INSIDE

- Worst floods in fifty years devastate Thai aquaculture
- Rebuilding giant prawn stocks around the Tonle Sap
- Scientists describe new species of walking catfish
- Climate change impacts on floods and fisheries
- CP sees Viet Nam acquisition as key growth driver
- Cambodia’s potential for reservoir fisheries
- Training the gender trainers
Contents

4  Flood damage to aquatic resources
Worst floods in half a century devastate Thai aquaculture industry

8  Escapees
Catching escaped crocodiles

10  Stock enhancement
Rebuilding stocks of once-abundant freshwater prawns around the Tonle Sap

14  Taxonomy
Singapore, Vietnamese researchers describe new species of walking catfish

16  Hydropower development
Further study on impact of Mekong mainstream development required

18  Aquaculture
Third edition of better management manual for Vietnamese catfish farmers

19  Climate change in the Lower Mekong Basin
Impacts on floods and fisheries

23  Management changes
New management at Department of Fisheries in Thailand

24  Investment
CP Hong Kong arm expects Viet Nam acquisition to be key growth driver

26  Interview
Cambodia’s potential for reservoir fisheries

30  Development
Viet Nam to set up high-growth economic zone in four Mekong Delta provinces

32  Gender
Training the gender trainers

35  Staff
Recent changes
Flood damage to aquatic resources

Worst floods in half a century devastate Thai aquaculture industry

THEERAWAT SAMPHAWAMANA *

With more than 130,000 farmers affected, damage to aquaculture and government compensation is estimated at almost $170 million

Thailand suffered its worst floods in half a century in 2011. Between June and October, the country was hit by four tropical depressions and a typhoon. The government declared 65 of the country’s 77 provinces as disaster areas. More than 12.8 million people were affected, with 693 deaths. According to the Meteorological Department, cumulative rainfall for the year rose to a record 1,674 millimetres, which was 42 percent higher than the average for the past 30 years.

Major flooding began in late June with heavy precipitation from Tropical Depression Haima, causing landslides in the north and the northeast as well as flash floods in many provinces. In addition, heavy rains from the annual southwest monsoon continued for longer than usual.

Major storms between June and October

<table>
<thead>
<tr>
<th>Storm</th>
<th>Type</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haima</td>
<td>Tropical depression</td>
<td>Late June</td>
</tr>
<tr>
<td>Nok-Ten</td>
<td>Tropical depression</td>
<td>Late July-early August</td>
</tr>
<tr>
<td>Haitang</td>
<td>Tropical depression</td>
<td>Late September</td>
</tr>
<tr>
<td>Nesat</td>
<td>Typhoon</td>
<td>Early October</td>
</tr>
<tr>
<td>Nalgae</td>
<td>Tropical depression</td>
<td>Early October</td>
</tr>
</tbody>
</table>

Source: Thai Meteorological Department

The heavy rainfall continued for more than three months, especially over the Mekong and Chao Phraya River Basins. Most dams were forced to increase discharge rates, resulting in rapid flooding of residential, industrial and agricultural areas including fish farms. The World Bank estimated damages at THB 1,440 billion ($45 billion) with four million families and six million hectares of land affected. The Office of Agricultural Economics estimated that two million hectares of farmland were damaged and more than 30 million heads of livestock lost.

Fish farmers affected by floods

<table>
<thead>
<tr>
<th>Region</th>
<th>Provinces affected</th>
<th>Farmers affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>North</td>
<td>16</td>
<td>33,590</td>
</tr>
<tr>
<td>Northeast</td>
<td>20</td>
<td>58,702</td>
</tr>
<tr>
<td>Central</td>
<td>24</td>
<td>37,294</td>
</tr>
<tr>
<td>South</td>
<td>10</td>
<td>2,795</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>132,381</td>
</tr>
</tbody>
</table>

Source: Department of Fisheries

Aquaculture affected by floods

<table>
<thead>
<tr>
<th>Type of culture</th>
<th>Area (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish ponds</td>
<td>34,890</td>
</tr>
<tr>
<td>Shrimp/crab/ponds and mollusc pens</td>
<td>8,590</td>
</tr>
<tr>
<td>Cages/cement tanks</td>
<td>30</td>
</tr>
<tr>
<td>Damage estimate (THB)</td>
<td>3.64 billion</td>
</tr>
</tbody>
</table>

Source: Department of Fisheries
The floods pushed a huge volume of water, sediment, pollutants and waste into the mouths of the Chao Phraya, Tha Chin, and Mae Klong rivers and then into the Gulf of Thailand, where the country’s most important fisheries resources are located. The degradation of water quality and significant drop in salinity affected marine fish and other animals, especially aquatic larvae and mud organisms such as mussels, cockles and oysters. Many smaller organisms sensitive to changes in water quality and salinity were believed to have died, affecting the food chain since they are eaten by large fish. Along the coast, many fish were found dead and it was reported that the quantity of fish caught by marine fishers fell sharply. How much of the coastline was affected and how long it will take to recover is unclear.

The floods also swept away many “temple fish”, the large fishes that congregate around temples located along the banks of rivers, particularly the Chao Phraya. These include shark catfishes, barbs, gouramis and bagrid catfishes fed by monks, local people and tourists who feed them as a way to make merit. Since fishing is banned at such fish sanctuaries, many of these fishes reach a mature size. After being swept away by floods, many were caught by fishmen with various types of fishing gear such as hooks, cast nets and gill nets. Some temples found that only a few fishes swam back after the flooding.

The floods also affected six Inland Fisheries Centers in Nan, Nakhon Sawan, Lop Buri, Uthai Thani, Ang Thong and Ayutthaya provinces as well as the DoF office in Bangkok. Drainage control systems were unable to prevent flood damage, resulting in broodstock escaping into open waters. Laboratory equipment, hatcheries, earthen ponds, staff housing and personal property were also damaged.

Wimol Jantrarotai, the director general of the

### Impact on marine life

<table>
<thead>
<tr>
<th>Place</th>
<th>Impact</th>
<th>Period</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mahachai estuary, Samut Sakorn province</td>
<td>Marine fish, mussels die</td>
<td>Mid December</td>
<td>Matichon, Dec 22</td>
</tr>
<tr>
<td>Bang Pa Kong, Cha Cherng Sao province</td>
<td>Marine fish die</td>
<td>Early December</td>
<td>Manager, Dec 9</td>
</tr>
<tr>
<td>Kang Kao Island, Chon Buri province</td>
<td>All coral bleached</td>
<td>Late November</td>
<td>Thai Post, Nov 27</td>
</tr>
<tr>
<td>Cha Um Beach, Phetch Buri province</td>
<td>Marine fish and other fauna die</td>
<td>Mid October</td>
<td>Manager, Oct 14</td>
</tr>
</tbody>
</table>
Department of Fisheries, said the floods resulted in “impoverishment for many fish farmers and damage to fisheries resources.” The department’s challenge was to “assist fish farmers and rehabilitate the natural resources,” Dr Wimol said.

On August 25, the Thai cabinet decided to compensate damaged fish farms at the rate of THB 4,225 ($132) per rai (1,600 square metres) up to five rai per farmer. Compensation for prawn, crab, or mollusc farms was set at THB 10,920 ($341). Farmers with cages and cement tanks and those raising other species such as ornamental fish, frogs and soft-shell turtles were offered THB 315 ($10) per square metre with the maximum set at 80 square metres per person. Budget expenditure on compensation was estimated at THB 1.5 billion ($47 million).

