

Impacts of Dam Construction on the Mekong: The experience of the Mun River

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Abstract

The Mekong River Basin, with its number of fish species ranking the second most numerous in the world following the Amazon, has freshwater fisheries almost everywhere in its lower basin. Here, fish are a vital natural resource for local residents, not only as food but also as a source of income. In the 1990s in Thailand, two dams, the Pak Mun Dam and Rasi Salai Dam, were constructed on the Mun River, one tributary of the Mekong River. These two dams had great impacts on the ecology of migratory fish which migrate between the Mun River and the Mekong River, and massive impacts on local fisheries. After strong protests from the local community, an agreement was made between the government and local community to stop operation of the dams and open the sluice gates for four months each year for both dams from 2003. However, no monitoring research has been conducted since this agreement. The opening and closing of the sluice gates does not match with the timing of fish migration and, according to local residents, the recovery of fish resources has not been confirmed. In addition, there are a number of dam construction plans in the whole basin, especially in Lao PDR, and there is concern over further impacts on the river ecosystem.

1. The Natural Environment in the Mekong River Basin

The Mekong River is an international waterway that rises in the Tibetan Plateau and flows through the Mekong Delta into the South China Sea. It is second only to the Amazon in fish biodiversity (ICEM 2010). Along with 850 species of fish, there are 20,000 species of plants, 430 animal species, 1,200 bird species, and 800 reptile and amphibian species that live in the river (Thompson 2008). The entire river basin covers 795,000 km² and the river has a length of 4,909 km (MRC 2000: 5).

The Mekong River passes through the six countries of China (Qinghai and Yunnan Provinces), Myanmar (Burma), Lao PDR, Thailand, Cambodia, and Vietnam.

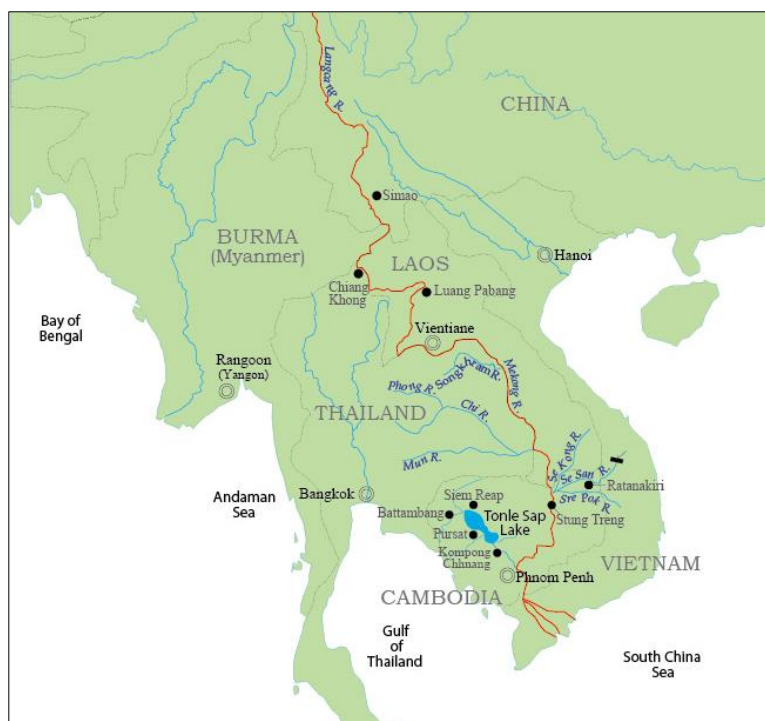


Figure 1. The Mekong River

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<http://www.mekongwatch.org/index.html>

Cambodia, and Vietnam, before flowing into the sea. After flowing through China, the Mekong River enters Lao PDR, forming the border between Burma and Lao PDR, and after flowing along the Thai-Lao border, enters Cambodia, where it connects with Tonle Sap Lake, a symbol of Cambodia. The river then enters Vietnam, where it is known as the “Nine Dragons River.” The Mekong Delta in Vietnam is one of the world’s largest rice-producing areas, and from there the Mekong flows into the South China Sea. The Mekong originates with melting snow from the Himalayas, but water from the river’s catchment area in China makes up 16% of the river’s flow, while Myanmar accounts for 2%, Lao PDR for 35%, Thailand 18%, Cambodia 18%, and Vietnam 11% (MRC 2005).

