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INSIDE

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Cover photo by Chhut Chheana shows fishing net outlets near the Al Azim Mosque in Prek Tapouv, a Cham Muslim quarter in the Cambodian provincial town of Takhmao near Phnom Penh

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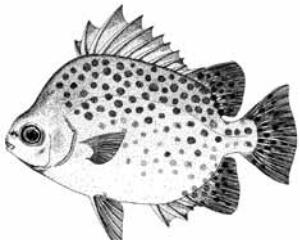
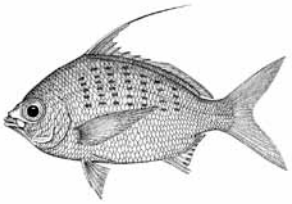
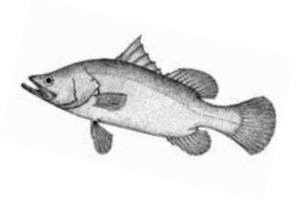






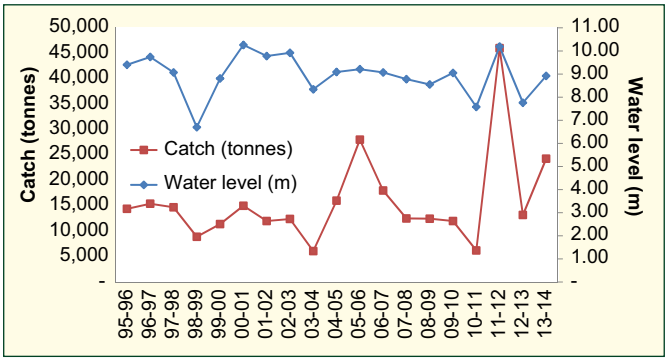
Declines in **catches** of some **large** and **medium-sized** species in **Tonle Sap** River

By Ngor Peng Bun, Chheng Phen and So Nam *

Trends in catches of some fishes targetted by the largest fishery in the Lower Mekong Basin indicate smaller catches of big species and bigger catches of small species

In 2013, the Mekong River Commission published the first comprehensive analysis of the *dai* fishery in Cambodia, one of the largest fisheries in the Lower Mekong Basin. Established around 140 years ago, the fishery on the Tonle Sap River is recognised as a very useful indicator of the country's inland fisheries. It could also be a good indicator of overall Mekong fisheries and their ecological health. The MRC has been monitoring this stationary bagnet fishery with Cambodian authorities for 20 years.

Catch of *dai* fishery 1995-2014

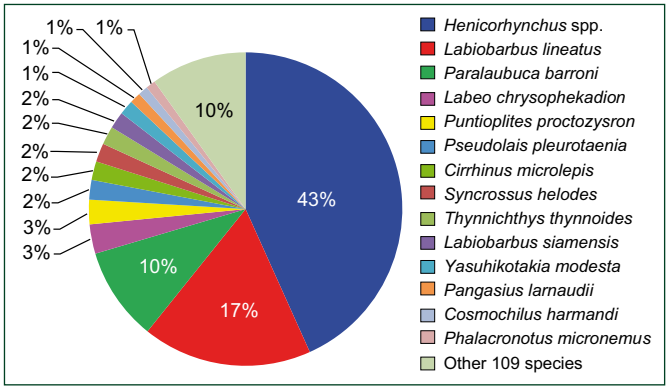


A key finding of the analysis was that changes in the size of the catch since 1995 largely reflect the impact of annual floods on fish growth. This increases with the extent and duration of the flood, presumably reflecting changes in feeding opportunities or competition. The analysis revealed "little or no compelling evidence of changes in the abundance, biomass, size or diversity of migratory fish populations" using the Tonle Sap system and beyond (Halls *et al.,* 2013).

In the absence of any clear trend in total catch, research has since looked at catches for different species in the fishery. Between 1998 and 2014, we found declining trends in catches of large species such as the Sutchi river catfish (*Pangasianodon hypophthalmus*) (maximum length: 130 cm). Similar trends were observed for three medium-sized species, *Cyclocheilichthys enoplos* (maximum length: 74 cm), the small-scaled mud carp (*Cirrhinus microlepis*) (maximum length: 65 cm) and *Osteochilus melanopleura* (maximum length: 40 cm). By contrast, catches of small mud carps (*Henicorhynchus* spp.) trended upwards over the same period. At the same time, the total lengths of some fishes have been declining. Such changes may indicate the population is being "fished down" with declining production of large high-value species accompanied by increased production of small low-value short-lived species (see box opposite). Apart from increased fishing effort, other factors behind the declining catches of these large and medium-sized fishes may be hydrological and hydraulic changes, habitat degradation, loss of habitat connectivity and climate change.

The *dai* fishery is located between Phnom Penh and the border between Kandal and Kampong Chhnang provinces. Catches usually range from 120 to 130 fish species each season. Up to 137 have been reported since 1995. Species richness seems to have been stable since 2003. The

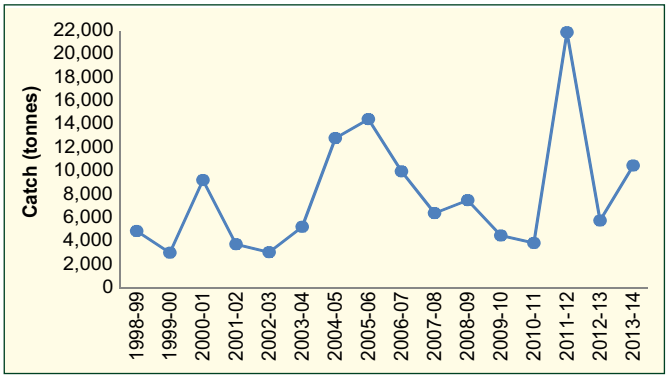
Dominant species in the *dai* fishery catch



catches are dominated by small and large carps, loaches and catfishes. Fourteen species accounted for about 90 percent of the total catch in the 2013-14 fishing season, which lasts from late October to early March with catches peaking in December and January. Species from the *Henicorhynchus* genus, mainly *H. siamensis* and *H. lobatus* made up more than 40 percent of the catch.

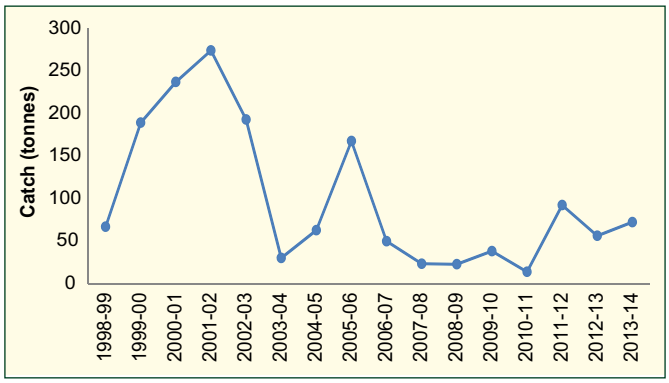
The trend in catches of the *Henicorhynchus* mud carps (*trey riel*) has been upwards since 1998 (see chart below). There have been five peaks of 9,000 tonnes in 2000-01, more than 12,000 tonnes in 2004-05, almost 15,000 tonnes in 2005-06 and 21,000 tonnes in 2011-12, the biggest catch on record. Catches in other years were between 3,000 and 6,500 tonnes.

Henicorhynchus spp.



Catches of Sutchi river catfish (*trey pra thom*), have shown a declining trend over the same period (see chart below). The peak catch for the pangasiid was around 270 tonnes in 2001-02. Catches have fallen in most years since with only around 72 tonnes in 2013-14, down from around 92 tonnes in 2011-12 when the overall catch for all species was the highest on record.

Pangasianodon hypophthalmus



Fishing down

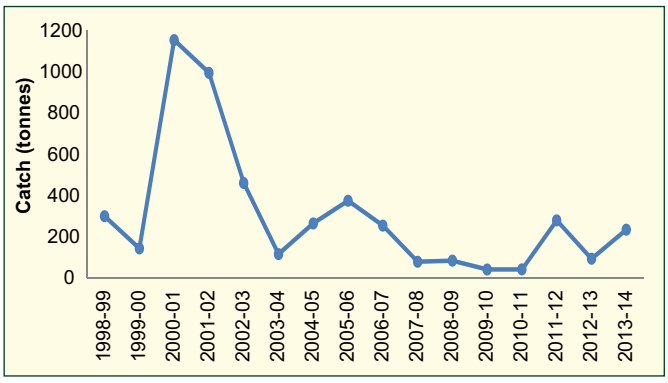
Fishing down refers to a gradual transition in fish landings from long-lived high trophic level, piscivirous bottom fishes toward short-lived, low trophic level invertebrates and planktivorous pelagic fishes. The phenonomenon was first described by fisheries scientist Daniel Pauly of the University of British Columbia and colleagues from the International Center for Living Aquatic Resources Management (ICLARM), now known as World Fish. In a paper published by *Science* in 1998, the authors observed that the average trophic level of species groups reported in global fisheries statistics of the Food and Agriculture Organization (FAO) declined between 1950 and 1994. This was also found to be occuring in inland fisheries. Fishing down food webs at lower trophic levels was found to first lead to increasing catches, then to a phase transition associated with stagnating or declining catches, indicating that exploitation patterns were unsustainable.

Reference

Pauly, D., V. Christensen, J. Dalsgaard, R. Froese and F. Torres Jr. (1998) Fishing down marine food webs. Science 279: 860-863

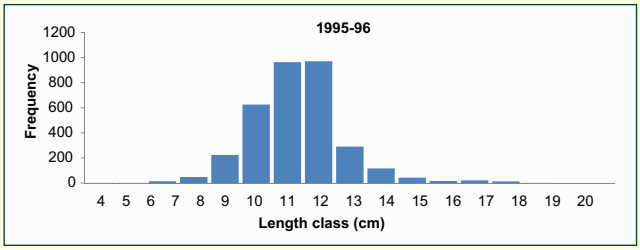
The trend for *Cyclocheilichthys enoplos*, known as *trey chhkok*, a cyprinid highly preferred among local consumers, is similar to that for Sutchi river catfish (see chart below). Catches decreased from 1,155 tonnes in 2000-01 to only 280 tonnes in 2011-12 despite the record overall catch. In 2013-14, the catch was assessed at 235 tonnes.

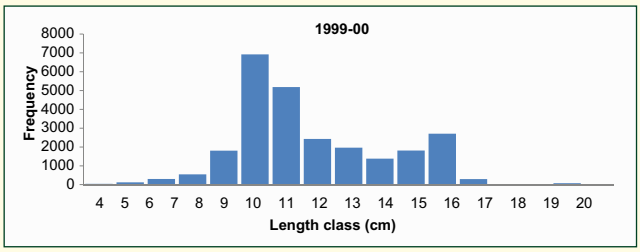
Cyclocheilichthys enoplos

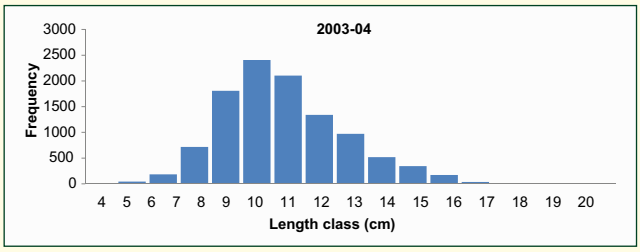


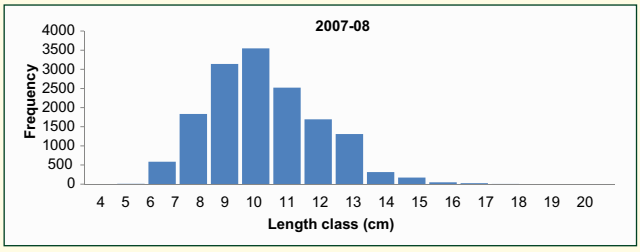
Length frequency distribution of selected small and medium-sized species

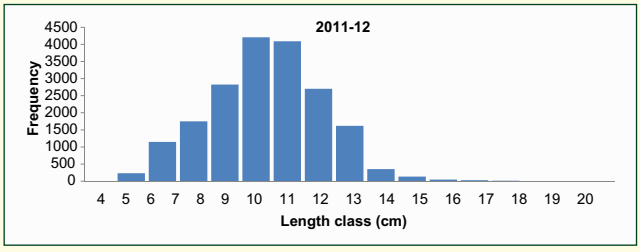
Henicorhynchus spp.

