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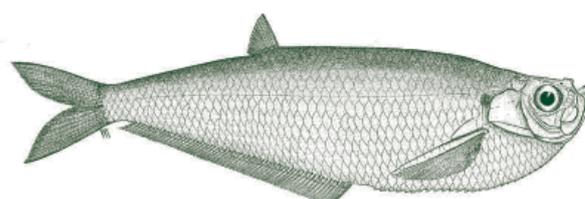
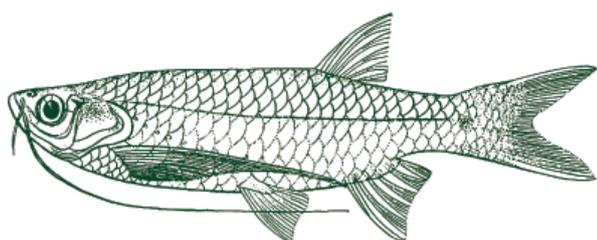
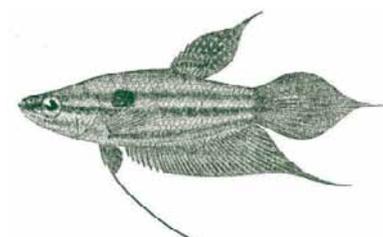
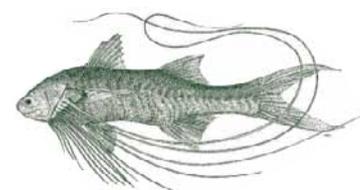
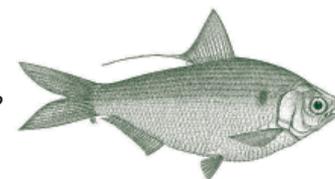
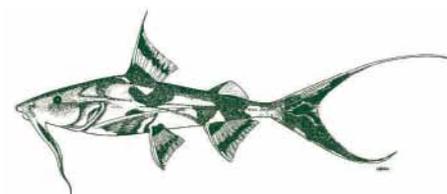
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Indochinese, Japanese researchers discover more than 88 species new to basin

Newly discovered fishes from Cambodia, Lao PDR and Viet Nam include 21 species new to science

In 2006, Japan's Nagao Natural Environment Foundation launched a five-year project to produce an inventory of fish species in the Mekong and Chao Phraya basins. The project aimed to develop a common understanding on sharing river resources with collaborative research and conservation efforts across the region. In addition, it aimed to develop a "sound national plan" for conservation in each country. Organisations taking part in the project included the Inland Fisheries Research and Development Institute (IFReDI) of the Cambodian Fisheries Administration, the National Uni-



versity of Lao PDR and Can Tho University in Viet Nam along with Srinakharinwirot University, Kasetsart University, Ubon Ratchathani University and Maejo University in Thailand.

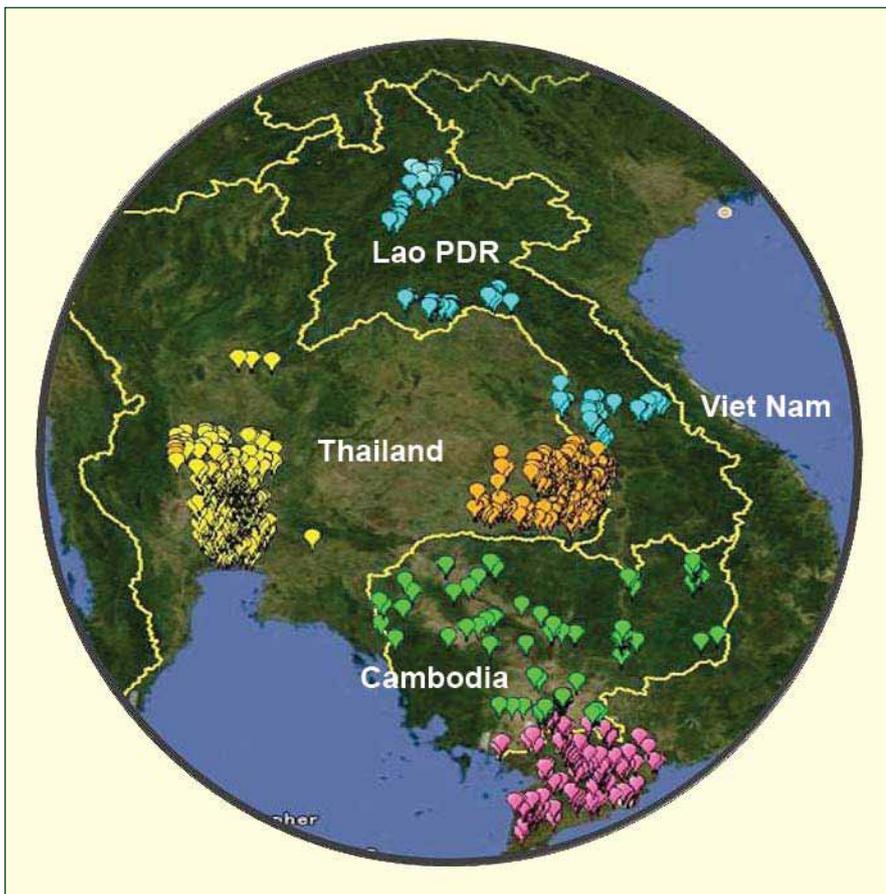
The project involved training on taxonomy and research methodology (in Thailand in 2007, Cambodia in 2008 and Viet Nam in 2009), field surveys, specimen management and inventory production. The field surveys photographed and identified

specimens collected from the Tonle Sap, the Mekong mainstream and tributaries in Cambodia, the Mekong mainstream in Lao PDR and almost all of the Mekong Delta in Viet Nam as well as the entire Mun River Basin and middle to lower stretches of the Chao Phraya River in Thailand (see map). Fish specimen rooms equipped with shelves, containers and preservatives were created in each country with microscopes, computers and cameras provided. The project also reviewed more than 700 papers and updated the scientific names of all species.

In Cambodia, Lao PDR and Viet Nam, 540 species were catalogued and preserved of which more than 88 were newly recorded from the Mekong. These included 21 undescribed species—12 in Lao PDR, 5 in Viet Nam and 4 in Cambodia (see table). Since Lao PDR is well studied by leading ichthyologists, the good number of undescribed species probably reflects variabil-

Field surveys

Sampling sites in the Lower Mekong Basin (green, blue, orange and pink) and the Chao Phraya Basin (yellow)



Comparison of new fish species records in three countries

	Species New to World	Species New to Mekong	Species New to Country
Cambodia	4	5	22
Lao PDR	12	1	1
Viet Nam	5	62	17

Source: Nagao Natural Environment Foundation

ity of habitat and difficulty of access. In Viet Nam, on the other hand, few studies of species diversity have been carried out in the Mekong Delta, especially in mudflat and mangrove areas. As for Cambodia, a systematic study was conducted in 1996 but has not been repeated.

Among targets for conservation, large species generate publicity but lack substantial data. What is needed is primary data on their life histories including larvae and juveniles. As for endangered species, numbers are too low to carry out research and there is no time to wait for results to be assessed. Immediate action therefore needs to be taken in areas such as artificial breeding and propagation as well as releasing or restocking these species while collecting scientific data through recaptures. Micro species are vulnerable to even

slight changes of environment and can be indicators of environment health. They also form an important part of ecosystems. Their habitats need to be maintained if they are to be conserved. Disregarding common species is not wise since a species could be composed of multiple sub-species, strains or populations. Extinction of a sub-species has the same magnitude as the extinction of a species. Since most common species are distributed across the region and are widely migratory, multi-national endeavours are essential.

The article is based on a keynote presentation by Dr So Nam, director of Cambodia's Inland Fisheries Research and Development Institute (IFReDI), to the Regional Symposium on Fish Diversity in the Mekong and Chao Phraya Basins, held in Sihanoukville in March. The symposium, sponsored by the Nagao Natural Environment Foundation, was chaired by Dr Nao Thuok, director general of the Cambodian Fisheries Administration.



Scientists from Japan and the Lower Mekong Basin who took part in the five-year project

PHOTO: NAGAO NATURAL ENVIRONMENT FOUNDATION

Lessons from Nam Houm Reservoir after ten years of co-management

BY SOMMANO PHOUNSAVATH, KAVIPHONE POUTHAVONGS AND WOLF HARTMANN *

With catches increasing from 37 tonnes in 2001 to 141 tonnes in 2009, people have more fish to eat and more income

The Nam Houm Reservoir is located about 30 km north of Vientiane Municipality. Built between 1978 and 1982, it has a catchment area of 108 km² and a maximum storage volume of 60 million m³ and a surface area when full of 12,000 ha. The reservoir is used for irrigation, water supply, navigation and fish culture in cages and pens, as well as capture fisheries. Before it was built, fisheries in the area were for subsistence only. After construction, the increased fishing area attracted not only the 3,300 villagers living around the reservoir, but

also people from outside. Fishing became more competitive and catches were mostly commercial. Numerous fishing methods were used, including illegal fishing gear (electrofishing and dynamite). As a result, fish catches declined due to overfishing and a lack of fisheries management. Local authorities and communities soon realised the need for management system to conserve and use fisheries resources sustainably.

