MEKONG RIVER COMMISSION FOR SUSTAINABLE DEVELOPMENT

MRC

Catch and Culture

Fisheries Research and Development in the Mekong Region

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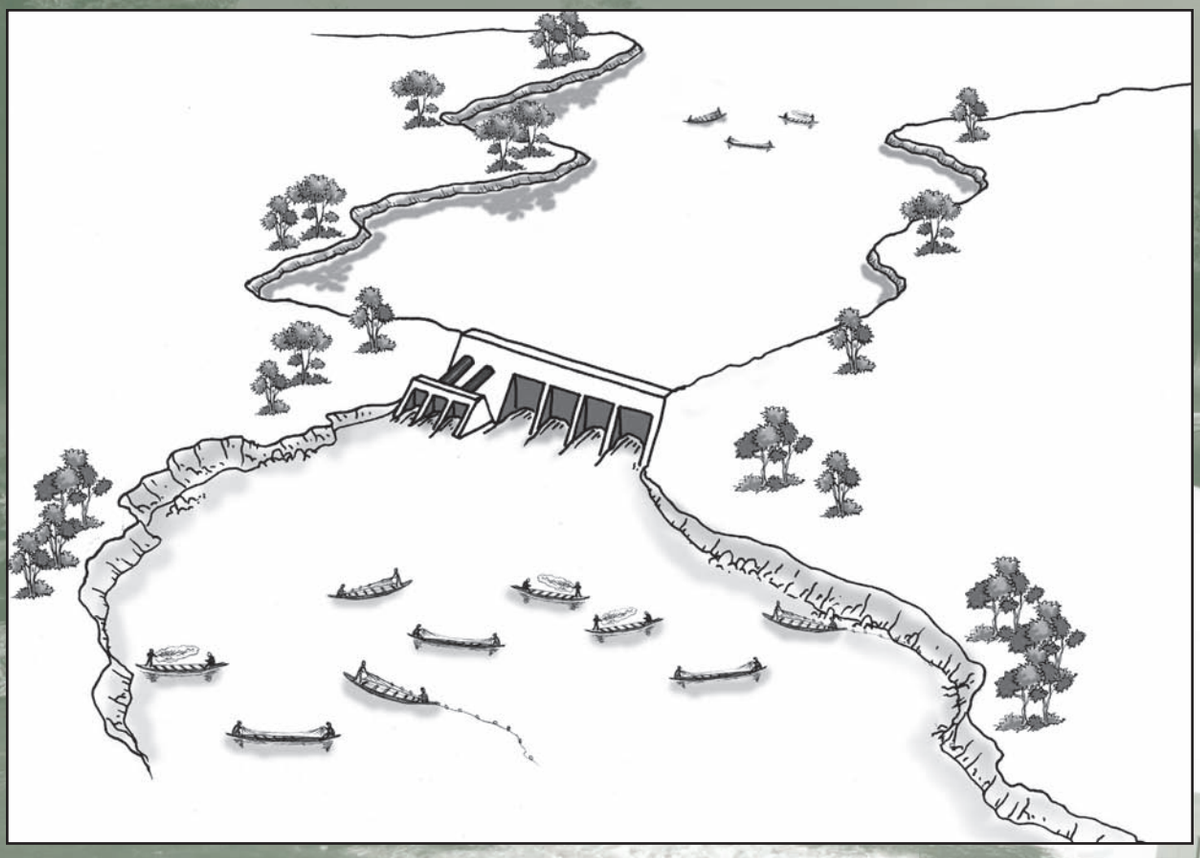

INSIDE

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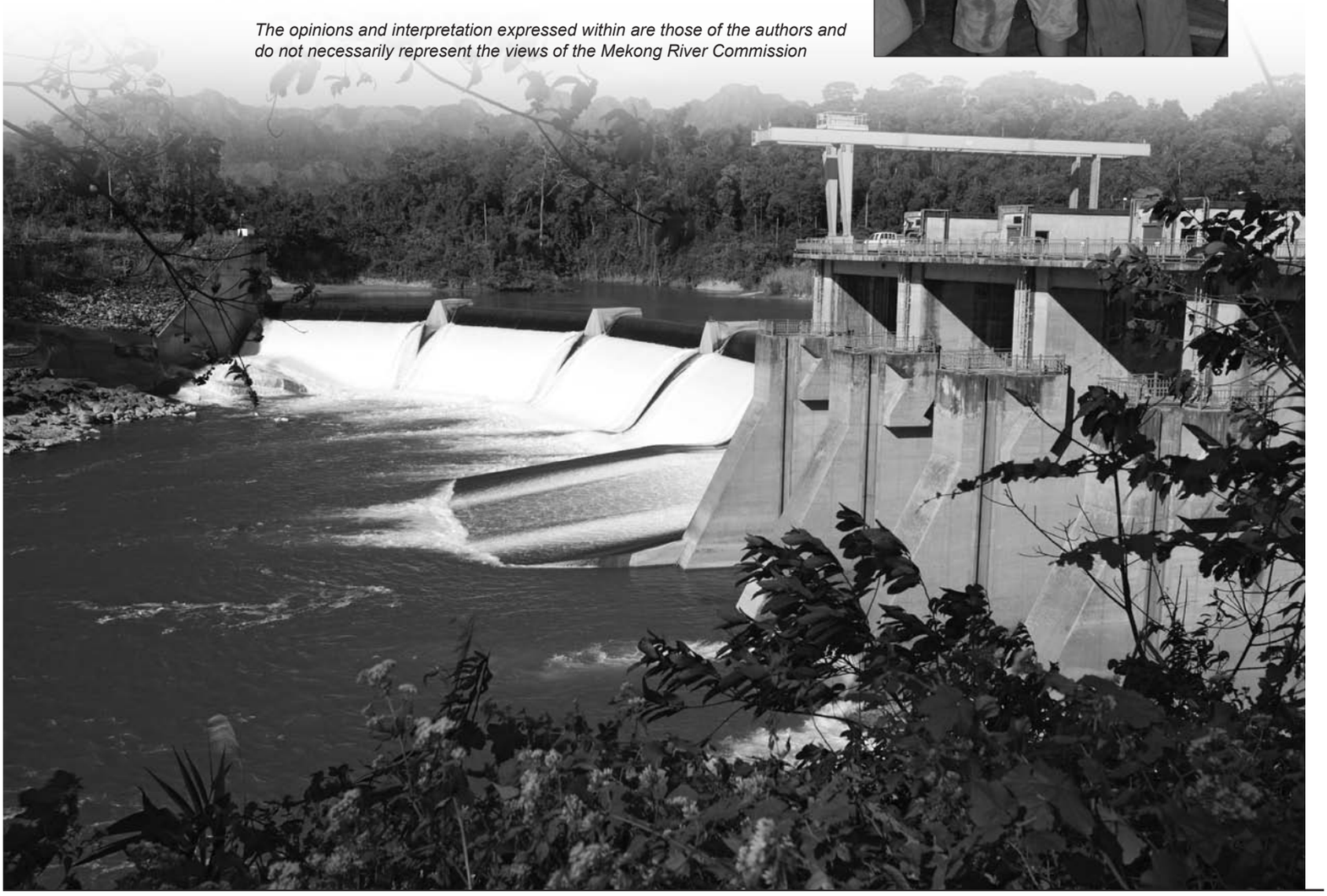
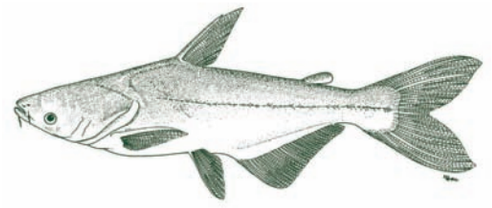


Editorial



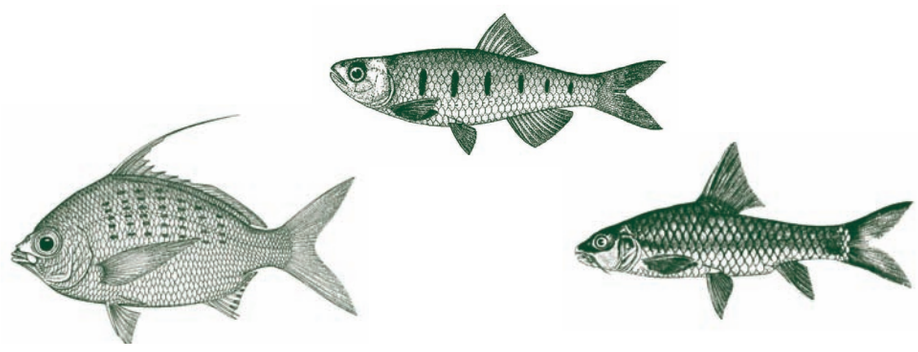
A key issue for all four countries sharing the Lower Mekong Basin is the extent to which dams will act as a barrier to fish migration and how this will affect people whose livelihoods depend on such migrations. In this issue, we look at the distribution of benefits that dams may bring to future generations and why it is better to have a cascade of several dams on one tributary rather than one dam on each of several tributaries. As Cambodia's Agriculture, Forestry and Fisheries Minister Chan Sarun warns elsewhere in this issue, developing dams and canals without impact assessments will have negative impacts on fish migrations.

In relation to hydropower development, we also look at deep pools, which provide critical dry-season habitats for migrating fish. Recent pilot testing to estimate fish abundance and biodiversity in deep pools has yielded promising results, especially in Cambodia and Viet Nam. A full-scale survey of up to six pools in each of the four lower basin countries is now planned for early next year. At the same time, a Deep Pools Atlas is being developed.

This edition takes a detailed look at the health risks associated with a liver fluke that is endemic in parts of the lower basin where people eat uncooked freshwater fish and other aquatic animals. We also examine how the recent meltdown of the Vietnamese equity market affected five catfish-processing companies listed on the Ho Chi Minh Stock Exchange during the first half of this year. The bad news is that investors wiped almost US$190 million off the value of these companies in six months. The good news is that exports are still booming, especially to Europe and Russia.

The special insert in this issue is devoted to Lao fisheries management—not only annual fish release ceremonies but also other efforts such as institutional capacity-building and the development of local regulations to protect river habitats. We would particularly like to thank the World Wide Fund for Nature (WWF) for helping us to prepare this timely supplement.

Please note that the final installment in our three-part series on hydrology has been postponed to the next issue to take account of recent extreme floods across northern parts of the basin.



Dams, fish and **fisheries** in the Mekong River Basin

By Chris Barlow*

Dams on the mainstream of the Mekong will affect fisheries. The MRC and its Fisheries Programme have started several activities to provide more information on likely impacts and possible mitigation measures.

Hydropower development is today the most important issue facing fisheries in the Lower Mekong Basin, home to 60 million people and one of the most productive inland fisheries in the world. Many hydro-electric dams are either already operating, under construction or planned along various tributaries of the Mekong, mainly in the Lao and Vietnamese parts of the basin.

On the mainstream of the river, there are currently only three hydro-electric dams. These are all located on the Chinese stretch of the Upper Mekong Basin, which also includes northeast Myanmar. China will commission several more hydro-electric dams across the mainstream over the next eight years. In the Lower Mekong Basin, there are currently no mainstream dams. But plans for as many as ten hydro-electric projects across the mainstream are at various stages of consideration. Nine sites have been proposed for the Lao stretch of the river and two for the Cambodian stretch (Hill and Hill, 1994; www.poweringprogress.org).

Hydropower on the mainstream

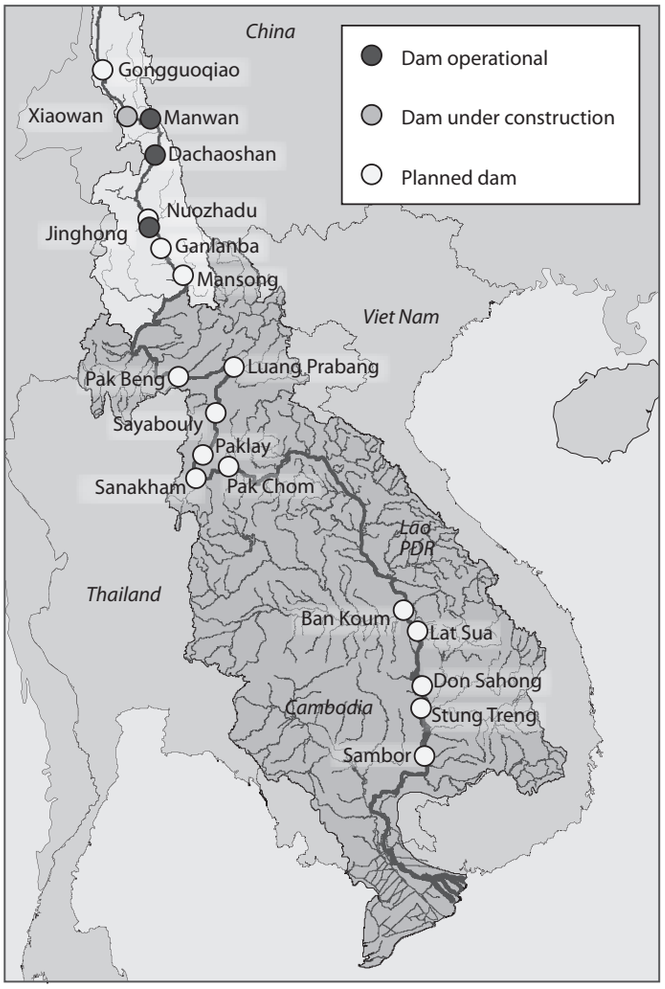
The renewed interest in hydropower development on the mainstream of the Mekong is driven primarily by two factors – the increase in international crude oil and gas prices over the past two years, and increased dry season flows resulting from the operation of dams in China. A third factor is that climate change concerns have led to resurgence in interest in hydropower as a clean energy source.

