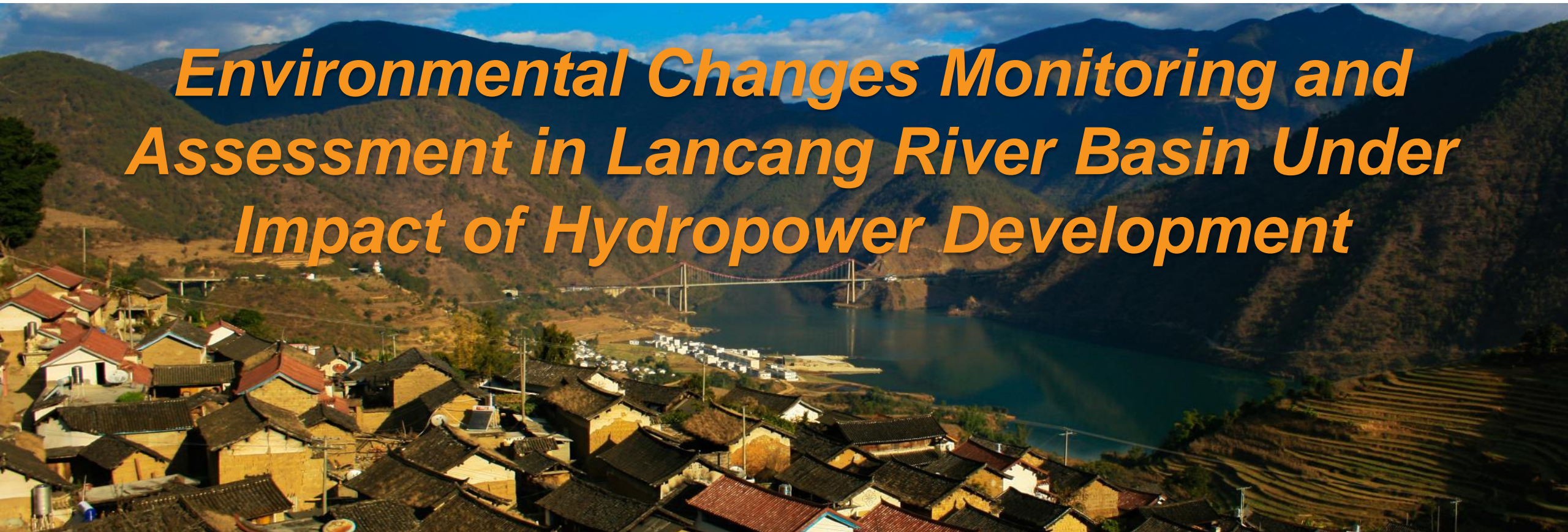


4th International Forum on Sustainable in Asia
4th NIES International Forum, Hanoi, Vietnam, Jan. 23-24, 2019



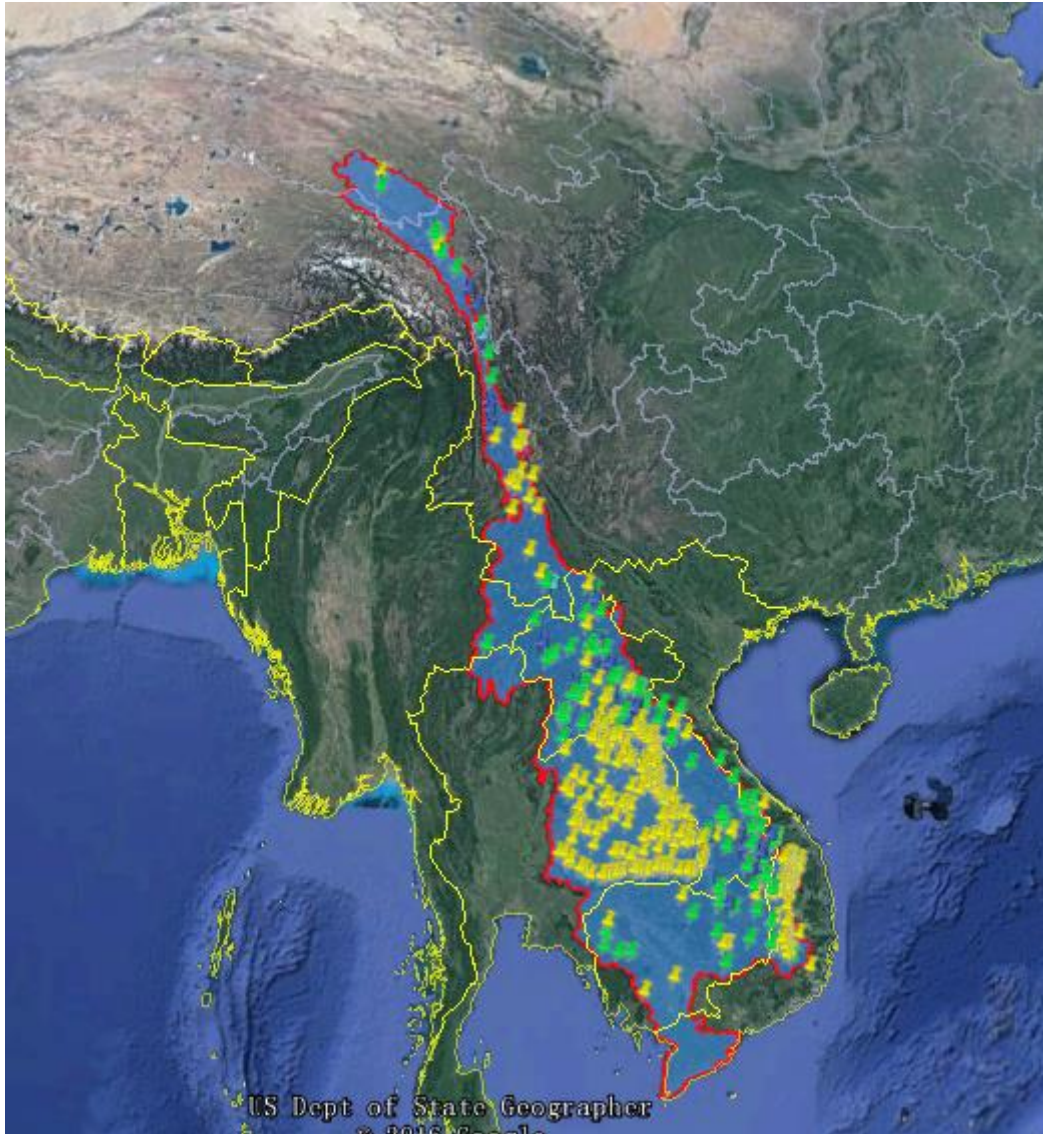
Environmental Changes Monitoring and Assessment in Lancang River Basin Under Impact of Hydropower Development



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Asian International Rivers Centre, Yunnan University
Yunnan Key Laboratory of International Rivers and Transboundary
Eco-Security, Kunming, China

Hydropower development in Lancang-Mekong River



- 367 hydropower plants were built or purposed along the river (power generation capacity > 15MW)
 - China accounts for about 54 percent of the total capacity, most of them located in Yunnan
-
- China 37
 - Myanmar 1
 - Laos 100
 - Cambodia 25
 - Thailand 150
 - Vietnam 54