	China	Myanmar (Burma)	Lao PDR	Thailand	Cambodia	Vietnam	Entire Region
Catchment area (km ²)	165,000	24,000	202,000	184,000	155,000	65,000	795,000
Catchment (% of entire watershed)	21	3	25	23	20	8	100
Volume (% of entire watershed)	16	2	35	18	18	11	100

Table 1: Comparison of the Six Countries in the Mekong River Catchment Area (MRC 2005: 1)

2. Fish Diversity in the Mekong Basin

Fish and other freshwater aquatic species are the main source of protein for the people who live in rural areas of the Lower Mekong Basin (the four countries of the Lower Basin, not including China and Burma). *The Fisheries Baseline Assessment Working Paper* estimates the diversity of fish species in the Mekong River from data registered in the FishBase database for the fish inhabiting 204 rivers and 32 lakes worldwide. According to data registered as of 2009, it has been confirmed that the 781 fish species found in the Mekong River is second only to the 1,271 species of the Amazon River, showing that the Mekong River is the second river in the world for fish diversity (ICEM 2010).

At present it is thought that there are 850 freshwater species, and that around 1,100 species inhabit the river if marine fish that make temporary incursions into the Mekong River delta are also included. Furthermore, 197 fish species are registered in FishBase for the Cambodian Thonle Sap Lake, indicating that this lake is fourth in the world for fish species diversity.



Figure 2. Mekong River Fish

The numbers of fish species in 20 locations in the river basin (including tributary river sub-basins) is shown in the following table:

Location	Species	Families	Endemic
Mekong Mainstream			
China-headwater	24	3	4
China-upper reach	34	4	4
China-middle reach	48	8	7
China-lower reach	122	21	15
Northern Lao PDR	140	30	26
Mekong down Khone Falls	168	34	25
Stung Treng-Kratic	204	37	33
Mekong Delta	486	73	28
Mekong Tributaries			
Nam Ou	72	15	29
Nam Ngum	156	27	43
Nam Mang	57	19	17
Nam Kadinh	99	21	38
Songkhram	216	40	39
Xe Bang Fai	157	31	51
Xe Bang Hiang	160	33	47
Mun/Chi	270	38	49
Sekong	214	33	63
Sesan	133	26	24
Srepok	204	32	38
Thonle Sap Lake	284	45	31

Table 2: Species Richness in 20 Locations of the Mekong Basin (ICEM 2010: 11)

Not only the Mekong River mainstream but its tributaries are also rich in aquatic life. More than 200 species of fish can be found in the Songkhram River basin and the Mun/Chi basin in Thailand, and in the Sekong and Srepok basins in Cambodia.

3. Mekong River Fisheries

Freshwater fish catches in the four countries of the Lower Mekong given in the statistics of the Food and Agriculture Organization (FAO) of the United Nations amount to 750,000 tons per year, but from field surveys they can be estimated at around 2.1 million tons per year, equivalent to 18% of the global freshwater fish catch (ICEM 2010). According to FAO data for 2000 to 2003, of the animal protein consumed per day, the proportion supplied by freshwater fish was 49.8% in Cambodia, 38.31% in Lao PDR, 16.19% in Thailand, and 12.87% in Vietnam, which can be seen to be extremely high when compared with the global average of 5.78%. Cambodia and Lao PDR are especially conspicuous in this regard.

