

Fish Spawning Habitats in the Mekong and 3S Rivers in Cambodia

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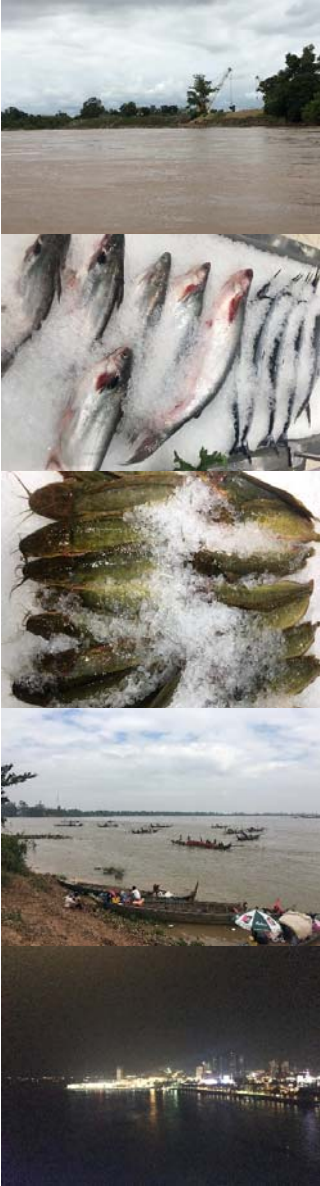
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Outline

I. Cambodia Inland Fisheries

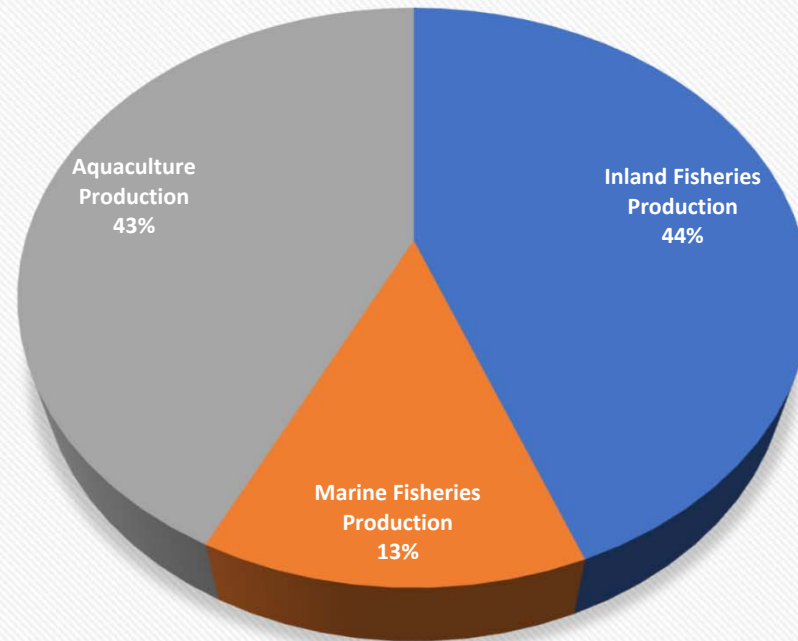
II. Pressures on fish and fisheries

III. Study of fish spawning in Mekong and the 3S Rivers

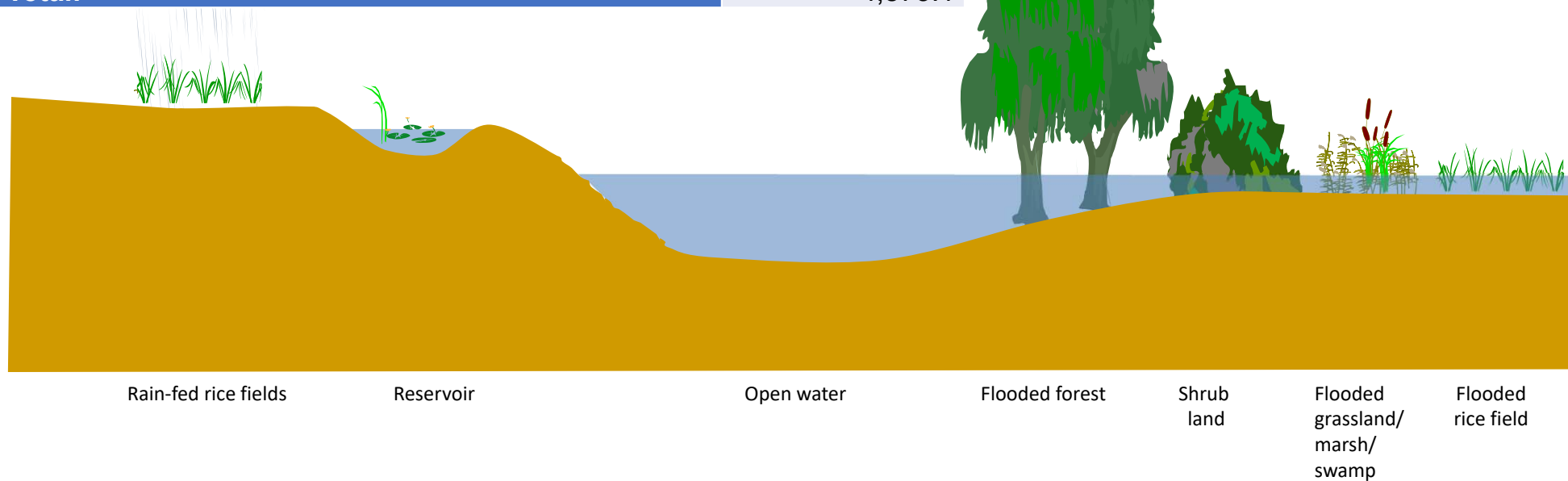


I. Cambodia Inland Fisheries

Cambodia Fisheries Production in 2020=935,900 Tons



Land use category	Area (1,000 ha)
Rain-fed rice field	3,215.6
Flooded rice field (receding and floating rice fields)	371.8
Flooded grassland/marsh and swamp	302.8
Flooded shrub land	533.6
Flooded forest	20.6
Open water (Mekong, Tonle Sap and main rivers)	416.9
Reservoir	11.8
Total:	4,873.1