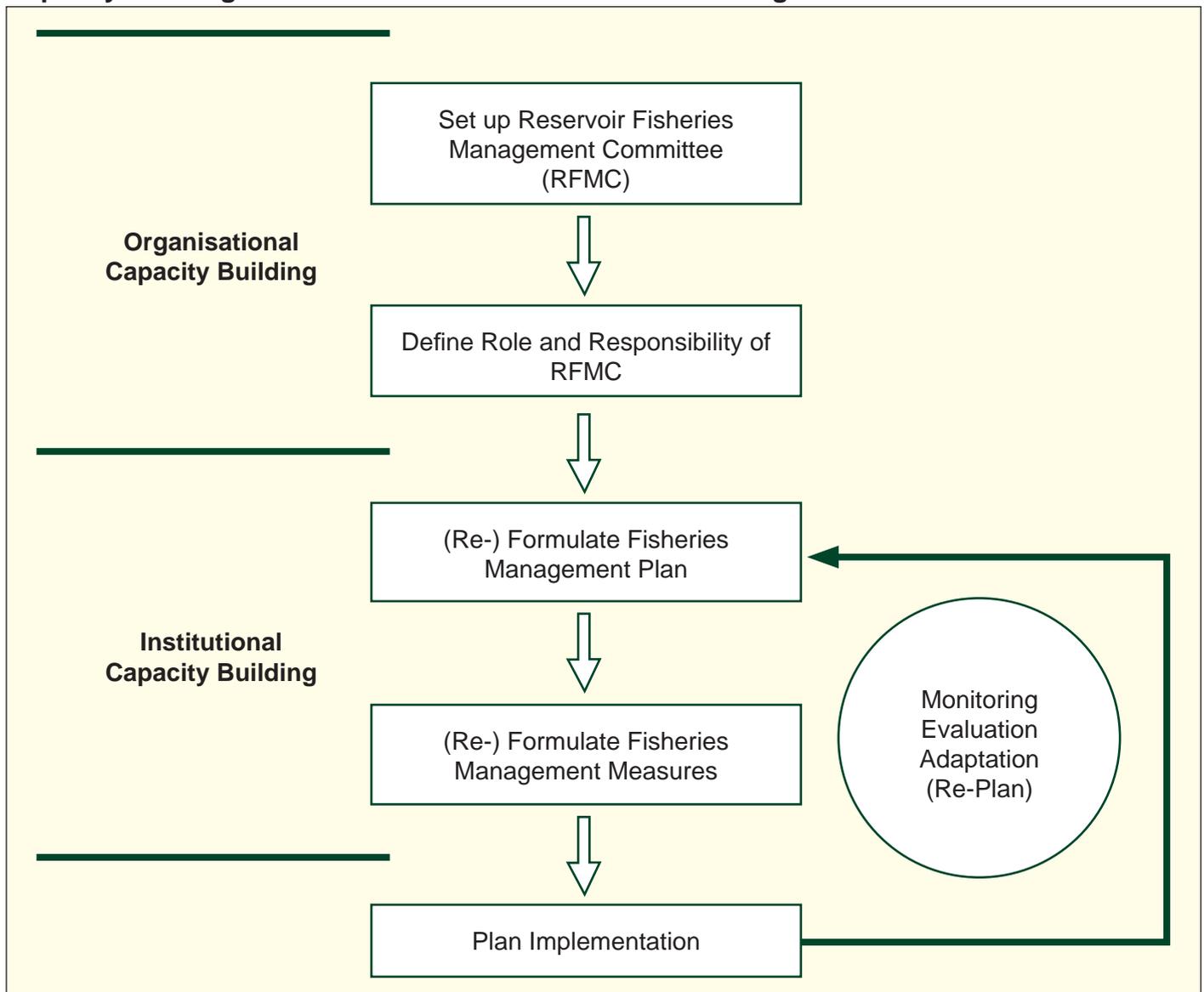
In 2000, the Management of Reservoir Fisheries Project of the MRC Fisheries Programme (later known as the programme's Fisheries Management and Governance Component) began working in Nam Houm. To identify problems and assess



Aerial view of the Nam Houm Reservoir, with aquaculture ponds downstream in the left background

PHOTO: KENT HORTLE

Capacity Building for Nam Houm Reservoir Fisheries Management Committee



needs to improve management, the project conducted a participatory rapid appraisal in the four fishing communities around the reservoir. The appraisal found that catches were decreasing due to illegal fishing and overfishing and that there were no proper management systems and a limited capacity to deal with management and enhancement.

Local users expressed the need to establish a management structure. The MRC project facilitated consultations with local users to set up a Reservoir Fisheries Management Committee in 2001 under an agreement with the district governor. The agreement included the roles, rights and responsibilities of the committee as well as its or-

ganisational structure and mode of operation. A Reservoir Fisheries Management Plan was drawn up with fishing regulations developed in consultation with local users. After various consultations at the village and district levels, the district governor approved the regulations in 2002. Five fish conservation zones were established—a permanently closed area where fishing is prohibited all year and four seasonal zones in small streams feeding into the reservoir which are closed during the main spawning season between May and August.

From 2001, the Fisheries Programme supported technical training for management committee members as well as provincial and district government staff. The training included participatory plan-



Training local people to use mobile fish hatcheries

PHOTO: SOMMANO PHOUNSAVATH

ning, monitoring and evaluation, establishing and managing conservation zones, cage culture, seed production techniques using mobile fish hatcheries, stock enhancement and fish processing. An office-cum-demonstration centre established in 2008 is used by the management committee for meetings, workshops, displays and distributing fisheries information and regulations to local people. Fish stocks are enhanced every year on July 13, which marks National Wildlife and Aquatic Animal Conservation Day in Lao PDR. The event aims to enhance fish production and create community awareness of the importance of protection and the sustainable use of fisheries resources. Cage culture, processing and marketing activities have led to the creation of a revolving fund, used to give small low-interest credits to local fishers. After ten years, many management aspects and

community livelihoods have significantly changed. The organisational structure of the management committee has been improved and strengthened and the role and responsibility of each committee member has been defined. With catches increasing from 37 tonnes in 2001 to 141 tonnes in 2009, the communities have more fish to eat and more income, improving their standard of living.

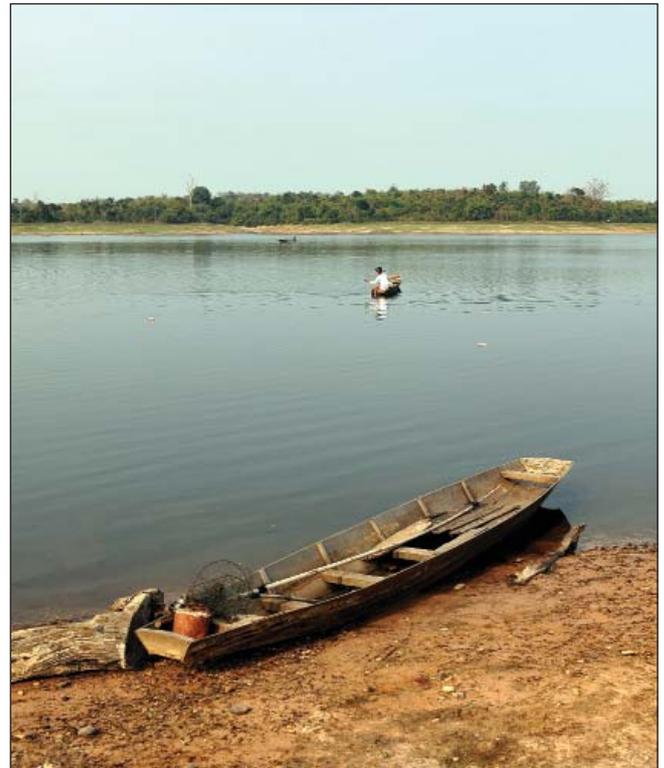
'We have to consider managing three factors—people, fish stocks and habitats'

To manage and use fisheries resources sustainably in small Lao reservoirs, experience with Nam Houm suggests we have to consider managing

three factors—people, fish stocks and habitats. To manage people, the project tried to improve the organisational structure and strengthen the capacity of the management committee. It also sought to improve regulation and enforcement, organise a fish marketing system and raise public awareness of fisheries co-management. To manage fish stocks, resources were enhanced via re-stocking and monitoring catch data. To manage habitats, fisheries conservation zones were subject to enforcement and patrols.

