



Catch and Culture

Fisheries Research and Development in the Mekong Region

Volume 9, No. 1

ISSN 0859-290X

June 2003



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Catch and Culture is published three times a year by the Mekong River Commission Secretariat in Phnom Penh, Cambodia, and distributed to subscribers around the world. Free email subscriptions to *Catch and Culture* are available through the MRC website, www.mrcmekong.org. For information on the cost of hard-copy subscriptions, contact the MRC's Documentation Centre by email to doc.centre@mrcmekong.org.

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Mekong River Commission 2003



Editorial panel

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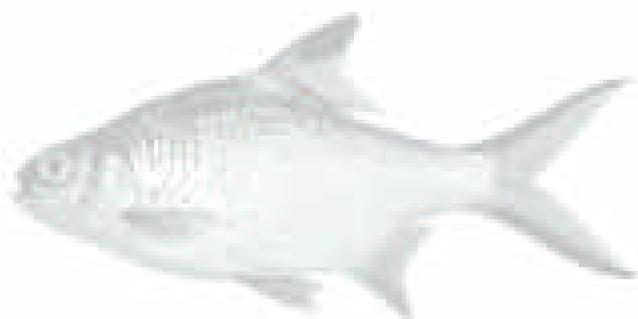
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Editorial

This is a good time to be talking about fisheries in the overall context of regional water resources management. For the first time in an international declaration on water, the importance of inland fisheries has been noted. This was in the Ministerial Declaration from the 3rd World Water Forum in Kyoto on 16-23 March, which devoted a whole paragraph to the subject, recognising inland fisheries as a major source of food, and calling for "intensified efforts to improve water quality and quantity in rivers and protection or restoration of breeding areas."

The statement reflects the joint declaration from the Large Rivers Symposium (LARS2) held in Phnom Penh from 11-14 February, which resulted in a call for better valuation of inland fisheries resources worldwide - the subject of our lead article this issue. It is also consistent with the Mekong River Commission's long-standing aim of integrating a proper valuation of fisheries into decisions about water resource use in the Mekong.

Inland fisheries, more than marine fisheries, are vulnerable to habitat loss - and healthy fisheries can only be maintained through an active collaboration between fisheries professionals and water use planners from other disciplines. The re-launch edition of *Catch and Culture* now before you is intended to further such collaboration.

Catch and Culture is the most long-standing programme publication of the Mekong River Commission, serving an audience within and outside the region over the past eight years. At this point in its evolution, it aims to reach as broad an audience as possible of people involved in public policy, research and planning in the region, as well as those outside it who maintain a professional interest in Mekong issues.

The new *Catch and Culture*, therefore, will provide more reporting of news on fisheries in the four MRC member countries of Cambodia, Lao PDR, Thailand and Viet Nam, while still maintaining *Catch and Culture's* technical content. Each issue will present some of the key issues and major lessons from fisheries research and development in the Mekong region, which we trust will also be of use to the rest of the world. It will remain true to the aims set out in the first issue in August 1995 - to be a newsletter for public administrators, managers, researchers and extension workers.

Catch and Culture is not an academic journal, but aims to bring you the ideas and events that are shaping fisheries management in the Mekong region today. We are therefore introducing the Mekong fisheries index - a regular listing of fisheries-related press and academic articles. This will not be complete without contributions from our readers. *Catch and Culture* still promotes a free exchange of professional opinions, viewpoints and theories. If you would like to have your paper listed in the index, please provide details to us. Papers will also still be accepted for publication in the usual way, with the editorial panel reviewing contributions. Articles must be signed and the authors are fully responsible for the content, though contributions may be edited for length or clarity.

We look forward to hearing from you.

The Editors

Time to revalue inland fisheries

By Peter Starr

Living river resources are undervalued. A recent international symposium in Phnom Penh has concluded that their real contribution to food production should be recognised.

Big rivers account for a disproportionate share of the world's aquatic biodiversity, including more than half of all freshwater fish species. Moreover, rivers have a higher proportion of endangered or threatened species than most other ecosystems. Recent evidence shows that the number of people who use rivers for food and recreation is much higher than previously thought. Studies also show that fish are particularly important to the livelihoods and diets of the poor, providing a cheap source of animal protein and essential nutrients not available elsewhere. River scientists and managers from around the world now believe that fish and other inland aquatic resources should be revalued to reflect their important role in food production.

Improving the valuation of living river resources was one of eight concrete actions recommended by the Second International Symposium on the Management of Large Rivers for Fisheries in Phnom Penh. Opened by Cambodian Prime Minister Samdech Hun Sen, the four-day symposium in February was attended by more than 220 experts representing 96 rivers around the world. The first such gathering since 1986, it was hosted by the Mekong River Commission, the Food and Agriculture Organisation of the United Nations and the Fisheries Department of Cambodia's Ministry of Agriculture, Forestry and Fisheries.

In a statement, participants noted that inland fisheries were "generally undervalued" in terms of their contribution to food security, income generation and the functioning of ecosystems. Moreover, the



people who catch the fish have themselves been largely excluded from valuation exercises. Conventional approaches use a cost-benefit framework which "may not sufficiently value the role and function of rivers", the statement said, calling for broader approaches 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 the proper placing of the fishery in the context of the many other uses of rivers".

Participants also called for better understanding of the social and economic aspects of fisheries, closer contacts with environment and water-resource managers and greater control over fisheries management. They also highlighted the need to set up national and regional mechanisms to take into account the needs of communities relying on living river resources. Other specific actions recommended by participants were enhanced planning for conservation and the sustainable use of river habitats, recognition of the ecological flow requirements of river and flood plain systems and the rehabilitation of degraded ecosystems wherever possible.

"There is an urgent need to rehabilitate degraded ecosystems", the statement said, noting that several cases of successful rehabilitation were already emerging even if they were costly and time consuming. Still, "the eventual cost of rehabilitating a resource is far likely to exceed the benefit derived from its destruction and it is clear that conservation is better than rehabilitation".

