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Can trans-boundary management save the dolphins in Lao PDR?

By Victor Cowling and Gerry Ryan

Efforts continue to get a transboundary management committee up and running

In April of this year, with the permission of the Council of Ministers of the Royal Government of Cambodia in partnership with the Commission for Conservation and Development of Mekong River Dolphin Eco-Tourism Zone, the Fisheries Administration and WWF-Cambodia, two highly experienced visiting scientists from NOAA Fisheries in the USA – Robert Pitman and Matthew Leslie – helped conduct remote biopsy research to support conservation of the Mekong River’s critically endangered Irrawaddy dolphin (Orcaella brevirostris).

The idea to do remote biopsy work was to provide information on the genders, genetics, and hormones of the wild population to support conservation efforts and try to better understand high levels of calf mortality. In 2012, a pilot project tested the feasibility and safety of this method on dolphins. The results from the pilot work found it to be safe and effective, with biopsy wounds healing rapidly and animals showing no long-term effects.

We employed a widely used method to biopsy wild cetaceans of many species world-wide. Darts with small cutting heads were used to take small (<0.5 cm³) tissue samples from wild dolphins. The darts were fired with a small Barnett Wildcat crossbow and a Pneudart 0.22 calibre projector – a rifle modified to fire darts with air.

Cameras with large (400 mm) telephoto lenses were also used to photograph all dolphins in the area, and photograph the firing of each dart. As dolphins can be identified from their dorsal fins, these photographs were used to match individual dolphins with the samples taken from them.

Research was conducted at Kampi in Kratie Province on 22–28/04/2013 and 01/05/2013, and at Anlung Cheuteal in Stung Treng Province on 29–30/04/2013. This latter place is right on the border between Cambodia and Lao PDR, and recent counts have shown there to be only six animals present. This is a critical population, which brings in tourists and their money to the area. But we don’t even know if the population is all one sex. So the biopsy could, it was hoped, tell us important information about the group.

Dolphins are also an important indicator of the health of their ecosystem – which in this case is an ecosystem local communities also rely heavily upon. The dolphin population using the trans-boundary pool may once have been several dozen, though by the early 1990s is thought to have been around 25 individuals. Extensive photo-ID surveys found that by 2007 just eight animals used the pool, and in 2012, this figure was just six individuals. These are the last six dolphins in Lao waters.

This deep pool, measured at more than 40 m deep in places, even in the dry season, has been the focus of attention from WWF Lao PDR and WWF Cambodia for many years. There is a 26 ha dolphin conservation zone on the Lao side, approved by the District Governor of Khong, and regular patrolling by Lao villagers and Cambodian
river guards. However, gill nets are still common in the areas surrounding the pool. Attempts so far to address the joint management by both sides have been slow in making progress. Because the area does attract a lot of tourists it was felt essential to let people know what was being done. Men in boats ‘shooting’ dolphins could obviously be taken the wrong way!

Biopsy samples were extremely difficult to get, and a total of only four samples were taken. Two of these samples consisted of skin only, while the other two were both blubber and skin. Three other animals appeared to be hit with darts, but no samples were taken from them.

All samples came from Kampi, with the animals at Cheuteal proving very wary of the boat. “We spent many long hours on the water this year, in the relatively confined areas where the Irrawaddies occur on the Mekong and had very limited success,” Mr Pitman said. "At Kratie, and especially at the border pool, the dolphins were on to us very quickly and became less approachable immediately after a few shots were fired. It is clear that there is no way to sweep in and biopsy sample a significant portion of the population in a short amount of time with the current technology, crossbow or Pneudart rifle - the dolphins are just too canny.”

The samples were transferred to the South-West Fisheries Science Center of NOAA in the USA where they will be analysed to determine the genders of the animals from the four skin samples, as well as stress hormone levels from the two samples with blubber. Efforts are also being made to use this genetic information to determine the taxonomic status of this population, i.e., how genetically different from other Irrawaddy dolphins are Mekong dolphins, and if they may be a separate sub-species.

It has been suggested by cetacean experts that relocation of the animals down to other groups in Cambodia is the best "solution", but we know this is completely impossible. It would also mean the end of dolphin tourism income at the site, which is one of the main reasons government and communities are interested in supporting conservation.

Between WWF in Lao PDR and Cambodia, we have been attempting to resolve difficulties in getting coordinated actions on both sides. Any action currently needs to be led via the two National Mekong Committees, and efforts continue to get a transboundary management committee up and running.

* Dr Cowling is technical advisor for sustainable hydropower and river basin management at the WWF Greater Mekong Programme and Mr Ryan is research technical advisor at WWF-Cambodia
Study finds urgent need to address any future declines in fisheries in Cambodia

A government study looks at the likely impact on fisheries yields, fish consumption and food security if two hydropower projects on the Mekong River in northeast Cambodia go ahead. The study also assesses food consumption in rural households nationwide.

Cambodia's Fisheries Administration has highlighted the "urgent need" to look at water, energy, land management and food security as cross-cutting issues to address any future decline in fisheries arising from proposed hydropower development along the Mekong mainstream in northeast Cambodia. In a paper* published in June, the Fisheries Administration said that a recent study had found that the development of two mainstream dams proposed for Stung Treng and Kratie provinces could reduce yields of fish and other aquatic animals by as much as a third from their levels two years ago.

Threat to food security and poverty
If the Stung Treng dam goes ahead, the study by the Inland Fisheries Research and Development Institute (IFReDI) of the Fisheries Administration forecast that annual fish yields would decline by 34,000 to 145,000 tonnes, down 6 to 24 percent from 2011. If the larger dam at Sambor in Kratie province goes ahead, the study predicted declines of 98,000 to 182,000 tonnes, down 16 to 31 percent from 2011. The study also noted that long-distance migratory fishes were "very sensitive to dam development" due to blockage of migration routes. These fishes account for 25 percent of total inland fish and include the Henicorhynchus mud carps (trey riel) and the Pangasius catfishes (trey pra).

"The decline in fisheries, if not properly addressed and adapted to in a timely fashion, decreases the likelihood that the country will meet the Cambodian Millennium Development Goals (CMDGs), since the decline will threaten food security and poverty," the Fisheries Administration warned. "Livestock, poultry and animal husbandry may compensate for those losses only partially and will be more costly," the agency said. At the same time, aquaculture or new stocking techniques can replace only a "small percentage" of the losses in wild fish catches and will require "levels of investment that are not normally available to the poor."

The government study began in 2011 and was conducted by a 25-member mostly Cambodian team supported by the World Wildlife Fund (WWF), Oxfam Australia and the Danish International Development Agency (Danida) (see Catch and Culture Vol 17, No 2). The Fisheries Administration said the findings "highlight the urgent need to look at water resources, energy management, land management and food security as cross-cutting concerns at the national and sub-national levels."