‘Many things still have to be done for the sustainable management of fisheries at Nam Houm’

“Although we have had some successful experiences, it is only a first step,” Management Committee Vice Chairman Thongmy Southammavong told the annual meeting of the Fisheries Management and Governance Component in December. “We understand that many things still have to be



Traditional boats are a common sight on the reservoir

PHOTO: KENT HORTLE



Stocking the reservoir

PHOTO: CHALEUNXAY PHOMMAVONGSA

Lao model for fisheries co-management

Over the past 10 years, the Nam Houm model of fisheries co-management has been highlighted at national, regional and international events. Visitors have included participants in the CGIAR Challenge Program on Water and Food, the International Forum on Water and Food and training organised by the Lao Ministry of Agriculture and Forestry (MAF), the Water Resources and Environment Administration (WREA), under the Lao Prime Minister's Office, the International Water Management Institute (IWMI) and the Stockholm International Water Institute (SIWI). Other visitors have included high-ranking members of the Lao National Assembly, the MAF and its Department of Livestock and Fisheries, the National Agriculture and Forestry Research Institute (NAFRI), and the National Agriculture and Forestry Extension Service (NAFES), as well as provincial and district agriculture and forestry offices and the provincial livestock and fisheries office. Guests from the MRC and donors such as Danida, SIDA and the World Bank have also visited the reservoir, along with organisations such as the Southeast Asia Fisheries Development Center (SEAFDEC), the Network of Aquaculture Centres in Asia-Pacific (NACA), the World Wildlife Fund (WWF), as well as projects and communities from different areas. There were also several visits by local delegations from within the country, including a delegation from southern provinces in 2007.



Residents of villages downstream from the Nam Theun 2 Hydroelectric Project in Khammouane Province visit the Nam Houm Reservoir

PHOTO: LAO DEPARTMENT OF LIVESTOCK AND FISHERIES



Fishermen with gillnets on the Nam Houm Reservoir

PHOTO: KENT HORTLE

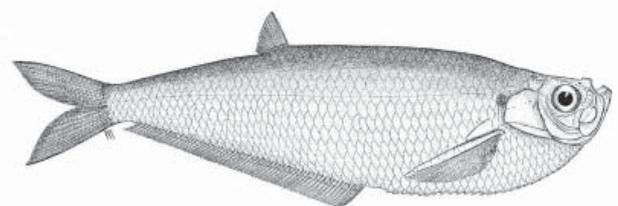
done for the sustainable management of fisheries at Nam Houm.” Despite the imminent termination of MRC project support, “we will continue to manage and protect our resources,” he said. Priorities include improving the fish marketing system, promoting fish processing and developing the revolving fund for processors, farmers and a marketing unit as well as establishing a fishing license system with fees. Mr Thongmy believes that income generated from some activities will be enough to cover the expenses of the management committee.

‘Fisheries co-management at Nam Houm reservoir is the first model for small-scale irrigation reservoirs in Lao PDR’

Fisheries co-management at Nam Houm reservoir is the first model for small-scale irrigation reser-

voirs in Lao PDR. The success over the past 10 years reflects strong support from local communities, district and provincial authorities and central line agencies such as MAF, NAFRI and the Living Aquatic Resources Research Centre (LARReC).

** Mr Sommano is a member of the technical staff at the Fisheries Division of the Department of Livestock and Fisheries of the Lao Ministry of Agriculture and Forestry, Mr Kaviphone is a MRC Fisheries Programme officer and Mr Hartmann is a consultant to the programme and the former coordinator of its Fisheries Management and Governance Component.*



Regional workshop on sustainable management of the Mekong River

By TUANTHONG JUTAGATE *

Scientists meet in Ubon Ratchathani to exchange recent research findings in the Lower Mekong Basin

Japan's National Institute for Environmental Studies (NIES) held a workshop on the Sustainable Management of the Mekong River at Thailand's Ubon Ratchathani University (UBU) in January. The workshop was a follow-up to the International Symposium on Fish Diversity, Fisheries and Aquaculture in the Mekong Basin, conducted by Ubon Ratchathani University in 2008. The primary objective of the NIES workshop, held in collaboration with the university, was to exchange recent research findings in the Lower Mekong Basin regarding fish

and fisheries, and to make these findings accessible to various stakeholders and decision-makers.

Ninety-six participants from eight countries joined the workshop, which had 9 oral and 18 poster presentations. The first oral presentation was by Mr Kent Hortle, chief technical advisor of the MRC Fisheries Programme, who illustrated the size and current trends in Mekong fisheries as well as threats to the fisheries. The second oral presentation was by Dr So Nam from Cambodia's Inland Fisheries Research and Development Institute. (IFReDI). He outlined recent comprehensive analyses variations, over both space and time, of the Dai fishery which reflected fish migratory behav-



Workshop participants in Ubon Ratchathani

PHOTO: MASAMI DAITO

iours. Dr Sinthavong Viravong, from the Living Aquatic Resource Research Centre (LARReC) in Lao PDR, provided information on fish larvae diversity and abundance in the Mekong main stem. By applying a field data with multivariate analyses, Dr Viravong also figured out the spatio-temporal patterns of fish larvae along the main stem.

Changes in fish communities after impoundment in four large reservoirs of Thailand were investigated by long time series data (20 years) and presented by Dr Tuanthong Jutagate (UBU). The results showed the contribution of exotic species in fish landings as well as changes in mean trophic level. Dr Bin Kang, from the Asian International Rivers Center in China, raised issues about Mekong fish myths and related topics that urgently need to be understood to sustain the integrity of the Mekong fishes and fisheries. At the end of Day 1, Dr Eric Baran from WorldFish Centre illustrated the impacts of dam construction on fish production in the Basin. He proposed options to avoid these impacts by rethinking dam locations and dam design.

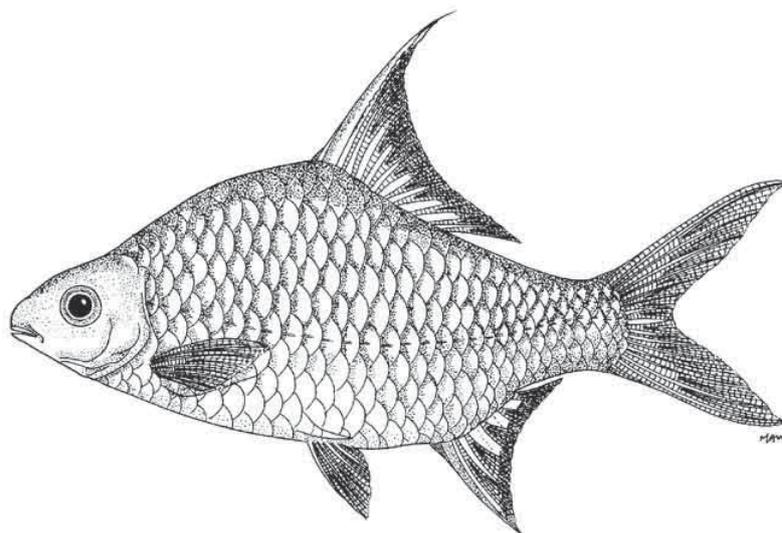
On Day 2, Dr Michio Fukushima (NIES) made a presentation on a state-of-the art study on fish migration by using otolith microchemistry. The migration pathway of Siamese mud carp (*Henicorhynchus siamensis*) in the Lower Mekong Basin was demonstrated. The preliminary results indicated that *H. siamensis* collected from northeast of Thai-

land and northern Cambodia most likely originated from different local populations breeding at different locations and migrating through different corridors.

Dr Shinsuke Morioka from the Japan International Research Center for Agricultural Sciences (JIRCAS) presented on his collaborative work with LARReC on the growth and reproduction of small-sized fishes in central Lao PDR. The results indicated that temperature was regarded as a key factor, which governed growth and reproduction. Implications of the study can be further applied for efficient stock management. The last oral presentation was given by Mr Khamsai Inthavong from WWF Greater Mekong who discussed WWF programmes to support food security and biodiversity in the Mekong, especially in terms of the impact of hydropower development and the conservation of threatened aquatic animals.

The poster presentations were involved in various aspects related to the Mekong River such as sediment transportation, flora diversity in mangroves, fish biodiversity, aquaculture and socio-economics.

* Dr Tuanthong is a lecturer with the Fisheries Programme of the Faculty of Agriculture at Ubon Ratchathani University. Abstracts of presentations to the workshop can be accessed at http://www.nies.go.jp/asia/mekong_workshop2011/Workshop_proceeding/oral_index.htm



Mekong catfish processor wins top prize for best retail product at European expo

Achievement expected to reassure consumers in the leading market for Vietnamese catfish producers

Illustrating how far the Vietnamese catfish export industry has come over the past decade, a company from the Mekong Delta won the top prize at the annual European Seafood Exposition in Brussels in May. Vinh Hoan Corp, based in Dong Thap Province next to the Cambodian border, announced in March that two of its value-added frozen catfish products were among 38 finalists from 14 countries in the annual Seafood Prix d'Elite.

On May 3, organisers announced that its “Provo-

cake” entry (see below) had won top prize as best retail product for 2011. It features Sutchi river catfish (*Pangasianodon hypophthalmus*) and black tiger prawn (*Penaeus monodon*), the two most widely farmed species in the Mekong Delta, with mushrooms and asparagus. The company’s second entry, “Basa Burger”, was also made from farmed river catfish and tiger prawn but failed to win a prize.