Country	Cambodia	Lao PDR	Thailand	Vietnam	Global Average
	49.8%	38.31%	16.19%	12.87%	5.78%

Table 3: Animal Protein Consumed per Day 2000-2003 (FAO)

Recent data show that catches by the Mekong Basin fisheries are estimated to have an annual economic value of between USD2.1 billion and USD3.8 billion, and between USD4.2 billion and USD7.6 billion at retail prices (ICEM 2010). In the vicinity of the Khone Falls in southern Lao PDR, the Mekong River mainstream fishing industry supports more than 65,000 households. The average household in this area is thought to catch an annual average of 355 kg of fish, and consume 249 kg of fish. The total catch in the area close to the Khone Falls is estimated at 4,000 tons, worth between USD450,000 and USD 1 million (Baran, Jantunen, and Chong 2008).

Different sources estimate that the freshwater fish production, including fish farming, in Cambodia accounts for between 11.7% and 16% or between 8% and 12% of GDP. While these figures are all estimates, and it is difficult to obtain accurate statistics for small-scale **fishing people**, the importance of the Mekong River fisheries can be understood from these approximate data (ICEM 2010).

4. Fish Migration

Because of the large difference in the condition of the river during the dry and rainy seasons, many fish migrate between the Mekong's mainstream and its tributaries. Three distinct, but inter-connected, migration systems have been identified in the lower Mekong River Basin, each involving multiple species. These are respectively the lower (LMS), the middle (MMS) and the upper (UMS) Mekong migration systems (MRC. 2002). See figure 3.

According to villagers surveyed in northeastern Thailand, which is located in MMS, with the exception of January, the migration of fish can be observed every month, though there are variations in fish species and direction, either upstream or downstream. The first peak migration season is through March and April, when small fish swim up the Mekong and into the tributaries such as the Mun River. The next season is May and June, when carnivorous migratory fish swim up the Mekong and also enter tributaries and flood plains. In October, fish that migrated upstream begin to return downstream into the Mekong mainstream. This continues until December.

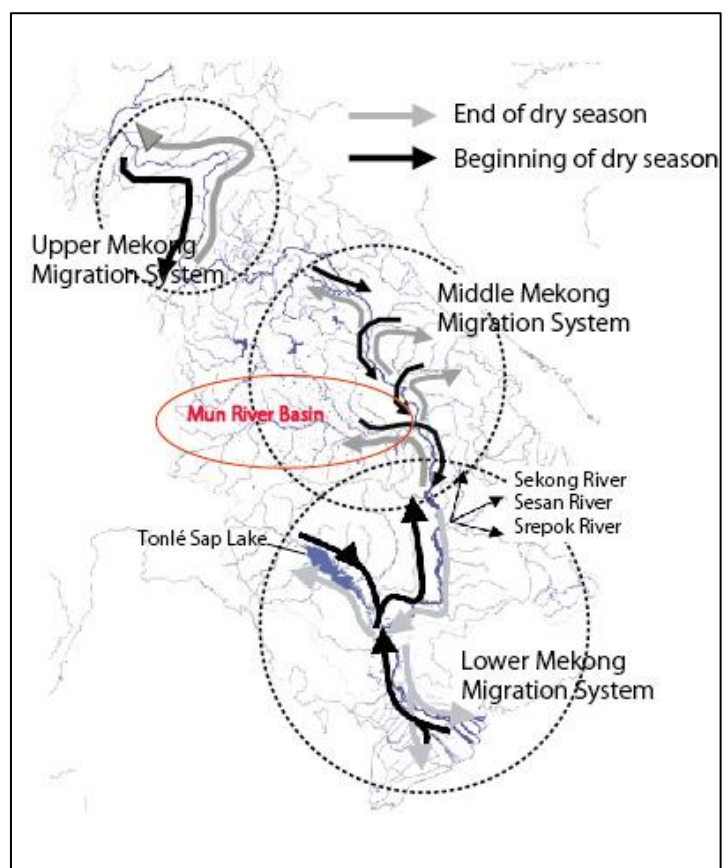


Figure 3. Fish Migration Systems of the Mekong

5. Experience of the Mun River, Northeastern Thailand

The Mun River flows through Thailand's northeast region, and the area of this basin is the largest of all the Mekong tributaries in Thailand. The source of this 750-kilometer river is Nakhon Ratchasima Province,