Need for integrated approach
At the national level, the agency identified the Rectangular Strategy for Growth, Employment, Equity and Efficiency and the National Strategic Development Plan of the Government of Cambodia as opportunities to integrate the sustainability of fisheries, water and land management, energy needs and the agriculture sector within a "green economic approach" and a sustainable livelihoods framework. As energy projects are developed, the Fisheries Administration recommends reinforced mechanisms to engage with relevant ministries such as the Ministry of Agriculture, Forestry and Fisheries, the Ministry of Water Resources and Meteorology, the Ministry of Land Management,
Urban Planning and Construction and the Ministry of Industry, Mines and Energy. To improve decision making related to water, food and energy, it also recommends a mechanism to coordinate and consult with development partners and the private sector.

"Furthermore, close monitoring and evaluation of the contribution of fisheries to national food security and nutrition should be carried out systematically to inform policies and decisions related to water management, land management, energy and food security," the Fisheries Administration said. "Decisions regarding the development of dams should be deliberated collaboratively through applying relevant scientific and indigenous knowledge and incorporating fisheries and their social, economic and livelihood dimensions in the decision-making process."

* IFReDI (2013) Key Considerations: Food and Nutrition Vulnerability to Mainstream Hydropower Development in Cambodia

The two proposed Cambodian dams on the Mekong mainstream in Stung Treng province and on the Sambor Rapids in Kratie province. The two dams would be the furthest downstream of 12 mainstream hydropower projects proposed for the Lower Mekong Basin and the only ones in Cambodia. The Stung Treng dam would be 22 metres high with an inundated area of 640 km² and an installed capacity of 980 MW while the Sambor dam would be 54 metres high with an inundated area of 880 km² and an installed capacity of 2,600 MW (see Catch and Culture, Vol 14, No 3).

Map: MRC
Preserving the Mekong System

BY WILLIAM E. TODD*

Balancing the priorities of clean energy, healthy rivers and abundant fish requires scientific analysis and taking the needs of all stakeholders into account

Many of you may know from my blog that fishing is a hobby that I have enjoyed my entire life. Recently, I tried my luck at fishing on the Mekong River – one of the most fascinating and dynamic rivers in the world – with a group of friends and some local fishermen. Unfortunately, I did not catch any fish; in fact, no one in the group even had a single bite during the entire three-hour trip. Our poor results inevitably led to a discussion with the seasoned Cambodian fishermen on the recent changes they have seen to the Mekong’s magnificent river system. I learned that over the last 10 years, fish in the Mekong have become much more difficult to catch and they are dramatically smaller in size. This troubling situation brought to mind a question not long ago from one reader who asked, “What does the United States think about the impact of dam construction along the Mekong River?”

The United States has a strong interest in the sustainable management of the Mekong River. In fact, two weeks ago, U.S. Secretary of State John Kerry met with Cambodian Deputy Prime Minister Hor Namhong and their counterparts from Laos, Burma, Thailand, and Vietnam under the banner of the U.S.-sponsored Lower Mekong Initiative, which serves as a forum to address complex, transnational development and policy challenges among the Lower Mekong countries (see page 10). A key part of the meeting was a discussion on advancing economic growth and sustainable development through policy dialogues and programs that improve the management of water and other natural resources like the Mekong River.

There is no doubt that the Mekong currently faces many challenges. Overfishing and damage to the forests and watersheds that line this great river affect its flow and biodiversity. Planned dams along the main branch of the river and its tributaries could also pose significant threats to the river’s environment. While dams are an important source of “clean” hydroelectric energy, if not planned and built correctly, they can seriously damage the health and livelihood of communities that depend on the river.

Poorly positioned and designed dams decrease fish populations by blocking upstream migration. Dams also affect water and soil movement, which is vital for productive downstream agriculture. Some experts estimate that the proposed Lower Sesan II Dam will endanger over 80 fish species, decrease overall fish populations by at least nine percent, and directly impact over 100,000 people who live near the proposed dam. These negative consequences are extremely important to a country where fish makes up over 75 percent of the average person’s protein consumption. Along the entire Mekong, more than 60 million people depend on fish for their main source of protein.
The United States has a long history and extensive experience with dam construction. We recognize the important role that dams can play in managing water resources to advance economic growth. At the same time, our own experience has made us acutely aware of the economic, social, and environmental impact that such large infrastructure projects can have over the long-term. Based on this experience, the U.S. Embassy is working with the Royal Government of Cambodia to help it make informed decisions regarding the Mekong’s development.

Clean energy, healthy rivers, and an abundant fish population are all critical to Cambodia’s future. The challenge lies in balancing the three priorities through scientific analysis and taking into account the needs of all stakeholders. In the United States, we have found that an effective way to strike this balance is by allowing for public review and comment on dam construction plans. Similarly, Cambodia could use the Mekong River Commission as a forum for a public review process of mainstream dams and other developments that impact the Mekong River and its tributaries in order to develop a public consensus on the best way forward.

As U.S. Ambassador to Cambodia, I care deeply about the country’s future and support efforts to ensure that planning for dam construction includes careful consideration of the potential impact on the environment and livelihoods, in addition to energy production needs. Any harm caused to Cambodia’s river ecology would have long-lasting and far-reaching effects for food security and overall development, for both Cambodia and its downstream neighbours. Therefore, the United States supports proper planning for dams that includes deliberate scientific inquiry, public review, and a consensus-driven approach to yield the best possible solutions. I am proud of the robust U.S. engagement on issues related to the Mekong, which is a clear sign of our strong commitment to a lasting and positive relationship with the countries of the Mekong Basin.

* Mr Todd is the United States Ambassador to the Kingdom of Cambodia. This article, based on an article originally published on July 14, is from his weekly newspaper column which appears every Sunday in Rasmei Kampuchea in Khmer and The Cambodia Herald in English.
Ministers agree environment, water among most important issues in region

Foreign ministers from the Lower Mekong region hold their third annual meeting with counterparts from Australia, Japan, Europe, Korea, New Zealand and the United States

The Third Friends of the Lower Mekong (FLM) Ministerial Meeting has agreed that environment and water are among the most important issues in the region, calling for "greater interaction" with Cambodia, Lao PDR, Myanmar, Thailand and Viet Nam including through the Mekong River Commission. Foreign ministers of the five countries reached the agreement in Brunei on July 1 during their annual meeting with counterparts from Australia, the European Union, Japan, Korea, New Zealand and the United States along with the secretary general of ASEAN and senior representatives of the Asian Development Bank (ADB) and the World Bank.

'Commitment to supporting transnational cooperation and coordination'

At the meeting, chaired by US Secretary of State John Kerry on the sidelines of the annual ASEAN Ministerial Meeting (AMM), "ministers reaffirmed their commitment to supporting transnational cooperation and coordination in the Lower Mekong sub-region," a statement said. They agreed that the Friends of the Lower Mekong have "contributed to building capacity, improving
particular through information sharing and donor mapping.

"Ministers agreed that one of the most important issues in the region was that of environmental issues and shared water resources. They noted that Lower Mekong country partners were already providing regional leadership in these areas, and considered further steps FLM partners could take to collectively advance these issues and support Lower Mekong country partners’ efforts.”