Vinh Hoan was competing in a field that included some of Europe’s top fish-processing companies. In the food service category, French company Halieutis won top award for a product made from pacu (*Colossa macropomum*), a freshwater spe-



Provocake, the prize-winning entry made from catfish, shrimp, mushrooms and asparagus

PHOTO: VIETFISH



Vinh Hoan Deputy Director General Nguyen Ngo Vi Tam (second from left) and other prize winners at the awards ceremony in Brussels on May 3

PHOTO: WWW.PRIXEDELITE.COM

cies from the Amazon farmed in South America and now also an invasive species in the Mekong. Other awards for health and nutrition, convenience, packaging and originality went to companies from Denmark, Belgium and Britain. In 2009, Vinh Hoan won a Prix d'Elite prize in the health and nutrition category for its "Seafood Harmony" product made from marine and brackish water species. Its valued-added farmed catfish products have previously won gold medals at the annual Vietnam Fisheries International Exhibition.

Sena De Silva, director general of the Network of Aquaculture Centers in Asia Pacific (NACA) in Bangkok, said the Vietnamese company's winning of the top prize in Brussels was "great news" for the aquaculture sector in the Mekong Delta. "All this goes to prove that some of the stories carried by the media are not entirely correct," Dr De Silva said. "It also confirms that the quality of Vietnamese catfish has been improving all the time to meet the stringent requirements of food quality

and safety, which is becoming evident by the very significant decline in the Rapid Alert Notifications issued by the EU."

Flavio Corsin, director of the International Collaborating Centre for Fisheries and Aquaculture Sustainability (ICAFIS) in Hanoi, made similar remarks "This is a great achievement that shows how pangasius is moving from being a cheap and 'simple' product to offering appealing value-added options," he said. "It witnesses the increasing shift we are observing in the sector, from a 'quantity' way of thinking to a 'quality' mentality." Dr Corsin said this was also reflected by the number of enterprises and organisations committed to sustainability efforts such as the Aquaculture Stewardship Council formed by WWF and the Dutch Sustainable Trade Initiative in 2009. "Hopefully, these efforts will be recognised by the pangasius critics who seem to have been selectively picking on issues needing improvement while completely neglecting the major achievements of the sector."

Children: the forgotten stakeholders in fisheries management

BY THOMAS AUGUSTINUS, WOLF HARTMANN AND MAJBRITT AUGUSTINUS *

Children fish, and they do it frequently and effectively. Evidence suggests that children contribute up to 50 percent of the effort in some local fisher-

ies. However, children are largely forgotten when governments address different stakeholders in inland fisheries management.



Children playing on the Mekong River in southern Lao PDR

PHOTO: KAVIPHONE PHOUTHAVONGS



Spearing fish on the Nam Song River

PHOTO: THOMAS AUGUSTINUS

In the autumn of 2009, research was carried out for a book that looks at child play in six countries on three continents. While working on the Southeast Asian section, devoted to child play in Lao PDR, it quickly became apparent that children who live along the Nam Song River spend most of their spare time 'playing' along the river for two to three hours a day. In fact, most play involves fishing-related activities such as fishing with home-made spearguns or scooping with nets for small fish, shrimps and aquatic insects. At the end of the day, the children bring home the catch, usually between 200 and 500 grams of fish which are mostly small and consumed by the entire family at dinner.

The behaviour of the children living along the Nam Song River in central Lao PDR is not unique. Studies from other parts of the Lower Mekong Basin suggest that children contribute significantly to fisheries. A survey among 179 households in

Luang Prabang Province in northern Lao PDR showed that about 48 percent of those actively involved in fishing were children under 15 years old (Sjorslev 2000). A similar study from Cambodia showed that between 4 and 25 percent of all fishers in one part of Battambang Province were children (Hortle et al. 2008).

In recent years, fisheries managers have paid more attention to the role that different actors play in Mekong fisheries. This distinction between different actors has typically focused on gender, specific roles in fisheries or traditional associations with fisheries. When children are mentioned, it is usually to note that fish is an important part of their diet. The fact that children are resource users, together with millions of adult men and women who fish every day, is largely ignored by fisheries managers.

For many children, fishing may be viewed simply as play. But the rest of the family also benefits as nutrient-dense foods are brought back home. Moreover, children learn independence and self-reliance and, as they experiment with various types of fishing gear, they build their motor skills and knowledge and also become familiar with the behaviour of river fish in general. Ultimately, this 'play' may build valuable competence for their adult lives as bread-winning fishers or in other occupations.

Given the numbers involved and their effectiveness as fishers and hunters, children could have large impacts on resources. Recent observations in

northeast Thailand suggest that there has been an increase in bird populations.

'Children could have large impacts, on resources'

A plausible explanation is simply that with increasing economic development, children have stopped hunting birds and instead spend their spare time playing video games. This is an example of the huge cumulative impact that thousands of 'child-hunters' can have on a resource.



Other aquatic animals

PHOTO: THOMAS AUGUSTINUS



Children enjoy fishing during the flood season in central Lao PDR

PHOTO: KAVIPHONE PHOUTHAVONGS

Children living along the Nam Song River will most likely not have access to video games for years to come. Instead, they will continue to harvest fish and other aquatic animals. Often this is done with tools that target juvenile fish, making their activities potentially destructive to the resource. However, their 'play' along the river is of great value to their families by providing food and additional benefits for themselves in building important life skills.

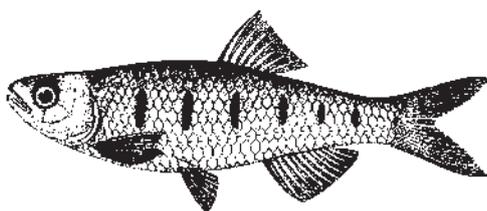
Given the large impact that children have on many local fisheries, there is an obvious need to involve them as stakeholders in fisheries management. The question then is how is this done most appropriately?

* *Thomas Augustinus is a natural resources management consultant with Dokumentar Gruppen in Denmark, Wolf Hartmann is a consultant with the MRC Fisheries Programme and Majbritt Augustinus is a journalist and author of a book on children and play.*

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Is the potential of food-led development through capture fisheries being missed?

BY ROBERT ARTHUR AND RICHARD FRIEND *

Food and food security lie at the very heart of notions of well being and development. In the Lower Mekong Basin, a critical source of food – even for people with poor diets and nutrition levels – has traditionally been the fish and aquatic resources that the river system supports. Despite high rates of national economic growth, nutritional status remains poor among many people. Yet within current regional debates about water resources development and poverty reduction, this food source appears as a potential trade-off in favour of other uses of water resources.

Securing food should be at the centre of development strategies in the region. However, when fisheries are considered in debates about water resources, the focus of attention is on potential impacts to fisheries. Rather than representing an objective of development, capture fisheries more often appear as a cost – to be mitigated and compensated. Yet fisheries and fish play critical roles in livelihoods across the region, making important contributions to income, health and nutrition.

That these food questions have been downplayed is perhaps due to the marginalisation of fishers and fisheries in regional debates. Fisheries can easily be presented as if they are doomed in any event and therefore as an unfortunate but necessary trade-off to economic growth. While fisheries production is recognised as high and many people catch or eat fish, there is a sense that this represents a dependency that is, in turn, a factor in people being poor. Put crudely, poor people fish - and because people fish they are poor.

With fisheries portrayed as being in crisis, positive options are seen as lying outside the fisheries sector, moving fishers out of fishing. The danger becomes that an important resource for millions of people is lost or replaced by substitutes over which local people may have less control. There are alternative ways to approach fisheries and the

