

# Wonders of the Mekong

Using Science and Education to Promote Informed Management of the Most Important River on Earth



#Mekong Wonders, Check us out on Facebook and youtube`



# WONDERS OF THE MEKONG A FOUNDATION FOR SUSTAINABLE DEVELOPMENT AND RESILIENCE

The Wonders of the Mekong project will conduct applied research, build capacity, outreach and communications products to highlight the economic, ecological, and values of biodiversity and ecosystem services associated with the Lower Mekong outputs and resulting products, developed as an integrated package, will lead to be protection of a vibrant and healthy Lower Mekong system.

## WHY THE LOWER MEKONG RIVER BASIN?

Biodiversity hotspot, the Mekong is the most productive river on Earth, supporting millions of people. From the tributary headwaters to the fertile delta and "rice bowl" of the Mekong supports almost 1000 species of freshwater fish, including the giant Mekong catfish, flood plains and flooded forests that support a variety of wildlife, including the Asian elephant, the Asian rhinoceros, and the Asian wild dog.



The poster features a background image of several long wooden boats on a wide river at sunset or sunrise, with silhouettes of people in the boats. The text is overlaid on this image. At the top, there are logos for USAID, the Royal Government of Cambodia, the University of Nevada-Reno, and the National Science Teachers Association. The title is in both Khmer and English. Below the title, it says 'Project Launch' and provides details about the event location, time, and dress code. A paragraph at the bottom describes the project's goals and the speakers.

**USAID** FROM THE AMERICAN PEOPLE

**ROYAL GOVERNMENT OF CAMBODIA**

**UNIVERSITY OF NEVADA-RENO**

**NATIONAL SCIENCE TEACHERS ASSOCIATION**

**វេទនាភាពនៃទន្លេមេគង្គ**  
**Wonders of the Mekong**

**Project Launch**

Raffles Hotel Le Royal, Phnom Penh, Cambodia  
February 7, 2017 3-5pm (please arrive at 2:45pm)

Dress: Business Casual

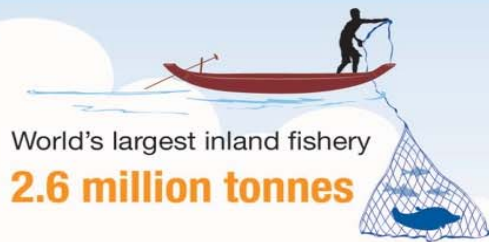
A new project highlighting the incredible benefits of the Mekong River to the countries through which it flows will be launched by the U.S. Agency for International Development, the Royal Government of Cambodia, and the University of Nevada-Reno at the Raffles Le Royal Hotel at 3:00 p.m. on February 7, 2017. USAID's Mission Director Polly Dunford, Secretary of State for the Ministry of Agriculture, Forestry and Fisheries His Excellency Nao Thouk, and National Geographic Fellow Dr. Zeb Hogan will provide remarks at the Wonders of the Mekong launch.



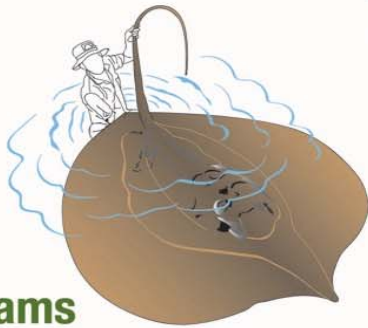
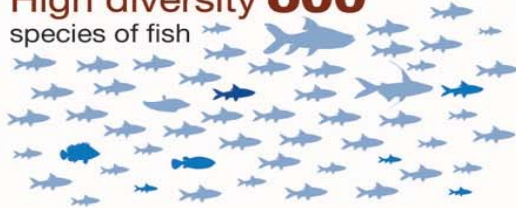


# THE AMAZING FISH AND FISHERIES OF THE MEKONG RIVER

Sustainable Fisheries and Healthy Rivers Provide for People and Protect Biodiversity



High diversity **800+**  
species of fish



Up to  
**300 kilograms**

The Mekong is home to many species of giant fish, including the current world record holder for largest freshwater fish on Earth



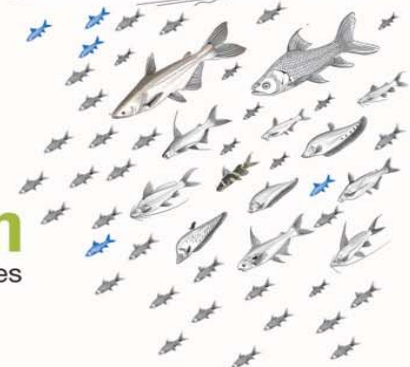
Past civilizations depended on wildlife, rice, and fisheries. Today, the Tonle Sap Lake remains the "beating heart" of Cambodia.