### Payments to farmers

<table>
<thead>
<tr>
<th>Culture</th>
<th>Compensation</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fish/paddy-field</td>
<td>THB 4,225/rai</td>
<td>5 rai</td>
</tr>
<tr>
<td>Prawn/crab/molluscs</td>
<td>THB 10,920/rai</td>
<td>5 rai</td>
</tr>
<tr>
<td>Cages/cement tanks</td>
<td>THB/315 m²</td>
<td>80 m²</td>
</tr>
</tbody>
</table>

Source: Department of Fisheries

To create opportunities for affected fish farmers, the DoF plans to provide training in aquaculture techniques and seed for fishes and other aquatic animals such as tilapia, sea bass, white leg shrimp and mussels. It also plans to provide feed and technical knowledge.

To address food security and the livelihoods of fishers, the DoF plans to release about 67 million individual marine animals in 2012 including sea bass, shrimp, crabs and clams. Broodstock of native molluscs, such as razor clams and angel wings, were moved and will be returned when water quality improves. Water and soil at the mouths of rivers and coastal areas are being monitored regularly for quality and treated with “effective microorganisms” in blood cockle and other farming areas. To rehabilitate marine ecosystems, artificial reefs are being established.

### Rehabilitating fish sanctuaries

To rehabilitate fish sanctuaries set up by the government’s Temple Fish Conservation Project launched 2002, the DoF is cooperating with private mills to provide feed to temples along rivers in Thailand.
Ang Thong, Ayutthaya, and Nontha Buri province. It is also advising monks and volunteers to continue feeding fish to bring about aggregations that can be naturally propagated to increase fish production in natural habitats.

“Promoting the conservation of temple fish is one of our tasks,” Dr Wimol said. “It will enable a new generation to know native fish from nature rather than books. Fish productivity will increase in the water as fertility returns to past levels.”

Plankton, insect larvae and plant seedlings are plentiful in the Mekong and Chao Phraya basins during the wet season and support the growth of fish larvae. In floodplain areas, the DoF plans to collect from the wild broodstock of at least six freshwater species including silver and red-tail barbs. After being reared and reaching a mature size, the best will be selected for breeding and the fry will be released into flooded areas. To improve awareness of conservation, this will be done in cooperation with local communities.

During the floods, the DoF mobilised 272 staff, 66 speed boats and 49 trucks to provide food, water and transport for victims, especially those in Nontha Buri, Ayutthaya, Pathumb Thani, Nakhon Sawan, Lop Buri, Uthai Thani, Sing Buri, Chainat, Samut Prakarn and Bangkok.

Special thanks to Naruenart Phakphongyothin, Phitan Nongnuon and Pratheep Sriphoca

* Mr Theerawat is an MRC Fisheries Programme Officer
Catching escaped crocodiles

Theerawat Samphawamanana and Charoenchai Srisuwan *

Department of Fisheries teams up with a private crocodile farmer to ally public fears

In past centuries, crocodiles were so plentiful in Thailand that they could be found throughout the country. People grew accustomed to living side by side with the reptiles. Due to the changing environment and hunting for meat and skins, however, the reptiles disappeared from the wild many decades ago.

Today, Thailand is among the world’s main exporters of crocodile products, farming roughly 200,000 heads at more than 30 farms and 900 small breeding operations, mostly around Bangkok.

During this year’s floods, news of escaped crocodiles in many provinces appeared, having a big impact on people’s fear of the reptiles. In response, the Thai Department of Fisheries (DoF) set up a hot line for people to report escaped crocodiles in flooded areas. It also set up a crocodile catch team comprising 15 staff from the department and three experts from Golden Crocodile Agriculture (Thailand) Co based in Nakhon Pathom in central Thailand.

Crocodile trivia

• When crocodiles sit on river banks with their mouths open, it’s not aggression. They’re trying to cool off as they sweat through their mouths.
• Crocodiles display increased aggressiveness during the mating season, which is linked to the monsoon.
• Each crocodile jaw has 24 teeth that are meant to grasp and crush, not chew. They swallow stones that grind food inside their stomachs, and also act as ballast.

Source: www.telegraph.co.uk/earth/wildlife

Receiving training on how to catch a crocodile

PHOTO: DEPARTMENT OF FISHERIES
team learned how to catch crocodiles by using long, electric cattle prods until the reptile fell unconscious. The technique then involved snaring it and dragging the animal on board, covering the eyes and jaws with thick rope.

“It’s important to use this opportunity to show people that they have nothing to fear about crocodiles,” Dr Wimol told the Asian Wall Street Journal. “We’ve lived alongside them in all kinds of habitats in the past. Now, we just have to learn to do so again.”

During October and November, the department caught nine crocodiles including four in Bangkok. Another four were caught in nearby Nontha Buri and one in Nakhon Pathom. All were taken to Suphan Buri Fisheries Centre for research.

* Mr Theerawat is an MRC Fisheries Programme Officer and Mr Charoenchai is Fisheries Officer with the Thai Department of Fisheries

---

The catch team swings into action in Nontha Buri
PHOTO: DEPARTMENT OF FISHERIES

Mr Praipan, a crocodile catcher, relaxing after work
PHOTO: DEPARTMENT OF FISHERIES
Rebuilding stocks of once-abundant freshwater prawns around the Tonle Sap

BY NAO THUOK, SO NAM & CHHENG PHEN *

Cambodia’s first stock enhancement trial for giant freshwater prawns results in recaptures of about 5,500 kilograms

The giant freshwater prawn (Macrobrachium rosenbergii) is indigenous to South and Southeast Asia and parts of Oceania. There are two sources of freshwater prawn production. The first is natural production from rivers, lakes and reservoirs. The second is from aquaculture in ponds and pens which requires high investment for seed, feed, labour and management. Globally, yields range from 336 to 2,338 kg/ha/yr (Ahmed et al., 2008). While natural production is lower than aquaculture production, it benefits poor fishers, where post larvae are widely released for stock enhancement in freshwater water bodies (New, 2002; Sripatrprasite & Kwei Lin, 2003; Kutty et al., 2010). Southeast Asian countries with stock-enhancement programmes include Brunei...
Darussalam, Indonesia, Malaysia, Myanmar, the Philippines and Thailand. In South Asia, programmes in India have been considered successful and are ongoing (Kutty et al., 2010; New & Kutty, 2010). The estimated recapture rate of these programmes has ranged from 1% to 7% (Kutty et al., 2010; Sripatrprasite & Kwei Lin, 2003).

The giant freshwater prawn is native to Cambodia, inhabiting several million hectares of nutrient-rich floodplains of the Bassac River in Takeo province, the Mekong River in Prey Veng province, the Tonle Sap River in Kompong Chhnang and Kandal provinces as well as Phnom Penh and part of the Tonle Sap Lake. After spawning in the brackish water of the Mekong Delta of Viet Nam, the post larvae migrate into Cambodia’s floodplains and up to Kompong Chhnang province, as noticed by Chinese envoy Zhou Daguan during the 13th century (see back cover), for nursing, foraging and grow-out. The prawn fishery used to be very abundant in Kompong Chhnang, Kandal and especially Prey Veng, Takeo and Phnom Penh with an estimated catch of 100 tonnes per year during the 1980s. Cambodians continued to enjoy rich catches until the middle of the 1990s. Nowadays, the species is being harvested mostly in Takeo and Prey Veng provinces, primarily along the Vietnamese border, with an estimated catch of about 30 tonnes per year. The drastic decline of 70% cannot supply growing local markets due to heavy fishing pressure and habitat degradation. The catch from Fishing Lot Nos 17 (Bangkang Vear) and 16 (Chrawlay) on the Tonle Sap in Kompong Chhnang and from the bag-net “dai” fishery along the Tonle Sap in Kandal and Phnom Penh has declined steadily. By 2005, there was virtually no catch from these fishing areas. In other words, total freshwater prawn production declined across the country and the distribution range of the species fell from six to two provinces.