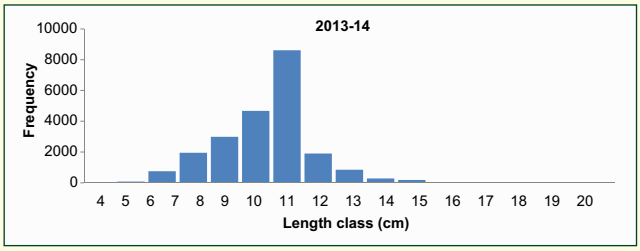




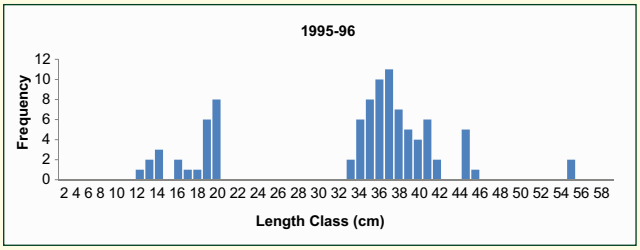


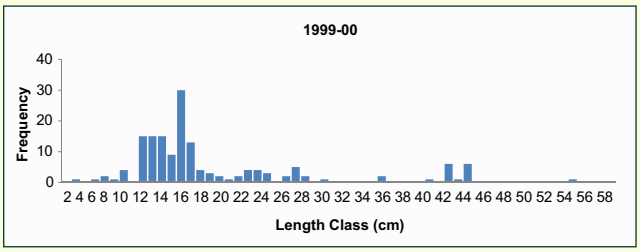


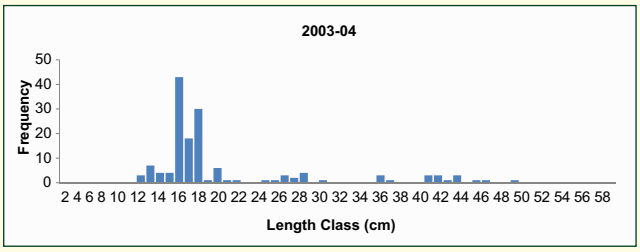


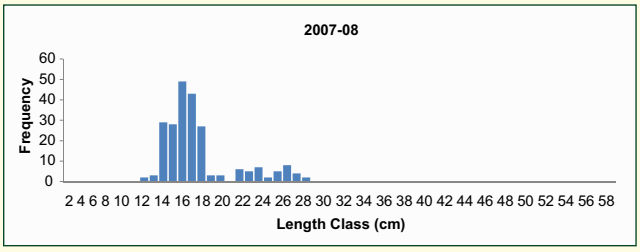


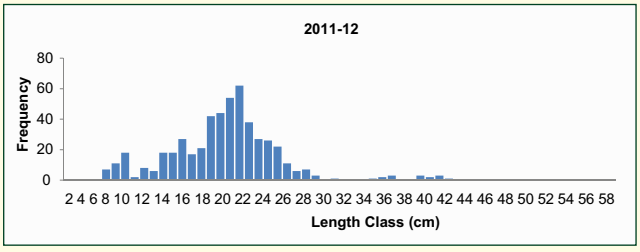
Cirrhinus microlepis

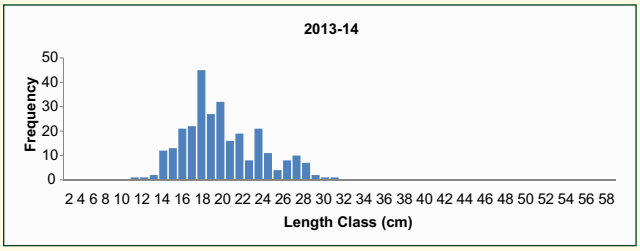






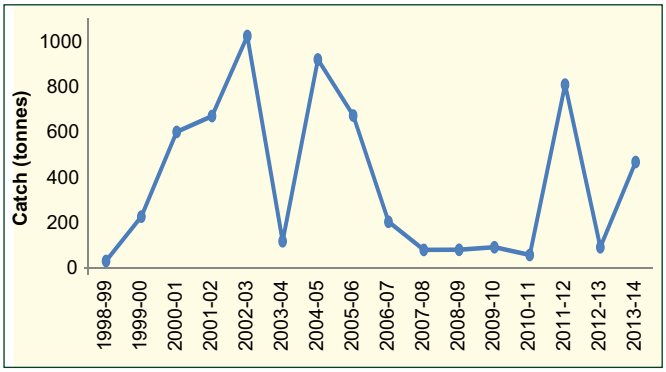






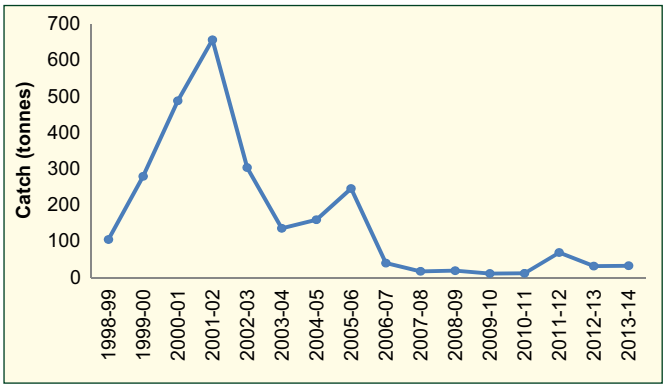
Catches of small-scaled mud carp (*trey pruol*), have fallen sharply since 2005-2006 except in 2011-12 when they recovered to around 808 tonnes (see chart below). This coincided with extensive floods, believed to be a key main factor behind the record overall catch in 2011-12. The catch fell sharply to around 90 tonnes the following season and increased to 467 tonnes in 2013-14.

Cirrhinus microlepis



Catches of *Osteochilus melanopleurus* rose steadily from 107 tonnes in the 1998-99 season to peak at 658 tonnes in 2001-02 (see chart below). After falling back to 137 tonnes in 2003-04, annual catches of this cyprinid species, known locally as *trey krom,* recovered to 248 tonnes in 2005-06. Since, then, however, the annual catches have failed to exceed 100 tonnes.

Osteochilus melanopleura



A separate analysis of length frequency distribution indicates declines in the total length of some fishes being caught from the Tonle Sap. Reduced lengths are less obvious for the small-sized mud carps but can still be observed. For example, catches of *Henicorhynchus* species show a decline in the number 11 cm to 15 cm individuals being caught between the 2003-04 season and the 2013-14 season (see left column in box on opposite page).

The trend is more obvious for the small-scaled mud carp, a medium-sized species. Catches of *Cirrhinus microlepis* show that individuals of 32 cm to 45 cm that dominated landings in the 1995-96 season have virtually disappeared from the fishery (right column). At the same time, ranges in size have tended to narrow over the same period.

We recommend continued monitoring of the fishery since it contributes significantly to understanding and interpreting status and trends in inland capture fisheries across the basin. However, many other types of fishing gear are also used along the Tonle Sap River. The yield of the fishery is therefore affected by the fishing effort of these other types of gear. Apart from bag nets, gillnets are widely used and are believed to contribute significantly to yield.

'Annual monitoring ignores gillnet catches, which could otherwise be caught by the *dai* fishery'

Fishers are believed to set about one thousand gillnets in the Tonle Sap River at around the same time of the year as the *dai* fishery operates. But annual monitoring ignores gill net catches, which could otherwise be caught by the *dai* fishery. A survey of gillnet operations on the Tonle Sap River is therefore of significant importance to understand the overall yield of the return-to-refuge migratory fishes from the lake, the biggest in Southeast Asia.

Reference

Halls, A.S.; Paxton, B.R.; Hall, N.; Peng Bun, N.; Lieng, S.; Pengby, N.; and So, N (2013). The Stationary Trawl (*Dai*) Fishery of the Tonle Sap-Great Lake, Cambodia. MRC Technical Paper No. 32, Mekong River Commission, Phnom Penh, Cambodia, 142 pp. ISSN: 1683-1489.

** Mr Ngor Peng Bun is the capture fisheries specialist at the MRC Fisheries Programme, Mr Chheng Phen is acting director of the Inland Fisheries Research and Development Institute (IFReDI) of the Cambodian Fisheries Administration and Dr So Nam is coordinator of the MRC Fisheries Programme*

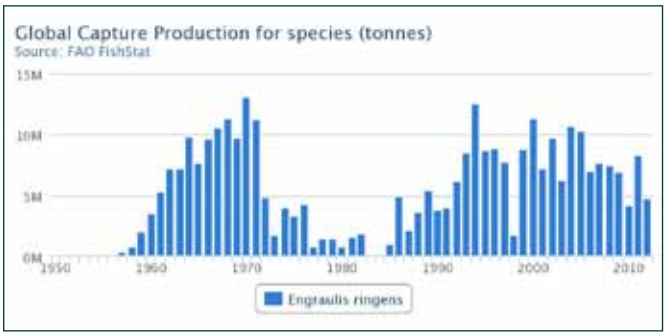
International **fishmeal prices** soar to **record high** on **severe** supply **shortages**

With continued growth in aquaculture and terrestrial farming, the FAO reckons demand for fishmeal and fish oil can only increase. In this article, we look at recent developments in the Peruvian anchoveta fishery, the biggest global source of fishmeal for which Viet Nam is now the world's fourth-biggest consumer.

What is the most heavily exploited fish in world history? According to the Food and Agriculture Organization of the United Nations, it's the anchoveta (*Engraulis ringens*), also known as Peruvian anchovy. Native to waters off the coast of Peru and Chile, the fish is in high demand in the global fishmeal market including major importers such as Viet Nam.

In 1971, the anchoveta fishery yielded a record of more than 13 million tonnes (see chart below). Since then, yields have fluctuated with the catch collapsing to less than 100,000 tonnes in 1984 in the wake of warm sea surface water temperatures in the Pacific Ocean off South America that accompanied the strongest El Niño episode last century.

Amid warm seas and signs of an emerging El Niño in late 2013 or early 2014, fishmeal prices soared to record highs on anchoveta supply shortages during the second half of last year. Despite the deadline for the first fishing season in Peru being extended to August 10, only 68 percent of the total allowable catch was caught, amounting to 1.71 million tonnes. According to the FAO, that compared with high percentages during the two seasons of 2013, which allowed 2.05 and 2.3 million tonnes.



In October, Peruvian authorities recommended no quota for the second season until a second assessment survey was completed. The first survey found only 1.45 million tonnes of anchoveta biomass compared with 10.8 million tonnes and 12.1 million tonnes in the two surveys in 2013. Markets responded with a record FOB price of $2,400 a tonne for super prime fishmeal in Peru in October, up from around $1,400 a tonne at the beginning of 2013. Prices stabilised at around this level, fuelled by increased seasonal demand over the following months from pig farmers in China, the world's biggest fishmeal consumer, ahead of the Lunar New Year holidays in February this year.

Demand can only increase

"In the long term, demands for fishmeal and oil can only increase with the growth of the aquaculture and terrestrial farming industry," the FAO publication *Globefish* wrote in its end-of-year market report on fishmeal and fish oil prices.

"Noticeably, Viet Nam, a significant aquaculture producer, has become the fourth largest destination for Peruvian fishmeal export. Oil production destined for direct human consumption will also seriously compete with the aquaculture and animal farming sectors."

Globefish reckons consuming countries will "strengthen their search for alternatives in order to reduce their dependency on fishmeal, especially given the current extreme prices. The fishmeal and soymeal price ratio is now 4.13:1, compared with 2.10:1 last year. In the short term, it seems that the vulnerability of fishmeal/oil production will not change if production continues to mainly rely on pelagic species. Utilising more by-products from processing factories could help the situation."

In December, Peruvian authorities announced

Viet Nam's Hung Vuong considers investing in catfish feed plant in Indonesia

Viet Nam's Hung Vuong Corporation is in talks with possible Indonesian partners to invest $15 million in a new catfish feed plant in Indonesia with annual capacity of 200,000 tonnes or take a majority stake in an existing plant, Bloomberg News reported in February. “This diamond opportunity might be the last one in my life to thrive in the industry,” Chairman Duong Ngoc Minh was quoted as saying. “That’s why I decided to aggressively invest and expand to jump on this last opportunity.”

Based in My Tho in the Mekong Delta, Hung Vuong is the country's largest catfish producer with exports expected to rise 43 percent from a year earlier to $660 million in 2015. The Bloomberg report from Ho Chi Minh City on February 12 said the company was also planning to open three catfish production facilities and expand shrimp production in Viet Nam this year, with investment totalling 1.2 trillion dong ($57 million).

Minh reportedly said that investments to upgrade facilities would trim operating costs by 20 percent and allow the company to export catfish at cheaper prices while improving quality. “It’s an opportunity to upgrade our production at low costs as Vietnam’s interest rates have been cut while the yen and euro have dropped,” the chairman was quoted as saying. The report said Hung Vuong was also planning to build a $30 million plant in Russia in April to process Alaskan pollock (*Theragra chalcogramma*).

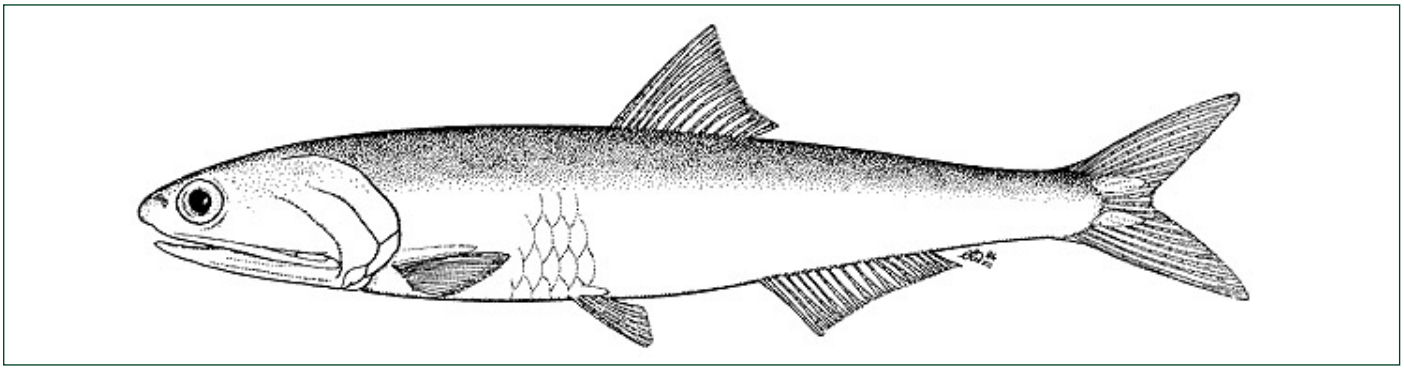
Reference

Mai, C. (2015) Catfish king ready to hook exports on free trade deals. Bloomberg. February 12, 2015

there would be no quota for a second season in 2013. In the meantime, the FAO publication noted "hopeful prospects" for Peru's upcoming survey for the first total allowable catch in April "when they could potentially find considerable stock volume with the appropriate size and weight. However, it could still be a difficult financial year for Peruvian fishmeal producers in 2015, as they will have to sell production made from the low catch of the previous year, similar to the situation in 2013." Although anchoveta is under high pressure from fisheries and may be affected by El Niño, the species is not currently threatened and is categorised as being of "least concern" by the International Union for the Conservation of Nature. "It has a wide distribution which includes Marine Protected Areas," the IUCN says. "However, continued monitoring of harvest levels and population trends is recommended to ensure that these pressures do not threaten this species.

Reference

FAO Globefish (2014) Ever-growing demands and extreme supply constraints pushed fishmeal/oil prices to a record high in 2014. Food and Agriculture Organisztion of the United Nations, Rome.



Anchoveta (*Engraulis ringens*), also known as Peruvian anchovy

Source: FAO

Conference urges **better management** of the world's **inland fisheries**

Decision makers will be able to make more strategic choices if they have more and better data on the contribution of inland fisheries to local nutrition and economic activities as well as the impacts they suffer from other industries

A global conference at the FAO headquarters in Rome in January concluded that inland fisheries need to be better managed to safeguard healthy diets and economies, particularly in developing countries. According to the Food and Agriculture Organization of the United Nations, 71 low-income countries produce nearly 7 million tonnes of freshwater fish every year, or about 80 percent of the global inland catch. But these waters are often affected by other needs, including energy, tourism and competition for freshwater.

"Leading researchers in the field of fisheries and water management, along with indigenous people's groups, warned that a dearth of data and sound policies means development decisions fail to take into account adverse impacts on inland fisheries," the FAO said in a statement released on January 29. The statement said lakes and rivers were an "essential source" of protein, micronutrients, vitamins and fats for diets, particularly in developing countries, where more than 60 million people rely on them for their livelihoods.

Árni Mathiesen

Photo: FAO/Giulo Napolitano

Árni Mathiesen, the FAO assistant director-general in the Fisheries and Aquaculture Department, said inland fisheries provided a "valuable but often overlooked source of nutrition and employment around the world. But to date, the international effort to effectively integrate inland fisheries into the broader development agenda has fallen short of what is needed," he said. "We hear a lot about the threats to coral reefs, but freshwater fish are the most threatened group of vertebrates used by humans," Mathiesen said.

'We hear a lot about the threats to coral reefs, but freshwater fish are the most threatened group of vertebrates used by humans'

Globally, some 70 percent of available freshwater supplies are now used for agriculture. "Pollution and the building of hydro-electric dams and channels further impacts the availability and quality of inland waters that are home to diverse types of fish," the FAO said.

Devin Bartley, senior fishery resource officer at FAO, said water and fisheries management should go hand in hand. "International cooperation is essential," Bartley said."If a country upstream dams a river or drains a wetland, fisheries management downstream is fairly useless."

'Contributions are undervalued in decisions on water management and development'

At the same time, the FAO noted that inland fishing activity was small scale with much going unreported and data on the sector being incomplete. "Its contributions are undervalued in decisions on water management and development," the UN agency said. "Research suggests that the harvests from river fisheries that are reported only account for 30 to 50 percent of the actual bounty that fisherfolk bring home. Having more and better data – on inland fisheries' contribution to local nutrition and economies, as well as for the environmental impacts they suffer from other industries — will allow decision makers to make more strategic choices."

The FAO jointly organised the Global Conference on Inland Fisheries with Michigan State University in the United States. Lou Anna K. Simon, the university's president, said human nutrition, environmental sustainability and community prosperity were "closely linked" to the health of freshwater fisheries worldwide.

