Learning about Fish in the Mun River Basin

Yuka Kiguch
Mekong Watch

Learning about Fish in the Mun River Basin

September 2020

There are various different kinds of fish.

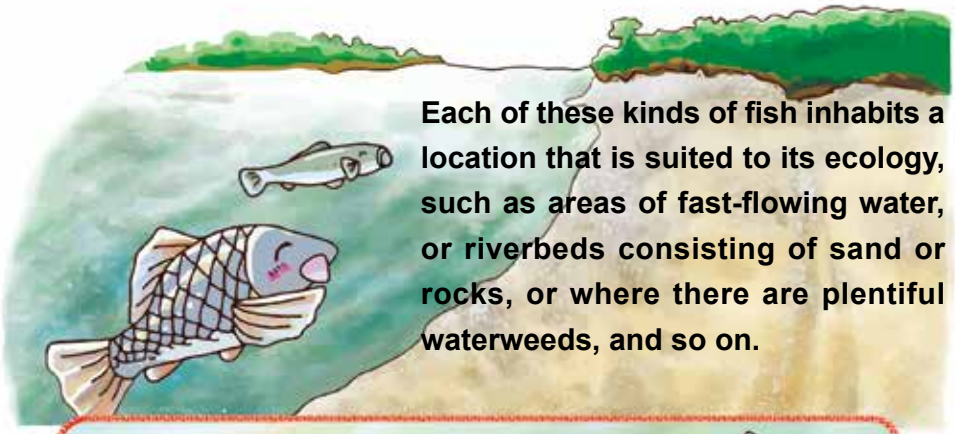
When the flow of the river is blocked, fish cannot migrate.

Published by Mekong Watch
1-12-11 Aoki Building, Taito, Taito-ku Tokyo, Japan
Tel: +81-3 3832 5034 Fax: +81-3 3832 5039
Website: http://www.mekongwatch.org/index.html
Email: info@mekongwatch.org
Supported by the Japan Trust for Global Environment

Japanese and Thai versions written by Yuka Kiguchi
English Translation from Japanese version by Rena Sugita
English editing by Tony Boys
Cover Design: Sawitchaya Chinphongsaton
Illustration: Kito Tokiwa
Layout: Yuka Kiguchi

It is also possible that riverbank revetments have a negative impact on fish living in the river.

When the water is still or stagnant, the water quality will deteriorate.



Each of these kinds of fish inhabits a location that is suited to its ecology, such as areas of fast-flowing water, or riverbeds consisting of sand or rocks, or where there are plentiful waterweeds, and so on.

We would like everyone to think about what they can do to make rivers comfortable for fish to live in.

Foreword

The village chief came to tell us that his village is going fishing in the swamp tomorrow. People in his village had protected the swamp by imposing a ban on fishing. He asked if we would like to catch fish there with them. “Wouldn’t the villagers be upset?” asked my uncle. The village chief said that the villagers are welcoming us coming from so far away. Uncle Khem replied, "Then I would like to thank you. The people in this village are really kind. We will never forget this. (From the chapter "Making Padaek (fermented fish sauce”) in the novel A Child of the Northeast; translation from Thai by Mekong Watch).

A Child of the Northeast is a famous novel written 40 years ago by Khampun Bunthawee. The family in the novel goes fishing on the Chi River and arrives at a village. The villagers are sympathetic to the fact that the family have made a long journey and invite the family to join them in fishing in a swamp managed by the village. This kind of sharing is still a commonly practiced form of mutual assistance in the villages in Northeast Thailand to this day.

People living along rivers live closely with nature, and fish support their daily diet. In the past, the livelihoods of people in these areas centered around rivers, lakes and marshes, and people were knowledgeable about the fish and natural environment. However, while the natural environment is deteriorating and new technologies are being introduced, it has become possible to cultivate fish at low cost, causing people to lose interest in the natural riparian environment.

How can we recover the nature that supports our lives? In the past, we only had to consider how to share the space and opportunities among people, as described in the scene from A Child of the Northeast. Today, however, we must also consider sharing the environment with fish. We would like to ask the reader to think about how fish and people can share their environment. We should always keep in mind that fish can live (comfortably) without people, but it would be difficult for people to live without fish.

If you protect the ecosystems of native fish in your village, you are helping to protect the environment of our planet. Furthermore, the conservation of fish is not only for the protection of fish, but is also for the benefit of people because it would allow us to continue to eat fish in a sustainable manner.

For several years, Mekong Watch, the Association of Esaan Fresh Water Fishery Community (Sisaket) and villagers have studied how and where fish breed in the Mun River Basin. We did not conduct a scientific survey of natural environments, but rather, we made visits to the Mun, Chi, and Sebai Rivers to document the local communities' knowledge concerning fish. Our field study found that although elderly people have a wealth of knowledge, many of them leave their villages for work, and the knowledge is not being passed on to the next generation. Children, in particular, rarely have the opportunity to eat native fish and do not know about the fish that live in their surroundings. If nothing is done, the valuable knowledge of the older generation could be

lost. Moreover, while much research has been done on fish migration, there is little information on fish reproduction. As a result, when ecosystems and natural fish are impacted by economic development, we have not been able to find effective ways to resolve or mitigate the impacts.

