



POTENTIAL IMPACTS OF WATER INFRASTRUCTURE DEVELOPMENT ON FISH SPAWNING IN CAMBODIA



OXFAM



Photo: Seiha Tiep/Oxfam

KEY MESSAGES

- A. Key freshwater habitats, such as fish spawning and feeding grounds, and ensuring access between these sites, is critical for maintaining fishery productivity.
- B. The Mekong mainstream and the Sesan, Srepok and Sekong (3S) rivers contain important fish spawning sites.
- C. The results of studies indicate that hydropower, dredging and land conversion in the vicinity of the Mekong-3S confluence will negatively impact fisheries resources by disturbing or obstructing access to important spawning grounds.
- D. There are sustainable options for fisheries in Cambodia to maintain food security and contributing significantly to GDP, maintaining healthy capture fisheries requires keeping the waterways open. The benefits to livelihoods, well-being and economic growth from fisheries are likely to far outweigh the benefits of energy from dams.

RECOMMENDATION

- 1. The National Government should provide the legislation and commitment to an ecosystem approach to fisheries management (EAFM) for maintaining sustainable fisheries and protecting key habitats and spawning areas.
- 2. Cambodia policy-makers should propose to keep the Mekong mainstream clear of hydropower dams to preserve the integrity of the fisheries, protect spawning grounds, and protect food security.
- 3. Dam development should follow a 'smart hydropower' approach that demonstrates the benefits of pushing dams into the headwaters and optimizing dam cascades for maintaining energy outputs whilst reducing negative impacts on flows, fish movement and spawning areas.
- 4. Strengthen payment for ecosystem services (PES) legislation to ensure hydropower developers and operators are contributing to the watershed protection enabling Government to off-set lost fishery revenue and critical habitats and spawning areas.
- 5. Studies should be conducted to evaluate the harm of a fish passes that may act as an ecological trap – (trapping larval and juvenile fish above the dam and moving adults above the dam without any solution to get them downstream again).

THE IMPORTANCE OF CAMBODIA'S FISHERIES

The Cambodian Fisheries Administration estimates from the 2009 national census that 33-45% of Cambodians are involved in fishing related professions, with as much as 90% of the community in some provinces. Average estimated yields of 570,000 tonnes per year deliver a first sale value of the fishery of USD1 to 1.4 billion per year. The fishery is vital for food security, providing from 76% to 85% of total animal protein intake and 37% of iron intake for Cambodians.

The Sesan, Srepok and Sekong tributaries to the Mekong River in Cambodia – collectively known as the 3S river basin – are important for fishery production and biodiversity. In particular, several studies have indicated the presence and high yields of migratory species that appear to rely on the 3S for spawning. As such, any barriers or disturbance to the area from development (dams, dredging, irrigation) is likely to impact not only fish harvest in the 3S area but also downstream and throughout the floodplain with the consequent impact on people who rely on the fish for food and income.