Devin Bartley

Photo: FAO/Giulo Napolitano

Lou Anna K. Simon

Photo: FAO/Giulo Napolitano

Ban Nam Phrai: the **last seasonal breeding station** for *Probarbus jullieni*

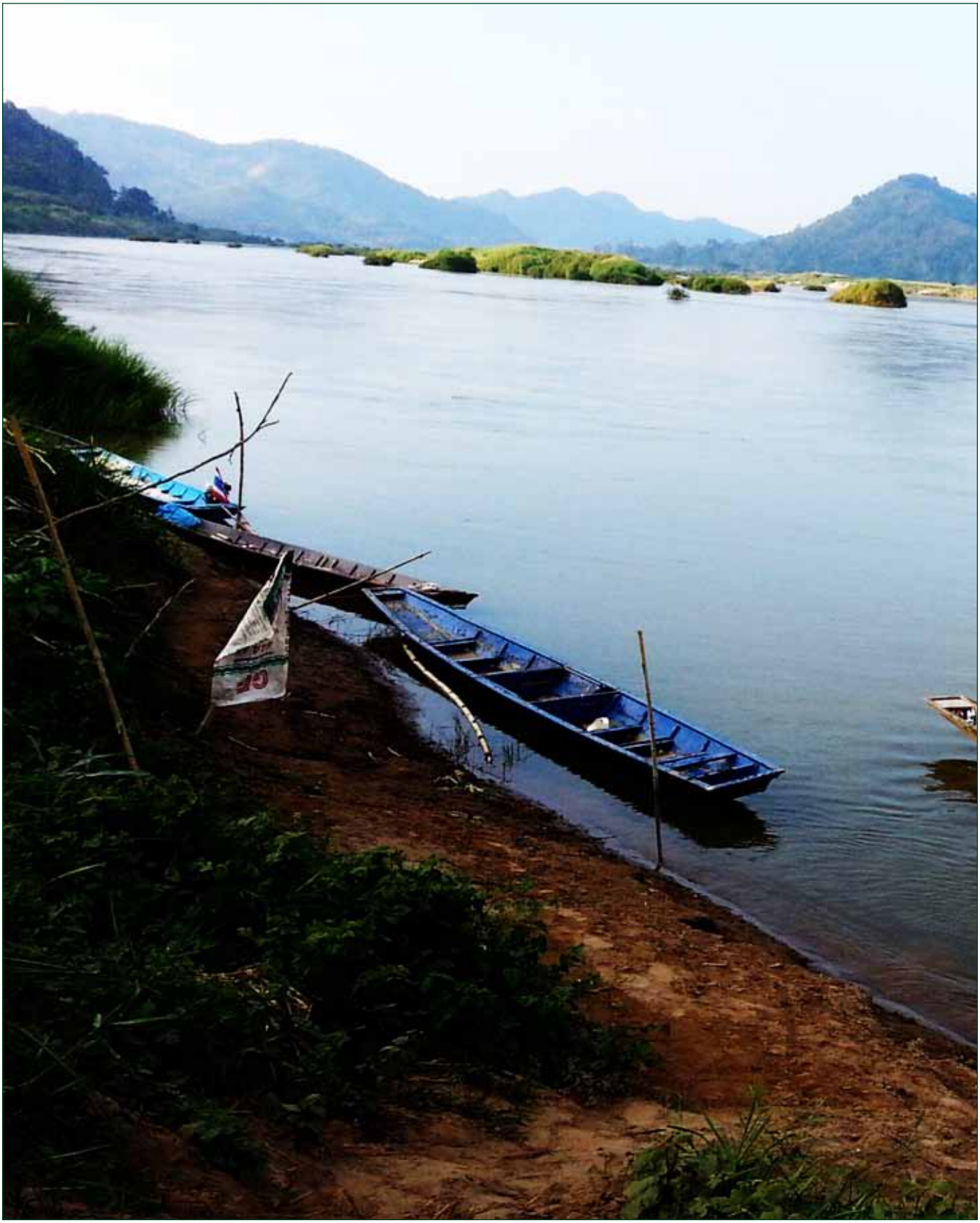
By Theerawat Samphawamana *

Over the past four decades, the Thai government has been breeding Jullien's golden carp (*Probarbus jullieni*) at seasonal stations along the banks of the Mekong River in northeast Thailand. With declining catches of mature individuals in recent years, most of these breeding stations are no longer operating. Amid concern that the endangered species will soon disappear from its natural spawning grounds, the last station is about to close

Jullien's golden carp (*Probarbus jullieni*) is a freshwater ray-finned fish in the Cyprinidae family. Known as *pla yi sok* or *pla earn* in Thai, it is classified as endangered on the IUCN Red List of Threatened Species. Buying and selling the fish is permitted only in exceptional circumstances under Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which covers species threatened with extinction. The fish has historically been found in many rivers across Southeast Asia. These include the Chao Phraya, Meklong and Kwai Rivers in Thailand, the Irrawaddy River in Myanmar and the Pahang and Perak Rivers in Malaysia. Jullien's golden carp is now mainly confined to the Mekong River Basin, particularly in fast rapids and clear pools in Cambodia, Lao PDR and Thailand. The maximum weight recorded for the species is about 70 kg.

Probarbus jullieni at the Bangkok Aquarium operated by the Thai Department of Fisheries

Photo: Lem Chamnap



Site of the last seasonal breeding station for *Probarbus jullieni* on the Mekong River in Ban Nam Phrai, a fishing village in Sung Khom District in Nong Khai Province in northeast Thailand. On the other side of the river is Sung Thong District in the Lao province of Vientiane.

Photo: Theerawat Samphawamana

Officers from the Thai Department of Fisheries checking whether a female is ready to spawn at Ban Nam Phrai in 2014

Photo: Nong Khai Inland Fisheries Research and Development Centre

A female releasing eggs. Some females require injections of hormones to stimulate the development of cells in the ovary.

Photo: Theerawat Samphawamana

A male releasing milt. No hormones are needed for males which have high volumes of milt during the spawning season.

Photo: Theerawat Samphawamana

Eggs being mixed with milt in muddy water to remove slime

Photo: Theerawat Samphawamana

In the Lower Mekong Basin, spawning grounds for the species are located from Loei Province in northeast Thailand to Champassak Province in southern Lao PDR. The fish spawns during the cool part of the dry season which usually lasts from November to January. Mature fish migrate upstream to form spawning communities of about 30-40 individuals in deep pools near islands in the Mekong River. Fertilised eggs drift downstream and juveniles can be found in floodplain areas during the wet season from May to October. The species mainly feeds on bivalves and aquatic insect larvae.

Chaninthorn Srithongsuk was the first fisheries biologist to breed the species successfully in 1974 when he was head of the Nong Khai Fisheries Station in northeast Thailand. Chaninthorn,

Breeding techniques for *Probarbus jullieni* at Ban Nam Phrai

Ban Nam Phrai is a small Thai fishing village near the Mekong River in Sung Khom District in Nong Khai Province. On the other side of the river is Sung Thong District, an important agricultural area in Vientiane Province in Lao PDR. The activities of the *Probarbus jullieni* breeding station at Ban Nam Phrai can be divided into three stages:

1. Preparation (late October to early November)

After the taskforce team is selected, surveys and monitoring of fishing grounds are carried out. A temporary camp is then set up and equipment prepared. Water quality and water levels are monitored and the availability of fishermen is checked. After approval to go ahead from the Director General of the Department of Fisheries, relevant local authorities are informed such as district and sub-district administration offices as well as the Border Patrol Police and the Mekong Riverine Unit. Conditions of boats and related equipment are then checked.

2. Meeting with stakeholders (early November)

Fishermen are invited to a meeting with other stakeholders including the district chief, representatives of the local administration office, security officers and members of the public to understand the purpose of the activity. The meeting agrees on a price for the fish. It also discusses lessons learned from the previous year and other sensitive issues. Participants are asked to share ideas and make comments or suggestions.

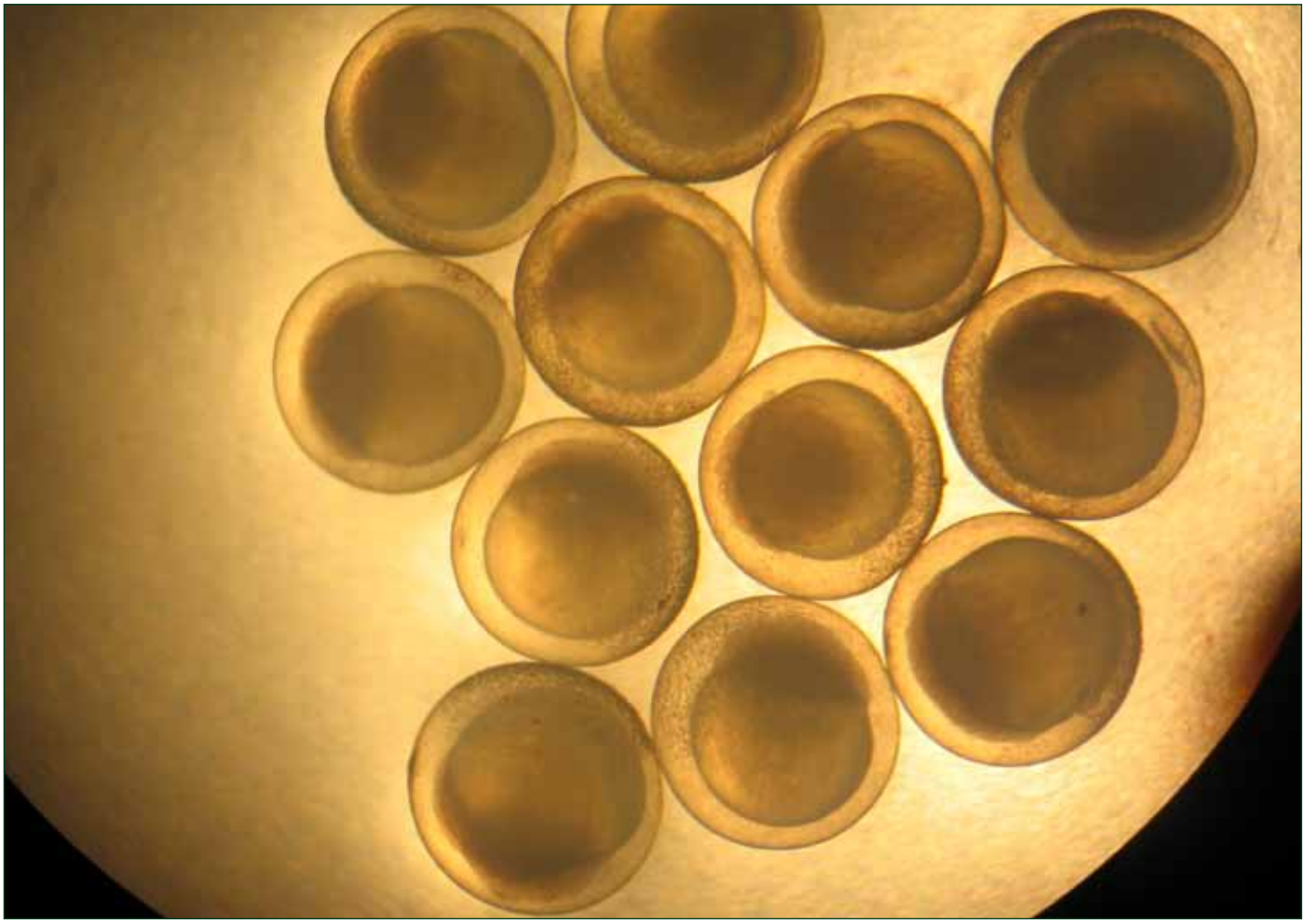
3. Operation (November or December)

Fishermen inform Department of Fisheries staff as soon as the first mature fish is caught, signalling the start of the spawning season. Mature fish are bought and observations made to distinguish males from females (at the peak stage of maturation, males release milt with even the slightest pressure on the abdomen while females are easily identified by the swollen belly). Females are ready to spawn when they are transported to the station. If they release eggs when the belly is pressed softly, injections of hormones are not necessary.

Some females, however, need to have their oocyte development stimulated by hormone injection (suprefact+motilium/Human Chrorionic Gonadrotropin, or HCG). The types and concentrations of hormone depend on the oocyte stage. No hormone injection is needed for males, which have high volumes of milt during the spawning season. The milt is mixed with the eggs in a dry bowl. Muddy water is applied to remove slime before the fertilised eggs are washed in clean water. The eggs, measuring 2-3 mm, are then packed in plastic bags with oxygen and transported to hatcheries at government fisheries centres in the provinces of Nong Khai, Loei, Kalasin, Sakon Nakhon and Udon Thani. About 5.5 million fertilised eggs were produced in 2014.

At the hatcheries, the fertilised eggs are incubated in fibre tanks with aeration. Hatching varies from 67-96 hours depending on water temperature (21.5-24 C). Hatchlings are about 8 mm in length. After the yolk sac disappears (3-5 days), the fry are transported to earthen ponds for nursing with a density of 200,000-300,000 fry/rai (1 rai = 1,600 m^2). After one month of nursing with mixed feed of fish meal and rice bran, the fingerlings reach 2-3 cm in length. The fingerlings are released into Thai water bodies, used for research and stocked as broodstock for future breeding.

The author wishes to acknowledge the Nong Khai Inland Fisheries Research and Development Centre for contributing to this article



Some of the 5.5 million fertilised eggs produced at Ban Nam Phrai in 2014. The eggs are packed in plastic bags with oxygen and transported to government hatcheries in nearby provinces.

Photo: Theerawat Samphawamana

who later served as deputy director of the Thai Department of Fisheries, bought mature fish from fishermen on the Mekong River to produce the fry. Government fisheries centres later set up temporary stations every year to breed the species on the banks of the Mekong River, particularly in the provinces of Loei, Nong Khai and Bung Karn where mature fish could be caught during the spawning season.

The Nong Khai Fisheries Centre has been operating one station in collaboration with the Loei Fisheries Centre. Located in Ban Nam Phrai in Sung Khom District in Nong Khai Province, it is the only station that has operated continuously since breeding began. Others halted their breeding activities several years ago due to an absence of mature fish. This has probably been caused by various human activities, particularly infrastructure development, overfishing and environmental changes. The station at Ban Nam Phrai is, however, expected to cease its activities in the near future because of continued declines in the number of mature fish being caught.

Production of *Probarbus jullieni* in Thailand is not limited to fish caught from the Mekong. Many provincial fisheries centres use broodstock raised in earthen ponds to produce fingerlings. The Department of Fisheries successfully developed this breeding technique in 1990 and has recently been producing more than one million fingerlings a year. However, most of the larvae are originally from Ban Nam Phrai. As numbers of mature fish continue to decline in the wild, there is a concern that the endangered species will soon disappear from its natural spawning grounds along the Mekong.