and it flows into the Mekong River at the Thai border with Lao PDR in Ubon Ratchathani Province. The riverbed in the downstream region of the Mun River is a complex formation of rapids created by the erosion of rocks, and these formations continue upstream for 30 kilometers from the mouth of the river. In the Middle Mun River Basin, there are seasonal wetlands – complexes of many oxbow lakes and flood forests called “*par bung par thaam*” – these areas become connected to rivers during the rainy season, functioning as fish habitats and their spawning and nursery grounds. The migration of many freshwater fish can be observed on the Mun River. With these rich aquatic resources, fishing became the main source of livelihood for villages located within the community along the lower Mun River.



Figure 4. Pak Mun Dam

In 1994, however, the construction of the Pak Mun Hydropower Dam at a location five kilometers from the river's mouth blocked fish migration and has had severe impacts on local fishing (AOP & SEARIN. 2002; WCD. 2000). The World Bank provided loan aid for the Pak Mun Dam construction project. As a result, villagers continued their protests against the dam even after the dam's operations began. In addition, in the oxbow lakes and flood forest areas of the Middle Mun River, the Rasi Salai Dam for irrigation was constructed. These two dams have had enormous negative impacts on the Mun River environment.

The Pak Mun Dam shut the migrating route of fish from the Mekong and Rasi Salai dramatically changed the hydrology of the oxbow lakes and flood forests, which were crucial habitats and spawning grounds for fish. As a result, fish numbers were drastically decreased.

In 1999, the people's movement calling for the opening of both dams' sluice gates gained strong momentum, and in 2001 the Thai government announced an experimental opening of the gates. The sluice gates were opened from June 2001 to November 2002. During this period, the partial recovery of plants on the banks of the river during the dry season and the return of migrating fish was observed, signaling the potential to restore the environment to the condition before construction of the dams. According to a survey conducted by researchers at Ubon Ratchathani University in the affected area of the Pak Mun Dam in 2001, 184 species from 44 fish families were found (Ubon Ratchathani University. 2002), while villagers documented 156 species (counted according to the number of local names for the fish) (AOP & SEARIN. 2002). A Mekong Watch survey documented 108 species from 26 families. According to our research with local fishing people in February 2002, small fish belonging to the Cyprinidae family have been observed in the shallow water in the Mun River rapids. When a hand-managed fishnet and *gaeng*, which must be used by two people, were cast to capture these fish,

