



# Scoping Study for Biodiversity Assessment of the Mekong River in Northern Lao PDR and Thailand



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Edited by Peter-John Meynell

The World Conservation Union (IUCN) Water and Nature Initiative and  
Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme

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Special thanks must go to the whole team, who worked well and enthusiastically together, and who all provided their comments, perceptions and inputs to the report.

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<sup>1</sup> The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) is a joint programme of the four riparian governments of the Lower Mekong Basin – Cambodia, Lao PDR, Thailand and Viet Nam – managed by the United Nations Development Programme (UNDP), The World Conservation Union (IUCN) and the Mekong River Commission (MRC).

## EXECUTIVE SUMMARY

In late February 2003, a rapid biodiversity scoping study of the upper stretches of the Mekong between Laos and Myanmar, and between Laos and Thailand was undertaken. The objective was to prepare for a more detailed survey of the area that has been scheduled for river modification activities under the Navigation Channel Improvement Project. The study was carried out by a team of ten people, including five international biodiversity specialists, three Lao government staff, and two from Thai environmental NGOs. The area studied was from the Tang Salum Rapid to Baan Huai Xai/Chiang Khong.

The area is rich in biodiversity, falling into at least three different ecological zones – fast mountain river with extensive rock outcrops and rapid systems, wider, slower moving meandering river, and then back to faster river with braided channels and deep pools. All of these areas are important for fish life cycles and fisheries, although in the upper reaches, fishery activities appeared to be limited at the time during which the survey was undertaken. Various stretches of the river and its surrounding landscape were identified as biodiversity refuges, for which steps should be taken for their protection.

The impacts of the navigation channel improvement measures carried out so far cannot be predicted without adequate prior assessment. The sites of the measures appear to be relatively limited, and they may not change the overall character of the river owing to the extensive nature of the rock formations and shoals over much of the length of river surveyed. However, there is far more cause for concern regarding the more extensive modifications planned under future phases of Navigation Channel Improvement Project. The absence of a comprehensive and effective EIA and/or baseline survey means that not only are the impacts difficult to predict, but also it will be very difficult to say how the modification measures have actually affected the river and its biodiversity.

The team members are much more concerned about the long-term impacts of increased and larger cargo boats using this part of the river. Already there is evidence of impacts upon the environment and the local livelihoods of riparian communities. The potential for increased negative impacts with the implementation of Phases 2 and 3 is considered to be high, and no further implementation should be done without an adequate impact assessment based upon baseline information gathered during additional surveys. It is also recommended that an impact assessment include a thorough assessment of options for improving trade communications, and that all assessments be undertaken with full consultation of local people.

In particular, three biodiversity surveys are recommended:

- An extensive biodiversity survey of the entire stretch of the river between the Chinese/Laos border to Luang Prabang, sampling at least 10 sites, during November/December 2003.
- An intensive baseline survey to be carried out at Khon Pi Luang (Thailand and Laos) rapids in both June and November 2003, to be coupled with a study of livelihoods of local communities. This rapid is significant both from a biological point of view, but also because it is scheduled for modification in December 2003. Hence a baseline survey can be carried out in time, at both rising water and falling water regimes.

- Preliminary survey of the habitat and spawning of Mekong Giant Catfish around Chiang Khong. The Mekong Giant Catfish is a Critically Endangered endemic species of the Mekong, which can be used as a flagship species and indicator for the health of the Mekong.<sup>2</sup>

In addition it is recommended that the EIA, carried out on behalf of the four countries, be updated in the light of the experiences of the channel improvement measures, the observations of these carried out by the Ministry of Communication, Transportation, Posts and Construction, and assessments such as have been carried out by The World Conservation Union (IUCN) and South East Asia Rivers Network (SEARIN), and the independent the review of the project EIAs commissioned by the Mekong River Commission (MRC). This process of updating the EIA should be carried out with the involvement of all the four countries and used to develop environmental management measures both for river modification works and for the sustainable use of the river for navigation. On the basis of this, environmental protection clauses should be included in the Navigation Agreement.

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<sup>2</sup> This interim study was carried out in May 2003 by Dr. Zeb Hogan, and a draft status report of the Mekong Giant Catfish has been prepared. Hogan, Z. (June 2003). *Current Status, Threats and Preliminary Conservation Measures for the Mekong Giant Catfish*. IUCN.

## 1 INTRODUCTION

The reaches of the Mekong River from where it flows out of China, between Laos and Myanmar and then Thailand, have been identified as important for biodiversity, especially for migratory species of fish including the Giant Catfish. However very little detailed information on biodiversity is available.

In late February 2003, IUCN, in collaboration with the Lao National Mekong Committee undertook a preliminary survey of the river and its riparian areas in preparation of a more detailed biodiversity survey later. It was intended that this rapid survey would provide basic information of the habitats and some of the species of importance to biodiversity conservation in this part of the river. A more detailed survey could then be planned, potential sites for sampling identified, and methods of survey described.

This survey was carried out under the auspices of the UNDP-GEF Mekong Wetland Biodiversity Conservation and Sustainable Use Programme<sup>3</sup>, currently in its preparatory phase before the GEF funding comes on stream by the end of 2003. This regional wetlands programme includes a number of outputs that deal with developing guiding principles for wetlands management, preparing biodiversity overlays and supporting training for Red Listing activities. The Giant Catfish, an Endangered Species on the IUCN Red List, has also been identified as a flagship species for this Mekong Wetlands programme.

This scoping assessment follows on from an IUCN-SSC<sup>4</sup> Training Course on "Biodiversity Assessment Tools for Inland Water Ecosystems in the Lower Mekong River Basin", held in Vientiane from 18-21 February 2003. Funding for this survey came from the Water and Nature Initiative Funds managed by the IUCN Asia Regional Office. Logistic arrangements were provided by the Lao National Mekong Committee and IUCN –Lao PDR.

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<sup>3</sup> The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) is a joint programme of the four riparian governments of the Lower Mekong Basin – Cambodia, Lao PDR, Thailand and Viet Nam – managed by the United Nations Development Programme (UNDP), The World Conservation Union (IUCN) and the Mekong River Commission (MRC).

<sup>4</sup> SSC – Species Survival Commission, the section of IUCN responsible for the red-listing process

## 2 OBJECTIVES AND METHODOLOGY

The objectives of the scoping survey were:

- To increase the understanding of the Mekong biodiversity in the riverine ecosystems, habitats and species in the stretch of the Mekong between the China/Laos border and Ban Baan Huai Xai (Laos) and Chiang Khong (Thailand), and of the riparian communities that depend upon the natural resources in this stretch of the river for their livelihoods.
- To establish a plan for a more detailed biodiversity survey of the area, including expertise required, proposed sites for sampling, and methods to be used.

### 2.1 Team Members and Itinerary

The rapid survey team consisted of the following persons:

- Mr Peter-John Meynell – Team Leader of Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme
- Dr. Will Darwall – IUCN Freshwater Biodiversity Assessment Officer
- Dr. Anders Poulsen – Fisheries Expert
- Dr. Zeb Hogan – Giant Catfish Expert
- Dr Channa Bambaradeniya – Head of Ecosystem Management and Species Conservation Unit, IUCN Sri Lanka

Lao Government officials:

- Mr Phonepaseuth Phoulipanh – Lao National Mekong Committee
- Mr Thavone Vongphosy, Department of the Environment, STEA
- Dr. Douangkham Singhanouvong, LARREC

From Thailand:

- Ms Wipapan Nakpaen – Environmental Education Specialist, GWFT
- Mr Chainarong Srettachau – Biodiversity/Rural Livelihoods Expert, SEARIN

The itinerary was as follows:

- Saturday 22 February. Team arrives in Vientiane and Luang Prabang
- Sunday 23 February. Team members from Vientiane fly to Luang Namtha. Team members in Luang Prabang drive to Luang Namtha. Initial team meeting. Overnight in Luang Namtha.
- Monday 24 February. Meeting with provincial representatives of Dept of Communication, Transportation, Posts and Construction. Drive from Luang Namtha to Xieng Kok. Boat trip to inspect Tang Salem Rapid. Overnight in Xieng Kok
- Tuesday 25 February Inspection of river by boat between Xieng Kok and Muang Mom. Overnight in Muang Mom
- Wednesday 26 February Inspection of river by boat between Muang Mom and Baan Huai Xai. Laos team members depart for Luang Namtha and flight back to Vientiane. Overnight in Baan Huai Xai.
- Thursday 27 February. Discussions with representatives of Giant Catfish Fishermen's Association. Inspection of river upstream of Chiang Khong to Chiang Saen by car in Thailand. Depart for Bangkok from Chiang Rai.

## 2.2 Methods

### 2.2.1 Documentation of Vertebrates and Selected Invertebrate Fauna

Different groups of vertebrates and selected invertebrates were documented in an opportunistic manner, along the ecosystems/habitats of the Mekong River in Northern Lao and Thailand. The specimens of fauna were identified using the scientific knowledge of experts who participated in the survey, and were further clarified/confirmed using available scientific guides on faunal groups of the Southeast Asian Region. The specific rapid sampling methods adopted to document the various groups of fauna, and the scientific guides used to confirm their identifications and taxonomy are summarised in Table 1.

Group	Method	Taxonomic Guides
Freshwater fish	Collection of specimens from commercial/subsistence catch; hand netting, setting of larval nets	Kottelat, M (2001)
Amphibians	Manual collection of adults/tadpoles	Nutphund, W (2001)
Reptiles	Observation of live specimens	Cox <i>et al.</i> (1998)
Birds	Direct observation of live birds using binoculars and Indirect methods (calls/songs; observation of feathers/wings of hunted birds available with villagers; verification of hunted specimens by showing illustrations of birds to villagers)	Robson, C (2000)
Mammals	Direct observation of live/dead specimens; indirect methods (faecal matter, tracks); interviews with villagers using IUCN poster of threatened animals	Francis, C. M. (2001)
Butterflies	Observation of live/dead specimens	Pinratana, A (Vol. 1 – 6)
Aquatic insects, molluscs and crustaceans	Manual collections using hand nets, vials	

**Table 1:** Summary of Rapid Sampling Methods for Fauna, and Guides Used for Identification and Taxonomy

### 2.2.2 Identification and Categorisation of Ecosystems and Habitats

Restrictions on time and financial resources did not permit an exhaustive survey of biodiversity in all habitats throughout the river basin – sampling had to be stratified to include the full range of available habitats. In this rapid assessment, notes were made to give a preliminary idea of the range and extent of habitats found in the survey area – the aim being to identify key sites for future more intensive surveys.

Coordinates of representative vegetation types and habitats, including relatively undisturbed natural ecosystems that serve as important biodiversity refuges along the stretch of the river were obtained with the aid of a GPS meter (Garmin 12XL).

Sections of the river were categorised according to velocity of water flow, abundance of bedrock/rock-outcrops and width of the river. Topographical variations along the mainland areas beside the river were also noted.

Vegetation types were categorised according to the physiognomy of flora (structure and composition) and human disturbance. In addition, specific wetland habitats within the river system, such as pools, mud/sand/pebble flats (islands), and rock-outcrops were also noted. Issues related to degradation/deterioration of ecosystems and habitats, over-exploitation of species and spread of invasive alien species were noted along the survey stretch.

A rapid classification method was employed by assigning a rank value (0-2) to a range of habitat features observed while descending the river by speed boat where, “0” = not present, “1” = present, and “2” = abundant/widespread.

The features recorded are listed in the accompanying spreadsheet (see box). Each column of entries represents the general impression obtained for the stretch of river between the two GPS Stations. Additional features were included for the second day (26/2/03) with the benefit of observations made on day 1 (25/2/03). These have then been presented on simple bar charts to indicate the change in the prevalence of different features with passage down the river. The features have been grouped according to a) river character, b) bank and river bed substrate, c) adjacent countryside character, d) human activity.

GPS Ref	<b>Adjacent countryside – Topography:</b>
Name or feature	Flood plain: wide/narrow
Distance from previous station	Mountains
<b>River features:</b>	Hills
Est. Av width (m)	Flat
Flow rate (fast/med/slow)	
Rapids	<b>Adjacent countryside – Vegetation:</b>
Narrows	Primary forest
Riffles	Bamboo
Pools	Banana
Estimated depth of pool (m)	Rubber/Teak
Run	Reeds
Mid-stream rocks	Scrub
Island	Adjacent vegetation cleared
<b>Riverbank character:</b>	
Large rocks/boulders	<b>Human Activity:</b>
Small rocks	Villages
Sand beaches	Riverside cultivation
Mud/sediment	Urban/Industry
Pebbles	Fishers
Artificial embankment	Gold mining
Natural banks	River modification activities

These preliminary observations can be employed to help design a more comprehensive survey method for mapping habitats using a slower boat to make recording of observations easier.

### 2.2.3 Discussions with Villagers, fishers and Key Informants

Group discussions were held on villager livelihoods, local knowledge and impacts of water fluctuation at a villager camp near Wong Wit Rapids and a village in Lao, Ban Don Moon. Perceptions on the concerns of local people and fishers such as riverbank collapse, and vulnerability of livelihoods were gathered.

One of the key methods for developing the fish species list was using illustrated books and pictures of Mekong fish, and discussing which species were found by the local fishers and issues such as seasonality, spawning behaviour and frequency of catch.

In-depth interviews were held with the key informants on local knowledge and villagers’ perspective of impacts of the navigation project and river traffic. Two key informants were fishers involved with the Giant Catfish Fishermen’s Association in Chiang Khong.

### 3 SURVEY OBSERVATIONS AND RESULTS

#### 3.1 Physical Description and Hydrology

The stretch of the river surveyed can be divided into three parts. First the upstream section from Tang Salum (waypoint TS2) to below the Tang Au Rapid (waypoint 32), about 10 km north of Muang Mom (waypoint 34). This area consists of a series of massive rocky outcrops, both above water and submerged, forming the rapids. Water flows fast and turbulently. Many rapids have associated deep pools and sand banks. The width of the river channel varies between less than 50 m to 150 m.

Because of the rocky substrate of this section, bank erosion is not considered much of a problem, except in the wider areas, such as at Ban Don Moon (waypoint 26). Here the banks consist of deposited sand, on which the villagers cultivate crops such as soy beans and ground nuts. According to the villagers this year there has been a lot of erosion in this part of river, and they are concerned about loss of banks for dry-season cultivation. The villagers also report short-term fluctuations in the river level, with marked differences during day and night. The cause of this is unknown however, and requires further investigation.<sup>5</sup>

The second part is the Mekong River from upstream of Muang Mom to Ban Nam Keung Mai (waypoint 48), where the speedboats stop before Baan Huai Xai. The river in this area is wider than upstream, up to 500 m across in places. The river is slower moving, with wide meanders, exposed sand and pebble banks on one side alternating with steep eroded banks on the other. Many tributaries and streams flow in to the Mekong river in this area include Nam Ruaak, Nam Kam, Nam Kok, Nam Yon. Water flow in this area is not turbulent.

The third section occurs after the Nam Keung Kao river flows in from the Lao side, when the Mekong flows through a narrow channel and over the Khon Pi Luang rapids system (waypoint 49) to just above Baan Huai Xai (waypoint 54). This system of rapids has a different character to the rapids higher upstream, consisting of rock outcrops (not as massive as upstream), mudflats and sand bars created by sedimentation, low lying islands (often with shrubs flooded during high flows) with long deep pools, rapids and whirlpools. The deep pools may be several hundred metres long and vary in depth up to 100 m, but more usually, 30 – 60 m deep.

The landscape on either side of the river was hilly from waypoints 1 – 22. The landscape in wider areas of the river consisted of generally flat plains (low altitude). Figure 1 shows a map of the river between the Tang Salum rapid and Baan Huai Xai is shown, with the waypoints marked.

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<sup>5</sup> This hydrological pattern is typical of upstream dam operation, but these observations would need to be documented from daily water level records, and correlated with operational information on upstream dams.



## 3.2 Biological - Overview of Ecosystems, Habitats and Species

### 3.2.1 Habitats Overview

A wide diversity of riverine habitats was observed. This section of river could be divided into the following distinct sections based on habitat types:

**Waypoints Tang Salum (TS2) to 28:** Fast flowing river, narrows bordered by extensive large rocks and boulders interspersed with rapids, mid-stream rocks, and probable deep water pools (depth measurements not possible because of strong currents and inappropriate survey boats). These habitats are likely to be important to many fish species – particularly as low water refuge areas and as possible spawning grounds. The high level of water turbulence provides good oxygenation of water at times of low flows. Occasional pebble banks were observed – this is a distinct habitat likely to be important to many smaller fish species and invertebrates (intensive sampling recommended). Forest cover is reasonable on the Lao side of the river which is largely hilly. The original natural forest on the Myanmar bank, which is comparatively flat and low-lying, has been largely cleared and replaced by extensive bamboo forest and occasional banana.

**Waypoints 29-34:** The river broadens out and the flow rate is reduced and rapids are absent. Deepwater pools may be present but further depth soundings are required to determine this. The riverbank is predominantly of sand interspersed with small rocky areas. Villages are more common in this stretch of river but fishing activity was rarely observed. Forest cover is still reasonable in many areas along the Lao bank but has again been largely replaced by bamboo on the Myanmar side. Both sides of the river rise into surrounding hills in most areas.

**Waypoints 36-47:** The river broadens out further and the apparent flow rate is further reduced. Rocky areas and rapids are absent. The riverbank is predominantly of steep, eroded mud/silt banks (4 - 10 m high) interspersed with extensive wide sand and pebble beaches. Islands are present in a few sections. The river has been heavily modified through embankments along a significant portion of this stretch of river which is heavily urbanised at Stations 36-39, especially on the Thailand side. The floodplain is wide at this point and the adjacent countryside is relatively flat. Natural forest is almost absent and has been replaced by cultivation on both banks. A narrow strip of reeds is often present on both sides of the river. There is an extensive area of reeds at the junction between the Mae Nam Kok river and the Mekong on the Thailand side below Chiang Saen. Villages are relatively common but fishers were only observed in the lower few stations of this stretch.

**Waypoints 49-52:** The final stretch of river to Huay Xai narrows down again to include frequent rapids. The riverbanks are of large rocks/boulders interspersed with sand and silt beaches and banks. Mid-stream rocks are evident. The riverbank leads into steeply rising hills and forest cover is present in patches on the Lao side. The Thailand side of the river is largely cleared and cultivated. Few villages were observed and fishing activity was limited to the lowest stretch where gillnetting and traps were commonly observed.

Several terrestrial vegetation types and wetland habitats were encountered along the river, and these included natural as well as human-influenced types. As a whole, the mixture of terrestrial and wetland habitats function as an ecozone harbouring a high biodiversity. The terrestrial vegetation/land use types are highlighted in Table 2, while the wetland habitat types are summarised in Table 3. The charts showing the river features and riverbank character, the surrounding landscape features and riparian vegetation, and human activity, are shown in Figures 1 – 5.