**Mr Theerawat is a programme officer at the MRC Fisheries Programme*

Cham Muslim fishing communities on the **Bassac** River in **Cambodia** and **Viet Nam**

By Peter Starr and Ly Vuthy *

Cham Muslims in the Mekong Delta have long been renowned for their fishing prowess. In Chau Doc, the only major Cham community in the Vietnamese part of the delta, they have a reputation as successful long-distance traders. In Cambodia, Cham Muslim communities further upstream on the Bassac River excel in making fishing nets, a skill observed by a French colonial administrator more than 100 years ago

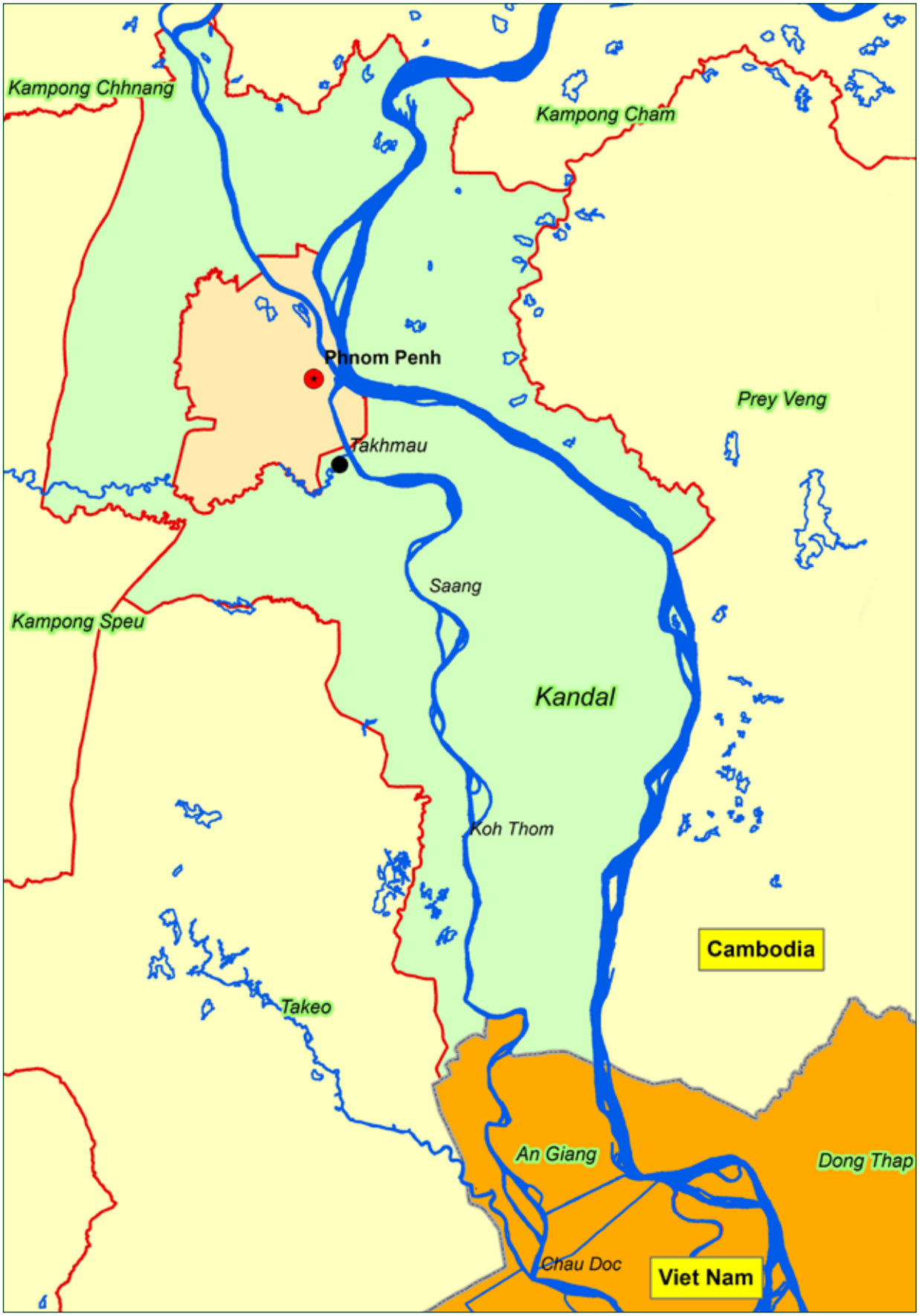
It's not clear when Cham people first settled in the Mekong Delta or from where they came.

The region's abundant fisheries, however, seem to have been a major attraction, along with commerce. According to Australian anthropologist Philip Taylor, some Cham Muslims living in Chau Doc in An Giang Province in Viet Nam trace their arrival from the central Vietnamese coast "several centuries ago." In these accounts, "the frontier region where they were resettled offered some localised subsistence opportunities but also the opportunity to trade," he wrote in the *Asia Pacific Journal of Anthropology* in 2006, "While over time more people engaged in trade, they also continued to fish and raise crops for subsistence purposes."

But according to other local accounts, the Cham

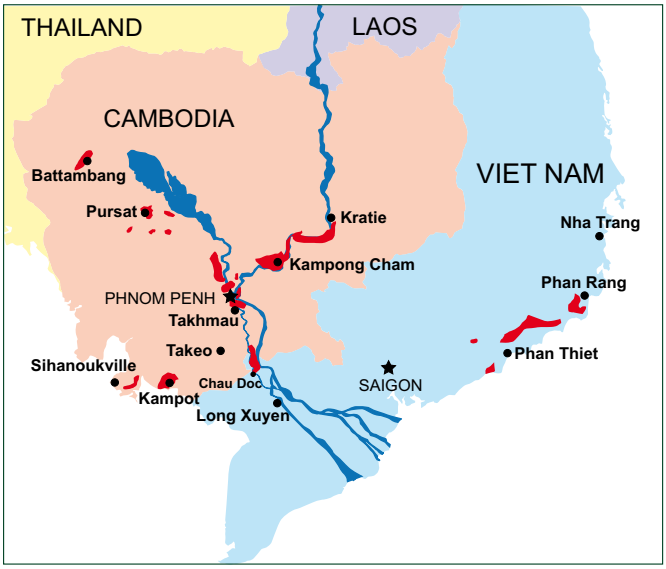
Cast net production at a shop near Masjid Al Azim, a mosque in Prek Tapouv Village in Takhmao in Kandal Province

Photo: Chhut Chheana



The Bassac River flows south from Phnom Penh through the heart of Kandal Province whereas the mainstream of the Mekong to the east forms much of the border between Kandal and Prey Veng Province

MAP: MRC INFORMATION AND KNOWLEDGE MANAGEMENT PROGRAMME



Cham communities (red) in Cambodia and Viet Nam in 1970. The original map of Indochina Ethnolinguistic Groups describes Cham people as being from a Malayo-Polynesian group.

Map: Chhut Chheana

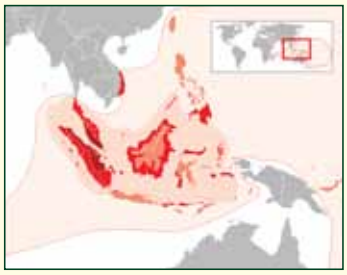
Muslims of Chau Doc trace their roots to people who came from the Malay world (present-day Malaysia and the Minangkabau Highlands of West Sumatra in present-day Indonesia) or the Middle East. These accounts also highlight the attraction of trading opportunities. "Other accounts attest that the earliest settlers came here to fish or alternatively to propagate the faith and only later turned to trade," Taylor wrote.

In the late 19th century, French colonial administrator Etienne Aymnonier observed that Cham people in central Viet Nam were different from those in Cambodia, southern Vietnam and present-day Thailand. The latter shared the same dialect (see box opposite) and religion and "apart from a few insignificant variations, the same traditions and customs." In Cambodia, Aymnonier found that many Cham Muslims lived along rivers where they fished and made nets from plant fibre (see box on page 27). They also built boats, travelling several days to trade fish in exchange for rice and navigating along the Mekong River to buy resin, wax and fibre for fishing nets (see box on pages 24 and 25).

Today, Cham Muslims of the Mekong Delta mainly live along the Bassac River, a distributory that flows from the confluence of the Mekong River and the Tonle Sap River in Phnom Penh. In Cambodia, these Muslim communities can be found on the left bank of the river in Meanchey District in southern Phnom Penh and also on the right bank in the municipality of Takhmao, the administrative centre of Kandal Province (see map on previous page). Numerous other Cham Muslim villages exist further downstream before the river flows into Viet Nam. About 20 kilometres from the border is the Cham Muslim community of Chau Doc District, located at the confluence of Takeo River and the Bassac, known as the Song Hau in Vietnamese.

Taylor estimated the population of this community in the Vietnamese part of the Mekong Delta at about 13,000 people. Residing in ten small settlements, most of the Cham Muslim families fished with nets, traps and spears. "Yet, despite the local abundance of fish, they rarely sell what they capture," the Australian anthropologist wrote. And despite being "renowned as a specialised fishing community," Taylor noted that the Cham Muslims had mostly not been engaged in the recent boom in caged catfish aquaculture in Chau Doc. This he attributed to lack of capital, collateral and technical knowledge

Austronesian language group



Austronesian languages are concentrated in Southeast Asia but stretch from Taiwan in the north to the Polynesian islands in the Eastern Pacific and Madagascar in the west

Map: Gunawan Kartapranata

The Cham language belongs to the Austronesian group of languages, largely spoken in the Malay world. French historian Anne-Valerie Schweyer, says Cham "probably" came to central Viet Nam from the island of Borneo (the large island in the centre of the map). The northern coast of Borneo today comprises East Malaysia and Brunei. The rest of the island, known locally as Kalimantan, is Indonesian territory. According to Schweyer, a researcher at the National Institute of Scientific Research in Paris who has written extensively on Cham history, the Cham people lived off fishing and trade. "Excellent seafarers, they used their knowledge to trade and provide a means of subsistence through fishing," she wrote.

A Cham Muslim woman making giant cast nets at a shop in Prek Tapouv Village in Takhmao in Kandal Province

Photo: Chhut Chheana

Lost origins

The Cham people of Cambodia and Viet Nam were considered by French colonialists as descendants of Champa, a series of political entities in present-day Central Viet Nam. Champa is believed to have originated as a small Indian state which halted Chinese expansion to the south by 192. Etienne Aymonier, an early colonial administrator in French Indochina, traced its early history from Cham inscriptions, both in Sanskrit and the Cham language itself, as well as old Vietnamese annals.

Historical extent of the Kingdom of Champa (green) in relation to the Khmer Empire (blue) and Dai Viet (yellow)

Map: C. Glassey

"Whether they came from the west or were brought overseas from India, the civilisation and power of Champa first propagated itself from south to north before being pushed backward," he wrote in his work on Cham religious practices published in 1891. According to Aymonier, the first capital was apparently in Quang Binh Province, on the northern part of the central Vietnamese coast. The second was further south near Hue, which would later become the Vietnamese imperial capital, and the third even further south near Quy Nhon, capital of present-day Binh Dinh province. Important centres of this civilisation extended south to what is present-day Nha Trang and Phan Rang. Traditional practices were said to include throwing living men into the sea every year "to honour the gods protecting fisheries."

Aymonier, who compiled a Cham-French dictionary and a book on Cham grammar, recounted several centuries of war between the Cham and the Chinese followed by clashes with a large Malay expedition which came to attack the south of the Chinese empire in 767. "Pushed back by the Chinese, this armada of pirates probably fell back on Champa," the Frenchman wrote, noting a Sanskrit inscription referring to "extremely dark and thin men who came from another country in ships" and who destroyed a temple near Nha Trang dedicated to the goddess Po Nagar, the legendary founder of Champa (see photo on opposite page). Aymonier traced the definitive fall of the last capital of independent Champa to 1397, but noted that Cham kings and lords continued to reside in Phan Rang until the early 18th century.

By the late 19th century, when the Frenchman was serving in Indochina, most Cham people were concentrated further south in Binh Tuan Province. While there were some "pagan" Cham, most were Muslims with some possible infusion of Arab blood. The overall population was estimated at no more than 30,000. Aymonier speculated that most of the Muslim Cham people, who probably lived in Champa from the 9th to 10th centuries, had emigrated to Cambodia or Siam (present-day Thailand). With the rise of Islam, Sanskrit probably fell into disuse around the middle of the 11th century.

Aymonier found the Cham of Cambodia to be "freely in contact with the Islamic world" with pagan ceremonies completely renounced. He estimated the Cham population in Cambodia, Cochinchina (southern Viet Nam) and Siam at up to 100,000 people of which less than 5 percent were from the Malay world. Most were "rich and thriving" in about 100 villages on the banks of the Mekong River in eastern Cambodia, where the province of Kampong Cham is located. But there were also two villages in Tay Ninh Province, about 20 villages with about 15,000 people in Chau Doc on the Bassac River in the Mekong Delta, three hamlets in Battambang near the Tonle Sap Lake, two or three villages in the

vicinity of Bangkok and a much larger group "a few days southwest from that capital on the edge of the Gulf of Siam."

According to Aymonier, Cham people in Cambodia either lived by the water or in the interior. The former were given to fishing, weaving their own nets from ramie (*Boehmeria nivea*), a flowering nettle native to East Asia (see box on page 25). They also traded rich crops such as cotton, indigo and sesame. Among them were silversmiths, sculptors and boat builders. The latter were "high country" people who cultivated rice but had "lost all notion of irrigation works that their ancestors had," Aymonier wrote. According to the Frenchman, "those living in river villages travel in small caravans several days away. They load their vehicles with the product of their fisheries and fields so as to barter it against rice from the high country." These were relatively small journeys. "True traders go much farther, overland to Laos, to buy oxen, buffaloes or horses. They also go by boat over the great river, to purchase lac, wax and ramie. Some go overseas, traveling to China, Siam, Java or Singapore where they buy the Koran. And those who go to Mecca are even more numerous."

Temple tower dedicated to Lady Po Naga, the legendary founder of the Kingdom of Champa. The temple is located near the central Vietnamese city of Nha Trang, previously known as Kauthara, and was built between 813 and 817. According to the Vietnam News Agency, Po Naga was worshipped as a wife of the Hindu deity Shiva and is credited with discovering rice as well as teaching people how to farm and make handicrafts. A three-day festival in honour of the "soul of the Cham" is held between the 20th and 23rd days of the third lunar month.

Photo: Petra and Bara Ruzicka, 2008. Used under a Creative Commons license, creativecommons.org/licenses/by-sa/2.0/

Writing three decades later, French archeologist Henri Parmentier asserted that the last Cham capital was in Binh Dinh province and fell in 1471, a date that corresponds to a Cambodian publication in 1928. "A good deal of the last Cham, those to whom Islam had given some cohesion and energy, emigrated to Cambodia in 1822," Parmentier wrote.

The influence of Malay and Khmer culture on the Cham people of the Lower Mekong is a recurring theme in the writings of Philip Taylor, a senior fellow in the Anthropology Department at the Australian National University. In his book on Cham Muslims of the Mekong Delta published in 2007, Taylor noted that recent work by anthropologists found that many Cham people in Cambodia and Viet Nam rejected the view that they were descended from Champa. Identification with Champa origins is "at best ambivalent," he wrote, adding that the Cham community in the Lower Mekong seemed to embody a dilemma that could be called "tragedy of lost origins."

In Chau Doc, which has the only Cham community in the Mekong Delta in Viet Nam, the Australian anthropologist wrote that many traced their roots to Champa. But others often mentioned Malaysia, Cambodia, Java and the Middle East. Some said that Malay and Javanese men were attracted by fishing grounds and trade opportunities in the Mekong Delta, intermarrying with Khmer, Chinese, Cham and Vietnamese women. Regardless of their origin, Taylor noted that one Chau Doc village had two mosques — one for speakers of the Cham language and another for Khmer speakers. As for Champa, it was a "water-based society, whose military and commercial dominance was based on sophisticated boat-building technology and knowledge of navigational and seaborne travel."

A Cham Muslim boy making a cast net in Baren Kraum, a village on the left bank of the Bassac River in Svay Proteal Commune, Sa'ang District, Kandal Province. The boy's father said he taught himself how to make nets and then passed on the skills to his son.