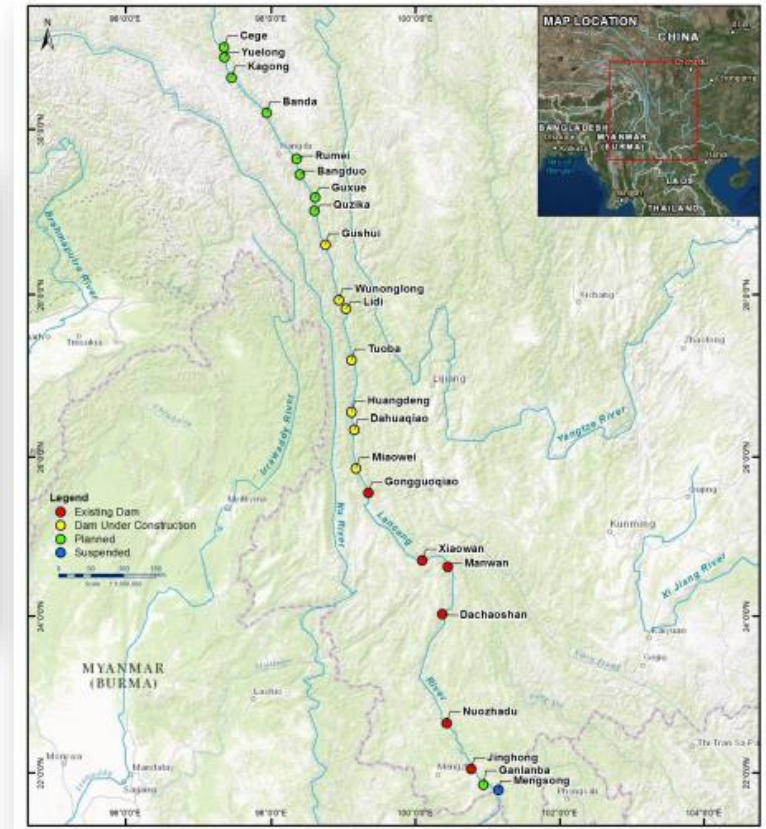
Timeline of the dam building in Lancang River

In Lower Lancang



Made by AIRC, 2015, more details in lancang-mekong.org

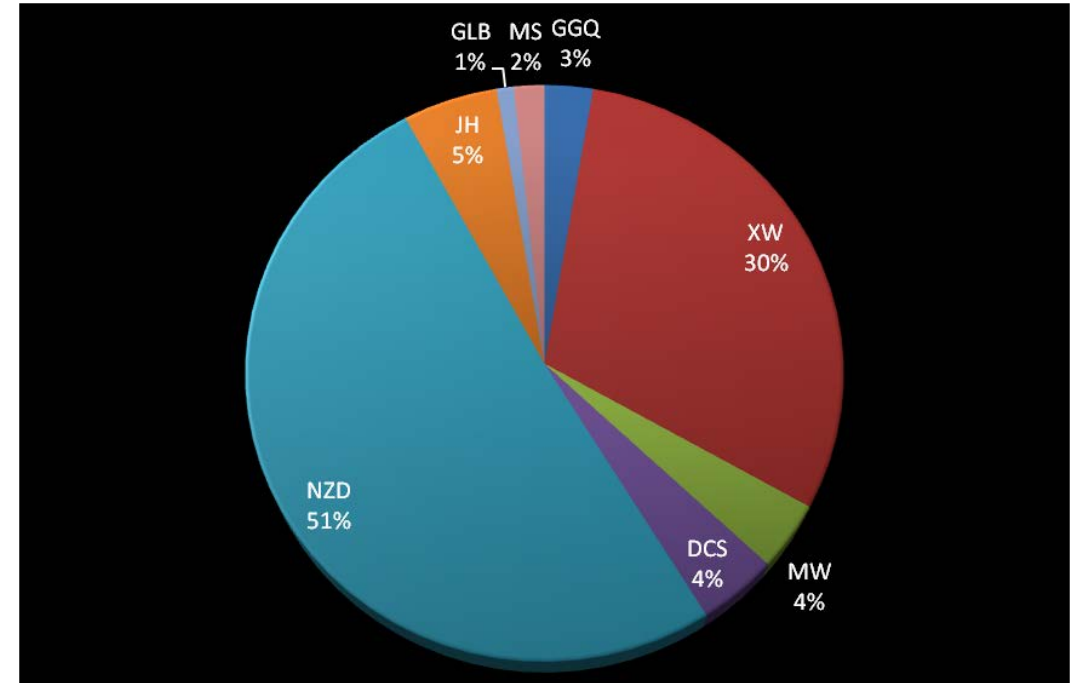
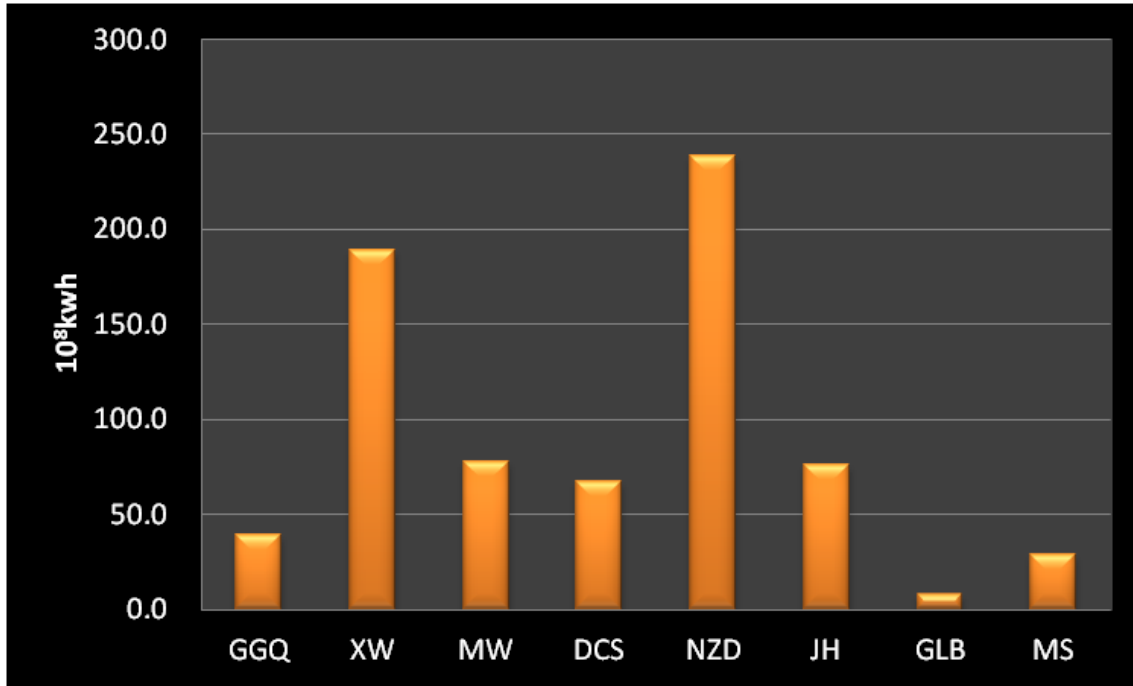
- Manwan dam is the first hydropower plants on mainstream which started to build in 1986
- We now in the middle and later period of dam building in Lancang



In Upper Lancang

- 15 dams are under construction

Annual electricity production & Reservoir fluctuating backwater area



- Nuozhadu and Xiaowan are the most productive HP
- Among the total reservoir backwater area, NZD and XW weight 80%