Dry-season flows in the Mekong will increase significantly as more Chinese dams are commissioned. In the Mekong between Vientiane and the border with China, where plans for four dams are currently being considered for implementation, preliminary estimations have indicated average dry-season flows will increase by 40-60% (Adamson, 2001). The increased water in the dry season makes hydropower dams on the mainstream a more financially attractive proposition.

Impacts of dams on fisheries

Dams and reservoirs block natural fish migration. Many of the commercial species in the Mekong

Mainstream Dams



GRAPHIC: TIM BURNHILL

have highly-developed migratory patterns. They generally move upstream to spawn and then juvenile fish move back downstream to feed and grow on the floodplains and wetlands (Poulsen *et al.*, 2002). Dams act as a barrier to fish migrating upstream; and returning fish migrating downstream past hydropower dams generally must go through turbines. This results in mortalities. As a result, spawning is greatly reduced and replenishment of fish stocks is diminished. Some species which currently undergo long-distance migrations may be able to adapt to new environments if their present migration patterns are facultative or opportunistic, rather than obligatory. However, whether this will occur or not can only be determined after migration routes are blocked (see box below, detailing an expert group meeting on dams as barriers to fish migration in the Mekong, and possibilities for mitigation).

Although the effect of blocking migrations on fisheries productivity has been observed in numerous rivers all around the world, it is extremely difficult to quantitatively predict the impact that blocking migrations has on overall fisheries productivity. What is obvious though, is that one dam's impact on fish migration can be the same as the impact of ten dams. That is why, in fisheries terms, it is far better to have a cascade of say ten dams on one tributary than one dam

Fisheries studies addressing dam development issues

The Fisheries Programme of the Mekong River Commission has a range of activities within its Fisheries Ecology, Valuation and Mitigation component that are designed to provide information relevant to basin planning processes. The recent focus on mainstream dams has resulted in the programme taking on a series of fast-tracked activities to provide information to regional policy makers so that they can make informed decisions about the costs and benefits associated with hydropower development. These fast-tracked activities are listed below.

1. Identification of important spawning sites on the mainstream
Sampling of fish larvae and juveniles will be conducted along the length of the Mekong mainstream over a 12-month period to identify important spawning habitats. The study is being coordinated by the Thai Department of Fisheries because of the specialist expertise on larval fish taxonomy available in Thailand. Planning is currently underway for the quantitative survey work to be carried out in 2009, with preliminary results available at the end of that year. The results will also help improve the reliability of the predictions of the dam impact model described below.

2. Modelling the barrier effect of proposed mainstream dams
The Fisheries Programme and the World Fish Center (Phnom Penh office) are collaborating to model the barrier effect of proposed mainstream dams. The modellers will look at how the barriers will affect populations of highly migratory species of different sizes and with different life history strategies (for instance, early and late maturing fish, fish with many eggs or few eggs). A report on the work will be available by May 2009.

3. Expert meeting on dams as barriers to fish migration on the mainstream, and possibilities for mitigation
The MRC Fisheries Programme and the Hydropower Programme are convening a meeting of experts from around the world on fisheries ecology and hydropower development. The aim is to bring their experience and knowledge to assess the possible impacts of mainstream dams on the fisheries of the Mekong, and to see what mitigation activities could be relevant to this region. The meeting is scheduled to take place on 22-23 September, 2008 with a summary report to be made available to the Hydropower Consultation on 25-26 September. The full paper detailing the outcomes of the meeting will be published in the form of answers to frequently asked questions about dams, hydropower and fisheries.

4. Development of guidelines for fisheries impact assessment, forecasting and mitigation
The development of these guidelines will be undertaken by a team of consultants contracted by the MRC Secretariat. The guidelines will draw upon lessons and experience from dam projects, environmental impact assessments, and related studies undertaken both within and beyond the Lower Mekong Basin to generate best practice guidelines for dam impact forecasting assessment and mitigation. The report will be completed by mid-2009.

5. Mitigating the impacts of dams on fisheries: a primer
The Fisheries Programme will prepare a report on measures that can assist in mitigating the impacts of dams on fisheries, before, during and after construction of a dam. The report will be written as a general source document for a wide audience. It will be published in the MRC Development Series in early 2009.

6. Review of fisheries in reservoirs in the Lower Mekong Basin
The programme also plans to publish a technical report on the development of fish communities and reservoir fisheries in the Lower Mekong Basin. This will look at what sort of fisheries we can expect in new reservoirs and will attempt to compare yields in reservoirs with those lost from the river fisheries. The report should be available by mid-2009.

on each of ten tributaries. And similarly, why one dam on the mainstream may have a severe impact on regional fisheries productivity if it blocks an important fish migration route.

Dams, particularly those with large storage capacity, also affect river hydrology. Changes to hydrology include modification of the extent, duration and timing of annual floods, which naturally occur between May and November in the Lower Mekong Basin. Smaller floods of shorter duration reduce the available habitat for fish, resulting in lower fish production (Halls *et al.*, 2008). They also reduce the survival rate of eggs and juvenile fish, which in turn decreases the recruitment of younger fish into the natural population. Changes to the timing of the floods, and indeed permanent increases in dry season flows, can disrupt the spawning and migration cues that trigger changes in fish behaviour and which are required for reproduction and ultimately the survival of different species (Baran, 2006).

Scientists can roughly estimate the impact of smaller floods of shorter duration on the overall fisheries yield. However, without detailed experimental studies (which are currently not feasible in the Mekong region due to the experimental infrastructure required), it is very difficult to predict how spawning and migration cues will be affected by hydrological changes involving not only reduced wet-season flows, but also markedly increased dry-season flows.

Most of the dams proposed for the mainstream have only limited storage capacities. Consequently, they are unlikely to have any significant effect on seasonal hydrology patterns, although they may affect daily flow patterns in the dry season, especially if they are operated to supply peak-demand electricity.

New fisheries in reservoirs

Dams do create opportunities for new reservoir fisheries. Yields in new reservoirs are initially quite high as the nutrients are released from the recently inundated land. However, the yields usually decline after five years or so as the nutrient supply is used up, and then stabilise at a lower level. Fisheries biologists can predict the yields from reservoir fisheries. How it is difficult to determine the extent of the reduction in the river fisheries due to dam construction, because the impact is diffuse and widespread. Hence a comparison between production from new reservoir fisheries and diminished river fisheries is in most cases problematic (Jackson and Marmulla, 2000).

Fish cages on the Nam Ngum Reservoir, Lao PDR
Photo: Sommano Phounsavath

Reservoirs for the dams planned on the Mekong mainstream will be small, and generally confined within the river banks. Consequently, the fisheries which develop in them will be similarly limited.

Distribution of benefits

As the Lower Mekong Basin develops, active engagement between the fisheries and hydropower sectors is needed to address both the positive and negative impacts of dams on fisheries. The positive impacts of hydro-electric and irrigation dams are relatively easy to measure. They can raise food production, improve living standards, and create secondary industries as well as sources of government revenue. Income generated from such activities is part of the formal economy.

But fisheries production is also an important part of the agricultural sector in the four countries of the basin, accounting for 2-10% of each of the four countries' gross domestic product between 2002 and 2006. Measuring the wider benefits of fisheries in terms of food security, livelihoods, biodiversity and ecological functions is much more difficult. Such benefits are not part of the formal economy. They do, however, form a crucial part of people's livelihoods, especially for those who share the waters of the Lower Mekong Basin and their migrating fish species.

The answer lies in comprehensive planning at both national and regional levels. Planning needs to encompass the region's requirements for energy security, food security, economic development, environmental protection, and equitable distribution of the benefits of developments. In a region such as the Mekong, which has vast hydropower potential and important fisheries resources, with good planning it is entirely possible to have both ample hydropower and healthy river systems that support highly productive fisheries.

**Dr Barlow is Manager of the MRC Fisheries Programme*

Fishing family on the Nam Houm Reservoir, Lao PDR
PHOTO: SOMMANO PHOUNSAVATH

Further Reading

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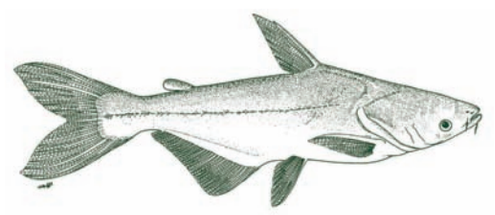
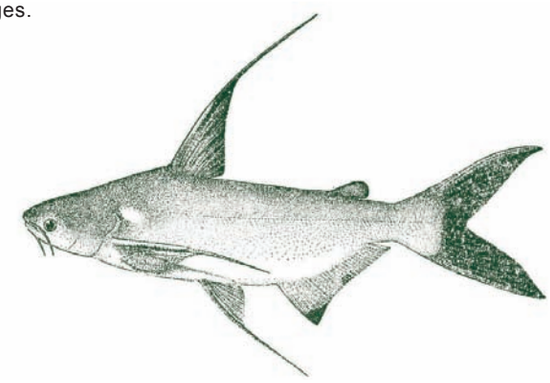




Deep pool mapping and **research**

By Ashley S. Halls*

Pilot testing of methods to estimate fish abundance and biodiversity in deep pools has yielded promising results. A full-scale survey of up to six deep pools in each country of the Lower Mekong Basin is now planned for early 2009 and a Deep Pools Atlas is being developed.

Deep pools are relatively deep areas in the river channel. Several workers, including Poulsen *et al* (2002), Baran *et al* (2005), and more recently Sinthavong *et al* (2006) postulate that in the Mekong River system these pools provide critical refuge habitat during the dry season and possibly also critical spawning and/or nursery habitat during the wet (flood) season for many species belonging to the migratory 'whitefish' guild. The health of this critical habitat is currently believed to be "good" but threatened by basin development activities, particularly hydropower dam construction, which may alter water flow and sediment transport and deny fish access to important deep pools.

Since its inception in 2000, the Technical Advisory Body for Fisheries Management (TAB) has actively promoted a greater understanding of deep pools and the "…regional significance of these local habitats…" to the fisheries of the Mekong. Priority action identified by the TAB during the MRC's 7th Technical Symposium on Mekong Fisheries in 2005 focused upon the identification and improved understanding of the fisheries ecology of deep pools in the basin, and thereby the appropriate fisheries management action.