Need for political will

The statement warned, however, that maintaining healthy rivers and restoring degraded rivers "will only be achieved if there is political will at all levels of society" and called for a collective approach sensitive to the needs of both resource users and society at large. "Adequate and accurate information on the value and functioning of rivers, as well as the impacts of other users on the resources, 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", it said.

Participants noted that the world community was "slowly becoming aware of the value of living inland aquatic resources" and listed several encouraging developments such as the decommissioning of dams and the reintroduction of species such as salmon through large-scale rehabilitation of some damaged rivers. At the same time, however, the symposium regretted the low profile attached to inland fisheries at the World Summit on Sustainable Development in Johannesburg last year.

As a result of the joint statement from LARS2, political recognition of the value of living river resources was more forthcoming at the Third World Water Forum in Kyoto in March, some six weeks after the Phnom Penh symposium. In a joint declaration, ministers from around the world agreed that inland fisheries were a "major source" of food.



"Freshwater fish production should be addressed through intensified efforts to improve water quality and quantity in rivers and protection or restoration of breeding areas", the declaration said.

- Papers submitted to the symposium can be found at www.lars2.org. Abstracts of all papers are available in book form from the MRC Secretariat's Documentation Centre, doc.centre@mrcmekong.org.

Peter Starr is an economics writer and the editor of Catch and Culture.

The average person living on the Mekong floodplains eats about 60 kilograms of fish every year, one of the highest rates of fish consumption anywhere in the world. Based on such estimates, the annual catch of fish and other aquatic animals in the Lower Mekong Basin is believed to be about two million tonnes. Yet inland fisheries tend to be neglected by economists.

Joern Kristensen, Chief Executive Officer at the Mekong River Commission, notes that Mekong fisheries are not alone. "This has been the case in river basins around the world", he says. "In part, the undervaluing of inland fisheries is due to the difficulty of estimating total yields. Typically, there are many small market points and a large part of river catches are for household consumption, never showing up in the national gross domestic product figures".

Revaluing inland fisheries won't make an immediate difference to the people catching and eating the fish. "But it puts the governments of poorer countries - which are the ones that depend most on fish and forests for their livelihoods - in a better position to bargain with neighbouring countries regarding the use of water resources and to make fully informed decisions about which development projects they will endorse in their own countries", Kristensen says.

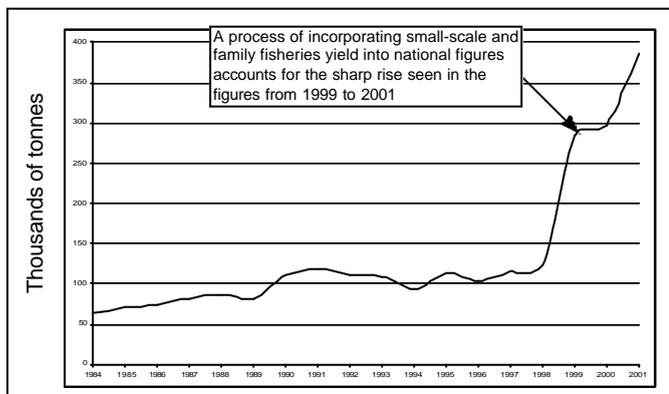
Fisheries production in Cambodia

Cambodia's reported fisheries production has increased dramatically since 1994. A process of incorporating small-scale and family fisheries yield into national figures accounts for the sharp rise seen in the figures from 1999 to 2001. Even so, recent unofficial estimates show that annual catches could be a third higher than officially recorded. Under-reporting aside, fisheries output accounted for almost 12 per cent of gross domestic product (GDP) in 2001, exceeding rice production, which amounted to 10 per cent of the country's total output of goods and services during the same period.

The catch was worth almost twice as much as livestock and poultry production, and accounted for about a third of Cambodia's entire agricultural output in 2001, illustrating its importance as a source of protein, income and employment, in a country where 80 per cent of the labour force is engaged in farming, forestry or fishing activities.

Since colonial times, fishing areas have been allocated to private concessions involved in large-scale operations, most commonly on the Great Lake, Southeast Asia's largest body of fresh water. While small-scale family fishers have continued to fish alongside commercial operators, the increasing population of small fishers in recent times has led to increased tensions between commercial operators and subsistence fishers. In 2001 the Cambodian government turned over more than half of the commercial lots to become open-access fisheries for riverside communities. Questions remain as to what institutions and processes are needed in order for sustainable community management of the fishery to become a reality. Still to come is an overall industry plan and a new fisheries law to manage resources.

Cambodia fisheries production 1984 - 2001



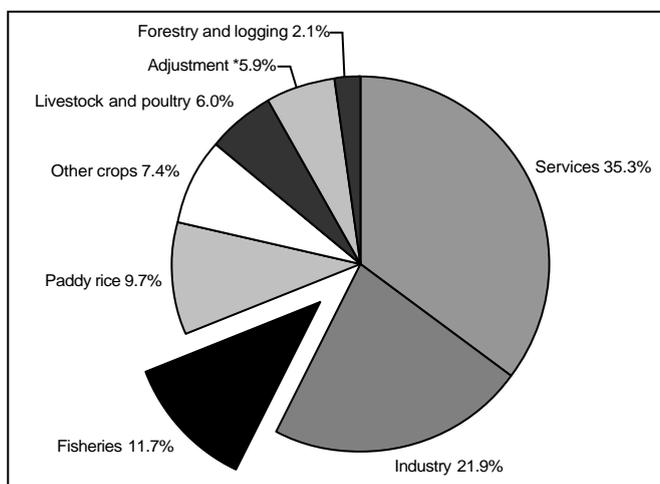
Source: Cambodian Department of Fisheries



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GDP breakdown in 2001



Source: International Monetary Fund/National Institute of Statistics

Maintaining habitats

Tropical rivers support a high rate of biodiversity, rivalling that of the most diverse marine systems. This is due, in part, to extreme ecosystem complexity. Such rivers traditionally support very important, but undervalued, fisheries.