Huge-altered hydro-geomorphic view

Dramatic changes occur

40m

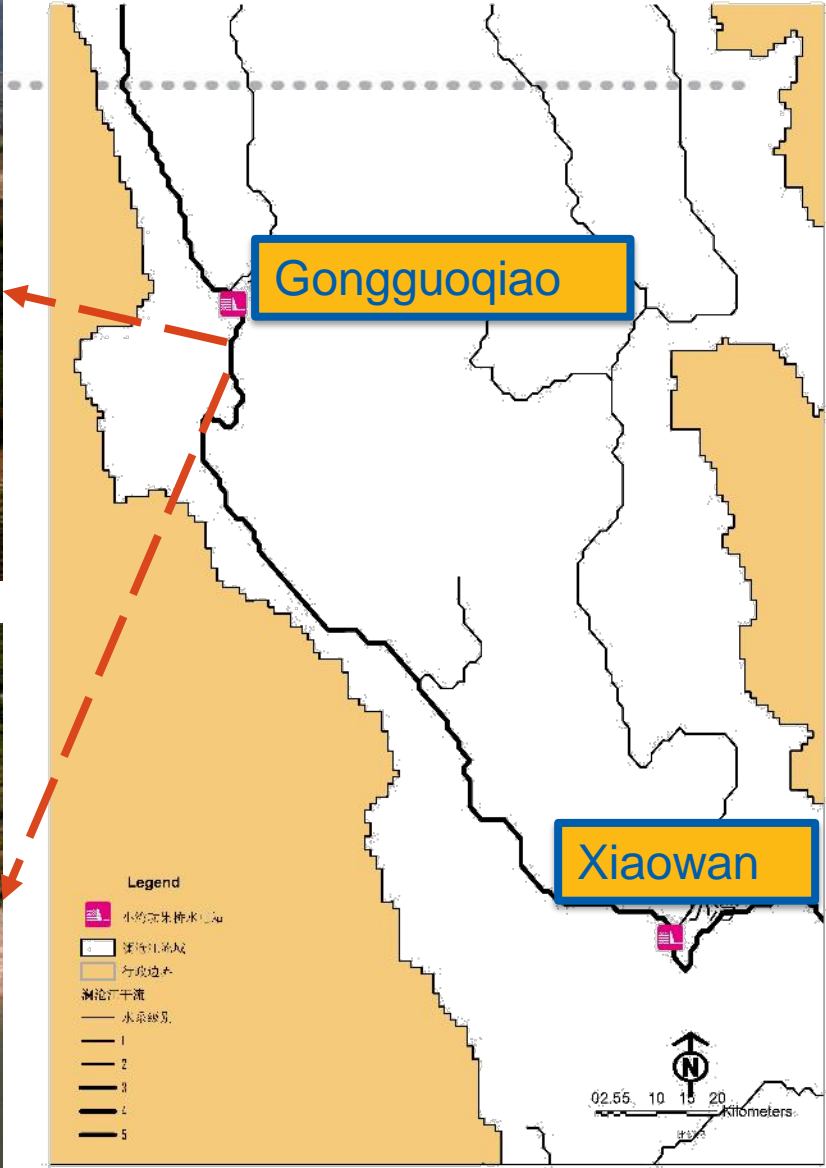
Upstream

40km

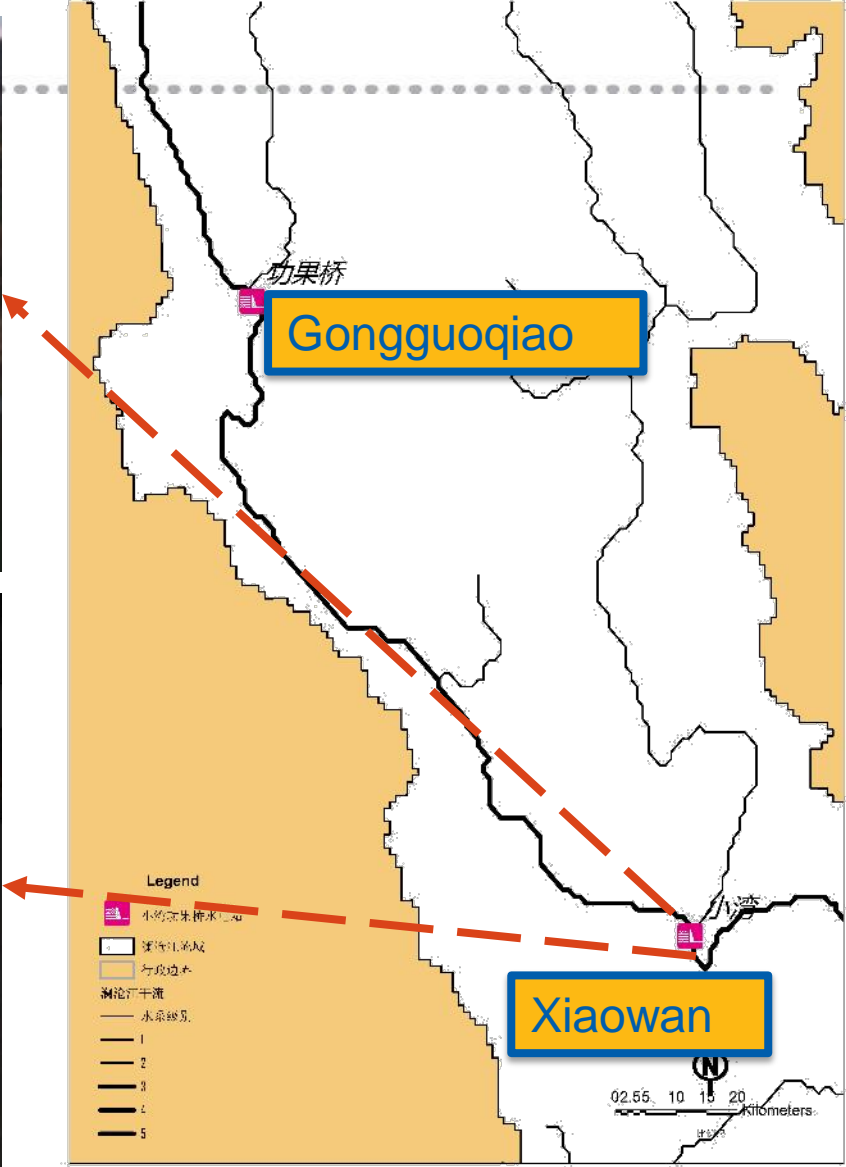
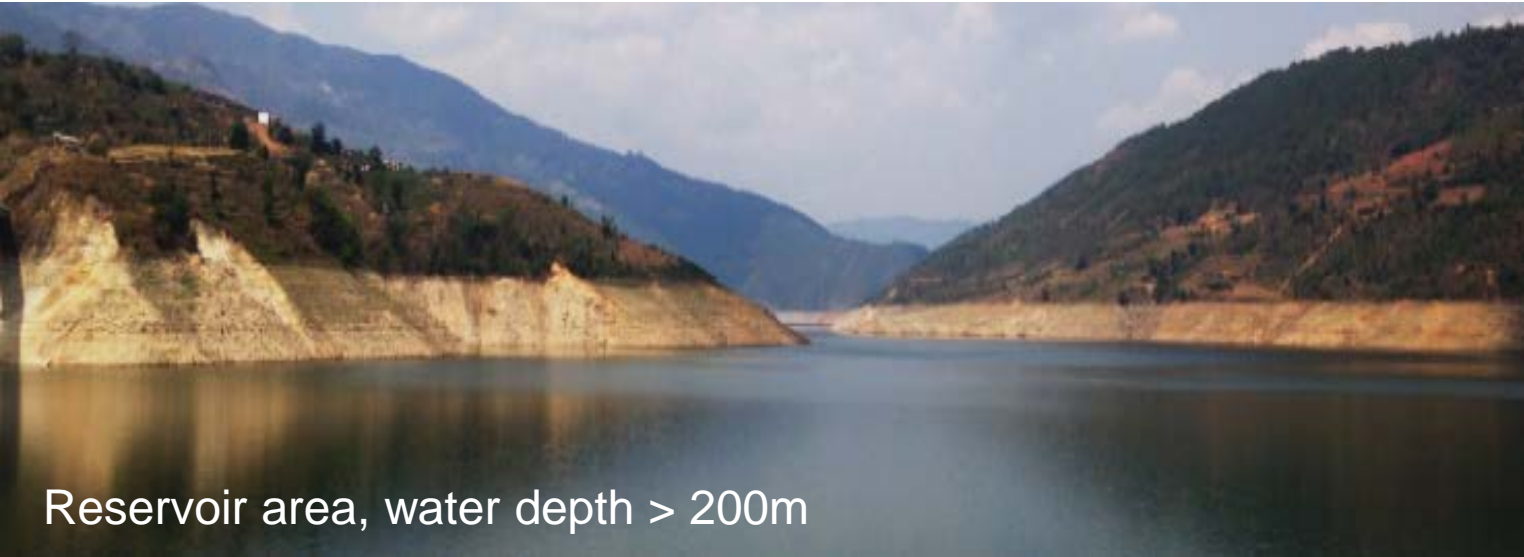
90m