In some cases these are expressed as percentages of each feature between the waypoints, in other cases, these are expressed as perceived abundance of the features. <sup>6</sup>

Vegetation/Land Use Types	Status	% Cover <sup>1</sup>
Evergreen riverine forest	Natural, undisturbed, high floristic richness in terms of woody plants	< 5%
Evergreen Disturbed riverine forest	Natural, disturbed due to logging. Includes secondary forest	15%
Bamboo forest	Disturbed forest invaded by opportunistic bamboo ( <i>Bambusa</i> ) species	25%
Wild banana shrubland	Disturbed forest invaded by opportunistic Banana ( <i>Musa</i> ) species	10 %
Abandoned cultivations/shrubland	Disturbed landscape used for shifting agriculture and abandoned, leading to development of shrubland. Patches of bare land also evident.	15%
Tall grass/reed beds	Tall grasses growing along banks of wider areas of the river	<5%
Farmland	Existing cultivations and home gardens	25%
Plantation forests	Teak Plantations	< 5%

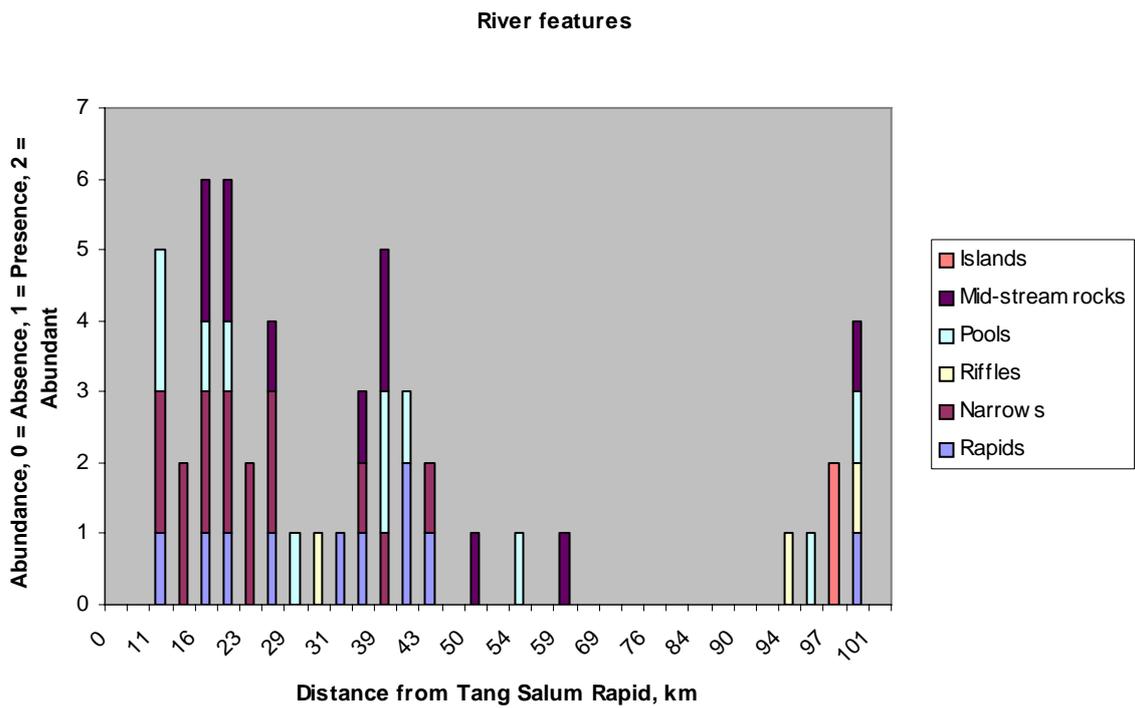
**Table 2:** A Summary Description of Terrestrial Vegetation Types Observed Along the Stretch Surveyed

<sup>1</sup> % Cover is a qualitative assessment of proportionate cover of specific vegetation/land use type in 300m either side of the Mekong River.

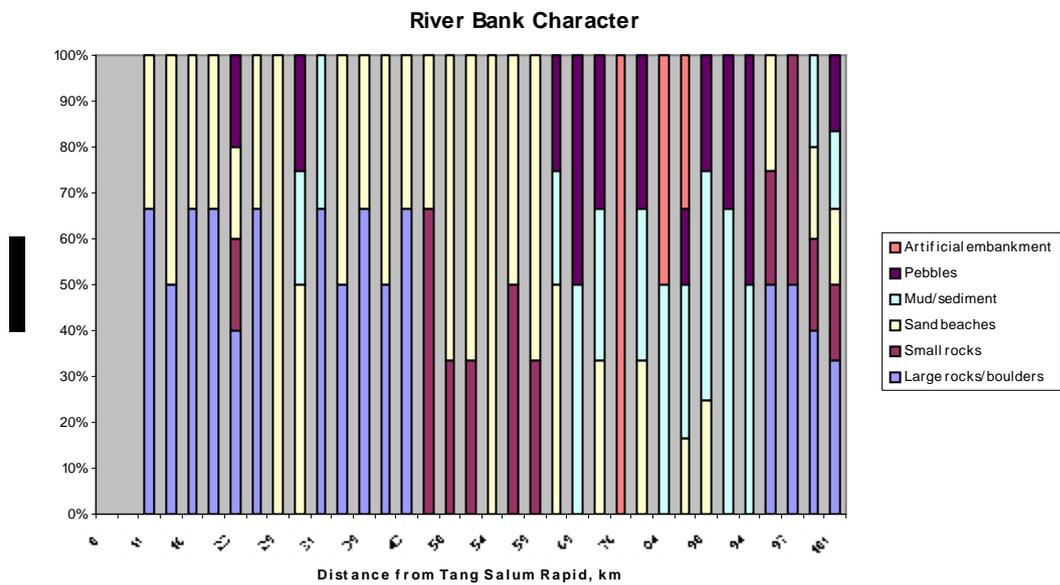
Wetland Habitat Type	Description
Rivers	Mekong and its tributaries
Streams	Several streams running through evergreen forest and joining the Mekong
Seasonal mudflats, pebble flats and sand bars	Seasonally inundated habitats
Seasonally inundated shrubland	Seasonally inundated herbaceous shrubland vegetation on either side of the Mekong river as well as in islands of the Mekong river
Seasonally inundated swamp forests	Areas with woody plants, including trees that are inundated during the rainy season, located in lowland areas beside the river
Rock outcrops	Wet rocks, boulders and cliffs emerging out of water. These would sometimes be colonised by specialised vegetation – e.g. <i>Kinsen</i> found at Tang Salum and Wong Wit rapids.
Riverine rapids and deep pools	Deep water pools in the river, especially in areas of riverine rapids
Pools in riverbank	Small water pools beside the river, with rocky/sandy/muddy substratum

**Table 3:** Wetland Habitats Located Along the Mekong River

<sup>6</sup> It should be noted that the proportion or abundance of features is not absolute and is based upon subjective perceptions noted as the team passed downstream.

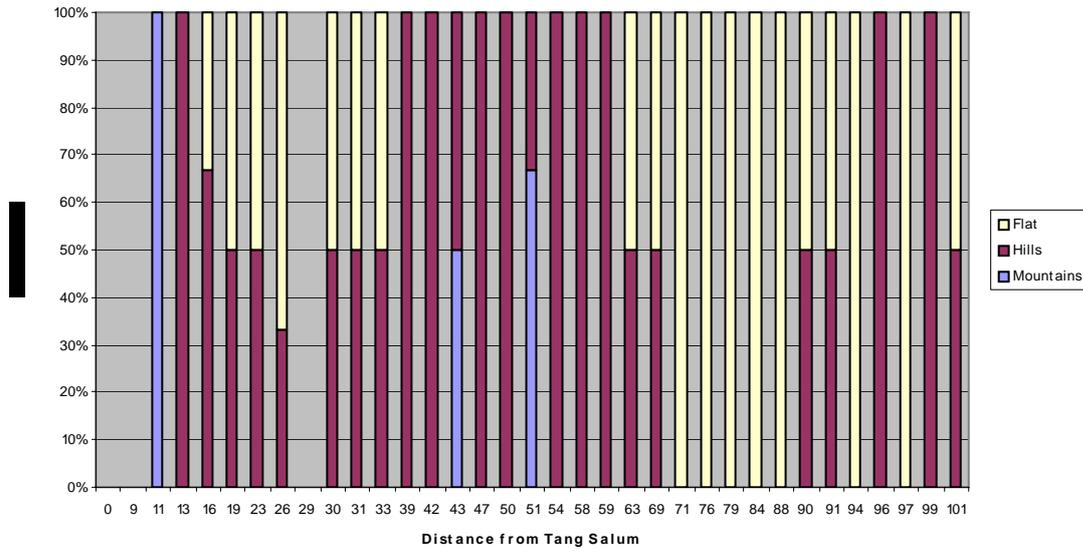


**Figure 2: River Features**



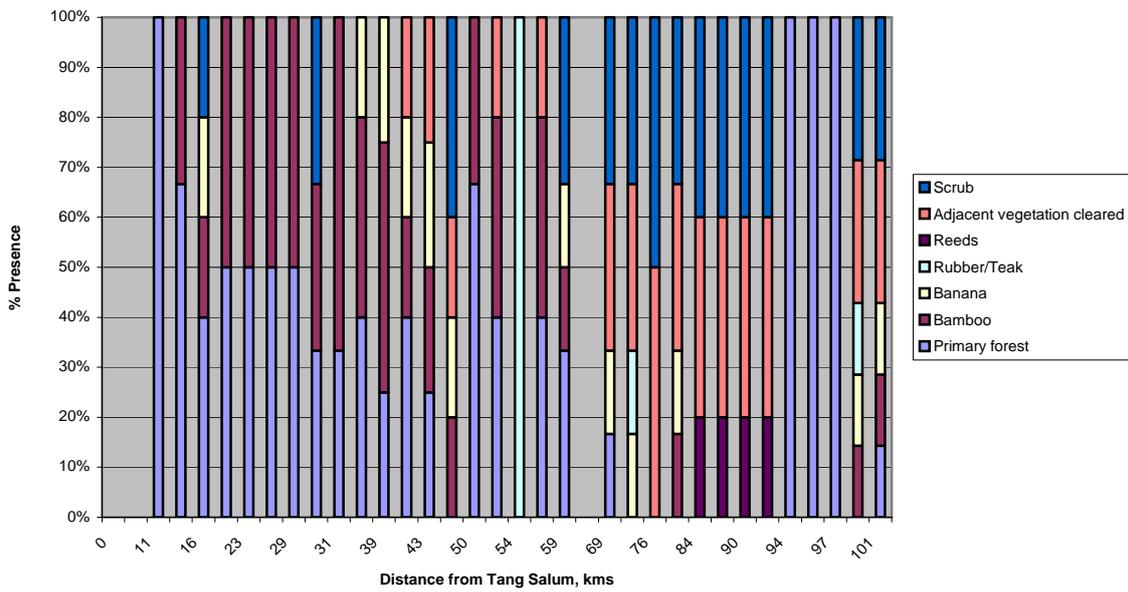
**Figure 3: Riverbank Character**

### Surrounding landscape features

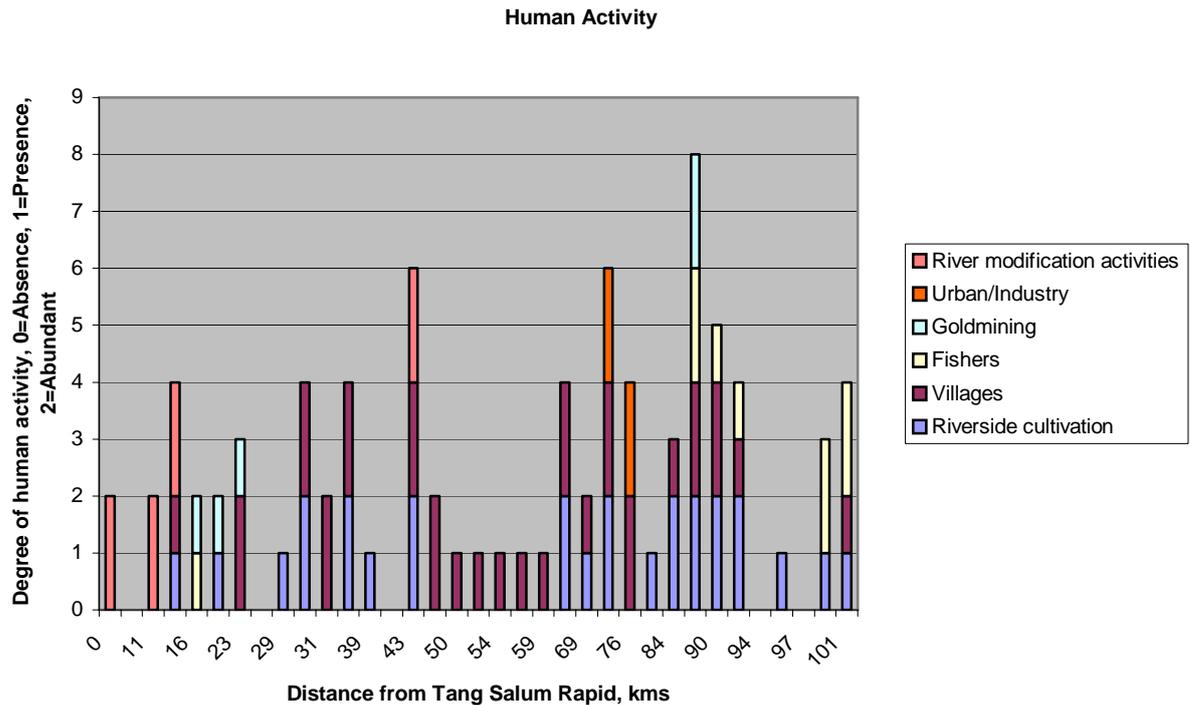


**Figure 4:** Surrounding Landscape Features

### Terrestrial Vegetation



**Figure 5:** Terrestrial Vegetation



**Figure 6:** Human Activity Observed

### 3.2.2 Important Ecosystems/Habitats To Be Conserved as Biodiversity Refuges

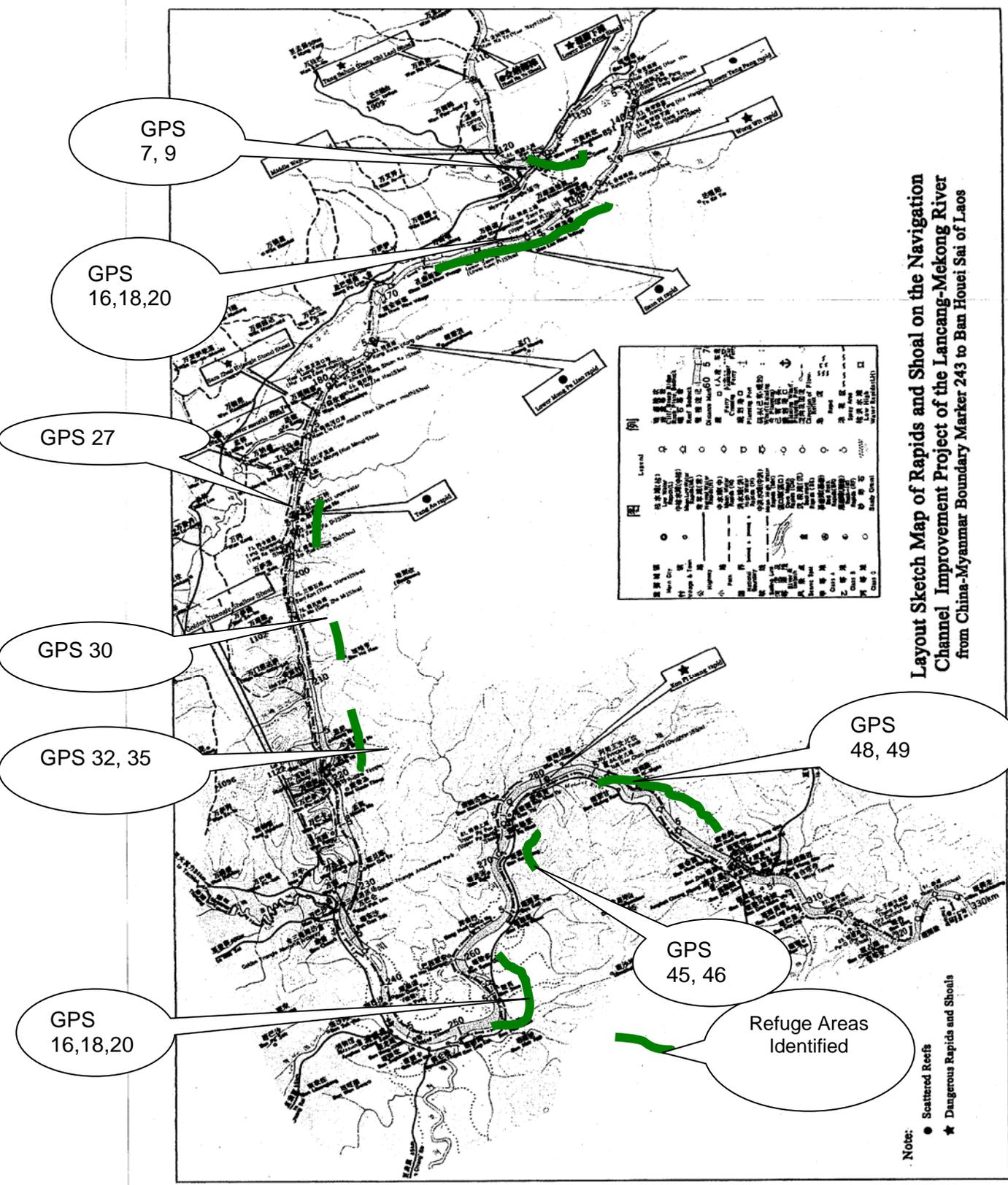
Ecosystems and habitats that are important for the conservation of biodiversity were noted along the survey stretch, and these are highlighted in Table 4. They include rapids, deep pool, long pool and whirlpools, sand bars (with and without pebbles) and islands where “seaweed” (*Kai*) grows in the shallow riffles and channels beside the islands, and the seasonally flooded shrub areas as well as. Based upon local knowledge, these habitats are very important as a source of fish food and spawning ground for fishes. In two places visited, seaweed was found growing on pebbles in shallow riffles near the sand bar at Don Noi (Huaitant Island) upstream of Muang Mom, Laos and Khon Pi Luang rapids. The dominant species growing in these riffles, which are submerged in the rainy season, is *Kai Haang Nak*. The main collection period for this is February to April.

More attention needs to be placed on mapping the extent of shoreline pools that may be important to birds, fish, aquatic insects and plants.

The forest cover adjacent to the river is significantly greater on the Lao side of the river and measures for its conservation should be developed. On the Myanmar/Thailand side forest clearance was extensive within most areas adjacent to the river. The development of a new road through the forest on the Lao side is a cause for concern as there are already signs that this will lead to clearance of this remaining riverine forest.