This booklet presents information from the Thai community as well as information about freshwater fish in Japan, because both countries are affected by the monsoon and have similar spawning conditions for freshwater fish, even though Thailand is in the tropics and Japan is in the temperate zone. We also included information about the Mekong River. We hope that you will use this booklet as a reference for fish conservation efforts in your community, and that the authors' intentions will be faithfully conveyed to the people of Thailand.

Yuka Kiguchi, Mekong Watch

Contents

1. Introduction: Mekong River and Mun River Basin

The Mun River flows through northeastern Thailand from west to east and is one of the main tributaries of the Mekong River. Rising in the mountainous region of Nakhorn Ratchasima Province, the Mun River passes through Buriram, Surin, Roi-ed, and Sisaket Provinces to flow into the mainstream Mekong in Ubon Ratchathani Province. Important tributaries of the Mun River include the Pra Proeng, Praymart, Chi, Lamdorm Yay, Lamdorm Noy, Sebai, and Sebok Rivers. Together with its tributaries, the Mun River basin encompasses 69,700 ㎢ over ten prefectures in northeastern Thailand. The Mun River appears in songs, movies, and novels, and is well known to everyone in northeastern Thailand.

The Mekong and Mun River Basins

The Mun River basin is the habitat of an abundance of fish. It is thought that at least 1,100 fish species inhabit the Mekong River basin, and of these 270 species have been confirmed in the Mun River basin. Many Mekong River basin fish species migrate long distances in the rivers. In the past, large numbers of fish also migrated up the Mun River, but the situation has changed significantly today due to economic development.

The Mun River basin is not only important for the lives of the people in northeastern Thailand, but also forms a critical part of the Mekong River ecosystem. Based on existing literature and our own survey findings, this booklet discusses the features of the environment and fish in the Mun River basin.

2. The Mun River

2.1 Upper basin

The Mun River originates in the mountainous region of Nakhorn Ratchasima Province, and gradually widens as it meets its tributaries flowing in from Buriram and Maha Sarakham Provinces.

2.2 Middle basin

The Mun River meanders through the flatlands of Surin, Buriram, and Sisaket Provinces. Many swamps and lakes, remnants of former river channels, exist in this area. The Mun River and its tributary, the Chi River, meander gracefully to Muang District in Ubon Ratchathani Province, leading to a vast wetland.

The Mun River and Chi River

Due to the tropical monsoon, northeastern Thailand experiences distinct dry and rainy seasons. Rainfall is concentrated between May and September. In the middle Mun River basin, there are extensive areas of flooded forests that become inundated in the rainy season, as well as marshes, oxbow lakes, and remnants of former river channels, which connect with the river as the water level rises in the rainy season. In Rasi Salai District in Sisaket Province, Ratanaburi District in Surin Province and Phonsay District in Roi-ed Province, forests and fields that become inundated in the rainy season are known locally as *Tharm*, which form the spawning grounds for many fish. Local people depend on the natural environment of *Tharm* for their livelihoods.

Including those migrating from the Mekong River, 270 fish species have been confirmed in the Mun River basin. It is said that, until the 1980s, there were so many fish swimming up from the Mekong River at the beginning of the rainy season, when many fish migrate, that the river turned black.

Characteristic topography of the middle Mun River basin

Kut (also known as Long)

This refers to locations in the former mainstream of a river that become isolated when the river changes its course. They are curved in shape and are known as oxbow lakes. There are two types of *Kut*. In one type, water is present all year round and the *Kut* is connected to the new river channel in the rainy season. In the other type, the *Kut* dries out in the dry season and only accumulates water in the rainy season.

Hong

A small water channel that flows through a flooded forest into a *Kut* or river. Some of these are water sources for *Kut, Nong* or rivers.

Nong

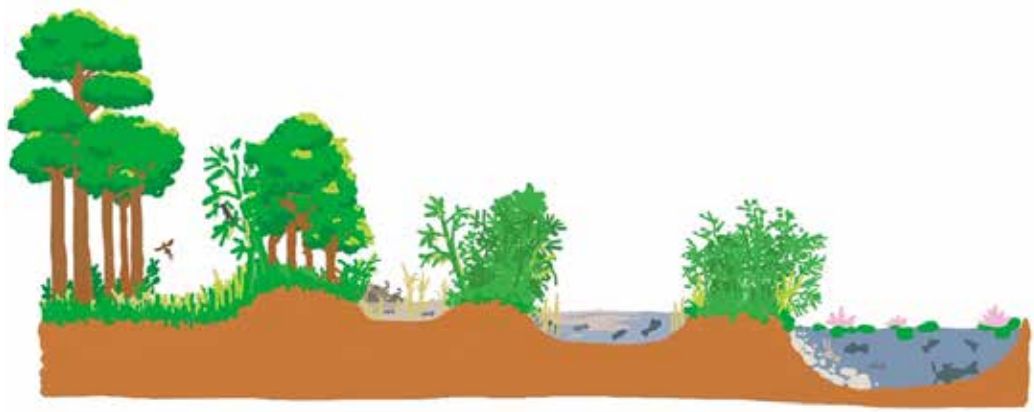
Small areas of low-lying land where water accumulates.

Loeng

Flat and shallow water channels that flow into a *Kut* and the river mainstream.

Wang

Locations in Mun River bends that are broader and deeper than other curved locations.