First trial and monitoring results
Faced with this critical situation, the Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries initiated the first trial for a stock-enhancement programme of the once abundant prawn in the Tonle Sap River on September 28, 2010. The administration released some 120,000 sixty to ninety-day-old post larvae (PL60 & PL90) into Fishing Lot No 17 to improve and increase the population in Cambodia. It was hoped that the released post larvae could survive predation and migrate into the huge nutrient-rich floodplain surrounding the fishing lot and other areas of Tonle Sap for foraging and grow-out to improve stocks.

After stocking, the regular fish catch monitoring program of the Inland Fisheries Research and Development Institute (IFReDI) of the Fisheries...
Stock enhancement

Administration recorded the number and weight of prawns caught along the Tonle Sap River from Kompong Chhnang to Phnom Penh between November, 2010 and March, 2011. The first positive and promising result came on November 25, 2010 when Fishing Lot No 7 on the Tonle Sap in Kompong Thom province, which had not caught any prawns for the 50 years, reported a catch estimated at about 180 kg. Fishing Lots Nos 6, 8 and 17 in Kompong Chhnang recorded 300 kg. This meant that the stocked post larvae of prawns in the Tonle Sap River migrated upstream beyond the floodplain of Kompong Chhnang to the floodplain of Kompong Thom for foraging and grow-out in the Tonle Sap Lake. In addition, stocked prawns were caught by small and medium-scale fishers around the Tonle Sap in Pursat, Kompong Thom and Kompong Chhnang provinces which had no catches for many years. The estimated catch was 0.5-1.0 kg per season per fisher or 36 kg in Pursat, 223 kg in Kompong Thom and 100 kg in Kompong Chhnang. Furthermore, each of the 63 dai fishers along the Tonle Sap River in Kandal and Phnom Penh recorded estimated catches ranging from 0.5 to 2.5 kg per day with an average of 73 kg per dai per season or 4,604 kg in total. In the four-month period from October 28, 2010 to January 28, 2011, the total estimated catch of stocked prawns harvested by all types of fishing gear along the Tonle Sap River in Pursat, Kompong Thom, Kompong Chhnang, Kandal and Phnom Penh was 5,443 kg (Figure 1) with a gross value of $81,645. It is worth noting that the net profit was $77,645 for four months after stocking, with an economic efficiency rate of 19.41. The weight of stocked prawns caught from the River ranged from 50 g to 200 g, with an average weight of 142.48 g (Figure 2). Records showed that prawn could be harvested within four months of stocking with an estimated recapture rate of 29%. This is a very high recapture rate which is due to the very large size of released post larvae (PL60 & PL90 or sub adult prawns), the very productive floodplain of the Tonle Sap and the very short period of recapture compared to many stock enhancement programs in Southeast and South Asia (Kutty et al., 2010).

Conclusions and recommendations

This first trial shows that the freshwater prawn stocking programme initiated by the Fisheries Administration was successful. The programme should be continued and expanded to replenish depleted stocks due to overfishing and intrusions, increase production for consumer needs and improve socio-economic conditions of fishers.
Stock enhancement

and communities. This will help to reduce poverty and improves people’s livelihoods and national prosperity as stated in the Strategic Planning Framework for Fisheries (2010–2019), the National Strategic Development Plan (2009–2013) and the Royal Government of Cambodia’s Rectangular Strategy II.

* His Excellency Dr Nao Thuok is Director General of the Fisheries Administration of the Ministry of Agriculture, Forestry and Fisheries, Dr So Nam is Director of the Administration’s Inland Fisheries Research and Development Institute (IFReDI) and Mr Chheng Phen is a Deputy Director of the Institute.

References


Figure 2: Proportion of giant freshwater prawn recaptured (%) from the Tonle Sap River by different weights (g)
New species, *Clarias gracilentus*, is believed to be indigenous to the Vietnamese island of Phu Quoc and southeastern Cambodia.

A fish resembling the slender walking catfish (*Clarias niehoffii*) has been found to be a new species from the *Clarias* genus of walking catfishes, the largest genus in the Clariidae family of airbreathing catfishes. Specimens of the fish were collected by Nguyen Van Tu of the Faculty of Fisheries at Non Lam University in Ho Chi Minh City during an ichthyological survey of Phu Quoc island off the southeast coast of Cambodia. While it is not part of the Lower Mekong Basin, the island is administered as part of Kien Giang province in the Mekong Delta.

Tu and two colleagues, Ng Heok Hee from the Raffles Museum of Biodiversity Research in Singapore and Dang Khanh Hong of the Agriculture and Fisheries Extension Center in Kien Giang, have subsequently described the new species in a paper that appeared in taxonomy journal *Zootaxa* earlier this year.

The authors noted that the new species, *Clarias gracilentus*, is also found in southeastern Cambodia and brings to 20 the number of *Clarias* species recognized in Southeast Asia out of 56.
Clarias gracilentus
PHOTO: NGUYEN VAN TU

species worldwide, mostly in Africa. The Southeast Asian species are divided into two species complexes based on their body forms. The slender walking catfish complex of elongated eel-like fishes now includes the new species as well as Clarias nigricans, discovered in the Mahakam River Basin in the Indonesian part of the island of Borneo in 2003, and Clarias pseudonieuhoi, which was discovered in Borneo in 2004.

Vietnamese news reports say the provincial Department of Science and Technology in Kien Giang has allocated almost $10,000 to study the new species to see if it is suitable for breeding.

Further reading:

Clarias gracilentus
PHOTO: NGUYEN VAN TU
Further study on impact of Mekong mainstream development required

Water and environment ministers agree in principle to approach Japan to assist with a study to provide a more complete picture of the impact of hydropower projects

The Mekong River Commission Council Members concluded on December 8 that there is a need for further study on the sustainable development and management of the Mekong River including impact from mainstream hydropower development projects.

The Council Members, comprising water and environment ministers from Cambodia, Lao PDR, Thailand and Viet Nam, agreed in principle to approach the Government of Japan and other international development partners to support the conduct of further study.

The agreement was made in response to the outcome of a verbal discussion by the four Prime Ministers of the MRC Member Countries—Cambodia, Lao PDR, Thailand and Viet Nam, at the 3rd Mekong-Japan Summit held on the sideline of the 19th ASEAN Summit in Bali, Indonesia in November 2011.

At the Bali meeting, the four national leaders discussed the need for conducting further study for the sustainable management and development of the Mekong River and its related resources.

The four ministers made this conclusion at their annual gathering to discuss the prior consultation process for the proposed Xayaburi hydropower project (see box on opposite page) along with other administrative and management matters.

“The outcome today demonstrates the Member Countries’ continued commitment to work together in the regional spirit of the Mekong Agreement to bring about economic development without compromising sustainability of livelihoods of their peoples and the ecology,” said Mr Lim Kean Hor, Council Member Chairperson and Cambodia’s Minister of Water Resources and Meteorology.

“Further study will provide a more complete picture for the four countries to be able to further discuss the development and management of their shared resources,” he said.