<b>GPS Location</b>	<b>Description</b>
7	Undisturbed, evergreen riverine forest stretch spread across hilly terrain. High floral richness.
9	Mud/pebble flats. Important habitat for wading birds.
16,18,20	Undisturbed, evergreen riverine forest stretch, interspersed with disturbed secondary forest and bamboo forest, spread across hilly terrain. High floral richness.
27,30,32	Undisturbed, evergreen riverine forest stretch, interspersed with disturbed secondary forest and bamboo forest and shrubland.
35	Huaitant Island (belonging to Laos), extensive mudflats, pebble flats and sand bars. Disturbed secondary forest interspersed with sparse patches of undisturbed forest within the island. Ideal habitat for wading birds as well as forest birds.
40,41,42, 43	Vast areas of tall grass reed beds and sand bars in Lao and Thailand borders. Important nesting sites of birds and small mammals.
45	Relatively undisturbed evergreen forests in hilly terrain (Lao border), and vertical riverbanks providing nesting habitats for birds such as Indian roller, Bee-eaters and Kingfishers
46	Seasonal Mud/pebble flats. Feeding and resting sites of waders and ducks.
48-49	Isolated Evergreen forests in hill tops (Lao side)
49	Khon Pi Luang Islands (up to Paknouw village) – seasonally inundated mud/pebble flats and sand bars with herbaceous shrub. Resting, nesting and feeding habitat of waders, ducks, and prinias.

**Table 4:** Biodiversity Refuges on the Mekong from Tang Salum to Baan Huai Xai



**Layout Sketch Map of Rapids and Shoal on the Navigation Channel Improvement Project of the Lancang-Mekong River from China-Myanmar Boundary Marker 243 to Ban Houei Sai of Laos**

**Note:**  
 ● Scattered Reefs  
 ★ Dangerous Rapids and Shoals

### 3.2.3 Species of Fauna Recorded

The species of vertebrates and invertebrates recorded in an opportunistic manner are listed in Appendix 3. Preliminary observations made during the 4-day expedition indicate that the different ecosystems and habitats along this stretch of the Mekong River harbour a high species richness of fish, birds and butterflies, and these groups could be used as surrogates/correlates for future biodiversity assessment and monitoring exercises. A total of 76 species of birds were recorded during the survey, of which 30% are species associated with wetland ecosystems.

Although fish diversity generally is considered to be lower in upper reaches of rivers compared to the lower reaches, the scoping mission confirmed that a large number of fish species inhabit the upper Mekong. Appendix 3.7 shows a list of species developed through various methods during the mission.

Larvae samples of *Opsarius* sp. and *Garra* sp. were obtained at two sites.

It was noted that many of the species, particularly the large species such as the Mekong Giant Catfish (*Pangasianodon gigas*) and *Pangasius sanitwongsei*, have experienced quite drastic declines in recent years.

The freshwater stingray, *Dasyatis laoensis*, was recorded from the market at Chiang Khong. The specimen was reportedly caught in the Mekong River, upstream of Chiang Khong.

Fishing activities were very scarce along the stretch from Xieng Kok and downstream to Chiang Saen. From Chiang Saen and downstream to Chiang Khong/Baan Huai Xai; fishing activities increase significantly. It is not possible to pinpoint one reason for the low activity level upstream of Chiang Saen. It may be a combination of several factors, including low population density in the area, relative difficulties of fishing in such turbulent waters, as well as more recent constraints imposed on fishing by the regular passage of large cargo ships.

### **3.3 Social – Communities Visited, Summary of Discussions**

Three sets of detailed discussions were held:

- Below the Wong Wit Rapid (WP 15), an encampment of villagers from Xieng Dao village, panning for gold.
- At Ban Don Moon village (WP 26) above Tang Au rapid, a village of some 140 persons, on the Lao side.
- In Chiang Kong a) market visit at which fish being sold and seaweed products for sale were inspected b) discussions with the ex-chair of the Giant Catfish Fishermen's Association c) discussions with a local fishing community worker investigating fish catches around Khon Pi Luang, and discussions with fishers at a small fishing camp near Ban Kaeng Kai, on the Thailand side.

#### 3.3.1 Below the Wong Wit rapid (waypoint 15)

- The villagers from Xieng Dao village said that during the free time they come to the beach just below the Wong Wit Rapid to find the gold, especially during the dry season. This activity will continue until rice cultivation time at the beginning of the wet season in May each year.
- The fishing activities in the Mekong River during dry season mostly take place by using small-mesh gill nets. By far the most important fishing habitat is small streams and rice fields near the village. Women make the most use of this habitat where they can catch a fish by hand and simple gears. Men tend to fish in the main river.

- According to fishers, in the past there were some large fish coming to this area particularly Pa Leum ( *Pangasius sanitwongsei*), and used to catch the large size which can be carried by four people (probably about 20 kg each) but nowadays this species is smaller than before.
- About the Giant Catfish, the fishers had only heard about it from many people, but they had never seen it.
- The main fishing period is from November to March and May to July each year.

### 3.3.2 At Ban Don Moon (waypoint 26)

- According to the villagers, they used to grow soybean and peanuts along the Mekong riverbank near the village. For the last couple of years, they have not been able to do so, because the bank has collapsed. The villagers think that this is because Chinese boats are passing close to Lao side and the number of boats is increasing day by day.
- The main fishing gear of this village is gill net, especially with a mesh size of 3 to 5 centimetres.
- The main fish catch in this area are *Mystus nemurus*, *Bagarius yarrelli*, *Puntiolites sp* (Pa Sa gang). One woman said that she caught a lot of *Channa sp* from the small stream, some time she can catch up to 4 kg in one day, particularly in February.
- Water level seems to rise and fall, day and night during the last two months, but nobody knows the reason for this fluctuation
- The villagers said that so far they did not see any fish die from blasting, but the noise of blasting has affected them.

The Leua people live in both places visited in Laos. In contrast to villagers in the southern part of Laos, their livelihood depends more on rice cultivation rather than fishing. Fish only contribute to their daily meals, but is not the main income source for most households.

It is commonly accepted that the lack of transport, roads and communication is a major reason for the low development in the Upper Mekong River Areas on the Lao side (limited access to market and social services). Furthermore, it is equally accepted that the water regulation and rapid blasting for navigation are important milestones of development in the northern part of Laos. Because the basic material and social infrastructure is insufficient, provinces, districts and villages need more funds to overcome chronic poverty. Business opportunities are limited by the small size of local markets and lack of access to larger markets.

The local communities visited possessed a very good knowledge on species such as fresh water fish, birds, mammals, some reptiles, and edible and medicinal plants. This knowledge would be valuable for future biodiversity assessments and monitoring. Local people with a good knowledge on species could be used in future biodiversity assessments.

The fisheries activities at this time of year appear to be few in this part of the Mekong River surveyed. According to both interviews below the Wong Wit rapid and Ban Don Moon, it would appear that streams are the most important fishing habitat for the local people in this area, and mainly for subsistence, rather than for income. Most of the fish species that we found in this area are small fish from small streams that fishers catch from Huay Pha and Huay Ka Lom near to the Xieng Dao village just below the Wong Wit Rapid.

From interviews and group discussions, local knowledge can explain the relation between fish and ecosystem including source of food for fish, fish's spawning ground. They also know the timing of fish migration and fertilising. They know where and when the Mekong seaweed grows.

The villagers can explain the detail of sub ecosystem in their area because they have long experience on fishing in that area. Further information can be gathered from the most knowledgeable members of the community.

The livelihoods of the people who live on the Mekong riverbanks in the downstream sections surveyed (both on Lao and Thai sides) are mixed between land-based and river-based. They farm rice in the upland area, fishing in the stream and Mekong River, growing vegetable gardens on sandbars and riverbanks when the water level is low in winter and summer. Deep pools, whirlpools and sand bars are most important fishing grounds.

Local people collect Mekong seaweed, which grows on pebbles in fast-flowing shallow waters at Don Noi (upstream of Muang Mom) and Khon Pi Luang for their income and food. However, the quantity of seaweed available is reported to be lower this year than in the past few years. Although one market stall selling a range of *Kai* products was inspected, seaweed collecting is usually for household consumption.

In some areas, villagers in Laos carry out gold panning, digging up sand and gravel with favourable appearance, panning it to isolate gold particles, and extracting the gold with mercury. Villagers, with whom this was discussed below Wong Wit, had small quantities of mercury for this purpose. Gold panning activities were observed below Wong Wit rapid and above the Khon Pi Luang rapid.

Villagers expressed their concern about:

- riverbank erosion and loss of area for growing vegetables on the riverbanks
- impacts on fish and fishery from water fluctuation
- lower production of seaweed
- noise and water pollution from river traffic
- the risks to small local boats from increased larger-boat river traffic

### **3.4 Other Aspects**

#### **3.4.1 River Traffic**

A variety of boats and vessels, ranging from very simple bamboo rafts, small fishing craft to modern high-speed motor boats and cargo boats were observed along the Mekong River. Cargo boats consisted of the wooden Lao cargo boats (about 30 tonnes) to the Chinese steel cargo boats (50 – 150 tonnes). The Lao MCTPC report that an average of 10 cargo boats of up to 100 tonnes use this stretch of the river (ranging between 5 and 18 boats per day) (Lattanamy Khounnyvong, Dept of Transport, MCTPC, pers. com.). During the passage down the upper section of the river between Xieng Kok and Mouang Mom, which took about 6 hours, a total of six 50 – 100 tonne cargo boats were observed moving upstream and four boats were observed moving downstream. Upstream boats appeared to be laden, some with up to 10 motor vehicles; downstream boats appeared to be mostly empty. At Chiang Kong, where the new port is under construction, there were more than 10 Chinese boats moored along the bank.

Cargo boat traffic, combined with the noise from the speedboats appears to have effectively forced all local craft off the river during the daytime. The river appears to have already become a highway for transport and cargo at the possible expense of local use of the river resources. Any remaining fishing activity is reported to now be largely restricted to night-time. It would be worth investigating whether fishing has always been conducted at night or if it is really an impact of the large boat traffic. Shoreline erosion is already apparent and will no doubt increase due to the wash as larger boats use the river.

Both high-speed boats and cargo ships cause noise pollution, large waves and water pollution. The high-speed motor boats in particular contribute significantly to noise pollution, which is even more concentrated in the steep valley of the river. This could disturb sensitive bird and mammal species, as well as local communities. Large waves from ships disturb fish and regularly swamp small-scale fisher boats. In the Mekong downstream of Chiang Saen, Chiang Khong and Baan Huai Xai, the water quality is lower, being less clean and clear because of urban pollution, river traffic and the port construction. Water quality monitoring for the Chiang Saen Port project in 1999 showed that whilst the dissolved oxygen and organic content of the river water was above the water quality standard, ammonia, oil and total coliform bacteria counts were below standard. (Thavone Vongphosy, STEA, pers.com.)

### 3.4.2 River Regulation Measures Observed

Chinese contractor crews were observed at four different sites on the river in the process of undertaking river regulation measures. In each case this consisted of a base/dredging boat moored on the bank or between the rocks at different rapids. These sites were:

**Tang Salum Rapid – Waypoint TS1 and TS2:** – rock outcrops common, sandy banks, small streams flow into river from Lao side. Evidence of rocks that had been removed, buried under sand on the Lao bank. Dominant vegetation – bamboo with scrub on both sides. Water flow moderate to fast. River quite narrow, 50+/- m. River modification vessel on Myanmar side.

**Lower Tang Pang Rapid – Waypoint 13:** – bamboo on Myanmar side, degraded secondary forest on Lao side. Rock outcrops common and rapid water flow. River modification vessel located on Lao side. Discarded excavated material observed on Lao bank.

**Wong Wit Rapid – Waypoint 14:** Description – large rock outcrops, throughout the river bed. Pebble flats, sandy shore. On Myanmar side, bamboo forest. On Lao side, degraded secondary forest and scrub. Water flow fast. Large pool c.100 m downstream with gold panning community. River modification vessel with excavator on Lao side.

**Above Tang Au Rapid – Waypoint 27:** – large rock outcrops, river quite narrow and fast flowing, degraded secondary forest on banks, river modification vessel located on Myanmar side. Drilling activities observed.

**Khon Pi Luang – GPS 49:** – no river regulation operations at present (proposed for December 2003). Islands of mud and pebble flats, seasonally inundated shrubland, rock outcrops. On Thailand mainland – tall grass reed beds. Mainland area of Lao is hilly with cultivation scrubland and evergreen forest caps to hilltops. Seasonally inundated flood forest on Lao side. Preferred habitat of waders and waterfowl, including the threatened Greater Thick-knee.

It was not possible to stop or to engage in discussions with the Chinese contractors, and we were not able to meet with the monitors from the Lao Ministry of Communications, Transport, Post and Construction. However, in passing it was possible to note the following:

- No blasting operations were observed.
- Above Tang Au, drilling operations were observed
- At Wong Wit, the boat was fitted with a mechanical digger used for extracting shoals and rubble from the blasting operations.
- At both Tang Salum and the Lower Tang Pang Rapid, collections of rubble and other debris from blasting and dredging operations were observed stacked on the banks of the river.
- Reported fluctuations of river level, which had been attributed by some to upstream river flow management to facilitate blasting preparations, were not observed.

### 3.4.3 Road Construction

Road construction activities were observed at different points between Xieng Kok and Mouang Mom. This is a new connecting road between communities that have until now been relatively isolated, with their main transportation links dependent upon river transport. This is an all-weather dirt road that generally follows the river, probably about 4 – 6 m wide. Visible scars of bare earth and fill materials, and depots of construction materials were observed. There was no evidence yet of the road being used for access for the removal of timber from the relatively undisturbed areas of primary forest, but this can be assumed to be only a question of time.

## 4 FISH AND FISHERIES

### 4.1 General

The Mekong River Basin hosts one of the richest freshwater fish faunas in the world. Currently, almost 1,000 species have been formally described and more will for certain be added to this list in the future. This diversity in turn supports arguably the largest inland fishery in the world. Recent estimates put the annual catch from the Mekong basin at 2.6 million tonnes, representing a direct value of more than US\$17 billion.

The Mekong fisheries are not only large in terms of tonnage but also in terms of the number of people involved. A large proportion of the 65 million people living in the basin depend directly or indirectly on fish and fisheries for sustaining livelihoods. The high participation is a direct reflection of the high fish diversity, since different species are exploited in different ways, at different times and by different people. As a consequence, a large proportion of the Mekong catch is taken by small-scale, subsistence operations.

Two of the main factors that explain the high diversity and productivity of the Mekong fish fauna are:

- An extreme habitat diversity of the river ecosystem - Basically, all types of freshwater habitats are represented in the Mekong basin, including: seasonal floodplains and wetlands, lakes, large slow-flowing rivers, in-stream rapids and pools, braided rivers, small mountainous rivers and streams, just to mention some of the broader categories. Importantly, the seasonal dynamics of the system, including the creation of seasonal aquatic habitats on the floodplains adjacent to rivers, is the “key driver” for the productivity of the fisheries.
- The state of health of the river - The Mekong is in relatively good condition compared with many other river systems. Thus, not only is habitat diversity high, but the ecosystem functioning and connectivity between habitats is largely intact. Fishes are still able to exploit different habitats according to natural seasonal changes and can, for instance, migrate between upstream spawning habitats and downstream rearing habitats, and between river refuges and floodplain feeding habitats.

### 4.2 Key Fish Habitats

Although species have different life cycle strategies, some generalisations can be made in terms of habitat requirements. Fish habitats can generally be separated into the following broad categories: feeding habitats, spawning habitats and refuge habitats.

**Feeding habitats** - Most fishes of the Mekong feed in the productive seasonal floodplains that are created when large areas adjacent to river channels are inundated during the flood season. These areas account for the bulk of the Mekong fish production. At the end of the flood season, when these habitats dry out, fishes move refuge habitats within river channels where they wait for the next flood cycle.

**Spawning habitats** - Most fish spawn at the onset of flood season. The main habitats used for spawning are rapids and deep pools in river channels as well as certain floodplains. Most migratory fishes, which account for a significant proportion of the fish catch of the Mekong, spawn within river channels at rapids/pools upstream from feeding and rearing habitats.

**Refuge habitats** - During the dry season, fishes retreat to permanent water bodies, e.g. river channels and floodplain lakes.

In river channels, it is particularly the deep areas that are important for a large number of species. During the low-water months of March and April, fishers report large numbers of fish congregating in deep pools in the Mekong River.

Key habitats are often separated geographically, e.g. spawning habitats are often situated far upstream of feeding habitats. As a result, many fishes migrate on a seasonal basis to complete their life cycle in the appropriate habitat at the appropriate time. Such species are particularly vulnerable to human activities and modification of river channels since they depend on many different habitats and the maintained connectivity between those habitats.

### **4.3 Fish Migration**

A large proportion of Mekong fish species are migratory. Many species move from one habitat to another to complete their life cycle. For instance, several important species migrate upstream to breed at the beginning of the rainy season. Then, as the water rises, the young fish are swept downstream to flooded areas. Several species migrate across international borders, either from Laos to Thailand or from Laos to Burma and China. One species, a large catfish, migrates from the South China Sea all the way to Laos and Thailand – a distance of over a thousand kilometres. Species that migrate long distances and "straddle" international borders warrant special attention because of the high level of knowledge and cooperation between countries needed to manage such shared-stock fisheries. More quantitative information about migratory fish species is needed. A large proportion of fisheries activities along the Mekong target fishes during their migrations

Fisheries in the Mekong revolve around seasonal cycles. The rains that fall throughout the basin result in increased river flow which floods lowland habitats. During the dry season, many species of fish migrate to the deep pools and tributaries of the Mekong River to spawn. During the rainy season, the Mekong and its tributaries fill, and young fish are swept into flooded areas to rear and grow. The productivity of the Mekong River (especially the lower Mekong) is dependent on the link between the upland watersheds, the important deep water spawning zones, and the huge expanses of flooded forest and other inundated habitat available to fish during the rainy season.

Though there is considerable uncertainty as to what triggers fish migrations, previous studies on the Mekong River suggest threshold river volumes trigger the migrations. Sudden increases in flow may stimulate migratory behaviour, especially during rainy weather. Other research suggests that temperatures, rainfall, water turbidity, or lunar cycles may influence the timing of migration (Bardach 1959, Mekong Secretariat 1992).

### **4.4 The Upper Mekong**

The upper reaches of rivers generally have less fish diversity than lower reaches, but often contain a larger degree of endemism (at both species and sub-species level). This holds true for the Mekong River. Upper reaches often play crucial roles in the life cycles of many important fishes of the lower reaches. For instance, many important mainstream species from the middle and lower Mekong spawn in upper reaches and rely on the natural flow of water to get offspring to their intended rearing habitats further downstream (e.g. this is the case for many of the Pangasiid catfishes, including the Mekong Giant Catfish, *Pangasianodon gigas*, and *Pangasius sanitwongsei*). Giant Catfish once spawned upstream of Chiang Khong.

#### 4.4.1 Flagship Species - The Mekong Giant Catfish

The Mekong Giant Catfish *Pangasianodon gigas* is a Mekong endemic. *P. gigas* is one of the world's largest freshwater fish, measuring up to three meters in length and weighing in excess of 300 kilograms. Historically, *P. gigas* was distributed throughout the Mekong River Basin from the coast of Vietnam to southern Yunnan Province in China.

In the Tonle Sap River of Cambodia, adult Giant Catfish are caught from October to December. At this time, the fish are moving out of the Tonle Sap Lake and into the mainstream of the Mekong River. Based on catch information provided by Roberts (1993) and others, *P. gigas* may migrate from Cambodia upstream into Laos, Thailand, or China to spawn. Spawning fish were reported in northern Thailand about twenty kilometres upstream of Chiang Khong, but there does not appear to be recent evidence of spawning activity in this area.