Photo: Chhut Chheana

as well as "absence of connections with those investing in and purchasing the fish."

Back in Takhmao, in Cambodia's Kandal province, the Cham Muslim community specialises in making fishing nets, or at least modifying basic nylon nets made in neighbouring countries such as Thailand, Malaysia and Viet Nam. These are bought from markets in Phnom Penh such as Chbar Ampeou Market, about 5 kilometres upstream on the left bank of the Bassac. The basic nets serve as the "raw material" for adding rope and metal chains to produce specialised types of fishing gear such as stationary gillnets, drag nets and cast nets. The work takes place in Prek Tapov Village in Daeoum Mean Commune near the centre of town. The village is located on the banks of the Prek Thnout River, a tributary of the Bassac originating in the mountains of Kampong Speu Province.

Sou Sen, the village chief, says Prek Tapouv has about 600 households including 446 Cham Muslim families of which about 200 are engaged in making fishing nets (the village reportedly had a Cham Muslim population of only 600 people in 1979, down from 3,000 in 1975). The work of making nets is carried out by men, women and children. In addition, 12 Cham Muslim households operate retail or wholesale outlets next to the local mosque, Masjid Al-Azim. These specialise in nets and other types of fish gear such as traps. A typical 7 kg cast net with metal chains attached sells for 200,000 riel ($50).

The village chief says customers are not only local fishermen but also traders from as far away as Svay Rieng Province, more than 100 kilometres east of Phnom Penh. Most of the net buyers are said to be ethnic Khmers, who resell the nets in their home provinces. But Sou Sen says customers also include fishermen from Kampong Cham, a province on the Mekong River upstream from Phnom Penh which is also home to Cambodia's largest population of Cham Muslims.

According to Sou Sen, the village has 95 Cham Muslim families engaged in fishing as their main occupation. Most of the fishermen use nets to catch fish from the Bassac River, although some venture further upstream to Koh Pich, an island at the confluence of the Bassac and the Mekong rivers in central Phnom Penh. At the same time,

Ramie fishing nets

In the late 19th century, Cham Muslims in Cambodia were observed using ramie (*Boehmeria nivea*) to make fishing nets (see box on pages 22 and 23). Also known as China grass or Chinese silk plant, ramie is a vegetable fibre native to East Asia. The fibre is known for its strength and toughness, especially when wet.

Ramie trees are reported to grow as high as ten metres. In Cambodia, they are cultivated for their fibrous light green bark which can easily be peeled from the trunk. The bark is then processed to make woven bags. The tree is also used in Cambodian traditional medicine. According to Cambodian pharmacologist Kham Lavit, a decoction of the leaves is used to treat urinary retention. The roots are reputed to be used as a haemostatic and to treat intestinal disease. As a powder, the roots are also used as a tonic, diuretic and antitussive.

According to the FAO, ramie is today an expensive and durable fibre that is mostly used in decorative fabrics such as curtains, wallpaper, sewing thread and furniture covers. The name of the species is said to be derived from *rami*, the Malay name for the plant. Ramie is also known as *daeoum thmoeui* in Khmer *ban rami* in Thai and *cây gai* hay or *cây lá gai* in Vietnamese.

Ramie

Si Yom sells fishing nets from Cham Leu, a village on a highway leading from Kandal Province to An Giang Province in Viet Nam. Located on the right bank of the Bassac River in Prek Thmei Commune, Cham Leu is one of five Cham Muslim Villages in Koh Thom District.

Photo: Chhut Chheana

about 200 other families in Prek Tapouv Village are engaged in subsistence fishing. Fishing activities mainly target small mud carps that start migrating down the Tonle Sap River at the end of the annual flood season in October. At the peak of the fishing season, the haul is said to be as high as two tonnes a day, about four times the regular daily catch.

Yunus Abdullah, the imam at the local mosque, says the village also produces fishing boats, a skill for which Cham Muslims in Cambodia are renowned. "Some boats are produced here," he says, adding that others come from Cham Muslim communities along the Mekong River upstream from Phnom Penh in Kampong Cham Province and Kratie Province.

Imam Yunus Abdullah

Photo: Chhut Chheana

Sou Sen says most of the Cham Muslim community in Takhmao originally came from Chau Doc and that textiles such as sarongs are still brought by traders from the Vietnamese district to sell in the Cambodian village. Writing in 2006, Taylor noted that the Cham Muslims of Chau Doc had recently started to import gas cookers from Cambodia. "In recent years the Cham have become the region's most successful long-distance traders," he wrote, describing trading journeys of two to three months as common. "Many Cham youths travel continuously, returning home briefly to visit their families and make new purchases." According to Taylor, Cham traders were using both the Vietnamese and Khmer languages, residing temporarily in places where they found demand for their wares and selling them from door to door.

Abdul Halim Ahmad

Photo: Chhut Chheana

Abdul Halim Ahmad, a commune councillor in Svay Proteal Commune in Sa'ang District, about 25 kilometres downstream from Takhmao, says he still has family in Chau Doc. His brother, a former soldier in Cambodia, now runs a small business in the Vietnamese district. Halim, who goes by the Khmer name of Mat Salim, says he and his siblings recently agreed to donate the property of his recently-deceased grandmother to a mosque near Chau Doc. The councillor is currently serving his third five-year term on the Svay Proteal Commune Council as one of six elected representatives of the ruling Cambodian People's Party (the council also has three representatives of opposition parties). Halim also served as the appointed village chief for the Muslim-majority village of Baren Kraum between 1994 and 2007.

Today, the village comprises about 700 households of which about 500 are Cham Muslim families. The rest are ethnic Khmers. Halim says about 20 percent of the Cham Muslim households are engaged in fishing full-time while about 40 percent are involved in part-time fishing for subsistence. The village's average catch per season is estimated at about 30 tonnes. The village also has three Cham Muslim households engaged in making nets, mainly gillnets but also drag nets. They use the same techniques as found in Takhmao, adding rope and metal chains to nylon nets made outside of Cambodia. Most of the customers are ethnic Khmers. According to one man engaged in net making, customers come from as far away as Siem Reap. "I don't have a job so I learnt to do this myself," he said.

Halim says he believes the inhabitants of the village, located on the left bank of the Bassac River, are descended from Champa in central Viet Nam. The village had more than 200 Cham Muslim families before Pol Pot's forces took over Cambodia in 1975. After liberation in 1979, there were less than 100. "Most of the victims were men," he says. "We have many widows."

Prek Thmei Commune is located even further downstream towards the Vietnamese border in Koh Thom District. The commune comprises 12 villages including two Muslim Cham villages. There are also 9 ethnic Khmer villages and one ethnic Vietnamese village. Another three Muslim Cham villages are located in nearby communes.

Mat Lah is the village chief in Cham Leu Village, one of the two Cham villages in Prek Thmei Commune. He says all 487 families in the village are Muslim and that about a third of

Cham fishing boats on Prek Thnout, a tributary of the Bassac River which flows through central Takhmao

Photo: Chhut Chheana

the households are engaged in fishing-related activities on a full-time basis. The village has more than 10 families engaged in making fishing nets. "The Chams don't buy nets, they sell them to the Khmers," Mat Lah says. "The Vietnamese buy their own nets from Viet Nam."

According to Mat Lah, the village was founded in 1868 by Cham Muslims living in another village seven kilometres away. He says the founders of the original village, known as Loung San, were Cham Muslims already living in Cambodia. Trade with Chau Doc, 37 kilometres downstream in Viet Nam, mainly comprises imports of mats, pillows, mosquito nets and kitchenware.

Fishing activities are not limited to the local stretch of the Bassac. Mat Lah says about 20 or 30 families go on major fishing expeditions to Phnom Penh, at the confluence of the Mekong River and the Tonle Sap River. Some even go as far upstream as Kampong Chhnang Province, on the Tonle Sap. Regardless of fishing grounds, they leave their boats and return to the village by road, awaiting phone calls from family or friends to return when fishing picks up. The boats return to the village at the end of the commercial fishing season around the middle of the year.

"We've always known fishing," Mat Lah says. "But now our young people are getting other jobs." Not all, however. Si Yom, a niece of the village chief, earns most of her income from growing corn, beans and rice. She supplements her income by modifying nylon fishing nets with rope and chains, a skill she learnt from her grandmother. In a good month, she can sell about 20 gillnets and castnets.

Like most Cham Muslim villages in Cambodia, the inhabitants of Cham Leu suffered disproportionately greater losses than ethnic Khmers during the Pol Pot period. Ben Kiernan,a history professor at Yale University, has estimated that 36 percent of the Cham population died during the Khmer Rouge regime compared with 21 percent for the country as a whole. Such numbers help explain the strong Cham allegiance to the ruling party, which liberated the country in 1979. Indeed, one of the 14 founding members of the United Front for the National Salvation of Kampuchea formed in late 1978 was Mat Ly, the son a Cham Muslim elder from Kampong Cham who was among the first Cambodians to join the Communist Party of Indochina as early as 1950. Another founding member was a Buddhist monk. Embracing both Buddhist and Muslim leaders was a top priority for the United Front headed by Heng Samrin, the former head of state for the People's Republic of Kampuchea who is now president of Cambodia's National Assembly.

Sa Sen, the 70-year-old imam, says the local mosque was used as a warehouse during the Pol Pot period between 1975 and 1979. Construction of a new mosque, Masjid Darun Noman, started in 1994 and was completed in 1999. About 300 Cham Muslim families lived in the village before 1975, the imam says. By the time the country was liberated in 1979, there were only about 200 families left.

Imam Sa Sen

Photo: Chhut Chheana

** Mr Starr is editor of* Catch and Culture *and Mr Ly Vuthy is an officer with the MRC Fisheries Programme*

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Impact Assessment Training Centre for Lower Mekong to be set up in **Viet Nam**

Donor group meets with Lower Mekong countries to discuss connection between water resources, energy needs and food security for the first time

The United States, Japan and Australia plan to work with the Asian Development Bank (ADB) and World Bank to develop a Regional Impact Assessment Training Centre for the Mekong region. In a statement released after an extraordinary meeting of the Friends of the Lower Mekong donor group in the southern Lao city of Pakse on February 2, the US State Department said the centre would be located at the Asian Institute of Technology (AIT) in Viet Nam.

Established in 1993, the Vietnamese institute was the first AIT centre outside of its headquarters in Thailand. It has three main offices in Hanoi, Ho Chi Minh City and Can Tho, the main city in the Mekong Delta, and programme offices in four other locations including the delta province of Tra Vinh.

Protein for Cambodia, rice for Viet Nam

"The health of the Mekong River is essential to the economic growth and sustainable development of the region," the statement said. "In Cambodia, the Mekong supports the rich biodiversity of a watershed that provides more than 60 percent of the protein intake for the entire country. The

Extraordinary meeting of the Friends of the Lower Mekong in Pakse on February 2

Photo: US Embassy, Vientiane

river irrigates the 'rice bowl' in Viet Nam, where more than half of the nation's rice production is concentrated in the provinces that make up the Mekong delta." The statement added that the Mekong was also an "important artery for transportation, a water source for aquaculture and agriculture, and a generator of electricity."

'Participants discussed the challenges of ensuring a future in which economic growth does not come at the expense of clean air, clean water, and healthy ecosystems'

In addition to Cambodia, Lao PDR, Myanmar, Thailand, Viet Nam and the United States, the meeting in Pakse included Australia, Denmark, Finland, Germany, Japan, Korea, the Netherlands and Sweden as well as the MRC, the ADB, the World Bank and the European Union. The US delegation alone included representatives of the US Army Corps of Engineers, the US Agency for International Development (USAID), the Environmental Protection Agency and the Department of Energy. It was the first time that donor group had come together with the Lower Mekong countries to discuss the connection between water resources, energy needs and food security. "Meeting participants discussed the challenges of ensuring a future in which economic growth does not come at the expense of clean air, clean water, and healthy ecosystems," the State Department said.

Social and environmental safeguards

The statement said the regional training centre planned for AIT Viet Nam was part of efforts to "strengthen the capacity of Lower Mekong countries to more effectively implement social and environmental safeguards such as environmental impact assessments and strategic environmental analyses." Other initiatives announced at the meeting in Pakse included the launch of USAID's Sustainable Mekong Energy Initiative to promote the use of alternative energy and low-emission technologies, technical assistance on hydropower management from the Army Corps of Engineers and a five-year extension of an agreement between the Mississippi River Commission and the MRC to exchange knowledge, information and best practices. In conjunction, the State Department will contribute $500,000 to support an MRC study on the impacts of hydropower on the community and environment.

In a joint statement, the United States also agreed to collaborate with the ADB, the World Bank and others to support development of a Lao national energy grid. "This national energy grid will help provide stable, reliable electricity to millions of people throughout the country," the State Department said, adding it was also working with the Department of Energy and the Lao government to develop a "smart hydro" project. This will "increase the efficiency and environmental sustainability of its existing small hydropower assets and help build technical capacity in hydropower management," it said.

The State Department said the United States would also spend $1.5 million this year on projects under its Smart Infrastructure for the Mekong programme, part of the ministerial-level Lower Mekong Initiative (LMI) launched in 2009. Ministers last met in Myanmar in 2014 and are expected to meet again on the sidelines of this year's ASEAN Ministerial Meeting in Kuala Lumpur in early August.

Regional Working Group Meeting in Bangkok

Ahead of the Pakse meeting, the State Department and the Thai Ministry of Foreign Affairs jointly hosted the seventh LMI Regional Working Group Meeting in Bangkok on January 29 and 30. In a statement, the Thai ministry said the meeting discussed water, energy and food security challenges, as well as women's empowerment and the promotion of gender equality. The meeting was also attended by Cambodia, Lao PDR, Myanmar and Viet Nam as well as Australia, Korea, the ADB, the European Union and the ASEAN Secretariat.

'Working together to enhance closer cooperation among all stakeholders in the Mekong region'

Chutintorn Gongsakdi, director-general of the Department of International Economic Affairs at the Thai ministry, reiterated the importance of "working together to enhance closer cooperation among all stakeholders in the Mekong region," the statement said. "He also informed the meeting

Mekong under threat: Kerry

In early February, US Secretary of State John Kerry recalled journeying down the Mekong River as a young naval lieutenant on an American gunboat almost four decades ago. "Even with the war all around us, in quiet moments we couldn't help but be struck by the beauty and the power of the river — the water buffalo, the seafood we traded for with local fishermen, the mangrove on the sides of the river and inlets," he wrote in a commentary published in *Foreign Policy* magazine the same day as the Friends of the Mekong meeting was taking place in Pakse.

"Today, the Mekong faces a new and very different danger — one that threatens the livelihoods of tens of millions and symbolizes the risk climate change poses to the entire planet. Unsustainable growth and development along the full reach of the river are endangering its long-term health and the region's prosperity.

"From the deck of our swift boat in 1968 and 1969, we could see that the fertile Mekong was essential to the way of life and economy of the communities along its banks. In my many visits to the region since then as a senator and secretary of state, I've watched the United States and the countries of Southeast Asia work hand in hand to pursue development in a way that boosts local economies and sustains the environment.

"Despite those efforts, the Mekong is under threat. All along its 2,700 miles, the growing demand for energy, food, and water is damaging the ecosystem and jeopardizing the livelihoods of 240 million people. Unsustainable development and the rapid pace of hydropower development are undermining the food and water needs of the hundreds of millions of people who depend on the river."

Kerry noted that the Mekong rivals the Amazon for biodiversity, with the giant mekong catfish and the Irrawaddy dolphin unique to the river, and new species of animals and plants constantly being identified. "Some of these newly discovered species could one day hold the promise of new lifesaving drugs," he wrote.