The fishery of the Mekong Basin is one of the most productive river fisheries in the world. The high diversity of resources, close to where many rural people live, leads to a high degree of people's participation in fishing activity. Impressive large commercial fisheries occur in the basin, but because most people farm as well as fish, their involvement is largely part-time, using smaller fishing gears. If the resource is over-exploited, biodiversity will decline, leading to fewer fishing opportunities, loss of livelihoods and generally unfavourable socio-economic impacts.

Caution needs to be exercised when applying to river fisheries conclusions that have been drawn from marine fisheries. These function differently in several notable respects. Threats to biodiversity that arise from within the sector include over-exploitation and the use of destructive gears. However, the most severe threats to biodiversity in the Mekong come from outside the fishery, from activities which cause extensive loss of habitat, ecosystem simplification and reduced water quantity and quality.

Effective solutions to problems within the fishery sector involve co-management approaches which are already widespread and, in places, locally effective. The highly developed resource allocation systems in use in the



Mekong and elsewhere (fishing lots), enable the control of open access to resources and are a potentially important tool in biodiversity conservation. However, they require more research before being widely promoted.

Aquaculture should be managed to avoid impacts upon biodiversity. Chief amongst these are habitat loss due to conversion of wetlands into aquaculture operations, and the widespread introduction of exotic species and native strains/varieties that result in direct loss of genetic diversity. Effective remedies for the latter include the application of codes of practice for use in pre-introduction assessments.

The major conclusion to be drawn about biodiversity in the Mekong is that the current benefits of river fisheries provide strong economic and social arguments for preventing and mitigating ecosystem degradation. Recognising this reality more fully in resource development policies would considerably strengthen the arguments for sustaining aquatic biodiversity in the Mekong.

Popular belief is that amongst the world's aquatic environments, it is the sea, and in particular coral reefs, where biodiversity is threatened most. The facts, however, disprove this. The loss of species from freshwater is far greater. The IUCN Red List for bony fishes, a database on extinct, threatened and vulnerable species, lists no marine species as extinct, in comparison with 96 freshwater species. Losses in other categories of fish confirm that the threat to biodiversity is much greater in freshwater environments (Figure 1). Interestingly, the Red List records one in five marine species as endangered through excessive exploitation, but only about one in 20 are categorised that way in the freshwater listings. It is environmental degradation (habitat loss and pollution), not over-exploitation, that

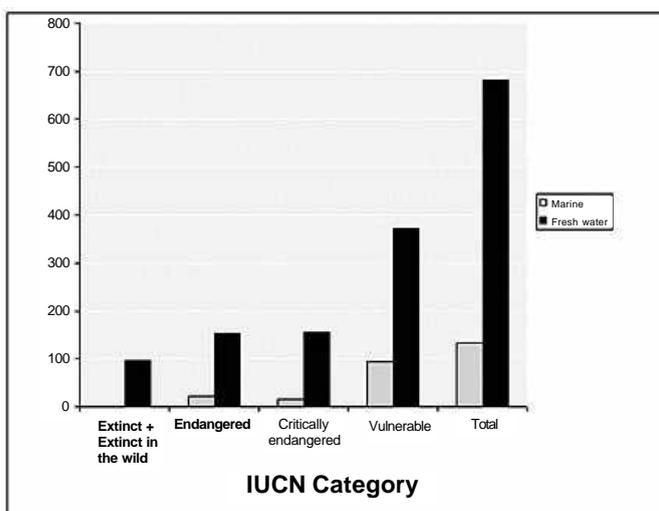


Figure 1: Number of fish species on the IUCN Red List from marine or freshwater environments (2001)

is generally the major problem and one that is far worse in freshwaters.

There are some grounds for optimism though regarding freshwaters. Awareness is growing that freshwater biological resources can indeed be sustained. This is not technically difficult, but it does require awareness and commitment. Serious efforts are also beginning to be taken to rehabilitate degraded rivers, with considerable success. Central to this, in developing countries, is the growing appreciation of the

importance of freshwater fisheries to the livelihoods of people in rural areas.

- This article is a summary of a new paper, **Biodiversity and Fisheries in the Lower Mekong Basin**, by David Coates, Ouch Peou, Ubolratana Suntornratana, N. Thanh Tung and Sinthavong Viravong, to be published by the Mekong River Commission in June 2003. Mekong Development Series No. 2.

Fish diversity in the Mekong

By John Valbo-Jorgensen

The Mekong may boast more families of fish than any other river. But determining how many species live in the river is a major challenge.

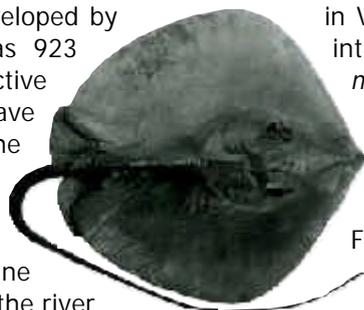
Fish taxonomists have recorded 91 families of fish living in the Mekong River. That figure, they reckon, is probably higher than for any other river in the world. But how many species are there in the river? According to a study by Dr Maurice Kottelat, who recently produced a book on the fishes of Lao PDR, the river has about 700 documented species. But Walter Rainboth, another taxonomist who is compiling an atlas of fish in the Mekong, lists more than 2,000. Between these two extremes, a new database developed by the Mekong River Commission has 923 species. The database, on an interactive CD-ROM, comprises species that have been recorded upstream from the mouth of the river, but only those already classified.

The problem in trying to determine how many fish species there are in the river



rests largely with the definitions used to include or exclude the marine vagrants - marine fish that are often

found in fresh water. The fishes in a river can be broadly categorised into three groups with respect to their ecological origins. Firstly, there are the primary freshwater fishes that have evolved in freshwaters, and so are very intolerant of saltwater. These include families such as the *Osteoglossidae* (bony tongue fishes) and *Notopteridae* (feather-backs). The secondary freshwater fishes have descended from fishes living more recently in the marine environment, but they now complete their life cycle in freshwaters. This group comprises the bulk of the fishes in the Mekong. Thirdly, marine vagrants are species that may complete their life cycle in the sea, but are also frequently found in freshwaters. Most of the Mekong's marine vagrants are found in the downstream reaches in Viet Nam. Some, however, move further upstream into Cambodia and one species - the sawfish (*Pristis microdon*) - used to swim all the way up to the Khone Falls.