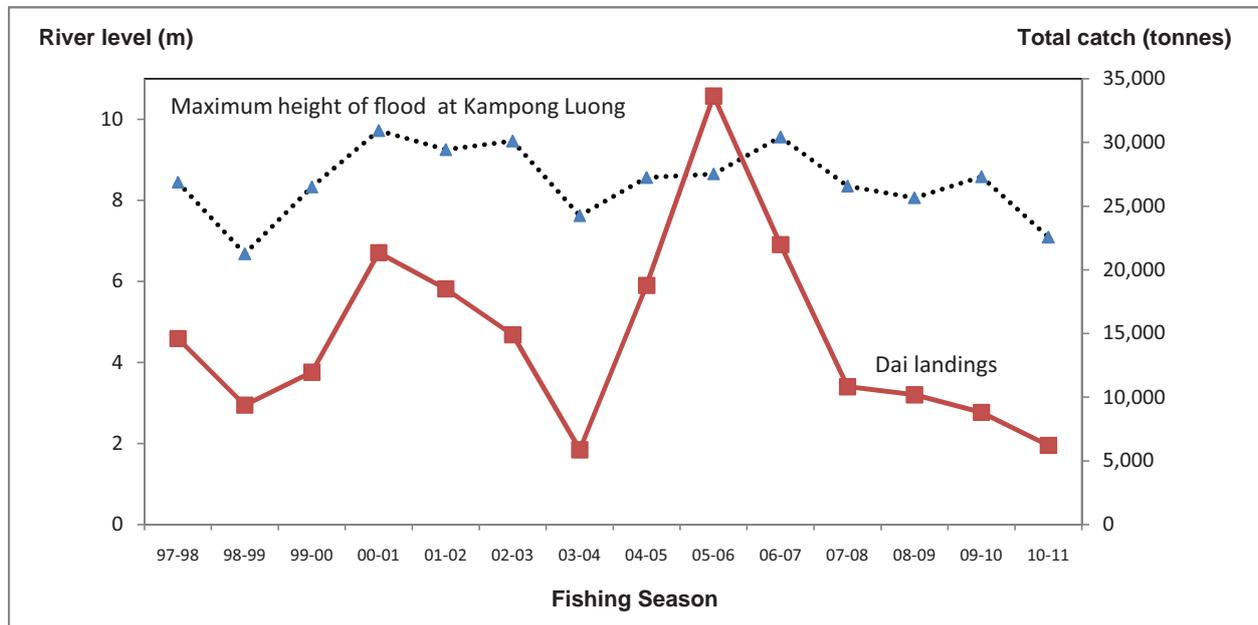
food benefits that they create, but this means we need to be asking different questions. For example, what would happen if food was placed centre stage, and this became the starting point for planning development? What options are there? What kinds of water resources management initiatives would then be prioritised?

‘Framing development as a trade-off between food and economic growth is inconceivable’

Having established the scale and importance of capture fisheries, the challenge now is to demonstrate a more integral role in supporting regional development, highlighting the potential that fisheries management continues to hold for strengthening the independence and self-reliance of rural people. Given the importance of fish as food, and of food to achieving developmental goals, framing development as a trade-off between food and economic growth is inconceivable. This problem goes beyond fisheries. It is essentially what we take as the starting point for development. Without romanticising rural livelihoods, these livelihoods and local food capabilities, including access to and control over the resources on which they depend, can represent a focus for support, building on existing strengths rather than addressing perceived weaknesses or attempting to replace existing livelihoods. But to achieve this means fishers themselves must be leading players in development debates while other factors in people being poor, primarily health, water and sanitation, and agricultural extension are also addressed.

* Dr Arthur is a senior consultant for MRAG Ltd in London and Dr Friend is an independent consultant based in Bangkok. This commentary is an edited version of arguments presented in their paper *Inland capture fisheries in the Mekong and their place and potential in food-led regional development* published in the journal *Global Environmental Change* in 2011.

Dai catches, 1997-98 to 2010-11



The annual fish catch from the dai (stationary trawl) fishery on the Tonle Sap River continued to decline in the latest season, according to data collected by the Cambodian Fisheries Administration. Total landings were 6,211 tonnes in the six months to March 31, down 27 percent from 8,566 tonnes in the previous season. The continuing decline can be attributed mainly to lower aquatic productivity as a result of low river flows and very limited flooding, caused by drought. The figure shows that the dai catches in most seasons were well-correlated with maximum flood height (which is itself correlated with river flows and extent of flooding). The unusually high catches over three seasons (2004-2007) coincided with high densities of fish fry and larvae recorded in separate monitoring. Maintaining or increasing production in the system depends upon flood extent and duration as well as spawning success and recruitment of fry. Located in northern Phnom Penh and Kandal Province, the dai fishery is the largest commercial fishery regularly monitored in the Lower Mekong Basin. The Inland Fisheries Research and Development Institute (IFReDI) of the Fisheries Administration has been monitoring the fishery with MRC support since the 1997-98 season. The latest catch is the lowest since the severe drought of 2003-04 when landings dropped to 5,869 tonnes.



Fishermen unloading a catch from the Dai fishery

PHOTO: NGOR PENG BUN

Developing fish-passage criteria for floodplain species in central Lao PDR

The Australian Centre for International Agricultural Research (ACIAR) recently completed a project to develop fish-passage criteria for floodplain species in central Lao PDR. The following is based on the executive summary in the final report * in 2010.

In the absence of information on how to build effective fish passes in the Lower Mekong Basin, the Australian Centre for International Agricultural Research launched a project in 2008 to develop such criteria for floodplain species in central Lao PDR. The project aimed to complete a proof-of-concept study to demonstrate the benefits of fishway construction. A team of Australian and Lao scientists collaborated with Thailand to complete a series of experiments investigating the potential to use vertical slot fishways to restore connectivity between the Mekong River and a small floodplain wetland. The team constructed an experimental fishway facility to demonstrate the potential for this technology to rehabilitate floodplain fisheries in central Lao PDR. This involved engaging the local community and gathering support for the work through a series of meetings and workshops. Establishing a local network of contacts and actively involving villagers in the work led to the timely construction of an experimental facility which was installed at a floodplain regulator in Pak San.

Experiments were highly successful and exceeded initial expectations. Main achievements for the project included:

- the passage over 46 days of more than 15,000 fish from 108 species through the experimental structure, including threatened species such as Jullien's golden barb (*Probarbus jullieni*);
- determination of appropriate cues for migration activity and an increased understanding of Mekong River fish ecology;

Absence of information

Work by the Mekong River Commission and the fisheries agencies of Cambodia, Lao PDR, Thailand and Viet Nam have demonstrated that valuable commercial and subsistence fishery stocks undertake migrations that are significant for survival, growth and reproduction. Barriers to migratory fish movements are therefore a key threat to the future subsistence and commercial use of these fisheries resources. Increasing development of Lower Mekong floodplains must consider potential impacts on fish passage because migratory fish form the major source of animal protein for most rural communities in the basin.

Fishways have been partially effective in maintaining pathways for migratory fish in order to prevent population declines. The construction of effective fishways requires targeted experimentation that seeks to develop the fish swimming criteria necessary to facilitate the passage of target species. Fish passage management guidelines are currently poorly defined in Lao PDR and other lower Mekong countries. This is partly because the empirical criteria required to construct effective fishways are yet to be developed. Presently, the absence of such information has river development projects progressing without the necessary requirements for fish passage. Whilst immediate effects may be localised, the long-term obstruction of fish passage will inevitably create large-scale declines in upstream and downstream fish assemblages. This will threaten the sustainability of many river communities reliant upon fish as a vital resource throughout the Mekong Basin.



The experimental fishway installed on a floodplain regulator at Pak Peung, central Lao PDR

PHOTO: LEE BAUMGARTNER

- the identification of a suitable design (vertical slot fishway) and optimal characteristics (1:15 slope) which can facilitate passage of high numbers of fish in both Lao PDR and Australia;
- increased awareness for potential to apply fish-passage technology to help rehabilitate floodplain fisheries in central Lao PDR;
- a review of the operation of existing fishway facilities in Thailand and Cambodia and direct involvement of district and village staff in experimental and construction work;
- raising the profile of fish-passage restoration and floodplain health with donor organisations (World Bank, Wetlands Alliance, World Wide Fund for Nature), riparian governments (Lao PDR and Thailand) and professional staff in both Australia and Lao PDR;
- direct demonstration that fishways can provide passage for many species of fish at floodplain regulators, which will help generate ecological outcome and provide food security for communities reliant upon wetland capture fisheries;
- dissemination of project activities and results through two major workshops, a local study tour and the preparation of scientific manuscripts; and



The project team successfully re-establishes the fishway after high river flows

PHOTO: LEE BAUMGARTNER

- identifying knowledge gaps and future research priorities which are necessary to help to rehabilitate degraded fisheries and improve the economic livelihood of river communities throughout the Lower Mekong Basin.

The project successfully achieved the objective of demonstrating that vertical slot fishways can provide passage for Lower Mekong fish species at low-head weirs. Results suggested that a vertical slot fishway constructed on a 1:15 (6%) slope with small slot widths (150 mm) and moderately sized cells (1,000 mm X 1,500 mm) was suitable for the majority of migratory species and size classes in Central Lao PDR. However, some species which prefer fast flowing water may not ascend a fish-

way on this slope. Migration rates were substantially influenced by river flow which suggests that the design of permanent fishway installations must make careful consideration of local hydrology to perform efficiently. Fishway efficiency must be optimised at times of water level increases to ensure maximum fish-passage rates. Careful consideration of these design aspects will provide functional fishways that have potential for widespread application. However, it should be recognised that the present study focused only on providing passage at floodplain regulators. The results cannot be applied to high-head mainstem dams where migratory biomass and hydrology necessitate an entirely different set of design criteria, which are yet to be determined.



