whirling Disease Symposium
Denver, Colorado, USA
Information: Wanda McCarthy, e-mail: whirling@mcn.net

7-11 March 2005
FAO Committee on Fisheries (COFI)
FAO HQ, Rome, Italy
Information: Ndiaga Gueye, e-mail: ndiaga.gueye@fao.org

9-13 May 2005
World Aquaculture Society
Nusa Dua, Bali, Indonesia
Information: http://www.was.org/Meetings/ConferenceInfo.asp?MeetingCode=WA2005

10-12 June 2005
5th International Exhibition & Conference on Fisheries and Aquaculture
Piraeus Exhibition Center (OLP), Athens, Greece
Information: http://www.europartners.gr/page/default.asp?la=2&id=16

5-9 August 2005
Aquaculture Europe 2005 - Optimising the Future
Trondheim, Norway
Information: http://www.easonline.org/home/en/default.asp

5-8 September 2005
4th Fish & Shellfish Larviculture Symposium
Ghent University, Belgium
Information: http://allserv.ugent.be/aquaculture/larvi/index.htm

11-16 September 2005
12th International EAFP Conference on Fish and Shellfish Diseases
Copenhagen, Denmark
Information: http://www.eafp.org/EAFP2005.html

18-21 October 2005
Interactions between aquaculture and wild stocks of Atlantic salmon and other diadromous fish species: Science and Management, Challenges and Solutions
Bergen, Norway
Info: http://www.ices.dk/iceswork/Symposium-2005-culti.htm ; e-mail: hq@nasco.int

25-28 October 2005,
6th Symposium on Diseases in Asian Aquaculture: Aquatic Animal Health – Facing New Challenges
Colombo, Sri Lanka
Information: Melba.Reantaso@fao.org