Comparing the number of fish species in rivers throughout the world is difficult for two reasons. Firstly, the degree of scientific investigation in rivers varies. The fauna of some rivers are extremely well documented, while other rivers contain many

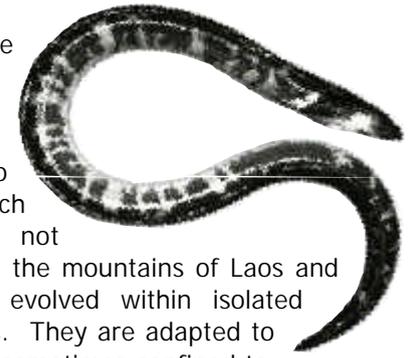
species that have not yet been described. Secondly, authors include differing numbers of marine vagrants in their species lists. Nevertheless, it is likely that only the Amazon River System (which has something like 3,000 species) is richer in species than the Mekong.

While the number of species in the Mekong is quite striking, it is not surprising considering the river's geological history, location and high degree of habitat complexity. The Mekong has at times been connected to other rivers particularly in the central and northern regions, and has thus gained some species that originally arose outside the Mekong. This is the main reason why the Mekong shares many species with the Chao Phraya in central Thailand.

The mouth of the Mekong is adjacent to the shallow coastal area known as the Sunda Shelf, where the fluctuating water levels during the ice ages allowed many species to adapt to the estuarine environment. Many then moved further upstream into the freshwater.

Within the river there are numerous different habitats, because the river flows from high mountainous areas to the vast floodplains of Cambodia and Viet Nam. Moreover, the monsoon and resultant annual flooding also creates habitat complexity and thus opportunities for fishes to specialise, and thus eventually form new species.

Indigenous species are dominant throughout the Mekong Basin and 24 percent of all species are peculiar to the region. But such endemic species are not evenly distributed. In the mountains of Laos and China many species evolved within isolated highland river systems. They are adapted to high altitudes and are sometimes confined to single streams or caves. As a result, the mountain aquatic habitats contain many endemic species. Given that these areas are difficult to access and some have never been surveyed, many new species are likely to be found there.



Further reading:

Kottelat, M. 2001. *Fishes of Laos*, Colombo, 198 pp.

Rainboth, W.J. 1996. *FAO species identification field guide for fishery purposes. Fishes of the Cambodian Mekong*. FAO, Rome, 265 pp.

John Valbo-Jorgensen is a fisheries biologist who formerly worked for the Mekong River Commission Fisheries Programme.

New fisheries institute

By Delia Paul

With the opening of the Inland Fisheries Research and Development Institute at the Department of Fisheries in February 2003, there is now, for the first time, a local institution in Cambodia dedicated to the professional research of inland fisheries, in its physical and socio-economic aspects.

The idea of such a research institute was first proposed in 1992, in the context of Danida support to Mekong fisheries research. The importance of the Great Lake and Tonle Sap to the associated river system was the basis for such an institute to be located in Cambodia, with the expectation that the knowledge generated would be shared for fisheries management in all four Lower Mekong countries.

With a core of around 20 former Department of Fisheries staff, the institute will carry out multi-

disciplinary research, with all staff being exposed to international standards of research through collaboration with partners including ICLARM (The World Fish Centre), the Danish Institute for Fisheries Management and others.

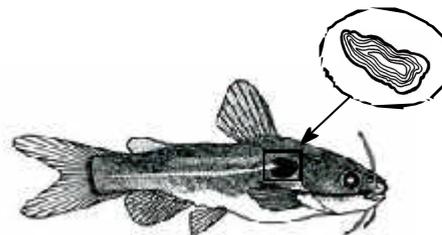
Priority areas for research will be include fish habitats, migration, consumption and export of fisheries products, freshwater fishing gear, valuing of the fishery and resource management systems.

The Institute has been completed at a cost of around US\$450,000 with the support of the Cambodian and Danish governments. The fledgling institute is now seeking further assistance over the next three years to establish financial and administrative management systems that will enable it to proceed on a strong footing.

Delia Paul is the MRC Secretariat's Communications Officer.

Otoliths

By Kent Hortle



There's more to fish ears than meets the eye

Far from being a silent world, the depths of the Mekong are a noisy place, with many species communicating by specific types of grunts, croaks or squeaks. Fish vocalise mainly to identify their own species. The noises made by some fishes during mating are in fact loud enough to be heard from the bank, a strange and eerie sound on a dark night. And the popular aquarium fish, the red-tailed botia (*Botia modesta*) will amaze its owner with its noisy grunts.

But to hear such sounds fish need specialised ears. Fish have a complex inner ear system, of which otoliths form a key component. Otoliths (or ear-stones) are bony structures which respond to sound waves differently than the body of the fish. Their differential movement stimulates cilia in the inner ear, which in turn trigger neural transmissions to the brain. The inner ear is also critical for balance, with otoliths forming the centre of a fish's gyrocompass, and the movements of otoliths informing the brain of the fish's orientation and acceleration.

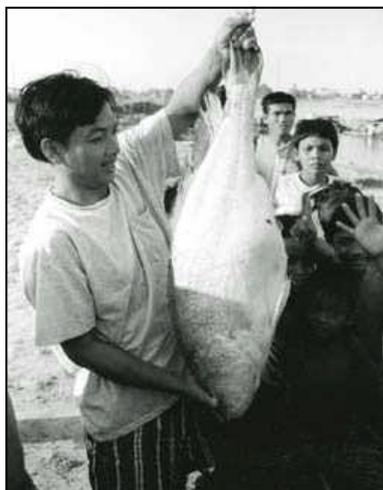
Otoliths are of great utility for fish biologists in many research areas. Otoliths have been used for many decades for determining the age of fish, because they grow more or less linearly as the fish grows, and because they comprise microscopic alternating layers or rings of protein and calcium carbonate, called annuli. Annuli are laid down daily so can be counted to determine the age of very young fish.