Removing fish from the experimental fishway

PHOTO: LEE BAUMGARTNER

The major outcome arising from this work is the realisation that development projects seeking to construct floodplain regulators could now provide fish passage by applying vertical slot fishways to the optimal design specifications. The species composition and total abundance of fish caught as part of this initial study demonstrate that a vertical slot fishway would be suitable at low head weirs, although other alternative low-cost designs should be considered to increase the potential for wider application at other wetlands throughout the Lower Mekong Basin. The long-term benefits of this work will help to rehabilitate wetlands and assist millions of people who rely on floodplain fisheries for food security and income. ACIAR has recently committed to a 5-year extension of this project, which will see the experimental work extended to southern Lao PDR and collaboration with the Wetlands Alliance to extend the outputs into Northern Thailand. Further work on the social and economic benefits of fishway construction is planned to provide quantitative data regarding rehabilitation of floodplain fisheries following the construction of permanent fishways

* Baumgartner, L and G Thorncraft, T Marsden, O Phonekhampeng, D Singhanouvong, I Stuart and U Suntomratana (2010) *Development of fish passage criteria for floodplain species of northern Laos*. Australian Centre for International Agricultural Research.



Lao scientists process a catch from the experimental fishway

PHOTO: LEE BAUMGARTNER

Thai company develops footwear and accessories from tilapia skin

Tilapia leather is seen as an environmentally friendly alternative to snake and crocodile skin

In Thailand, red throat tilapia (*Oreochromis mossambicus*) was introduced from Malaysia in 1949 while Nile tilapia (*Oreochromis niloticus*) was introduced from Japan in 1965. Nile tilapia and a hybrid of the two species are now the country's most widely farmed fishes. In 2007, Thailand produced 213,000 tonnes of tilapia worth more than \$200 million, accounting for 42 percent of the country's aquaculture production in terms of volume.

Among the country's tilapia processors are Xianning Seafood Co Ltd, a Thai-Taiwanese venture established in 1996 with initial capital of 100 million baht (\$3.3 million). Its factory, located on a 6.4 ha site in Petchaburi Province south of Bangkok, employs 1,000 people and produces frozen shrimp as well as tilapia (whole, gutted and scaled, regular fillets and breaded fillets). Tilapia skins are an important byproduct which was previously sold to snack vendors. Today, however, the skins are processed into various leather products, notably women's shoes and handbags. The leather products are also marketed through a subsidiary, Jerada Leather and Product Co Ltd. Established in 2006, Jerada is also located in Petchaburi Province, but maintains a separate website from the parent company.

'At first it was very difficult to develop the market and get the acceptance of buyers as people did not know about or believe in tilapia skin products'

"At first it was very difficult to develop the market and get the acceptance of buyers, as people did not know about or believe in tilapia skin products," says Pongsaton Rujira, the company's manag-

FAO on value-added fish products

According to the Food and Agriculture Organisation of the United Nations (FAO), there are several factors that explain the choice to add value to products. On one hand, producers and exporters aim at satisfying the increasing demand for value-added products from consumers, aided by demographic and economic changes. At the same time, governments of countries with fish resources wish that value addition takes place in their own countries rather than in the importing country as it is thought to benefit job creation and higher economic activity. However, a number of factors make the strategy of value-addition quite complex and not at all clear-cut. On the other hand, value-added products generally face higher import duties than unprocessed products or raw materials. At the same time, value addition frequently involves large investments in buildings and equipment. This not only decreases flexibility and increases vulnerability in situations with uncertain supplies of raw material, which often is the case for many fish stocks, but also channels large amounts of scarce economic resources into fixed capacity. In addition, production, sales and distribution of value added products often require large economic resources for marketing and promotion, which smaller companies usually do not possess. In conclusion, value-added production is just one of many possible strategies that must be considered by a company or by a policymaker. Alternative uses of the relevant economic resources must be evaluated in order to arrive at the optimal long-run strategy.

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FAO (2005-2011) Fisheries and Aquaculture topics. Value-added products and trade. Topics Fact Sheets. Text by Audun Lem. In: *FAO Fisheries and Aquaculture Department* [online]. Rome. Updated 27 May 2005. [Cited 22 May 2011]. <http://www.fao.org/fishery/topic/13291/en>



Handbag

PHOTO: JERADA LEATHER AND PRODUCT CO LTD

ing director. “So we tried to cooperate with brand names which have been accepted not only in Thailand but also outside countries as we thought the market for these products would expand.” Jerada currently produces more than 100 tilapia skin products. A recent company catalogue featured keychains from 100 to 200 baht (\$3 to \$6), footwear from 300 to 600 baht (\$10 to \$20), wallets from 450 to 1,600 baht (\$15 to \$53) and women’s handbags from 1,700 to 5,000 baht (\$57 to \$167).

In an interview with the *Bangkok Post* published in May, Mr Pongsaton described tilapia leather as an environmentally friendly substitute for

snake or alligator skin with a similarly exotic appearance. “I used to work in the department of research and development at a factory that exported tilapia meat, and thought there should be a better way to make use of the skins—100,000 pieces a month—that were being peeled off and sold off as scrap,” he was quoted as saying “In the past, we sold them to local vendors for 2 or 3 baht per kilogramme, to be cooked as deep-fried fish snacks ... Then, I learned that salmon skin could be made into leather, and I thought there might be a possibility to do the same with tilapia.”

Mr Pongsaton told the newspaper that the com-



Wallets

PHOTO: JERADA LEATHER AND PRODUCT CO LTD



Footwear products include stilettoes

PHOTO: XIAN-NING SEAFOOD CO LTD

pany achieved better than expected results when it introduced tilapia products to an international leather trade fair in the United States. “Many people found it exotic,” he reportedly said. “We were very surprised to be approached by many designers from different countries. People bought all our samples that we had meant only to show. Our booth was literally empty once we left.”

‘Tilapia leather has proved popular among foreign designers. However, the price of the material seems to be an obstacle for major local use’

Although the company’s website is in Thai only, “80 percent of our clients are international,” Mr Pong-

saton told the *Bangkok Post*. “Being a rare material and so-called environmentally friendly since it is produced from a non-endangered animal, tilapia leather has proved popular among foreign designers. However, the price of the material seems to be an obstacle for major local use.” Mr Pongsaton was also quoted as saying that the company was hoping to develop a technique to seal small pieces of tilapia leather together. “One of the flaws of the fish skin is its size, which sometimes doesn’t meet designers’ needs,” he told the newspaper. At the same time, “our team is now working on a special project to develop tilapia leather for bulletproof jackets. We are going to show the world how extraordinary an ordinary fish can be.”

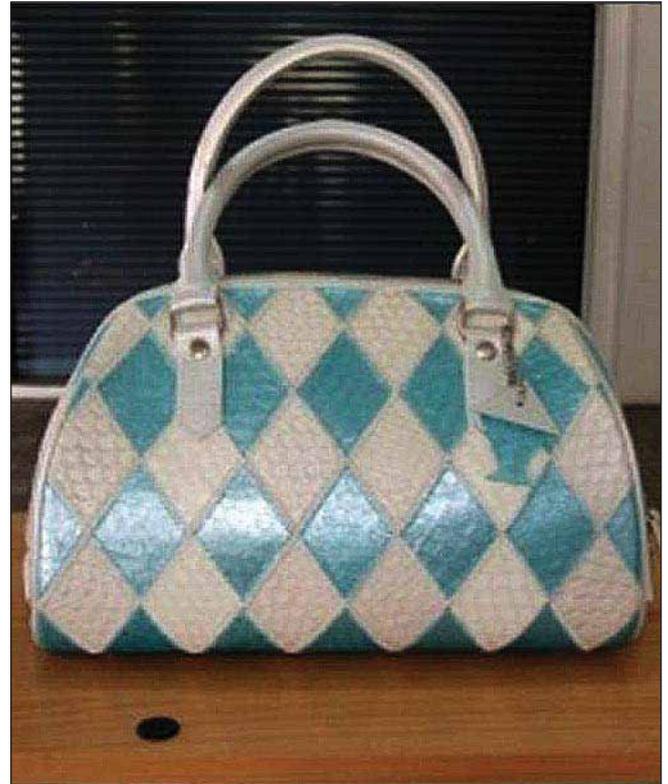
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Mekong River Commission (2010) *State of the Basin Report 2010*. Mekong River Commission. Vientiane.

Welcomme, R. and Chavalit Vidthayanom. 2003. *The impacts of introductions and stocking of exotic species in the Mekong Basin and policies for their control*. MRC Technical Paper No. 9. Mekong River Commission. Phnom Penh. 38 pp. ISSN: 1683-1489.

Xian-ning Seafood Co Ltd (www.xianningthai.com)



Handbag

PHOTO: JERADA LEATHER AND PRODUCT CO LTD



Chitralada 3 strain of tilapia from Thailand

PHOTO: DEPARTMENT OF FISHERIES, THAILAND

Five years of fisheries research in the Central Highlands of Viet Nam

A rare glimpse at a frequently overlooked part of the Lower Mekong Basin

Regular readers of *Catch and Culture* will be aware that we have given considerable coverage to the activities of the Research Institute for Aquaculture No 2 (RIA2) in Ho Chi Minh City over the years. Not so for Research Institute for Aquaculture No 3 (RIA3) in Nha Trang which is also a partner of the MRC Fisheries Programme. Although its primary focus is marine fish and other aquatic animals, RIA3 also conducts significant research into freshwater fisheries in the Central Highlands of Viet Nam. This is a frequently overlooked part of the Lower Mekong Basin, with several provinces bordering northeast Cambodia being the sources of two major Mekong tributaries, the Se San and Sre Pok Rivers. To redress this imbalance, we publish below the English-language abstracts of selected articles from a Vietnamese-language publication summarising five years of technological and scientific research by RIA3. We hope they serve as a useful introduction to some of the important fisheries issues faced by people living in the Central Highlands part of the Lower Mekong Basin.