*P. gigas* presently appears to be limited to the Mekong River and its tributaries in Thailand, Lao, and Cambodia. The species has been stocked in various reservoirs in the Mekong and other basins in Thailand but invariably such introductions have failed to result in established populations. *P. gigas* is now very rare in northeast Thailand, southern Lao, and Vietnam (see Table 5).

Location	Status (based on catch data)	Source
Chiang Khong, Northern Thailand	The catch has declined from a peak of 69 fish in 1990 to just 7 in 1997. Since 2000, no fish have been caught in Chiang Khong.	Srettacheua 1995, Hogan 1998
Luang Prabang, Laos	The catch declined from about 12 fish per year to just 3 in 1968. No fish were caught in 1972, 1973, or 1974. Since that time, no significant catch of <i>P. gigas</i> has been reported in the Luang Prabang area.	Davidson 1975
Nong Khai Province, Northeast Thailand	In the early 1900s, 40-50 fish were caught per year. Since that time, the number of fish has declined. In 1967, fishers captured 11 fish in the Nong Khai area. By 1970, <i>P. gigas</i> occurred only rarely as by-catch of beach seine fisheries. Today, very few <i>P. gigas</i> are reported from Nong Khai Province.	Pholprasith and Tavarutmaneegul 1998 Pookaswan 1969
Khone Falls, Southern Laos	Fishers reported 3 to 4 fish before 1993, almost all caught in the first half of the year. No fish were reported in 1993. The status of <i>P. gigas</i> in the Khone Falls area has not been assessed since 1993.	Roberts 1993
Tonle Sap River, Cambodia	Four fish were captured in the bagnet ( <i>dai</i> ) fishery in 1999 and 11 fish reported in 2000. Fishers report that they catch a few <i>P. gigas</i> each year.	Pengbun <i>et al.</i> 2001 Hogan <i>et al.</i> 2002
Mekong Delta, Vietnam	Once abundant in the delta, <i>P. gigas</i> is now very rare. No significant fishery for this species exists in Vietnam.	Lenormand 1996

**Table 5:** Status of Mekong Giant Catfish from Records

Note: The status of the Mekong Giant Catfish *Pangasianodon gigas* in the Mekong River Basin. Based on catch data, the abundance of *P. gigas* appears to be declining throughout the basin. The range of *P. gigas* is also shrinking. Fish have disappeared from sites where they were once caught. For example, fishers in Vietnam, Northeast Thailand, and Southern Lao no longer report the species.

Key points regarding the Giant Catfish:

- The Mekong Giant Catfish is well known throughout the Mekong River Basin (Kottelat and Whitten 1996, Hogan 1998). Thus, the species can be used as a flagship species. The Mekong Giant Catfish is the ideal species for promotion of transnational cooperation between countries of the lower Mekong River.
- Wild Giant Catfish may become extinct in the near future. Until more is known about the capture rates, migration patterns, and basinwide distribution patterns of the species, it is difficult to determine the status of the population(s). Despite this uncertainty, fishing and habitat degradation continue.
- While the Mekong Navigation Channel Improvement Project may impact many fish species, no fish is more at risk than the Mekong Giant Catfish. The population of Giant Catfish is declining rapidly. The long-term viability of this population is dependent on our ability to minimise the impacts of human activities on this species. Given that we know that the Giant Catfish spawns in the stretches of river where modifications are planned, a comprehensive assessment of the Mekong Navigation Channel Improvement Project on the Mekong catfish is imperative.
- The Mekong Giant Catfish is listed in the IUCN Red List of Endangered Species, the Convention on the Conservation of Migratory Species (CMS), and the Convention on Biological Diversity (CBD). These agreements, most notably the Convention on Biological Diversity, are legally binding instruments signed by the countries of Mekong River Basin (including China).
- Scientific techniques exist to study this species and the international agreements mentioned above mandate such research. The IUCN, CMS, and CBD require specific information to determine whether the species is: 1) endangered 2) transnational 3) particularly vulnerable to transnational threats and 4) apt to benefit from management at an international level. The Mekong Giant Catfish fits these criteria. Cooperative research (involving all countries) is necessary to verify population status and establish a scientific basis for stock management.
- In the case of *P. gigas*, the problem is to determine whether “lower Mekong” fish and “upper Mekong” fish represent distinct stocks or one population. If fish from Cambodia do, in fact, spawn in Thailand, Laos, Burma, and China, this implies that the lower Mekong stock and upper Mekong stock represent a single population and should be managed accordingly. On the other hand, the existence of multiple spawning sites and multiple reports of young fish (distributed throughout the basin) implies that the Thai fish and Cambodian fish represent different stocks.
- The status of Mekong Giant Catfish is complicated by the operations of the Thai Department of Fisheries captive breeding program for *P. gigas*. The Department of Fisheries has been releasing young *P. gigas* into the Mekong since 1984. Although catches of *P. gigas* in the Thai portion of the Mekong River have continued to decline since the establishment of the breeding program, the impact of the program on the abundance and population structure of *P. gigas* have not been assessed. Genetic studies are underway to determine the population structure of wild *P. gigas* and probable population genetic impacts of the Thai breeding program on wild *P. gigas* populations (Hogan, unpublished manuscript).
- No Mekong Giant Catfish have been observed in northern Thailand, Laos, Burma, or China since 2000. It is difficult to conduct field studies on a fish as rare as the Mekong Giant Catfish.

## 5 IMPACTS OF RIVER MODIFICATION MEASURES AND NAVIGATION

### 5.1 Outline of River Modification Measures Carried Out, Observed and Future Plans

The experience of ship captains navigating the river over the years and hydrographic investigations have shown that in the stretch between the China/Myanmar boundary marker no. 243 and Ban Baan Huai Xai in Laos, there are 11 major rapids and 10 scattering reefs that seriously threaten navigation. The first phase of the Navigation Channel Improvement Project involves the modification of these sites together with the setting up of 100 navigation aids, 106 landmarks and mileage marks, and 6 self-winchng facilities.

The 11 major reefs and 10 scattering reefs are listed below:

Major Reefs	Scattering Reefs
Huaila rapids	Chuang Namtany Lan rapids
Lower Thang Luang rapids	Ban Bo rapids
Kai rapids	Kon Mutai rapids
Long Zhom rapids	Ton Pa Nok Yang rapids
Nam Loi river mouth rapids	Huai Nayo rapids
Khong Tan rapids	Tang Pang rapids
Tangsalam rapids	Saen Pi rapids
Wang Seng shoal	Lower Pa Liao rapids
Wong Wit rapids	Nam Lon river mouth rapids
Sam Shao rapids	Tang Aon rapids
Khon Pi Luang rapids	

These rapids are formed of bedrock, slides, reef islands and cove mouth sediments and make the navigation channel narrower and shallower. The technical standards for the navigation channel, for a double lane minimum width of 30 m, with a water depth of 1.5 m and a minimum curvature radius of 260 m. In a few situations the single lane is adopted with a minimum width of 22 m and minimum curvature radius of 160m.

At these sites, the measures for improving the channel include underwater and above water bore-hole reef blasting and removal of the protruding outcrops. Outcrops, reefs, sediment cones and slides, which cause poor flow and hindrance, would be removed. Bore-hole and underwater double blasting may be used to regulate bank lines, widening of the navigation channel and expand the cross-section of the water-way to adjust the mean gradient and improve the flow pattern. For sediments in the shallow shoals, such as the Wan Seng shoals, excavation will be used to deepen and widen the channel. For the 10 scattering reefs, bore-hole blasting will be used.

The total quantities of materials removed are as follows:

	Option 1	Option 2
Above water reef removed	64,109.4 cu.m.	65,738.4 cu.m.
Underwater reef removed	75,787.8 cu.m.	106,330 cu.m.
Excavation material	14,333 cu.m	32,594 cu.m

There are six rapids where conventional vessels will not be able to pass through under their own power – Ban Za Wo, Nam Lon, Nam Soak river mouth, Tang Luang, Tang Salum, Lower Tang Pang. Self-winchng facilities will be established at these sites.

Future phases of the navigation channel improvement works may extend the navigation channel down to Luang Prabang, and allow for larger vessels. No decision has been taken on these phases, and this will depend upon the experiences with both the channel improvement and operation of navigation.

By the end of April 2003, all the mentioned rapids had been modified as planned, except for the Khon Pi Luang Rapid on the Thai/Laos border. Work on this rapid has been delayed pending further investigations on the impact upon border alignment, and upon environment and adjacent communities.

## 5.2 Environmental Impact Assessment

An EIA on the channel improvement measures described above was prepared by the joint experts group on EIA of China, Laos, Myanmar and Thailand during 2001<sup>7</sup>. This was accepted by the four countries. However, concern has been expressed about the quality of the EIA carried out, and that it did not comply with international standards. The Mekong River Commission Secretariat solicited international expert opinion to comment on the EIA report. The principle concerns included the way in which the public consultation was carried out, and the overall lack of information about the areas where river modification was due to take place.

From the point of view of this scoping study, we found that the EIA report focused on the physical changes and the risks of accidents and possibilities for pollution, but did not make adequate linkages with the biological and ecological impacts. These were dealt with in a very general way, and no attempt was made to address the particular ecological character and importance of each of the sites. This is considered significant because each site is different both in terms of its character and also in terms of what is to be done in each site.

Many of the scoping issues identified in this present study were not addressed in the EIA, particularly issues of long-term effects of increased navigation, such as bank erosion, and social impacts. Mitigation measures such as timing of the blasting and the use of pre-blasting explosions to scare fish away from the blasting sites were suggested, and it is understood that these were used in the process. The suggested disposal of blasted materials by allowing this material to sink into the deep pools is also an area of concern, though this could not be confirmed.

## 5.3 Observations of Direct Impacts

The immediate impression regarding the direct impacts of the rapids blasting in connection with the upper Mekong Navigation Channel Improvement Project is that the current phase of the project appears to focus on a number of isolated sites within a very extensive complex of rapids and pools. Also, only parts of rapids at each site seem to be removed.

In cases where the removal of rock has already been completed it is hard to judge the level of impact, particularly where the work site is underwater. In general, without the benefit of previous baseline data on the ecological state before rock removal, it is hard to make a judgement on the level of impact. Clearly for this phase of the river modification a relatively small proportion of river habitat is *directly* impacted but, all available scientific and anecdotal evidence indicates that the deep-water pools below the rapids are important sites for spawning of some of the rare and endangered fish species, such as the Mekong Giant Catfish. Any dumping of waste rock in these areas could have significant negative impacts for those species. Further study of the role of deep pools for these species is imperative before more rock is dumped in these areas.

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<sup>7</sup> Report on Environmental Impact Assessment of the Navigation Channel Improvement Project of the Lancang-Mekong River from China-Myanmar Boundary mark 243 to Ban Houeisai of Laos. September 2001.

Though we did not observe a high level of fishing activity in the upper stretch of the survey area (from the Lao-Chinese border to Muang Mom), the river channel in this area is characterised by deep pools, rapids, and rock outcrops (reefs). Previous research has shown that such habitats are important for fish and other aquatic life.

However, the lack of any baseline data prior to the start of the rapids removal significantly constrains our ability to assess impacts. Also, the lack of information on how the removals are carried out, or precautionary measures taken to minimise direct impacts on fish and fisheries and on how the resulting debris from the blasts is handled after the removal (e.g. where it is deposited) further impair our ability to assess impacts. In the continued absence of information on the importance of deep pools rock should be disposed of elsewhere.

Above the Tang Salum Rapid, there are as many river modification measures being undertaken in Phase 1, as there are below it. The field survey extended from Tang Salum to Baan Huai Xai only, where the blasting activity is less intensive. We were not able to see what has happened in the upstream area from Tang Salum to the China border. We also didn't have a chance to observe when a Chinese contractor's team were actually blasting the rapid. It is thus difficult to draw any conclusions about the actual impacts.

In terms of scoping the impacts in the design of baseline and mitigation measures, the following direct impacts should be considered for every site where works are considered, i.e. not as a general impact assessment:

- Potential fish mortality because of blasting
- Disturbance to animals (i.e. fish, birds) that are feeding, nesting, resting in and around the areas subjected to blasting
- Temporary loss of habitats for aquatic organisms
- Destruction of the habitat, sources of food and spawning grounds for fish, particularly in the blasting and blasted-rock dumping areas including sand bars, on riverbanks and deep pools
- Erosion of riverbanks from operating blasting and rock clearing machinery
- Impacts on fish, fishery, seaweed, riverbanks collapse and riverbank vegetable garden through possible water level fluctuation

#### **5.4 Comments Made by Communities on River Regulation Measures**

The communities with whom the river regulation measures were discussed, mentioned that they had been affected by the noise of the blasting, but they did not report any fish kills or any other direct adverse effects although the full impacts would not necessarily be immediately apparent. They were, however, concerned about the increase in larger cargo traffic and the impacts of bank erosion upon their seasonal crops and livelihoods.

The reports that there have been water-level fluctuations during project implementation are a cause for concern since these may have reduced seaweed production, caused riverbank collapse and led to changes in fish behaviour. The concern expressed from local people confirms that these impacts have created significant problems for their river-dependant livelihood activities.

A hydrographic monitoring station at Chiang Saen has been commissioned but has not been operating fully because of problems related to cross-border data exchange agreements. Also the equipment is not yet considered reliable. Hydrologists from MRCS suggest that the water fluctuations are likely simply the result of the Chinese operating the dams according to the demands for hydroelectricity and also allowing surges downstream to assist navigation, rather than coordinated releases to facilitate the river modification measures (Campbell and Sok, pers com).

## **5.5 Possible Future Impacts on Biodiversity**

### **5.5.1 Phase 2 and 3 of Construction Activities and Operation**

The indirect impacts of the Mekong Navigation Channel Improvement Project, such as increased boat traffic, immigration, road building, deforestation, deteriorating water quality, flow regulation, etc., which may be substantial, should be assessed. The greatest impact is likely to come from the increased boat traffic facilitated by removal of the reefs. Potential impacts of bank erosion, pollution, and danger to those in smaller craft must be assessed. Other indirect effects that should be considered include:

- Hydrological (changes in velocity of water flow) and river morphology changes in the Mekong River, which in turn could have negative impacts on seasonal islands that serve as important feeding and nesting habitats of migratory and native birds.
- Waterway changes arising from other river modification measures, embankments and port construction.
- Reductions in the populations of the endemic Mekong Giant Catfish, from loss of spawning habitat and other disturbances associated with increased traffic.
- Permanent loss of habitat of seaweed and some plant species, which grows on rapids, sand bar and riverbanks (where covered by blasted rock).
- Disturbances on resting, feeding and breeding habitats of animals, especially fish and birds, due to increased river traffic and associated sound pollution.
- Water level fluctuations related to water control by Chinese dams will cause of ecosystem degradation including loss of seasonally-flooded forest, seasonally flooded shrub, and riverbank collapse.
- Pollution of the river by ballast water discharges and oil discharges especially from larger vessels.
- Impacts from river traffic including water and noise pollution and wave from larger ships.
- Erosion of riverbanks and loss/adverse impacts on micro-habitats on either side of the river by increased turbulence of water from river traffic.
- Increased introduction and spread of invasive alien plant and animal species along the Mekong River and its bordering terrestrial landscape, due to increased traffic.
- Increase in wildlife trade and non-timber forest products such as medicinal and edible plants, leading to over-exploitation of animal and plant species.
- Increase in logging and clearance of remaining undisturbed forests.
- Increase in settlements/towns along the river, contributing to clearance of forested areas, and increased river pollution by effluent and sewage discharge.
- Potential increase in commercial fishery, using better-equipped boats, which could lead to reduced fish populations.

## **5.6 Conclusions on Navigation Developments**

Considering the vast extent of rock-outcrops and rapids along the Mekong River, the immediate impacts on biodiversity of current activities may be limited, since Phase 1 river regulation measures (blasting and dredging) is done only in a few places along the upper region of Mekong (during Phase 1).

Blasting will certainly result in the death of fish species in the area subject to the impact and temporary displacement of habitats of fish and other aquatic organisms. The blasting of rapids could have serious and substantial impacts on certain species, such as the Mekong Giant Catfish. The impacts of the project on the Giant Catfish are extremely difficult to predict because very little is known about its ecology.

Based on available knowledge, the stretch of river between China and Chiang Khong (Thailand) is considered to be critical Giant Catfish habitat.

Should Phase 1 of this project be allowed to be completed without any effective assessment of the ecological and social impacts (as is the current situation) then there is a great danger that this will provide the “green light” for Phase 2 and 3. Should these additional activities be allowed to go ahead, then the direct impacts to river ecology will become far more significant as more river habitat is removed and the indirect impacts are likely to be highly detrimental to local users. It is essential that baseline studies and a comprehensive EIA be carried out according to international standards if measures to implement Phases 2 and 3 are considered.

Improved navigation of the river may well be beneficial to current craft but it seems likely that with the subsequent introduction of larger, less manoeuvrable vessels, accidents will continue to occur and plans will be made to further improve navigation channels by removal of yet more rocky areas and shoals. Without strict regulation and comprehensive assessment of the ecological impacts of such developments there is a danger that the river will be seriously impacted in the future through removal of habitat heterogeneity critical to associated biodiversity, loss of riverine habitats due to increased erosion, and subsequent artificial embankments.

## 6 ISSUES NOTED

The following issues have been noted:

### 6.1 Issues of Development

The expected costs and benefits of the Mekong Navigation Channel Improvement Project on local fishing communities are not properly understood. The development of the stretch of river between the Lao-China border and Luang Prabang may have a negative impact on fisheries and thus on the fishing villages of Laos, Burma, and Thailand (as well as communities in Cambodia and Vietnam). River development would probably destroy many local fisheries, and may have basinwide impacts in the case of migratory fish species that spawn in this stretch of Mekong.

Many characteristics of local fisheries (e.g. net/trap sites, management regime, fishing gear) are specific to the geology and hydrology of the river channel. These fisheries may disappear as soon as the river channel is altered. Without these fisheries, villagers in the area may lose a means for feeding themselves and generating cash income. While the majority of these impacts are likely to be restricted to a small area, we cannot rule out the possibility of large-scale impacts, especially in the case of fisheries for migratory species.

Other indirect impacts on socio-economic development include:

- Potential increase in drug trafficking
- Increase in the trade/traffic of humans
- Increase in gold mining activities that are occurring at a small scale at present
- Impacts of tourism and trade
- Impacts of population migration
- Risk from navigation on local boaters and fishers
- Conflicts over access to natural resources and property right regimes.

### 6.2 Issues for Conservation

“As far as I can see, these areas are the most beautiful in Laos, especially the forests along the Mekong River. Therefore, we should consider forestry as well as wildlife protection for tourism purposes in the future.” (Douangkham Singhanouvong, Team member from LARReC).