Checks in growth disrupt the daily pattern, with the most distinct checks in temperate species occurring during winter when growth slows; these form distinct annual bands, which then show the age of the fish in years. Tropical species are more difficult to age, as checks may be seasonal or be caused by other factors which suppress growth.

The shape of otoliths varies greatly between fish species, and they are digested very slowly, so they persist for a long time in the gut of predators, allowing biologists to determine the types of fish eaten by predatory fishes and other animals.

Many recent uses for otoliths take advantage of their composition, which varies depending upon exposure of a fish to differing environmental concentrations of chemicals. The proportions of trace elements in otoliths provide distinct "signatures", which can be used to identify stocks which have developed in different environments, and which can also show whether fish have spent part of their life in the sea. This technique has been used to show that the Mekong catfish (*Pangasius krempfi*) spends part of its early life in the sea. Otoliths also reflect the concentrations of pollutants in the environment, so are useful indicators of lifetime exposure of a fish.

The newest applications depend upon analysis of stable isotopes in otoliths. Otoliths accumulate varying proportions of different oxygen isotopes at different temperatures, so they show the temperature of the waterbody at the time the fish lived. Fossilised fish otoliths are now being used to determine prehistoric temperature patterns.



The smallscaled croaker, *Boesemania microlepis*, makes loud sounds which can often be heard above the water.

Stable isotope proportions can show whether a fish is a herbivore, omnivore, or a predator, and also the primary photosynthetic source in the food-chain on which it depends (whether, for example, algae or higher plants are key to the fishes' survival), with very useful applications in fisheries management.

Kent Hortle is a fisheries biologist with the MRC Fisheries Programme.

Lao legends

In Lao PDR, giant catfish have traditionally been associated with spirits, royalty and sacrifice

A few decades ago, Mekong giant catfish were relatively common in Laos and many were caught near Vientiane. Every February, people camped out at Ban Ang Noi to celebrate the catfish with offerings of flowers to the spirits. In addition to an old man who could contact the spirits, the ceremony was attended by senior officials and sometimes even the king. The first fish caught belonged to the spirits and the old man while the second was for the king or a senior official, The rest of the catch was for villagers and people who joined the ceremony.

According to Sinthavong Viravong, a fisheries biologist at the Living Aquatic Resources Research Centre (LARReC) in Lao PDR, old Lao fishermen believed that giant catfish were different from other fish. Unafraid of being caught, they would swim towards fishing boats. Moreover, they gave the impression that they were sacrificing themselves by entering the nets sideways - not head first like other species. Legend has it that the

giant catfish used to meet every year in a cave called Tum Pa Beuk in Luang Prabang. The annual gathering determined which fish would migrate to spawning grounds in the north, and which would sacrifice themselves to the fishermen.

The legend of King Souriyavongsa

Mr Sinthavong and another LARReC colleague, Kongpheng Bouakhamvongsa, recall another legend involving King Souriyavongsa of Luang Prabang. To get permission to catch giant catfish, the king would sacrifice a man and a woman to cave spirits every year. Known as cha pha leab, the spirits lived in caves with deep pools connected to the river in Xayabouri province. The ritual required 100 men and women, preferably volunteers, with 50 men entering one cave and 50 women entering another. When a drum called on the participants to return, a man and a woman would be missing. The sacrifice complete, the king would then start fishing in the pools. Catching one or two giant catfish apparently signalled good luck and a long life. Catching nothing was a sign of bad luck.



Uncharted waters

Little is known about the diets of Mekong fish species. More research is needed

For fisheries biologists, diet is one of the most interesting and important sources of information. But a systematic study of the feeding habits of Mekong species has never been carried out. In the absence of such a study, the Mekong River Commission has incorporated existing data on 391 freshwater species into its new database. Drawn from a wide range of sources, the information covers the diets of more than 40 per cent of all species listed in the database. Notable exceptions are exotic species and marine vagrants.

As the accompanying chart shows, 51 per cent are carnivorous species feeding on animal matter. Eight per cent are herbivorous feeding on plant material and 37 per cent are omnivorous, feeding on both plants and animals. The rest feed on plankton, mud or parasites.

Insects and insect larvae are among the most common foods. Other fish, algae and zooplankton are also important. But such figures may hide changes in feeding patterns as fish grow. Juveniles and adults, for example, often have different feeding habits. It is also common for fish to shift from a highly-specialised diet during the flood season, when food is abundant, to an omnivorous diet during the dry season, when less food is available for most species. Regardless of such

changes, the apparent high incidence of carnivorous and omnivorous diets needs further investigation. Diets of most species still haven't been described. Moreover, the proportional contribution to the production of each group remains a mystery.

JVJ

Food item included in diet	Number of fish species feeding on it
Insects 	201
Fish 	149
Algae	90
Insect larvae	80
Zooplankton	75
Detritus	69
Worms	67
Shrimps/prawns	57
Phytoplankton	48
Periphyton	44
Fruits	31
Crabs	25
Snails/gastropods	20
Terrestrial plants	12
Scales	11
Aquatic macrophytes	11
Fins	10
Flowers	6
Frogs	5
Bivalves	5

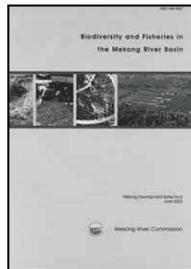
Calendar

4-5 June	Tenth Annual Meeting of MRC Fisheries Programme, Udon Thani, Thailand.
25-29 August	International workshop on the use of mechanisms for the control and responsible use of alien species in aquatic ecosystems, Yunnan Province, PR China.
15-23 September	Third Regional Training on co-management, MRC Fisheries Programme in Cambodia.
22-25 September	Official meeting of the Asia-Pacific Chapter of the World Aquaculture Society, Miracle Grand Hotel, Bangkok, Thailand.
25 November	Steering Committee Meeting, Fisheries Programme, Pakse, Champassack Province, Lao PDR.
26-28 November	Sixth Technical Symposium on Mekong Fisheries, Pakse, Champassack Province, Lao PDR.