Downstream

Photoed in Dec, 2018, Xiaowan reservoir

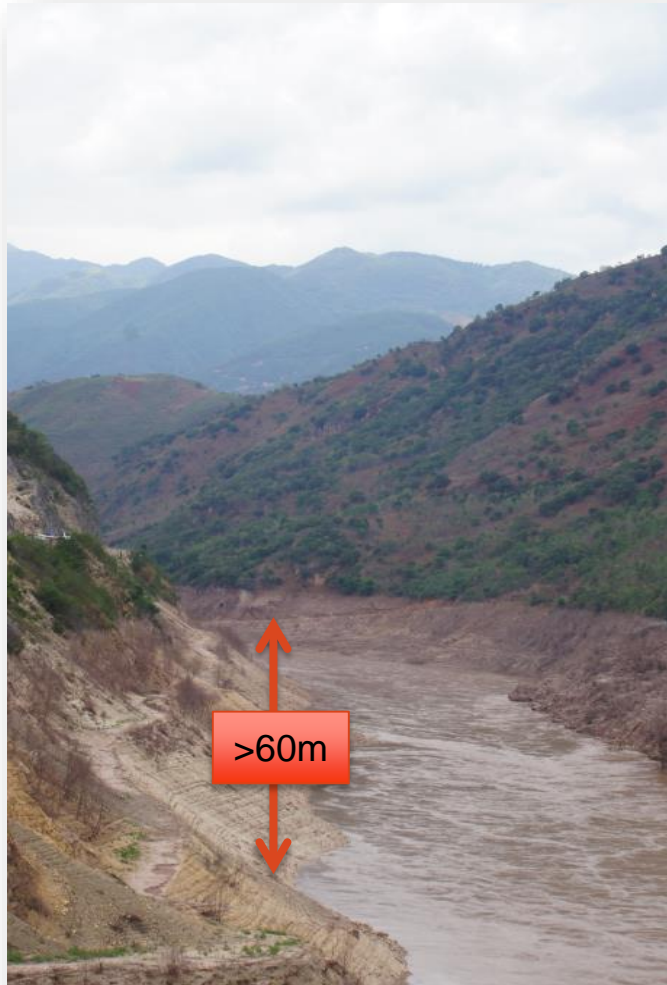


Huge-altered hydro-geomorphic view



1km

Water-level-fluctuating zone



Photoed in 28th may, 2018 Xiaowan reservoir



Photoed in 25th October, 2018 Xiaowan reservoir



Sand-less water below the dam



Photoed in Jan, 2018, Nuozhadu reservoir

- bamboo rafts along the river to extract the sand from the riverbed

Pollution stress



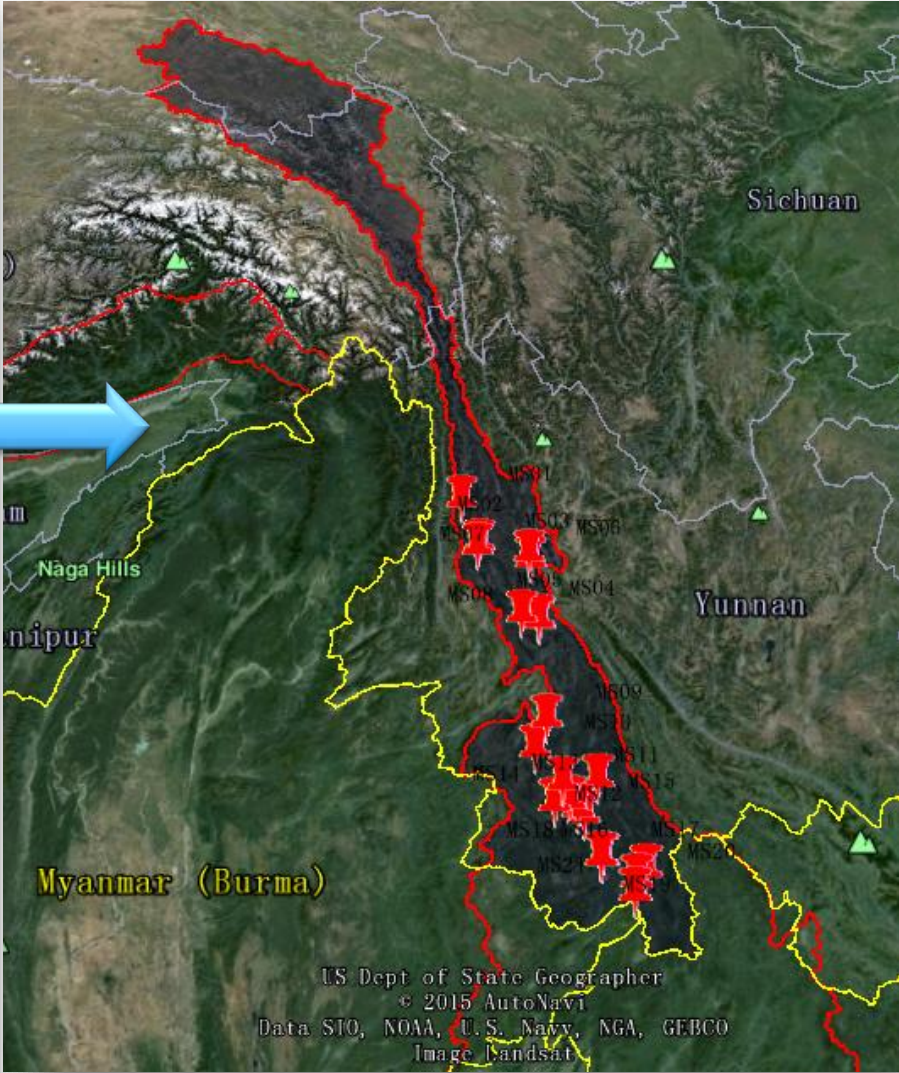
Photo'd in 14th October, 2014 Xiaowan reservoir

Pollution stress



Photo'd in 20th June, 2016 Xiaowan reservoir

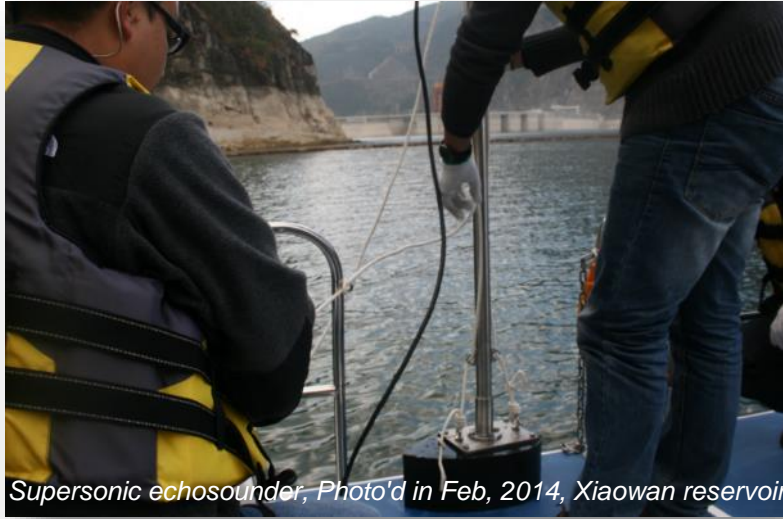
Aquatic monitoring on the Lancang River



- Under the support by NSF and HuaNeng Hydropower company, a research for building basin wide aquatic monitoring system were carried out since 2013.
- The purpose is to establish a framework for monitoring not only hydrological regime, but more focus on water quality and aquatic ecosystem responses.
- 21 sites were selected on the main stream and important tributaries, collecting nutrients, sediment, water temperature, harmful heavy metals in water and aquatic organism.