John Kerry

Photo: US State Department

"The entire Mekong region must implement a broad strategy that makes sure future growth does not come at the expense of clean air, clean water, and a healthy ecosystem," Kerry continued. "Meeting this challenge requires that we work with these countries to address very real development needs even as we work to sustain the environment. This requires good data for proper analysis and planning, smart investments, strong leaders, and effective institutions to manage the Mekong's riches for the benefit of everyone in the region.

"To that end, we joined with Cambodia, Laos, Myanmar, Thailand, and Vietnam, to launch the Lower Mekong Initiative. Its goal is to create a shared vision of growth and opportunity that recognizes the river's role as an economic engine and respects its place in the environment …

"This is not a question of dictating the path of development in these countries. Rather, it is about the United States and other countries working alongside our partner nations to establish a consistent set of investment and development guidelines that ensure long-term environmental health and economic vitality all along the river's path."

of the progress made by Thailand in key areas of LMI cooperation, including Health, Connectivity, Education, Environment and Water, Agriculture and Food Security and Energy Security. The issue of science, technology, and innovation was also mentioned, since Thailand aims to use this issue for economic restructuring toward sustainability, quality growth, and overcoming the middle income trap."

The Thai ministry said the outcomes of the meeting would be incorporated into a draft LMI Plan of Action for 2015-2020. It also noted that the meeting included the first gathering of a new Eminent and Expert Persons Group to meet and discuss recommendations for achieving sustainability in the region. The establishment on the group was announced at the annual ASEAN Ministerial Meeting in Myanmar in 2013 (see *Catch and Culture*, Vol 20, No 1).

Water resources for water-food-energy security nexus

By Sok Siphana *

The water-food-energy security nexus is a revolutionary concept and approach for the sustainable development of the Mekong River. For Cambodia, the Mekong is more than just a stream or water: it is an irreplaceable source of life. During the rainy season, when the water level in the Mekong rises and then flows into the Tonle Sap River, the level in the Tonle Sap Lake rises accordingly.

At the end of the rainy season, the water level in the Mekong begins to drop gradually. The level of the Tonle Sap Lake also goes down and reverses its flow into the Mekong, marking the beginning of the fishing season in Cambodia. This exceptional phenomenon has made the Tonle Sap home to the largest freshwater capture fisheries in the world. During the fishing season, many Cambodians in rural areas go to the Tonle Sap to catch fish to produce a fermented fish and other sorts of dried and smoked fish as sources of staple food and nutrition all year round.

Cambodia is therefore emboldened to see the efforts of the Friends of the Lower Mekong combining their efforts to further strengthen cooperation with the Mekong countries on sustainable use and development of the Mekong water to cope with the multitude of interdependent challenges. The thirst for energy for development has led to the development of hydropower without much recognition or with limited consideration on the “health" of rivers and its impact on food security.

Cambodian Eminent Person Dr Sok Siphana

Photo: US Embassy, Vientiane

Watt Botkosal, Deputy Secretary General of the Cambodia National Mekong Committee (CNMC) shares the view that, in the context of Cambodia's national and transboundary river basin, there is a clear nexus between hydropower development and food for the poor (thus a hydropower-food nexus). He has called for a thorough Cooperative Regional Assessment (CRA) to ensure that sound social and environmental safeguards are identified and put in place to avoid irreversible damage to the vital ecosystems and food production systems which sustain millions of lives throughout the Mekong River Basin. This initiative would be a positive contribution to the realisation of the water-food-energy security nexus.

** Dr Siphana, Advisor to the Royal Government of Cambodia, is a member of the Lower Mekong Initiative Eminent and Expert Persons Group which held its inaugural gathering in Bangkok in late January*

Overview of **aquaculture** in the **Mekong Delta** in Viet Nam[1]

By Tran Van Viet, Nguyen Hai Son and Kong Sovanara *

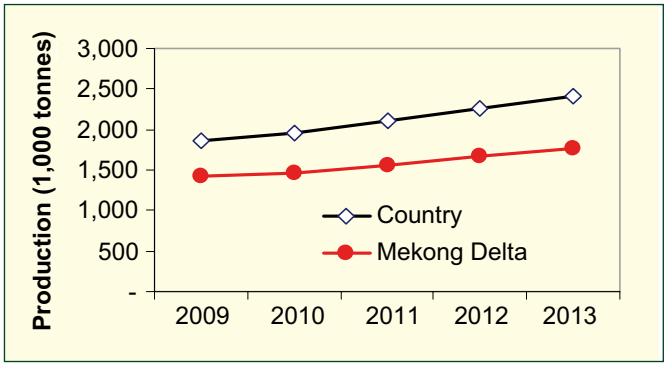
Aquaculture in the Vietnamese part of the Mekong Delta seems to be reaching its limits

Aquaculture plays an important role in the Vietnamese economy. Total fisheries production of 5.2 million tonnes generated exports to 164 countries worth $6.1 billion in 2011. That accounted for 22.4 percent of the country's agricultural production and 6.3 percent of its exports (Directorate of Fisheries, 2014). For aquaculture alone, production expanded from 2.1 million tonnes in 2008 to 3.1 million tonnes in 2013. During the same period, however, the area devoted to aquaculture rose at a slower pace, from 1.019 million to 1.039 million hectares (General Statistics Office of Vietnam, 2014).

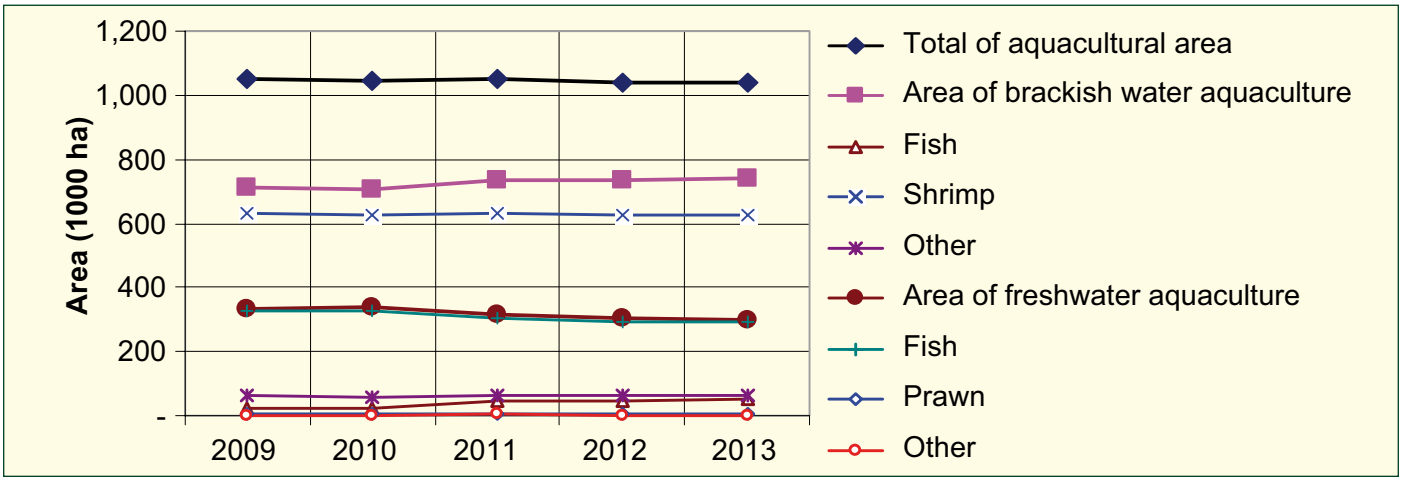
The Mekong Delta accounts for most of the production. Stretching across 3.9 million km^2, it accounts for 19.7 percent of the country's land area and 12.2 percent of its population (General Statistics Office of Vietnam, 2013). With the area covered by aquaculture rising from 0.724 million hectares in 2008 to 0.727 million hectares in 2013, the delta was responsible for 71 percent of Vietnamese aquaculture production. During the same period, production in the delta grew from 1.5 million tonnes to 2.2 millions tonnes (General Statistics Office of Vietnam, 2014).

Between 60 and 70 percent of aquaculture production is from freshwater species. Exports

Production from aquaculture 2009-2013



Area used by aquaculture in Viet Nam from 2009 to 2013



[1] This article summarizes preliminary results of one of the outputs of the project "Survey of Status and Trends of Aquaculture in the Lower Mekong Basin of Viet Nam", implemented by Can Tho University, Viet Nam

Aquaculture in the Mekong Delta covered an area of almost 730,000 hectares in 2013

Photo: Nguyen Hai Son

of *tra* catfish (*Pangasianodon hypophthalmus*) are significant and were valued at $1.8 billion in 2011 (General Statistics Office of Vietnam, 2012). The area used for intensive *tra* catfish culture in the Mekong Delta was about 6,000 hectares and yielded 1.2 million tonnes of fish in 2012 (An Giang Department of Agriculture and Rural Development, 2012).

Giant snakehead (*Channa micropeltes*) is another important species for intensive culture in the delta. Production of the species soared from an estimated 5,294 tonnes in 2002 (Long *et al.*, 2004) to 40,000 tonnes in 2009 (Chung *et al*., 2011). Tilapia is also common with production rising from 5,428 tonnes in 2001 to 34,962 tonnes in 2008 (An Giang Department of Agriculture and Rural Development, 2009). Other fishes cultured intensively in the delta include climbing perch (*Anabas testudineus*) and walking catfish (*Clarias* spp).

Aquaculture has contributed significantly to Viet Nam's development, although export revenues often fluctuate. In 2012, for example, the value of shrimp exports fell 6.6 percent from a year earlier to $2.24 billion. Exports of *tra* catfish dropped 3.4 percent to $1.74 billion in the same period (General Statistics Office of Vietnam, 2012)

In recent years, aquaculture in Viet Nam has faced many challenges. Land suitable for aquaculture is already being used in many parts of the country. In the absence of government planning, farmers often expand aquaculture activities themselves, with a focus on expanding the area to increase production. Many farms are small in scale and 80 percent of individual households involved in aquaculture have to rely on imported feed. Seed quality is limited, with low survival rates of 25 to 55 percent. In many regions, infrastructure and irrigation are inadequate for supporting aquaculture, and fish health can be affected by the use of pesticides and herbicides on crops. Information is limited on such activities including species, yields and farming systems

A shrimp farm in Bac Lieu, a coastal province in the southern part of the Mekong Delta. The delta had almost 600,000 hectares being used for shrimp culture in 2015, more than four-fifths of the total area devoted to aquaculture. The land on which many shrimp farms now sit used to be used for cultivating rice

Photo: Nguyen Hai Son

in each province. Market instability arising from imbalances in supply and demand is another challenge. Updating information on aquaculture is necessary to address such challenges and is expected to be an effective tool for stakeholders to adjust their business activities to avoid imbalances in supply and demand. More timely information would also be useful for managing natural resources such as water and addressing pollution to help make the industry more sustainable.

Apart from *tra* catfish and giant snakehead, other major species farmed in the Mekong Delta include red tilapia (*Oreochromis* spp.) and an exotic walking catfish hybridised with a native species from the same genus (*Clarias gariepinus* male x *Clarias macrocephalus* female). The choice of species depends on the kind of culture (pond, tank or cage) and the natural conditions of a province. Market prices, culture techniques and the financial capabilities of farmers are also very important in choosing species. Most cultured species in the delta are indigenous. Apart from tilapia, exotic species farmed in recent years include pirapatinga (*Piaractus brachypomus*) and pond loaches (*Misgurnus anguillicaudatus*).

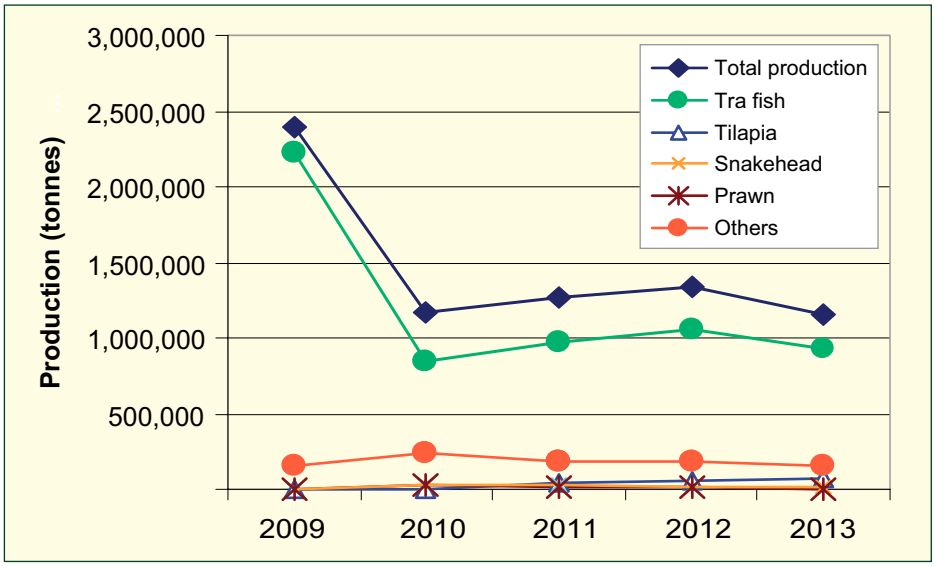
Area for aquaculture in the lower Mekong Delta

The area used for farming freshwater fish species in the delta rose from 94,639 hectares in 2001 to 138,885 hectares in 2010 (General Statistics Office of Viet Nam, 2014). For *tra* catfish, the area expanded from 2,413 hectares in 2002 to 5,910 hectares in 2012. Donh Thap Province had the largest area for *tra* catfish culture amounting to 1,925 hectares in 2012, down from about 2,000 hectares in 2011.

Shrimp culture is concentrated in delta coastal provinces. The Mekong Delta had 595,724 hectares being used for shrimp culture in 2013, about 82.5 percent of the total aquaculture area. The two species cultured are black tiger shrimp (*Penaeus monodon*) and white leg shrimp (*Littopenaeus vannamei*). In 2010, the cultured areas were 579,997 hectares for black tiger shrimp

(79.7 percent) and 15,727 hectares for white leg shrimp (2.2 percent). Other species farmed in the delta include the giant freshwater water *(Macrobrachium rosenbergii)* In 2010, the four coastal provinces of Ca Mau, Bac Lieu, Kien Giang and Soc Trang were using 520,057 hectares to farm shrimp, amounting to 87 percent of the 599,724 hectares devoted to shrimp culture in the delt . The area used by aquaculture in the delta has been stable over the past five years with expansion constrained by high production costs (mainly feed and seed) and low market prices for fish.

Aquaculture of important species in the Mekong Delta



According to the General Statistics Office (2014), aquaculture production in the Mekong Delta was 2,221,182 tonnes in 2012, or 71.4 percent of the country's total production. *Tra* catfish accounted for 1,255,500 tonnes and contributed $1.744 billion in value. Production was 280,647 tonnes for tiger shrimp (93.9 percent of the country's total tiger shrimp production). 77,830 tonnes for white leg shrimp (42.8 percent) and 50,662 tonnes for molluscs (37.5 percent). The slight increase in aquaculture production between 2009 and 2013 has not been accompanied by an increase in the area used by farms.

The average yield for *tra* catfish culture in the Mekong Delta was 212.4 tonnes per hectare between 2009 and 2013. Production rose from 93,135 tonnes in 2002 to 653,264 tonnes in 2007 and 1,255,500 tonnes in 2012. During this period, the area used by *tra* catfish farming increased 2.45 times and average yields rose 5.5 times. While the production of *tra* catfish has declined sharply since 2010, the production of other species has been more stable.