Topography of the middle Mun River basin

2.3 Lower region

In the lower Mun River, there are successive rapids and deep pools which extend for approximately 30km before meeting the Mekong River. The rapids have rocky riverbeds and are locally known as *Kaeng*. The bottom of deep pools, called *Wang*, often consist of sand or mud, but some are rocky. Local fisherfolk recognize different forms of riverbed topography, using a detailed classification of their characteristics. For example, shallow rapids with a flat riverbed where the flow is relatively slow are called Khan, and deep pools where water flows like a whirlpool are called *Woen*. A survey in which villagers themselves compiled their knowledge revealed more than 20 classifications for the river's topographical features.

Pak Mun (Mouth of the Mun River)

Tana Rapids

Column: Plants in *Tharm*

A variety of plants can be found in *Tharm*. Many of them can survive submergence in water for several months a year. For example, a type of shrub known as Ben becomes a home for fish when submerged. *Phu Hang Kar* is a grass that grows at the water's edge. Certain kinds of fish eat the fruit of the *Dua* tree, a relative of the fig tree.

3. Fish in the Mun River basin

3.1 People's classification of fish

People in the Mun River basin categorize fish according to whether or not they have scales. Fish with scales are collectively called "white fish," most of them being of the Cyprinidae family. Fish without scales are often catfish-like species. They are tasty and easy to eat, since they generally have fewer bones, and therefore fetch a higher price in the market. Small fish with scales are also fully utilized by making them into fermented food, known locally as *Padaek*.

There are various types of fish, such as those that prefer rocky locations, those that stay in deep pools, and those that prefer sandy beaches. The variety of the environment of the Mun River basin includes habitats for 270 fish species. Thus, the Mun River supports world-class fish diversity.

3.2 Fish in the Mun River basin

During our survey in the Mun River, we found 62 species of fish with scales and 26 species without scales. Below are a few examples of the sampled fish.

● Pa Hak Kluay (Banana root fish)

Fish locally known as Pa Hak Kluay, or loach, prefer sandy beaches. Where the river meanders, sandy beaches are often created inside the curves. Pa Hak Kluay are often seen on such beaches. This fish is commonly sold in the market, as it can be dried and preserved, and is also delicious when fried.

● **Pa Noo**

Pa Noo, a scaleless fish, feeds on shellfish in the river. As they eat whole shellfish, a large number of shells remain in their stomachs, as seen in the photo. Reduction in the numbers of shellfish will affect the population of Pa Noo.

Many shells, as well as eggs, were found inside the Pa Noo's stomach. (Photo taken in May)
Shells found inside the Pa Noo's stomach. Many of them are bivalves.

Column: What are floodplains?

A floodplain refers to a place near a river where there is no water during the dry season, but which becomes a wetland when the river water overflows during the rainy season. There are many floodplains in the middle Mun River basin, the Chi River basin, and along the Mun River tributaries such as the Sebok and Sebai Rivers. These are the environments known in Northeast Thailand as *Tharm*. In Asia, which is affected by the monsoon, many kinds of fish spawn on floodplains.

3.3 Fish that have disappeared from the middle basin of the Mun River

Construction of concrete agricultural weirs began on the Mun River around the mid-1970s. In the 1990s, the construction of the Pak Mun Dam, built about 5km from the mouth of the river, and the Rasi Salai Dam in the middle basin, resulted in dramatic changes in the river's environment.

Pa Saway: This fish almost completely disappeared after the construction of the dams. (Photo taken in Pak Mun area)

Pa Phot or Pa Yaang: This fish was no longer found after the construction of the Rasi Salai Dam. (Photo taken in Pak Mun area)

Pa Room: As this fish used to migrate from the Mekong River, they have also disappeared.
(Photo taken in Pak Mun area)

Pa Khaman or Pa Khaoman: This fish is no longer seen since the construction of the Rasi Salai Dam.

Pa Pung: Far fewer numbers of this fish are seen than before.

Long-bearded Pa Khajeng: Numbers of this fish are beginning to decline. Their numbers grow if there is flowing water.

Pa Ki-hiya: In the past, there were so many of this fish in the river that they used to jump into the boats. Now, however, there are very few of them. The reason for the decline is unknown, but the fish prefer places with flowing water.

Pa Khao: This fish used to move from *Hong* to *Kut* (oxbow lakes) during the rainy season, but now there are very few of them. Their numbers declined after the construction of the Rasi Salai Dam.

Pa Khea: Numbers of this fish have declined. The reason for the decline is unknown, but the fish prefers places with flowing water. （Photo taken in Laos）

New fish that appeared after the dams were built:
Pa Dyado, Pa Meo, Pa Shoka (Pa Dutofun), Pa Shon (similar to snakehead)
Numbers of Pa Chadhoo have increased more than other fish since the Rasi Salai Dam was built. However, as these fish are carnivorous, it is felt that the balance of the ecosystem has been disrupted

Pa Dyado

Pa Shoka

Column: Ayumodoki in the face of extinction

Ayumodoki or Kissing Loach (Parabotia curtus) is found in Japan and is a member of the Pa Moo Lay (Syncrossus helodes) and Pa Kiew Kai (Yasuhikotakia eos) families that inhabit Northeast Thailand. Ayumodoki migrates between a main river and a floodplain, because in the rainy season it spawns in the temporary waters that are formed on the floodplain. Ayumodoki lay their eggs among submerged grass in the temporary waters. Fry that grow successfully are those that were hatched in an environment where such a condition lasts for a long time.