In addition to Mr Lim Kean Hor, other MRC Council Members gathered at the meeting were Mr Noulinh Sinbandhit, Lao Minister of the Ministry of Natural Resources and Environment, Mr Preecha Rengsomboonsuk, Thai Minister of Natural Resources and Environment, and Mr Nguyen Minh Quang, Vietnamese Minister of Natural Resources and Environment.
Procedures for Notification, Prior Consultation and Agreement

The 1995 MRC Mekong Agreement established the Procedures for Notification, Prior Consultation and Agreement (PNPCA), which states that Member Countries must notify the MRC’s Joint Committee in the event they wish to engage in any major infrastructure developments (such as hydropower schemes) on the mainstream Mekong or tributaries, particularly if those developments may have significant trans-boundary impacts on people or the environment downstream.

The PNPCA process itself is the formal mechanism in place to enable one or more individual Member Countries to submit an individual project for the 4-country regional consideration. In the case of the Xayaburi dam project, the Government of Lao PDR notified the MRC to begin the PNPCA process.

The MRC received the notification of the Xayaburi hydropower development project from the Government of Lao PDR in September last year. Under the PNPCA, the four countries consult each other on the proposal and then reach a conclusion, within six months since the notification, on how to proceed with the project.

Since the notification, the countries have conducted national consultations with related stakeholders including potentially affected communities to gauge their views and perspectives on the project. The MRC Secretariat also commissioned a team of environmental experts to review documents including the Environmental Impact Assessment submitted by the Government of the Lao PDR.

This consultation process is one of a number of protocols in the 1995 Mekong Agreement to promote cooperation in sustainable management of the basin’s water resources and avoid regional disputes developing.

The Xayaburi hydropower project would be the first such project on the Mekong mainstream downstream of China and would be capable of generating 1260 megawatts of electricity, mainly for export to Thailand.

The Xayaburi dam is located approximately 150 km downstream of Luang Prabang in northern Lao PDR. The dam has an installed capacity of 1,260 MW with a dam 810 m long and 32 m high and has a reservoir area of 49 km² and live storage of 225 Mm³. The primary objective of the Xayaburi dam project is to generate foreign exchange earnings for financing socio-economic development in Lao PDR. The developer is Ch. Karnchang Public Co. Ltd. of Thailand who negotiated a tariff agreement with EGAT in July 2010.

The MRC acts as a facilitating body for this PNPCA process. It is the intergovernmental body responsible for cooperation on the sustainable management of the Mekong Basin whose members include Cambodia, Lao PDR, Thailand and Viet Nam. In dealing with this challenge, the commission looks across all sectors including sustaining fisheries, identifying opportunities for agriculture, maintaining the freedom of navigation, flood management and preserving important ecosystems.

After the six-month period required for the PNPCA’s prior consultation process, the four Member Countries met to discuss the proposed Xayaburi project at the Special Session of the MRC Joint Committee in April 19, 2011 held in Vientiane, Lao DPR. However, the countries could not come to a common conclusion on how to proceed with the project because there is still a difference in views on the matter. The Joint Committee Members agreed that the matter be tabled for discussion at the ministerial level or the MRC Council.
Third edition of better management manual for Vietnamese catfish farmers

New version based on feedback from farmers and other stakeholders

Australia’s Collaboration for Agriculture and Rural Development (CARD) Project has published a third version of a manual designed to get Vietnamese catfish farmers in the Mekong Delta to adopt better management practices.

The new version incorporates revisions based on feedback and experiences from 11 demonstration farms, from among 89 surveyed (see red dots on map below), that volunteered to adopt a draft of the second version. The manual is supplemented by simplified, easily comprehensible and adaptable instructions and advice to farmers and booklets for regular record keeping.

It also includes numerous consultations that the project team had with the volunteer farmers and other stakeholders as well as revisions made at a national workshop with all stakeholders in Long Xuyen in November, 2011 (see Catch and Culture, Vol 16, No 13).

CARD, funded by the Australian Agency for International Development (AusAID) says the farmers will be provided with handbooks that summarize the third version. These will feature simple Vietnamese translations together with standardised record-keeping booklets for use on farms. Considered as primary dissemination material for farmers, the handbooks aim to facilitate industry-wide adoption of better management practices by farmers raising Sutchi river catfish (*Pangasianodon hypophthalmus*) in Viet Nam.

Launched in 2007, the three-year project to develop better management standards was overseen by the Ministry of Agriculture and Rural Development. It was undertaken by the Research Institute for Aquaculture No 2 in Ho Chi Minh City in collaboration with the College of Aquaculture and Fisheries at Can Tho University in partnership with the Department of Primary Industries in the Australian state of Victoria and the Network of Aquaculture Centres in Asia-Pacific (NACA) based in Bangkok.
How might the floods and fisheries of the Lower Mekong Basin be impacted by climate change?

This policy brief examines this question in the context of planned basin development activities drawing upon recent research findings.

A recent study¹ ranked the vulnerability of national economies to the impacts of climate change on their fisheries using indices of exposure, sensitivity and adaptive capacity. The study ranked Viet Nam and Cambodia as two of the most vulnerable countries in tropical Asia (ranking 27 and 30 respectively), along with Bangladesh, Pakistan and Yemen. Their vulnerabilities arise from the combined effect of predicted warming, the economic and dietary importance of their fisheries and their comparatively limited capacity to adapt. Lao PDR was also found to be vulnerable but its ranking at 37 may underestimate its true relative vulnerability because its fisheries are likely to be grossly underestimated in the statistics employed for the study. Thailand ranked 82 in the study because, despite the significance of its fisheries, it is better able to cope with climate change impacts, having a higher gross domestic product, a more diversified economy, and lower rates of poverty.

The study described above clearly demonstrates the vulnerability of the fisheries of the LMB to climate change. But what might be the nature and scale of climate change impacts on the fisheries resources in a warming basin with increasing, but more variable, precipitation?

Impacts of climate change on fisheries resources are likely to arise through complex behavioural, physiological and habitat change-related responses. These may be exacerbated by the effects of adaptive coping strategies pursued by other sectors, particularly those that compete for water²,³,⁴. Whilst there is a large and growing literature on climate change impacts associated with marine systems, far fewer studies have examined impacts on freshwater systems and their fisheries, particularly in tropical regions.
Climate change impacts on inland fisheries

Temperature

Expected higher temperatures in the future have the potential to reduce oxygen solubility in water but can raise the oxygen and food intake demand of fish as their metabolic rates are raised. Higher water temperatures, particularly during the winter months, can favour the survival and poleward spread of parasites and bacteria. Combined, these responses have the potential to reduce fish growth in food limited environments, as well as rates of fish survival. Studies have shown that the reproductive success of tropical species can also decline under elevated temperatures.

Populations inhabiting regions where temperatures already exceed their thermal optima, and stenothermal species with narrow thermal tolerances, are therefore most at risk of impact from rising temperatures. Stenothermal species may therefore be displaced to regions where water temperatures more closely match their thermal optima and be replaced by more temperature-tolerant eurythermal species such as common carp (Cyprinus carpio).

Higher temperatures could also reduce the productivity of large lakes and reservoirs by thermal stratification and stabilisation of the water column reducing the availability of nutrients in the surface layers, thereby impacting on fish production. Sudden overturn of cold anoxic deep waters created through these processes can cause fish mortalities.

Flows

Changes to river flow in response to changing spatial and temporal patterns of precipitation are expected to impact on fish stocks inhabiting river systems. Flows affect habitat availability, system productivity, and also fish population processes i.e. growth, survival and reproduction.

It has been suggested that changes in primary production and transfer will have a key impact on fisheries. Increasing flows during the flood season translate to more extensive and prolonged floodplain inundation, potentially increasing overall system productivity in river systems including the fish component. Longer, more extensive floods are likely to provide greater and more prolonged feeding and opportunities for fish. In response, improved growth should also favour survival and reproductive potential.