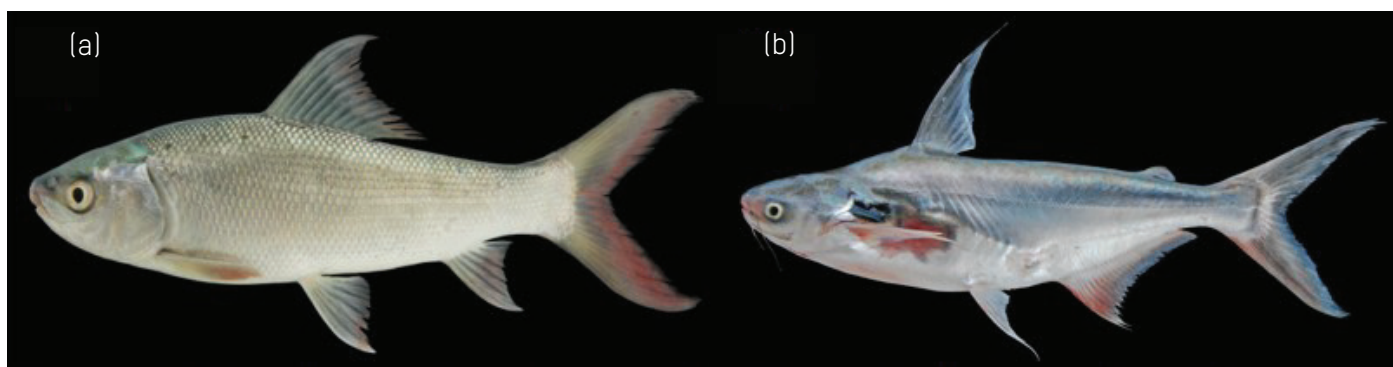
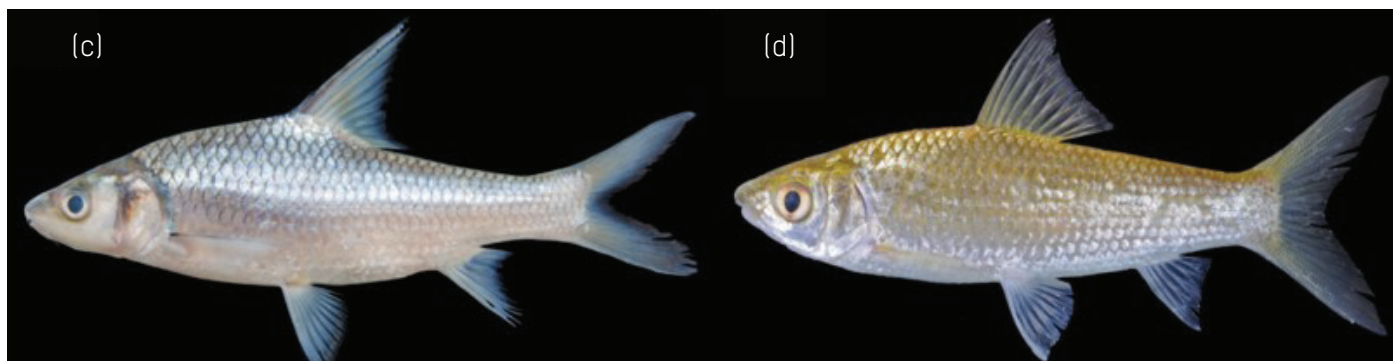


Figure 1: Important fish species from the Mekong and 3S river (a) *Cirrhinus*, (b) *Pangasius larnaudii*, (c) *Cyclocheilichthys enoplos*, (d) *Henicorhynchus lobatus*.



THE IMPACTS OF DEVELOPMENT ON THE FISHERIES

Understanding upstream and downstream impacts of dams on fisheries and habitats is key to evaluating the sustainability of development and the 'trade-offs' for fish production. Thus, knowing the spatial distribution of fish and identifying significant habitats for various key life-stages is critical for effective management. With the increasing development in the Lower Mekong Basin (LMB) potentially threatening key fish habitats and hydropower preventing access and dredging and land conversion destroying flood plains, it is important to know where these critical sites are located.

Confirming the importance and determining species-specific spawning behavior with rivers in the 3S river basin and its confluence with the Mekong helps determine fishery impacts. A recent study on fish spawning in the 3S area collected prior to the building of the Lower Sesan 2 dam found that the majority of species – both migratory and non-migratory, spawn in the 3S river system and that the majority of species classified as long-distance migrants are ready to spawn in the Mekong.