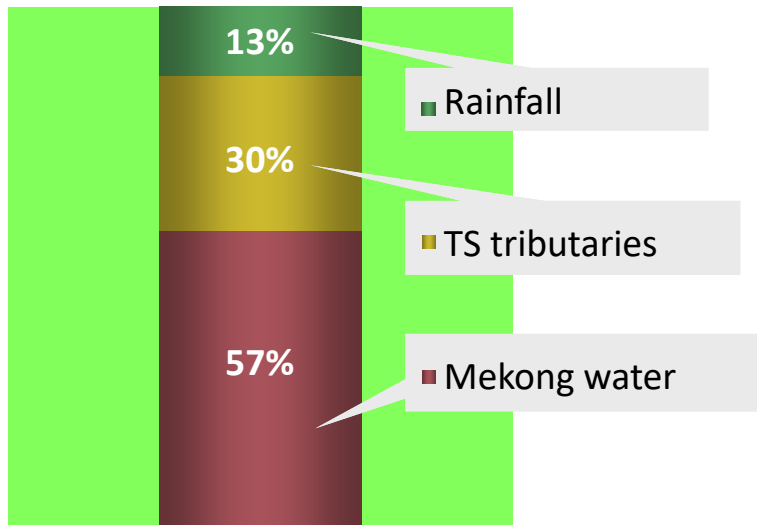
Cambodia's Capture Fisheries 500,000 tonnes annually



Fish providing 76% - 81% of total animal protein intake for the population

- Floodplain 40.000 km² = 22.1% total
- Tonle Sap Lake 1,500km² in dry season, 16,000km² in flooding season
- Flooded forest 670,000 ha
- Connectivity between different habitats
- Influences by Mekong flood regime

- At least 498 fish species recorded in the Cambodia's Mekong River
- Tonle Sap Lake hosts 296 fish species ranked third in the world after Lake Malawi (433 species), and Lake Tanganyika (309 species).
- Tonle Sap Lake production is > 60% of total fish production



Factors driving Cambodia inland production



HYDROLOGY

Water level
(higher flood = more fish)

Flood duration
(longer flood = more fish)

Flood timing
(early flood = more fish)

Flood regularity
(Anoxic mortality)

FLOODPLAIN ENVIRONMENT

Flooded vegetation
(less trees = less fish)

Built structures
(more structures = less fish)



EXOTIC SPECIES



Affect

drives

influences

Fish stocks

condition

allows

MIGRATIONS

Access to feeding and breeding areas

Access to refuges
(ponds, sanctuaries, deep pools)
(better protection = more fish)



FISH CATCH

yields

FISHING

Number of fishers
Impossible to control

Fishing intensity
Difficult to assess



White Fish



Gray Fish



Black Fish



II. Pressures on fish and fisheries

- ✓ Increasing demand
- ✓ Habitats degradation
- ✓ Disrupt connectivity
- ✓ Over fishing
- ✓ Illegal fishing's
- ✓ Climate changes and mining, etc.