Meeting the demand

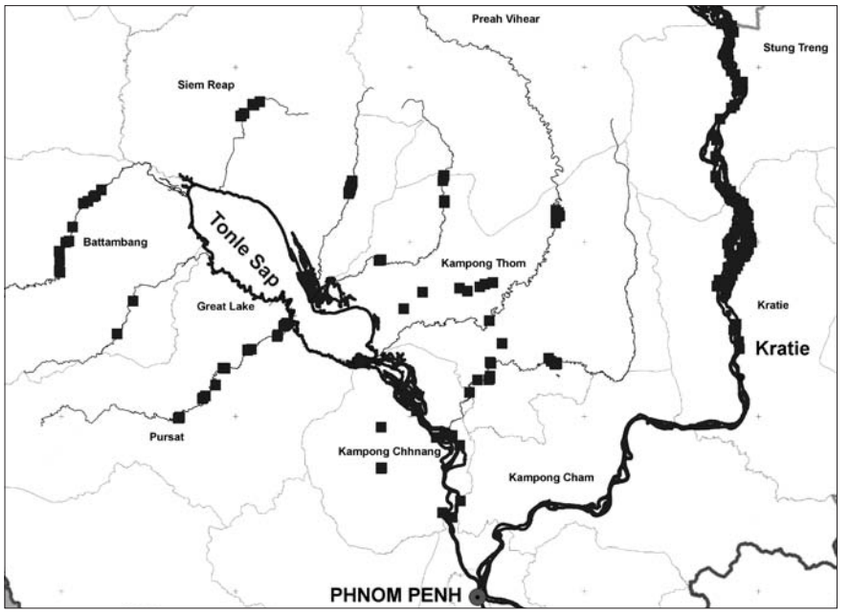
In response to these research needs, and under the growing likelihood of mainstream dam development in the Lower Mekong Basin (LMB), the Fisheries Ecology, Valuation and Mitigation (FEVM) Component of the MRC's Fisheries Programme, together with its four counterpart riparian research institutes, designed a regional deep pool research project. The two-and-a-half year project, entitled 'MRC Atlas of Deep Pools and Identification of Factors Affecting the Quality of Deep Pool Refuge Habitat', began in June last year. Early next year the project will publish an atlas containing a synthesis of deep pool research and management activities in the region together with detailed maps illustrating the location and shape of all deep pools in the mainstream and some of its tributaries. The maps will be annotated with summaries of available information about each pool, including their depth, area, and numbers of fish species and fishers. The project will also attempt to estimate fish abundance and biomass, and to measure important environmental variables in a sample of deep pools throughout the length of the mainstream to improve understanding of why some pools are more important than others as refuges for fish. This will help basin planners and fisheries managers to predict and map the locations of important refuges, thereby focusing their conservation and management efforts.

Deep pool mapping underway

With colleagues from the MRC Information and Knowledge Management Programme, the project has already compiled a deep pool database and mapped the locations of more than 200 important deep pools in the mainstream and tributaries of the Cambodian Great Lake (see below). The locations of the pools were identified using local ecological knowledge (LEK) and hydro-acoustic surveys (see Chan *et al* 2006; An

Deep pools in Cambodia

Data from Inland Fisheries Research and Development Institute, updated 2008



Map: Information and Knowledge Management Programme, MRC

Deep pools in the Lower Mekong Basin

Data from the MRC Fisheries Programme, updated 2002

2007 and Sinthavong *et al* 2006 for further details). The remaining deep pools are being identified with the support of the MRC's Environment Programme using a digital bathymetric atlas of the mainstream and the 'zero-crossing method' (Carling & Harriet, 2000). The method has identified more than 500 deep pools in the mainstream (including those identified from the LEK surveys) from deviations in mean riverbed depth. The World Wide Fund for Nature has also offered to contribute its own research findings on deep pools in tributaries in the Lao PDR to the atlas.

Testing methods to estimate fish abundance

In March this year, the FEVM component also pilot-tested depletion and hydro-acoustic methods for estimating fish abundance and biomass in a sample of deep pools of different depths and substrate type, in preparation for a basin-wide survey planned for next March. The work is being undertaken by the Inland Fisheries Research and Development Institute in Cambodia, the Living Aquatic Resources Research Centre in the Lao PDR, the Inland Fisheries Research and Development Bureau of the Department of Fisheries in Thailand and Reseach Institute for Aquaculture No 2. in Viet Nam.

The depletion method involves monitoring how catch-per-unit-effort (CPUE) - an index of fish abundance - declines in response to removals (catches) of fish to estimate the original population size. The population size corresponds to the predicted removals when the catch rate (CPUE) falls to zero (see Hilborn & Walters, 1992). It requires no sophisticated technology or expertise but requires monitoring of intensive fishing over a period of time when there is no significant immigration or emigration of fish to and from the pool (closed population). The hydro-acoustic method makes the same 'closed population' assumption, and requires technical expertise to operate expensive sonar-type equipment and to interpret the output, but can provide estimates of deep pool fish abundance and biomass in less than a day without the need to monitor any removals.

The depletion method was tested in two deep pool sites in both Cambodia and Viet Nam and in four sites in the Lao PDR where the hydro-acoustic method was also tested. For the depletion method, the pool boundaries were first demarcated, local fishers were identified and the purpose of the study explained. To encourage intensive fishing effort within the deep pools, a $100 prize was offered to the fisher who recorded the highest total (cumulative) catch during the monitoring period. For one month all removals of fish from the pools and corresponding fishing effort was recorded daily by teams of enumerators permanently stationed at each pool. In Laos hydro-acoustic surveys were also undertaken in the same pools at the start of each week. The depletion surveys in Cambodia and Viet Nam were undertaken in March when few fish are believed to migrate. The surveys in Laos were unfortunately delayed by one month.

At six of the eight deep pools selected, judging by the statistical significance of the fitted depletion models, the depletion method was found to be successful (see chart below). The remaining two pools in Laos may have also yielded reliable depletions had they been fished during the planned survey month, since the observed non-linear decline in CPUE was indicative of fish migrations through these two sites.

Fishers removed 34-87% of the fish seeking refuge in the pools representing 32-121 species of fish. Average fish size (all species combined) ranged from 36-220 g. On average the largest fish occupy pools in Cambodia

Depletion model

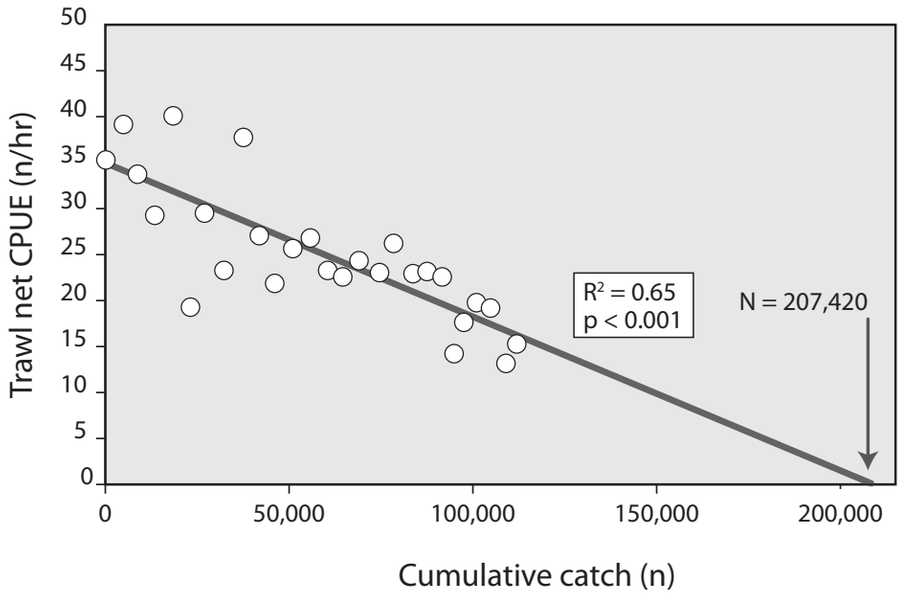
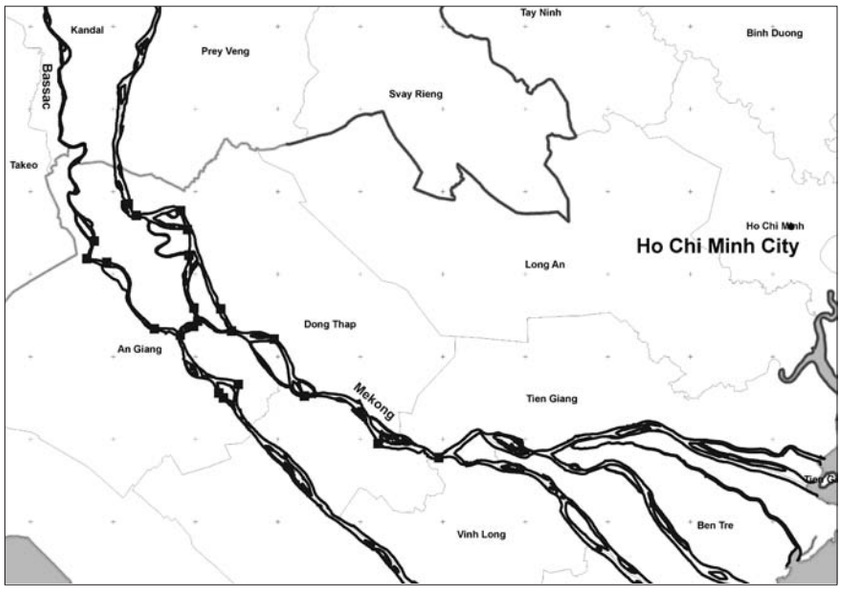


Illustration of the Leslie depletion model used to estimate fish abundance in the deep pools. The figure shows the model fitted to daily trawl catch rates (CPUE) and cumulative catch in Vam Nao pool in An Giang Province, Viet Nam, from March 5-31. The number of fish (N) in the pool on March 5 was estimated to be in the order of 207,000.

Fishing in a deep pool in Luang Prabang, Lao PDR
Photo: Joe Garrison

Deep pools in Viet Nam

Data from Research Institute for Aquacutlure No. 2, updated 2008



Map: Information and Knowledge Management Programme, MRC

while the smallest are in Laos. Biomass density estimates ranged from 48-1151 kg per ha.

Depletion and hydro-acoustic methods

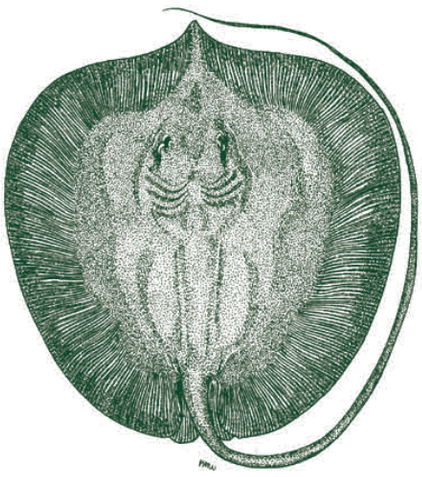
The estimates of fish abundance for the depletion and hydro-acoustic surveys were similar only for one pool in Laos (Ban Na), but here the estimates increased by a factor of five during the four-week survey period, despite removals of approximately only 1500 fish. The hydro-acoustic abundance estimates were more stable through time at two sites, but at one (Don Haout) the population estimates were almost ten times higher than the estimate derived from the depletion method. No comparisons could be made with the other site because of the absence of any depletion in the population. At the remaining Lao pool (Ban Pymanpon), the hydro-acoustic estimates of abundance declined monotonically by more than 90% over four weeks, despite only modest

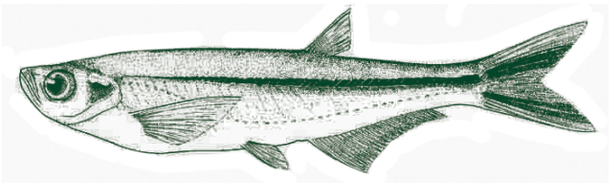
removals (about 800 fish). Therefore conclusions surrounding the accuracy or reliability of the hydro-acoustic method could not be drawn.

Findings used for survey next year

These results were discussed in detail during a second project planning workshop held in Udon Thani, Thailand. The 15 participants from the MRC, the four riparian research institutes and a representative of the TAB concluded that the depletion method should be employed for the abundance and biomass survey planned for next year. When applied during periods when few fish are migrating and when removals are significant (fishing is intensive), the method appears capable of providing reliable estimates of fish abundance and biomass. It was also recognised that unlike the hydro-acoustic methods, it is also possible to report uncertainty (95% confidence intervals) around the population estimates and to determine which species form the pool population.

The workshop provided a valuable opportunity for research staff to receive training in depletion model fitting using spreadsheets and to make recommendations for improvements to next year's survey, which will include more than 20 mainstream pools representing alluvial and bedrock substrate and three depth strata (shallow [<15 m], medium [15 - 35 m] and deep [>35 m]). The survey will also measure at each pool up to 15 environmental variables that will be used to help explain variation in fish abundance and diversity among the pools, thereby facilitating conservation and management activities.





** Dr Halls is the coordinator of the Fisheries Ecology, Valuation and Mitigation Component of the MRC Fisheries Programme*

Further reading:

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Correction

In our last issue, *Catch and Culture* recounted historical descriptions of the deep-pool fishery at Ban Ang from the first half of the 20th century ("Historic Lao fishery for Mekong giant catfish sheds light on traditional management"). We wrote that "chanting" was said to be heard as far as Vientiane. In fact, these historical accounts of animist rites were referring to the sound of the cave door opening. Sorry.