An area that is dry ground during the dry season and submerges under water in the rainy season is referred to as temporary waters. These areas are usually located around rivers or in wetlands that surround rivers and their former courses, including paddy fields. Ayumodoki use temporary waters.

Ayumodoki is now in danger of extinction in Japan. They are no longer able to migrate freely between rivers, irrigation canals, and paddy fields due to river development for flood control purposes and field development projects, which are undertaken to increase the scale of paddy fields to facilitate the use of machines. As rivers are now carefully managed, water levels no longer rise suddenly. Even if there is a sudden increase in water, it is immediately returned to the usual water level. Ayumodoki are thought to have lost their spawning grounds due to these human activities. Today, the number of Ayumodoki has fallen to the point that the Japanese Ministry of the Environment has designated the Ayumodoki an endangered species.

Photo: Akihisa Iwata

● Fish that have disappeared in the Chi River

According to interviews with local fisherfolk, some fish, such as Pa Sua Tor, Pa Khuun and Pa Ka-hor (also known as Pa Kaman on the Mun River), have disappeared since the early 1990s, when the construction of large weirs began on the Chi River. Although Pa Khi-hiya and Pa Khae are not seen very often, as in the case of the Mun River, local fisherfolk do not feel that other kinds of scaleless fish have diminished. However, changes have been brought about by the construction of weirs. Scaleless fish, such as Pa Moo, Pa Nang, Pa Kot, Pa Khayeng and Pa Noo, and scaly fish, such as Pa Soy, Pa Tapian, Pa Kaeng, Pa Kum, Pa Khuylam, Pa I-thai and Pa Peap, now hold eggs whenever there is a water level fluctuation. Pa Pung and Pa Khao hold eggs later in the year.

4. Spawning of fish

In both the Mekong and Mun River basins, fish spawning behavior is not easily visible because spawning often takes place in the rainy season when the water is cloudy. However, people who live around the Mun River and its tributaries know from experience that schools of fish of same kind gather in inundated *Tharm* during the period when the fish are carrying eggs, and the sound of fish leaping in the water can be heard. Such activities are considered by Japanese researchers to be the spawning behavior of fish.

From our survey, we were able to obtain information on the spawning of several types of fish. Below are some of their unique features.

The behavior known as *Pa Oh*

A period when the river water level rises due to rainfall in June and July and the *Tharm* forest is inundated is known locally as N*am Lark*. During this period, fish known as Pa Soy, Pa Itai, and Pa Khuylam (small fish of the Cyprinidae family) gather in shallow water (about 15cm deep) in inundated grassland in the Tharm forest. Moreover, when the water level rises in the rainy season, natural waterways called *Hong* are created in *Tharm*, connecting the mainstream Mun River and *Kut*. When the water level rises, Pa Kot and Pa Khajeng (a catfish-like species) start to gather in *Hong*. This behavior is also called *Pa Oh*. *Pa* means fish and *Oh* is a local word for “gathering together to form a group.” During this period, it is said that the fish do not swim away even when they are approached by people.

Nest-building Clown Knifefish

The carnivorous clown knifefish is known to build nests and guard its fry. When a fishing net gets caught in an underwater tree during fishing, fisherfolk dive into the water to retrieve the net. At that time, they might see a clown knifefish making a round pit by submerged fallen logs. There are eggs and small fish in the pit. When approached by people, clown knifefish try to threaten them, apparently to protect its fry. It is uncertain whether it is the male or the female that guards the eggs. Fisherfolk have different opinions about whether the eggs are guarded by one or two fish.

● Fish in the Chi River

The Chi River basin, like the middle Mun River basin, is a flood-prone terrain, the river meandering across the plain, with old and new river channels intertwining. There are many flood plains, and the types of fish that are no longer commonly seen in the Mun River are known to spawn in the area. During the flood, we encountered people on a bridge who were catching small fish that were being washed away. We confirmed about 20 species of fish, including young fish that seem to have been hatched in the area.

5. Causes for the decline of fish

5.1 Fish are unable to migrate

Naturally, if people catch a lot of fish from the river, fish resources will diminish, but that is not the only reason for fish decline.

On the Mun River, the Rasi Salai Dam was constructed in the middle basin in 1993, the Pak Mun Dam was constructed at the confluence of the Mun and Mekong Rivers in 1994, and the Hua Na Dam was constructed between the two dams in 2014.

Rasisalay dam, Hua Na Dam, Pak Mun Dam

Pak Mun Dam is the furthest downstream of the three dams, being located 5.5km upstream from the confluence with the Mekong River. During the period when the water gate is closed for power generation, fish are not able to migrate between the Mekong and the Mun Rivers. The Pak Mun Dam water gate is opened for several months a year, but is closed to store water in the dry season (roughly November to May). Fish migration upstream in the Mun River begins from February and continues to August. Thus, fish migration from the Mekong River to the Mun River is no longer seen from February onwards, since the water gate is closed. Furthermore, the Pak Mun Dam's water gate is often not opened until or after August every year, making it difficult for fish to swim upstream at the start of the rainy season.

Since the gates of the three dams are not opened or closed at the same time, it is almost impossible for fish to reach the middle Mun River basin, which was once a suitable spawning ground for fish.