However, not all species may benefit. Increasing river flows may hamper upstream spawning migrations, erode spawning beds or sweep eggs and juveniles past downstream nursery and feeding habitat. Overly-rapid changes in water level can also lead to diminished reproductive success of channel-margin spawning and nest-building species. Changes to the timing of flows also have the potential to disrupt spawning behaviour.

The dry season is a period of great stress to many river fish species arising from diminished feeding opportunities and water quality, and elevated risk of predation or capture.

Greater precipitation and water availability during this period might favour fish survival and ultimately exploitable biomass, whilst drier conditions would have the converse effects. However, increasing dry season water levels may diminish primary production and habitat diversity within the system by permanently inundating fringing forests and vegetation leading to permanent die-back and by effectively reducing the size of the flood margin or ‘aquatic-terrestrial-transition-zone’ (ATTZ) for nutrient re-cycling.

Increasing hydrologic variability in river systems could select for generalist species that are better able to exploit a wide range of resources and tolerate to a wide range of environmental conditions leading to the loss of locally adapted or specialist species.

Salinity

Lower flows combined with sea level rise could increase saline intrusion into river deltas. This might displace stenohaline species with narrow salinity tolerances further upstream and increase the upstream range and biomass of more salinity tolerant euryhaline species including those that depend upon brackish water environments to complete their life-cycles e.g. the giant freshwater prawn (Macrobrachium rosenbergii). Changes in species composition might therefore be significant but the net effect on wild fish production and fishing opportunities might be small.
Predicted impacts on fisheries in the LMB

No mechanistic models currently exist with which to predict the net effects of all of these potential responses and their interactions. The task of understanding the impacts of climate change on fisheries production is therefore very daunting. However, empirical models applied at the community level might offer a practical alternative.

A recent study adopted this empirical approach to examine how predicted precipitation and evapotranspiration-driven changes to flow, indicated by extent and duration of flooding under different climate change and basin development scenarios, may affect exploitable fish biomass in the Tonle Sap-Great Lake (TS-GL) system.

The TS-GL is the largest wetland in Southeast Asia and supports productive fisheries and dependent livelihoods both locally and regionally due to the migratory nature of the species of fish that seasonally inhabit the system.

The study assumed that the predicted response for this system would be applicable throughout the lower basin.

The predicted response of fish biomass in the TS-GL System to hydrological conditions each year under six different scenarios of basin development and climate change were examined (Table 1).

The 20-year Future Development Scenario includes the construction of 31 tributary and 11 mainstream dams, and the expansion of irrigation projects by some 2 million hectares according to the Basin Development Plan (BDP). This development has the potential to modify the hydrology of the basin through storage and abstraction effects. Future precipitation in the basin was predicted under future emissions scenarios A2 and B2.

Both minimum and maximum water levels, and the flood indices combining annual flood extent and duration, are predicted to increase over the next 40 years as a consequence of climate change, but not significantly at the 5% level. These increases will be greater under the A2 compared to the B2 emissions scenario.

However, given the extent of their between-year variability, and the predicted marginal changes to their values under each scenario, the study concluded that flow-mediated effects of climate change on fish biomass in the TS-GL system during the next 40 years are unlikely to be detectable (Figure 1).

Basin development activities were predicted to have a significant effect on minimum (dry-season) water levels, raising them by approximately 30 cm depending upon the climate change scenario. However, the study also concluded that these increases would have little effect on fish biomass.

Figure 1 Estimates of the mean loge-transformed fish biomass index for the TS-GL System corresponding to the predicted flooding conditions for the six scenarios. Error bars give 95% confidence intervals around the mean.

Table 1 Climate change and basin development scenarios examined

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Title Description</th>
<th>Development</th>
<th>CC</th>
<th>Development/Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>S1</td>
<td>Baseline Scenario 1985–2000</td>
<td>x</td>
<td>x</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td>Baseline Scenario A2, 2010–2050</td>
<td>x</td>
<td></td>
<td>A2 Future Emissions</td>
</tr>
<tr>
<td>S3</td>
<td>Baseline Scenario B2, 2010–2050</td>
<td>x</td>
<td></td>
<td>B2 Future Emissions</td>
</tr>
<tr>
<td>S4</td>
<td>20 Year Future Development 1985–2000</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S5</td>
<td>20 Year Future Development A2, 2010–2050</td>
<td>✓</td>
<td>✓</td>
<td>A2 Future Emissions</td>
</tr>
</tbody>
</table>

CC: climate change effects
Development: basin development project effects
✓ included in scenario
x not included.
Balancing the threats

Improving impact predictions

This study of climate change impacts on fisheries has made no attempt to quantify the potential impacts on fish biomass caused by changes to water temperature in the basin, or salinity changes in the delta caused by changes to flow. The predicted impacts may therefore be conservative. A more comprehensive assessment would require greater knowledge and understanding of the physiological responses, tolerances and potential behavioural adaptations of the species of fish and the likely response of the ecosystem as a whole. On the other hand, given the plasticity in their reproductive strategies to changes in temperature, their typical high critical thermal maxima, and the small temperature increases predicted for the tropics, the effects of temperature on tropical species are likely to be marginal compared to those arising from altered flow regimes. Furthermore, whilst changes to species distribution in the delta may arise in response to salinity conditions under future climatic conditions, the net effect on wild fish production and fishing opportunities is also anticipated to be marginal.

Flow vs barrier-related impacts

Planned basin development activities will not only modify the hydrology and associated productivity of the river system but are also, particularly in the case of dam construction, likely to obstruct fish migrations between critical habitat and raise natural mortality rates in fish populations as a consequence of fish passage through turbines and other dam structures. These additional barrier and passage effects should be given careful consideration in addition to the climate change or basin development mediated flow-related impacts included in the study described here. Indeed, these barrier effects are likely to be significant and become ever more important in a warming basin because they will diminish opportunities for fish to migrate to areas with appropriate thermal conditions. Even if opportunities for migration were maintained, fish would have to cope with a new physical environment and compete for space potentially bringing about changes in species composition in favour of generalist species and altering ecosystems.

References


* Dr Halls is Director of Aquae Sulis Ltd, a fisheries management and development firm based in Bath, United Kingdom.
New management at Department of Fisheries in Thailand

BY THEERAWAT SAMPHAWAMANA *

Two former members of the MRC Technical Advisory Body for Fisheries Management (TAB) assume senior positions in Thailand

Wimol Jantrarotai has been appointed director general of the Thai Department of Fisheries, succeeding Somying Piumsomboon who has retired. Dr Wimol was previously inspector general of the Ministry of Agriculture and Cooperatives. Before that, he was deputy director general of the DoF.

Dr Wimol has conducted outstanding fisheries research, especially in the development of fish nutrition. He used to head the Thai councils for the Network of Aquaculture Centres in Asia-Pacific (NACA) and the Center for Fisheries Development in Southeast Asia (SEAFDEC). He is also a former member of the MRC Technical Advisory Body for Fisheries Management (TAB).

Three years after joining the department in 1981, the young fisheries biologist won a scholarship from the Ananda Mahidol Foundation for master degree studies at Auburn University in Alabama which led to a PhD. After returning to the department in 1990, he served as director of fisheries affairs and senior fisheries expert before becoming deputy director general of the department in 2007 and the ministry’s inspector general in 2009.

Dr Wimol completed his BSc in Fisheries (first class honors, gold medal) at Kasetsart University.

In other developments, Somwang Pimolbutr has been appointed as one of three deputy directors general. Mr Somwang was previously director of the Inland Fisheries Research and Development Bureau, a position he held since 2008. Before that, he served as director of fisheries centers in many provinces, including Chainat, Ayutthaya, Pattani, Nakorn Sawan and Suphan Buri.