Minister urges **irrigation** and **hydro developers** to address **fish migration**

Effective measures to protect deep pools and other refuges also needed

Preparing to release fish at Lake Khnar in Kampong Chnnang Province on July 1
PHOTO: LEM CHAMNAP

Cambodia's Agriculture, Forestry and Fisheries Minister Chan Sarun has reiterated the need for developers to assess the negative impacts of irrigation and hydropower projects on fish migration. Speaking at a National Fish Day ceremony at Lake Khnar in Kampong Chhnang province in July, Chan Sarun said the 2006 Law on Fisheries was an effective tool for managing, protecting, conserving and developing fish resources for future generations. "The development of irrigation and hydropower dams and canals without impact assessments must be avoided, as such development will negatively affect fish migrations," he said. "Effective measures must be developed in order to protect refuges and deep pools in lakes and rivers for brood fish to hide, feed and spawn".

The minister noted that with rapid population growth of 1.8% per year, Cambodia's demand for fish and forest products was expected to increase dramatically by 2010. "Therefore, much attention has to be paid to developing and conserving these limited resources for the country and people". Chan Sarun described the Tonle Sap Lake and the Mekong River as being among the country's five important areas for development and conservation, along with the Cardamom Mountains, the Northern and the Eastern Highlands. He said that Cambodia ranked fourth in the world in terms of inland fish production after China, India and Bangladesh. He also noted that Cambodian fisheries employed 1.4 million people on a full-time basis and another 6 million people on a part-time basis in occupations such as processing, sales, fishing gear production and boat building. At the same time, fish provides more than 75% of the animal protein in the average local diet, giving Cambodians one of the highest rates of fish consumption in the world. "Fish and other aquatic animals are very important for all Cambodians, being the second staple food after rice," he said. The minister's comments followed recent work by the Cambodian Fisheries Administration and the MRC to develop a new flood index to measure the health of Tonle Sap fishery resources. Research has indicated that long-term or permanent declines in the extent or duration of the flood could threaten the livelihoods of people dependent on fishery resources (see *Catch and Culture*, Vol 14, No 1).

> ***'Dams and canals without impact assessments ... will negatively affect fish migrations'***

Liver and intestinal **flukes:** an under-rated **health risk** in the Mekong Basin

By Kent G. Hortle*

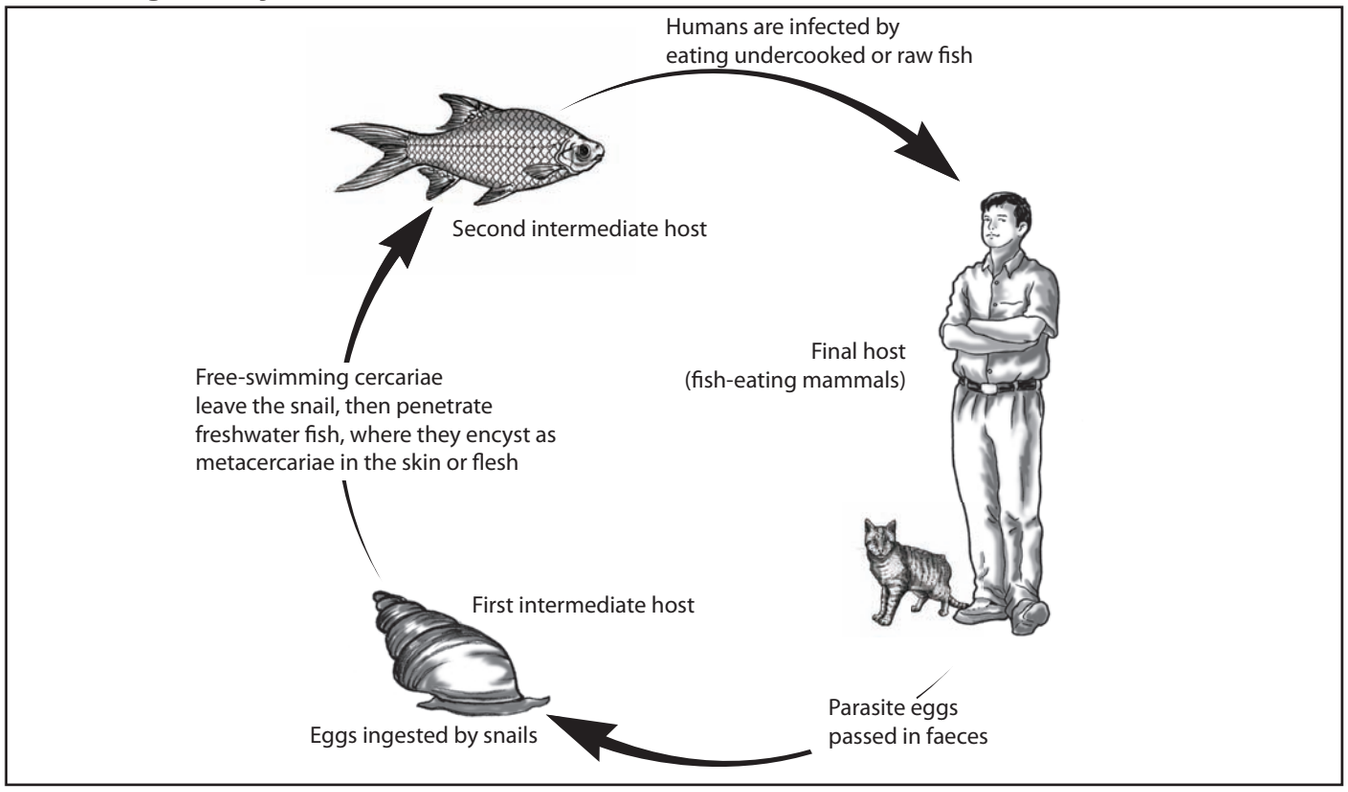
Humans and other mammals can become infected by eating uncooked freshwater fish and other aquatic animals, including insect larvae

In the Mekong Basin, fish and other aquatic animals such as frogs, molluscs and crustaceans are important components of the traditional diet. Despite a generally high average intake of aquatic animals [1], individual consumption varies widely across the Lower Mekong Basin. Inadequate intake of high-protein foods is associated with malnutrition, which is still common, particularly in remote and rural areas or where people have limited access to fish and other aquatic animals—such as Luang Prabang in northern Laos. Although governments and aid agencies have emphasised the need to increase rice production to ensure people receive sufficient energy each day, there is increasing awareness of the importance of maintaining a nutrient-dense diet. Fish or other aquatic animals can provide much of our essential daily requirements of protein, minerals and vitamins. But improving the intake of high-nutrient foods alone will not necessarily translate to improved public health. Inadequate health care and hygiene can lead to infection by common water and soil-borne parasites, which may impair absorption or metabolism, leading to malnutrition despite apparently adequate dietary intake [2, 3]. Efforts to improve nutrition must therefore be complemented by health education and the provision of basic services for water and sewage management, vital elements in rural development.

Southeast Asian liver fluke

In the Mekong Basin, as in Asia generally, another health risk comes from consuming raw or fermented fish and other aquatic animals that may contain the cysts of parasites, including liver and intestinal flukes. Particularly implicated in parasite transmission are

Three-stage life cycle of liver flukes



Graphic: Phannavanh Anoulack

common dishes such as *koi pla* (fish, salt, chilli, lemon and other ingredients) or partly fermented fish such as *pla som* and *pla ra* [4]. Fermentation for several months or high concentrations of salt and spices may kill parasites, but cooking is the only way to ensure that fish is safe to eat [5].

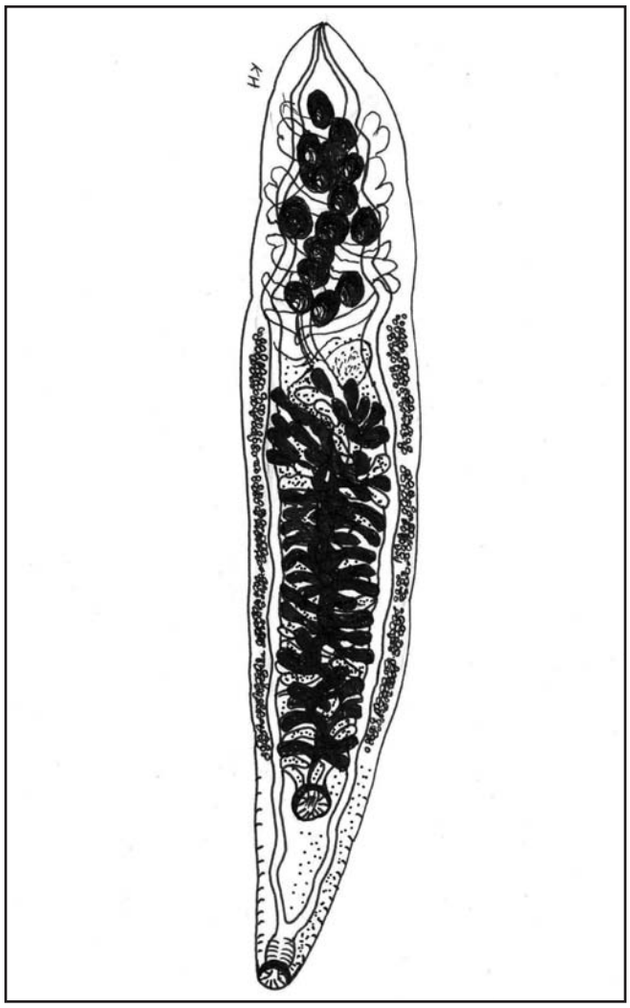
Flukes are from a class of flatworm known as trematodes. Among fish-borne zoonotic trematodes (those that can be transmitted to humans), the most well-documented in the Mekong Basin is the Southeast Asian liver fluke *Opisthorchis viverrini*, a small fluke about 6-10 mm in length. Like many flukes, *O. viverrini* requires three hosts to complete its life cycle. Adult flukes typically live in the bile ducts of mammals, including dogs, cats, rats, pigs and humans, but they may also be found in the gall bladder and pancreatic ducts. Adults reproduce sexually, passing eggs with the bile into the host's small intestine, from where they eventually enter the environment in faeces. If the eggs reach a water body, they may be ingested by an aquatic snail. In the Mekong Basin, only snails in the genus *Bithynia* are suitable first intermediate hosts. They typically inhabit shallow, clear weedy waters such as rice paddies, and it appears that irrigation favours these snails by providing a suitable habitat year round. After passing through several stages within the snail, many cercariae — the free-swimming stage of the fluke — emerge from each snail and search for a fish, into which they burrow and encyst as metacercariae, which are usually found in the muscle and skin.

The Southeast Asian liver fluke infects at least 93 species of fish in the Mekong Basin, and cyprinids seem to be particularly susceptible [6]. If a person eats infected parts of a fish raw, the fluke cysts rupture in the duodenum, releasing larvae that swim up the bile ducts, where they develop into adults. People who are infected typically have less than 50 flukes, but some individuals may harbour up to 3,000 [7, 8]. The flukes can live inside humans for up to ten years, so consumers of raw fish tend to accumulate a parasite burden as they get older. The adult flukes feed by sucking on the walls of the bile duct, ingesting blood, other fluids and fragments of tissue. Although some people appear not to be greatly affected, the parasites can cause a range of gastrointestinal symptoms, liver enlargement, and various other ill-effects, the most serious being cholangiocarcinoma, a cancer of the bile ducts that is usually fatal. The parasite has been dubbed 'the carcinogenic liver fluke' and liver cancer rates are high throughout northeast Thailand [4], with Khon Kaen province having the highest incidence of cholangiocarcinoma in the world [9].

Distribution in the Lower Mekong Basin

Northeast Thailand was considered the epicentre for *Opisthorchis viverrini* infection, which led to a major campaign from 1984-1994 to treat infected people, discourage people from eating raw fish, and reduce environmental contamination by faeces. Although the campaign had some success, infection rates remain high in rural areas where people eat raw or partly fermented fish, and where defecating outdoors is still commonplace. In Thailand, rates are highest in the north (19.3% of the population) and the northeast (15.7%), reflecting consumption of raw or fermented fish products. Rates are lower in central Thailand (3.8%) and are zero in the south [4].