Booming aquaculture in  
Vietnam Mekong Delta  
export to over

**100**  
countries globally

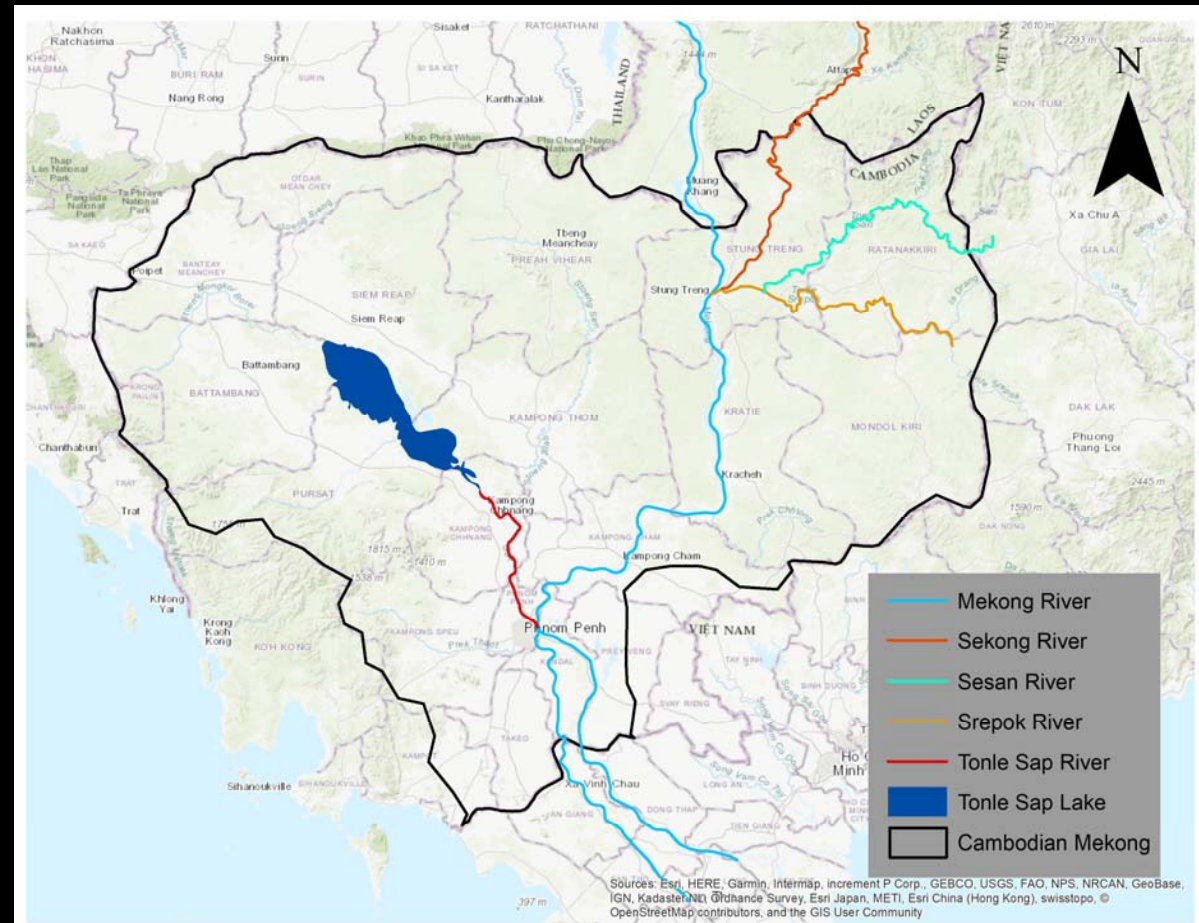
The Tonle Sap River is a migration  
corridor for billions of fish.  
**30 - 70%**  
of Mekong fish are migratory



**\$11 billion**  
value of Mekong fisheries



Wonders of the Mekong focuses on the many values of a healthy, connected Mekong River, and especially the Sekong, Mekong, Tonle Sap corridor – an area of immense economic, ecological, and cultural value.