Removing flooded forest for agriculture development in
Tonle Sap Lake





Building Dike within the flooded forest area



Destruction of Flooded Forest



- Clear flooded forest areas for crop cultivation



Cutting flooded forest for firewood



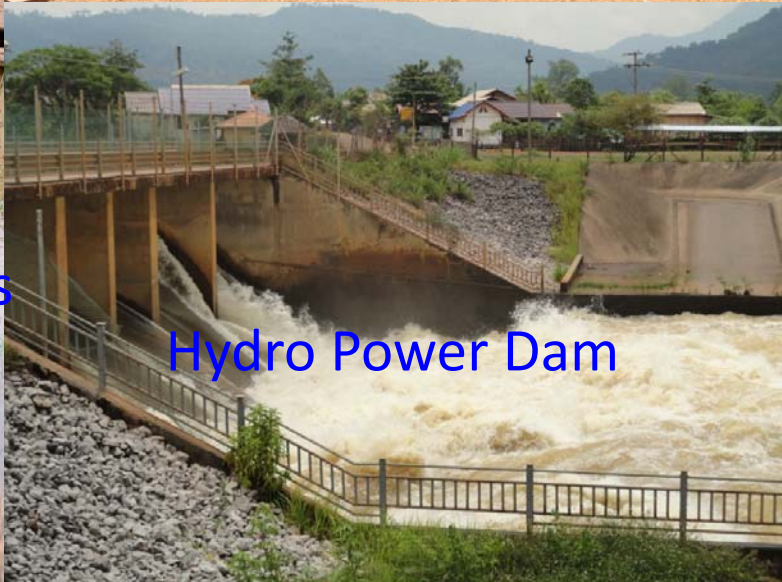
Mosquito net fishing gear



Rat Tail Traps



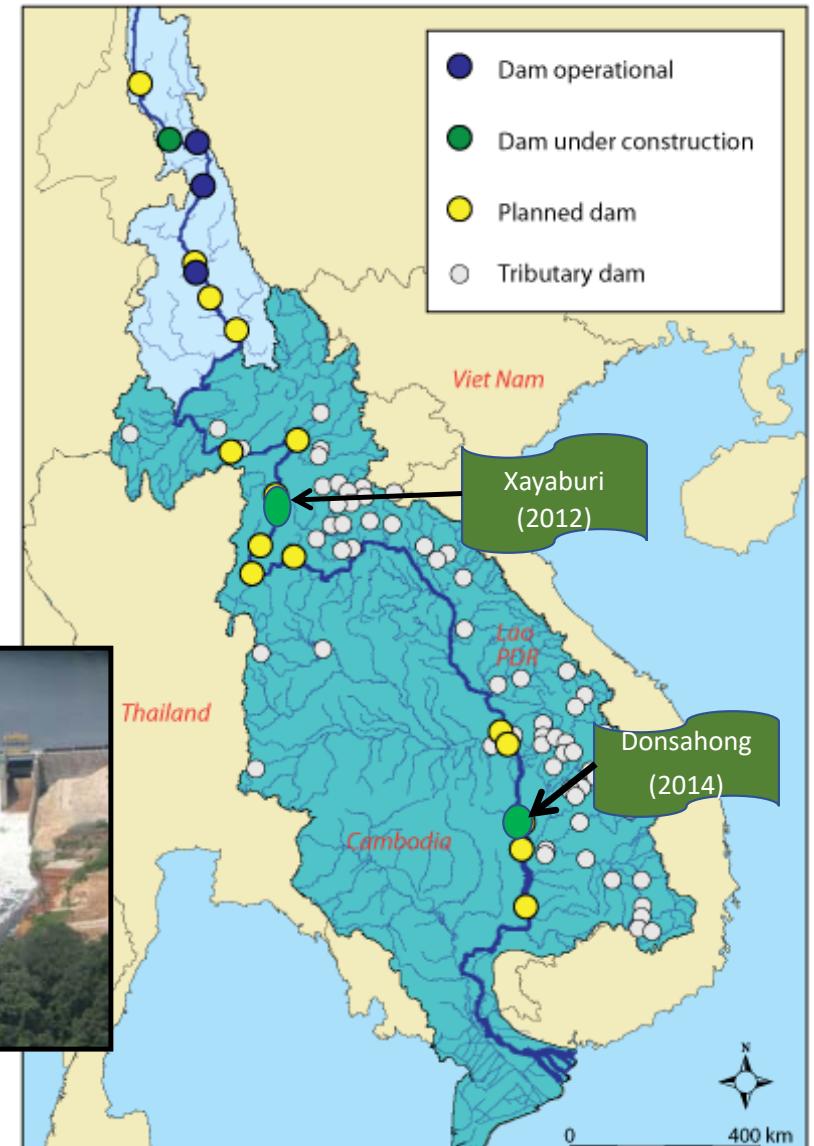
Electro-cute fishing gears



Hydro Power Dam

Biggest potential threat is considered hydropower dams

- ❖ 9 planned dams on LMB (mainstream) – Two are operation.
- ❖ 23 existed dams (> 20 MW) on tributaries
- ❖ Many more tributary dams are projected or under construction



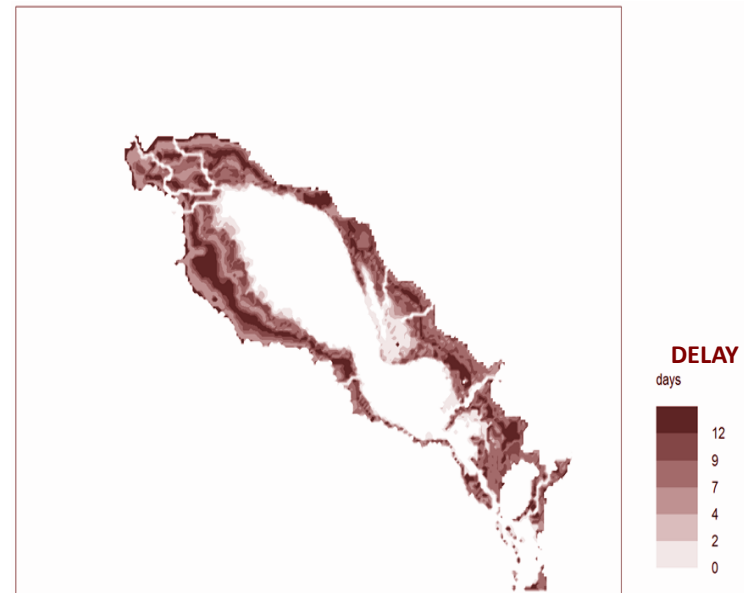
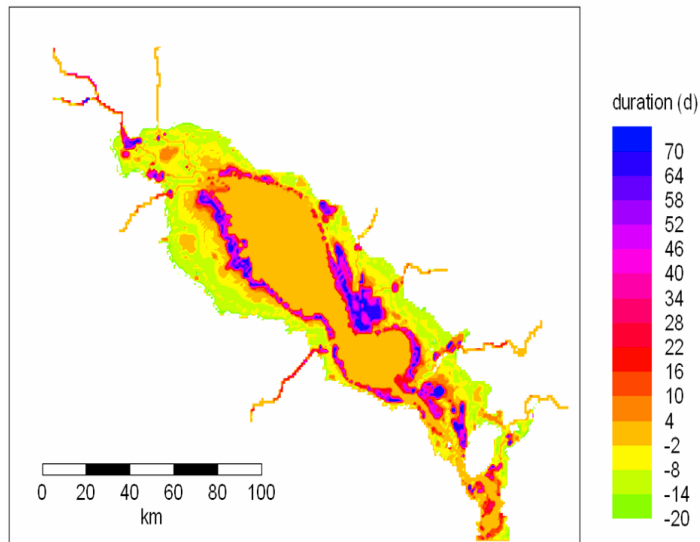
Dam will totally blocks migration route of fishes both upstream and down stream



About 87% of well known fish species in the Mekong are migratory species.