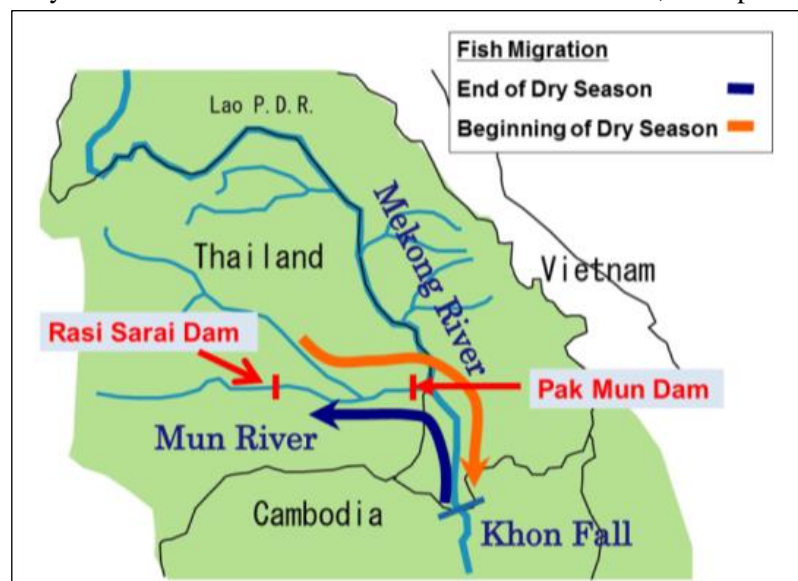


Figure 5. Dams and Fish Migration System of the Mun River

fish flies of several types were captured. They included *pla theep* (*Parachera* sp.), *pla suut* (*Hampala dispar*), *pla sathong* (*Xenentodon* sp.), and *pla moon* (*Toxotes microlepis*). Although many other fish fly were also captured, it is quite difficult to taxonomize members of the Cyprinidae family (Mekong Watch. 2004).



Figures 6, 7, 8. Fish of the Cyprinidae family, *pla sathong* and *gaeng* fishing

According to surveys by Ubon Ratchathani University, the average fishery income of local people decreased sharply from 25,742 baht before the dam construction to 3,045 baht after the dam construction and then reportedly recovered to 10,025 baht in the survey conducted when the dam gates were opened. The university research team proposed keeping the sluice gates open year round on a trial basis for five years, citing figures on the degree of the villagers’ impoverishment, documenting recovery of fishery resources through opening the sluice gates, and noting that the gates’ opening would have no impact on the electric power supply, but would improve economic conditions for the impoverished people in the villages (Ubon Ratchathani University 2002).

The Thai government, however, did not adopt the proposal and decided to open the sluice gates for only four months each year (from July to October).³ This way, while claiming to mitigate the impacts on fishery resources, they began opening the sluice gates at times that did not match the fish’s migratory period. Many fishing people are dissatisfied with this decision, however, since they feel that it is insufficient to restore the riverine resources necessary for their livelihoods. There have also been no surveys conducted on fish species during four months when the gates are open.

6. Fish Support Daily Life and Culture

The Mun River is like a miraculous rice field. In this field, thousands of people plant rice at the same time and then harvest it. On this river, even if many people fished at the same place, they could all catch fish, so there was never any need to stop anyone from doing anything. In addition, different from rice fields on land, those who would come first cannot claim possession. The river was everyone's asset. (Fisher from Khongjiam District, Ubon Ratchathani).

Until about 50 years ago, the exchange of fish and rice took place over an extensive region, including southern Lao PDR and northeastern Thailand. In the era when a subsistence lifestyle was virtually universal, people spent much of their time gathering in order to secure food supplies. In villages where the main vocation was farming, it was difficult to find time to obtain supplementary foods (to eat with rice) during the busy farming seasons of rice seedling transplantation and rice harvesting. At the same time, in riverside villages, where fish were available in abundance, fish were caught and processed into fermented or dried foods, which the villagers then actively exchanged for the goods they needed. Food was thus distributed

³ According to local NGOs, the four-month gate-opening period was set for the rainy season, when the Mekong’s water level below the dam rises enough to eliminate the difference in water levels between the dam and downstream, and almost no electricity can be generated anyway.

across the region by barter.

These exchanges not only had practical aspects, but also social and cultural significance. A northeastern Thai woman in her 70s relates that in her youth she would make large amounts of dried and fermented foods, load them onto an ox cart and often set off together with a friend without first deciding on a destination. She would then negotiate with people she met along the way to exchange the fish products she had brought with her for rice and other agricultural products. There was no fixed exchange rate for rice and fish, so when she had a surplus she would give more to the other person, and if she was in short supply she would negotiate with the other person to obtain larger amounts of rice. It was explained that what was important in these negotiations was to be openhanded. We also learned from the interviews that setting off to an unknown village, engaging in exchanges, and making new friends with the people there was considered something enjoyable to be looked forward to. People who became friends through exchange frequently exchanged visits with each other.