Field work in Lancang River

- Near dam underwater topographic survey



Water temperature monitoring, Photo'd in Jun, 2015



Water quality and sediment monitoring



Photoed in jun, 2015

Aquatic ecosystem survey



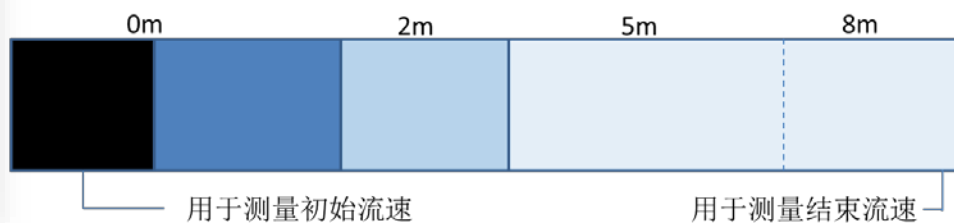
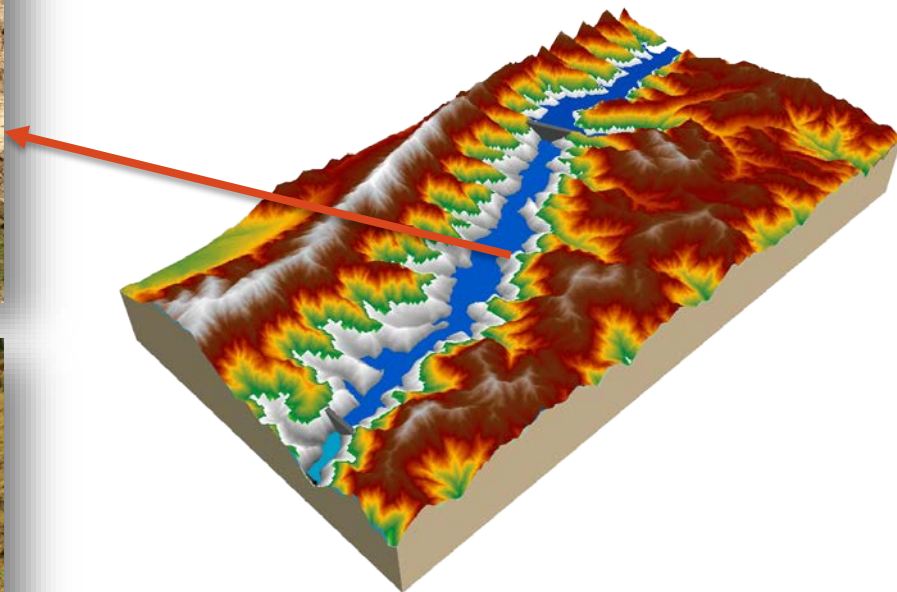
Endemic fish species investigation