Southeast Asian liver fluke
(Opisthorchis viverrini)



Graphic: Kent Hortle

In the Lao PDR the southeast Asian liver fluke is possibly more prevalent than in Thailand. Nationwide, the infection rate among primary school children is about 11% [10], and in rural areas average infection rates vary between about 44% and 95% [11]. In Cambodia, infection rates with intestinal parasites are high in rural areas, but infection with *Opisthorchis* is relatively rare, presumably because few people eat uncooked fish. In Kampong Cham, one study found

Family Species	Known definitive hosts	1st intermediate snail host	2nd intermediate host
Opisthorchiidae			
Opisthorchis viverrini	Mammals, including dogs, cats, rats, pigs and man	Bithyniidae. 3 species of *Bithynia* in the Mekong Basin	Freshwater fish
Heterophyidae			
Haplorchis taichui	Piscivorous birds and mammals, including cats, dogs, foxes and man	Thiaridae. Includes *Melania* spp. and *Tarebia granifera* in the Mekong Basin	Fish, freshwater and brackish species
Haplorchis pumilio			
Haplorchis yokogawai			
Centrocestus formosanus			
Centrocestus caninus			
Stellantchasmus falcatus			
Procerovum calderoni			
Echinostomatidae			
Echinochasmus japonicus	Birds and mammals, including cats dogs, pigs, rats and man	Lymnaeidae and Planorbidae	Snails, mussels, tadpoles, frogs, fish
Echinostoma malayanum			
Echinostoma ilocanum			
Echinostoma revolutum			
Lecithodendriidae			
Prosthodendrium molenkampi	Birds and mammals, including bats, primates - macaques, slow loris and man	Bithyniidae, *Bithynia* spp., *Melania*?	Dragonflies and damselflies
Phaneropsolus bonnei			
Phaneropsolus spinicirrus			
Plagiorchiidae			
Plagiorchis harinasutai	Bats, some other mammals, birds, reptiles	Viviparidae Lymnaeidae	Aquatic insect larvae and nymphs, snails

only 4% of children had liver flukes [12] and in a study in Battambang, no children were infected with liver flukes [13].

Although present in southern Viet Nam, the Southeast Asian liver fluke seems uncommon, although there has been no comprehensive study in the Mekong Delta. But the similar Chinese liver fluke, *Clonorchis sinensis*, is common in parts of northern Viet Nam where fish is eaten raw. In one study, the infection rate was about 52% and all respondents were infected by at least one species of fish-borne fluke [14].

Other flukes transmitted by aquatic animals

It is only recently that the occurrence and prevalence of other fish-borne zoonotic trematodes has begun to be documented in the Mekong Basin, and there is even less information on the trematodes that are transmitted via other aquatic animals (see table above).

In the family Heterophyidae, at least seven species of intestinal flukes are now known to occur in the Lower Mekong Basin, and several of these are common.

These flukes are smaller (<1-2 mm) than *Opisthorchis* species and adults live in the intestine, where they may cause various ill effects, which usually increase in severity as the parasite load increases. Significant pathology in the heart, brain, and spinal cord of humans may also occur, thought to be caused by the atypical movement of fluke eggs through the circulatory system [15]. Heterophyid flukes live as adults in mammals and birds, and they infect snails and fish as intermediate hosts. In some parts of the basin, the rate of infection with intestinal flukes such as *Haplorchis taichui* is much higher than that of *O. viverrini*, which probably reflects the distribution of the intermediate snail hosts [7, 16].

Echinostomatids are also commonly found in humans in the Mekong Basin, and are probably most-often contracted by eating raw fish. But undercooked or raw molluscs, tadpoles or frogs may also be a significant route for infection.

Lethicodendriids and plagiorchids appear to be relatively rare in humans, as they are only contracted by people who eat raw or undercooked aquatic insects

such as dragonfly or damselfly nymphs or naiads. However, in northeast Thailand, a study published in 1973 estimated an infection rate of 10-40% as a result of widespread consumption of raw dragonfly naiads (the aquatic nymphal stage) caught in flooded rice fields [17]. A possible infection route that has not been studied is the incidental ingestion of cysts in aquatic insects in the stomachs of fish that are eaten whole and uncooked.

Fish-borne flukes and aquaculture

The role of wild fish in transmitting some species of flukes is well-documented, but there is less information on fish grown in aquaculture systems. Some authors speculate that an increasing rate of human infection with the Chinese liver fluke in China and several other countries is a consequence of aquaculture development [18]. But studies in Viet Nam show that fluke infections in farmed fish vary greatly, depending upon such factors as proximity of fish to aquatic snails, the use of pelleted feed, the species cultured, and the presence of reservoir hosts. In the Mekong Delta, one study found that zoonotic trematode infection rates were low in aquaculture fish - 2.6% in catfish and zero in snakeheads, compared with an average infection rate of 10.3% for wild fish [19]. Another study [20] examined four kinds of aquaculture systems in the Mekong Delta and also found generally low rates of zoonotic fluke infection, with only heterophyid flukes detected. In intensive rearing systems, where fish were largely isolated from snails, few fish were infected. In farms raising walking catfish (*Clarias*), no fish were infected and in giant gourami farms only 1.7% of fish were infected. In the other two systems, human and animal waste was used and fish may have been near infected snails. In garden-pond-pigsty systems, known as VAC in Vietnamese, 3% of fish were infected and in carp polyculture systems, the infection rate was 6.6%. Infection rates increased in the flood season, consistent with greater proximity of fish to snails. Some fish species in aquaculture systems had higher infection rates than others, probably because they fed in shallow water where snails were present.

In a fish-farming area in northern Viet Nam, infection rates in farmed fish were much higher than those reported from the Mekong delta. About 45% of fish were infected with zoonotic trematodes, despite a very low infection rate of 0.6% in the fish farmers themselves [21]. The high incidence of cysts in fish may be a result of the presence of dogs, cats and pigs as reservoir hosts of adult flukes, as well as poor preparation of ponds, from which snails and other fish should be removed before restocking.

The occurrence of cysts in fishery products calls for continuing vigilance at fish processing factories, given the importance of aquaculture for exports in the region and the need to certify food safety.

Eliminating and avoiding fluke infections

Cooking all freshwater fish and other aquatic animals prevents any infection by zoonotic trematodes. Hence there is no need to be concerned about the safety of eating fishery products, providing they are cooked. People who have become infected as a result of eating raw or undercooked aquatic animals are treated with antibiotics, usually praziquantel, which is typically 100% effective for eliminating the parasites. It should also be noted that the problem of zoonotic parasite transmission is not confined to fish and other aquatic animals; all kinds of meat (including beef, lamb and pork) may transmit parasites, but it is the lack of cooking (or undercooking) that is the main health issue.The prevalence of zoonotic flukes can be reduced by improving human hygiene, but there is no practical means to completely eradicate these parasites in the environment. To do so, we would need to prevent dogs, cats, foxes, fish-eating birds and other primary hosts from eating raw fish, and we would also need to eradicate the snails that are intermediate hosts, which would be very difficult and ecologically undesirable [22].

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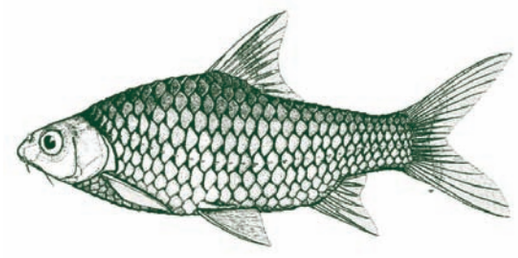
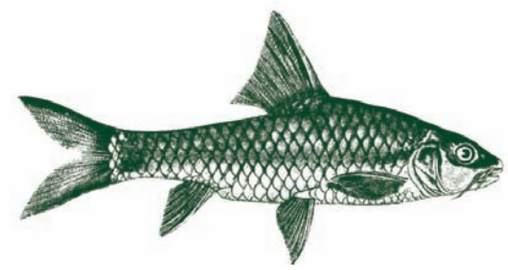




Mekong Delta catfish **industry** under **intense** financial **pressure**

*By Peter Starr**

With the Vietnamese economy overheating earlier this year, the aquaculture bubble has burst. But catfish exports are still booming.

With the value of shares listed on the Ho Chi Minh Stock Exchange losing more than half their value during the first half of 2008, the aquaculture industry has emerged as one of the weakest sectors of the overall Vietnamese equity market. As monetary authorities raised interest rates to curb inflation, the market capitalisation of five catfish processors in the Mekong Delta dropped by 72% in the six months to June (see table below). Leading catfish producer An Giang Fisheries (Agifish), a major exporter which has been listed for six years, lost two thirds of its value. So did Cuu Long Fish (CL-Fish Corp), a rival catfish processor from An Giang province which listed its shares only last year (see charts overleaf).

Another relative newcomer to the market, Ben Tre Forestry and Aquaculture (Faquimex), suffered an even steeper decline. Faquimex, which processes both catfish and shrimp, made its trading debut on January 14 this year. By the end of June, its share price had lost three-quarters of its value and was barely trading above par. The heaviest losses were suffered by Nam Viet Corp (Navico), the biggest catfish exporter. Navico's share price fell almost 90%. In the space of six months, it went from being the biggest to the smallest of the five processors in terms of market capitalisation. Losses were less acute for Ben Tre Aquaproduct (Aquatex Bentre). Its share price dropped 59%, broadly in line with the 57% decline in the VN Index (see chart above).

VN Index
Six months to June 30, 2008

Source: Vietcombank Securities

The upshot is that investors wiped 3.1 trillion dong (US$187 million) off the value of these five companies during the first half of the year. As a result, their combined market capitalisation fell from 4.3 trillion dong ($260 million) at the end of 2007 to 1.2 trillion dong ($73 million) at the end of June. The impact on actual business conditions has been mixed. In January for example, CL-Fish announced plans to contribute 32.4 billion dong ($2 million) towards the establishment of a joint venture capitalised at 90 billion dong ($5.5 million), giving it a stake of 36%. In April, it decided to go ahead with the venture with Thai Son Co and three foreign partners—Singapore's Inter-Ocean Foods, Malaysia's Piau Kee Holdings and a Saudi Arabian partner. However, the company also announced that it had postponed the construction of a joint-venture processing plant targeting export markets in Russia, Singapore and Eastern Europe. At the same time, Faquimex postponed an additional share issue to raise 105 billion dong ($6.4 million).

Selected catfish processors
Listed on the Ho Chi Minh Stock Exchange

Code	Name	Province	Est	List	Staff	Ownership (%)		Market Cap (VND bln)	
						State	Foreign	Dec 28 2007	Jun 30 2008
ABT	Aquatex Bentre	Ben Tre	NA	2006	NA	NA	51.8	729	297
ACL	CL-Fish	An Giang	2003	2007	1223	NA	NA	761	230
AGF	Agifish	An Giang	2001	2002	2561	8.2	47.0	1060	390
FBT	Faquimex	Ben Tre	NA	2008	NA	32.8	8.8	*630	155
NAV	Navico	An Giang	2001	2006	853	30.0	NA	1104	127
								4284	**1199**

*Source: Vietcombank Securities * Jan 14*

Share prices
First Half, 2008

Company	Dec 28, 2007 Closing Price (VND)	Jun 30, 2008 Closing Price (VND)	Change (%)
Aquatex Bentre	90,000	36,600	- 59.3
CL-Fish	84,500	25,600	- 69.7
Agifish	82,400	30,300	- 63.3
Faquimex	*42,000	10,300	- 75.5
Navico	138,000	15,900	- 88.5
VN Index	*927.02*	*399.40*	*- 56.9*

*Source: Vietcombank Securities * Jan 14*

Results and forecasts
Based on annual meeting resolutions

Company	Sales (VND bln)		Net Profit (VND bln)	
	2007 (actual)	2008 (forecast)	2007 (actual)	2008 (forecast)
Aquatex Bentre	427	500	39	40
CL-Fish	538	640	56	60
Agifish	1,246	1,400	40	NA
Faquimex	366	727	16	37
Navico	NA	NA	NA	NA

Source: Vietcombank Securities

Despite sharp declines in values, foreign investors remain among the key shareholders in at least two companies, holding 47% of Agifish and 52% of Aquatex Bentre in August. These included a fund listed on the Irish Stock Exchange and several funds operated by Dragon Capital, a foreign portfolio fund manager with offices in Viet Nam, Britain and New Zealand.

Government and central bank intervene

According to Nguyen Hoang Vu, a former marketing manager with Roussel Viet Nam who now runs his own consulting firm, the dollar's recent appreciation against the dong and rising inflation caused considerable difficulties among all stakeholders. "The situation in early 2008 was an alert to the industry," Vu wrote in the May-June edition of *Aqua Culture Asia-Pacific* magazine. "Farmers with banks loans had to pay higher interest rates while processing plants could not sell (dollars) to get Vietnamese dong in order to purchase raw materials".