Mr Somwang has also served as a TAB member. He is also well known for his research into various indigenous fish species and was the first person to succeed in breeding the Boeseman croaker (Boesemania microlepis), a highly commercial species known as pla ma in Thai.

After completing his BSc in Fisheries at Kasetsart University in 1976, Mr Somwang joined the Department of Fisheries in 1977. He was promoted as the first director of Mae Hong Son fisheries station in 1988.

Nopphadon Phuwaphanit has succeeded Mr Somwang as director of the Inland Fisheries Research and Development Bureau. He was previously head of provincial fisheries at Prachauob Kirikhun and director of the Coastal Fisheries Research Institute in Songkhla province. He has graduated a BSc in Fisheries from Kasetsart University and a master’s degree from University of the Philippines.

* Mr Theerawat is an MRC Fisheries Programme Officer

Dr Wimol
PHOTO: PONGSIRI PRASOBSUK

Mr Somwang
PHOTO: SUMOLMAN SUWANNAPOOM

Mr Nopphadon
PHOTO: NARISA NUSORN
CP Hong Kong arm expects Viet Nam acquisition to be key growth driver

BY PETER STARR *

Thai feed mill giant Charoen Pokphand sees benefits from increased Vietnamese production of corn and soybeans for use as feed raw materials

CP Pokphand Co Ltd, the Hong Kong-based investment arm of Thailand’s Charoen Pokphand Group, has invested more than $600 million to acquire a controlling interest in CP Vietnam Ltd, an integrated livestock and aquaculture company with a significant presence in the Mekong Delta.

Listed on the Hong Kong Stock Exchange since 1988, the Bermuda-incorporated company already has 78 feed mills in China where its aquatic, swine and poultry feeds have received national awards.

The deal, completed in July, involved CP Pokphand buying Modern States Investments Ltd, a British Virgin Islands company that controls 70.8% of CP Vietnam, for HK$ 4.375 billion ($US 608 million). Modern State is controlled by the Thai group, the country’s leading agricultural conglomerate.

In releasing its interim financial results in August, the Hong Kong company said the acquisition would accelerate the expansion of its business, which has mainly focussed on China until now. “From 2011 to 2015, the Vietnam government has set annual growth targets of 7.5% to 8.5% as part of the five-year growth plan for its local livestock industry,” the company said.

“When to achieve these goals, the Vietnamese government has been facilitating the modernization of its livestock industry, and increasing the production of corn and soybean for use as feed raw materials. With this favourable market environment, the group is confident that its newly-acquired Vietnam operation will stand to benefit.”

CP Vietnam began its aquaculture business in 1999, three years after establishing a subsidiary to cover southern Viet Nam and six years after it first entered the local market with a subsidiary covering the north of the country. The two companies merged in 2009 with operations spanning feed production, breeding and farming to food processing and packaging.

In addition to three shrimp hatcheries, three shrimp farms and nine fish farms, CP Vietnam has three aquatic feed mills in Can Tho, Ben Tre and Dong Nai provinces with a combined capacity of nearly 0.61 million tonnes a year. It also has an aquatic food processing and cold storage plant in Dong Nai and four livestock feed mills in various provinces with plans to invest almost $170 million on another six by 2014.

When the deal was first announced, Dhanin Chearavanont, chairman of the Hong Kong company, said the acquisition would position it as the leader in the commercial feed and industrial farming market of Viet Nam. “We expect the fast growing business in Viet Nam to become a key growth driver and to contribute to a broader and more diversified income base for the group going forward,” Dhanin said, adding that the company’s goal was to become a “significant player in Asia’s promising agri-food market.”

During the first six months of 2011, sales of CP Vietnam jumped 45.3% from a year earlier to VND 13.3 trillion ($US 665 million). For the full year ended 2010, the company posted a net profit of VND 964 billion ($US 50 million) on sales of 22.1 trillion ($US 1.05 billion).

CP Vietnam’s sales in the first half of 2011 represented more than half the Hong Kong company’s sales to external customers of $US 1.14 billion in the same period. More than 95% of revenue was from China, with the rest coming from the United States and other countries.

* Mr Starr is editor of Catch and Culture
In addition to four livestock feed mills and 2,300 farms, CP Vietnam operates three aquatic feed mills in Viet Nam as well three shrimp farms, six shrimp hatcheries and nine fish farms. Feed products are distributed through more than 1,300 dealers while food products are distributed through both traditional and modern channels. Aquatic food products are exported primarily to overseas markets such as the European Union, Japan and other Asian countries.
Cambodia’s potential for reservoir fisheries

After five years in Bangkok as Director-General of the Network of Aquaculture Centres in Asia-Pacific (NACA), an inter-governmental agency that promotes rural development through sustainable aquaculture, Sena De Silva recently returned to Australia where he is Honorary Professor at the School of Life and Environmental Sciences at Deakin University in Victoria. Professor De Silva began his career working on fish populations in reservoirs in Sri Lanka. He later also worked in Scotland and Singapore before finally settling in Australia. He has acted as principal investigator on many reservoir fisheries development projects in Sri Lanka, Viet Nam and Lao PDR over the past 25 years and has published widely in the field. He has also worked extensively on fish nutrition and is an expert on aquaculture planning and development as well as climate-change impacts on aquaculture.

Catch and Culture recently interviewed the professor, an honorary life member of the World Aquaculture Society, about the potential for reservoir fisheries in Cambodia in light of proposals for two hydropower projects on the Mekong mainstream in northeast Cambodia.

Catch and Culture: What are the different systems of fish production in reservoirs in the region?

Professor De Silva: Basically, you have four. The first is where you harness the natural production through natural recruitment and the fisheries thereof. When reservoirs are not good enough for sustainable natural production, stock enhancement can be used. A third system is to partition off reservoir coves with nets or bamboo fences and stock with suitable species. There’s a huge drawdown in reservoir coves and the fish can be harvested as the water level recedes. Such systems can be up to two hectares and are suitable for community fisheries. You also have cage culture and variations of these four systems.

Catch and Culture: What would be the most suitable systems for dam reservoirs, in particular for large mainstream dams such as those proposed for Stung Treng and Sambor?

Professor De Silva: In mainstream dam reservoirs where the water flow is quite high, the chances of enhancing fish stocks is quite low compared with standing water bodies in normal reservoirs. I don’t think aquaculture will be feasible in mainstream dam reservoirs.

“I don’t think aquaculture will be feasible in mainstream dam reservoirs ... there are lots of technical constraints and you probably won’t get cost-effective returns.”

Catch and Culture: What are the constraints and limitations of each production system?

Professor De Silva: With mainstream dams, there are lots of technical constraints and you probably won’t get cost-effective returns. In culture-based fisheries, feed is not a problem as the fish consume what’s available naturally. Regardless of whether you have stock-enhanced fisheries, cage culture or reservoir cove fish culture, you’ll have to have production of suitably-sized fingerlings as seed stock. There’s also a need to consider exotic fish production. People have to be trained in activities such as stock enhancement at the community level. Hatchery managers also have to be trained. Stock-enhanced and culture-based...
fisheries also require rules for things like the type of fishing gear that can be used and how and when the fish are harvested. Issues such as water quality and availability or soil acidity will be very specific to each site. My experience in most of Asia is that none of these issues are problems.

“Fingerling supplies are always a problem. People need to be conscious that it can only be done through proper hatchery production.”