New information products

NEW Biodiversity and Fisheries in the Mekong River Basin

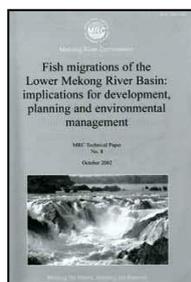
This new publication in MRC's Mekong Development Series argues persuasively for the elimination of boundaries between fisheries management and biodiversity conservation, showing that when biodiversity is well managed, fisheries production goes up.



Mekong Development Series No. 2, June 2003. US\$5.

Fish migrations of the Lower Mekong Basin: Implications for development, planning and environmental management

In the Mekong Basin, many fish species are migratory. Many swim hundreds of kilometres, often across international borders, during their seasonal migrations. Since millions of people are dependent on migratory fish for their food security and livelihoods, plans for dams and other water management projects must consider their consequences on fish migrations. To aid in these assessments, this paper identifies key features of the Mekong River ecosystem that are crucial for migratory fishes and suggests how to incorporate this information into environmental assessments.

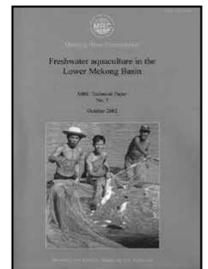


MRC Technical Paper No. 8, October 2002. 62 pages. US\$5.

Freshwater aquaculture in the Lower Mekong Basin

Aquaculture - the farming of fish, other aquatic animals and plants - is an increasingly important source of income and means of assuring food security for rural people in the Lower Mekong Basin. This paper reviews the status of freshwater aquaculture in Cambodia, Lao PDR, Thailand and Viet Nam and trends shaping aquaculture development.

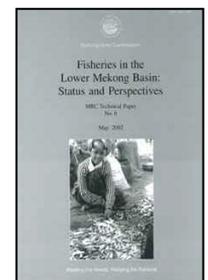
It also provides recommendations for increasing the importance and success of aquaculture, particularly in poor communities.



MRC Technical Paper No. 7, October 2002. 62 pages. US\$5.

Fisheries in the Lower Mekong Basin: Status and Perspectives

This status report provides current data from the Lower Mekong Basin on capture fisheries and aquaculture, as well as data on consumption, processing and marketing. The study includes an overview of development that affects fisheries, and recommendations on what is needed for sustainable management of capture fisheries and aquaculture.



MRC Technical Paper No. 6, October 2002. 95 pages. US\$5.

Where there is water, there is fish

From Cambodia's Great Lake, vast numbers of fish travel across borders in journeys of up to a thousand miles to spawn. Their story is told in this new 26-minute film.



Together with rice production, the rich fishery in Cambodia provided the basis for the flourishing of the great Angkorian empire that grew around the Great Lake from the 9th to the 15th centuries. The lake is like the beating heart of the Mekong River system as it swells and shrinks with floodwaters, triggering each cycle in which vast numbers of fish travel across borders in journeys of up to a thousand miles to spawn.

Today, the food security of Cambodia's population of 12 million still rests on fish and rice. The film highlights the importance of regional cooperation to protect these inland fisheries that are among the richest and most biologically diverse in the world.

2002. VCD. US\$5.
Available in English and Khmer.

Mekong Fish Database

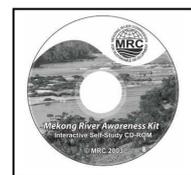
Key information on Mekong fish species including taxonomy, migration, common names, synonyms, pictures, occurrence data, maps and biological information. Information contained in the database is fully referenced and was obtained both from published material and from the results of surveys coordinated by the MRC Fisheries Programme in collaboration with riparian line agencies.



2003. CD-ROM. US\$5.

River Awareness Kit

Designed for self-study, this interactive CD-ROM provides an introduction to basic scientific facts and concepts to do with river ecology.



2003. CD-ROM. US\$10.

MEKONG NEWS

Quarterly newsletter of the Mekong River Commission provides news and information for professionals interested in development issues in the Lower Mekong Basin in Cambodia, Lao PDR, Thailand and Viet Nam.



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Mekong Fisheries Index



1. **In Mekong Basin, giant catfish swim toward oblivion.** *International Herald Tribune*, Dec 19, 2002.
A programme that tags giant fish species on the Mekong tracks their migrations and a decline in their numbers. Zeb Hogan and the Mekong Fish Conservation Programme pay rewards to fishers for contacting them with specimens.
2. **Taxonomy: What's in a name?** *The Economist*, Jan 4, 2003.
For thousands of years, humanity has classified the living things of this world in much the same fashion: by their appearance. If it looks like a duck, walks and quacks like a duck, then it is a duck. But tackling millions of species in this way has proven to be a recipe for confusion.
3. **Govt urges fisheries to keep close watch on export quality to hit goals.** *Viet Nam News*, Jan 13, 2003.
The quality of exported seafood must be strictly monitored if the sector is to hit this year's target of \$2.3 billion, Prime Minister Phan Van Khai said at the Fisheries Ministry's meeting held in Ha Noi.
4. **Completion of draft fisheries law raises hopes.** *Phnom Penh Post*, Jan 17-30, 2003.
The Department of Fisheries completed its long-awaited draft fisheries law this week, raising hopes that problems within the fisheries sector will soon be resolved.
5. **Viet Nam stresses trade ties ahead of US catfish decision.** *Cambodia Daily*, Jan 20, 2003.
Viet Nam warned the US that bilateral trade and economic relations would be affected if Vietnamese exporters are found guilty of dumping catfish on the US market.
6. **Fisheries summit begins in Cambodia.** *Viet Nam News*, Feb 12, 2003.
The international Large Rivers Symposium (LARS2) will address the current status and future of international large river fisheries, which provide vital food and income to rural and land-locked populations.
7. **PM: Protect Fisheries.** *Cambodia Daily*, Feb 19, 2003.
Prime Minister Hun Sen called on fishermen to protect the country's fishing resources and prevent the use of harmful fishing devices that could deplete fish populations.
8. **US catfish decision eating away at profits in An Giang Province.** *Viet Nam News*, Feb 22, 2003.
Catfish farmer Nguyen Thi Lanh doesn't dare to feed her fish too much for fear they will grow too fast, forcing her to unload them in a market where prices are rapidly falling.
9. **Sar Kheng: Local officials selling fishing lots.** *Cambodia Daily*, March 5, 2003.
Co-Minister of Interior Sar Kheng said that fishing grounds allocated to poor fishermen by the government are being sold to private businessmen.
10. **Crocodiles set to return after 20 years.** *The Nation*, March 5, 2003.
For Plodprasop Suraswadi, permanent secretary of the Natural Resources and Environment Ministry, a plan to reintroduce crocodiles into the Beung Boraped freshwater lake is a "gift" for both crocodiles and people.
11. **Government floats aquaculture growth plan.** *Viet Nam News*, March 11, 2003.
The government has announced plans to expand Viet Nam's aquacultural area to 1 million ha, a rise of 4.5 per cent over last year.
12. **Mekong River Commission to coordinate food and water research programme.** *Vientiane Times*, March 25-27, 2003.
The Mekong River Commission has been chosen as the basin coordinator for the