Long term environment factors monitoring base

- Long term environment factors monitoring base

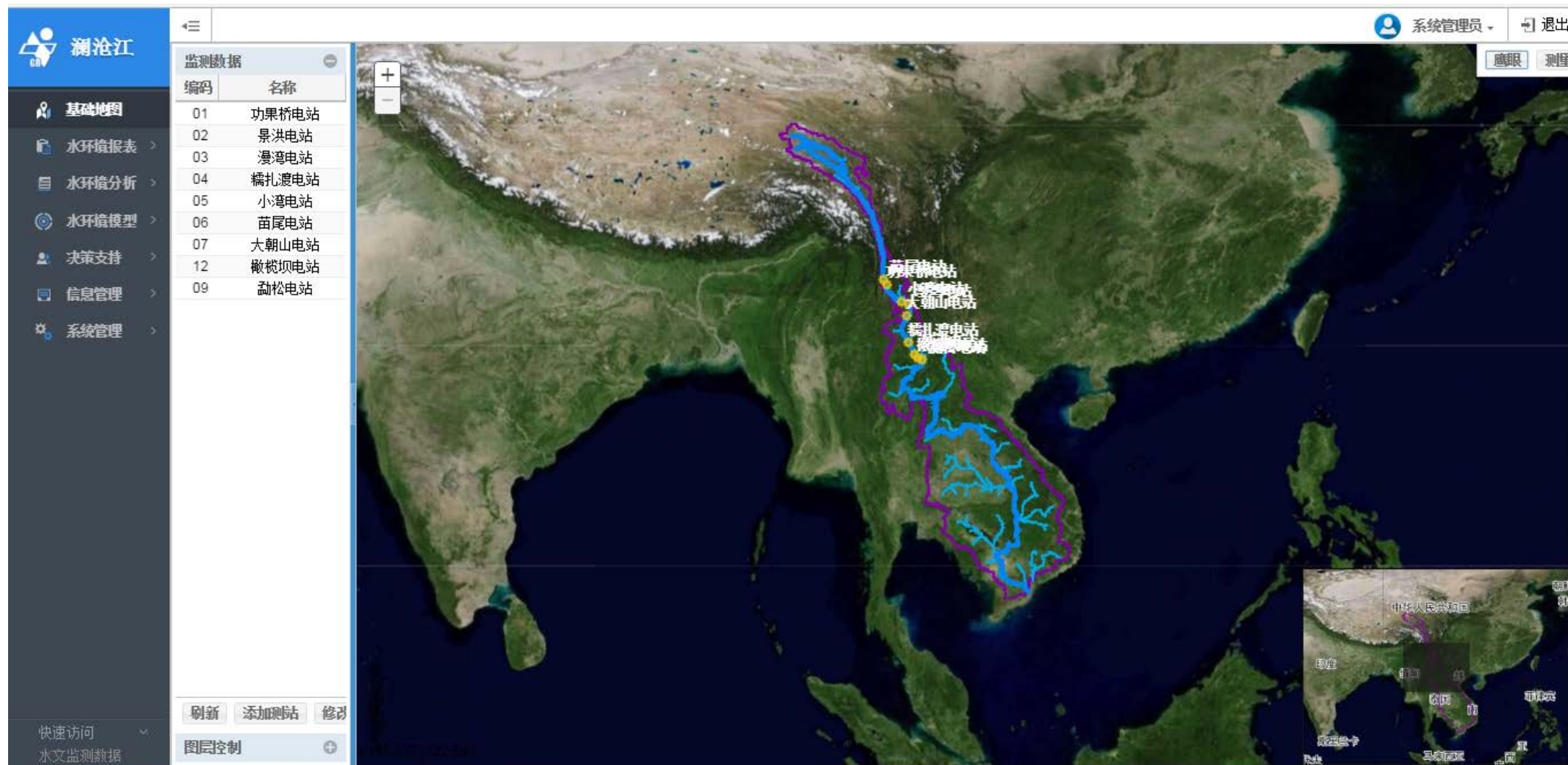


Water-level-fluctuating soil erosion research

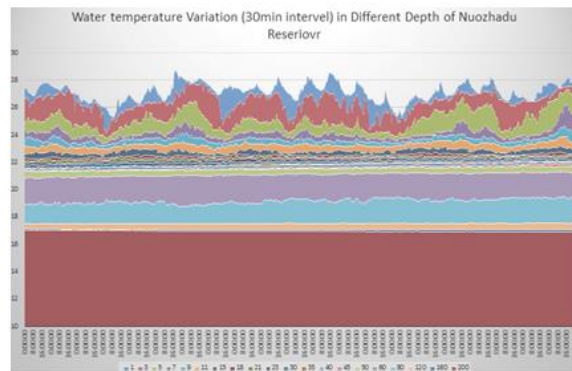
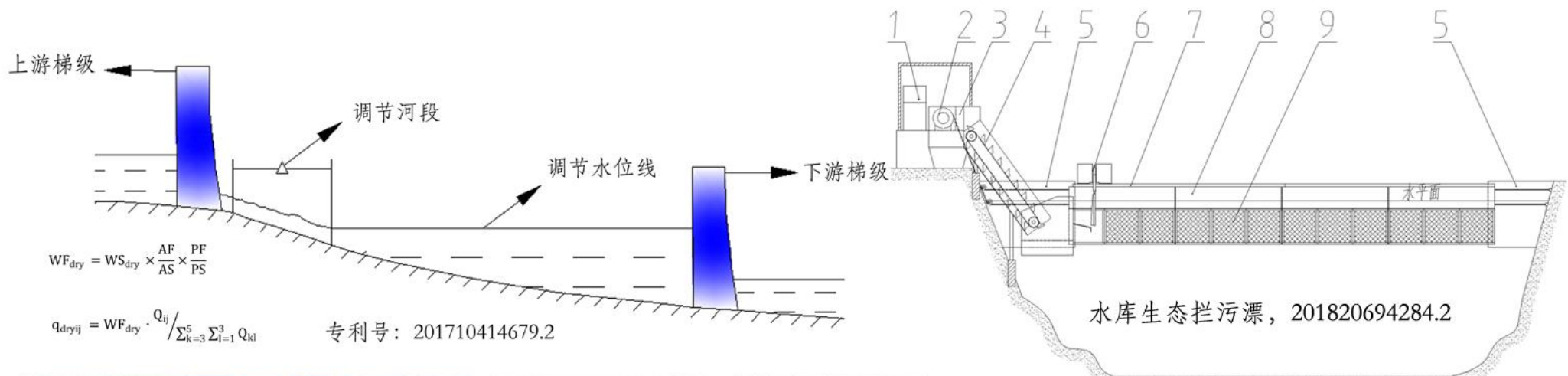


宽1m

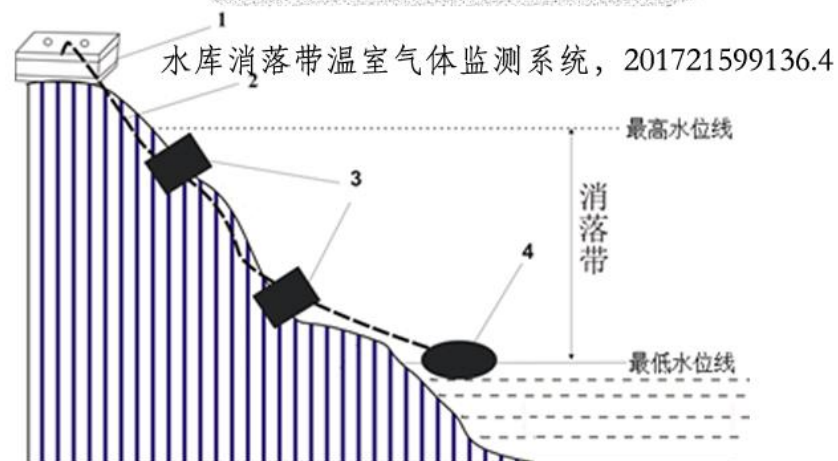
Water environment information data platform



Methods for better monitoring and reservoir regulation

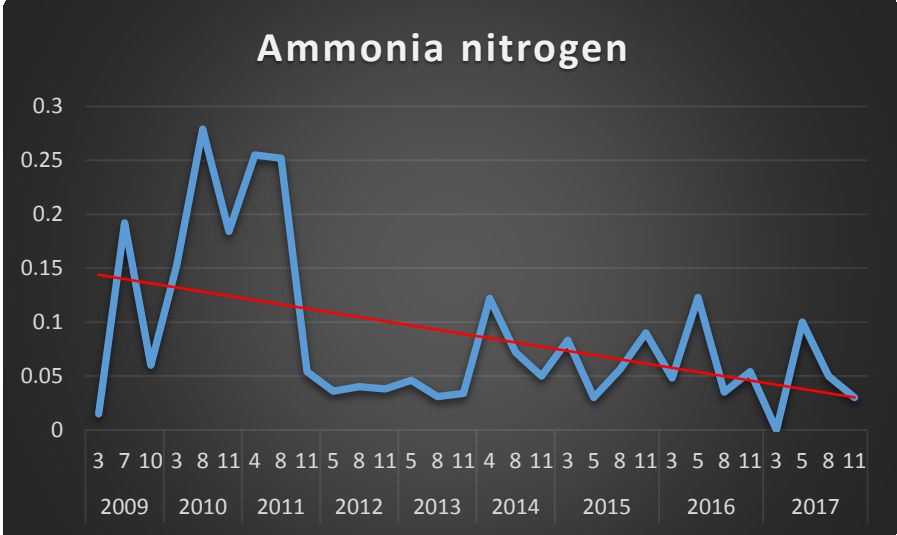
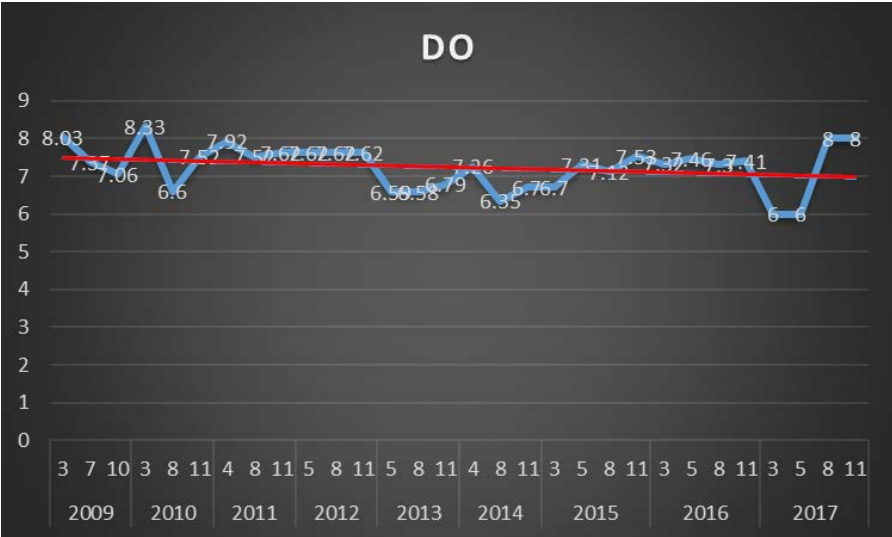
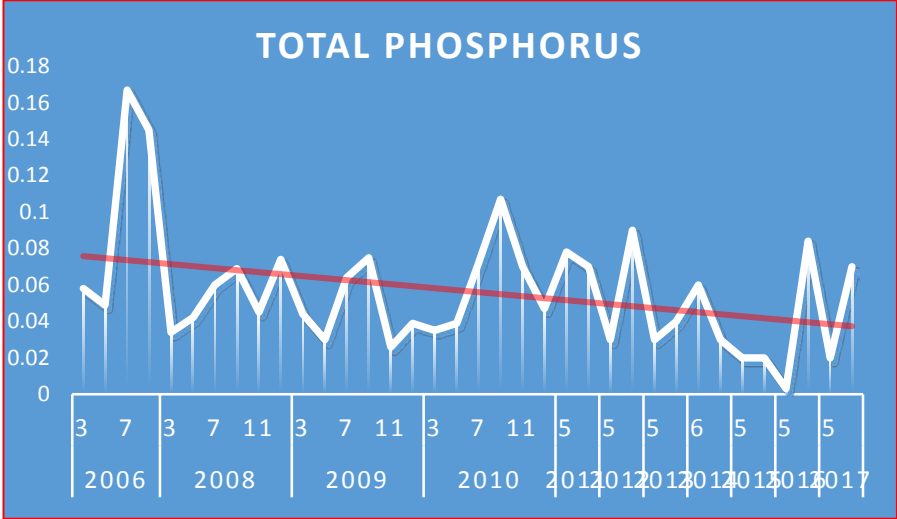