Where you do have problems is when you have an explosion of cage culture in a reservoir which could lead to build up of nutrients in the sludge, resulting in deteriorating water quality over a period of time and finally leading to fish kills when the upwelling occurs. Reservoir coves are more suitable for community-managed culture-based fisheries. But while water quality may not initially be a problem, increased anthropogenic developments in the catchments and the resulting discharge could be a problem for water quality in the future. At the socio-economic level, most reservoir aquaculture is at the community level such as culture-based fisheries with the exception of cage culture by private entrepreneurs. So there's a need for co-management measures. With reservoir coves, communities need to be interested and enthusiastic about stocking fish.

Catch and Culture: What are the challenges related to supplying fingerlings?

Professor De Silva: Fingerling supplies are always a problem. People need to be conscious that it can only be done through proper hatchery production. In most countries, the production of fry is okay. Artificial reproduction is state of the art for many cultured species and is not a problem since many have high fecundity. The next stage, from fry to fingerlings, is where the bottlenecks occur. It’s not just lack of technical know-how. It’s also lack of space and not being able to use available water resources for fry to fingerling rearing in a judicious manner.
What are cultured-based fisheries?

Culture-based fisheries are not a new concept nor a new practice. Culture-based fisheries, as a rule, involve ownership either singly, as in the case of farmer lessees of small reservoirs in Vietnam and/or collectively, in the form of a cooperative or a similar organisation, such as the case in oxbow lakes in Bangladesh and seasonal tanks (small water bodies that retain water only for 6–9 months in the year) in Sri Lanka. As such, culture-based fisheries fall into the realm of aquaculture.

On the other hand, culture-based fisheries may not have received the attention they deserve from aquaculture developers and planners because they are often not perceived to fall within the realm of conventional aquaculture. In culture-based fisheries, not only is the ownership defined, but there is also intervention in the life cycle because the practice can be sustained only with regular stocking.

What is important, however, is that culture-based fisheries are considered to have a very high potential for contributing increasingly and significantly to aquaculture production, particularly in developing countries. This has further positive implications in the current era, particularly in the light of increasing competition in most places for land and water for traditional, intensive forms of aquaculture practices with other uses.

Culture-based fisheries, on the other hand, use existing water resources—which may be natural such as oxbow lakes, or man-created for other purposes such as reservoirs and farm dams and therefore compete minimally, if at all, with other uses. Culture-based fishery practices are essentially non-consummptive practices of primary resources, in particular water, in contrast to the more conventional aquaculture practices such as pond culture.

Moreover, culture-based fisheries often do not involve external inputs, such as feed, and therefore are environmentally less perturbing than traditional aquaculture practices. The only downside with regard to culture-based fisheries, if at all, is its dependence on exotic species to a large extent, already introduced either accidentally or for other purposes in most nations.

It is also important to make a distinction between culture-based fisheries and fisheries enhancement, although the former is a mode of enhancement. Fisheries enhancement in the broader sense includes, for example, sea ranching and/or the introduction of a species that is capable of reproducing in the water body and, with time, forms sufficiently large populations that could be exploited commercially. A good example of the latter is the introduction of tilapia species into perennial reservoirs in Sri Lanka, which with time have become the mainstay of the relatively large artisanal fishery of these reservoirs. Once established, these water bodies do not require regular stocking of these species.


Catch and Culture: Can you see any problems related to environmental impacts, hybridization or invasive species?

Professor De Silva: Let’s face it, any farming system, on land or in water, will have environmental impacts. The challenge to us is to keep such impacts to a minimum so that future generations will not be deprived in harnessing the ecosystems to their benefit as a food source. In respect to reservoir fisheries—reservoirs being man-created and having already brought about environmental changes—it would be detrimental to have stock enhancement without due care.
being taken with the genetic diversity of stocks. Apart from cage culture, the chance of artificially-bred stocks intermingling with natural stocks is high. And if cage culture explodes, the nutrient load of the water will be affected. I don’t think hybridization would be a problem. As for invasive species, this term is used in a very loose sense, especially in the West. Tilapia has been introduced into Asia and it’s a very important food fish. But there’s no explicit scientific evidence that it has had a detrimental impact, as the Mekong River Commission itself has pointed out. But we usually try to promote the use of indigenous species in future activities. But keep in mind that our current knowledge of genetics has to be applied in our attempts to use indigenous species. Science has progressed much further than in the era when biodiversity impacts were attributed to loss of strains and species.

“For reservoir fisheries in general, the main cost is the fingerlings. Other costs are labour including harvesting.”

Catch and Culture: What about production costs and what are the production prospects for each system of reservoir fish production, particularly for large mainstream dams such as Stung Treng and Sambor?

Professor De Silva: For reservoir fisheries in general, the main cost is the fingerlings. Other costs are labour including harvesting. Apart from cage culture, the fish grow fending on what’s available in the water and there are no feed costs whereas feed ranges between 50 and 70 percent of production costs in other types of aquaculture. There has been very little research on production costs in reservoirs on mainstream dams and very little is known.

“With respect to pangasius, I don’t think it can be replicated in any other country, to the same intensity”

Catch and Culture: Can the successful cases from Viet Nam (pangasias) and Lao PDR (Nam Ngum reservoir) be easily replicated in Cambodia?

Professor De Silva: With respect to pangasius, I don’t think it can be replicated in any other country, to the same intensity, producing on average 250-400 tonnes per hectare per crop. It’s more to do with Vietnamese culture and entrepreneurship as well as the simple fact that they can pump the water in and out of their ponds. We don’t know for how long this could be kept going but I don’t think it can be replicated. And I don’t think we should try to. This does not preclude pangasid aquaculture being developed in other countries. There are indications that it is being developed, for example, in India, using the ponds that were once used for Indian carp culture. But here again no where near the intensity and productivity gains as in the Mekong Delta in Viet Nam. Nam Ngum reservoir is very different to those proposed mainstream run-of-river dams in Cambodia. The latter are unlikely to be productive like the former. As such, the scenario in Nam Ngum is unlikely to be replicated in the proposed reservoirs in Cambodia.

“I don’t think cage culture is appropriate for Cambodia. That’s why we’re focusing on culture-based fisheries.”

Catch and Culture: What are the production prospects for existing water bodies in Cambodia?

Professor De Silva: I think there are plenty. Cambodia, like Laos, has many small water bodies of 10 to 15 hectares with changing water levels, mostly rain fed although some are riverine. These water bodies are also the heart of village communities for drinking, water buffaloes, cooking and washing. These water bodies should be enhanced for community-based fisheries through culture-based fisheries which, in essence, are an extensive form of aquaculture, a form of stock and recapture with the ownership firmly defined. When I was still at NACA, we developed a project to develop culture-based fisheries in Laos and Cambodia. ACIAR is financing this three-year project which is expected to start in the first half of 2012 and cost $A640,000. I don’t think cage culture is appropriate for Cambodia. That’s why we’re focusing on culture-based fisheries as the only input where, apart from labour, the major input is the fingerlings.
Viet Nam to set up **high-growth** economic zone in four Mekong Delta provinces

**Contribution of agriculture, forestry and fisheries to economic output in the southwest corner of the delta is expected to be halved over the coming decade as the government targets rapid expansion of manufacturing and service sectors**

Vietnamese Prime Minister Nguyen Tan Dung has decided to establish a key economic zone in the Mekong Delta that is targeted to account for 40% of the country’s gross domestic product (GDP) by 2020.

The Vietnam News Agency (VNA) reported on December 5 that the new zone would comprise Can Tho City and An Giang, Kien Giang and Ca Mau provinces. An Giang shares a border with Kandal and Takeo provinces in Cambodia while Kien Giang borders the Cambodian provinces of Kampot and Kep. The zone is targeted to grow 25% faster than national GDP over the next 10 years, the VNA report said.

