



THE TECHNICAL ADVISORY BODY FOR FISHERIES MANAGEMENT (TAB)

Deep pools as dry season habitats in the Mekong River Basin

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Working towards Effective, Sustainable and Regional Fisheries Management in the
Lower Mekong Basin

BACKGROUND

Deep pools are an integral part of the diverse yet interconnected ecological habitats supported by Mekong river system. They provide an important refuge for many migratory fish species during the dry season and hold a permanent fish fauna of their own. The preservation of these habitats is critical to the conservation of many Mekong fish species and the fisheries they support. Local and national regulations to protect many pools are in place, but effective enforcement is difficult.

Despite the important role deep pools play in fisheries and rural livelihoods, we know little about details of the ecological mechanisms that control these habitats and the faunas they contain. The pools need further study to help determine the appropriate measures needed protect and preserve these crucial habitats.¹

This note provides a synopsis of the existing knowledge on deep pools and discusses some of the factors future plans for their management should take into account.²

DEEP POOLS IN MEKONG ECOSYSTEMS AND THEIR IMPORTANCE TO FISHERIES

What are deep pools?

The definition of a deep pool is somewhat arbitrary, but with regard to fisheries it is simply a confined, relatively deep area, within a river channel that acts as a dry season refuge for a number of important fish species. Deep pools may also provide spawning grounds for some species. This definition places more emphasis on the ecological importance of the pool than on its bathymetric or hydrological features. However, deep pools are contiguous with the rest of the river and their habitats are an integral part of the broader river system.

Geographic distribution of deep pools

The physiographic factors that control the formation of deep pools involve the topography, geology, climate and the hydrology of the river system. They can form in different settings along the course of a mature river. In relation to river fisheries, the term 'pool' is most often associated with the 'riffle and pool' system of alternating shallow rapids followed by deeper pools in the upper, mountainous, stretches of river systems. This part of the river is characterised by fast and turbulent flow over a riverbed consisting of rocks, stones and gravel. In the lower parts of rivers, which are characterised by slowly flowing water and a sandy or muddy riverbed, the bathymetry is more in the form of 'shallows' and 'deeps'.³ Both of these types of pool are found in stretches of the Mekong and its tributaries.

Because of a combination of geological and hydrological factors, the deep pools in the mainstream of the Mekong occur in discrete, geographically separated, clusters.⁴ From a fisheries perspective the most important clusters are found:

- ✓ Between the Khone falls on the border between Cambodia and Lao PDR downstream to the town of Kratie
- ✓ In the area around the Khone falls
- ✓ In northern Lao PDR, especially in Luang Prabang province

Other stretches of river in the Mekong system also contain deep pools, but little information exists on these, especially those in the Mekong's tributaries.

Fish faunas in deep pools

Deep pools have long been known as a refuge for migratory fish during the dry season⁵ although some sedentary species, such as the Boeseman croaker, *Boesemania microlepis*, may spend their whole life-cycle in these habitats, often preying on migrating fish. Other migratory species, like the cyprinid *Hypsibarbus malcolmi*, use the deep pools as spawning grounds. The pools are also important dry season sanctuaries for many of the endangered giant Mekong fish such as the giant catfish, *Pangasianodon gigas*.

The deep pools in the area of the Khone falls and the section of the Mekong from Kratie to Stung Treng have been the subject of several ecological studies; as a result their fish fauna are fairly well documented.

Interestingly, comparisons of the fauna and these in pools and with pools in other stretches of the Mekong show little overlap of species, suggesting that some fish have preference for the habitats of particular pools.⁷ (This preference is reflected in the local names of some of the pools; for example *Boong pba gooawng* translates to 'Boeseman croaker Pool'.) The reasons why particular species prefer specific microhabitats requires further research but probably relates to factors such as water depth, speed of the current, substrate type, slope, proximity to wetland forest and the presence of objects such as logs and rocks that provide shelter.

Fisheries and deep pools

Although the deep pools have their own fisheries, their principal importance lies in the role they play in the life cycle of migratory fish and the major upstream and downstream fisheries that target migrating fish. As an example the Cambodian and Vietnamese fisheries targeting the catfish *Pagasianodon hypothalamus* depend on stock spawned in the deep pools in the stretch of the Mekong north of Kratie.⁸

Status of deep pools

Local villagers and fishing communities understand the importance of deep pools as habitats and recognise the vital role they play in maintaining fish stocks. Some have established Fish Conservation Zones (FCZs) to protect the deep pools in their locality.