Mekong in a global research programme called the CGIAR Challenge Programme on Water and Food. The research programme aims to increase food production without increasing water use beyond the levels used in 2000.

13. **Poor depend on sound management of Mekong fisheries. Opinion piece by Joern Kristensen, *Cambodia Daily*, April 8, 2003.**

People on the Mekong floodplains rank among the highest consumers of fish and fish products in the world. Sound management of inland fisheries will be essential as Cambodia, Laos, Thailand and Viet Nam make the transition to more modern and open economies.

14. **More food sought from less water. *Phnom Penh Post*, March 28-April 10, 2003.**

A global research programme to determine how to properly manage the resources of key river basins brought a number of representatives from Mekong River countries and international research institutions to Phnom Penh on March 26-27.

15. **Blasting put on hold as threat to river border. *The Nation*, April 7, 2003.**

A Cabinet screening committee has resolved to postpone the proposed blasting of the Mekong River to prevent a possible demarcation dispute with Laos.

16. **Pak Mool struggle goes on. *The Nation*, April 9, 2003.**

Yet with the eight water gates of the Pak Mool dam now closed as a result of a Cabinet resolution last year, villagers say fish stocks are far down on previous years.

17. **Focus on Mekong at conference. *The Nation*, April 28, 2003.**

"Business Opportunities: the Mekong Region comes of age" is the theme of the fourth annual Nation International Conference, which

is expected to attract 1,200 visitors over two days. Expert, ministerial-level representatives and leading business executives from the six Mekong region countries and beyond have been invited to the conference, to be held on June 12 and 13.

18. **Dam threatens the balance: For lake's ecology, a murky future. *International Herald Tribune*, April 29, 2003.**

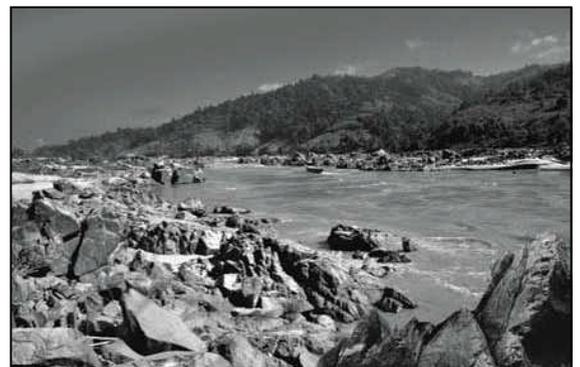
It is an intricate ecology of flux as the waters of Cambodia's Great Lake rise and fall with the seasons, now favouring the fish, now flatlands. It is a balance that is threatened now, with plans to dam the river that feeds it, muting its annual rhythm.

19. **Fire ravages flooded forest in Battambang, *Cambodia Daily*. May 6, 2003.**

An estimated 18 sq km of flooded forest was destroyed in the fire last month, killing tortoises and decimating vital wildlife habitat, the officials reported.

20. **Women need bigger say in fisheries network. *Vientiane Times*, May 13-15 2003.**

Women in Laos, Viet Nam, Cambodia and Thailand need to become as involved in fisheries network operations as men, according to the Regional National Coordinator of the Department of Livestock and Fisheries, Nounhak Liepvisay.



Published by the Mekong River Commission Secretariat

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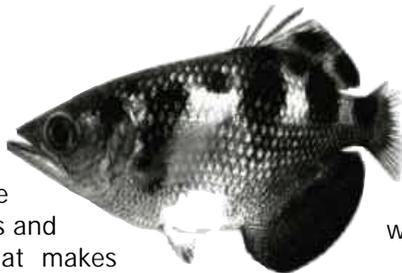
Archer fishes (*Toxotidae*) - the swimming water pistols of the Mekong

By John Valbo-Jorgensen

The archer fishes (*Toxotidae*) are conspicuous creatures due to their surface-oriented habits and unusual appearance. But what makes them unique in ichthyology is their extraordinary ability to hit little insects and spiders with drops of water which they spit out of their mouths with remarkable power and precision.

The archer fishes are characterised by dorsal and anal fins that are equipped with both soft rays and spines. The body is silvery or yellowish and the back is embellished with several black stripes or blotches, an appearance that has given it the name "tiger fish" in several Mekong countries. The dorsal fin is located far back on the body, The mouth is large and turned upwards and the sizeable eyes are located close to the mouth, giving them good binocular vision that allows them to determine distances precisely.

Archer fishes occur from India to the Philippines and northern Australia. Only six species are known and all belong to the *Toxotes* genus. Three have been recorded in the Mekong - the large-scale archer fish (*T. chatareous*), the small-scale archer fish (*T. microlepis*) and the banded archer fish (*T. jaculatrix*).