With tighter credit conditions creating supply bottle-necks, Deputy Prime Minister Hoang Trung Hao instructed banks in June to provide loans to processors to buy an estimated 300,000 tonnes of catfish over the next three months. According to *Sai Gon Giai Phong*, the party newspaper in Ho Chi Minh City, processors in An Giang province alone needed 2.2 trillion dong ($133 million) to maintain operations until the end of the year. At the same time, State Bank of Viet Nam Governor Nguyen Van Giau reportedly indicated that priority commercial bank lending would be directed towards the catfish sector as a key export industry. With inflation rising to 25% during the first half of the year, feed traders and farmers were also reported to be suffering. *Sai Gon Giai Phong* reported that feed traders had stopped accepting instalment payments from farmers and that some buyers were taking advantage of the situation to squeeze farmers. Agifish indicated as much in its first-quarter earnings statement released in late May. Although sales in the March quarter declined 5.7% from the December quarter, earnings more than doubled to 5.3 billion dong ($0.3 million) in the same period. Agifish attributed the higher, albeit modest, earnings to controls over input costs and management expenses in addition to lower

Agifish share price (AGF)
Six months to June, 2008

Source: Vietcombank Securities

Cuu Long Fish share price (ACL)
Six months to June 30, 2008

Source: Vietcombank Securities

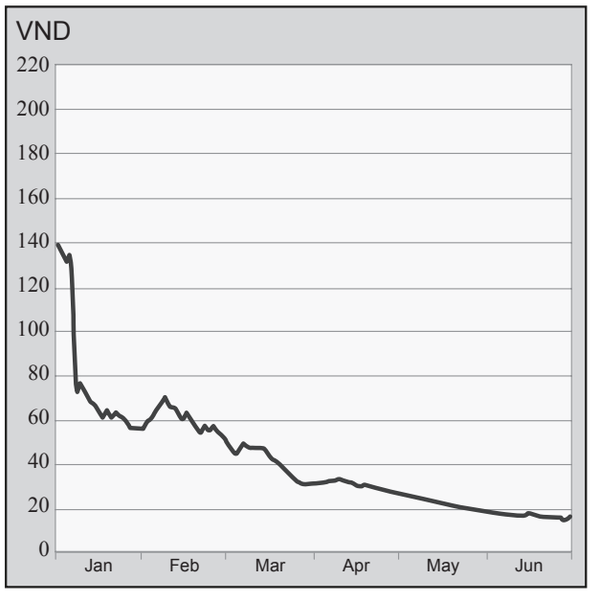
Faquimex share price (FBT)
January 14 to June 30, 2008

Source: Vietcombank Securities

Aquatex Ben Tre share price (ABT)
Six months to June 30, 2008

Source: Vietcombank Securities

Navico share price (NAV)
Six months to June 30, 2008



Source: Vietcombank Securities

catfish prices. According to the Viet Nam Association of Seafood Exporters and Producers (VASEP), average export prices for catfish were $2.33 per kilogram in the five months to May, down 18% from the same period in 2007. Navico blamed falling export prices and rising production costs for its lower first-half earnings. In August, Navico said its pre-tax profit fell 19% from a year earlier to 164 billion dong ($9.9 million) in the six months to June.

Exports keep booming

The Vietnamese catfish export boom meanwhile showed no signs of contracting during the first five months of this year. The value of exports of Sutchi river catfish (*Pangasianodon hypophthalmus*) and Bocourt's catfish (*Pangasius bocourti*) leapt 31% from a year earlier to $487 million in the five months to May. According to VASEP, export volumes jumped 48% to over 209,000 tonnes in the same period. In terms of value, Russia was the biggest single market for these two species, known as *ca tra* and *ca basa* in Vietnamese. Russia accounted for more than 12% of all exports followed Spain with more than 10% and the Netherlands and Germany with about 8% each. Ukraine and the United States each accounted for about 6% of exports and were followed by Mexico (4%), Hong Kong and Australia (3% each) and Thailand and Singapore (2% each).

During the five-month period, Navico was the leading exporter with shipments of $81 million. Among the other listed companies, Agifish ranked fourth with $20 million, while CL Fish was seventh with $15 million. Following an anti-dumping ruling by the United States in 2003 and confusion with American species of catfish, the two Mekong species are mostly marketed abroad these days as pangasius, basa, panga or sutchi filets. According to Vu, "new export markets such as Mexico and the core markets in Europe are seen as a guarantee that catfish production will continue its growth as previewed."

**Mr Starr is editor of* Catch and Culture

Extreme floods in northern Mekong

The water level in Vientiane on August 15 was the highest since records were established in 1913
PHOTO: CHRIS BARLOW

Submerged Buddhas in Ban Bo'o on the oustkirts of Vientiane
PHOTO: PETER ADAMSON

Lao soldiers preparing sandbags

New Products

Flood Situation Report, August 2008

The recent flooding along the Mekong in northern Laos and northern Thailand, and its causes, naturally generated much interest across the region. The MRC provided updated information during the events through its website and other means, and received constructive feedback on this information service from a variety of sources. Substantial technical analysis of the flooding events has now been summarised in the Commission's latest technical paper, which can be downloaded from: http://www.mrcmekong.org/download/free_download/Technical_paper21.pdf (direct download) or http://www.mrcmekong.org/free_download/research.htm#tech (download from publications list).The report explores the meterological and hydrological processes behind the floods, compares the recorded water levels and discharges with the high marks recorded in other flood years, and comments on the potential for further flooding later in the 2008 season.

Cambodian, Lao Fisheries Programme **drivers meet** for the **first time**

Cambodian driver Im Huy (above left) and Lao counterpart Thongsouay Xayaphet (above right) at the Dong Kralor border crossing on August 29. Overland travel between the two countries recently became easier with the completion of a new highway and bridge across the Sekong River in Cambodia's northeastern provinces of Kratie and Stung Treng (below). Cambodian Prime Minister Hun Sen inaugurated the bridge and the new sections of National Routes No. 7 earlier this year. The new section between Kratie and Stung Treng has halved the driving time between the two provincial capitals to 90 minutes. With the bridge and other new sections of the highway, it is now possible to drive from Phnom Penh to the Lao border in six hours. The Dong Kralor crossing complements the Mekong River checkpoint at Veun Kam just below the Khone Falls, which is accessible only by boat or four-wheel drive from the Cambodian side. Mr Huy, who frequently drives to the Vietnamese border, first drove to Dong Kralor in late 2006 when the new highway was nearing completion. Mr Thongsuay, who often drives in Thailand, drove to Dong Kralor at the same time but did not meet his Cambodian counterpart on that occasion. Mr Huy has been working for the MRC and the Mekong Secretariat since 1993 while Mr Thongsuay has been driving for the MRC and the Living Aquatic Resource Research Centre in Vientiane since 1999.
PHOTOS: LEM CHAMNAP

Mekong fisheries **index**

Aquatic biodiversity preservation urged in Laos
Vientiane Times, June 7, 2008

At a workshop on aquatic biodiversity and nutrition in rice-based ecosystems, organised June 4-5 in Vientiane by FAO and the Lao Ministry of Agriculture and Forestry, participants discussed the potential role of aquatic biodiversity in the alleviation of malnutrition. This depends on good management practices which combine enhancement of aquatic biodiversity with increased rice production.

Recommendations were made for future activities and immediate steps towards enhancing aquatic biodiversity and increasing rice production. Laos has a rich aquatic biodiversity which has always been tapped for food, barter and income, and numerous studies have shown its importance for the nutrition and livelihood of the Lao people.

Rice-based ecosystems, usually seen as a source of rice only, form part of the intricate system of wetlands found throughout Laos and therefore harbour a highly diverse set of aquatic organisms. The catch from rice fields is usually modest and only sufficient for a single day. For this reason, the fish and other aquatic animals caught from rice-based ecosystems go largely unnoticed – making it an "invisible" fishery. Nevertheless, since many people are involved in this type of fishery day after day, the total amount can be quite significant.

A household survey conducted on 240 households across three provinces from 2006-2007 revealed that about two-thirds of all aquatic organisms consumed by the targeted households originated from rice-based ecosystems. Among the organisms caught and consumed regularly were fish, frogs, snails, shrimps and aquatic insects. The findings once again underlined the importance rice fields as a source of non-rice foods.

The International Rice Commission has acknowledged the importance of aquatic biodiversity and recommended its member countries pay more attention to the nutritional contribution of aquatic organisms in the diets of rural people. The global shortage of rice has led to increased rice production through traditional intensification, namely increased input of chemical fertilisers and pesticides, plus expansion into natural wetlands. This may worsen the overall nutritional situation of rural people by reducing biodiversity, and ways must be found to combine increased rice production with enhanced rice-associated aquatic biodiversity for the benefit of the Lao people.

Controlling illegal fishing on the Xekong River
June 8, 2008, http://www.panda.org/about_wwf/where_we_work/asia_pacific/our_solutions/greatermekong/index.cfm?uNewsID=136441

The depletion of fish stocks due to illegal and destructive fishing is a growing problem in southern Laos, undermining one of the main sources of food security.

Villages and local authorities working with WWF have successfully established management plans to control illegal and destructive fishing activity in the Xekong Basin. Villages have established fish conservation zones, seasonal restrictions on fishing in spawning grounds, and clear prohibitions against fishing with damaging methods. Village and district authorities have already confiscated fishing gear from and issued fines to people fishing in conservation zones.

"We could never enforce rules to manage our resources without the support of the district authorities," said Somboun, a village leader from Attapeu, "Poachers are often well-connected outsiders that don't have respect for village rules." Through dialogue with all major stakeholders, officially recognised regulation was developed. Thus far, these new arrangements have proven effective in enabling local people to better manage their resources. The project hopes to develop a basin-wide model for participatory aquatic resources management.

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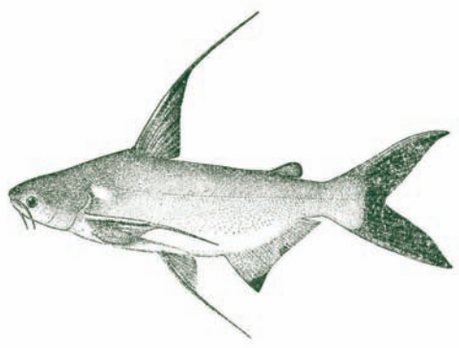


New law to protect Lao fisheries
Vientiane Times, June 11, 2008

A new fisheries law should protect Lao aquatic resources by ensuring their sustainable use, according to FAO representative Serge Verniau. Mr Verniau made the comments at a workshop with the Ministry of Agriculture and Forestry's Department of Livestock and Fisheries in Vientiane.

The workshop was the latest step in a process which began prior to December 2007, when a national workshop agreed there was an urgent need for a new fisheries law. One month later a draft law was presented to the Lao government and FAO was asked to become involved.

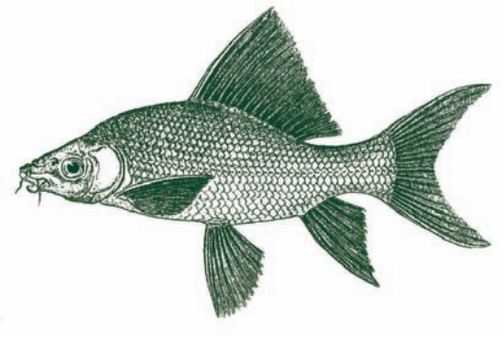
"FAO financially supported this process as we consider the country is at risk during a time of massive investment in mining, hydropower and agro-industry," Mr Verniau said. "The new law takes into account the push for increased rice production and the increased input [into waterways] of mineral fertilisers and pesticides that negatively affect aquatic biodiversity."

The workshop was held to resolve issues that must be addressed before the law can be adopted by the government. Mr Verniau said the law must reflect local conditions and take into account the importance of aquatic resources to Lao people. It should detail a new management system for the sector, which can be adapted to changing situations. "The draft law has been the subject of review by provincial stakeholders and experts from the Ministry of Justice," he said. "In only six months, we moved from a mere concept note to a substantive draft law."

"The challenge is to ensure the collective effort invested in drafting the law is not wasted," Mr Verniau said. Following the workshop, the new draft will be sent to the Ministry of Agriculture and Forestry for consideration.

Villagers fish for sustainable future
Vientiane Times, June 21, 2008

Fish stocks in Savannakhet province have been replenished following efforts by local people to conserve aquatic resources and protect forest areas over the past five years. Savannakhet Poverty Reduction Fund provincial coordinator, Soubin Luangdouang, said before 2003 many important river intersections were dry and villagers did not see big fish in isolated river pools during the dry season. "We now see a lot of fish in the rivers whenever we visit fish conservation areas in Phin, Nong, Vilabouly and Xepon districts," he said.



In 2005 villagers in these areas experienced a serious drought and had difficulty finding food. Many streams close to villages were dry and locals only saw a small number of fish. It was this drought which made villagers even more aware of the importance of protecting their food sources. According to Mr Soubin, villagers approached PRF officials to ask what could be done to establish conservation areas in local forests and deep pools.