The ministers also agreed that donors and other actors should coordinate their efforts “to avoid unintentional duplication and to identify areas of potential collaboration. To that end, ministers committed to working together with other donors, ASEAN, and the Mekong River Commission to promote complementary efforts in the region.” The statement said the US-led Lower Mekong Initiative (LMI) was "already engaging with ASEAN to identify areas of overlap and potential collaboration” and expressed support for "similar coordination efforts within the donor community, in infrastructure and promoting stability in the region, and expressed a desire to continue to work closely with Lower Mekong countries to achieve sustainable growth and address the development gap in the region thus contributing to ASEAN integration and community building.”

"Ministers committed to working together with other donors, ASEAN, and the Mekong River Commission to promote complementary efforts in the region."
ASEAN forms public-private taskforce for sustainable fisheries, aquaculture

New partnership aims to recognise strengths and competencies in each sector

Government fisheries agencies in Southeast Asia are deepening their engagement with the private sector ahead of the establishment of the ASEAN Economic Community in 2015. "In preparation for the realisation of the ASEAN Economic Community, and to address issues threatening the sustainability of fisheries and aquaculture in ASEAN, the public and private sector has decided to further the level of engagement, from dialogues to partnership and collaboration in the implementation of activities," the ASEAN Secretariat said in a statement dated May 7.

The secretariat noted that such dialogues, dating back to 2010, had been supported by US technical assistance and the Maximizing Agricultural Revenue through Knowledge, Enterprise Development and Trade (MARKET) project. At a meeting in Bangkok in December, 2012, the public and private sectors agreed to set up the ASEAN Public-Private Informal Taskforce for Sustainable Fisheries and Aquaculture to "serve as a platform for ASEAN’s public and private sector stakeholders in the fisheries and aquaculture industry to work collaboratively on tackling issues that threaten the sustainability of the industry," the statement said.

Representatives of ASEAN governments, the private sector and smallholder fishers and farmers met in Bali in March to discuss structural and operational details of the taskforce. For capture fisheries, several areas were prioritised for further exploration including the design of common ASEAN fisheries improvement program protocols for key fisheries and combating Illegal, Unreported and Unregulated (IUU) fishing. In the aquaculture sector, priority activities include disease management, harmonisation of standards, improvement of seed quality and availability, addressing the cost of feed through better feeding practices, applied research on alternative protein sources and the development of marine aquaculture.

A representative of small-scale fishers and farmers said the priorities were in line with private sector interests. Collaborative implementation of the activities will have "positive impacts on business opportunities and in ensuring the success of production in the future," the representative said.

Elvi Wijayanti, speaking on behalf of Anang Noegroho, chairman of the ASEAN Sectoral Working Group on Fisheries, welcomed the closer engagement of governments with the private sector. "Partnership between the public and private sector provides a new opportunity for doing development better – by recognising the strength and competencies of each sector and finding new ways of harnessing the common good," she said.

The ASEAN Secretariat urged any stakeholders in the fisheries or aquaculture industry of Member States who were interested in taking part in the task force to contact Ms Pouchamarn Wongsanga at pouchamarn.w@asean.org.
Sihasak Phuangketkew, secretary general of the Thai Ministry of Foreign Affairs, at the Lower Mekong Ministerial Meeting in Brunei in July

Photo: Mahdi Marsidi/Information Department, Prime Minister’s Office, Brunei Darussalam

Vietnamese Foreign Minister Pham Binh Minh at Lower Mekong Initiative ministerial meeting in Brunei in July

Photo: Hatral Hazami HaMid/Information Department, Prime Minister’s Office, Brunei Darussalam

Greater interaction through MRC

"Within the framework of the establishment of the ASEAN Economic Community and the challenge of reducing the existing development gaps, Ministers urged LMI Members and the ASEAN Secretariat to ensure optimal complementarities between their activities in this area. Ministers suggested that greater interaction with Lower Mekong partner countries, for example through Regional Working Group meetings and other regional mechanisms such as the Mekong River Commission and the ADB’s Greater Mekong Sub-region program, would enable the alignment of FLM partner technical strengths and programs with Lower Mekong partner countries’ priorities. This would allow the identification of opportunities for donors and countries in the region to work together on specific projects in support of sound management of natural resources and shared water resources."

Earlier, Kerry met separately with the five foreign ministers under the initiative launched by his predecessor Hillary Clinton on the sidelines of the annual meeting of ASEAN foreign ministers in Phuket in 2008 (see Catch and Culture, Volume 18, No 2). At the smaller meeting, ministers endorsed the US initiative as "a forum through which to address complex, transnational development and policy challenges," a separate statement said.

During the meeting, ministers launched an Eminent and Expert Persons Group (EEP Group) comprising two experts from political, academic, cultural, economic or business circles in each LMI member country. The group will "make recommendations to the ministers on the strategic direction of LMI and the way forward," the statement said.

Agriculture and food security

Ministers meanwhile endorsed an action plan for the initiative’s Agriculture and Food Security Pillar "to expand agricultural trade and investment in the region and increase engagement with the private sector, agriculturists, and other sectors." They also approved mapping donor activity in the agriculture and food security sector "to detect programming gaps, identify potential partnerships, and avoid overlapping activities."
Cambodia seeks more effective measures against illegal fishing

BY CHHUT CHHEANA AND NGOR PENG BUN *

Deputy prime minister also calls for continued conservation efforts and incentives to attract investment in aquaculture

Cambodia’s Deputy Prime Minister Dr Yim Chhay Ly has urged authorities to combat illegal fisheries activities more effectively while continuing to conserve fish resources. In an address to a National Fish Day ceremony at the Stung Chinit Reservoir in Baray District in Kompong Thom province on July 1, the chairman of the Council for Agricultural and Rural Development (CARD) also called for incentives to encourage both local and foreign investors to invest in fish and shrimp culture and processing, especially indigenous species with high economic value for export markets.

During the ceremony, the deputy prime minister oversaw the release of about a million post-larval giant freshwater prawns (Macrobrachium rosenbergii) and other aquatic animals. In his speech, he called on the Fisheries Administration
Khmer Rouge irrigation scheme rehabilitated by Asian Development Bank

Kompong Thom province, which borders the Tonle Sap Lake, is one of Cambodia’s major rice-growing areas. Stung Chinit Reservoir, the site of this year’s National Fish Day ceremony, was built during the Pot Pot Regime in 1977 and 1978 to store water from Stung Chinit, a tributary of the Tonle Sap Lake, for irrigating farms in Santuk and Baray districts. The reservoir, which also receives water from underground sources, has a surface area of about 2,530 hectares and is capable of storing up to 38 million cubic metres of water.

The irrigation scheme has two dike roads 15 kilometres in length and two water gates along with 9,600 metres of canals and 42 kilometres of drainage pipelines. The reservoir can irrigate about 22,000 hectares of land in the rainy season and about 5,000 hectares in the dry season.