水温监测野外布置照片及其监测数据



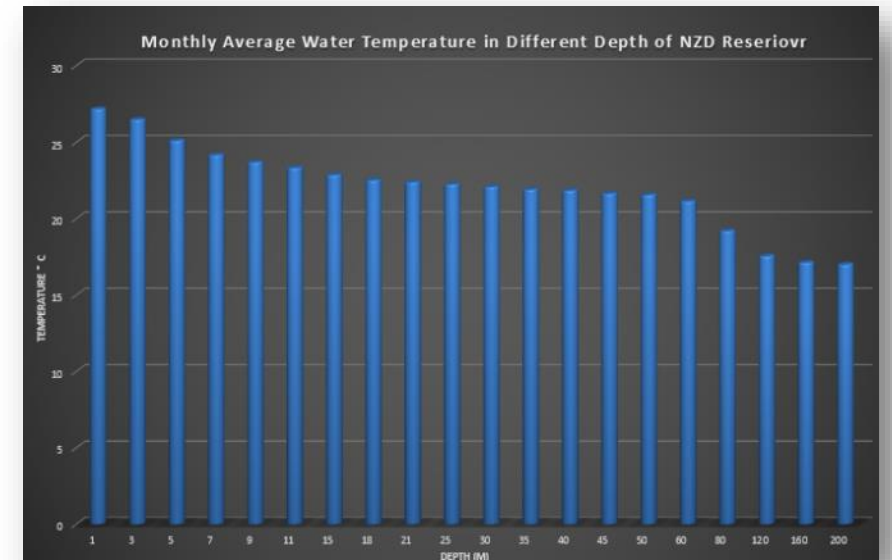
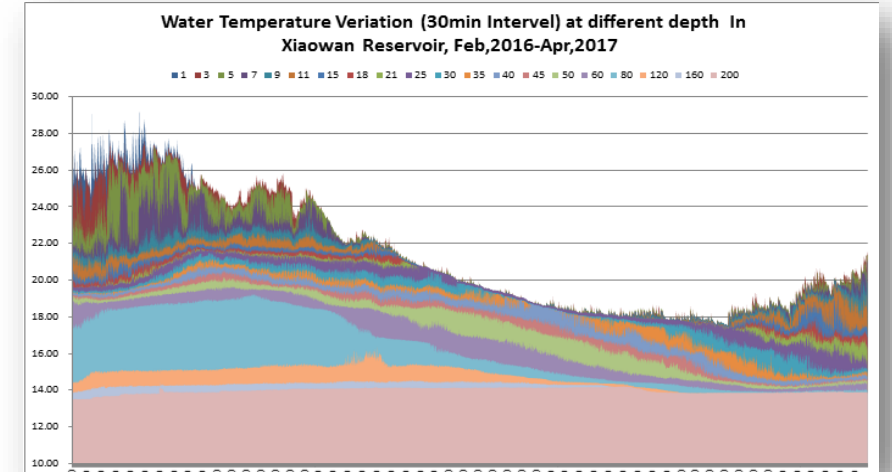
Effects on water quality

- The water quality of the main stream is gradually improved without obvious fluctuation;
- The water quality of some tributaries are facing the deterioration trend, especially on dry season.



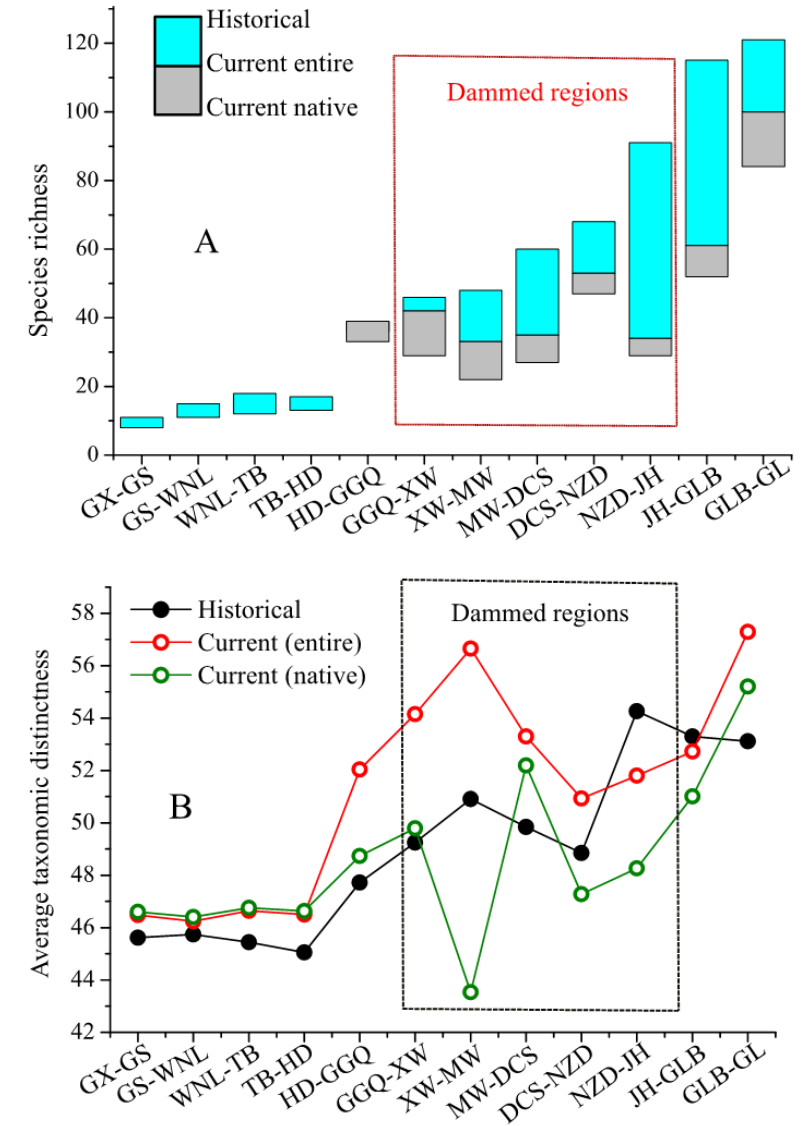
Effects on water temperature

- Water temperature affective area: 26~50 km from dam to downstream
- Affect time: September to next year March, influence peak occurs in January ($-9^{\circ}\text{C} \sim +2^{\circ}\text{C}$ compared to natural/historic)
- The water temperature among the dam outlet and natural section is close during the end of spring and the beginning of summer, and this is the critical time for endemic fishes to breed. In most dams of the lower Lancang, low-temperature water discharge exists, but has limited impact on the fish reproductive stages.