VNA said the zone would focus on industry and services and rely less on agriculture, forestry and fisheries. Industrial and construction activities are targeted to rise from 29% of economic output in 2010 to 40% in 2020 while the services sector is expected to increase from 42% to 45% in the same period. The agriculture, forestry and fisheries sector is targeted to decline from 29% to 15%.

At the same time, the ratio of trained workers is targeted to jump from 38% of the labour force in 2010 to 65% in 2020 with annual income rising from $1,200 per capita to a targeted $3,000, the report said.

VNA said the zone would focus on developing three thermal power plants with a capacity of up to 9,400 megawatts, fueled by gas from fields off the southwest coast. It said the government was also putting priority on developing transport infrastructure in the zone including Phu Quoc island, which borders the Cambodian province of Kep.
Economic zone proposed for Can Tho, An Giang, Kien Giang and Ca Mau

MAP: MEKONG RIVER COMMISSION
Training the gender trainers

BY MALASRI KHUMSRI *

MRC Fisheries Programme continues to support the Network for Promotion of Gender in Fisheries

Women have been recognised as an integral part of the fisheries sector. Their contribution is significant and their involvement in some activities is greater than that of men. Fisheries development plans in the Lower Mekong Basin must therefore take the role of women fully into account.

In 2000, women in fisheries “focal points” were formed along with a network that became known as the Network for the Promotion of Gender in Fisheries (NGF). In 2004, the Swedish International Development Cooperation Agency (SIDA) began funding a three-year project under the Technical Advisory Body for Fisheries Management (TAB). The aim of the TAB Gender and Women in Fisheries project was to help line agencies in the four MRC countries integrate gender issues into fisheries management. The MRC Fisheries Programme has continually supported NGF activities including 12 annual meetings and a regional workshop on Gender Awareness and Mainstreaming in 2009.

Effective promotion of gender equality in fisheries development requires training of trainers (TOT) on gender aspects and tools. In December, 2011, the MRC Fisheries Programme and the Integrated Capacity Building Programme (ICBP) therefore organised a regional TOT workshop on Gender in Fisheries Development as part of the NGF Action Plan for 2011-2012. Twenty-five people took part in the workshop, which was held in Khon Kaen in northeast Thailand. Among the 21 women and four men were representatives of National Mekong Committees, NGF members and fisheries officers from the four countries.

The workshop aimed to strengthen skills for training in gender mainstreaming in fisheries development. It also aimed to share experiences, knowledge and lessons learnt while developing an action plan for participants to apply the skills gained from the training course into their work.
Four men and 21 women took part in the regional workshop on training of trainers on Gender in Fisheries Development

PHOTO: Inthira Pomrattanapong

Gender Tree

Community:
impact on health, education, social status, income, information, land, credit accessibility.

Organization:
impact on gender progress

Maintained by:
education, family, state/Law, religion, economic system, media

Activities/Work
Responsibilities
Roles
Norms
Beliefs
Tradition
By linking gender into fisheries management, training of trainers will:

1. Provide overview of gender mainstreaming in fisheries management
2. Provide tools and practical skills for participants to plan and conduct gender-sensitive training
3. Reach agreement on plan for training to be conducted

The main approach was to train the trainers in both theory and practice. The contents of the workshop covered three main topics:

1. Giving future gender trainers experience in gender-sensitive training (see three modules below);
2. Methods and practical training skills; and
3. Designing a sequenced gender training plan that identifies objectives, targets, lessons and methods engaged.

This regional workshop benefited participants with three main outcomes. First, they now have a better understanding of gender mainstreaming in integrated water resources management as well as fisheries management and development so they can consider gender issues in work plans and activities. Second, the participants understood technical skills for gender-sensitive training and practised exercises for organising, preparing, and facilitating training sessions. Third, the participants are now able to design gender-training plans based on identifying gender problems.

In addition, participants agreed on important points in moving toward upcoming NGF training in the four countries. At the same time, the workshop represented an output under the Project Implementation Plan of the Fisheries Programme for 2011-15 which aims to develop the technical and administrative skills and knowledge of fisheries managers. It was also a good example of collaboration between two MRC programmes in promoting gender mainstreaming in the Mekong region.

* Dr Malasri is Fisheries Management and Governance Specialist at the MRC Fisheries Programme

<table>
<thead>
<tr>
<th>Key contents</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raising gender awareness</td>
<td>Background of gender and development in fisheries sector/agencies and policy makers</td>
</tr>
<tr>
<td></td>
<td>Pre-attitude assessment on gender concept</td>
</tr>
<tr>
<td></td>
<td>Revising expectations, small rules and objectives</td>
</tr>
<tr>
<td></td>
<td>Gender difference and inequality</td>
</tr>
<tr>
<td></td>
<td>Revising gender concepts &amp; some important terminologies</td>
</tr>
<tr>
<td>Identification gender problem and solutions</td>
<td>Gender problem identification &amp; analysis</td>
</tr>
<tr>
<td></td>
<td>Problem solving in programmatic and organisational practices</td>
</tr>
<tr>
<td>Incorporating gender in practices and planning</td>
<td>Why fisheries development activities need gender equality and women’s empowerment</td>
</tr>
<tr>
<td></td>
<td>Planning priorities and support needs</td>
</tr>
</tbody>
</table>
Kong Sovanara has joined the MRC Fisheries Programme as aquaculture specialist. Mr Sovanara was previously head of the Fisheries Department at Prek Leap National School of Agriculture in Phnom Penh. Before that he headed the school’s Office of Planning and International Relations and also served as vice head and lecturer at the school’s English Centre. His areas of expertise include hatchery techniques, growout production, genetics and stock improvement, aquaculture system design and management as well as feed and nutrition. He joined the staff of the school’s fisheries section in 1994 as a lecturer in aquatic chemistry and English. In addition to Cambodia, Mr Sovanara has studied in Australia, Canada and New Zealand. He has a Master’s Degree in Applied Science in Aquaculture from James Cook University in Australia, completed in 2009, and a Master of Science in Aquaculture and Aquatic Resources Environment from the Royal University of Agriculture, completed in 2006. He also has a Bachelor of Fisheries Science from the Royal University of Agriculture and a Bachelor of Education from the Royal University of Phnom Penh.
"Of their fish and turtles, black carp are the commonest. Other fish that are plentiful include common carp, gold fish and grass carp."

"There are (gobies) — the large ones weigh up to three pounds. Otherwise there are very many fish whose names I don’t know, all of them coming from the Freshwater Sea. …"

"There are also swamp eels and freshwater eels from the lakes."

"Prawns from Zhanan weigh a pound and a half or more each. The goose-necked barnacles from Zhenpu may be eight or nine inches long …"

"The razor clams look very fine. They get clams, mud clams and pond snails just by scooping them out of the Freshwater Sea …"

"There are crocodiles as big as boats. They have four feet and look exactly like dragons except they have no horns."

_Thènla fèngtúji_ is the original title of the oldest first-hand account of the Angkor civilisation. Written by Chinese envoy Zhou Daguan, who visited the city in 1296-97, a direct translation from Chinese to English did not become available until 2007 when "A Record of Cambodia" was published. The excerpts above from the translation by Peter Harris indicate the diversity of fish and other aquatic animals more than 700 years ago. The “Freshwater Sea” refers to the Tonle Sap Lake. “Prawns from Zhanan” is believed to refer giant freshwater prawns, possibly from Kompong Chhnang. “Zhenpu” is on the coast of southern Viet Nam, possibly near Vung Tau.