Under an Asian Development Bank project to rehabilitate the Khmer Rouge scheme, a vertical-slot fish pass was completed in 2006. The fish pass is the second of its type in Asia and followed the construction of a similar fish pass in Bangladesh. Both were designed by the late Garry Bernacsek, a veteran Canadian fisheries scientist who spent much of his career in Africa. Dr Bernacsek started a programme to monitor the impact of the fish pass on local fisheries and was working as the coordinator of the Fisheries Ecology, Valuation and Mitigation Component of the MRC Fisheries Programme when he died of complications from hepatitis in 2006 (see Catch and Culture, Vol 12, No 2).
In a separate address, Agriculture, Forestry and Fisheries Minister Dr Chan Sarun reiterated the government’s commitment to eliminate illegal fishing, especially the use of mosquito netting with fences and electro-fishing gear. He also called for promoting the release of fish fingerlings and post-larval prawns in natural water bodies, conserving community fish refuge ponds as well as protecting and replanting flooded forests and mangroves. The minister said the annual migration of fish from the Tonle Sap Lake between October and March this year was highlighted by the reappearance of the small-scale mud carp (*Cirrhinus microlepis*), known as *trey proul* in Khmer. He added that major reforms in the fisheries sector had positively benefited Cambodians by boosting household fish production for about 1.5 million people fully dependent on fishing and a further 6 million people whose livelihoods are related to fishing activities.

**Fisheries production up 14 percent in 2012**

Dr Chan Sarun said Cambodia’s fisheries production rose 14 percent from a year earlier to 682,000 tonnes in 2012. Freshwater fish accounted for 509,000 tonnes. The country now has 280 fish hatcheries of which 267 belong to farmers. During the year, the Fisheries Administration provided training on fish and prawn breeding techniques to 350 farmers of whom 154 had become trainers and extension workers. About 61,000 families are now engaged in aquaculture, he said.
Following fisheries reforms in 2012 (see *Catch and Culture*, Vol 18, No 1) the minister said an additional 47 community fisheries were established and 33 community fish refuge ponds strengthened. Cambodia now has 516 community fisheries covering almost all important fishing domains and some 146,315 households or 325,239 people. In addition, Cambodia has established a total of 765 community fish refuge ponds, 174 of which are in Kampong Speu province. He said the Fisheries Administration was committed to establishing 50 new conservation areas with an area of 97,503 hectares in addition to 95 existing conservation areas covering 203,347 hectares of which 79 are in freshwater areas.

Dr Chan Sarun said concrete poles were gradually replacing wooden poles demarcating the boundaries of conservation areas. “We have also built patrol stations in collaboration with local authorities, the armed forces and representatives of local communities,” the minister said. “Other conservation activities include the establishment of conservation areas within community fisheries and protected areas for coral reefs, sea grass, flooded forests and mangroves as well as deep pools along the Mekong River for breeding.” To maintain fisheries resources and increase production, measures are being taken to protect endangered species such as the Irrawaddy dolphin (*Orcaella brevirostris*), the Mekong giant catfish (*Pangasianodon gigas*) and the giant barb (*Catlocarpio siamensis*).

**Fisheries account for 7 percent of GDP**
The minister meanwhile indicated that fisheries accounted for almost 7 percent of Cambodia’s gross domestic product in 2012. Agriculture overall accounted for 27.5 percent of GDP, with an annual growth rate of about 4.3 percent. He said fisheries alone accounted for 25.4 percent of agricultural production last year.

With other sectors such as clothing and footwear manufacturing and tourism growing rapidly in recent years, the latest figures indicate that the value of the Cambodian fisheries sector has been rising since its share of overall economic activity has been relatively stable.

* Mr Chheana is a consultant and Mr Peng Bun is a capture fisheries specialist with the Fisheries Programme at the MRC Secretariat in Phnom Penh.
Traditional rituals aim to prolong life of Mother of Water in northeast Thailand

By Theerawat Samphawamana *

Thai and Lao people come together in Loei province once a year to pray for the future of the Mekong

The Mekong River is one of the world’s largest and the second in terms of biodiversity after the Amazon. Many generations have used it as a source of food, transport and water for agriculture. In Thailand, the river runs through seven provinces and is known locally as Mae Nam Kong where mae means “mother” and nam means “water.” The Mother of Water supports the livelihoods of millions of people including subsistence farmers and fishers.

The abundance of fish and other aquatic animals in the Mekong has rapidly decreased in recent decades amid overfishing, infrastructure development, wastewater discharges and climate change. Authorities and local communities have tried to sustain fisheries resources with various management tools. These have included law enforcement, co-management, the establishment of fish conservation zones, bans on fishing in protected areas and raising awareness of the need to conserve the Mekong’s natural resources.

Buddhist ceremonies are also held to protect the Mekong. Blessings have long been held every year in the seven provinces through which the river flows (Chiang Rai, Loei, Nong Kai, Bung Karn, Mukdahan, Nakorn Phanom and Ubon Ratchathani). Each province organises ceremonies at different times of the year.

A Brahman priest (right) and senior policeman (left) place joss sticks on fruits during the ceremony

Photo: Mongkol Toyammuang
depending on local beliefs. The traditional ceremonies aim to prolong the life of the Mekong, seek forgiveness for any bad actions against the river and raise awareness of the need to sustain what is vital for local people.

The annual ceremony in Chiang Khan district in Loei province is the most well-known ritual in the seven provinces. Held in August, it is organised by the district municipality in collaboration with local communities and the Network of Councils of the Mekong Tambon Community Organisations. Representatives of the Lao Government and local people from across the river in Sanakham district in Vientiane province are invited to join the ceremony to strengthen cultural cooperation between the two countries.

The ceremony begins with a parade around the town, with students and local people performing traditional dances in front of the procession. The parade stops at the Sri Kun Muang Temple on the banks of the Mekong where food and prayers are offered ahead of a traditional ceremony known as Bai Sri Su Kwun (where bai sri means "auspicious rice" and su kwun means "spirit" or "soul"). A Bai Sri tree is made from banana leaves stitched together at three or more levels. Adorned with white and colored strings, the tree contains rice and essential elements such as flowers, a prosperity candle, young coconut juice, three candle trays and nine ordinary candles.

People believe the Bai Sri Su Kwun encourages their mental strength and supports their wishes. They pray and listen to recitations to fend off demons. Some put candles and incense in floating banana leaves known as krathong, praying for prosperity and a prolonged life for the Mekong before placing the leaves in the river.
After the rituals are completed, various species of indigenous Mekong fishes are released into the river with the support of the Department of Fisheries. These include fingerlings of the critically-endangered Mekong giant catfish (*Pangasianodon gigas*).

Other activities include exhibitions on the current state of the river and the impacts of mainstream development as well as various spiritual and traditional performances. A platform is provided for representatives of various organisations to share ideas about human impacts on the Mekong and how to sustain the river.