The banded archer fish is the largest and grows up to 30 centimetres. It can easily be distinguished as it has only four dorsal fin spines compared with five in the other two species. It is most common in the estuary, where it prefers mangrove habitats.

The large-scale archer fish grows to 27 centimetres. It has five rows of scales between the lateral line and the dorsal fin, and 33 or 34 lateral-line scales. It occurs in the estuary and upstream to Laos and Thailand.

The smallest species, the small-scale archer fish, is the most common. It grows to only 15 centimetres but has a deeper body than the other two species. It has at least six rows of scales and 34 or more lateral-line scales.

Archer fishes are active hunters, constantly swimming near the surface looking for prey in, on or above the water. The dorsal profile of the body is almost straight from the tip of the snout to the dorsal fin. The shape of the body and the location of the dorsal fin allows them to swim very close to the surface and look up without creating a disturbance.

When an archer fish locates a prey sitting on a leaf or flying low over the water, it may try to shoot it down with a drop of water by spitting at great speed. An

Fisheries Research and Development in the Mekong region

adult can spit up to about three metres and hit a fly more than a metre away - quite impressive for a fish that rarely reaches 20 centimetres in length.

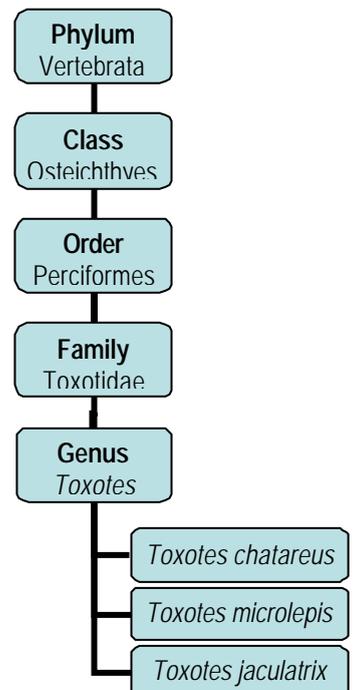
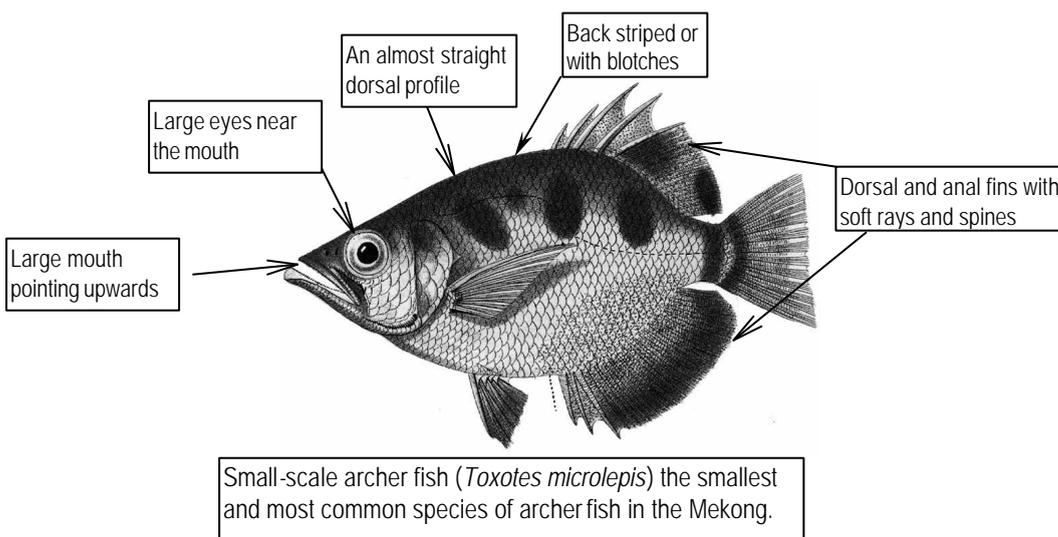
When news of a spitting Asian fish reached Europe about 250 years ago, the scientific community was incredulous, and it was not until the early 20th century that the extraordinary habits of the archer fishes were properly described and recognised. The mechanism behind its shooting ability is still in the early stages of discovery.

It appears that both the upper and lower jaws have two valves separated by a small notch, kept open by a membrane connected to the roof and the floor of the mouth. When spitting, water is squeezed out of a small hole that appears between the valves when they are closed. To maximise the power of the shot, the fish sticks its mouth out of the water. However, the eyes stay fully submerged - so the fish has to correct the deflection of the image by the water. This makes its

ability to hit from various angles - and therefore different degrees of distortion - even more impressive. Contrary to what was believed until very recently, it seems that the archer fish is born with its shooting ability.

Despite its efficiency, such a method of hunting is not the favoured way of foraging. Archer fishes often feed on floating insects or shrimp, or jump out of the water to catch insects near the surface. Only when everything else fails do they resort to spitting. This is because they often swim in small schools, and the one that shoots down the prey is far from certain of being the one feasting on the meal.

Archer fishes can be caught with hook and line as well as various nets. They are an esteemed food and are sold fresh in markets. However, they have a much higher value when sold as aquarium fish because of their interesting behaviour.



Key references:

- Allen, G.R. 1978. A review of the archer fishes (family Toxotidae). Rec. West. Austr. Mus, **6**: 355-378.
- Elshoud, G.C.A. 1985. A biomechanical analysis of spitting in archer fishes (Pisces, Perciformes, Toxidae). Zoomorphology **105**: 240-252.
- Rainboth, W.J. 1996. FAO species identification guide for fishery purposes, Fishes of the Cambodian Mekong, FAO, Rome, 265 pp.
- Smith, H.M. 1945. The fresh-water fishes of Siam, or Thailand. Bulletin of the US National Museum **188**: 1-622.
- Timmermans, P.J.A. 2001. Prey catching in the archer fish: angles and probability of hitting an aerial target, Behavioural Processes **55**: 93-105.
- Timmermans, P.J.A. and Vossen, J.M.H. 2000. Prey catching in the archer fish: does the fish use a learned correction for refraction? Behavioural Processes **52**: 21-34.