Wonders of the  
Mekong Component 1:  
Applied Research

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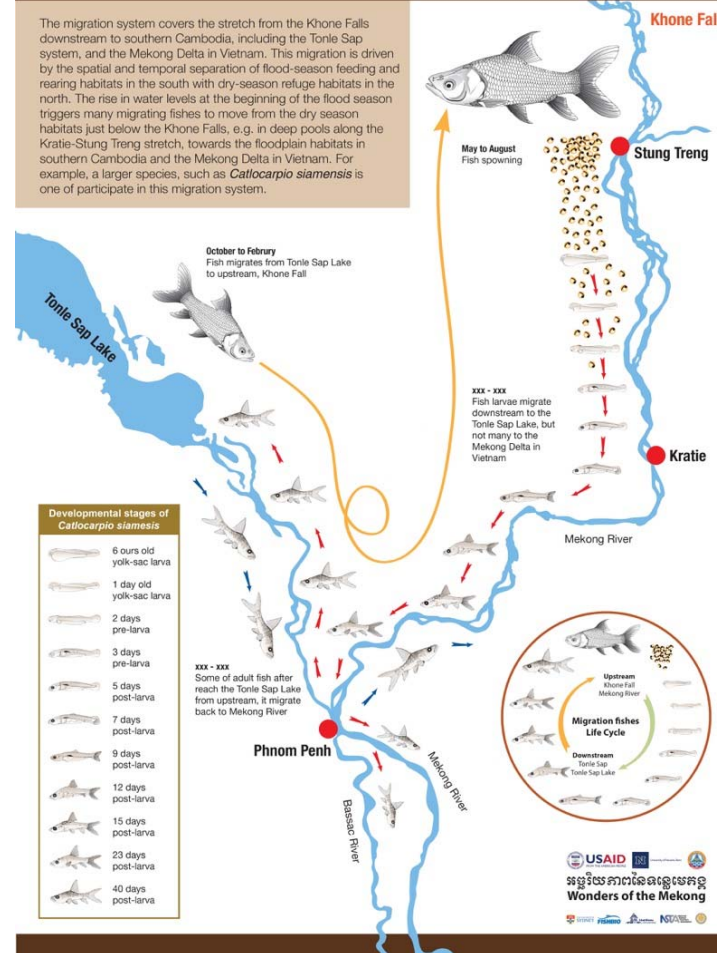
# 2019 Research Highlights

Free-flowing rivers / fish  
migration

Biodiversity of fishes and illegal  
fishing

## The Lower Mekong Migration System

The migration system covers the stretch from the Khone Falls downstream to southern Cambodia, including the Tonle Sap system, and the Mekong Delta in Vietnam. This migration is driven by the spatial and temporal separation of flood-season feeding and rearing habitats in the south with dry-season refuge habitats in the north. The rise in water levels at the beginning of the flood season triggers many migrating fishes to move from the dry season habitats just below the Khone Falls, e.g. in deep pools along the Kratie-Stung Treng stretch, towards the floodplain habitats in southern Cambodia and the Mekong Delta in Vietnam. For example, a larger species, such as *Catlocarpio siamensis* is one of participate in this migration system.