Chiang Khan district is well known for its old wooden houses and Buddhist temples. The Loei Tourism Authority encourages visitors to enjoy the lifestyle of local people and offer alms to monks who walk the streets every morning. In August, tourists can also take part in the traditional ceremony to prolong the life of the Mother of Water.

* Mr Theerawat is a Fisheries Programme officer at the MRC Secretariat in Phnom Penh
Mekong governments **awarded** for outstanding **progress** in fighting **hunger**

The Food and Agriculture Organization of the United Nations has awarded Cambodia, Thailand and Viet Nam for halving hunger ahead of schedule. The three countries were among 38 recognised for their outstanding progress in fighting hunger during the week-long annual meeting of the FAO Conference at the UN agency's headquarters in Rome in June.

Cambodia was among 20 countries awarded for achieving Millennium Development Goal (MDG) Number One to halve the proportion of hungry people between 1990-92 and 2010-2012. The UN General Assembly set the goal in 2000. Thailand and Viet Nam were among another 18 countries congratulated for achieving both the MDG goal and the more stringent World Food Summit goal set in 1996 to reduce by half the absolute number of undernourished people between 1990-92 and 2010-2012.

"You are living proof that when societies decide to put an end to hunger, and when there is political commitment from governments, we can transform that will into concrete action and results," Graziano da Silva told the award ceremony. "FAO is proud to work with all our Member Nations, developed and developing, to reach our common vision of a hunger-free and sustainable world."

Graziano da Silva also urged countries to go beyond the MDG deadline in 2015 and aim for the complete elimination of hunger. "We are the first generation that can end hunger, which has plagued humanity since the birth of civilisation. Let's seize this opportunity," he said.

FAO Director-General José Graziano da Silva presenting awards to H.E. Chan Sarun, Minister for Agriculture, Forestry and Fisheries of Cambodia (top), H.E. Yokol Limlamthong, Deputy Prime Minister and Minister for Agriculture and Cooperatives of Thailand (middle), and H.E. Nguyen Thi Xuan Thu, Vice-Minister for Agriculture and Rural Development of Viet Nam (bottom) in Rome on June 16

PHOTOS: FAO
Aquaculture and fisheries in the Central Highland reservoirs of Viet Nam

By Phan Dinh Phuc and Nguyen Hai Son *

Efforts to develop Central Highland fisheries production yield mixed results

The Central Highlands of Viet Nam comprise the five provinces of Kon Tum, Gia Lai, Dac Lac, Dac Nong and Lam Dong, an area of 54,639 km². In 2010, the population was more than 5.2 million, or 95 people/km², according to the Central Highlands Committee. Annual population growth was 14.8 percent, higher than the average growth of 10.3 percent for Viet Nam. Eighty-eight percent of the population was involved in agricultural activities. The area has 40 ethnic groups of which ethnic Vietnamese Kinh people account for 58 percent.

With its huge potential for aquaculture, the Central Highlands have recently seen the construction of many reservoirs. Data for 2011 indicated that 34 large and middle-sized and 88 small hydropower dams had a capacity of 4,523 MW. About 200 hydropower reservoirs were under construction.

The two main Central Highland catchments in the Lower Mekong Basin are the Se San River and the Srepok River which both flow into Cambodia where they join the Mekong. Within Viet Nam, the catchment area of the Se San River (see map opposite) is about 11,450 km². The river is 252 km in length with a slope of 14.4 percent. The Srepok River (see map on next page) has a catchment area of 12,030 km² in Viet Nam. The river is 291 km in length up to the two main tributaries, the Krong No and Krong Ana streams. The Krong No branch has a catchment area of 3,920 km² and is 156 km in length with an average slope of 6.8 percent. The Krong Ana branch has a catchment area of 3,960 km² and is 215 km in length with a slope of 0.25 percent.

Nineteen hydropower reservoirs have been built or are under construction on the Se San River and the Srepok River. On the Se San, seven reservoirs have been impounded as part of a cascade of dams (see map below which shows six). Another cascade of seven dams has been built on the Srepok River (see map on next page which shows five).

Aquaculture
Fingerlings have been stocked in the hydropower reservoirs of the Central Highlands, usually as soon as the reservoir is impounded.
Stocked species have included silver carp (Hypophthalmichthys molitrix), big head carp (Hypophthalmichthys nobilis), Indian major carp (Labeo rohita), common carp (Cyprinus carpio) and grass carp (Ctenopharygodon idella). Catches have been low, however, due to poor management.

'Cage culture development has been constrained by high prices for seed and feed'

Given the quality and availability of water, the reservoirs are suitable for cage culture. However, cage culture development has been constrained by high prices for seed and feed for fishes such as snakehead (Channa spp), catfish (Clarias spp), tilapia and red tilapia (Oreochromis spp) as well as low farm-gate prices (see Table 2 on next page). Cool weather is another constraint with growth rates affected by temperatures falling below 20 degrees for as long as five months each year. Yields have fluctuated from 20-40 kg/m³ for tilapia and red tilapia and about 30 kg/m³ for catfish. High-priced species such as red-tail catfish (Hemibagrus wyckioides) and sturgeon (Acipenser spp) have been cultured in irrigation and hydropower reservoirs in the Central Highlands.