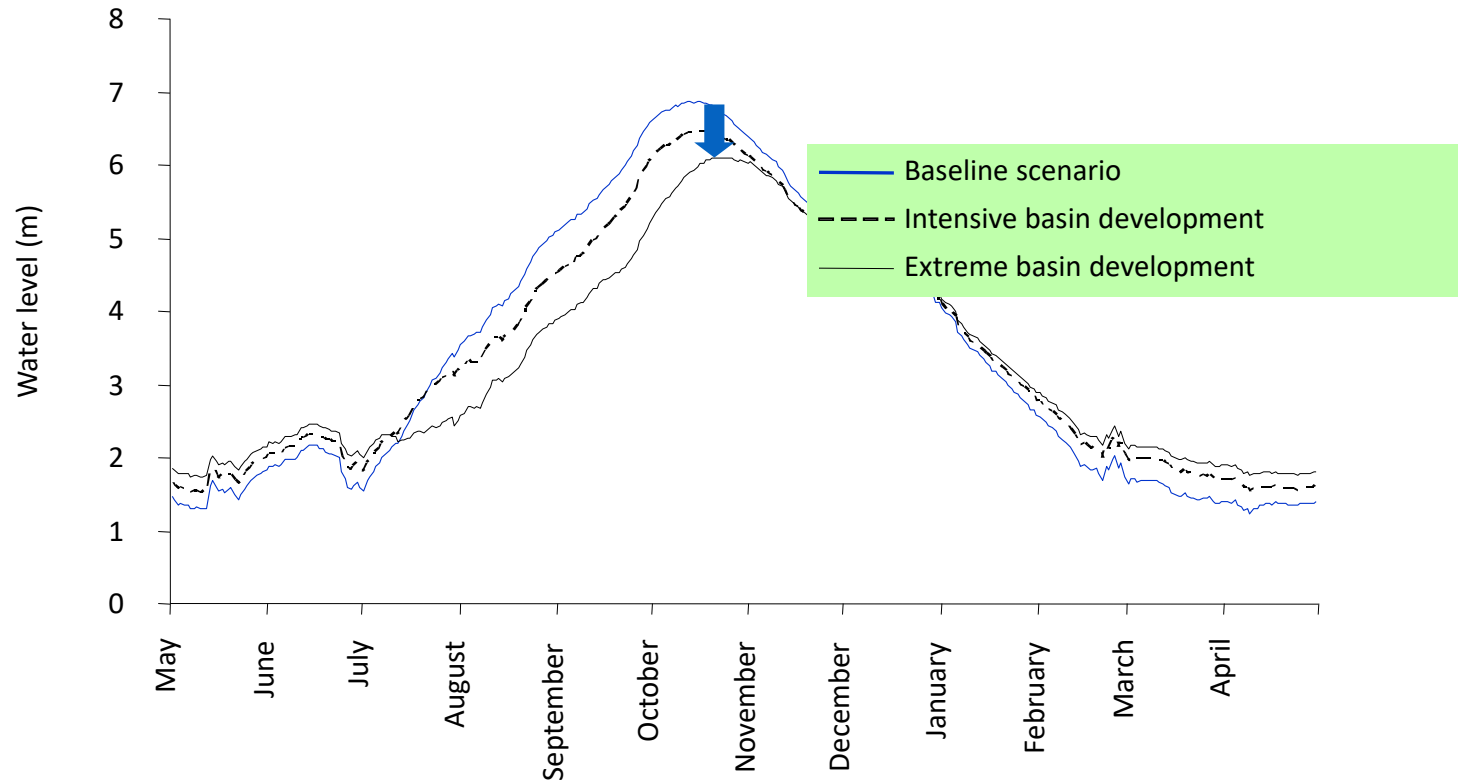


Upstream developments
will result in floods
arriving later

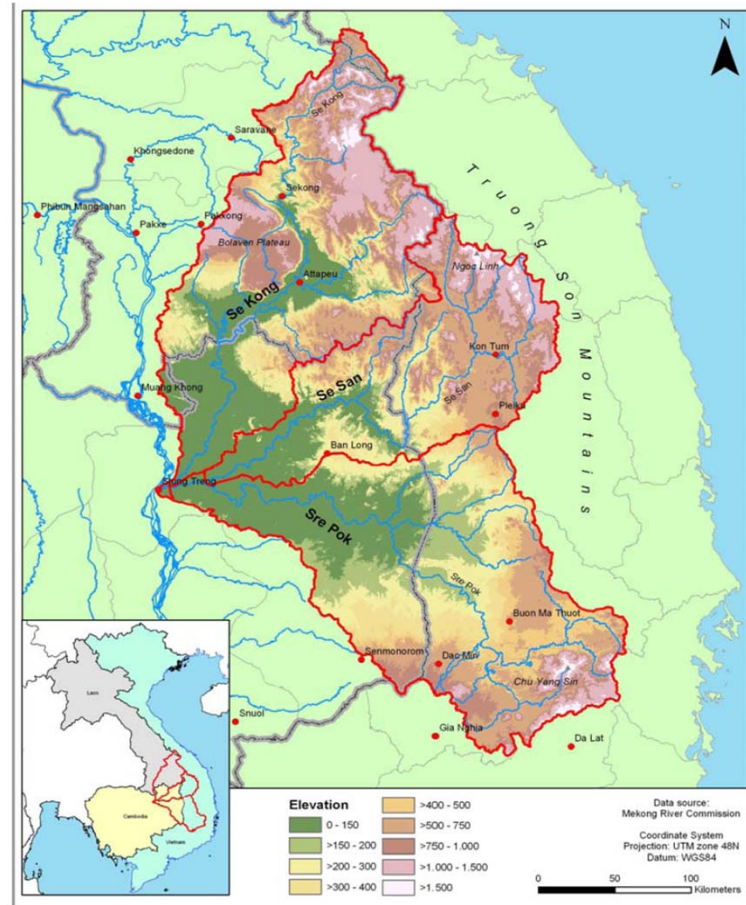
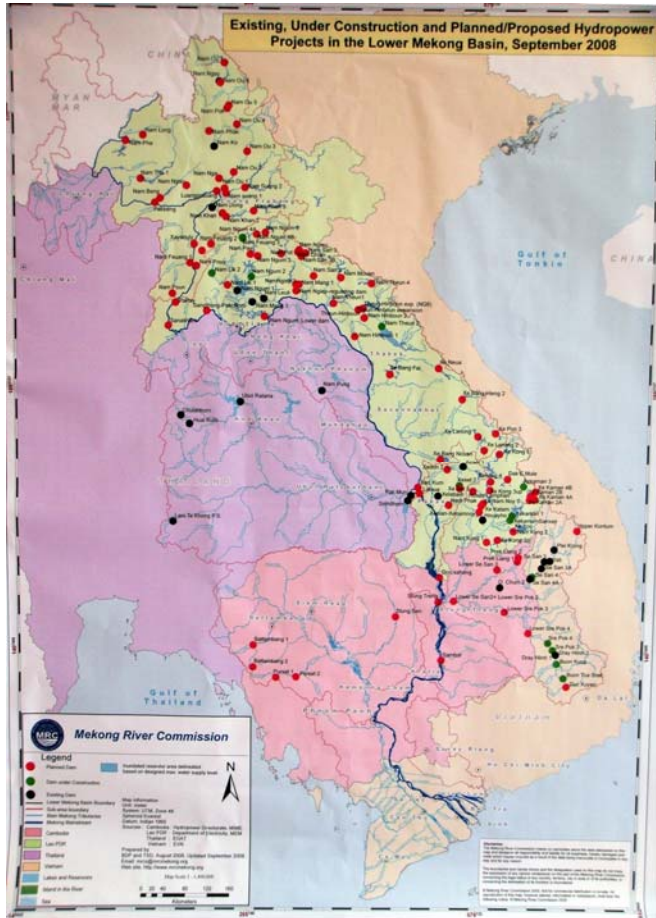


Upstream developments
will shorten the duration
of the flood

Upstream developments will reduce the water level and the surface area flooded



Introduction to Mekong and 3S river system in Cambodia