The PRF mobilised local people to achieve this goal, and in the past five years they have established 24 conservation forest areas on 6,200 hectares and 16 fish conservation areas. Fishing and hunting is not allowed in conservation areas because the aim of these areas is to allow fish, animals and plants to increase their populations. Protecting them now will ensure there are sufficient stocks in the future.

"The advantage of preserving the forest is that local people will have a variety of forest products and many important rivers won't be dry," Mr Soubin said. "More fish will be available, and women and children won't have to walk as far to collect water," he said.

A number of fish conservation areas have been so successful they are being held up as models for other districts. These are: Vangkhong fish conservation area in Houyhong village, Vilabouly district, Mettachith fish conservation area in Tathaixe village, Phin district, and Keng fish conservation area in Xepon district. "A variety of fish and lots of big fish are available in these areas now. The surrounding forests in these areas are

More and more local people have become involved in protecting their food sources. "Villagers are very happy to have conservation forest areas and fish conservation areas. Every conservation forest area is sustainable and there are plenty of forest products now," Mr Soubin said. "The outcome is that we see rich natural areas in forests and more local people are aware of protecting natural resources."

In addition to establishing these protection areas, the PRF also helped build gravity fed water systems in 11 areas of four villages. This meant women and children

could access clean water close by and did not have to walk many kilometres to obtain it. The project also educated rural people in targeted districts about its programmes to help them understand the benefits and importance of establishing these areas.

Giant catfish population dropping amid changing eco system
June 24, 2008, Thai News Agency http://enews.mcot.net/view.php?id=4896

The scene of giant catfish being caught in the Mekong River is now a rare one, as the catfish population has dropped and some fishermen have stopped hunting them, joining the conservation trend to protect the big freshwater fish. Boonrien Chinarat is a founding member of the giant catfish club and the Headman of Had Krai Village in the northern province of Chiang Rai. He used to fish for giant catfish but stopped ten years ago.

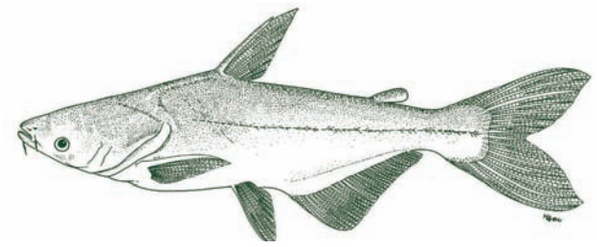
He said "People outside of the village did not understand our way of life. They think we harm the fish. Nowadays, most of the giant catfish hunters have stopped due to the reduction of the fish population." Boonrien said the main reason for the reduction in giant catfish numbers was the change in eco systems, caused by rapids blasting and clearing of water channels, the habitat of the fish. The spots where the fish lay eggs are gone. Another reason is the practice of fishing by electric shock and dynamite.

In Chiang Rai's Wiengchai district is a giant catfish farm called *wang pla beuk*. It is owned by a retired fisheries officer, who set up the farm to help build up the stocks of giant catfish. In 1983, he became the first person in the world to successfully breed giant catfish. "We have cooperation from the fishery department to breed giant catfish for conservation." This farm has been producing over 100,000 fish a year. It has also been helping the Had Krai villagers raise their own fish.

Many markets in Chiang Rai province sell the farmed giant catfish. At Chiang Saen market, this seller says she's been selling the fish for five years at a cost of 170 baht per kg. The farmed fish is famous although some customers say wild giant catfish, which are harder to find and more expensive, are tastier.
Cutting catfish for higher export prices
June 27, Thanh Nien, http://www.thanhniennews.com/business/?catid=2&newsid=39680
Pangasius (tra and basa catfish) production, which has grown rapidly recently, needs to be reduced to help loser supply and boost the fish's export value, an industry leader has suggested. Ngo Phuoc Hau, deputy chairman of the Viet Nam Association of Seafood Exporters and Processors, said free breeding had increased the catfish output significantly but farmers had to sell at low prices as supply surpassed demand.

Catfish farmers blamed local businesses for paying them low prices. While this is true, it's also true that local catfish companies are being forced to lower their prices by foreign customers who know about the domestic production surplus, Hau said. The Mekong Delta region is home to 84 catfish processing factories and the region's catfish output has reached over 1.2 million tonnes this year. He suggested supply in the catfish industry, one of the country's most lucrative agricultural industries, should be adjusted to a lower level than demand to help raise catfish prices.

The Southern Institute of Fisheries Economics and Planning said the catfish industry in the Mekong Delta region has yet to be sustainable and is vulnerable to market changes while also potentially detrimental to the environment.



Fish die after alleged Mekong plant leak
July 1, 2008, VNS, http://vietnamnews.vnagency.com.vn/showarticle.php?num=01AGR010708

CAN THO — An estimated 400 tonnes of fish raised along the Hau River bank in southern Can Tho Province died last Saturday, causing heavy losses for breeders, according to a local official. Nguyen Minh Toai, deputy chairman of the Thot Not District People's Committee, said the damage occurred mainly in Thoi Thuan Commune's Phung Hamlet and Trung Kien Commune.

Most of the dead fish were white pomfret and tilapia and the loss is estimated to be around VND6 billion (US$361,000). A breeder, Tran Hoang Anh, said 30 tonnes of fish he had been farming in three rafts had died en masse around noon on Saturday. His family had invested over VND700 million ($42,000) and lost it all, he said. Dao Thanh Tung lost 16 tonnes of white pomfret. He said a buyer had even paid him VND14,000 per kg for the fish which he had intended to sell next week. Without money to begin afresh, he was trying to sell his rafts, he added.

The Thot Not District People's Committee has warned aquaculture households in the area not to use water

from the river. It also directed agencies concerned to collect water samples for analysis. The Department of Environment and Natural Resource and the Environmental Police are investigating the case. Local residents claimed the fish died due to a leak from a local alcohol manufacturer and the sinking of a boat containing insecticide in the area. But authorities have yet to offer an explanation.

Scientists breed rare Mekong River fish
5 July, 2008, VNA, http://www.vnagency.com.vn/Home/EN/tabid/119/itemid/257165/Default.aspx

CUU LONG – Scientists from the National Centre for Freshwater Fish Breeding of Southern Viet Nam have successfully bred several rare species of fish indigenous to the Mekong River, saving them from the threat of extinction.

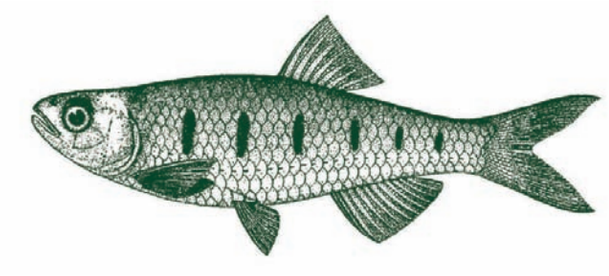
Dr Pham Van Khanh, director of the centre, which is based in the delta province of Tien Giang, said the centre had successfully bred more than 20 species that either had high commercial value or faced extinction. They included *ho* (Catlocarpio siamensis) and *ca coc* (cyclocheilichthys enoplos).

Khanh, who was in charge of a project to breed and raise *ca coc* said the centre had succeeded in artificially propagating the fish after six years of study. He said the centre's scientists had to go to the Tien and Hau rivers, two Mekong distributaries, to buy rare the species from fishers.

Huynh Huu Ngai, who was in charge of the project breed *ho* fish, said when the project began in 2003 he and his colleagues had to go to An Giang, Vinh Long and Dong Thap provinces to find *ho*, also known as giant barb. In June 2005, Ngai and his team successfully hatched the first *ho* by artificial means, with a success rate of 13%. The rate now tops 40%, he said. *Ho* live mainly in the lower Mekong basin in Viet Nam and Cambodia, but population has declined sharply due to overfishing. Ngai said since April 2002 he had not heard of anyone catching a *ho* weighing more than 150 kg in the delta. The fish grow to 300-400 kg when fully mature.

The centre now has 84 breeding pairs of *ho*, with the largest weighing 25 kg. The centre has supplied more than 10,000 *ho* fry to farmers in An Giang and Dong Thap provinces and to an aquaculture company in Ho Chi Minh City. It annually supplies around 20 million breeding fish to farmers, including rare species like *ca et moi* (*Morulius chrysophekadion*) and *ca chai* (*Leptobarbus hoevenii*).

The centre is also one of the leaders in artificial propagation of catfish like tra and basa, which are now bred in the Delta in large quantities for export. Khanh said the centre was also studying artificial propagation of other rare fish species, including *ca lang* (*Hemibagrus clongatus*) and *ca ket* (*Kryptopterus bleekeri)*.



Blackouts put fish business in poorhouse
July 5, 2008, Thanh Nien, http://www.vnagency.com.vn/Home/EN/tabid/119/itemid/257165/Default.aspx

Recurring blackouts have cut production at some Mekong Delta fisheries by over 60% as the country's power shortage continues to hinder development. Nguyen Dinh Huan, deputy general director of the An Giang Fisheries Import and Export Joint Stock Company (Agifish), said production at the company's cold store plants had been halted by power cuts many times over the past several days.

There are days when the company processes nearly 100 tonnes of tra catfish, only a third of its normal daily capacity, he said. Large quantities of fish died before being processed for export, which the company then had to sell on the domestic market at a loss of VND 10,000 per kg, he said.

Other fishery companies at the Tra Noc Industrial Zone in Can Tho City's Binh Thuy District, the region's economic hub, are complaining about the power cuts. Nguyen Phuong, a manager of Thien Ma Company, said outages often lasted the whole day and tonnes of the company's fish had been left to die without the electricity needed to cool their tanks. "Power cuts have forced us to reduce production to 50-60% of our normal capacity," he said. "Thus, we cannot buy enough fish to fulfil our contracts with fish breeders," he said.

Do Ngoc Tai, deputy general director of Kim Anh Seafood Processing Company, said his company in Soc Trang Province had begun running a dynamo generator that consumed some 200 litres of diesel fuel every hour and had driven electricity costs up three times higher than before the power problems.

In a recent proposal to Deputy Prime Minister Hoang Trung Hai, the Viet Nam Association of Seafood Exporters and Producers asked that the government

take urgent measures to ensure a sufficient power supply for Mekong Delta fisheries. The Deputy Prime Minister then asked power suppliers to speed up the construction of electricity power plants and facilities to solve the problem.

One million fish released for Wildlife Conservation Day
July 14, 2008, Vientiane Times

One million fish were released into Houayson Reservoir in Naxaithong district, Vientiane to mark Wildlife Conservation Day yesterday. Vientiane Agriculture and Forestry Department Head Latsanivong Amarathithada said the event was held to educate people about conservation. “In Vientiane we have a lot of rivers and reservoirs, which are home to a range of aquatic life and wildlife,” he said. “People need to be aware of the importance of preserving this wildlife and also preserving our natural biodiversity.”

Mr Latsanivong said it was necessary for individuals and private and state organisations to make conservation a priority, because it was linked to development, economic growth and the sustainable management of natural resources. This year’s slogan is “Don’t catch, kill, or sell wildlife”. “It is essential to talk to people, such as people at the markets, and give them information about regulations and the law as it’s related to the protection of wildlife,” he said.

Mr Latsanivong said he hoped releasing fish would become an annual custom to encourage people to think about the survival of threatened species. The department has released more than 12 million fish between 1994 and 2007. Wildlife Conservation Day aims to provide a wake-up call about the devastating loss of wildlife and aquatic life.

Lao fish conservation pays off
July 15, 2008, Vientiane Times

Funding is being sought by the World Wide Fund for Nature for phase two of their successful fish conservation project in Borikhamxay province. Project Advisor, Mr Roger Mollot, said the project started in 2005 and was supposed to finish in May 2008, but the Department of Livestock and Fisheries had repeatedly asked them to seek funding for a second phase.

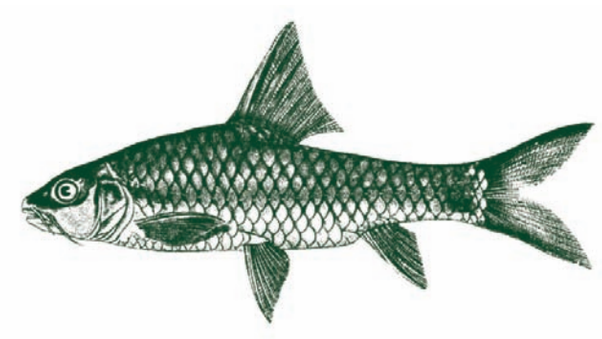
If the project is able to access funding it will focus on the community during the next phase, because they would like to see information exchanged between districts, provinces and river basins. “We would like to exchange knowledge of the successes and failures that villagers along the Xekong River in Xekong province have had, and use this to teach villagers along the Kading River or any other provinces involved with our fish conservation projects,” said Mr Mollot. “Social harmony in a village is the key factor for success in conservation.”