Conservation management must be at the **river basin level** to address not only the direct impacts to riverine habitats (as directly impacted by the river modification measures under the Navigation Agreement) but all other activities within the catchment such as road construction, deforestation, and upstream water regulation, which may have indirect impacts. A conservation management plan should aim to ensure the maintenance of ecosystem functions for a network of key sites for biodiversity within the river system. The network of sites should aim to ensure the continued viability of populations of representing all species currently existing within the river system. Management measures must therefore include consideration of issues such as the environmental flows required to maintain those sites.

However, the trans-boundary location of the Mekong River, (between Laos and Myanmar, Laos and Thailand, and the Golden Triangle area) could lead to complex political issues during future negotiations pertaining to conservation.

### **Impacts upon wildlife and fisheries**

- What are the expected indirect impacts (costs and benefits) of the Mekong Navigation Channel Improvement Project on local fish and wildlife resources?
- Disturbance to fauna by river traffic (increased water turbulence, sound pollution etc.).
- Poaching wildlife – a common practice among villagers, while bush meat (including threatened species) is freely served in restaurants located throughout the Mekong basin.
- Illegal fishing by using explosives and electricity by both Lao and Thais

### **Forest issues**

- Logging and clearing of forests (both legal and illegal).
- Reforestation (by plantation and mono-crop) on the upland area near riverbank in Thai side
- Forest fires – especially in areas subjected to shifting agriculture.

### **Invasive species**

- Introduction and spread of invasive alien species along the Mekong River and surrounding terrestrial habitats (i.e. fish species such as Plectosomus catfish – *Hypostomus plecostomus*, Plant species such as Water hyacinth – *Eichhornia crassipes*, Giant mimosa – *Mimosa pigra*, Giant sensitive Mimosa vine – *Mimosa invisa*, and Napier grass - *Pennisetum purpureum*). The spread of Giant Mimosa along the riverbanks is of particular concern, as this species tends to form uniform thickets within 5-6 years after introduction, gradually displacing native riverine plant species (Additional information on weedy invasives in Thailand: Majchacheep, S, 1995).

### **Pollution issues**

- Mining for gold – use of harmful chemicals (mercury) that may be released in the river, disturbance to habitats.
- Pesticide contained in the water influence to the Mekong, particularly from orange plantations on the tributaries of the Mekong in Thai side near Chiang Khong.

### **Infrastructure**

- Impacts of ports construction and urban development for trade and tourism. How are increases in boat traffic impacting communities?
- Concrete embankments along riverbanks (especially on the Thai side), resulting in loss of habitats for fauna, and also increasing bank erosions in other areas. The demand for this will increase as increased river traffic causes further bank erosion.
- Construction of a road along the Lao bank of the Mekong – contributes to erosion and potential road wash in future.
- Downstream impacts of Chinese cascade dam construction and operation.
- Is the Chinese government regulating the flow of the main channel Mekong? Why, when, where, and by how much is this flow regulation occurring? How is the regulation of flow impacting downstream communities?
- How closely linked are the Navigation Project and the current hydropower development of the Mekong/Lancang? The hydropower scheme has the potential to seriously impact downstream sites. The combined impacts of the Navigation Project and hydropower development need to be studied.
- Impacts of GMS project including bridge construction over the Mekong between Baan Huai Xai and Chiang Khong, road construction from Baan Huai Xai and China (in the Luang Namtha river basin)

### **6.3 Issues Related to Biodiversity Sampling**

#### **Technical**

- Lack of baseline data or inadequate baseline data on plant and animal species.
- Timing of assessments to document temporal changes – to sample seasonal habitats such as island mudflats, swamp forests.
- Monitoring must be seasonal and regular enough to detect events such as fish spawning periods.
- Sampling of fish – need sophisticated equipment to capture species and monitor populations.
- Standard sampling gear will be hard to deploy in the rapids areas.
- Fish detection may best be achieved using remote sampling by “Fish Finders” - the more sophisticated devices may also be able to provide information on river bed substrate.
- Sampling of molluscs on rock faces in the rapids is problematic – a method needs to be determined.
- The numbers of villages along this section seem to be a few compared to other parts of the country - this may limit discussions with fishers and communities.

#### **Personnel**

- Trained personnel who are able to conduct a biodiversity assessment and monitoring exercise along the Mekong River (need to build capacity).
- Ideally, the survey team should consist of representatives from Laos, Thailand and Myanmar, in addition to any foreign experts.
- Local knowledge is very important. Lack of experienced translators for communication with the ethnic people living along the Mekong limits access to this information. In the future, we need to have translators who can communicate with local people.

#### **Logistic**

- The need for a convenient mode of transport that could function as a mobile field laboratory, with relevant sampling equipment (i.e. the typical wooden boats of Myanmar).
- Biodiversity survey within the rapids and deep pools requires a highly manoeuvrable craft such as a Rigid Hull Inflatable Boat (RIB) if it is to be conducted with a relative degree of safety.

#### **Permissions**

- Nocturnal sampling of fauna in important areas such as the Huaitant Island that are under Lao military control, need to obtain permission from relevant authorities.
- Permission to sample the bordering terrestrial landscapes up to 500 m on either side of the river, in Myanmar, Laos and Thailand.

### **6.4 Questions and Gaps in Information**

The following questions and gaps in knowledge will limit the surveys and will need to be filled as far as possible before or during the surveys.

- Diurnal and seasonal fluctuations in the river?
- Seasonal changes in water quality of the Mekong River?
- Dearth of information on fish spawning areas.
- Availability of accurate maps covering the past 10 years.
- No baseline data on use of impacted habitats by flora, fauna, and local people.

## **7 BIODIVERSITY SURVEYS ON THE UPPER MEKONG RIVER**

Three separate yet interconnected biodiversity surveys on the upper reaches of the Lower Mekong Basin from the border between Yunnan province (in China) and Laos and Myanmar down to Luang Prabang (Laos). These surveys will be conducted on those stretches of river that form the border between Laos and Myanmar, and between Thailand and Laos.

The three biodiversity surveys are:

- An extensive biodiversity survey of habitats, flora and fauna found at selected sites from the Chinese border to Luang Prabang.
- A more intensive baseline survey of the biodiversity at the Khon Pi Luang rapids that will enable impact monitoring to be carried out after river modification. It is envisaged that this will require a survey when the river is rising (June/July, and one when it is falling, November/December). It is anticipated that the latter survey could be undertaken as a part of the extensive survey.
- A focused study on the Mekong Giant Catfish in this stretch of the river that will feed into a Giant Catfish conservation plan.

These biodiversity surveys are described below:

### **7.1 Extensive Biodiversity Survey**

#### **7.1.1 Objectives and Products**

The main objective for this extensive survey of biodiversity in this stretch of river is an improved understanding of the upper Mekong ecosystem at the transition between a fast flowing mountain river and the slower lowland river. Such transitions are important ecologically, and the survey would describe the key habitats, flora and fauna found there. Essentially this would be a qualitative survey, though indications of abundance should be included.

This improved understanding will be important for a) identifying potential areas and species for particular conservation effort and b) identifying potential impacts of developments, such as the Navigation Agreement, and serving as a baseline for monitoring these impacts.

The products from this survey would be:

- Survey report
- Baseline conditions for key ecological and biodiversity aspects
- Recommendations for a conservation strategy for the area

#### **7.1.2 Personnel and Expertise Required**

The team for the extensive survey and the more intensive biodiversity survey will be the same or similar. The team should include persons with the following expertise:

- Team leader to coordinate the work of the team and ensure that the different aspects are covered, and to edit the report/s. The team leader should be able to provide expertise in large river ecology or in one of the specialist areas.
- Field botanist who is able to identify aquatic and terrestrial flora of the Mekong basin, preferably with GIS experience to ground-truth remote-sensing vegetation/land-use maps.
- Limnologist for plankton – phyto- and zoo-plankton assessments
- 2 ichthyologists, with specialist knowledge of Mekong fish species

- Ornithologist, for riverine and associated birds
- Herpetologist, for reptiles and amphibians
- Freshwater invertebrate specialist, especially for molluscs
- Entomologist (who should be familiar with butterflies in the area).
- Hydrographer/river morphologist to describe and explain the river structure and possible changes
- 2 sociologists to describe the human communities and their use of natural resources

This team should be supported by:

- “Research” boat captain and crew
- Logistics coordinator
- 3 field technical assistants
- 2 interpreters to translate discussions with local communities – especially Lue, Thai and Lao languages
- Local fishers at the different sampling sites to assist with the setting of nets and to provide local knowledge on fish and fish characteristics, riverine vegetation and habitats.
- 2 small boat handlers
- Cook and cleaner

### 7.1.3 Institutional Arrangements

Ideally, the following organisations/institutions should be involved with the survey, and IUCN should invite them to provide specialists, coordination or other assistance.

- The Mekong River Commission
- National Mekong River Committees of Thailand and Laos
- Environment Departments in Thailand (Office of Environmental Policy and Planning, Ministry of Natural Resource and Environment), and Laos (STEA)
- Departments responsible for transport and navigation, Waterways Administration, MCTPC in Laos and Ports and Harbour Dept in Thailand.
- Fisheries Departments in Lao and Thailand, including Living Aquatic Resources Research Centre (LARReC).
- Department of National Parks, Wildlife and Plant Conservation (including the National Herbarium and the Natural History Museum.).
- Local authorities in Bokeo and Luang Namtha provinces in Laos, and Chiang Mai in Thailand
- Biology Departments of leading universities in Lao and Thailand.
- Local NGO’s working on wildlife conservation in Lao and Thailand, including SEARIN, Project for River and Community- a Chiang Khong Conservation Group, Ethet Study Center, Chiang Mai, Lao Women Union
- Other international NGOs – WWF, WCS, Oxfam etc.

Collaboration with relevant authorities in Myanmar and Yunnan province (China) should also be considered, e.g. with Chinese Academy of Sciences.

### 7.1.4 Process

Whilst this survey has identified the need and the potential for further extensive and intensive biodiversity surveys, the methods to be used have not been elaborated. These need to be of standard and replicable form so that that can form the basis for future work and monitoring. Methods used should also be compatible with ecological monitoring work being proposed by the Mekong River Commission.

It is suggested that the first step in the process would be to organise a survey planning meeting at which the interested organisations would come and assist in the survey design, to confirm what information should be collected, the methods to be used and the equipment required and/or available.

This would be followed by a smaller and more detailed planning meeting with the team. At this meeting the protocols and recording forms for the surveys should be agreed to, e.g. interview forms for local communities and others related to the biodiversity assessment. The logistics for the surveys should be agreed to.

In addition a literature review should be undertaken to collect information about critical habitats for Mekong fish, triggers to migration, threats to endangered species, and likely direct and indirect impacts of the Mekong Navigation Channel Improvement Project on regional aquatic biodiversity

Whether they are involved directly in the process or not, it will be essential to establish liaison with government agencies that can provide information about the details of development plans for the Mekong River, including data on numbers of blasting sites, numbers of deep pools filled with debris, degree river regulation by upstream dams, plans for industrial development, estimates regarding increases in boat traffic and trade, etc.

#### 7.1.5 Possible Methods To Be Used

The following activities are proposed:

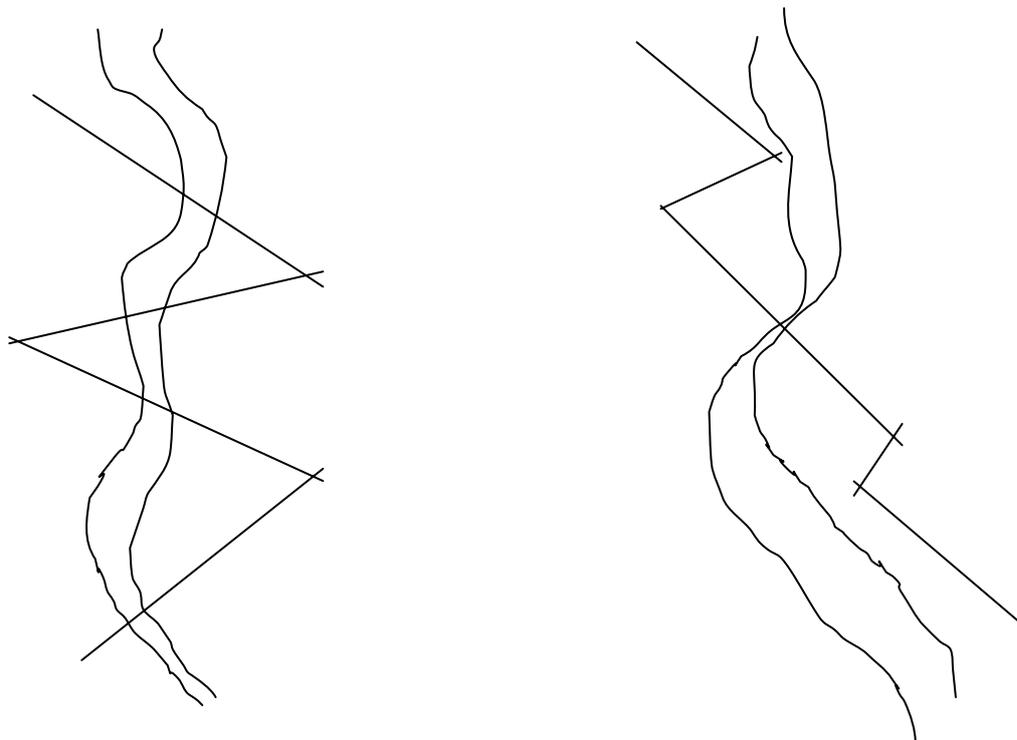
- A socio-economic baseline survey of villages along the river.
- A survey of local knowledge along the stretch through systematic interviews with local people, including such issues as: species occurrence, migration timing, spawning timing and sites, abundance, utilisation, historic trends
- Sampling of selected fisheries activities and fish markets/landing sites (e.g. the important 'pa soi' fishery near Baan Huai Xai, which peaks in October-November)
- Larvae sampling at selected sites using bongo-nets. Preferably, several stations should be sampled consecutively in order to obtain data on timing and duration of drift and potential spawning grounds. The best period for carrying out larvae sampling is from May to August.
- Hydro-acoustic survey (e.g. 'fish Finder' or similar equipment) with particular emphasis on deep pools along the entire stretch from Baan Huai Xai to Luang Prabang. This should also be carried out further upstream (Chiang Kok to Baan Huai Xai) – but the first priority is the stretch planned for the second phase of the navigation project. Each site should be 'sampled' both at day and at night, and preferably on a weekly basis over each season (a few sites could alternatively be selected for regular 'sampling'.

Proposed sampling methods include both qualitative and quantitative methods. For qualitative purposes, only the presence of species needs to be recorded, by thorough surveys carried out in the different habitats. For quantitative sampling, at least two replicates/sites/habitats should be conducted, using the methods summarised in Table 6, for different groups of fauna and flora.

#### 7.1.6 Sampling of Terrestrial and Seasonally Inundated Ecosystems/Habitats Located 500 m Either Side Of the Mekong River

Considering the vast extent of terrestrial and seasonal wetland habitats located along the Mekong, a cost-effective and efficient sampling methodology for the larger area would be the GRADSECT sampling technique. The method involves the orientation of transects along environmental gradients (i.e. altitude) in order to sample the full range of biological diversity within a selected area. Large-scale maps of the soil and vegetation would be useful in deciding where to align the transects. Transects need not follow a straight line, but can change direction to maximise variability between plots and to enhance accessibility as necessary. The riverine landscape could be sampled in a zig-zag direction, as indicated below (Figure 7).

A transect within 500 m of one side of the river should consist of two 100 m x 5 m plots, located 300 m apart. However, spacing of plots depends on the uniformity of habitat, i.e. the distance apart being farther for more uniform areas. The vertebrate fauna (amphibians, reptiles, birds, and mammals), selected invertebrate fauna (butterflies and terrestrial molluscs) and woody/herbaceous plants would be recorded on species inventory forms. The exact location of each plot should be marked with a GPS meter, to facilitate future monitoring exercises to be conducted in the same locations. In addition to technical and scientific sampling, the local knowledge of villagers would also be useful to document the presence of faunal species.



**Figure 7:** Alignment of Sampling Transects in a Zig-Zag Manner along the River

### 7.1.7 Sampling of Freshwater Wetlands

The freshwater wetland habitats could be sampled according to the methods indicated in Table 6.

<b>Group</b>	<b>Sampling Methods</b>	<b>Equipment</b>
Freshwater fish	- Use of local fishers and fishing methods, seines where possible, setting larval fish traps - Use of acoustic 'Fish Finder'	- Various nets, larval fish traps - 'Fish Finder' (LARReC has an inexpensive model)
Herpetofauna	- Setting of pitfall traps (overnight) - 100 x 5m line transects in forests and tall grass reed beds. - Terrestrial habitats including islands: 6 pitfall traps set in a triangular manner - Aquatic habitats such as ponds/mudflats: pitfall traps set in a circular manner	- Pitfall traps (10 L water buckets with lid), 6 x 3 sets - Green mesh (100 m x 0.5 m) - hand nets
Birds	- Aquatic habitats: 0.5 hour point counts - Forests and Tall Grass Reed beds: 100m transects	- Binoculars, spotting scopes
Mammals	- 100 m x 5 m line transects, direct and indirect observations - Nocturnal surveys: Terrestrial habitats: 24 - Sherman traps in sets of 4 x 6 parallel traps and IR camera traps set across animal pathways.	- Sherman traps to capture mammals (live) - IR camera traps to document nocturnal mammals
Lepidoptera and Odonata	- Aquatic habitats: 25 x 5 m transects - Forests and Tall Grass reed beds: 100 m x 5 m transects	- Standard insect sweep nets
Aquatic insects	- Light traps	- 2 standard light traps
Aquatic molluscs	- 25 m x 1 m belt transects along river edge	
Aquatic plants	- Seasonal islands: 5 m x 5 m plots - Seasonal swamp forests: 25 x 5 m belt transects	- Brightly coloured nylon rope, polythene bags, tags,
Terrestrial plants	- Forests: 25 x 5 m belt transects	- Brightly coloured nylon rope, polythene bags, tags,
Plankton	- Standardised phyto- and zoo-plankton trawls	- Phyto- and zoo-plankton nets

**Table 6:** Potential Sampling Methods for Biodiversity Survey

<b>Group</b>	<b>Sampling Methods</b>	<b>Equipment</b>
Fish species and characteristics	-Record the sample of fish species -Group discussion and documentation	- Digital camera - computer and colour printer - Note book
Sub-ecosystems	-Record the local knowledge on sub-ecosystem by field survey, making map and focus discussion -Mapping	-Notebook -mapping materials
Plants and herbs	-Collect the sample of plant and herb -Focus group on each species	-Specimen collection and preservation -Notebook
Seaweed	-Collecting the data on the amount of seaweed harvest by villager -Focus group	-Questionnaire -Weighing -Notebook
Riverbank vegetable gardens	-Focus group	-Notebook

Group	Sampling Methods	Equipment
Fisheries including local knowledge on fishing and fishing gears	- Focus group and key informant interviews	
Riverbanks collapse	-Direct observation and group discussion	-Questionnaire -Notebook
Impacts of water fluctuation	- Focus group and key informant interviews	-Notebook
Impacts of river traffic	- Focus group and key informant interviews	-Questionnaire -Notebook
Social and cultural aspects: history of communities, resource management, livelihoods and social relations	- Key informant interviews	-Questionnaire -Notebook

**Table 7:** Proposed Sampling Methods for Local Knowledge Survey in KPL Area

(NB. SEARIN and local groups are already collecting some of this data around the Khon Pi Luang area. Thai Baan Research methodology can be applied.