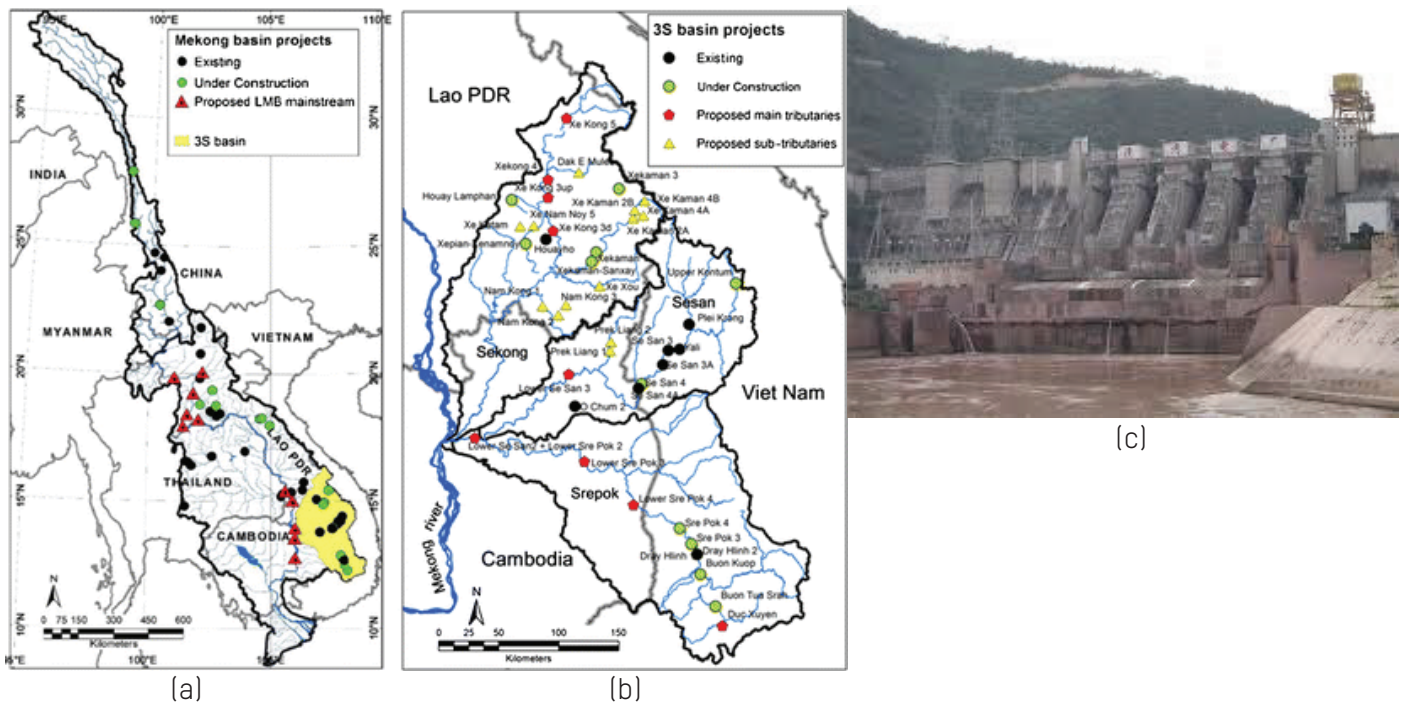


Figure 2: (a) Regional map of Mekong, (b) Hydropower development planned in 3S, (c) Lower Sesan2 Dam

KEY FINDINGS

1. Many migrant species show location specific spawning behaviours, which confirms the importance of the 3S-Mekong confluence for spawning.
2. Over half the fish sampled were large-bodied, long-lived, long-distance migrants – all of which were ready to spawn in the Mekong. This suggests the importance of the main-stream as a spawning ground for these larger species.
3. The confluence of rivers is important for biodiversity with 124 species captured by the study many of which were found to be in spawning-ready condition. This demonstrates the importance of the Srepok and Mekong at the confluence for providing spawning locations.
4. 98% of the small, short-lived, long-distance migrant species, such as Treyl species were spawning ready in the Mekong and one or more of the other rivers in the system.
5. The Srepok is an important spawning location for a majority of the more sedentary species such as *Mystus* species.
6. Few species were spawning ready in the Sekong river near to the confluence with the Mekong. However, the habitat in the lower Sekong has been shown to be less suitable for spawning (sandy banks, rock pools, leafy overhangs) compared with the habitat available further upstream. The study results taken together with other evidence of the importance of the Sekong and its high biodiversity, suggest that fish will migrate further upstream to spawn.
7. This study confirmed the spawning peak period is June to August for most species, but that many species will also spawn outside of this peak.