Fish migrate to places that are advantageous for spawning or growth. As a result of blocking fish migration, fish numbers are diminishing in the middle region of the Mun River, especially catfish-like species migrating from the Mekong River.

5.2 Irrigation also has an impact on fish

In the past, rice farming was conducted once a year in the rainy season in the Mun River basin. However, rice cultivation using irrigation during the dry season is becoming more common in recent years. In order to irrigate farmland efficiently, it is necessary to dam water channels, and thus many weirs are being built.

While weirs are necessary for agriculture, they obstruct the movement of fish. The same is true for the sluices that are built on small tributaries that flow into the mainstream Mun River. Moreover, since raised roads are built on wetlands that submerge during the rainy season, this causes the water to flow as it would over a weir, hindering the movement of fish. In addition, the river will dry up if too much water is used in the dry season, making it impossible for fish to live.

Habitats are also lost when riverbank vegetation is eliminated due to revetment work, or when riverbanks are covered with concrete and rocks. Structures that are intended for human convenience are causing the depletion of habitats for fish and other organisms, especially hideouts for small fish that need to evade larger fish and places for fry to grow.

Furthermore, each year increasing volumes of sand are being dredged for building concrete structures. The collection of river sand not only alters the riverbed environment but can also cause riverbank erosion.

These changes in the river environment caused by economic development have decimated suitable environments for fish to spawn and fry to grow.

Viedo: Mekong River: Small fish gathering a few centimeters from the riverbank.
https://youtu.be/g--6ehBWKDk

5.3 Impact of climate change

The world's climate has changed significantly due to the emission of greenhouse gases, such as carbon dioxide, caused by human economic activities. The 2018 to 2019 drought caused fish habitats in the Mekong and Mun River basins to diminish. If water does not reach the flooded forest, fish will miss the opportunity to spawn. Spawning is also affected when the start of the rainy season is delayed. This may make it impossible for some fish to spawn. Moreover, the river water level dropped, making it easier to catch fish. As a result, even the fish that usually inhabit the bottom of deep pools were caught. Because this climate change occurred very suddenly, villages were not able to carry out their natural resource management efforts in a suitable way. Currently, there is concern that the number of fish that will lay eggs in the next rainy season has been severely reduced.

6. Important points for protecting the diverse fish population of the Mun River

There are various reasons for the decline in fish numbers. It is not only overfishing but also manmade changes in the river environment that are causing fish stock to decline. In order for villagers in the basin to be able to continue to eat fish, we believe that it is necessary to pay attention to the following points when developing the region. Furthermore, dialogue among stakeholders is also necessary in order to realize sustainable development. For reference, we have listed the important stakeholders for each item below.

6.1 See the mainstream and the tributaries as one environment

Fish in the lower Mekong basin migrate between the mainstream Mekong and its tributaries. Today, however, the dams have cut off the connection between the Mekong River and the Mun River. In addition, fish are not able to swim into *Kut* (oxbow lakes) and other areas from the tributaries due to the existence of weirs and sluices. In order to maintain the river ecosystem in a good condition, it is crucial to keep the water flowing. Rain patterns have changed due to climate change caused by global warming. When new weirs and sluices are constructed in the future, we must consider not only their impact on living organisms, but also the fact that the climate is no longer what it used to be. In addition, regarding existing dams with large environmental impacts, and weirs where water level adjustment is difficult, their operation should be reconsidered and the possibility of their future decommissioning or removal should be examined. It is possible that restoring the river's natural flow will result in a reduction in damage caused by natural disasters and also have a positive impact on the local economy.

Important stakeholders:

Local communities living in the basin, researchers, Tambon administrative organizations, prefectures and Irrigation Departments.

(Tambon is the local government unit below the district. One Tambon consists of around 10 villages (Moo Ban).)

● Migration of Fish

Why do fish migrate? There is no clear answer, but it is thought that it is because migration is advantageous for breeding and growing. This signifies that over a long period, fish that have moved to spawning grounds where their fry can grow safely and to places with abundant food have adapted to the environment, enabling them to survive to this day.

Scrape marks left by fish

There are many places on the Mun River that are suitable for fish spawning and the growth of fry. Depending on the season, fish are also better able to feed in the Mun River than in the mainstream Mekong.

In the past, fish migration from the Mekong River to the Mun River began around February, and the first peak was in March/April. First, small fish in the Cyprinidae family and loach-like fish swam up the Mekong River, and some of them entered the Mun River. The next peak was at the beginning of the rainy season in May/June, when catfish-like species and other large carnivorous migratory fish moved up the river. Some of these fish laid eggs in the Mun River. Finally, in October, fish that had swum up and the young fish that hatched on the Mun River returned to the mainstream Mekong. Today, however, such migration is hardly ever seen.

Fish Ladder at the Pak Mun Dam

6.2 See the vegetation around the river as a part of the river

Organisms in the river eat waterweed, such as algae, and plants that are submerged during the rainy season. They also use the vegetation to hide from predators. If there is rich vegetation, there will be more aquatic insects for fish to eat. Fish also feed on insects that live in swamps, on riverside plants, fallen leaves and nuts. Riverbanks covered with trees will bring the river water temperature down. More scientific investigation is required to elucidate the natural relationships between fish and vegetation in the Mekong River basin. Both the wisdom of local residents and scientific findings need to be utilized in conservation activities.