#### 7.1.8 Key Sampling Sites and Habitats

Representative sites from terrestrial and wetland habitat types highlighted earlier (Tables 2 and 3), will have to surveyed. Emphasis should be placed on undisturbed riverine evergreen forests, disturbed secondary forests, bamboo forests, tall grass reed beds, rock outcrops, mud/pebble flats (islands), streams, seasonal swamp forests and pools. Special attention should be directed towards biodiversity assessments in the refuges highlighted in Table 4.

Initial survey should include representatives of all distinct riverine habitats including:

- Rapids
- Deep pools
- Riverine pools
- Pebble, sand and mud banks
- Riffle areas
- Mid-stream rocks
- Slow water runs
- Tributary/Mekong confluence areas
- Floodplains/backwaters

In addition, particular attention should be paid to seaweed locations, known fishing grounds, riverbank vegetable gardens, and areas where riverbanks have collapsed. Fisher camps and communities nearby the rapids supposed to be blasted should be interviewed.

#### 7.1.9 Selection of Sampling Sites for the Extensive Survey

On the basis that the approximate length of the river between the Chinese border and Luang Prabang is 300 km, and that the extensive survey should take about 14 days, (plus additional 5 days at Khon Pi Luang for the intensive survey), this would allow sampling of at least 10 or 11 sites (plus the additional sites between Khon Pi Luang and Baan Huai Xai). It is suggested at present that these sites may be allocated as follows:

- Between the Chinese border and Xieng Kok - 2 sites of which one would be at Tang Salum rapid.
- Between Xieng Kok and Mouang Mom – 3 sites, of which one would be at Wong Wit rapid and one at the Don Noi Island
- Between Mouang Mom and Khon Pi Luang – 2 sites, e.g. sand bar islands near Chiang Saen
- Between Baan Huai Xai and Pak Beng – 2 sites, including Don Kai Nok, on the border between Thailand and Laos
- Between Pak Beng and Luang Prabang – 2 site, e.g. near Pak Oe village in Luang Prabang Province.

The identification of the actual sites chosen would be based upon study of available charts (such as have been prepared by the Royal Thai Survey Department and Service Geographique National of Laos, 1992), aerial photography, and remote-sensed vegetation cover/land-use maps. Suitable sites would show a combination of the features identified above and be representative of different terrestrial and freshwater habitat types. For the stretch between Baan Huai Xai and Luang Prabang, a preliminary trip can be easily undertaken over 2 – 3 days on one of the commercial river boats.

#### 7.1.10 Equipment

It is suggested that the survey be undertaken using one of the 30 tonne wooden cargo boats, suitably adapted as a research vessel, with accommodation for up to 20 persons. This could be leased for the purpose and fitted with the following:

- Stand-by generator
- Electrical fittings for work lights and computer power supply
- Work tables and benches for sorting samples and for computer workstations
- Deep freeze for samples
- At least one small tender boat to serve as a sampling boat, plus, if possible, a rubber inflatable, e.g. Zodiac with outboard engine
- Field guides of flora and fauna - The available scientific guides on fauna and flora of the Southeast Asian region would be useful for taxonomic verifications, plus any species lists that have been prepared.
- Photographic illustrations of fish etc. to aid discussions with local people
- Drift nets (to collect young fish)
- Scoop nets
- Zoo- and Phyto-plankton nets
- Larval traps
- Benthic grabs
- Scale
- Measuring tape
- Sorting sieves
- Sorting trays and Petri dishes
- Dissecting kit
- Alcohol/formalin for preservation of specimens
- Plastic bottles and bags for storage of specimens
- Hydro-Acoustic survey equipment – “Fish Finder”
- Flow meter
- Dissolved oxygen meter
- GPS

- Telemetry equipment
- 2 stereo-microscopes
- Hand lenses
- Cameras – digital and conventional, with macro and zoom lens (300 – 500x)
- Binoculars and spotting telescope
- Flashlights
- Pencils and interview/recording forms
- Computers (laptops)

#### 7.1.11 Timing

From the point of view of key fisheries and other aspects, the following times of year are important:

- Changes in fish species being caught and their characteristics: all year round
- Seaweed/river algae: February-April
- Migratory catfish: April-July
- Giant Catfish: May-June
- Plants and herbs: near the end of dry season and beginning of rainy season
- Riverbank collapse: rainy season
- Migratory cyprinids (*pa soi*): October-November
- Riverbank vegetable gardens: winter and summer

Ideally, each sampling site needs to be sampled during the dry and wet seasons to determine seasonal variations in biodiversity. November is an appropriate month for an initial survey and the survey should take at least two weeks.

#### 7.1.12 Logistics

The boat would be fitted out during September/October and make its way upstream to the most accessible point above the Tang Salum Rapid. The team would fly up to Luang Namtha and then drive to meet the boat. The team and the boat would slowly move downstream, allowing at least one day for sampling at each site. The team would be accommodated on the boat, with all food and supplies provided.

At the Khon Pi Luang rapid down to Baan Huai Xai, the more intensive baseline survey would be undertaken for a period of 4 –5 days. Thereafter, the team would proceed to Luang Prabang where the survey would end.

Equipment would be stored for future surveys.

## **7.2 Baseline Survey and Monitoring for Khon Pi Luang Rapids, Thailand and Laos**

### 7.2.1 Objectives and Products

The main objective of this more intensive biodiversity survey is to provide a reliable baseline for monitoring changes associated with the river modification programme, proposed for December 2003. It is important that this is both qualitative, as per the extensive survey, and, where appropriate, quantitative, so that changes may be perceived more clearly. Replicability is also important and it should link to the ecological surveys proposed by the Mekong River Commission. However, it is also important that there is an ongoing continuity of monitoring, at a lower level of intensity and involving the work that SEARIN is currently engaged in with local communities on the Thai side.

The products would include a stand-alone survey report highlighting the findings and the particular features to be investigated in future monitoring. Recommendations should be put forward for a monitoring programme. Where possible, the effects of river modification on the different ecological components and communities may be predicated so that greater focus can be placed upon those critically affected.

It is anticipated that this survey may also provide opportunities for individual team members to produce scientific papers on their findings.

### 7.2.2 Survey Concept and Design

In concept, this baseline survey consists of two parts:

- Two intensive, semi-quantitative biodiversity surveys to cover the rising water (June/July) and the falling water (November/December) flow patterns in the river. The first should be undertaken in June/July 2003, and be developed as a model for future surveys. The November/December survey will be undertaken as part of the more extensive survey.
- Ongoing, community-facilitated monitoring, consisting of regular monthly interviews with key informants (e.g. fishers, boat operators, seaweed gatherers, gold panners) who use the natural resources of the river, go out on the river on a daily basis and who can provide information on the status of those resources, and the general river environment. This monitoring would be based on the work that SEARIN is already undertaking and efforts would be taken to systematise and strengthen this effort.

### 7.2.3 Identification of Key Habitats and Survey Sampling Sites

The key area for this survey of the Khon Pi Luang rapids system is the Mekong River from Baan Had Bai to Haad Hae (down stream of Baan Don Thi). This is shown in Figure 8. Figure 9 shows a schematic of the river modification activities envisaged in the EIA report. (Joint experts Group on EIA of China, Laos, Myanmar and Thailand (2001).

Sampling should be conducted in representative, replicate sites covering each of the above terrestrial and freshwater habitats in the KPL area. Special emphasis should be given to the Khon Pi Luang Island (GPS location 49, 20° 23.895'N, 100° 17.629'E), which seems to be a hot spot for birds. At least two replicate sites per habitat type should be covered.

Initially, it would be useful to find GIS maps/Remote Sensing Images/aerial photographs of the KPL area, covering at least the past five years. This would be useful to study the seasonal changes in habitats in the KPL area, and select the sampling sites accordingly.

The key terrestrial habitats in the KPL area include evergreen forests (on hill tops on the Lao side), cultivations (Lao side), shrubland (Lao side) and tall grass reed beds (Thai side).

The freshwater habitats include riverine rapids and deep pools, seasonally inundated mudflats/sand bar islands with shrubs, pools in islands, seasonally inundated woody swamp forests (Lao side) and rock outcrops, creeks and tributaries flowing into the Mekong

Priority groups to survey: Molluscs (potentially most sensitive to alterations in hydrology); fishes; Odonata (also useful indicator species); amphibians; aquatic plants; and birds.

#### 7.2.4 Expertise Required

This should be the same as has been described in section 7.1.

#### 7.2.5 Sampling Methods and Equipment Required

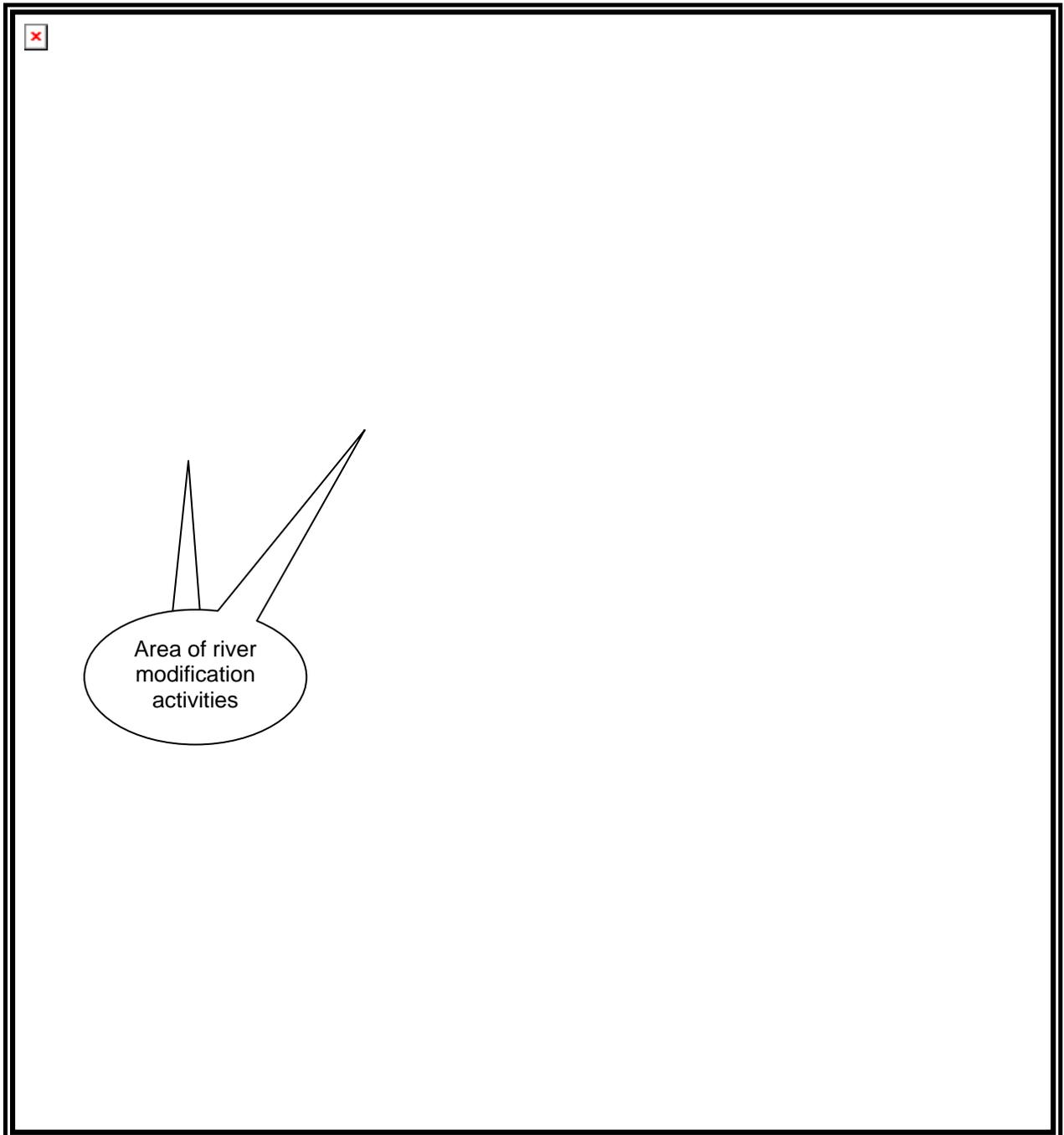
The sampling methods for the biodiversity surveys would be similar to those developed for the extensive survey, but where possible attempts should be made to provide semi-quantitative assessments, or at least estimates of abundance, and trends.

On the fishery aspects, the following should be considered:

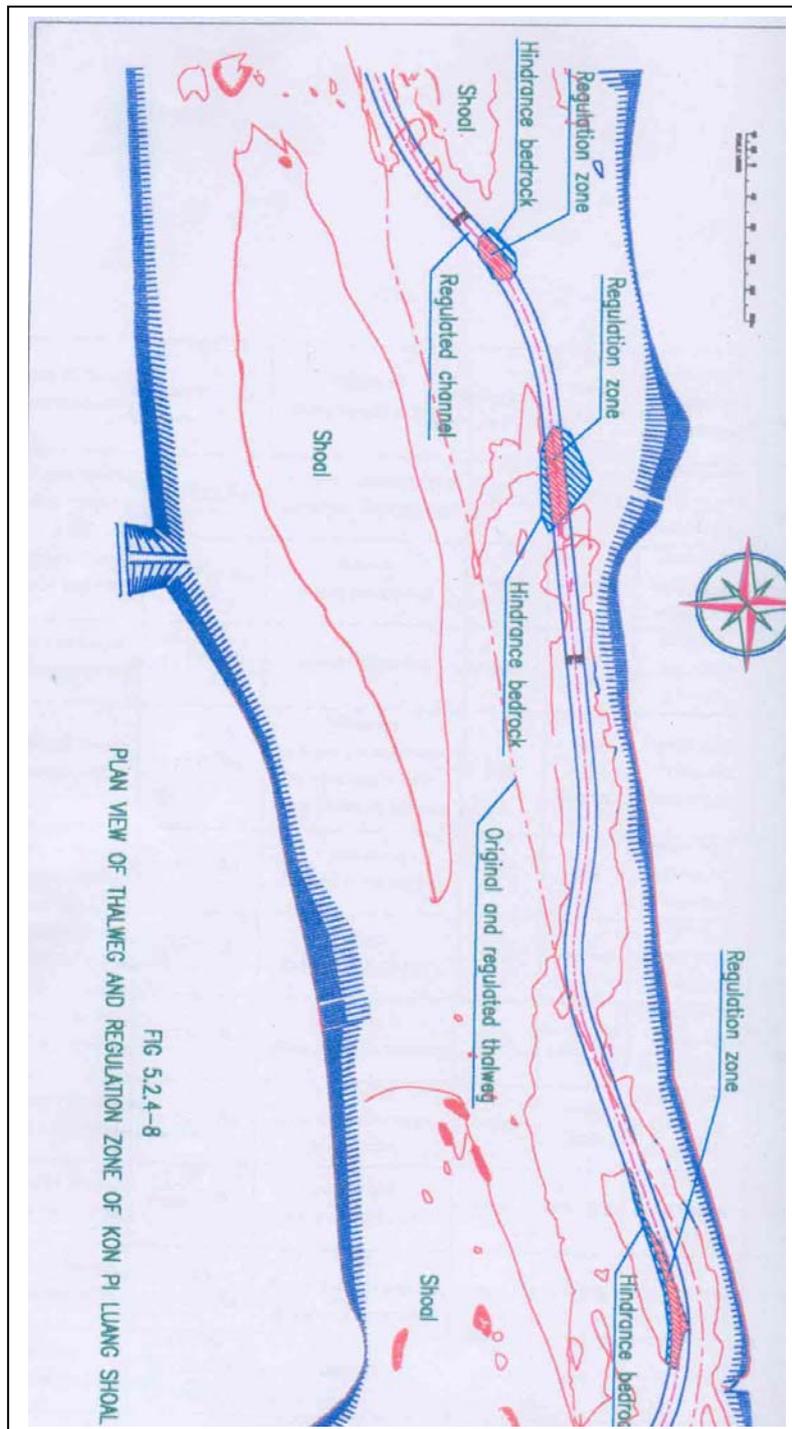
- **Drift net sampling** (for young fish) - collection of information on the presence/absence of spawning activity upstream of sampling sites and identification of critical habitats for young fish
- **Opportunistic use of more technical approaches** (i.e. 'Fish Finders', telemetry, environmental tracers, genetics, etc.) - collection of quantitative information about fish biomass, fish abundance, fish dispersal, and migration corridors

While local knowledge and the cooperation of local people are **crucial**, we should recognise the scientific limitations of collecting data using traditional gears. For example, some gears (e.g. gill nets) may not provide a random sample of fish population. In the case of migratory species, local knowledge of fishers may be able to provide important information about fish biology and ecology, but local data from single areas cannot provide a complete picture of migration routes, because fishers generally only have information about limited geographic areas. Therefore, a combination of local knowledge (from different sites), fish sampling, and more complex research methods such as fish finders, genetic analysis, tagging, or experimentation are necessary to answer the unresolved questions about fish ecology.

Other methodologies include market surveys, consumption studies, CPUE (catch per unit effort) studies, trawl sampling, sampling with electricity/poison (standard method in the U.S. and Europe but problematic in the Mekong River), and sampling during blasting operations (obviously with authorisation and cooperation from the appropriate government agencies).



**Figure 8:** Detailed Topographical/Hydrographical Map of Khon Pi Luang Rapids to Baan Huai Xai (Source: Royal Thai Survey Dept. /Service Geographique National Laos)



**Figure 9:** Schematic of River Modification Activities Envisaged For Khon Pi Luang Rapids  
 (Source: EIA report of Navigation Channel Improvement Project)

Key methodologies for the ongoing community monitoring will include:

- **Village interviews** - collection of information about important community fisheries, the seasonality of fisheries, the timing of the migrations, fish spawning conditions, price, fishing gears, and local fisheries management

- **Fisheries surveys** - collection of information about fish species, daily fish catch, individual fish length, individual fish weight, the timing of the migrations, fish spawning condition
- **Case studies** - collection of information on two or three of the most important fisheries in the study area. For example, the *pa soi* fishery (food security), the catfish fishery (commercial importance), and the giant catfish fishery (cultural/biodiversity significance).

#### 7.2.6 Timing and Duration

In order to document temporal variations in biodiversity, sampling will have to be conducted during the dry and wet season. It is important that both surveys are carried out before the river regulation works are undertaken.

The intensive biodiversity surveys will take at least 5 days in the field. The community data collection should be undertaken on at least a once per month basis, following an initial sociological study and community training process that may take an initial two weeks.

Once baselines have been conducted in both wet and dry seasons, monitoring may be refined and carried out at least once per month for three continuous months per season.

#### **BOX 1: WHAT WE NEED TO KNOW FOR A FISH IMPACT ASSESSMENT**

How many fish species occur in the study area? How many of these fish species will be impacted by the Navigation Project?