Now fish can easily be sold for cash, but even today, when fish catches are good in southern Lao PDR the fish are given out to friends and relatives. These exchanges still exist in some communities in northeastern Thailand, and when the fish catch is small and the cost of the gasoline to take the fish to market cannot be recouped, the fish are sold in the village at a very low price. The fish of the Mekong Basin even now play an important role in strengthening social relations, and support the food security of people who have limited opportunities to gain cash income.



Figure 9. Dams in China

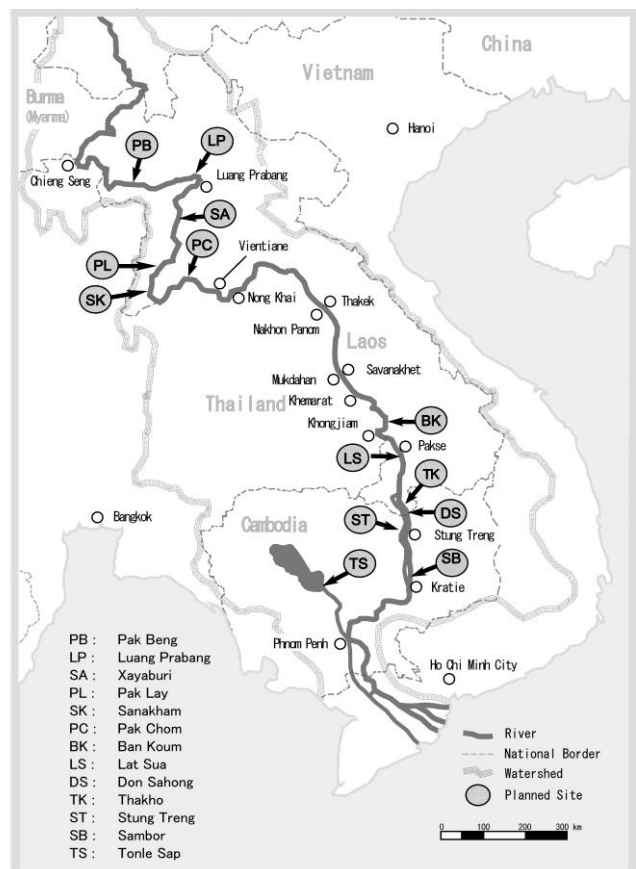


Figure 10. Planned Mekong Mainstream Dams (©TERRA)

7. Conclusion

Inside China’s borders, the Mekong River is known as the Lancang Jiang. Of the eight dams projected for the basin of the Lancang Jiang in Yunnan Province, six (i.e., Xiaowan, Gongguoqiao, Jinghong, Dachaoshan, Manwan, and Nuozadu) have been completed and are in operation. Two further dams (i.e., Ganlanba and Mengsong) are in the planning stages.

At present, including a project put forward by a private Thai company, there exist plans for twelve mainstream dams, excluding the Mekong River mainstream in China. Of these, the construction of the Lao Xayaburi Dam in the north and the Don Sahong Dam in the south are now underway in Lao PDR. All dams are for the purpose of generating electricity. If a dam is built on the mainstream, then the migration of fish will certainly be obstructed. Even if the dam construction on the mainstream of the Mekong River could be avoided, dam development continuing on the tributaries of the river would ultimately block the flow of these, resulting in an inevitable dramatic decrease in the aquatic life of the Mekong River, similar to that of the Mun River. The environmental and social impacts of development and dam building on the tributaries should also be reconsidered. Research on the cumulative impacts of dams in the Mekong River Basin is a crucial requirement that should be completed before new projects start. To realize sustainable use of natural resources and conservation of fish species in the Mekong River Basin, what is needed is to protect the mainstream and tributaries as one ecosystem. And also we have to reconsider that Pak Mun Dam continues to bring adverse impacts on the Mekong River ecosystem.

Furthermore, the experience of the Mun River indicates that recovery of fish resources is possible by opening dam sluice gates. However, this knowledge is never reflected in actual practice and dam construction is proceeding both in the mainstream and tributaries. This is the current reality of the Mekong River Basin.

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