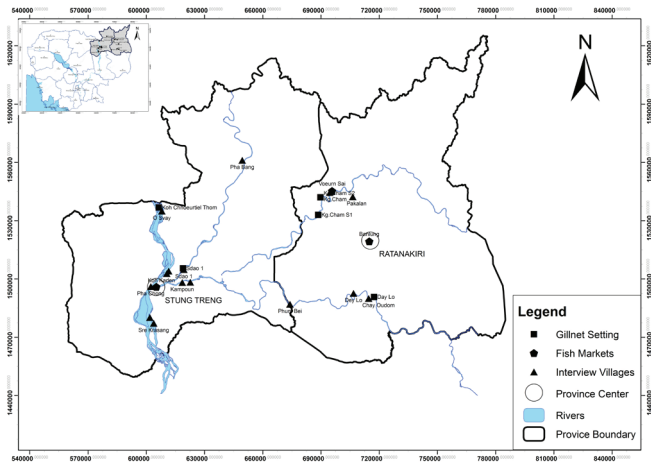
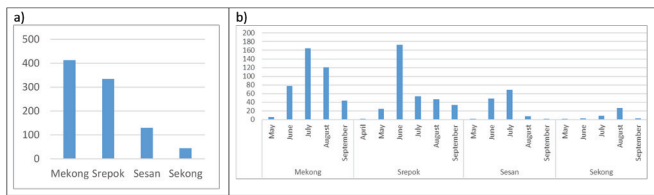
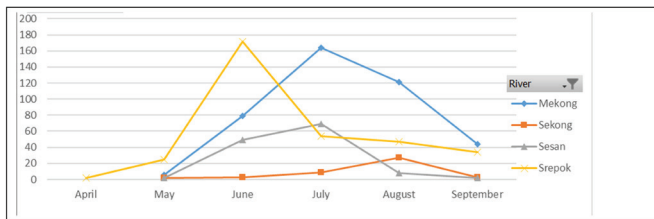


Figure 3 : Sampling sites in the Mekong & 3S river system

Seasonal pattern of spawning-ready female fish abundance by river



a) Total number of eggs at stage 5/6 in each river. b) Seasonal difference in number of individuals with stage 5/6 eggs in each river

Figure 4: Fish spawning seasonality in the 3S-Mekong river confluence.

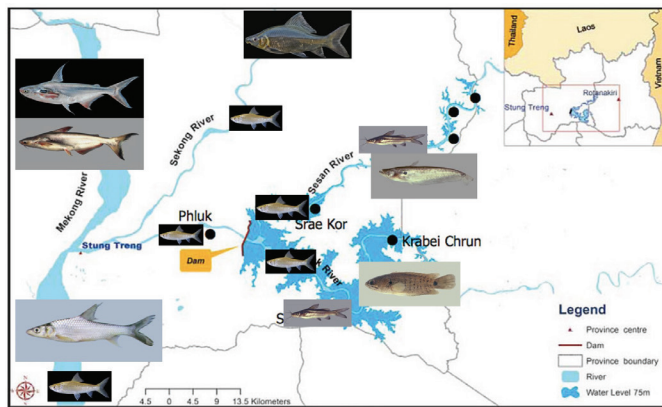


Figure 5: Distribution of important species in the Mekong & 3S rivers, following different life-history strategies

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CONCLUSIONS

Taken together with other evidence the results suggest:

1. The proposed hydropower development and associated river damming sites will negatively impact the access of migratory species to important spawning sites
2. It is likely, the proposed hydropower dams on the lower parts of the 3S rivers will have impacted many species but even more will be impacted by mainstream dams. In particular, there will be a disproportionate impact on large-bodied, long-lived commercially important cyprinids and catfish as well as many of the short-distance migratory species that are heavily relied on for subsistence
3. No successful solution exists to get larval and juvenile fish downstream of dams
4. Unless a satisfactory solution is developed those species trapped above the dams, such as by Lower Sesan 2, are likely to become isolated and may not survive the transition from running river to a reservoir. Many Mekong fish species are unlikely to be viable in reservoir habitats – conversion to reservoirs generally results in a 50-70% loss of diversity. Species diversity is important for maintenance of fish production particularly under changing climate conditions
5. Development of a fish pass to move fish can potentially act as an ecological trap to those species using the fish pass as they will be trapped in a non-viable habitat
6. The Khone Falls is a natural and historic barrier to many species, keeping a free-flowing river south of the falls is very much still relevant despite previous barrier effects from dams upstream in Laos and at the falls itself