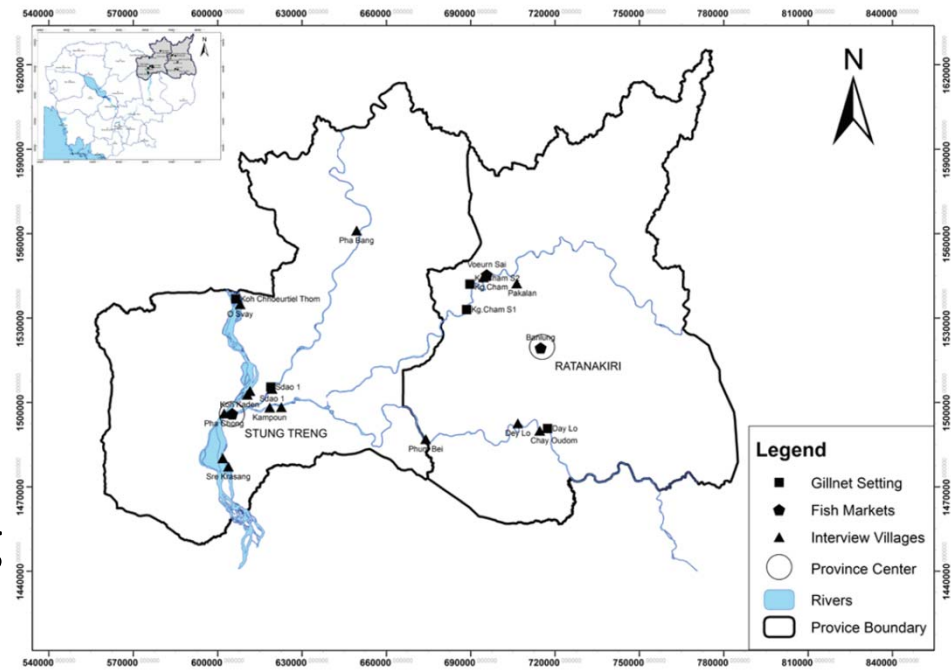


Introduction to 3S river system in Cambodia

- Sekong originates in Vietnam, a long stretch in Lao PDR, joint with Mekong at Stung Treng Town,
- Sesan originates in Vietnam, in Cambodia it joint with Sekong about 15 km above Stung Treng Town, and
- Srepok originates in Vietnam, in Cambodia it joint with Sesan about 30 km above Stung Treng Town.