The value of Viet Nam's fisheries exports increased dramatically from $1 billion in 2000 to $5 billion in 2010, rising further to $6.1 billion in 2012 and $8 billion in 2014. In 2012, the Mekong Delta alone accounted for 78.3 percent of the total export value. Shrimp exports from the delta came to more than $2.4 billion while exports of *tra* catfish exceeded $1.7 billion. The biggest markets for fisheries products from the Mekong Delta are the European Community, the United States and Japan.

The Mekong Delta has considerable advantages and potential for aquaculture development. It has favourable natural conditions and benefits from high demand for aquaculture products in both domestic and international markets. It also has access to new techniques and biotechnology. However, aquatic resources have been declining. In coastal regions, yields from extensive shrimp culture have fallen to 80kg/ha/crop, down from 200 kg/ha/crop in 1980. Many catfish farms have been abandoned due to high production costs and low sales prices. At the same time, the Mekong Delta is expected to be significantly affected by climate change and upstream hydropower development.

In many regions, the areas used by both freshwater and coastal aquaculture has reached their limit. Shrimp culture is at high risk due to frequent pollution and outbreaks of disease. Furthermore, *tra* catfish culture faces high investment (from $285,714 to $380,952 per hectare), a long culture period (6-7 months) and high production costs, mainly from seed and feed which occupy between 70 and 86 percent of total costs (Institute of Southern Agricultural Science, 2011). The industry has also suffered from

fluctuating prices and high interest rates, causing losses for many fish farmers.

Conclusion

The Mekong Delta has 24 aquatic animal species being cultured, mostly freshwater species. The choice of species fluctuates from year to year. Types of culture include ponds, tanks, rice fields, garden ponds and cages. The area for pond culture accounts for most production in terms of both volume and value. Cages are used for only a few species and tank culture has the lowest contribution. Aquaculture in the delta is no longer expanding, in terms of either area or production. At the same time, export earnings are at their limits.

** Dr Viet is senior lecturer in fisheries at Can Tho University while Mr Son is serving as programme officer and Mr Sovanara as aquaculture specialist at the MRC Fisheries Programme*

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Feeding time on a catfish farm in the Mekong Delta. Amid high production costs and low sales prices, many catfish farms have been abandoned

Photo: Nguyen Hai Son

Experts float **ideas** for **restructuring** catfish **industry** in Mekong Delta

Vietnamese exports of catfish were flat last year with increased shipments to the Asia-Pacific region offset by declines in exports to Europe and the United States. In such an environment, restructuring measures are being considered for the industry.

A proposed restructuring of the Vietnamese catfish industry should focus on improving quality, diversifying products, developing export markets as well as addressing financial and management issues among processors, experts reportedly told a seminar in Dong Thap Province in the Mekong Delta in February. According to the daily newspaper *Viet Nam News*, published by the country's official news agency VNA, Central Economic Committee Deputy Director Le Vinh Tan told the seminar that the industry had been showing "signs of decline" over the past five years. Challenges include drops in exports to major markets, trade barriers in some importing countries and unhealthy competition between Vietnamese processors and farmers.

Tan was quoted as saying that restructuring and sustainable development were needed at "every stage" of production from zoning and farming to processing and consumption, and that survival largely depended on developing export markets for *tra* catfish (*Pangasianodon hypophthalmus*), a native shark catfish species known in English as Sutchi river catfish.

'Plagued by oversupply'

Vu Trong Binh, head of the Central Economic Committee's Local Economy Department, reportedly said that the industry was "plagued by oversupply" and required precise identification of the area needed for catfish farming, which mostly takes place in earthen ponds. He called for the establishment of a catfish research centre, improved quality fry and better information about the catfish market which can be somewhat opaque (see *Catch and Culture* Vol 15, No 3).

The call for improved fry was echoed by Truong Thi Le Khanh, chairwoman of Vinh Hoan Corporation, a catfish exporter based in Cao Lanh, the capital of Dong Thap province which recently surpassed An Giang Province as Viet Nam's largest catfish producer. Khanh appealed for advanced farming techniques and product diversification as well as improved financial capabilities and business strategies among processors. At the same time, she reportedly urged the government to offer tax breaks and adopt flexible policies.

Duong Quoc Xuan, deputy head of the Southwest Region Steering Committee, was meanwhile quoted as telling the seminar that provinces in the Mekong Delta should review the area used for farming catfish. The newspaper noted that the delta accounted for most of the 6,000 hectares

Truong Thi Le Khanh

Photo: Vinh Hoan Corporation

Mekong Delta shrimp exporter expects turnover to hit $1 billion this year

Le Van Quang

Photo: Global Aquaculture Alliance

Minh Phu Seafood Corporation aims to export 60,000 tonnes of shrimp and generate turnover of $1 billion in 2015, the Vietnam Association of Seafood Exporters and Producers (VASEP) reported in February. The report said chairman Le Van Quang was planning to reorganise production lines in factories to "increase productivity and optimise capacity" after the Lunar New Year, which started on February 19 this year. "Minh Phu also plans to build a new plant and expand investments abroad," the report said.

Minh Phu already has a majority stake in a California-based distributor for its seven shrimp processing and farming subsidiaries in the Mekong Delta. Two processing companies are in Ca Mau Province, which is also home to Minh Phu's headquarters. A third is located in Hau Giang Province. Two of the farming subsidiaries are also located in Ca Mau and another two are in Kien Giang Province. Minh Phu also has a fifth farming subsidiary and a post-larvae production facility northeast of Ho Chi Minh City as well as a minority interest in a port services company in Hau Giang, which is located on the Bassac River, one of the two main branches of the Mekong in Viet Nam.

In 2014, Minh Phu performed better than expected, earning a pre-tax profit of VND 1,057 billion ($50 million) on turnover of about VND 16,000 billion ($762 million). The company had forecast pre-tax earnings of only VND 487 million ($23 million) on revenues of VND 11,715 billion ($558 million). Quang attributed the solid performance to company efforts to overcome the twin challenges of weak economic growth in export markets and losses caused by early mortality syndrome (EMS), a new shrimp disease which was named as acute hepato-pancreatic necrosis syndrome (AHPNS) in 2013. The disease emerged in southern China in 2010 and spread to Viet Nam and Malaysia in 2011.

In terms of export revenues, the company's biggest markets were the United States (33 percent) and Japan (25 percent) in 2012, the most recent year for which figures are available. South Korea (17 percent) ranked third and was followed by the European Union (9 percent), Canada (7 percent), Australia (3 percent) and Hong Kong (2 percent).

Minh Phu's export products include white leg shrimp (*Littopenaeus vannamei*) (left) and black tiger shrimp (*Penaeus monodon*) (right) targetting the Japanese market

Photo: Minh Phu Seafood Corporation

devoted to catfish farming in Viet Nam.

Need for better quality fry questioned

A government official questioned the need for a catfish research centre, noting that "many" valuable research activities were already taking place at the government's Research Institute for Aquaculture No 2 (RIA2) in Ho Chi Minh City as well as universities such as Can Tho University and Nong Lam University.

'Any improvement in fry will increase costs and use a lot of drugs and chemicals, possibly being harmful'

As for improving the quality of catfish fry, the official proposed a simpler idea. "Since *tra* catfish is so prolific with high fecundity producing a lot of eggs, you just need to ensure that broodstock are good, no inbreeding during mating and accept 10 to 15 percent survival from fry to fingerlings. This way, you save a lot of money, use less drugs, and still get a profit because the price of fry is so low," the official said. "Any improvement in fry will increase costs and use a lot of drugs and chemicals, possibly being harmful."

Five possible remedies

The official outlined five measures for restructuring the catfish industry in the Mekong Delta—maintaining a long-term selective breeding programme that aims for robustness, disease resistance, growth and other traits; conducting more research on nutrition at all stages of fish development; licensing hatcheries; licensing grow-out farmers with strict regulations similar to the Norwegian salmon industry; and limiting stocking densities at all stages of development from fry to sub-fingerlings to fingerlings to grow-out. "When carrying out these five points, you can control the final production, thus the price and quality of marketable-size fish," the official said.

According to the Vietnam Association of Seafood Exporters and Producers (VASEP), exports of pangasius, mostly *tra* but also *basa c*atfish (*Pangasius bocourti*), rose 0.4 percent from a year earlier to $1.8 billion in 2014 and were expected to remain flat in 2015. "Pangasius import demand does not show any signs of recovery," VASEP wrote in late February, adding that any pickup was not likely until the second quarter after international seafood exhibitions and trade fairs were held.

In 2014, the European Union and the United States were the biggest markets, accounting for imports of about $340 million each. But exports to Europe were down almost 11 percent, which VASEP blamed on weak demand, stricter inspections on chemicals and antibiotics along with abundant supplies of competing fish like cod. Exports to the United States were down almost 12 percent, depressed by increased anti-dumping duties which has been doubled to almost $1 a kilogram for 24 exporters.

Exports to other markets such as the Association of Southeast Asian Nations, Mexico and China improved last year, along with shipments to Brazil. Exports to ASEAN alone rose 9 percent from a year earlier to $137 million. VASEP said the biggest market in ASEAN was Thailand, where imports of Vietnamese pangasius rose 27 percent to $44 million. Other major markets in Southeast Asia were Singapore and the Philippines. All three countries imported most of their catfish from Viet Nam, although they also bought catfish from other countries, VASEP said.

Pangasianodon hypophthalmus, known as *tra* catfish in Vietnamese

Photo: FiMSeA (http://ffish.asia)

Pangasias bocourti, known as *basa* catfish in Vietnamese

Photo: FiMSeA (http://ffish.asia)

Brush-park fisheries in **Cambodia**: cheap, productive and **illegal**

People convicted of harvesting fish and other aquatic animals through brush parks in Cambodia face up to three years in prison. To be sure, brush-park fisheries can degrade flooded forests and cause siltation. They can also lead to overfishing. But can such problems be managed?

Brush-park fisheries, in which bushes and tree branches are placed in water bodies to attract fish and other aquatic animals, are prohibited under Cambodia's Law on Fisheries passed in 2007. French colonial administrators referred to brush parks in Cambodian rivers and lakes as early as 1939, describing how they were made from branches that surpassed water levels by several metres and kept together with floating bamboo. These structures were about 30 metres long and served as fish refuges near riverbanks or the shores of lakes as floodwaters were receding during the dry season.

In 1981, the Food and Agriculture Organization of the United Nations acknowledged that such low-technology aquaculture is practised in inland and brackish waters in many areas of the world, especially in West Africa. According to the FAO, brush parks seem to offer biological and economic advantages for fisheries management.

In Cambodia, however, the use of brush parks,

Cambodian villagers prepare to harvest a brush park from a branch of the Mekong in Kien Svay District in Kandal Province in January, 2015. Harvesting typically requires 5 to 20 people and 2 to 5 boats.

Photo: Michele McLellan

Harvesting fish from the brush park involves attaching a seine net to bamboo poles

Photo: Michele McLellan

known as *samrah* in Khmer, is categorised as a Class 2 offence, along with other illegal activities such as electro-fishing and the use of mosquito nets. Under Article 100 of the law, those convicted of Class 2 offences face fines of KHR 5 million ($1,250) to KHR 50 million ($12,500) imprisonment for one to three years. Transporting *samrah* is classified as a Class 3 offence with penalties including fines of KHR 1 million ($125) to KHR 5 million ($1,250) and prison terms ranging from one month to one year.

Despite the legal restrictions, brush parks are very popular in Cambodia as a fish aggregating device. According to Sam Chin Ho, a former fisheries officer who is now a university lecturer in Phnom Penh, brush parks in Cambodia were traditionally used for subsistence purposes and expanded into commercial operations at the beginning of the 20th century under French colonial rule.

In a paper published in 1999 as part of a DANIDA-funded research project by the MRC Fisheries Programme and the Cambodian Department of Fisheries, Sam noted that *samrah* were a "low-cost, but highly productive fishing method." At the time, *samrah* were also prohibited under an earlier law on fisheries management and administration. "But law enforcement is not very effective," Sam wrote. "The government is ignoring this problem, although the fishermen have cut inundated forest everywhere causing degradation of the environment."

According to a definitive guide to Cambodian fishing gear published by the MRC, the Department of Fisheries and DANIDA in 2003, flooded forest is usually the "nearest available source" for the bushes and tree branches used to make brush parks. The book noted that demand for branches in Takeo, a province in southwest

Cambodia where there is virtually no flooded forest left, had led to a trade in brush wood between the uplands and the floodplains that even crosses the border with Viet Nam."

Despite the ban on brush-park fisheries, Sam noted that commercial-sized *samrah* were still operating in the late 1990s, especially in Kampong Chhnang Province on the Tonle Sap River. He estimated 165 brush parks totalling about 6.6 hectares between the town of Kampong Chhnang and the border with Kandal Province further downstream. The average size of each *samrah* was about 400 square metres. "The brush park plays an important role compared with other mobile fishing gears," he wrote, estimating their catch in Kampong Chhnang Province at almost 172 tonnes in the three months from March to May in 1997. Between February and May the following year, the catch was estimated at almost 200 tonnes. During the three-month period in 1997, bagrid and shark catfishes accounted for a quarter of the catch. Carp, featherback, snakehead and sheatfish species were also dominant. In the four-month period in 1998, the composition of the catch was similar, although small carps were the most dominant, comprising a third of the catch.

After taking into account expenses such as boat and net rentals, Sam calculated that return on capital for a hectare at about 23 percent. At one location in Kampong Chhang town in 1998, the value of catches by three samrah fishermen in March was estimated at KHR 2.8 million ($696) (about twice as much in today's prices). In May, when fish prices rise at the onset of the wet season, the value was 4.5 million ($1,120). At another location in Kampong Tralach District near the border with Kandal Province, the value of catches by another three *samrah* fishermen

Removing branches and water hyacinth

Photo: Michele McLellan

Robin Welcomme, speaking at global conference on inland fisheries in Rome in January

Photo: FAO/Giulo Napolitano

was estimated at almost KHR 1.8 million ($446) in March and KHR 3.4 million ($856) in May the same year.

Despite the harsh penalties for building samrah under the new fisheries law, brush parks are still popular in Cambodia today. The accompanying photos show a relatively small brush park being harvested in Kien Svay District in Kandal Province in January this year. Amounting to more than 100 kilograms, the harvest was shared by villagers taking part in three days of animist rituals to inaugurate a new spirit house.

'Frequently criticised as a predatory fishing method'

In a review of tropical brush parks published in 2002, British fisheries scientist Robin Welcomme noted that such fish-aggregating devices were "highly controversial" and "frequently criticised as a predatory fishing method". Yet despite their widespread use, high yields as well as the social and environmental contention surrounding them, brush parks had been little studied. "As a result, efforts to define their role remain restricted to some of the more conspicuous fisheries in Africa, Sri Lanka, Bangladesh, India and Cambodia," he wrote.

Welcomme, a former chief of the FAO Inland Fishery Resources and Aquaculture Service, found that critics viewed brush parks as "exploitative fishing gear that removes an unduly large proportion of the fish population thereby damaging the fishery as a whole." In addition to obstructing other types of fishing gear and causing deforestation, brush parks can lead to siltation since they can slow currents, especially in lagoons and floodplain lakes.