Table 1: Hydropower in the Central Highlands of Viet Nam

<table>
<thead>
<tr>
<th>No</th>
<th>Reservoirs</th>
<th>Province</th>
<th>Area (ha)</th>
<th>Volume (Mln x m³)</th>
<th>Capacity (MW)</th>
<th>River/stream</th>
<th>Year of impoundment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ialy</td>
<td>Gia Lai, Kon Tum</td>
<td>6,450</td>
<td>1,037.0</td>
<td>720</td>
<td>Sesan</td>
<td>2003</td>
</tr>
<tr>
<td>2</td>
<td>Pleikrong</td>
<td>Kon Tum</td>
<td>5,328</td>
<td>1,048.7</td>
<td>100</td>
<td>Sesan</td>
<td>2009</td>
</tr>
<tr>
<td>3</td>
<td>Se San 3</td>
<td>Gia Lai</td>
<td>340</td>
<td>92</td>
<td>260</td>
<td>Sesan</td>
<td>2006</td>
</tr>
<tr>
<td>4</td>
<td>Se San 3A</td>
<td>Gia Lai</td>
<td>453</td>
<td>80.6</td>
<td>108</td>
<td>Sesan</td>
<td>2007</td>
</tr>
<tr>
<td>5</td>
<td>Se San 4</td>
<td>Gia Lai</td>
<td>5,841</td>
<td>893.3</td>
<td>360</td>
<td>Sesan</td>
<td>2010</td>
</tr>
<tr>
<td>6</td>
<td>Se San 4A</td>
<td>Gia Lai</td>
<td>155.2</td>
<td>7.55</td>
<td>63</td>
<td>Sesan</td>
<td>2009</td>
</tr>
<tr>
<td>7</td>
<td>Thuong Kon Tum</td>
<td>Gia Lai</td>
<td>—</td>
<td>173</td>
<td>220</td>
<td>Sesan</td>
<td>Implementing</td>
</tr>
<tr>
<td>8</td>
<td>Buon Kuop</td>
<td>Dac Lac</td>
<td>1.20</td>
<td>—</td>
<td>280</td>
<td>Srepok</td>
<td>2010</td>
</tr>
<tr>
<td>9</td>
<td>Srepok 3</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>220</td>
<td>Srepok</td>
<td>2010</td>
</tr>
<tr>
<td>10</td>
<td>Srepok 4</td>
<td>Dac Lac, Dac Nong</td>
<td>—</td>
<td>—</td>
<td>33</td>
<td>Srepok</td>
<td>2010</td>
</tr>
<tr>
<td>11</td>
<td>Srepok 4A</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>64</td>
<td>Srepok</td>
<td>Implementing</td>
</tr>
<tr>
<td>12</td>
<td>Buon Tua Srah</td>
<td>Dac Lac</td>
<td>2</td>
<td>520</td>
<td>86</td>
<td>Krong No-Srepok</td>
<td>2009</td>
</tr>
<tr>
<td>13</td>
<td>Dray H’linh</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>12</td>
<td>Srepok</td>
<td>—</td>
</tr>
<tr>
<td>14</td>
<td>Dray H’linh 2</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>18</td>
<td>Srepok</td>
<td>—</td>
</tr>
<tr>
<td>15</td>
<td>Krong Kma</td>
<td>Dac Lac</td>
<td>20</td>
<td>—</td>
<td>12</td>
<td>Krong Kma</td>
<td>2008</td>
</tr>
<tr>
<td>16</td>
<td>Hoa Phu</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>29</td>
<td>Srepok</td>
<td>—</td>
</tr>
<tr>
<td>17</td>
<td>Easoup 3</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>6</td>
<td>Ea H’leo</td>
<td>—</td>
</tr>
<tr>
<td>18</td>
<td>Duc Xuyen</td>
<td>Dac Nong</td>
<td>—</td>
<td>—</td>
<td>58</td>
<td>Krong No-Srepok</td>
<td>—</td>
</tr>
<tr>
<td>19</td>
<td>Ea Hiao 3</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>Ea H’leo</td>
<td>Implementing</td>
</tr>
</tbody>
</table>

Source: MRC Fisheries Programme Fishery Management and Governance Component, Viet Nam (2010)
However, domestic demand for such species is limited. At the same time, the investment and production costs for sturgeon culture are very high.

**Fish fauna**

The fish resources in the Srepok catchment are diverse in terms of number of species and distribution. More than 200 fish species have been described including many economically valuable species such as Jullien’s golden carp (*Probarbus jullieni*), the red-tail catfish (*Hemibagrus wyckiioides*), Bangana behri, the giant goonch (*Bangarius yarrelli*), the Indochina featherback (*Chitala blanci*), the giant mottled eel (*Anguilla marmorata*), *Tor tambroides* and the giant snakehead (*Channa micropeltes*).

Data on the number species in Central Highland reservoirs is shown in Table 3 below. With the exception of reservoirs connected to large water bodies such as Easoup Reservoir, the fish fauna in Central Highland reservoirs are not diverse. The impoundment of reservoirs without fish passes affects fish diversity.

In 2004, the Research Institute for Aquaculture No 3 (RIA3) indicated that common carp (*Cyprinus carpio*) accounted for 50 percent of the total catch in Ialy Reservoir, the biggest hydropower reservoir in the Central Highlands. The bronze featherback (*Notopterus notopterus*) accounted for 23 percent, goldfish (*Carassius auratus*) for 14 percent and

![Bronze featherbacks (*Notopterus notopterus*)](image)

Table 2: Cage culture in the Central Highlands of Viet Nam

<table>
<thead>
<tr>
<th>No</th>
<th>Reservoirs</th>
<th>Province</th>
<th>Cage area (ha)</th>
<th>No of cages</th>
<th>Cultured species</th>
<th>Investors</th>
<th>Year started</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Srepok 4</td>
<td>Dac Lac, Dac Nong</td>
<td>1,100</td>
<td>44</td>
<td>Catfish</td>
<td>Srepok 4 Hydropower Company</td>
<td>2011</td>
</tr>
<tr>
<td>2</td>
<td>Buon Tua Srah</td>
<td>Dac Lac</td>
<td>1,000</td>
<td>40</td>
<td>Sturgeon</td>
<td>Viet Nam Sturgeon Company</td>
<td>2012</td>
</tr>
<tr>
<td>3</td>
<td>Buon Kuop</td>
<td>Dac Lac</td>
<td>—</td>
<td>—</td>
<td>Catfish, Snakehead, Tilapia</td>
<td>Residents</td>
<td>2011</td>
</tr>
<tr>
<td>4</td>
<td>Eakao</td>
<td>Dac Lac</td>
<td>—</td>
<td>40</td>
<td>Catfish</td>
<td>Companies</td>
<td>2010</td>
</tr>
</tbody>
</table>

Source: MRC Fisheries Programme Fisheries Management and Governance Component, Viet Nam

Table 3: Distribution of fish species in Central Highland hydropower and irrigation reservoirs

<table>
<thead>
<tr>
<th>No</th>
<th>Reservoir</th>
<th>Area (ha)</th>
<th>Species</th>
<th>Impoundment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>Stocked</td>
</tr>
<tr>
<td>1</td>
<td>Ialy</td>
<td>6,450</td>
<td>19</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>Easoup</td>
<td>240</td>
<td>45</td>
<td>7</td>
</tr>
<tr>
<td>3</td>
<td>Eakao</td>
<td>210</td>
<td>19</td>
<td>7</td>
</tr>
<tr>
<td>4</td>
<td>Eakar</td>
<td>141</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>5</td>
<td>Buon Triet</td>
<td>120</td>
<td>27</td>
<td>4</td>
</tr>
<tr>
<td>6</td>
<td>Yang Reh</td>
<td>56</td>
<td>15</td>
<td>7</td>
</tr>
</tbody>
</table>

Source: MRC Fisheries Programme Fisheries Management and Governance Component, Viet Nam
sharpbellies (*Hemicuter leucisculus*) 8 percent. The rest were rohu and tilapia.

The Mekong Fisheries Management Project in 2004 indicated 45 species in the Easoup Reservoir and 19 in the Eakao Reservoir. Among the exotic species, only tilapia was capable of breeding naturally in the reservoirs.

**Fishing gear**

Central Highland fisheries are generally at the artisanal or household level. Fishing gear normally includes a small wooden boat for one to four people. The main purpose of fishing is for household consumption.

Around 60 percent of fishers are part-time fishers while 40 percent fish full time. Fishing gear is the same as in other parts of Viet Nam—gill nets with one or three layers, lift nets, long-line hooks, electro-fishing and cast nets. Integrated nets are used only in Eakao Reservoir and Ajun Ha Reservoir, with silver carp and big head carp accounting for most of the catches.