Which habitats are most important for fish and other aquatic life? How will the Navigation Project impact these critical habitats?

How many fish species migrate through the study area? Will the Navigation Project impact migratory species? How can we determine the scale of these impacts (many impacts will be localised, but not all)?

- The migratory fish of the Mekong River basin support many important community-based. Although little is known about the origin or destination migrating fish, it seems likely that fish migrate from Laos and Thailand (and maybe from Vietnam and Cambodia) in the study area. The stretch of river between Luang Prabang and Baan Huai Xai may be an important migratory corridor.

How many species spawn in the area? How will spawning be impacted by the Navigation Project? Possible impacts include destruction of spawning habitat, increased pollution, increased disturbance (boat noise, boat traffic, etc.), and increased fishing pressure.

How important are fish and wildlife to local communities? Will local fisheries and wildlife hunting be impacted by the Navigation Project? Will the Navigation Project impact local ownership and management regimes of natural resources?

The development of the stretch of river between the Lao-China border and Luang Prabang may have a negative impact on fisheries and on the fishing villages of Laos, Burma, and Thailand (as well as other communities in Cambodia and Vietnam). River development would likely destroy many local fisheries, and may have basinwide impacts in the case of migratory fish species that spawn in this stretch of the Mekong. Moreover, many characteristics of local fisheries (e.g. net/trap sites, management regime, fishing gear) are specific to the geology and hydrology of the river channel. These fisheries may disappear as soon as the river channel is altered. Without these fisheries, villagers in the area may lose a means for feeding themselves and earning money. While the majority of these impacts are likely to be restricted to a small area, we cannot rule out the possibility of large-scale impacts, especially in the case of fisheries for migratory species.

### 7.3 Interim Study on Mekong Giant Catfish and Associated Fisheries

#### 7.3.1 Objectives

The objective of this study is to establish information about the status of the Mekong Giant Catfish, to assist in developing a longer-term action plan for the conservation of this species.

#### 7.3.2 Activities

- Document the presence/absence of Giant Catfish during the 2003 fishing season.
- Sample larval fish (a preliminary study in conjunction with local fishers).
- Gather information (literature review and village interviews) about Giant Catfish life history, critical habitats, and causes for population decline.
- Catch, tag, and release of Mekong Giant Catfish in conjunction with the National Geographic Conservation Trust and the Thai Department of Fisheries (if possible).
- Develop a methodology and schedule for systematic sampling of fish catches. Important data includes species presence/absence (a species list), changes in species composition over time, catch per unit effort, economic value of fisheries, and seasonality of fisheries.
- Develop plan for integrated approach to the conservation of giant catfish, including Lao and Thai DOF, the Giant Catfish Fishermen's Club of Chiang Khong, and local communities.
- Describe the history of the aquaculture program, the potential for captive breeding, and options for the future use of the captive stock of Mekong Giant Catfish.
- Inventory all museum collections of Mekong Giant Catfish (as sources of DNA for possible population genetic analysis of catfish from Thailand and Cambodia).
- Draft a conservation status report and action plan for all giant catfish within the Mekong River Basin

#### 7.3.3 Implementation of Interim Mekong Giant Catfish Status Report

Following the production of the draft report of this scoping survey in May 2003, Dr. Zeb Hogan was contracted by IUCN- WANI to undertake the activities listed above and to produce a status report on the Mekong Giant Catfish. He also worked with SEARIN in developing various questionnaires and methods for collecting further community sourced information on the fishery and on the Mekong Giant Catfish. The status report is being published as: **Hogan, Z.** (August 2003). *Current Status, Threats and Preliminary Conservation Measures for the Mekong Giant Catfish*. IUCN.

## 8 RECOMMENDATIONS

In the absence of an effective and comprehensive EIA process for the Mekong Navigation Channel Improvement Project it is very difficult to predict impacts. River modifications have already been carried out during December to April, and one set of rapids, Khon Pi Luang, between Thailand and Laos, remains intact, and predicted to be implemented in December 2003. It is very important that at least a baseline survey be carried out of the hydrology, biodiversity and livelihoods of local people before the river modification is carried out. This will provide the basis for monitoring and for assessing impacts. It will also allow greater preparedness when EIAs for other phases are proposed.

**As a matter of urgency, it is recommended that two biodiversity surveys be carried out in the Khon Pi Luang area in June and in November 2003.** This should be combined with surveys of the local fishing communities about both fish species and local livelihoods. During these surveys, the opportunity should be taken to build the capacity of personnel in the Mekong region for future biodiversity assessment and monitoring exercise. Funding will have to be sourced for these surveys.

The EIA carried out for the Navigation Channel Improvement Project lacked an assessment of the indirect impacts of increased river cargo traffic along this stretch of the Mekong. These potentially have greater impact upon the biodiversity, ecology and livelihoods of local people than the present set of river modification activities. Issues such as bank erosion, long-term impacts on fish and fisheries, long-term hydrological changes to the river, risks to smaller craft, and increased noise pollution, as well as continued demand for further removal of “hindrances” in the river bed as cargo traffic increases; all need to be assessed realistically and objectively, before any other decisions are taken for future phases.

**After consultations on the draft report with both the Governments of Laos and of Thailand, it is recommended that the EIA be reviewed and updated** in the light of the experiences of the river modification work and monitoring by the governments that has been carried out to date; and the additional studies, such as this one, and the work by SEARIN and local organisation in Thailand, that have added to our knowledge of the aquatic ecosystems along the Mekong. The updating should address issues mentioned in this report, including the longer-term social and ecological issues resulting from increased navigation traffic. It should lead into the development of operating guidelines for safe, environmentally sound and sustainable navigation on this stretch of the Mekong. Such a review should be carried out by experts from each of the four countries, with involvement of downstream countries if possible. IUCN could provide a facilitating role in such a process if necessary.

**Biodiversity assessments need to be started at the earliest possible time, to gather baseline information that would be useful for future monitoring, specifically to document the impacts of navigation development in the Mekong.** The Mekong countries should also start the process of developing cargo traffic regulations along the Mekong to minimise the risks of these impacts.

The scoping survey highlights the lack of information about the biodiversity in and along one of the most beautiful stretches of the Mekong, between Laos and Myanmar. There are undoubtedly areas where conservation activities should be undertaken to protect the forests and riverine areas. **It is recommended that an extensive survey of biodiversity and areas suitable for conservation be carried out from the Chinese border to Luang Prabang, probably in November/December 2003. This should include fish and fisheries aspects.**

Based upon the findings of this extensive survey, steps should be taken to declare the biodiversity refuges identified as protected areas or other form of protection measures. It would be necessary to initiate inter-governmental level discussions for this purpose, since the potential to declare trans-boundary protected areas should also be actively pursued. For instance, the Huaitant Island (Laos) and the surrounding mainland area in Myanmar and Laos qualify as an ideal biodiversity refuge that could be declared as a trans-boundary protected area. Areas that have been identified as deforested may also be considered for reforestation so as to protect the watershed.

If certain stretches of the river are identified as critical areas for fish (e.g. deep pools refuges, spawning sites for particular species), efforts should be made to formally and practically protect those habitats, preferably through trans-boundary agreements between the riparian countries. In this regard, the history and uncertain current status of the Mekong Giant Catfish indicates the need for more detailed survey and assessment of impacts upon the catfish and the habitats that it depends upon during its lifecycle. The Mekong Giant Catfish is a flagship species in that it has a cultural, almost mythical value for all the people of the Mekong and its health and survival can be taken as a reflection of the overall health of the river as a whole. An initial survey has already been carried out during this spawning season (April to June 2003) to develop more detailed studies and conservation action plans.

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## **APPENDIX 1: TERMS OF REFERENCE**

### **INTRODUCTION**

The reaches of the Mekong River from where it flows out of China, between Laos and Myanmar and then Thailand, have been identified as important for biodiversity, especially for migratory species of fish including the Giant Catfish. However very little detailed information on biodiversity is available.

IUCN, in collaboration with the Lao National Mekong Committee is proposing to undertake a preliminary survey of the river and its riparian areas in preparation of a more detailed biodiversity survey later. It is intended that this rapid survey will provide basic information of the habitats and some of the species of importance to biodiversity conservation in this part of the river. It will enable a more detailed survey to be planned, potential sites for sampling to be identified, and methods of survey to be described.

This survey will be carried out under the auspices of the UNDP-GEF Mekong Wetland Biodiversity Conservation and Sustainable Use Programme, currently in its preparatory phase before the GEF funding comes on stream by the end of 2003. This regional wetlands Programme includes a number of outputs that deal with developing guiding principles for wetlands management, preparing biodiversity overlays and supporting training for Red Listing activities. The Giant Catfish an Endangered Species on the IUCN Red List has also been identified as a flagship species for the Mekong under the regional wetlands programme.

This scoping assessment follows on from an IUCN-MRC Training Course on "Biodiversity Assessment Tools for Inland Water Ecosystems in the Lower Mekong River Basin", to be held in Vientiane from 18-21 February, 2003. Funding for this survey comes from the Water and Nature Initiative Funds managed by the IUCN Asia Regional Office. Logistic arrangements are being carried out by the Lao National Mekong Committee and IUCN –Lao PDR.

### **OBJECTIVES**

- Increased understanding of the Mekong biodiversity of the riverine ecosystems, habitats and species in the stretch of the Mekong between the China/Laos border and Ban Houay Sai (Laos) and Chiang Khong (Thailand), and of the riparian communities that depend upon the natural resources in this stretch of the river for their livelihoods.
- Plan developed for a more detailed biodiversity survey of the area, including expertise required, proposed sites for sampling, and methods to be used.

### **ACTIVITIES/METHODS**

- Visit the area by boat according to the attached draft programme
- Inspect key sites down the river, taking biological samples and photographs where possible
- Visit riparian communities, discuss the features, habitats and species that they use from the river, including seasonal variations
- Inspect any fish catches and other natural resources, identify species, inspect gut contents to establish feed species
- Prepare report of the rapid biodiversity assessment according to format and authors to be agreed
- Develop plan for more detailed biodiversity survey
- Team Leader to finalise and present the report to LNMC

## **PARTICIPANTS**

The rapid survey team will consist of the following persons:

- Mr Peter-John Meynell – Team Leader of Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme
- Dr. Will Darwall – IUCN Freshwater Biodiversity Assessment Officer
- Dr. Anders Poulsen – Fisheries expert
- Dr. Zeb Hogan – Giant Catfish expert
- Dr Channa Banbaradeniya – Head of Ecosystem Management and Species Conservation, IUCN Sri Lanka

Lao Government officials:

- Mr Phonepaseuth Phoulipanh – Lao National Mekong Committee
- Mr Thavone Vongphosy, Department of the Environment, STEA
- Dr. Douangkham Singhanouvong, LARREC

From Thailand:

- Ms Wipapan Nakpaen - environmentalist
- Mr Chainarong Srettachau – biodiversity/rural livelihoods expert, SEARIN

## **DRAFT PROGRAMME**

- Saturday 22 February. Team arrives in Vientiane
- Sunday 23 February. Team flies to Luang Prabang dep 10.20 arrive 11.00. Drive to Luang Namtha, Overnight in Luang Namtha
- Monday 24 February. Drive Luang Namtha to Xieng Kok. Boat trip to inspect Tang Salem rapid. Overnight in Xieng Kok
- Tuesday 25 February Inspection of river by boat between Xieng Kok and Muang Mom. Overnight in Muang Mom (home stay)
- Wednesday 26 February Inspection of river by boat between Muang Mom and Houiesai. Overnight in Houiesai.
- Thursday 27 February. Inspection of river by boat in Thailand. Meet Thai reps in Chiang Khong.
- Friday 28 February. Depart for Vientiane and Bangkok

## **EQUIPMENT REQUIRED AND PERSON RESPONSIBLE**

- GPS recorder – PJM
- Fish larvae sampling traps – Zeb Hogan
- Plastic sample bags/bottles – obtain in Vientiane
- Dissection kits and preservative – LARREC ?
- Other sampling gear etc. LARREC?
- Maps of river – LNMC, PJM
- MRC Mekong Fisheries Database on computer – PJM
- EIA reports by Chinese on Navigation channel improvements – PJM
- Additional photocopies of maps and diagrams of rapids from EIA - PJM

## **RESPONSIBILITIES**

Each member of the Scoping Team will be required to produce a report on the findings of the mission as specified by the Team Leader. This report is to be in two parts:

- Individual report on the Field Trip
- Report as a contribution to the Main Report (to be prepared by the Team Leader)

Reports are to be prepared within one week of the end of the mission and presented as a hard copy and as an electronic copy in MS Word.

## **APPENDIX 2: LIST OF PERSONS MET**

- Mr Chanseng Vivaxay, Deputy Director of Telecom, Transportation, Post and Construction Office of Namtha province.
- Mr Soulid Tomsavath, Chief of Administration section of Telecom, Transportation, Post and Construction Office of Namtha province.
- Mr Bounechanh, Head of Don Moune Campus (Don Moune, Phakhao, Houysanh and Houy Pong lo Village)
- see also interviewees listed in Appendix 4

## APPENDIX 3: SPECIES LISTS

### 3.1. List of Amphibians Recorded

Family	Common & Scientific Name	Habitat
Ranidae	White-lined flood frog - <i>Phrynoglossus martensi</i>	Pool in sand bar (transparent tadpoles)
	Tubercled flood frog – <i>Phrynoglossus magnapustulosus</i>	Muddy bank beside pool
	<i>Rana</i> spp.	Muddy bank beside pool

### 3.2. List of Reptiles Recorded

Family	Common & Scientific Name	Habitat
Gekkonidae	Spiny-tailed House Gecko – <i>Hemidactylus frenatus</i>	Home gardens
	Four-clawed Gecko – <i>Gehyra mutilata</i>	Home gardens
Agamidae	Common Garden Lizard – <i>Calotes versicolor</i>	Home gardens

Note: A villager of Don Moun (Laos) informed on the presence of several reptiles in surrounding forests, including threatened reptiles such as the King Cobra and Reticulated Python.

### 3.3. List of Aquatic Molluscs Recorded

Family	Scientific Name	Habitat
Ampularidae	<i>Pila</i> spp.	Rocky edge in river
Thiaridae	<i>Paludomus</i> spp.	Rocky areas along river, attached to rocks
Viviparidae	<i>Bellamya</i> spp.	Slow flowing area, shallow edge with algae and pebbles
Unidentified bivalve species		

### 3.4. Checklist of Birds Recorded along the Northern Mekong Riverine Ecosystems from Tang Salum to Houei Sai

(Total bird species recorded: 76 species)

<sup>1</sup>Habitats:

RB – Riverbank; SB – Sand bars; MF – Mud flats; RO – Rock outcrops;

REF – Riverine evergreen forests; BF – Bamboo forests; TGB – Tall Grass beds;

S – Shrubland; HG – Home Gardens; DSF – Disturbed secondary forest, C - Cultivations

<sup>2</sup>Relative abundance - Based on frequency of observations along the riverine ecosystem stretch:

C - Common (> 50% of observations); UC - Uncommon (20-50% of observations);

R - Rare (< 20% of observations)

Family	Common & Scientific Name	Habitat <sup>1</sup>	Relative Abundance <sup>2</sup>
Anatidae	Ruddy Shelduck – <i>Tadorna ferruginea</i>	SB, MF	R
	Spot-billed Duck – <i>Anas poecilorhyncha</i>	SB, MF	R
Scolopacidae	Common Sandpiper – <i>Actitis hypoleucos</i>	SB, MF	C
Burhinidae	Great Thick-knee – <i>Esacus recurvirostris</i>	SB, MF	R
Charadriidae	Little-ringed Plover – <i>Charadrius dubius</i>	SB, MF, RB	C
	Long-billed Plover – <i>Charadrius placidus</i>	SB, MF	R
	Kentish Plover – <i>Charadrius alexandrianus</i>	SB, MF	UC
	River Lapwing – <i>Vanellus duvaucelii</i>	SB, MF, RB	UC
	Grey-headed Lapwing – <i>Vanellus cinereus</i>	SB, MF, RB	UC
	Red-wattled Lapwing – <i>Vanellus indicus</i>	SB, MF, RB	UC
	Temminck's Stint – <i>Calidris temminckii</i>	SB, MF	UC
Glareolidae	Small Pratincole – <i>Glareola lactea</i>	SB, MF, RB,RO	C
Ardeidae	Little Egret – <i>Egretta garzetta</i>	SB, MF, RB	C
	Intermediate Egret – <i>Mesophoyx intermedia</i>	SB, MF, RB	UC
	Great Egret – <i>Casmerodius albus</i>	SB, MF	R
	Chinese Pond Heron – <i>Ardeola bacchus</i>	SB, MF, RB	C
	Grey Heron – <i>Ardea cinerea</i>	SB, MF	UC
	Little Heron – <i>Butorides striatus</i>	RO, RB	R
Alcedinidae	Common Kingfisher – <i>Alcedo atthis</i>	RB, RO	UC
	Blyth's Kingfisher – <i>Alcedo hercules</i>	RB, RO	R
Halcyonidae	White-throated Kingfisher – <i>Halcyon smyrnensis</i>	RB, RO	C
Motacillidae	White Wagtail – <i>Motacilla alba</i>	RB, RO, MF,SB	C
	Grey Wagtail – <i>Motacilla cinerea</i>	RB, MF	R
	Paddyfield Pipit – <i>Anthus rufulus</i>	MF, HG, C	UC
Hirundinidae	Barn Swallow – <i>Hirundo rustica</i>	SB, RO, HG	C
	Red-rumped Swallow – <i>Hirundo daurica</i>	HG, SB, DSF	C
	Wire-tailed Swallow – <i>Hirundo smithii</i>	DSF, RB	R
	Plain Martin – <i>Riparia paludicola</i>	RB, SB, S, C	UC
Apodidae	House Swift – <i>Apus affinis</i>	S, C,	C
	Asian Palm Swift – <i>Cypsiurus balasiensis</i>	HG,RB	C
Hemiprocnidae	Crested Treeswift – <i>Hemiprocne coronata</i>	S, DSF	R
Tytonidae	Barn Owl – <i>Tyto alba</i>	HG, DSF	R
Strigidae	Asian Barred Owlet – <i>Glaucidium cuculoides</i>	REF, DSF	R
	Collared Scops-Owl – <i>Otus Lempiji</i>	REF, DSF	R
Eurostopodidae	Great-eared Nightjar – <i>Eurostopodus macrotis</i>	REF, DSF	UC
Pycnonotidae	Red-whiskered Bulbul – <i>Pycnonotus jocosus</i>	REF,BF,DSF, HG	C
	Black-crested Bulbul – <i>Pycnonotus melanicterus</i>	REF,BF,DSF, HG	UC
	Black Bulbul – <i>Hypsipetes leucocephalus</i>	REF, DSF	R
	Grey-eyed Bulbul – <i>Hypsipetes propinquus</i>	REF, DSF	UC
	Sooty-headed Bulbul – <i>Pycnonotus aurigaster</i>	REF, DSF, HG	C
Oriolidae	Black-hooded Oriole – <i>Oriolus xanthornus</i>	DSF	R
	Grey-chinned Minivet – <i>Pericrocotus solaris</i>	REF, DSF	R
Dicruridae	Black Drongo – <i>Dicrurus macrocercus</i>	DSF	R
Muscicapidae	Asian Brown Flycatcher – <i>Muscicapa dauurica</i>	DSF, HG	R
	Red-throated Flycatcher – <i>Ficedula parva</i>	RB, DSF	UC
Megalaimidae	Blue-throated Barbet – <i>Megalaima asiatica</i>	REF, DSF	C