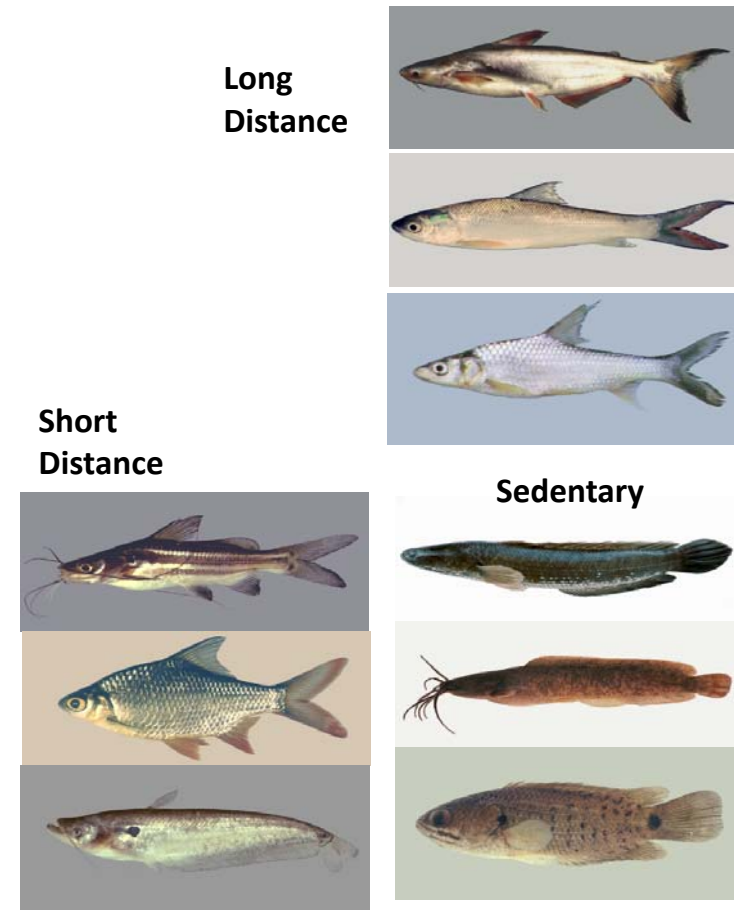
III. Study of fish spawning in Mekong and the 3S River system

- Fish caught in the Sesan, Srepok and Sekong near the confluence with the Mekong and in the Mekong mainstream near Stung Treng
- Fish assessed for presence of eggs and what stage of development (early, late)
- Used to determine their 'readiness' to spawn – used as an indicator of spawning locations



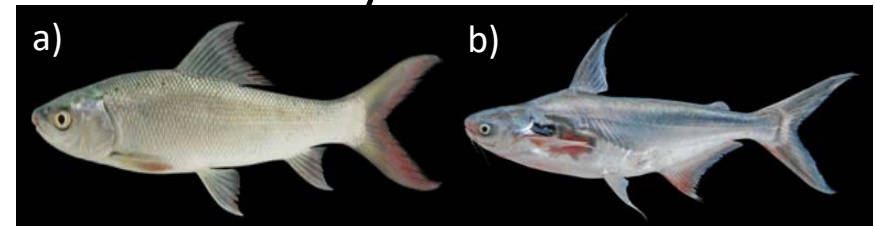
Study of fish spawning in Mekong and the 3S River system

- Evaluated the location and seasonal spawning readiness of 124 species caught by the study
- Used cluster analysis to determine patterns in spawning ready behavior across species, location and timing
- Identified species that are following similar patterns of spawning behavior
- Determined relative importance of the 4 rivers for different species groups and timing of spawning.

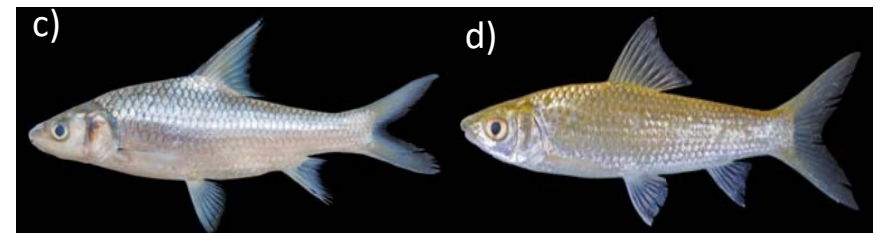


Study Results

- Both migratory and non-migratory species of Mekong fish spawn in the 3S river system
- The majority of species classified as “long-distance migrant” were found in ‘spawning-ready’ condition in the Mekong river
- Many of the smaller, more sedentary species were heavily reliant on the Sesan Srepok and Sekong.