The selection of gear depends on many factors such as the season, water levels, the fishing ground, fish size, target species and the structure of...
the reservoir bottom. Integrated nets are used only in reservoirs where the bottom has been cleaned before impoundment. Lift nets, on the other hand, are not used in moonlight or strong winds. Seine nets are used in low-water levels but not during stocking or the breeding season.

Under the Prime Minister’s Decision No 01/1998/CT-TTg, management authorities issue regulations limiting the number and mesh size of fishing gear as well as imposing closed fishing seasons for some kinds of gear.

The Fisheries Law of 2003 bans some kinds of fishing gear, limits mesh size and stipulates fishing seasons. However, illegal fishing gear is still widely used in the Central Highlands except for some reservoirs with stocking programs and good management such as Eakao and Easoup Reservoirs.

**Fish production**
The Central Highlands have great potential for inland fisheries development. Statistics in 2011 indicated total fish production of 29,086 tonnes, almost twice the volume of 2007. Catches accounted for between 14 and 21 percent of fish production in the area and between 0.8 and 1.2 percent of national production between 2007 and 2011. With the development of many dams in the Central Highlands, however, fish production including capture fisheries has recently declined.

Yields are generally higher than in other areas of Viet Nam

Yields and total fish production from some typical Central Highland reservoirs are shown in Table 5. Yields are generally higher than in other areas of Viet Nam. For reservoirs in the north that are stocked with fingerlings, Nguyen Quoc An (2001) indicates maximum yields of 55 kg/ha at Dong Mo Reservoir (800 ha), 45 kg/ha at Cam Son Reservoir (2,000 ha) and 62.5 kg/ha at Suoi Hai Reservoir (960 ha).
Table 4: Fish production in the Central Highlands of Viet Nam

<table>
<thead>
<tr>
<th></th>
<th>Tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2002</td>
</tr>
<tr>
<td><strong>Total fish production</strong></td>
<td></td>
</tr>
<tr>
<td>Viet Nam</td>
<td>2,647,408</td>
</tr>
<tr>
<td>Highlands</td>
<td>12,882</td>
</tr>
<tr>
<td><strong>Capture fisheries</strong></td>
<td></td>
</tr>
<tr>
<td>Viet Nam</td>
<td>1,802,599</td>
</tr>
<tr>
<td>Highlands</td>
<td>2,779</td>
</tr>
<tr>
<td><strong>Aquaculture</strong></td>
<td></td>
</tr>
<tr>
<td>Viet Nam</td>
<td>844,810</td>
</tr>
<tr>
<td>Highlands</td>
<td>10,103</td>
</tr>
</tbody>
</table>

Source: National Statistics Department

In general, the larger reservoirs in the Central Highlands have lower yields. Production also depends, however, on the number of fingerlings stocked in the reservoirs as well as morphology and other environmental factors.

Further reading:

*Dr Phuc is Director of the National Center for Freshwater Seed Production in Central Vietnam under the Research Institute for Aquaculture No. 3 (RIA3) in Nha Trang and Mr Son is a Fisheries Programme officer at the Mekong River Commission Secretariat in Phnom Penh

Table 5: Fish yields (kg/ha) and production (tonnes/year) in reservoirs in Central Highlands of Viet Nam

<table>
<thead>
<tr>
<th>No</th>
<th>Reservoir</th>
<th>Province</th>
<th>Area (ha)</th>
<th>Yield (kg/ha)</th>
<th>Production (tonnes)</th>
<th>No of fishers</th>
<th>Survey year</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ialy</td>
<td>Gia Lai, Kon Tum</td>
<td>3,700</td>
<td>71</td>
<td>263</td>
<td>90</td>
<td>2003-2004</td>
<td>NA</td>
</tr>
<tr>
<td>2</td>
<td>Pleikrong</td>
<td>Kon Tum</td>
<td>6,400</td>
<td>117</td>
<td>750</td>
<td>1500</td>
<td>2012</td>
<td>NA</td>
</tr>
<tr>
<td>3</td>
<td>Ajun Hà</td>
<td>Gia Lai</td>
<td>3,700</td>
<td>85-208</td>
<td>315-770</td>
<td>70-100</td>
<td>1996-2003</td>
<td>Yearly stocking</td>
</tr>
<tr>
<td>4</td>
<td>Eakao</td>
<td>Dac Lac</td>
<td>210</td>
<td>230-570</td>
<td>NA</td>
<td>80</td>
<td>1996-2002</td>
<td>Yearly stocking</td>
</tr>
<tr>
<td>5</td>
<td>Eakar</td>
<td>Dac Lac</td>
<td>141</td>
<td>454</td>
<td>NA</td>
<td>NA</td>
<td>1996-2000</td>
<td>Yearly stocking</td>
</tr>
<tr>
<td>6</td>
<td>Easoup</td>
<td>Dac Lac</td>
<td>240</td>
<td>147-246</td>
<td>NA</td>
<td>60</td>
<td>1996-2002</td>
<td>Yearly stocking</td>
</tr>
<tr>
<td>7</td>
<td>Yang Reh</td>
<td>Dac Lac</td>
<td>56</td>
<td>566</td>
<td>NA</td>
<td>25</td>
<td>1998-2000</td>
<td>Yearly stocking</td>
</tr>
<tr>
<td>8</td>
<td>Buôn Triệt</td>
<td>Dac Lac</td>
<td>120</td>
<td>183</td>
<td>NA</td>
<td>30</td>
<td>2009-2012</td>
<td>Yearly stocking</td>
</tr>
</tbody>
</table>

Source: Dac Lac Statistics Department
Myanmar posts region's fastest growth in aquaculture between 2000 and 2010

Myanmar’s aquaculture production expanded at an annual rate of 24 percent between 2000 and 2010, the fastest growth recorded among countries in the Mekong region, according to the Food and Agriculture Organization of the United Nations. The annual FAO Statistical Yearbook published in June showed that fisheries production from farms in Myanmar reached 851,000 tonnes in 2010, up from 778,000 tonnes in 2009 and mostly derived from inland waters (see table).

Growth was slower in Viet Nam and Thailand, the biggest aquaculture producers in the Lower Mekong Basin. Production from Viet Nam’s aquaculture sector grew at an annual rate of 18 percent over the decade to hit 2.7 million tonnes in 2010. Output in Thailand rose six percent to 1.3 million tonnes over the same period. Elsewhere in the lower basin, aquaculture production increased seven percent to 82,000 tonnes in Lao PDR and 15 percent to 60,000 tonnes in Cambodia.

Worldwide, the FAO said aquaculture represented the fastest-growing, animal-based food production sector on planet, with 60 million tonnes of production in 2010. "Aquaculture growth continues to outpace population growth," it said. "Great strides in breeding technology, system design

Enhanced production from culture-based fisheries contributes significantly to Myanmar’s fish yield

PHOTO: WOLF HARTMANN
and feed technology in the second half of the twentieth century have enabled the expansion of commercially viable aquaculture across species and in volume." The UN agency also noted the increasing shares of aquaculture products in international trade, "not only for high-priced products but also for a broad range of other species."