Three districts in the Srepok River Basin

Buon Don and Krong Ana districts in Dak Lak Province and Cujut district in Dak Nong Province cover an area of 2,485 km² accounting for 13.6% of the Srepok River Basin in the Central Highlands of Viet Nam. A survey of fisheries and socio-economic status carried out by the Vietnamese sub-component of the Fisheries Management and Governance Component of the MRC Fisheries Programme found about 1,200 fishers in the three districts, accounting for 0.35% of the total population of about 342,800 people.

Ethnic minorities accounted for 77% of all fishers. Since most riparian fishing communities are poor with members having little formal education, capture fisheries play an important role in providing daily food. Fishing gear used in the basin is relatively diverse with more than 20 types such as

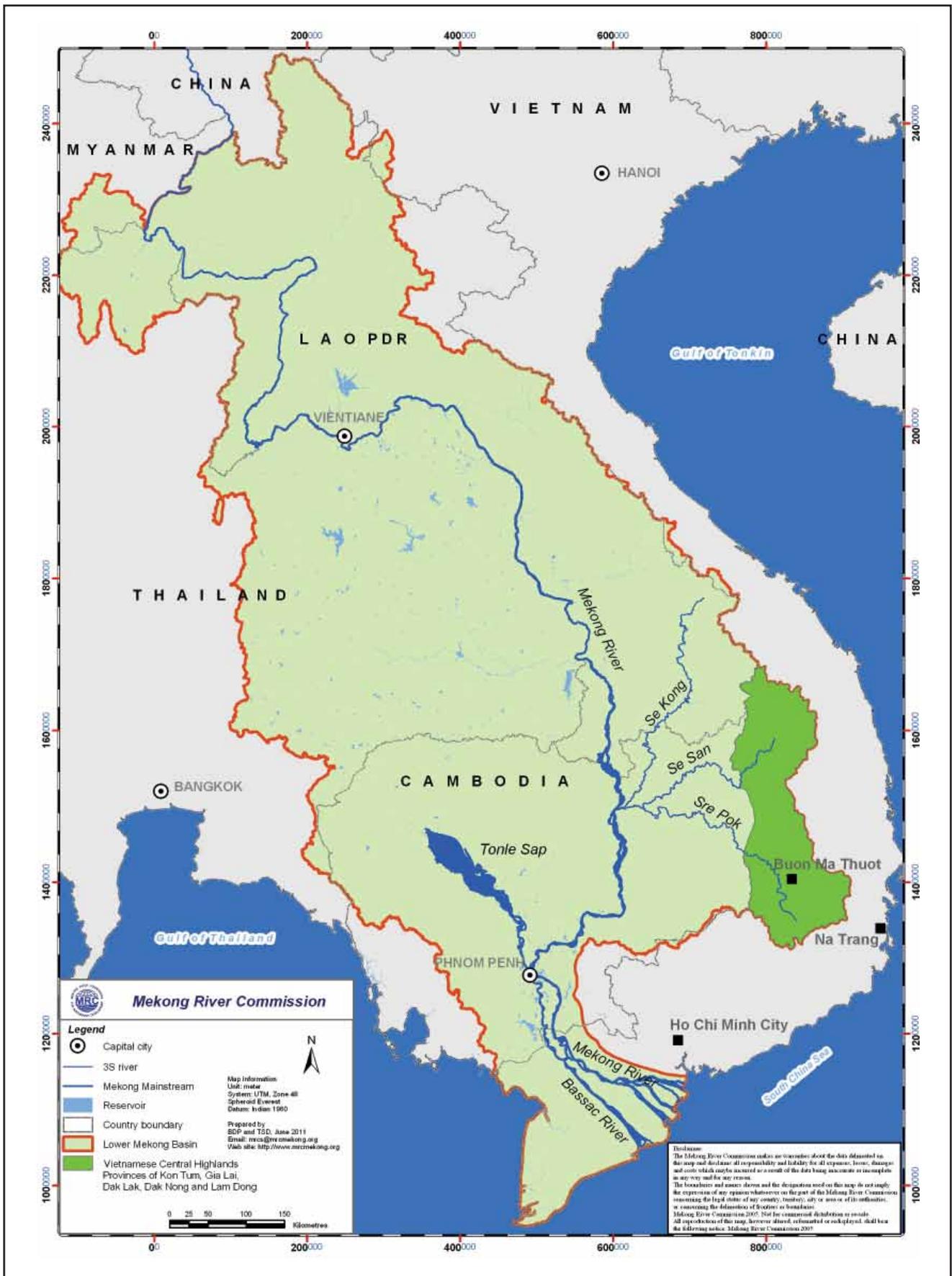
gill nets, cast nets, trawl lines, electrofishing, trap nets, blasting, poisoning, traps and lift nets.

Fish fauna and other aquatic animals are abundant with an initial survey indicating around 100 species including two fishes on the Red List of IUCN, Jullien's golden carp (*Probarbus jullieni*) and the Indochina featherback (*Chitala blanci*). The area has diverse aquatic ecosystems with many types of water bodies including streams, waterfalls, deep pools and floodplains. The capture fisheries here are open access and state management is the main management model. Fisheries management is mainly based on Viet Nam's Fisheries Law and relevant regulations.

Capture fisheries production and natural fisheries resources in the area have decreased significantly in recent years. The capture fishery yield is estimated at about 2,000 tonnes per year and is now about 30% of its level ten years ago. The size of capture species is also smaller and many important species have disappeared or decreased significantly in production in this area in recent years.

There are about 20 ethnic groups in this area, mainly Kinh (ethnic Vietnamese) and other groups such as Ede, Thai, Tay and Nung. About 90% of the population lives in rural areas and agro-forestry is the main economic activity involving 85% of the labour force. Annual income per capita in the study area ranges from 2 to 5 million dong (\$100 to \$250) although the annual income of fishing households averages 23.3 million (\$1,165) with income from fishing activities accounting for about 28% of total income.

Less than 1% of all inhabitants engage in fishing, much less than many other parts of the Mekong Basin; fisheries are nevertheless significant for poor communities, especially ethnic minorities which are particularly underprivileged. The initial survey was not able to shed light on the existence of any fisheries-resource management systems which help to restore aquatic resources and sta-



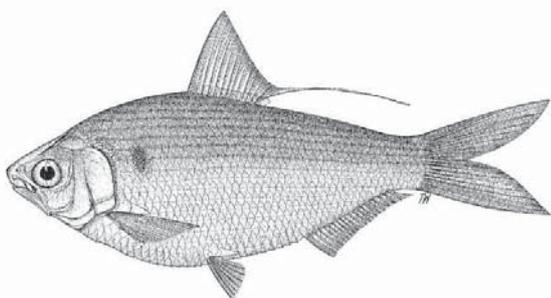
Location of the Vietnamese Central Highlands, showing the Se San and Sre Pok Rivers. RIA3 headquarters office is at Na Trang

MAP: SOU VIRAK

bilise the livelihoods of fishing communities in the area.

Further reading

Le Van Dieu, Phan Dinh Phuc, Ly Ngoc Tuyen and Duong Tuan Phuong (2009) Inland fisheries in the Srepok River Basin in the Central Highlands, Vietnam. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.



Easoup Reservoir and Lak Lake

Dak Lak, one of five provinces in the Central Highlands, has developed inland fisheries in recent years with about 500 reservoirs and a total water surface estimated at 9,500 ha. The province has diverse aquatic ecosystems with many types of water bodies including streams, waterfalls, deep pools and floodplains. According to the province's statistical year book in 2007, Dak Lak produced 1,400 tonnes of fish from capture fisheries and about 5,500 tonnes from aquaculture.

Under the Research Institute for Aquaculture No 3 (RIA3), the Fisheries Management and Governance in the Mekong Basin Project began fisheries-management activities in Dak Lak Province in 1995. The project worked with fishers and local government officials around Easoup Reservoir and Lak Lake, two water bodies with high fish production and diversity. After many meetings, workshops, training courses, field trips and discussions between fishers, local government officials and line agencies, fisheries co-management bodies were set up in Easoup Reservoir in 1999 and Lak Lake in 2002 with the project providing support and monitoring.

Fisheries management improved following the establishment of two fisher unions which led to union activities such as enhancing the capacity of fishers and local authorities, training courses, workshops, study tours, patrols, collecting fishing fees and providing credit. With better management, fisher-

ies production has increased and the livelihoods of fishers have improved.