Trees along riverbanks serve the very important functions of creating shade and keeping the river temperature low. Studies in North America have reported cases where salmon, which prefer cold water, declined in the river due to the disappearance of riparian forest. Moreover, fish feed on aquatic insects that eat fallen leaves and algae in the water. When trees are lost, the water temperature rises and the amount of fallen leaves decreases, but with more sunlight on the water there will be more aquatic algae. Insects that prefer fallen leaves are different from those that prefer algae. When trees disappear, therefore, the kinds of insects that live in the water will also change. Such changes are thought to have a great impact on fish that eat aquatic insects.

Until now, there has been no thorough investigation into the effects of the disappearance of riverside trees in the Mekong River basin. Detailed research is awaited in this area.

Important stakeholders: Local communities living in the basin, farmers who use the water, Tambon administrative organizations, prefectures, port authorities, and researchers.

● Changes in the Tributaries of the Mun River

The Sebai River, a tributary of the Mun River, is said to have been narrower and deeper, and to have had more forests along its banks in the past. In the last 20 years, not only the Sebai River but also other tributaries have, in general, increasingly lost the trees along their riverbanks due to agricultural land development and the construction of weirs. Moreover, concrete revetments are becoming more common, and riverbank trees are often cut to make way for revetment construction.

The Sebai River

The Sebok River (another tributary of the Mun River) 20 years ago

● Relationship between plants and fish

The water in the Mekong River basin is naturally cloudy. The level of clarity of the Mun River basin is also low. However, water clarity is higher in the dry season because there is no rain. Moreover, as the water level falls due to lack of rain, it becomes easier for light to penetrate down to the riverbed. Thus, large amounts of algae and waterweed grow in the Mun River during the dry season. Algae and waterweeds become food for fish and also serve as fish hideouts. Furthermore, with more plants, there will be more aquatic insects. Research has found that when river water flows, the sparkling effect of sunlight on the water accelerates the photosynthesis of plants below the water's surface.

In the middle Mun River basin and the Chi River, there are many oxbow lakes called *Kut* and marshes known as *Nong*. They are created as result of water remaining when there is a shift in the course of the river. Large amounts of waterweeds grow in *Kut* and *Nong*, where the water is shallow. This brings about an environment that is suited to the growth of fish.

Image of *Kut* in dry season (left), rainy season (right)

In this area, there are flooded forests called *Tharm*. *Tharm* trees remain above water during the dry season, but while they are inundated in the rainy season, they do not die. The leaves and fruits of *Tharm* plants can become food for fish. Furthermore, when *Tharm* are inundated in the rainy season, large amounts of plankton will grow temporarily, as in the case of paddy fields in Japan, also becoming food for fish. Flooded *Tharm* plants also serve as good hideouts for fish. There are many places for newly hatched fry to hide and evade bigger fish.

An area that is dry ground during the dry season and submerged in the rainy season is referred to as temporary waters. These areas are usually located around rivers or in wetlands surrounding rivers and their former courses, including paddy fields. Many fish species use temporary waters. When the ground submerges due to the rising water level, a large outbreak of

plankton occurs, this becoming food for small fish. Temporary waters are often shallow, allowing small fish to escape from large fish predators.

Tharm forest in the dry season

Tharm forest in the rainy season

6.3 Understand that artificial fluctuation of the water level can alter the river ecosystem

People build dams and weirs on rivers to manage water and to utilize the water for water supplies, agriculture, and power generation. However, dams and weirs cause artificial fluctuations of the water level that differ from natural fluctuations. On both the Mun and Mekong Rivers, many fish lay their eggs during the rainy season. It is thought that some fish can adapt and lay eggs even if the water level fluctuates many times a year, while some fish cannot. It is presumed that those fish that cannot adapt have become unable to lay eggs and therefore their numbers have declined.

Important stakeholders: Local communities living in the basin, farmers who use the water, Tambon administrative organizations, prefectures, port authorities, provincial Departments of Fisheries, the Electricity Generating Authority of Thailand (EGAT) and researchers.

● "Triggers" for fish migration and spawning

The fish species seen in the Mun River basin are almost the same as those in the Mekong River in Cambodia and Laos. According to the Mekong River Commission (MRC), a survey of the Mekong River basin found that fish migration is triggered by the following:

1) the first heavy rain in the rainy season
2) rapid water level rise in the rainy season
3) change in water color (turbidity)

These correlate with the findings of our interviews with residents of the Mun and Chi River basins. River water becomes cloudy when the water level suddenly rises at the beginning of the rainy season, when rainwater containing the red soil (laterite) of the area flows into the river.

People who catch fish on the Mun River and its tributaries refer to this period as the *Nam Daeng* (red water) season, which is said to be the season of fish migration. According to the residents of the lower Mun River basin, changes in temperature also affect fish migration, especially for those fish that descend down to the mainstream Mekong.

Fish appear to understand the seasonal changes from the rise of the water level at the beginning of the rainy season and from the rainwater flowing into the river. Water level fluctuations have a major impact on fish ecology.