"Production from Myanmar's inland capture fisheries was two and a half times that of Cambodia, which has the largest wild freshwater fisheries production in the Lower Mekong Basin'"  

Data from the yearbook meanwhile showed that production from Myanmar's inland capture fisheries, mainly from the Irrawaddy Delta, was two and a half times that of Cambodia which has the largest wild freshwater fisheries production in the Lower Mekong Basin.

On a global basis, "inland water fishery production has expanded to over 10 million tonnes, accounting for more than 10 percent of global capture production," the FAO said. "However, the state of inland fishery resources and the ecosystems that support them is not generally well known, and the reliability of data on inland water catches reported by several countries remains questionable. There is a growing appreciation of the need to improve in land fishery statistics." 

**MRC assessment of Myanmar fisheries**

Members of the Technical Advisory Body (TAB) of the MRC Fisheries Programme visited Myanmar in 2007 as guests of the local Department of Fisheries (see Catch and Culture, Vol 13, No 1). The inland fishery in Myanmar was found to be huge, as expected from a country with a flood plain area approaching that of the entire Mekong basin, and both politically and culturally valued for its contribution to food security.

The study tour found that some management approaches in Myanmar and the Lower Mekong Region were similar—such as the "leases" in Myanmar and the "lots" in Cambodia. But the TAB members also found differences such as interventions to improve physical habitat for fish production and large-scale stocking of fingerlings into open systems, coupled with efforts to improve living conditions of people in these areas.

Stocking with exotic species was found to be massive at the Taungthaman and Tethe Inland Fisheries with large numbers of fingerlings (3,000-9,000/ha) of Indian major carps observed. Although the impact on fish biodiversity was not yet clear, the study tour concluded that interventions appeared to have significantly increased yields, contrary to the widely-held opinion that river fisheries cannot be improved.

**Fish production**

<table>
<thead>
<tr>
<th></th>
<th>Total 000 tonnes 2009</th>
<th>Total 000 tonnes 2010</th>
<th>Inland 000 tonnes 2010</th>
<th>Marine 000 tonnes 2010</th>
<th>Annual growth (%) 2000-10</th>
<th>Total 000 tonnes 2009</th>
<th>Total 000 tonnes 2010</th>
<th>Inland 000 tonnes 2010</th>
<th>Marine 000 tonnes 2010</th>
<th>Annual growth (%) 2000-10</th>
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<tr>
<td>MRC members</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cambodia</td>
<td>465</td>
<td>490</td>
<td>405</td>
<td>85</td>
<td>5.6</td>
<td>50</td>
<td>60</td>
<td>58</td>
<td>2</td>
<td>15.3</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>30</td>
<td>31</td>
<td>31</td>
<td>0.6</td>
<td>75</td>
<td>82</td>
<td>82</td>
<td>2</td>
<td>6.9</td>
<td></td>
</tr>
<tr>
<td>Thailand</td>
<td>1,871</td>
<td>1,827</td>
<td>210</td>
<td>1,617</td>
<td>-4.8</td>
<td>1,417</td>
<td>1,286</td>
<td>999</td>
<td>287</td>
<td>5.7</td>
</tr>
<tr>
<td>Viet Nam</td>
<td>2,280</td>
<td>2,421</td>
<td>194</td>
<td>2,227</td>
<td>4.1</td>
<td>2,556</td>
<td>2,672</td>
<td>2,498</td>
<td>173</td>
<td>18.3</td>
</tr>
<tr>
<td>Dialogue partners</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>China</td>
<td>15,690</td>
<td>16,270</td>
<td>2,289</td>
<td>13,981</td>
<td>0.4</td>
<td>35,066</td>
<td>37,045</td>
<td>24,723</td>
<td>12,321</td>
<td>5.5</td>
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<tr>
<td>Myanmar</td>
<td>2,767</td>
<td>3,063</td>
<td>1,002</td>
<td>2,061</td>
<td>10.9</td>
<td>778</td>
<td>851</td>
<td>822</td>
<td>29</td>
<td>24.0</td>
</tr>
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</table>

Source: FAO
Trịnh Quốc Trọng, who served as Vietnamese National Director for the Aquaculture of Indigenous Mekong Fish Species (AIMS) component of the MRC Fisheries Programme between 2004 and 2007, received a doctoral degree from Wageningen University in the Netherlands on June 19 for his research into breeding programs for Nile tilapia (Oreochromis niloticus). Born in 1976 and raised in Hồ Chí Minh City, Dr Trong initially studied at the University of Agriculture and Forestry in Thủ Đức, Hồ Chí Minh City, where he specialised in aquaculture and conducted his thesis on masculinisation of Siamese fighting fish (Betta splendens).

After completing his aquaculture engineering degree in 1998, he joined the Research Institute for Aquaculture No 2 (RIA2) in 1999, when he also began working for the AIMS component of the MRC Fisheries Programme. He started his master’s degree at Agriculture University of Norway (now known as the Norwegian University of Life Sciences) in 2002. After completing his thesis on the simulation of fish breeding programs comparing “walkback” selection and family selection schemes, he graduated in 2004 and returned to work at RIA2 and also the MRC Fisheries Programme.

In 2007, he commenced a sandwich PhD study on breeding programs for Nile tilapia at the Animal Breeding and Genomics Centre at Wageningen University. All experiments were done at the National Breeding Centre for Southern Freshwater Aquaculture in the Mekong Delta of Viet Nam, under the auspices of RIA2, with funding for field work from the WorldFish Center, in Penang, Malaysia.

Dr Trọng is currently working as director of the National Breeding Centre for Southern Freshwater Aquaculture in Cái Bè.
Phan Thi Thu has joined the MRC Fisheries Programme as a junior riparian professional for six months. Ms Thu previously worked for four years as a researcher at the Southern Sub-Institute for Fisheries Planning in Ho Chi Minh City where she analysed socio-economic issues and also worked as a project secretary. She completed a Bachelor of Fisheries Economics at Nha Trang University in 2008.

Theng Lipine has joined the MRC Fisheries Programme as a junior riparian professional for six months. Mr Lipine began working at the Cambodian Fisheries Administration in 2007 and was a WWF awareness officer from 2007 to 2010. He completed a Master's Degree in Natural Resources Management at the Asian Institute of Technology in Thailand in 2012 and a Bachelor of Fisheries and Aquaculture at the Royal University of Agriculture in Phnom Penh in 2003.
Women with children bathing on the spillway of the Stung Chinit Reservoir on the Stung Chinit irrigation scheme in Baray district, Kompong Thom province, Cambodia. The scheme includes a vertical-slot fishway, the second of its type in Asia (see page 15).

Photo: Chhut Chheana

Website: mrcmekong.org/news-and-events/newsletters/catch_and_culture