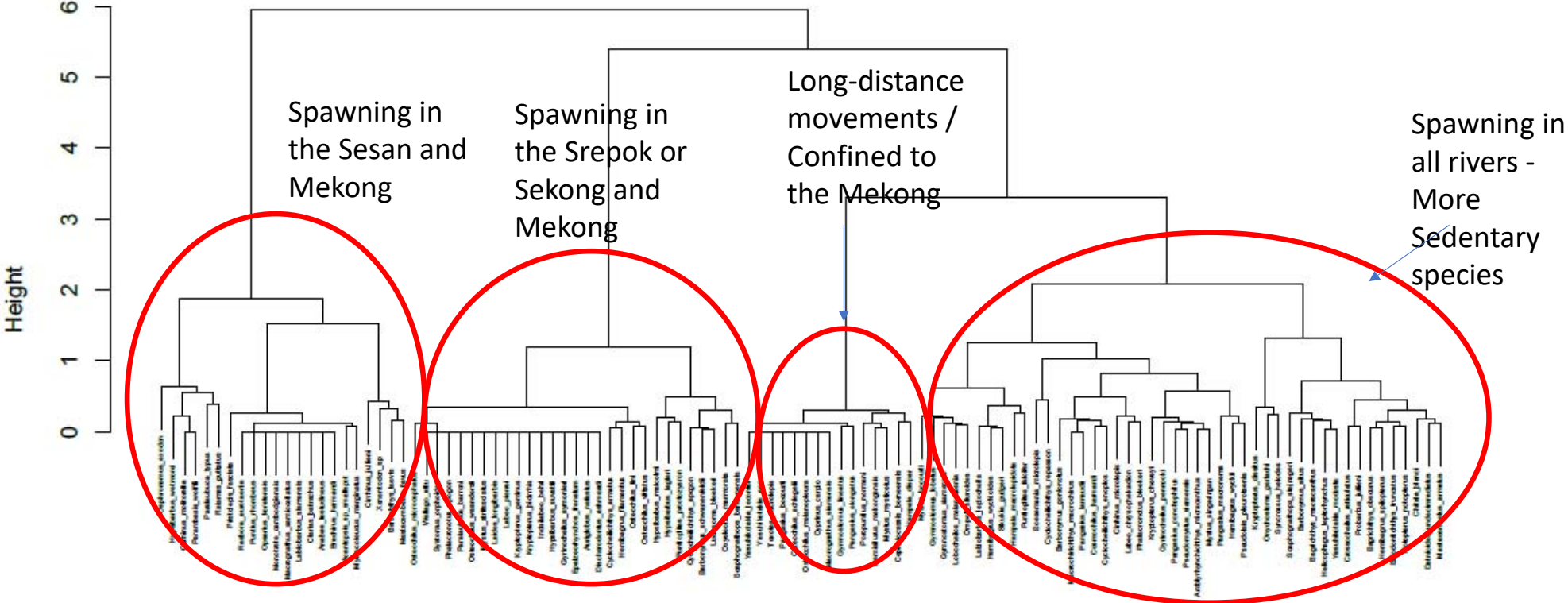


Important fish species from the Mekong and 3S river a) *Cirrhinus microlepis*, b) *Pangasius larnaudii*, c) *Cyclocheilichthys enoplos*, d) *Henicorhynchus lobatus*



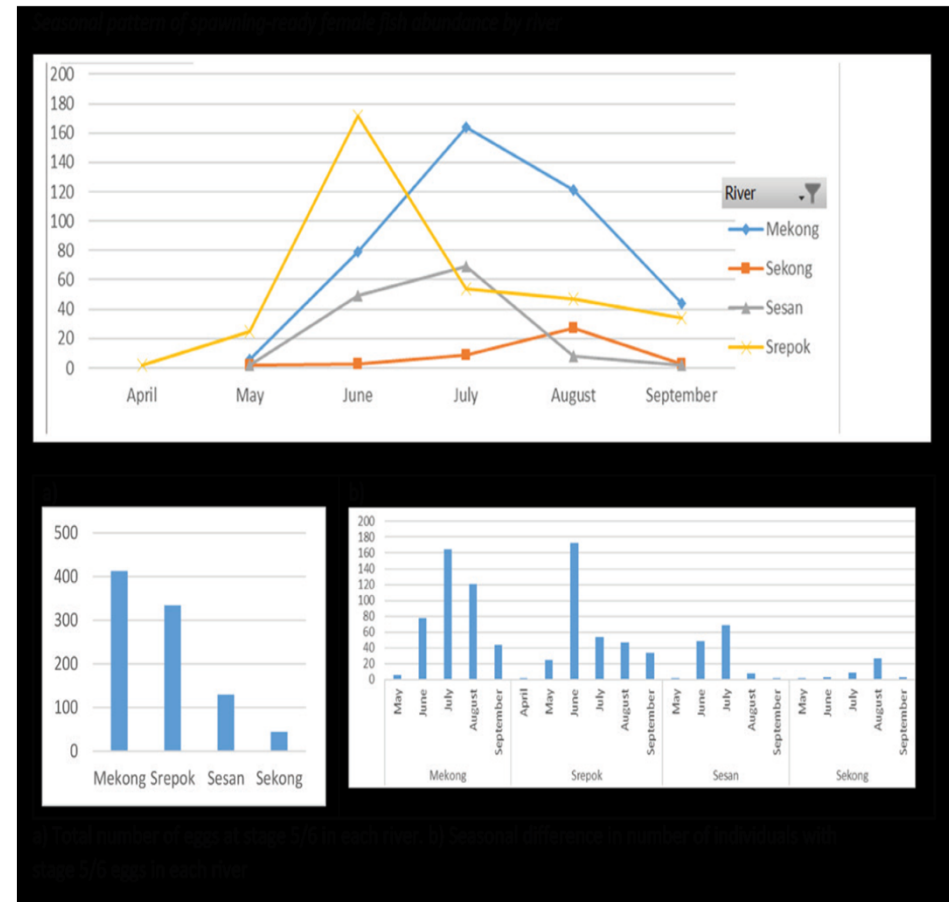
Ward cluster analysis shows groupings of species following similar patterns of behavior – importance of rivers and season

Cluster Dendrogram



Key Findings

- Many migrant species show location specific spawning behaviors, which confirms the importance of the 3S-Mekong confluence for spawning.
- Over half the fish sampled were large-bodied, long-lived, long-distance migrants – all of which were found in spawning ready condition in the Mekong.
- The mainstream is particularly important as a spawning ground for large migrant species.