At the same time, newly-introduced brush parks can disrupt traditional management as well as land and

water tenure, as seen in the West African nations of Benin and Togo where they were discontinued in the interests of social harmony. "By contrast, in Cambodia brush parks are illegal but, because of their traditional nature, are still flourishing," Welcomme wrote, noting that the artisanal practice among Cambodian fishermen seemed to be becoming a commercial medium of production.

'The perceived damaging nature of the parks is exaggerated and in certain cases wrong'

The British scientist argued that government bans on brush parks were flawed. "There is every evidence that the perceived damaging nature of the parks is exaggerated and in certain cases wrong," he wrote. "Despite the long-term use of this gear, deterioration of the fisheries has only emerged recently and parallels similar deterioration in fisheries from which brush parks are absent. The impression therefore is that it is the totality of effort that is affecting the fisheries, rather than the operations of any one gear."

Welcomme found that management solutions could be applied to most problems raised by brush parks (see table below). As for social problems, the framework accepting and supporting the practice is already in place in long-established brush parks, "although it may be challenged from time to time as social goals respond to a changing world." As for social strains in places where the practice has been newly introduced, these need to be weighed against social goals for the fishery.

'Fish parks, with their high productivity, seem a reasonable mechanism'

"If the objective is to produce the maximum amount of fish to satisfy the needs of rural and urban populations then fish parks, with their high productivity, seem a reasonable mechanism," Welcomme concluded. "In such cases education and extension programmes should encourage acceptance of the fishing method and adoption of co-operatives and other communal management institutions." Should social harmony among fishing

Brush-park management: problems and solutions

Problem	Solution
Excessive removal of fish and risks of parks contributing to overfishing	• Sensibly allocating stock between gears • Limiting numbers and fishing frequencies of parks through licensing
Regulation of fishing period and frequency	• Specifying longer times between fishing in parks where fish breed • Regulating size of fish landed
Conflict between gears	• Zoning water body surface restricting parks to specific locations
Deforestation	• Creating plantations to supply brush park fisheries
Siltation	• Siting brush parks in areas with moderate current or tidal flow
Social	• Clearly defining property rights regarding installation sites and access to defined areas
Training and extension for fishermen	• Incorporating brush parks into co-management systems
Financial	• Make crediting available to fishermen from rural banks for initial setting-up expenses • Funding ancillary services such as brushwood plantations

Source: Welcomme, R. L. (2002) An evaluation of tropical brush and vegetation park fisheries. Fisheries Management and Ecology 9, 175–188. Blackwell Science Ltd.

communities remain the main goal "banning brush parks altogether can be followed with the loss in overall fish yield that accompanies it."

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Although still very popular in Cambodia, the practice of using brush parks to catch fish carries penalties of up to three years in prison

Photo: Michele McLellan

Gender training **transforms lives** of both **men and women** in Lao fishing village

By Dongdavanh Sibounthong and Souvanny Phommakone *

Don Xayoudom is a fishing village, the largest and poorest on an island with the same name in Nam Ngum Reservoir, located about 100 kilometres north of the Lao capital Vientiane. The village is accessible only by boat, which takes about an hour from the shore of the reservoir. It has no basic infrastructure such as water or electricity and little in the way of educational facilities. In 1997, more than 65 percent of the population of about 1,300 were extremely poor. Incomes were less than a dollar a day, mainly through fishing and agriculture. There were many cases of family problems and domestic violence. Few girls went to school. Those who did had a high drop-out rate since they were under pressure to take care of their younger siblings and help with household work.

Under the traditional division of labour, men left for fishing in the early evening and got back home around 3 or 4 a.m. The women got up at 4 or 5 a.m. and worked all day, going to bed after their husbands left to fish overnight. In the absence of coordination or consultations between husband and wife, men never did housework and women knew little about fishing at night.

As part of a fisheries management project for Nam Ngum communities launched in 1997, the MRC Fisheries Programme provided training to

Pickled fish produced at Don Xayoudom on the Nam Ngum Reservoir

Photo: Saleumphone Chanthavong

Pickled fish balls (left) are wrapped in banana leaves (right). The fish balls are kept for two or three days before being ready to eat.

Photo: Saleumphone Chanthavong

increase gender awareness and sensitivity. As part of another project in 2007, the MRC and the Living Aquatic Resources Research Centre (LARReC) in Vientiane provided technical training on fish preserving and processing through the Reservoir Fisheries Management Committee that covers four other reservoirs in Lao PDR. The Japan International Cooperation Agency (JICA) offered more support in 2009 and 2010.

Family incomes have since risen to about two dollars a day and the division of labour has changed. Men help women do the house work including fish processing and taking care of the children. The women now have more time to work on fish processing, storing fish and keeping it fresh. They sometimes help men fishing in the early evenings as well. Daily problems and preferences are shared.

Living conditions have improved as women have been trained to pay more attention to hygiene and sanitation. Villagers understand concepts of gender and their roles. Some women have become trainers on fish processing and gender in their own right, and more girls are able to stay in school.

Key factors for the success in Don Xayadoum have included government commitment and support through national laws, policies and budget allocations along with support from the MRC (project, budget and officers) and other development partners such as JICA, the World Bank, the Asian Development Bank and the European Union. Other key factors have been active and committed gender focal points and teams within Lao government agencies as well as support from the country's political leadership.

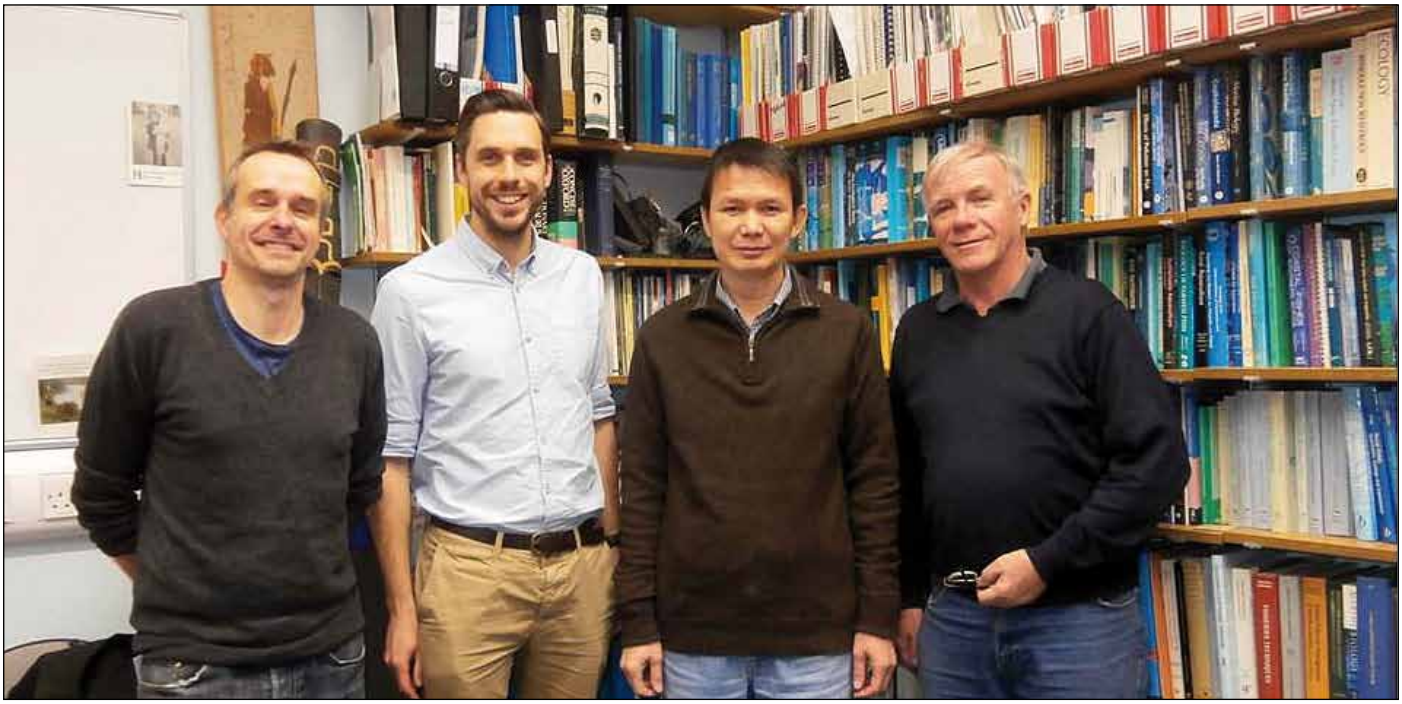
** Ms Dongdavanh is the current chair of the MRC-supported Regional Network for the Promotion of Gender in Fisheries (NGF) in the Lower Mekong Basin and Ms Souvanny is a programme officer at the MRC Fisheries Programme*

Dr Kaviphone

Kaviphone Phouthavong, who served as Lao programme officer and coordinator of the Fisheries Management and Governance Component of the MRC Fisheries Programme between 2007 and 2011, has completed a doctoral degree at the University of Hull in the United Kingdom for his research into fisheries management and livelihoods. Dr Kaviphone joined the Department of Livestock and Fisheries of the Lao Ministry of Agriculture and Forestry in 1991 after graduating with a bachelor degree in farm management from the Kharkov Zooveterinary Academy in the Soviet Union. In 1998, he joined the Assessment of Mekong Fisheries project of the MRC Fisheries Programme, where he was responsible for Geographical Information Systems (GIS), database management and fisheries baseline surveys.

In 2000, he moved to the Living Aquatic Resources Research Centre (LARReC) where he served as acting national director for the new Assessment of Mekong Fisheries Component (AMFC) of the MRC Fisheries Programme, designing and conducting baseline surveys in the southern Lao province of Champassak. It was during this period that he oversaw gill and lee net monitoring programmes. He also supervised fish market studies in Vientiane and Champassak. Between 2004 and 2006, he studied at the University of Sydney under a DANIDA scholarship, receiving his MsC for research into the use of GIS technology in fisheries management in Lao PDR.

Dr Kaviphone returned in January this year to LARReC where he is responsible for fisheries impact assessments, fisheries surveys and data collection. He is also the Lao national technical manager for the MRC Fisheries Programme and national team leader for two projects being implemented under the programme (Study on Socio-Economic Impacts and Social Implications from Reduced Capture Fisheries in the Lower Mekong Basin; and Survey of Fisheries Yield per Habitat at Landscape Scale).



Dr Kaviphone (third from left) with supervisors Dr Jon Harvey (left) and Prof Ian Cowx (right) with Dr Jonathan Bolland (second from left) from the Hull International Fisheries Institute at the University of Hull

Correction

In *Catch and Culture* Volume 20, No 3, we misidentified the river barb at the top of page 9 as *Cyclocheilichthys enoplos*. In fact, this species is *Cosmochilus harmandi*, known as *pla ta kark* or *pla joke keaw* in Thai. We convey our apologies to readers — and thanks to our colleagues at the Nagao Natural Environment Foundation (NEF) in Tokyo for pointing out the error. The photo of the *Cosmochilus harmandi* below is from the Fishes of Mainland Southeast Asia website, a database managed by NEF as part of a project which works to document the freshwater fish diversity for Southeast Asia, with the ultimate aim of protecting the freshwater ecosystems of the region. Collaborating institutions are from the four MRC member countries, Malaysia and Japan.

Cosmochilus harmandi

PHOTO: FIMSEA (HTTP//:FFISH.ASIA

Further reading

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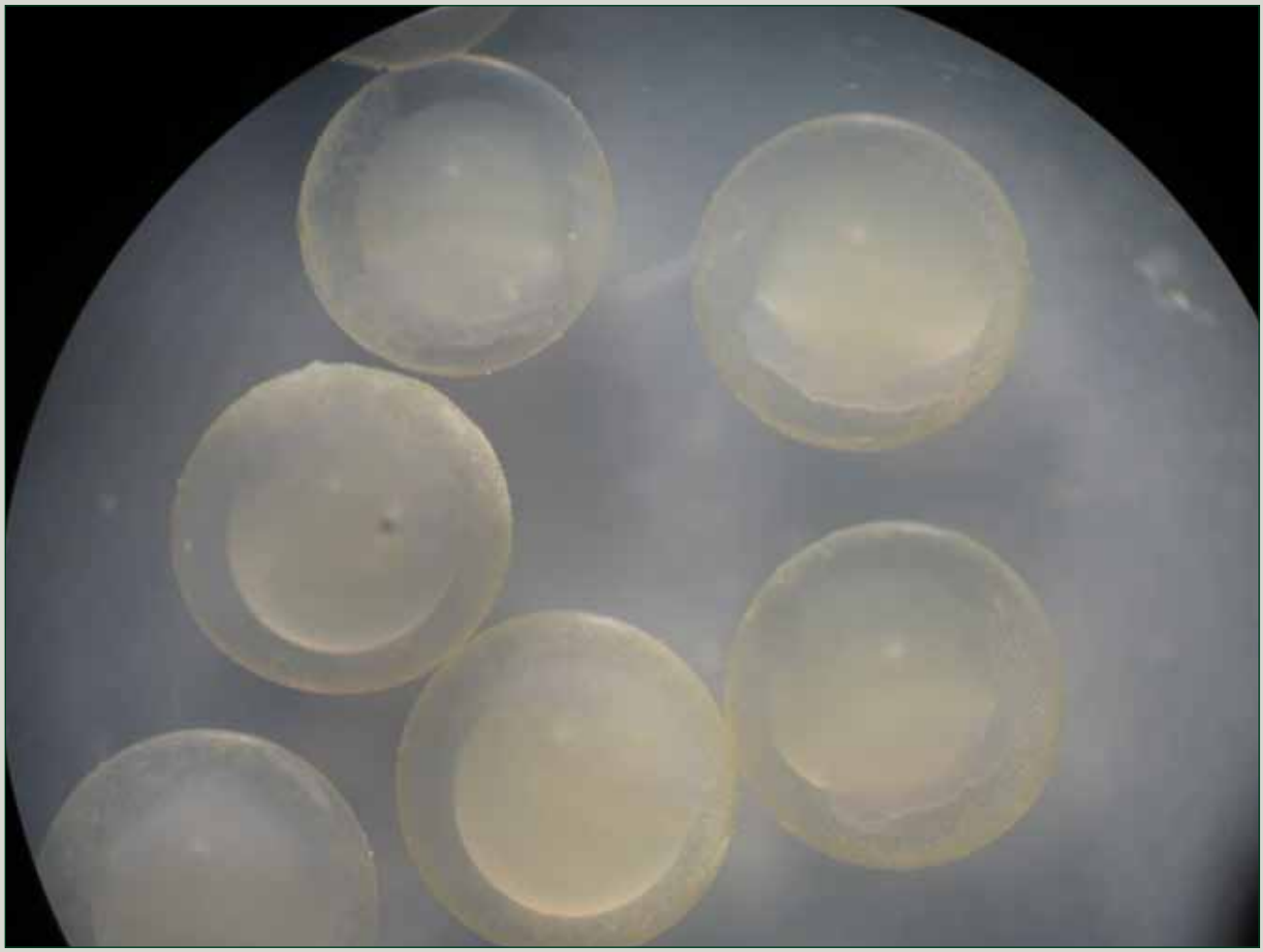

Fertilised eggs of Jullien's golden carp (*Probarbus jullieni*) bred in Thailand. The Thai Department of Fisheries used to operate several seasonal breeding stations on the Mekong River for this endangered species. Most have ceased operating with declining catches of mature fish during the spawning period. In this issue, we highlight the work being done at Ban Nam Phrai, where the last seasonal breeding station is located in Nong Khai Province (see page 12).

PHOTO: THEERAWAT SAMPHAWAMANA

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