Family	Common & Scientific Name	Habitat <sup>1</sup>	Relative Abundance <sup>2</sup>
	Coppersmith Barbet – <i>Megalaima haemacephala</i>	REF, DSF	UC
	Green-eared Barbet – <i>Megalaima faiostricta</i>	REF, DSF	UC
Picidae	Greater Yellownape – <i>Picus flavinucha</i>	REF, DSF	R
Sylviidae	Lanceolated Warbler – <i>Locustella lanceolata</i>	TGB, S, DSF	R
	Arctic Warbler – <i>Phylloscopus borealis</i>	DSF, S, HG, TGB	R
	Great Reed – Warbler – <i>Acrocephalus arundinaceus</i>	TGB	UC
	Common Tailorbird – <i>Orthotomus sutorius</i>	DSF, HG, BF, TGB	C
	Dark-necked Tailorbird – <i>Orthotomus atrogularis</i>	DSF	R
Cisticolidae	Grey-breasted Prinia – <i>Prinia hodgsonii</i>	DSF, HG, TGB, S	C
Sylviidae	Striped Tit Babbler – <i>Macronus gularis</i>	DSF, BF	UC
	Rufous-fronted Babbler – <i>Stachyris rufifrons</i>	DSF, S	C
	White-browed Scimitar Babbler – <i>Pomatorhinus schisticeps</i>	DSF, REF	R
	Puff-throated Babbler – <i>Pellorneum ruficeps</i>	DSF, REF	UC
Zosteropidae	Oriental White-eye – <i>Zosterops palpebrosus</i>	DSF, REF, BF	UC
	Japanese White-eye – <i>Zosterops japonicus</i>	DSF, REF, BF	UC
Columbidae	Green Imperial Pigeon – <i>Ducula aenea</i>	REF, DSF	R
Centropodidae	Greater Coucal – <i>Centropus sinensis</i>	DSF, REF	C
Cuculidae	Asian Koel – <i>Eudynamys scolopacea</i>	DSF, HG	UC
Meropidae	Blue-tailed Bee Eater – <i>Merops philippinus</i>	RB	C
	Green Bee Eater – <i>Merops orientalis</i>	RB, DSF	UC
Dicaeidae	Scarlet-backed Flowerpecker – <i>Dicaeum cruentatum</i>	DSF, S, HG	UC
Nectariniidae	Purple Sunbird – <i>Nectarinia asiatica</i>	DSF, HG, REF	C
Passeridae	House Sparrow – <i>Passer domesticus</i>	HG, S, C	C
Phasianidae	Red Junglefowl – <i>Gallus gallus</i>	DSF, REF	R
	Silver Pheasant – <i>Lophura nycthemera</i>	DSF, REF	R
Coraciidae	Indian Roller – <i>Coracias benghalensis</i>	DSF, C, S	C
Corvidae	Black-billed Magpie – <i>Pica pica</i>	DSF, HG, C	C
Irenidae	Common Iora – <i>Aegithina tiphia</i>	DSF, HG, C	C
Estrildidae	White-rumped Munia – <i>Lonchura striata</i>	BF, DSF	C
	Scaly-breasted Munia – <i>Lonchura punctulata</i>	BF, DSF	C

### 3.5. List of Mammals Recorded

Family	Common & Scientific Name	Habitat
Lorisidae	Slow Loris – <i>Nycticebus coucang</i>	Riverine evergreen forests, disturbed secondary forests
Cercopithecidae	Pig-tailed Macaque – <i>Macaca nemestrina</i>	Riverine evergreen forests, disturbed secondary forests
Felidae	Fishing Cat – <i>Prionailurus viverrinus</i>	Riverbanks, Riverine evergreen forests, disturbed secondary forests
Sciuridae	Sundasciurus spp. and Callosciurus spp.	Riverine evergreen forests, disturbed secondary forests
Bovidae	Domestic/feral buffalo – <i>Bubalus bubalis</i>	Mudflats

Note: A villager of Don Moun (Lao) informed the presence of several mammals in surrounding forests, including threatened mammals such as the Pygmy Loris, Saola, Owston's Palm Civet, Giant Muntjac, Black-striped Weasel, Small-clawed otter and Marbled cat.

### 3.6. List of Butterflies Recorded

Family	Common & Scientific Name	Habitat
Papilionidae	Lime Butterfly – <i>Papilio demoleus</i>	Home gardens, Mud flats
	Crimson Rose – <i>Pachliopta aristolochiae</i>	Home gardens, secondary forests, riverine evergreen forests
	Red Helen – <i>Papilio helenus</i>	Home gardens, secondary forests, riverine evergreen forests
	- <i>Papilio noblei</i>	secondary forests, riverine evergreen forests
	Common mormon – <i>Papilio polytes</i>	Home gardens, shrublands
	- <i>Graphium antiphates</i>	Shrubland, degraded forest
Danaidae	Plain Tiger – <i>Danaus chrysippus</i>	Home gardens, shrublands
	Common Tiger – <i>Danaus genutia</i>	Home gardens, shrublands
	Glassy Tiger – <i>Parantica aglea</i>	Home gardens, shrublands
	Blue Glassy Tiger – <i>Ideopsis similis</i>	Home gardens, shrublands
	Common Crow – <i>Euploea core</i>	Home gardens, shrublands, mudflats
Pieridae	Several species	Riverbank shrubland
	<i>Artogeia canidia</i>	Shrubland, degraded forest
Lycaenidae	Several species	Riverbank shrubland
Nymphalidae	Several species	Riverbank shrubland

### 3.7. Fish Species Lists (from discussions with fishers)

Species	Local name	Interview, Chiang Dao Village, 24 February <sup>1</sup>	Interview, Ban Don Moon, 25 February	Sampling fish catches + market, Huay Xay, 27-28 February	Photos of fishes from Mekong upstream Chiang Khong <sup>2</sup>	Observed at market in Chiang Khong	Sample from seine net fishery upstream of Muang Mom	Sampling from Larvae net	Comments
<i>Dasyatis Laoensis</i>	Pa fa lai					X			
<i>Acheilognatus barbatulus</i>	Pa satay	X	X						
<i>Acheilognatus deignani</i>	Pa bik leang		X						
<i>Abbottina rivularis</i>	Pa man	X	X						
<i>Acrossocheilus xamensis</i>	Pa chat	X	X						
<i>Albulichthys albuloides</i>	Pa khieng		X	X	X		X		
<i>Amblyrhynchichthys truncatus</i>	Pa sabak		X						
<i>Bangana lippus</i>	Pa wa	X	X						
<i>Barbonymus gonionotus</i>	Pa sapak	X	X						Common
<i>Barbonymus altus</i>	Pa vie	X		X					
<i>Chela laubuca</i>	Pa siu	X							
<i>Cirrhinus molitorella</i>	Pa kieng	X	X	X	X				
<i>Cosmochilus harmandi</i>	Pa satay	X							
<i>Cyprinus carpio</i>	Pa nai	X	X						
<i>Cyclocheilichthys repasson</i>	Pa satay	X	X						
<i>Dangila (Labiobarbus) siamensis</i>	?				X				
<i>Danio chrysotaeniatus</i>	Pa siu		X						
<i>Danio fangfangae</i>	Pa siu tong		X						
<i>Garra caudifasciata</i>	?				X				
<i>Garra cambodgensis</i>	Pa man	X	X					X	
<i>Garra cyclostomata</i>	Pa them hin	X	X						
<i>Hampala macrolepidota</i>	Pa sik	X	X						
<i>Hampala dispar</i>	Pa khoun		X						
<i>Hemibarbus labeo</i>	Pa siKai		X						
<i>Henicorhynchus</i> sp.	Pa soi			X	X		X		Possibly 2 spp.
<i>Hypsibarbus pierrei</i>	Pa deng		X						
<i>Morulius chrysophekadion</i>	Pa wa khan	X		X	X				
<i>Lobocheilus</i> sp.	?				X				
<i>Luciocyprinus striolatus</i>	Pa kim	X							Nam Pa
<i>Macrochirichthys macrochirus</i>	Pa pep	X	X		X				
<i>Mystacoleucus greenwayi</i>	Pa nam ya	X	X		X				
<i>Neolissochilus stracheyi</i>	Pa deng	X							
<i>Opsarius pulchellus</i>	Pa kham	X						X	
<i>Paralaubuca typus</i>	Pe tep			X	X				
<i>Parachela williaminae</i>	Pa siu pep	X							
<i>Porppuntius</i> sp.	?				X				
<i>Puntioplites falcifer</i>	Pa wi	X		X	X		X		
<i>Puntius brevis</i>	Pa pok	X			X				

Species	Local name	Interview, Chiang Dao Village, 24 February <sup>1</sup>	Interview, Ban Don Moon, 25 February	Sampling fish catches + market, Huay Xay, 27-28 February	Photos of fishes from Mekong upstream Chiang Khong <sup>2</sup>	Observed at market in Chiang Khong	Sample from seine net fishery upstream of Muang Mom	Sampling from Larvae net	Comments
<i>Raiamus guttatus</i>	Pa ma hao	X	X						
<i>Scaphiodonichthys acanthopterus</i>	Pa kep		X						
<i>Scaphognatops theunensis</i>	Pa pak piik leung	X							
<i>Sikukia stejneri</i>	?				X				
<i>Tor laterivittatus (sinensis)</i>	Pa deng, pa hien	X	X		X				
<i>Tor tambroides</i>	Pa kha	X			X				
<i>Botia beauforti</i>	Pa chichang	X			X				
<i>Botia helodes</i>	Pa chiang		X		X				
<i>Acanthopsoides gracilentus</i>	Pa khun lun	X	X						
<i>Acanthopsoides delphax</i>	Pa khim	X							
<i>Lepidocephalichthys berdmorei</i>	Pa Khun lun	X							
<i>Lepidocephalichthys hasselti</i>	Pa khun lun	X							
<i>Botia nigrolineata</i>	Pa khi lai	X							
<i>Misgurnus anguillicaudatus</i>	Pa lang ou, pa ngu kieu	X	X						
<i>Schistura sp</i>	Pa pan	X	X						
<i>Sewellia sp.</i>	Pa pong	X							ID from Sekong
<i>Hemibagrus wyckii</i>	Pa kot	X	X	X	X				
<i>Hemibagrus filamentus</i>	Pa kot mun	X		X	X				
<i>Hemibagrus wyckiioides</i>	Pa kot deng	X	X	X					
<i>Belodontichthys truncatus</i>	Pa khao	X	X						
<i>Ceratoglanis pachynema</i>	Pa hu khong	X	X		X				
<i>Micronema apogon</i>	Pa dap	X							
<i>Pangasianodon gigas</i>	Pa beuk								not seen for 3 years
<i>Pangasius sanitwongsei</i>	Pa leum	X							
<i>Pangasius sp.</i>	Pa humud	X			X				
<i>Laides longibarbus</i>	Pa ngone			X	X				
<i>Wallago attu</i>	Pa khao	X							
<i>Wallago lehri</i>	Pa khao dam	X							
<i>Helicophagus leptorhynchus</i>	Pa chalang	X							
<i>Bagarius yarreli</i>	Pa khae leung	X	X	X					
<i>Clarias fuscus</i>	Pa duk	X	X						
<i>Notopterus notopterus</i>	?				X				
<i>Chitala ornata</i>	?				X				
<i>Sundasalanx mekongensis</i>	?							X	in Muang Mom
<i>Xenentodon canciloides</i>	Pa sob nok		X						

Species	Local name	Interview, Chiang Dao Village, 24 February <sup>1</sup>	Interview, Ban Don Moon, 25 February	Sampling fish catches + market, Huay Xay, 27-28 February	Photos of fishes from Mekong upstream Chiang Khong <sup>2</sup>	Observed at market in Chiang Khong	Sample from seine net fishery upstream of Muang Mom	Sampling from Larvae net	Comments
<i>Dermogenys siamensis</i>	Pa ike	X							
<i>Monopterus albus</i>	Pa yen	X	X						Rice fields
<i>Mastacembelus armatus</i>	Pa lang ou	X							
<i>Macrogathus</i> sp.	Pa lad hua		X						
<i>Badis ruber</i>	Pa sidet	X							
<i>Parambassis wolffii</i>	?				X				
<i>Oxyeleotris marmorata</i>	Pa buu			X	X				
<i>Oreochromis niloticus</i>	Pa sam deng	X							Ponds
<i>Anabas testudineus</i>	Pa sadet	X	X						
<i>Glossogobius aureus</i>	Pa tep	X							
<i>Trichogaster trichopterus</i>	Pa tep	X	X						
<i>Channa gachua</i>	Pa khang	X							
<i>Monotrete turgidis</i>	Pa pong, pa phao	X	X						

<sup>1</sup> Interviewed at camp near Hung Chong Pool, downstream from Vangvit Rapids

<sup>2</sup>Oot's photos of fishes from upstream Chiang Khong: Dec 2002 - Feb 2003

## APPENDIX 4: FISHERIES INTERVIEWS

Interview 1 Participants: Mr Sam Joi, Age 44, Mr Mai Norn, Age 40, Ms Gong, Age 35  
Ms Yort, Age 40 (all from Chiang Dao Village)

Date: 25 February 2003 Location: Below Wong Wit Rapid near Chiang Dao Village

The group consisted of 5 families, mainly panning for gold but also fishing. The group seemed totally dependent on hunting and fishing for food, catching fish in both the Mekong River and associated tributaries and hunting in the surrounding area for pig, deer, fowl, squirrel, frogs, and turtles.

Fishing gears included long lines with hooks, cast nets, and gills nets. The best fishing season is October and November. They reported that fishing is more difficult now than in the past due to daily fluctuations in the water level of the river (day time = high water level, night time = low water level). They reported catching 1-2 large catfish (*P. sanitwongse*) per year.

Interview 2 Participants: Mr Tam Chiangsawan, Age 49, Ms Phan, Age 38

Date: 25 February 2003 Location: Muang Mom

Fishing activity occurs in both the Mekong River and the associated wetlands. In general, people do not fish in deep water. Along the riverbanks, people fish using hooks, floating gill nets, and cast nets. Some catfish species migrate during May, June, and July but the exact nature of these migrations (species? for spawning?) is not clear.

Interview 3 Participants: 4-5 fishers (mixed Thai-Lao)

Date: 26 February 2003 Location: Approximately 15 km upstream of Xuay Xai

April, May, and June are the best months for fishing. Fishers look for fish at the mouths of the tributaries (although they were fishing in the main river when I saw them). The fishers reported *Mystus* spp. in spawning condition. The main catch during April, May, and June includes several species of migratory catfish and cyprinids.

Interview 4 Participants: Mr and Mrs Boonrian (ex-chair of the Giant Catfish Fishermen's Club)

Date: 27 February 2003 Location: Ban Hat Khrai (near Chiang Khong)

Fishing for giant catfish begins about May 1. Both Thai and Lao fishers will fish for the Giant Catfish (both at the same location) but the number of fishers participating this year will probably be fewer than in the past due to declining catches. The fishing site may also change this year because of the construction of an embankment near the old fishing site.

For the past 7-8 years the water levels have been very low, making fishing for Giant Catfish difficult. Over the last few years, water levels have been rising and falling quickly - this also makes fishing difficult.

Historically, there have been three locations (near Chiang Khong) for catching Giant Catfish: downstream of Chiang Khong where the Mekong River re-enters Laos (only a few fish), upstream of Chiang Khong at the mouth of the Kok River, and at Ban Hat Khrai (just downstream of Chiang Khong). Fishers reported that the fish caught at the mouth of the Kok River had no eggs (whereas the fish at Chiang Khong always have eggs), so Boonrian suspects that the fish spawn between Chiang Khong and Chiang Saen.

Boonrian believes that two types of habitats are important spawning sites for giant catfish: 1) rapids/pool areas and 2) at the mouths of rivers (i.e. the Ing River and the Kok River). These areas are deep-water sites. Fishers saw Giant Catfish spawning at the mouth of the Kok River.

Populations of Giant Catfish and *P. sanitwongsei* (another species of giant catfish) are declining. In the case of *P. gigas* (Giant Catfish), the catch has been declining for the past 10 years and no fish have been caught since 2000. In the case of *P. sanitwongsei*, the catch has been declining at a similar rate (though this species is definitely still more common than the Giant Catfish). Fifteen years ago, 100 *P. sanitwongsei* were caught per year with an average weight of 60-80 kg. Five years ago, about 5-20 fish were caught per year (some of the fish came by boat from fishers in Luang Prabang). Recently, the catch has declined further and the fish has disappeared.

Boonrian believes that fishers catch only 10% of the fish that pass Chiang Khong. The smallest catfish captured ever weighed about 100 kg. This indicates that the fish in Chiang Khong are likely adult fish undergoing a spawning migration.

Boonrian says that catfish catch numbers have declined for two reasons. First, numbers have declined because the population of wild fish has declined. The fish population is declining due to changes in water quality (increased turbidity, pollution), big ships, riverbank development, and port construction. Second, the catch has decreased because the number of fishers has decreased.

Boonrian believes that the area of rapids blasting is important spawning habitat for nearly all fish found in the Chiang Khong area.

#### Interview 5 Participant: Uncle Sao, Age 74

Date: 27 February 2003

Location: Approximately 15 km upstream of Xuay Xai

Uncle Sao has been a fisher for 54 years. He used to catch large catfish (*P. sanitwongsei*) on big hooks. He also used to catch stingrays. Both of these species have now disappeared from his catch. He claimed to have seen a Giant Catfish at Hat Luang about 30 years ago.

He uses gill nets to fish. Fishing is difficult now.



## Mekong Wetlands Biodiversity and Sustainable Use Programme (MWBP)

The Mekong Wetlands Biodiversity Conservation and Sustainable Use Programme (MWBP) is a joint programme of the four riparian governments of the Lower Mekong Basin – Cambodia, Lao PDR, Thailand and Viet Nam – managed by the United Nations Development Programme (UNDP), The World Conservation Union (IUCN) and the Mekong River Commission (MRC), in collaboration with other key stakeholders. MWBP is a five-year programme that aims to strengthen the capacity of organisations and people to develop sustainable livelihoods and manage wetland biodiversity resources wisely. [www.mekongwetlands.org](http://www.mekongwetlands.org)

## The World Conservation Union (IUCN)

IUCN - The World Conservation Union brings together States, government agencies, and a diverse range of non-governmental organizations in a unique partnership. As a Union of members, The World Conservation Union seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. [www.iucn.org](http://www.iucn.org)

## IUCN Water & Nature Initiative (WANI)

The Water & Nature Initiative is a 5-year action programme to demonstrate that ecosystem-based management and stakeholder participation will help to solve the water dilemma of today - bringing rivers back to life and maintaining the resource base for many. [www.waterandnature.org](http://www.waterandnature.org)