Key Findings

- 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.
- 98% of the small, short-lived, migrant species, such as Trey Riel species were spawning ready in the Mekong and one or more of the other rivers in the system.



Key Findings

- The Srepok is an important spawning location for a majority of the more sedentary species such as *Mystus* species.
- 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 (no availability of sandy banks, rock pools, leafy overhangs) compared with the habitat available further upstream



Mystus cf. wolffii



Srepok River near Stung Treng



Sekong River near Stung Treng

Conclusions

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.

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.

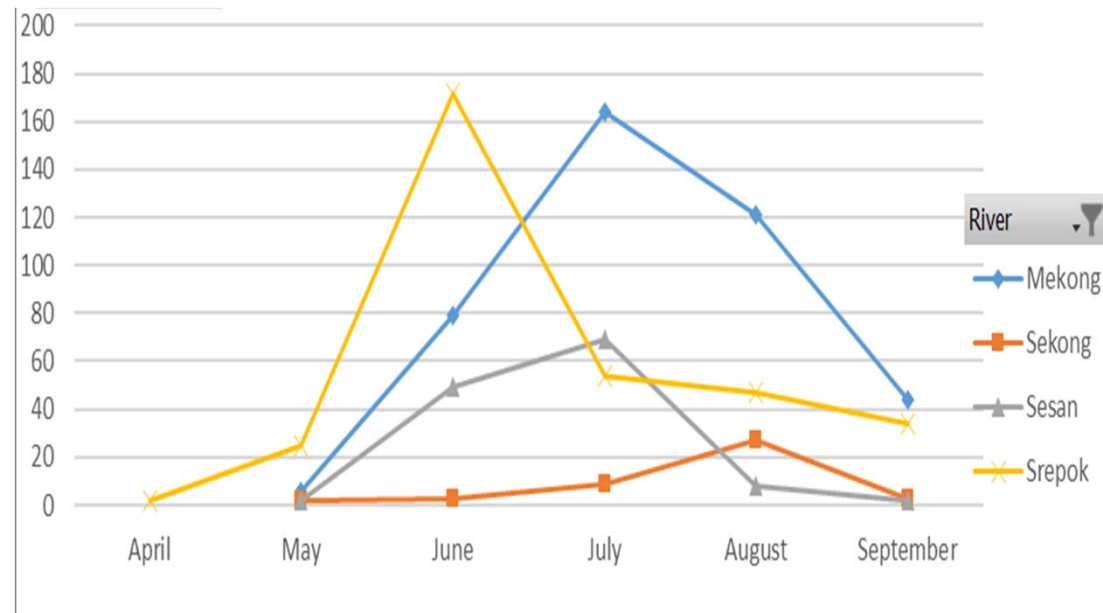
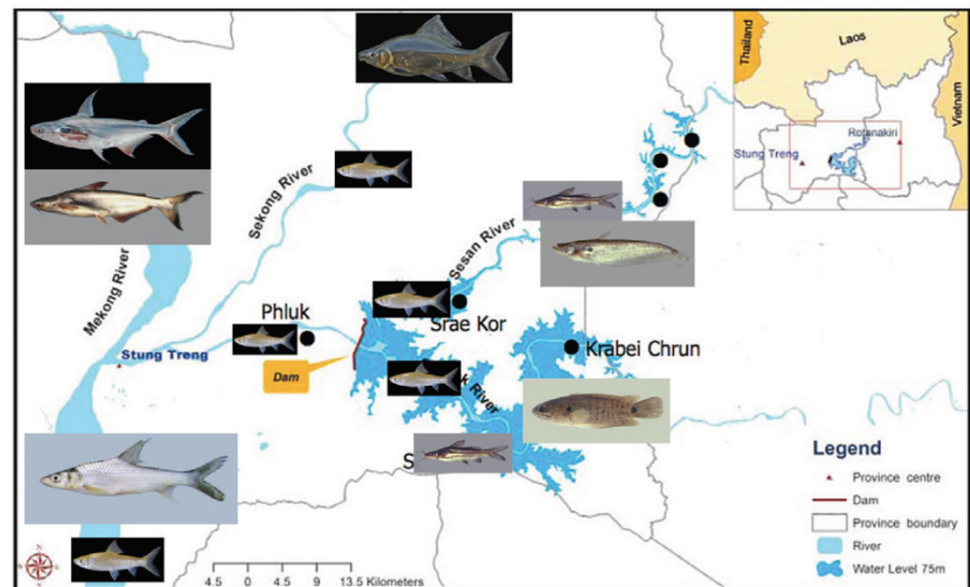


Figure 3: Seasonal pattern of spawning-ready female fish abundance by river.

Likely Impacts of development on spawning

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.

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



No successful solution exists to get larval and juvenile fish downstream of dams

Unless a satisfactory solution is developed those species trapped above dams, such as Lower Sesan 2, are likely to become isolated and may not survive the transition from running river to a reservoir.

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

Species diversity is important for maintenance of fish production particularly under changing climate conditions

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

Future

- Understanding the importance of river connectivity and monitoring dam impacts is key
- Important to determine which dams to build and which to avoid
- Important to understand how and for which species to mitigate dam impacts
- Continued work on fish pass design will be critical to mitigate the negative impacts of the Sesan 2 dam



Thank you for your attentions