6.4 Increase study on the ecology of fish

In the river, you may see very small transparent fish in shallow water less than 10cm deep. These may be the fry of large fish. Much is yet to be studied in the Mun River basin, including which fish lay their eggs where, where fish fry grow, and what kinds of environments fish inhabit during their lifetime. Although the Department of Fisheries uniformly prohibits fishing during the spawning season, local communities have little option but to catch fish to live. To allow fish to spawn, more basic data on fish behavior and habitats is needed in order to have discussions on what types of fishing gear should be allowed, and where fishing should be prohibited at any given time.

Important stakeholders: Local communities living in the basin, fishing people, Tambon administrative organizations, provincial Departments of Fisheries and universities in Northeastern Thailand.

● **What the fish are eating**

There are both herbivorous and carnivorous fish species. Moreover, some fish like to eat insects and worms, while others, like Pa Noo, eat only shellfish. Some fish change their diet depending on the season, but the details are unknown. A partial summary of villager knowledge is shown in the table below.

What fish feed on	**Type of fish that feed**
Plants (e.g. mosses and fallen leaves in water)	*Pa (Bak) Peap, Pa Chin, Pa Khae, Pa Khayeng, Pa Kum, Pa Park, Pa Soy, Pa Tapian*
Plants and insects	*Pa Kaeng, Pa Khaonom, Pa Khuylam, Pa Suut, Pa Ee-thai*
Water weed and shellfish	*Pa Hark Kluay*
Shrimps, fish, shellfish and plants	*Pa Buk, Pa Khao, Pa Khop Pa Nok Khao, Pa Suay*
Termites, nuts, small fish, worms and shellfish	*Pa Pung*
Shellfish, shrimp and small fish, etc.	*Pa Boo, Pa Nang, Pa Tong Kay*
Shellfish only	*Pa Noo*

Column: Difficulties of investigating fish in *Tharm*

In cooperation with Japanese students, we attempted to collect the fry of fish species that are thought to inhabit *Tharm*. We tried to collect fry at night using a light, and put nets around the plants in *Tharm*, but with little success. However, at around seven p.m. a fisherman collected the fry of Pa Yon (Pangasius macronema) using a net attached to the tip of his boat. In the end, we realized that that fry are indeed hiding in *Tharm*.

Small size of Pla Yon

Investigation at *Tharm*

6.5 Learn about local good practices

Currently, no-fishing zones, called *Wang Pla*, have been set up in many villages in the Mun River basin. Decreasing fishing pressure is necessary to avoid overfishing. In the villages along the Mun River, there are several *Wang Pla* protected areas. Locations that are designated *Wang Pla* are, for example, areas in front of temples and deep pools near spirit forests. Because villagers have always been careful not to violate religious sites, conservation activities in such areas often seem to be successful. Some villages prohibit fishing in *Kut* except for one time a year.

At this annual occasion, the villages collect fishing fees from fisherfolk and use the profit for public works in the villages. There is a need for a space to share these good practices and experiences among the local communities.

The one day a year when the fishing ban was lifted on a *Kut*

Conservation area nearby a spirit forest

The effect of a fishing ban starts to show after about two years, when the fish stock begins to increase. However, there is no scientific support for the local people's experience that setting up Wang Pla leads to increased fish stocks. It would be extremely useful if researchers and provincial Departments of Fisheries could collect quantitative data on a continuous basis, and also keep records of the species that have grown in number.

Important stakeholders: Local communities living in the basin, farmers who use the water, fishery groups, Tambon administrative organizations, provincial Departments of Fisheries, prefectures and researchers.

● Wang Pla in Nong-Ong Village

(Tambon Nong Sang, Kanthararom District, Sisaket Province)

In this village of about 100 households along the Mun River, almost all of the households engage in fishing. Since the dam was built nearby, the water has become deep and the river dangerous, so only the men go fishing. Since the villagers increasingly felt that there were fewer fish in the area after the dam was built, they decided to create a *Wang Pla* in front of the temple. A fish conservation committee was set up in the village, and villagers decided to make rules and impose fines on violators. The clear rules and the existence of the committee members have been made widely known among the villagers, and there have been no violators thus far. It is said that locating the Wang Pla in front of the temple also has a positive effect because the villagers are respectful to the monks.

To enable fish to spawn, the village chief would like to restore the nearby creek, which has been separated from the Mun River due to river development.