One example is near the Khone Falls, in Champassack province, southern Lao PDR. Here villagers from 59 fishing communities set up a co-management programme that included the creation of FCZs.⁹ In a preliminary assessment of the effectiveness of FCZs⁹ villagers reported increased numbers of 24 fish species. These include both relatively sedentary species (such as *Boesemania microlepis*, *Chitala blanchi* and *Chitala ornata*) and migratory species (such as *Pangasius conchophilus*, *Pangasius macronema*, *Probarbus jullieni* and *Cirrhinus microlepis*). Fishing communities in Luang Prabang Province have established similar FCZs.

However, despite these conservation measures, any alteration of the river's natural hydrologic regime, such as hydroelectric projects or flood mitigation schemes, threatens the preservation of deep pools. Changes in the flow of the river and its suspension lode may cause the deep pools to fill with silt or increased sediment slumping resulting from increased erosion of the riverbank. To date these problems are largely limited to the Mekong's tributaries and do not affect the mainstream; but were any of the pools in the Mekong to silt up, particularly in the stretch between Kratie and Stung Treng, the damage inflicted on fish populations throughout the basin would be serious. Degradation of deep pool habitats may have equal, or more serious, consequences than the often cited blockage of migration routes caused by dams.

DISCUSSION

Preserving the health of deep pools is a trans-boundary issue. Fisheries throughout the four countries in the lower Mekong basin depend on fish that use these habitats as a sanctuary during the dry season. Although many of these fish neither spawn nor feed extensively in deep pools, most have evolved complex life cycles and migration systems that involve these special environments. The three geographically distinct major migration systems recognised in the Mekong probably developed because of the existence of these sanctuaries. For these reasons, the deep pools are an inseparable part of the larger of Mekong ecosystem. Plans for their protection and management must consider this interrelationship. Furthermore, these plans must serve both the management of local stocks and of migratory stocks (i.e. trans-boundary stocks).

Clearly, any development scheme that alters the hydrology of the river threatens deep pool habitats. Environmental Impact Assessments (EIAs) and Fisheries Impact Assessments (FIAs) must take preservation of the pools into account, even though they may be remote from the site of the project.

Co-managed ventures that include FCZs seem the most appropriate way to manage the pools. Local communities recognise the benefits of these zones and are keen to be involved in their establishment.

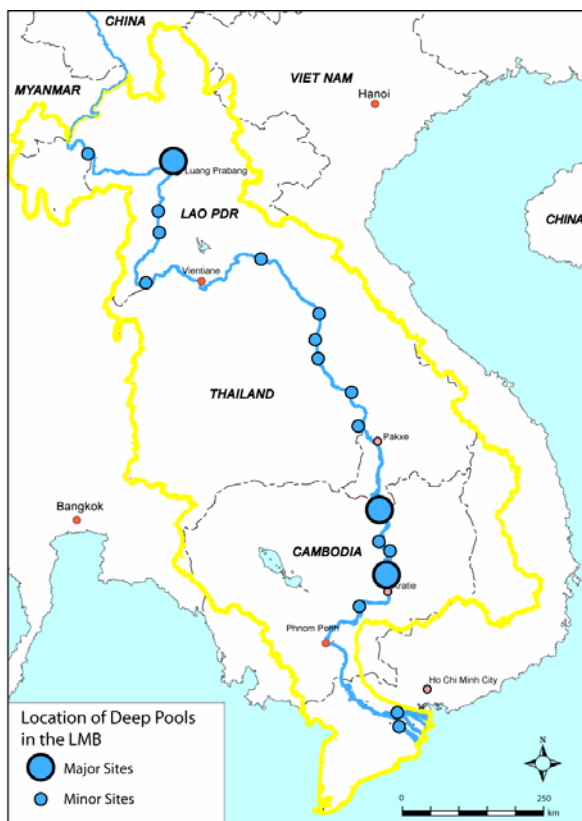
RECOMMENDED MANAGEMENT ACTIONS

Current knowledge on deep pools highlights how important these habitats are to fisheries and to the ecological integrity of the basin as a whole. Any future work in relation to deep pools should take a 'systems approach', i.e. the recognise role of deep pools as integrated elements of the larger system. This means basing research and management activities involving deep pools on the importance of these habitats to the ecosystem as a whole, rather than on their local significance. With this in mind we recommend the following actions:

1. Draw up an inventory of important deep pool areas across the basin (note: not necessarily individual deep pools, aggregations of pool clusters may suffice). Build on existing knowledge with a more elaborate and focused study directly aimed at identifying important dry season refugees across the basin by interviewing local villagers and fishers. Classify important deep pool areas based on their hydrographical characteristics using the *Hydrographic Atlas of the Lower Mekong Basin* for reference.
2. Because deep pools function as 'sink habitats' during the dry season they are good sites for future surveys into the health of the environment and the state of the fisheries. In the near-term, hold discussions about which parameters to focus these surveys on and what are the best survey methods to use in deep pools.
3. Promote further research into the ecological functioning and significance of deep pools. However, it is important to discuss priorities before jumping into *ad hoc* and uncoordinated research projects.
4. Initiate discussions with stakeholders on how to include the issue of deep pools in future EIAs and FIAs of water management projects.

END NOTES

1. *At its first meeting, in 2000*, the Technical Advisory Body for Fisheries Management (TAB) commissioned a study the function of deep pools in the Mekong. The study was undertaken by staff of the MRC Fisheries Programme and their findings published in 2002 (see end note below).
2. Poulson, A., Ouch Poeu, Sinatvong Viravong, Ubolratana Suntornratana and Nguyen, T.T. (2002). Deep pools as dry season fish habitats in the Mekong River *MRC Technical Paper No. 4*, Mekong River Commission, Phnom Penh. 22 pp.
3. Welcomme, R. L. (1985) River fisheries. *FAO Fisheries Technical Paper No. 262*, Rome.
4. Location of deep pools in the Mekong mainstream



5. Roberts, T. R. & I. G. Baird. (1995) Traditional fisheries and fish ecology on the Mekong River at Khone Waterfalls in southern Laos. *Natural History Bulletin Siam Society*, 1995. **43**: pp 219-262.

6. Comparison of the species composition in four important deep-pool areas

	Luang Prabang	Champassack	Khong Island	Kratie
<i>Pangasius djambal</i>				X
<i>Boesemania microlepis</i>			X	X
<i>Mastacembelus armatus</i>	X		X	
<i>Channa striata</i>		X		
<i>Lalates hexanema</i>		X		
<i>Pangasius siamensis</i>				X
<i>Pangasius pleurotaenia</i>			X	X
<i>Pangasius macronema</i>	X			X
<i>Pangasius larnaudiei</i>				X
<i>Pangasius krempfi</i>				X
<i>Pangasius bocourti</i>	X	X		X
<i>Pangasius conchophilus</i>				X
<i>Pangasianodon hypophthalmus</i>			X	
<i>Heligophagus waandersi</i>			X	X
<i>Micronema sp.</i>	X	X		X
<i>Bagarius yarely</i>			X	X
<i>Botia modesta</i>				X
<i>Henicorhynchus sp.</i>			X	X
<i>Cirrhinus microlepis</i>				X
<i>Morulus chrysophekadion</i>		X		X
<i>Mekongina erythrospila</i>		X		
<i>Hampala macrolepidota</i>	X			
<i>Hypsibarbus malcolmi</i>	X			
<i>Barbodes gonionotus</i>	X	X		
<i>Puntioplites falcifer</i>		X		
<i>Cychoeichthys enoplos</i>				X
<i>Probarbus jullieni</i>	X			X
<i>Probarbus labeamajor</i>			X	
<i>Paralabuca typus</i>				X
<i>Lxcothrissa crocodylus</i>		X		
<i>Tenualosa thibeadeaui</i>			X	
<i>Chitala blanchi</i>		X		
<i>Chitala ornata</i>	X		X	X



7. Baird, I. G., P. Kisouvannalath, V. Inthaphaysi & B. Phylaivanh. (1998) The potential for ecological classification as a tool for establishing and monitoring fish conservation zones in the Mekong River. *Technical Report No. 2*.
8. Van Zalinge, N., Lieng Sopha, Ngor Peng Bun, Heng Kong, and Jørgensen, J.,V. (2002). Status of the Mekong *Pangasianodon hypophthalmus* resources, with special reference to the stock shared between Cambodia and Viet Nam. *MRC Technical Paper No. 1*, Mekong River Commission, Phnom Penh. 29 pp.
9. Chomchanta, P., P. Vongphasouk, S. Chanrya, C. Soulignavong, B. Saadsy & T. J. Warren. 2000. A preliminary assessment of the Mekong Fishery Conservation Zones in the Siphandone area of Southern Lao PDR, and recommendations for further evaluation and monitoring. LARReC Technical Paper No. 0001. The Living Aquatic Resources and Research Centre, Vientiane.



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