Further reading

Phan Dinh Phuc, Ly Ngoc Tuyen, Le Van Dieu and Duong Tuan Phuong (2009). Assessment of the fisheries co-management model in Easoup Reservoir and in Lak Lake, Dak Lak Province. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.

Sustainable culture of a new species

Since it is an imported and new species in aquaculture in Viet Nam, it is difficult to assess the potential risk of white-leg shrimp culture towards biodiversity. To diversify cultured species and increase exports, the Ministry of Agriculture and Rural Development has approved white-leg shrimp culture. It is, however, necessary to have an assessment on the culture status in recent years with the aim of proposing appropriate solutions towards sustainable aquaculture development in the future.

Further reading

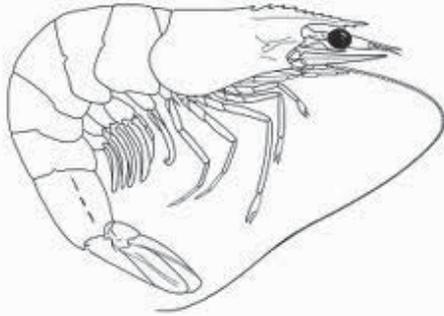
Dao Van Tri (2009) Assessment on the culture status of white-leg shrimp in Vietnam and solutions towards sustainable aquaculture development. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.

Central Highlands reservoir fisheries

The Central Highlands is one of the regions with most reservoirs in Viet Nam. It has about 859 medium and small-sized reservoirs with a total water surface of 54,000 ha. The reservoirs are built mainly for irrigation and flood control, hydroelectricity and agricultural development. Investment in reservoir fisheries has developed only recently. Management of reservoir fisheries is diversified between state, private and co-management and depends on the province. The major fish species stocked in reservoirs are silver carp, big head carp, Indian carp, grass carp, common carp and tilapia. Average annual yields range from 200 to 300 kg and the main fishing gears used are gill nets, lift nets, cast nets, long lines, integrated nets, traps and electro-fishing.

Further reading

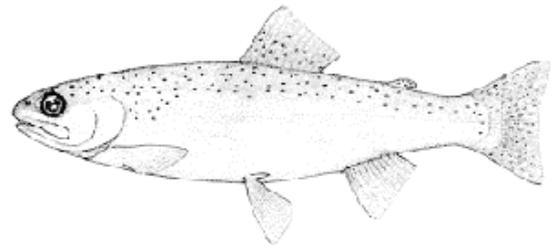
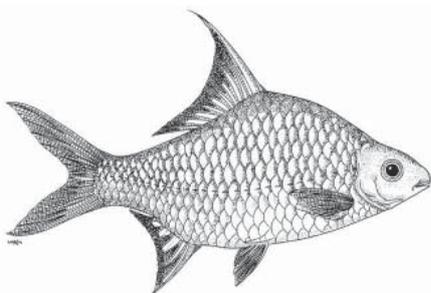
Phan Dinh Phuc, Ly Ngoc Tuyen, and Duong Tuan Phuong (2009) An overview of reservoir fisheries and aquaculture in the Central Highlands of Vietnam. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.

**White-leg shrimp culture in Buon Ma Thuot**

A study on the grow-out of white-leg shrimp was conducted in freshwater ponds in Ea Tam ward, Buon Ma Thuot city, Dak Lak Province between August, 2005 and April, 2006. The ponds were 1000 m² and the stocking densities 15, 20, 25 PL/m² with seed obtained from a RIA3 shrimp hatchery. After 3.5 and 4 months with a food coefficient of 1.1 to 1.2, the survival rate was 50-78%. The size of harvest was 700-111 individuals/kg and average final weight was 8.97-11.27 g/shrimp with an average growth 0.075-0.107 g/day. The yield was 0.88-1.577 tonnes/ha/crop.

Further reading

Phan Thi Le Anh, Le Van Dieu, Hoang Trong Tien and Duong Tuan Phuong (2009) Results of the study on grow-out of white-leg shrimp (*Litopenaeus vannamei* Boone, 1931) in freshwater ponds in Dak Lak Province. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.

**Rainbow trout culture in Lam Dong Province**

Rainbow trout (*Oncorhynchus mykiss*) was introduced to Lam Dong Province from Finland in 2006 through the Research Institute for Aquaculture No 1 (RIA1). Culture ponds were built in the mountains, where the elevation is over 1,200 m with forest streams throughout the year having a water temperature of 15-21 degrees Celsius and oxygen concentration of 5-6 mg/L. Culture results showed that one year-old fish weighed 800 - 1,000 g and that some individuals were gravid with roe. Fecundity ranged from 1,900 to 2,200 eggs/kg, with an average egg diameter of 4.4 mm and weight of 50 mg per egg. However, the eggs could not be fertilised, possibly because of high temperatures as broodstock were being reared.

Since 2007, the Research Centre of Cold Water Fish in the Central Highlands under the Research Institute for Aquaculture No 3 (RIA3) purchased triploid and all-female trout eggs from the United States. They were self-incubating and used to raise fingerlings provided to local commercial trout farms. Recently, the centre formulated female trout broodstock selected from commercial fish and sex-inversion males from all-female eggs, improving the rearing regime to produce all-female trout fingerlings by the end of 2010. Research on locally produced pellets is taking place to replace imported feed and take advantage of fish eggs to produce red caviar.

Further reading

Nguyen Quoc An and Nguyen Viet Thuy (2009) Rainbow trout and solutions for developing the aquaculture of this species in Lam Dong Province. *Collection of 5 years Scientific and Technological Research (2005-2009)*, RIA3. Agriculture Publishing House.



Cambodian biologist Chea Tharit preparing a bongo net for trial dry-season sampling of fish larvae in the Mekong River near Phnom Penh. When river flows are low, the bongo net must be towed behind a boat to sample a standard volume of water. Dr Tharit was previously a deputy director of the Inland Fisheries Research and Development Institute (IFReDI) of the Cambodian Fisheries Administration and is now a deputy director of the administration's recently-established Marine Fisheries Research and Development Institute (MaFRReDI)

PHOTO: KENT HORTLE

Theerawat Samphawamana



Theerawat Samphawamana

PHOTO: KENT HORTLE

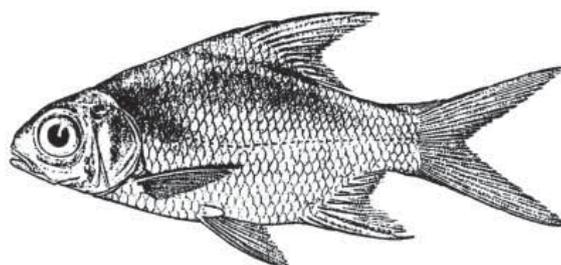
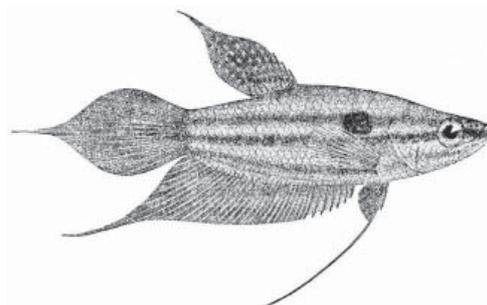
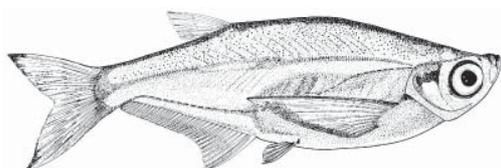
Theerawat Samphawamana has been appointed as MRC Fisheries Programme officer to succeed Suchart Inghamjitr who returned to Thailand's Royal Department of Fisheries at the end of 2010 after six years with the programme. Mr Theerawat, a fisheries biologist, was previously with the Inland Fisheries Research and Development Bureau in Bangkok with responsibility for a food safety project that especially covered freshwater species and a tilapia fish farming improvement project. Before that, he was studying for a Master Degree in Aquaculture and Aquatic Resources Management from the Asian Institute of Technology (AIT) in Pathum Thani. Mr Theerawat joined the department in Ayutthaya in 1992 and later worked in Ang Thong, Phuket and Surat Thani Provinces. He has a bachelor's degree in fisheries from the Rajamongkala Institute of Technology in Chon Buri.

Malasri Khumsri



Malasri Khumsri

Malasri Khumsri has been appointed as Fisheries Management and Governance Specialist for the MRC Fisheries Programme. Dr Malasri joined the Inland Fisheries Research and Development Centre in Ubon Rachathani in northeast Thailand in 1997. Between 2003 and 2010, she was Thailand's national coordinator for the Management and Governance Component of the Fisheries Programme. Between 1997 and 2000, she was a counterpart staff of the programme's Management of Reservoir Fisheries Component and its Management of Reservoir and River Fisheries Component. Dr Malasri completed a PhD in aquaculture and aquatic resource management at the Asian Institute of Technology (AIT) in 2008 and also has a master's degree in aquaculture and aquatic resource management from AIT in 2002. She graduated from the Rajamangala Institute of Technology in 1994 with a BSc in agriculture and fisheries education.





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