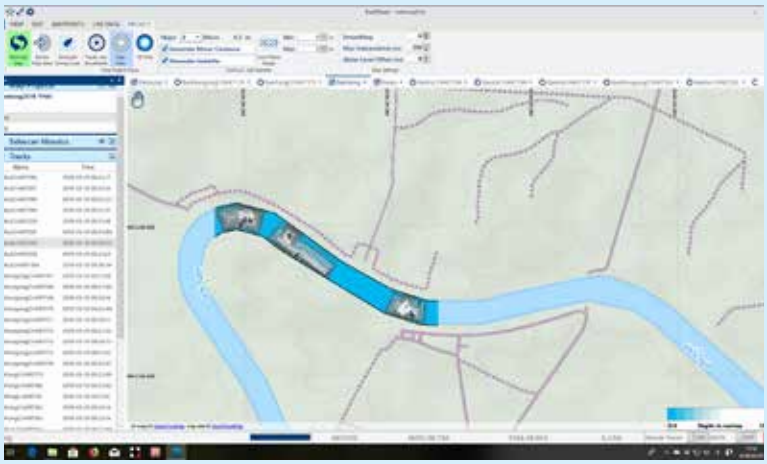
Viedo: Fish Conservation Area Nong-Ong

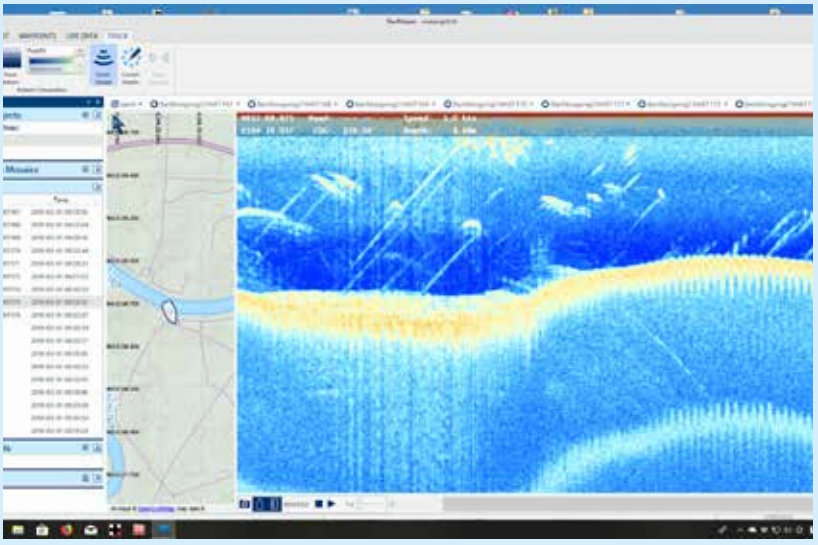
https://www.youtube.com/watch?v=rwqGYTSZJAc&t=2s

Column: Survey using a fish detector

We used a fish detector at the *Wang Pla* in Nong-Ong village and three other locations to try to see where the fish are. In Nong-Ong Village, we found fish near the surface of the water and at a depth of about five meters. At Kut Vienkham, the depth of the water was only about two meters and the waterweeds were too thick to confirm the presence of any fish. At *Wang Yai*, located in the Rasi Sarai Dam reservoir on the Mun River, small fish were gathering at a depth of about 2.5 meters and larger fish at a depth of about five meters. We found that fish were particularly abundant in the old river channel.

For villages that are planning to establish *Wang Pla*, it may be helpful to seek cooperation from researchers who have the equipment to find out where fish are congregating.





6.6 Tell children about fish

With economic development taking place in the villages, the villagers' diet has greatly changed. As river development has reduced the numbers of fish and aquatic organisms, fewer young people have had the experience of catching and collecting food from rivers. In particular, children no longer have the opportunity to eat local fish. As a result, fewer young people are interested in rivers or fish. In the past, there were also opportunities to learn about the local community in the "local time" class at schools, but the class has now been abolished. Schools and local governments need to work together to educate children about nature in their locality and the wisdom for utilizing nature. Effectiveness of the education can be enhanced with the help of local NGOs, citizen groups, and universities.

Important stakeholders: Local communities living in the basin, teachers in primary and junior high schools, village chiefs, fishery groups, Tambon administrative organizations, researchers and universities in Northeastern Thailand.

● Activities at Kharm Village Elementary School

In cooperation with Ecology, Agriculture and Arts Exhibition, a group involved in children's education in Northeast Thailand, we held a two-day workshop with primary school students to learn about local fish. Children learned the names of local fish through games, listened to talks by adults who fish, and made an environmental map of their village.

The following educational materials, published by Mekong Watch, can be used as a reference for local environmental education. Please click on the links to download the materials.

Peoples' Stories and Natural Resources Around Us (Thai)
http://www.mekongwatch.org/PDF/PeopleStory_Thai.pdf

NATURE TALES - A Handbook of Environmental Education through People's Stories (Thai)
http://www.mekongwatch.org/PDF/Handbook_Thai_PeopleStory.pdf

Ms. Bun Wangphu

Mr. Panya Khamlarp

Mr. Praphan Khanchuu

Ms. Wonpana Wongpinij

Acknowledgments

A great many people collaborated with the survey that formed the basis of this booklet. We would like to apologize for not being able to mention the names of each and every person who provided information, but would like to take this opportunity thank all of them for their valuable contributions. In addition, a large number of people, including members of the Chi River Protection Association and the Sebai River Protection Association, also cooperated in the survey. In particular, our knowledge during the survey was greatly enhanced by Mr. Praphan Khanchuu and Ms. Bun Wangphu. Mr. Panya Khamlarp supported this research as an advisor, and Ms. Wonpana Wongpinij as field researcher. Dr. Akihisa Iwata, formerly of Kyoto University, provided photographs and advised us on the content of the booklet. Part of the fieldwork was supported by Oxfam, the Critical Ecosystem Partnership Fund (CEPF) and the Center for Social Development Studies, Faculty of Political Science, Chulalongkorn University.

Our two-year fieldwork period, production of this booklet and the event at the primary school were supported by the Japan Trust for Global Environment. We would like to express our deepest gratitude to all those who made this booklet possible.

Mekong Watch is a Japanese NGO based in Tokyo. We combine research and advocacy to address and prevent the negative environmental and social impacts of development in the Mekong Region. We are especially concerned about the lack of consultation with affected communities in development planning and implementation and the role of Japanese financing. By contacting communities directly, we try to bridge the information and communication gaps between them and decision-makers in Japan.