The project will also concentrate on the experience and knowledge that communities in other parts of the country have, and research the factors that determine successful management of fisheries. They will exchange this information so other parts of the country can improve management of their fisheries. News and achievement of the fish conservation project in Pakkading has spread to neighbouring villages and districts, which have requested district agriculture and forestry officials implement similar local programmes.

The co-management is a partnership between communities and government agencies, but they have different responsibilities. Villagers have authority and responsibility to manage their areas, while government agencies provide technical support. The project is attempting to create a network in the community so villagers can develop their own management plan and regulations for fisheries. Thirteen fish conservation areas have been created in Pakkading and Viengthong districts, which is more than anywhere else in the country.

The project found potential locations on the Kading River because it is one of the largest tributaries of the Mekong River and is a significant fishery. The district had a reputation for having large numbers and varieties of fish but the use of modern equipment and over-fishing has reduced catch numbers.

Deputy District Governor, Mr Langsy Keoviseth, said population increase, high demand on food supplies and a lack of knowledge by villagers were the main factors that caused a decline in fish stocks. “In the past, villagers were able to catch fish only twice a year, but now they can catch fish all year round because the population of fish has increased,” he said.

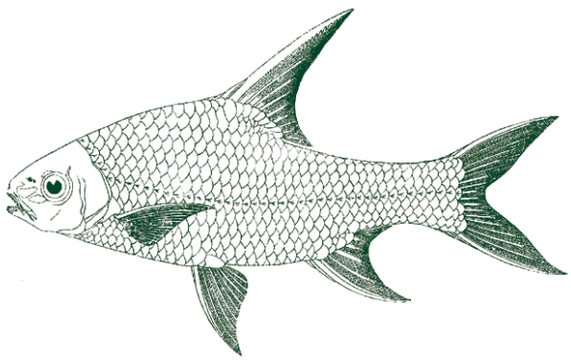


Australian scientist lends helping hand to Asian neighbour
July 15, 2008, ABC, http://www.abc.net.au/news/stories/2008/07/15/2304058.htm

A Narrandera scientist has returned from Laos, where he helped build trial fishways to revive the Asian nation's declining fish stocks. Research scientist Lee Baumgartner says weirs have severely cut fish numbers in the Mekong Delta.

Mr Baumgartner says on his recent six-week visit to Laos there was great help from locals keen to see their wetlands return to productivity. "Most of the local villagers who actually helped us out with our work were quite excited that up to 70 species of fish will be returning to that wetland sometime next year," he said. "Hopefully once the fishways are built they'll see a big increase in their sustenance fishery upstream of the wetland."

Mr Baumgartner says the research also has potential to help Australian fish stocks. "We learnt quite a bit about the behaviour of their small bodied fish in terms of the actual dimensions of the fishway," he said. "We'll be investigating that for some of our local species. We've also collected a lot of information on fish in the Mekong that are potential invaders over here, so that if they do get released over here we might be able to coordinate a response."



It's basa-and-chips as shoppers choose sustainable fish
3 August, 2008, Daily Telegraph

LONDON - A catfish from the murky depths of the Mekong Delta in Viet Nam is becoming an unlikely favourite of British diners.

New figures show that sales of the fish - which is known as basa, tra or panga - are increasing at a far faster rate than any other species. Over the last year, Britons have eaten more than 555 tonnes of the fish, 42 times more than over the previous 12 months.

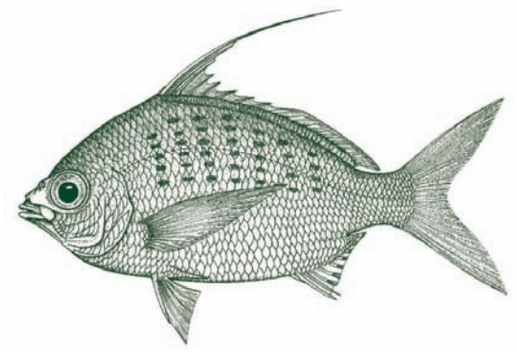
It is one of a series of unusual types of seafood which are growing in popularity, as shoppers and retailers look for alternatives to the threatened stocks of more traditional staples like cod, tuna, haddock and monkfish. Basa is a freshwater fish with a tender, mild flavour, and is farmed in the Mekong delta - an area which saw heavy fighting during the Viet Nam War.

It is sold in the UK as fillets or in processed meals, and has proved popular in restaurants and chip shops. It has featured in recipes from the television chef Anthony Worrall Thompson. Sales last year totalled more than £4 million. The figures, produced for Seafish, the trade body that represents the seafood industry, also show continued increases in sales of pollock (up 144 per cent to 5,511 tonnes), a relative of cod, which is caught in UK waters but also imported from the Pacific; and sea bass (up 27% to 1,628 tonnes), most of which is farmed in the Mediterranean.

Squid sales have also risen sharply, up by 57 per cent to 628 tonnes, as climate change has led to a large increase in the numbers caught in UK waters. Sales of tilapia, a freshwater fish from East Africa, have risen by 55 per cent to 179 tonnes. Although cod remains the most popular fish, with 54,000 tonnes eaten last year, its sales fell by more than 12 per cent. Sales of haddock and tuna also declined, while plaice sales remained largely static. Experts believe consumers are turning away from the traditional species because of concerns over the long-term sustainability of some stocks.

The Marine Conservation Society is expected to publish this month its latest guide of ethical fish to eat. Its Fishonline website currently suggests fish to avoid include Atlantic cod, halibut, wild salmon and turbot from the North Sea. Philip MacMullen, head of environment for Seafish, said: "Choosing alternative species helps to ease the pressure on stocks of more traditional fish. Basa has had a meteoric rise. Our palate tends to appreciate fish that are not strong-flavoured, and basa is one those. It has a texture and taste that is quite similar to a white sea fish. "People are becoming more adventurous, partly in response to TV chefs happy to cook different types of fish and partly because retailers and processors are much more focused on sourcing fish responsibly."

Seafood supplier Young's was the first to introduce basa as an alternative species, and now offers a range of products made from the Vietnamese fish. Basa is also sold in restaurants, as well as battered in chip shops. Arthur Parrington, from the National Federation of Fish Friers, said: "People are experimenting with more fish and basa is a very acceptable type of fish. There is no bone and it fries very well."



Viet Nam catfish safe to eat
18 August, 2008, New Straits Times, http://www.straitstimes.com/Breaking%2BNews/Singapore/Story/STIStory_268163.html

The Singapore Agri-Food and Veterinary Authority (AVA) has given catfish imported from Viet Nam a clean bill of health following rumours stocks were contaminated with toxic chemicals like arsenic.

The decision, revealed to The Straits Times this week, is a relief for the growing number of shoppers who are opting for the fish, which is much cheaper than staples like cod and *saba*. Concerns about catfish - also known as pangas or sutchi - were raised in January when an e-mail began making the rounds claiming that they were laced with poisons.

The message said the fish were farmed in the heavily polluted Mekong River and had also been injected with hormones made from urine. The AVA has received about 100 calls from concerned consumers since the e-mail first surfaced. Most were from anxious parents who fed the fish to their children. But tests revealed the fish was clean, according to AVA officials.

Cambodian freshwater fish resources under increasing pressure
22 August, 2008, IRIN. http://www.irinnews.org/Report.aspx?ReportId=79937

PHNOM PENH, - Each year, between July and October, Cambodia's Tonle Sap river, swollen by monsoon rain and excess flow from the nearby Mekong River, reverses its course. As water pours back into Cambodia's Great Lake, swelling its size by over four times, the flood-plain is transformed into a vast breeding ground for over 250 species of fish - a vital source of livelihoods and sustenance for Cambodia's rural poor.

But population growth and economic development in the Mekong basin are threatening fish resources, according to scientists, who say the country's food security could be hanging in the balance. "This is one of the most intensely fished freshwater areas in the world," said Eric Baran, a research scientist at the World Fish Center, an international fisheries research institute. "The 2.6 million tonnes of fish caught annually in the Mekong basin represent seven times more than the catches of the North American inland fisheries sector and more than 10 times the entire [inland] fish catch in Australia."

But population growth and increased fish consumption is straining Great Lake's fish resources. "Between 1940 and 1995, fish production increased twofold, but population increased threefold," he said. "We are close to a maximum level of production, but the population keeps growing," Baran said.

So Nam, deputy director of the Cambodian government's Inland Fisheries Research and Development Institute, told IRIN: "Population growth is the main concern. Although the catch is now 400,000 tonnes per year," he said, "most of the [fish] are small sized." The trend to smaller fish was also observed in River At Risk, a 2004 report by Milton Osborne, who noted the "regular complaints from [Great Lake] fishers about the difficulty of catching their desired quantities of fish."

Cambodia's heavy reliance on freshwater fish as a source of protein makes it particularly vulnerable to fluctuations in production, said Baran. "[Cambodia] is a country where fish production is three times pig production and 20 times chicken production. If it loses fisheries, the agriculture sector will not be able to catch up," he said.

A rise in illegal fishing due to collaboration between outlaw anglers and local officials, is also a growing problem. Nao Thuok, director of the Cambodian Fisheries Administration, said the law was difficult to enforce in a country as reliant on fish as Cambodia. "Families can fish year round," he said. "But the [2006] Fisheries Law only enables them to use small-scale fishing gear. The problem is that families complain they cannot survive and are using larger gear in the spawning season." To combat illegal fishing and encourage the long-term sustainability of Cambodia's freshwater fisheries, the government has devolved decision-making powers and enforcement to the local level.

According to So Nam, the central Fisheries Administration is focusing its efforts on educating fishermen about the challenges of sustainable development. "Education is very important. One of the aims is to strengthen the community by building the capacity of the community, teaching people to do their management, their conservation and their planning," So Nam told IRIN.

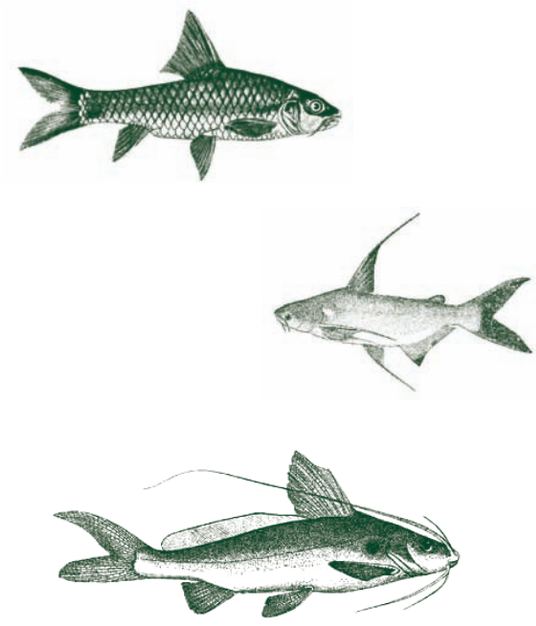
Over 500 “community fisheries” have been established so far throughout the kingdom, which act as focal points for law enforcement, conservation and the adoption of new fish cultivation methods, including aquaculture, according to So Nam.

Generating accurate information for decision-makers is critical, according to Baran. The World Fish Center is experimenting with computer modelling to predict variations in fish levels and guide policy decisions relating to fisheries. One such model, known as BayFish, is bringing together all of the complex variables that impact fisheries - including flood levels, water oxygen levels and rainfall - enabling scientists to predict how changes in one variable will effect overall fish levels. “But it’s a work in progress,” said Baran. “Our raison d’être is to produce scientific information on fisheries. That’s the way to help national governments make informed decisions, he said. Having this scientific information integrated in national and regional policies would be a significant step forward.”

Mekong Delta catfish price up as supplies down
August 31, 2008, Thanh Nien. http://www.thanhniennews.com/business/?catid=2&newsid=41626

Prices of pangasius, or tra and basa catfish, have jumped some VND1,500 per kg over the past few days in the Mekong Delta as farmers have quit breeding the fish due to price drops earlier this year.

Duong Ngoc Minh, general director of seafood processing firm Hung Vuong Corp., said that tra and basa were selling for VND15,500 (about 94 U.S. cents) per kg. He added that supplies had dwindled since 50% of the region’s farmers had stopped raising the fish. Even with a price increase, many farmers will still lose VND1,500 (9 cents) per kg due to higher input expenses, said Minh. Meanwhile, the demand from the European and Central American markets has increased by 20-50% recently, he said.



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