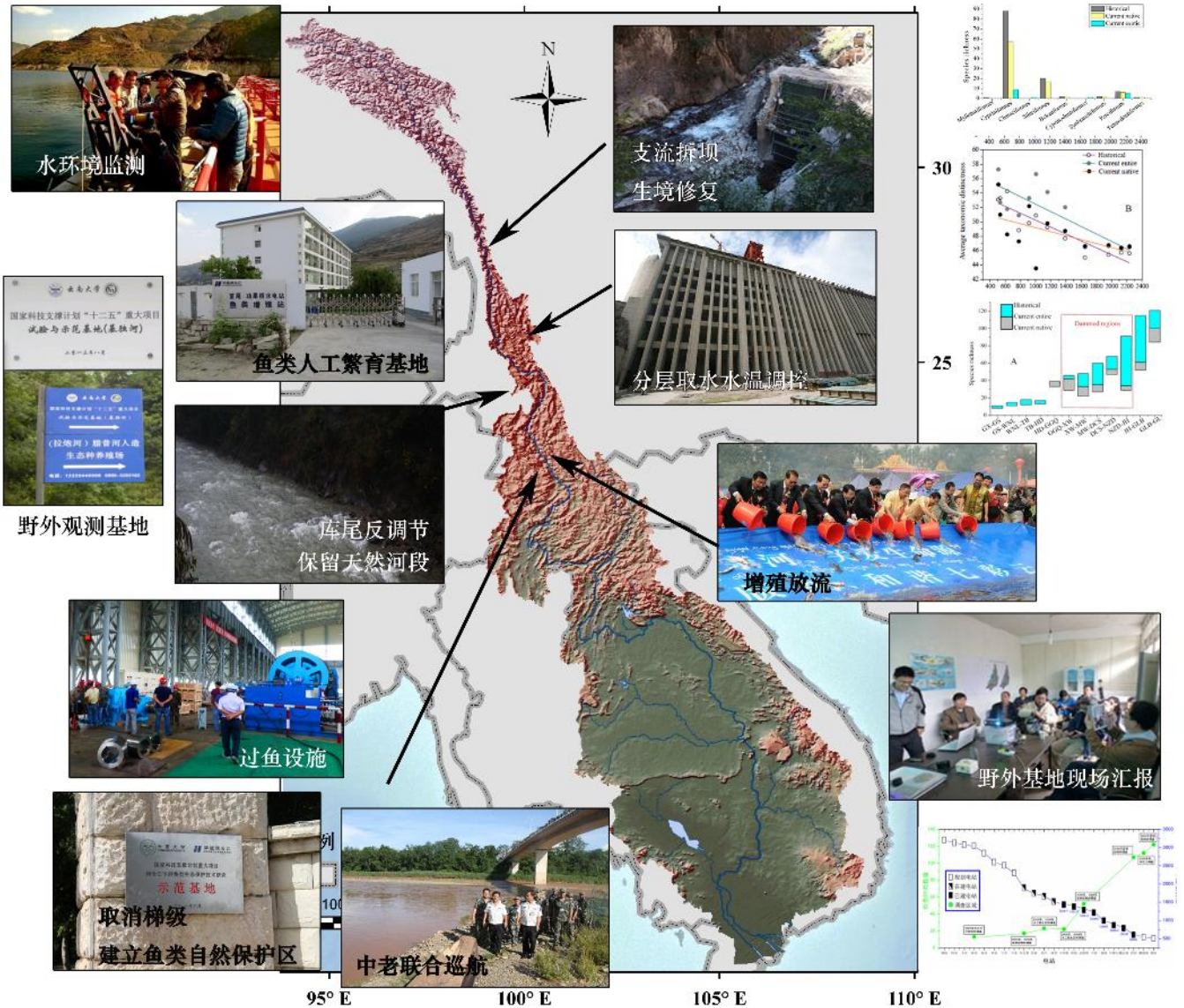
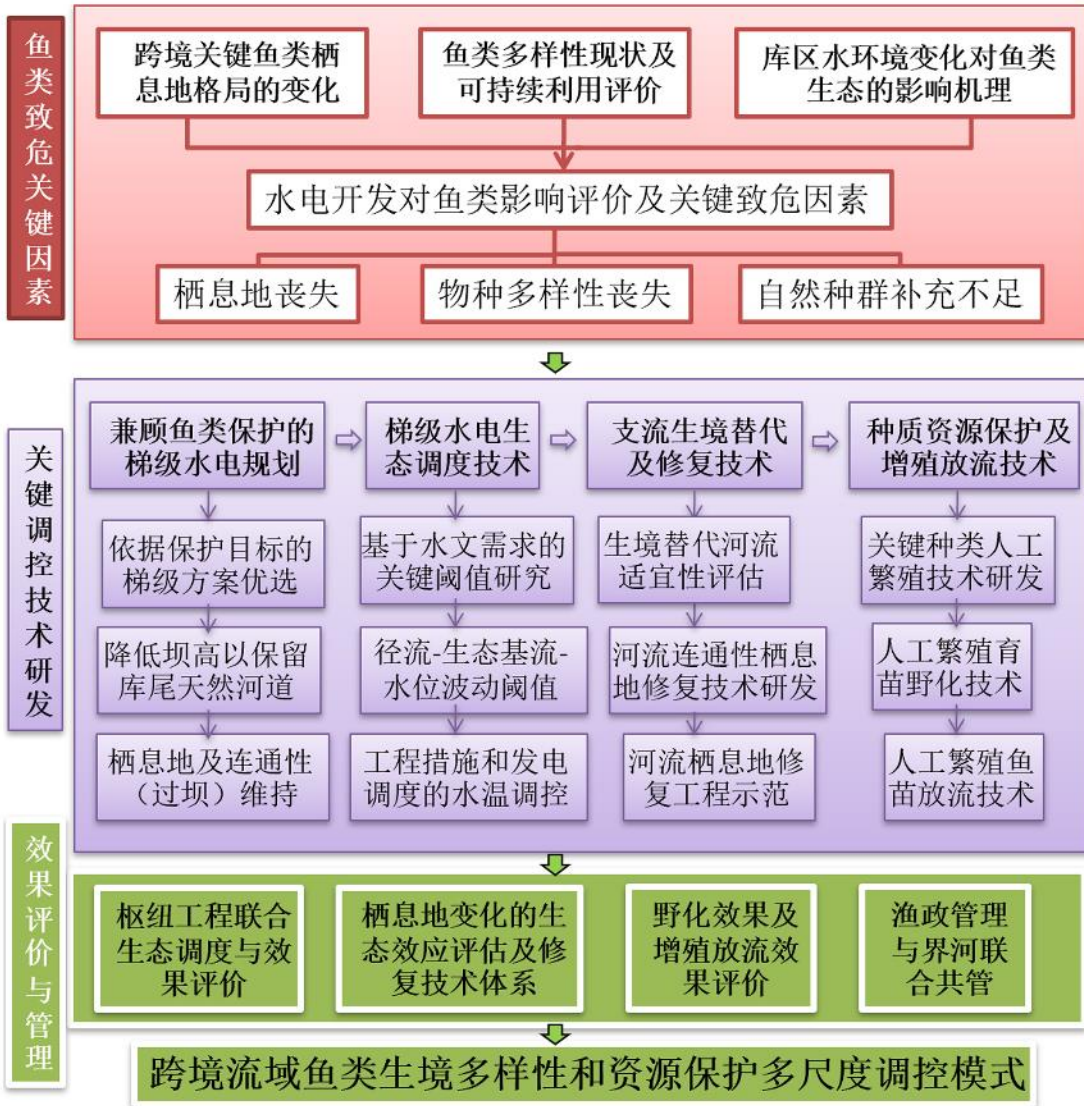


Effects on fish species richness

- The cascade development has posed a significant impact on the fish diversity in the cascade reach;
- In the last three decades (1990s-2018), the fish species in the Lancang River Basin declined from 162 to 113, 49 native species were extinct;
- 21 non-native species had become established in the LCR;
- The proportion of the loss of fish species in the exit section of LCR will be much lower than that of the cascade development section. The species decreased from 121 to 84, with a reduction rate of 31%.



Solution for Fish Diversity Conservation





THANKS!