# Mapping the world's free-flowing rivers

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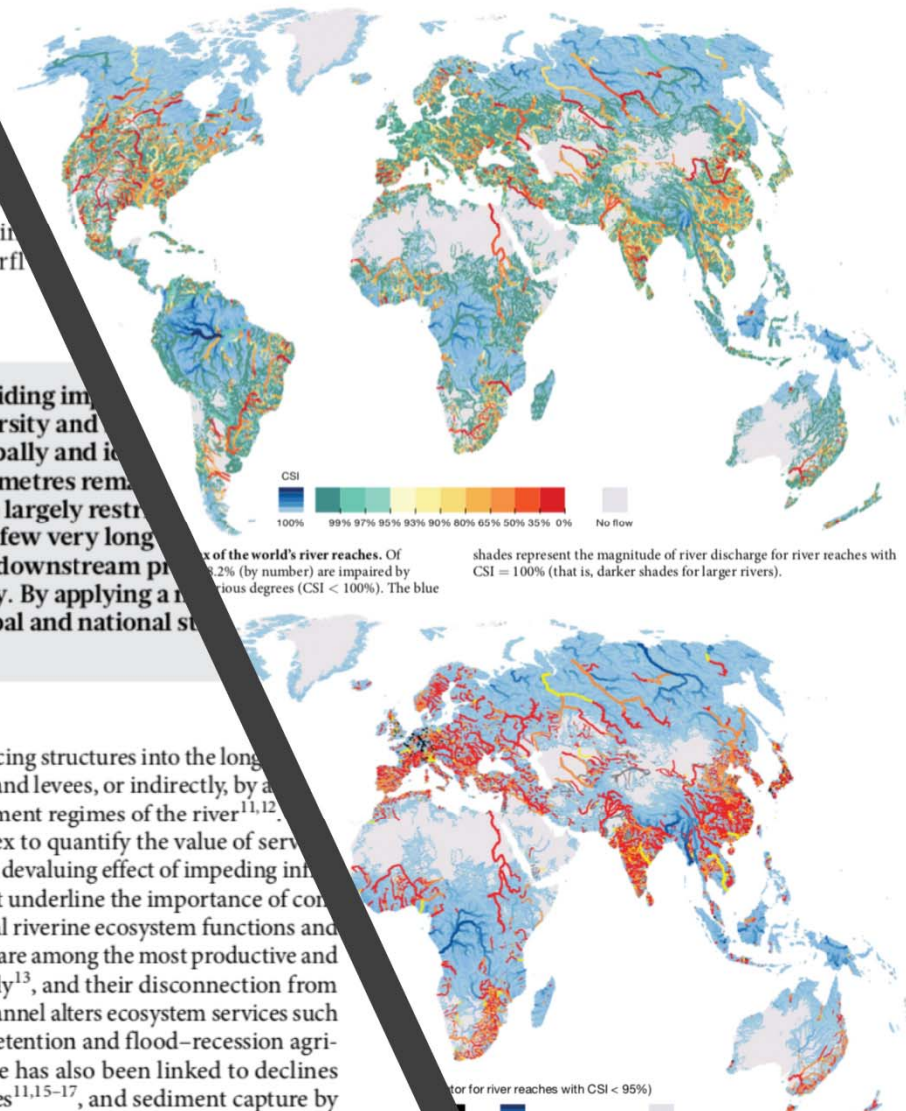
## Free-flowing Rivers and Fish Migration

- Wonders of the Mekong research on the status and importance of free-flowing rivers has been integrated into global studies, which have then been used to show that solar and wind are viable alternatives to hydropower to protect tropical rivers fisheries and biodiversity

Rivers are essential sources of environmental health, economic wealth and human well-being. For millennia, rivers have provided food, contributed water for domestic use and agriculture, sustained transportation corridors and, more recently, enabled power generation and industrial production<sup>1</sup>. These goods and services generally require built infrastructure, and society has addressed this demand by constructing an estimated 2.8 million dams (with reservoir areas  $> 10^3 \text{ m}^2$ ), regulating and creating over 500,000 km of rivers and canals for navigation and transport<sup>3,4</sup> and building irrigation and water-diversion schemes. As a result, rivers are exposed to sustained pressure from fragmentation and loss of river connectivity, constraining their capacity to flow unimpeded, affecting many fundamental processes and functions characteristic of healthy rivers<sup>5</sup> and leading to the rapid decline of biodiversity

multiple ways, either directly, by placing structures into the long or lateral flow paths, such as dams and levees, or indirectly, by altering the hydrological, thermal and sediment regimes of the river<sup>11,12</sup>.

Although it is inherently complex to quantify the value of services provided by FFRs or to measure the devaluing effect of impeding infrastructure, many examples exist that underline the importance of connectivity for the provision of natural riverine ecosystem functions and processes. For instance, floodplains are among the most productive and diverse riverine ecosystems globally<sup>13</sup>, and their disconnection from the upstream catchment or river channel alters ecosystem services such as natural flood storage, nutrient retention and flood-recession agriculture<sup>14</sup>. Built river infrastructure has also been linked to declines in terrestrial and freshwater species<sup>11,15–17</sup>, and sediment capture by





# Predictive statistical modeling of forest-cover change in the Lower Mekong Basin

Forest loss in the Lower Mekong basin is directly related to the development of dams and road networks -> need for proper planning and development to minimize landscape impacts from development

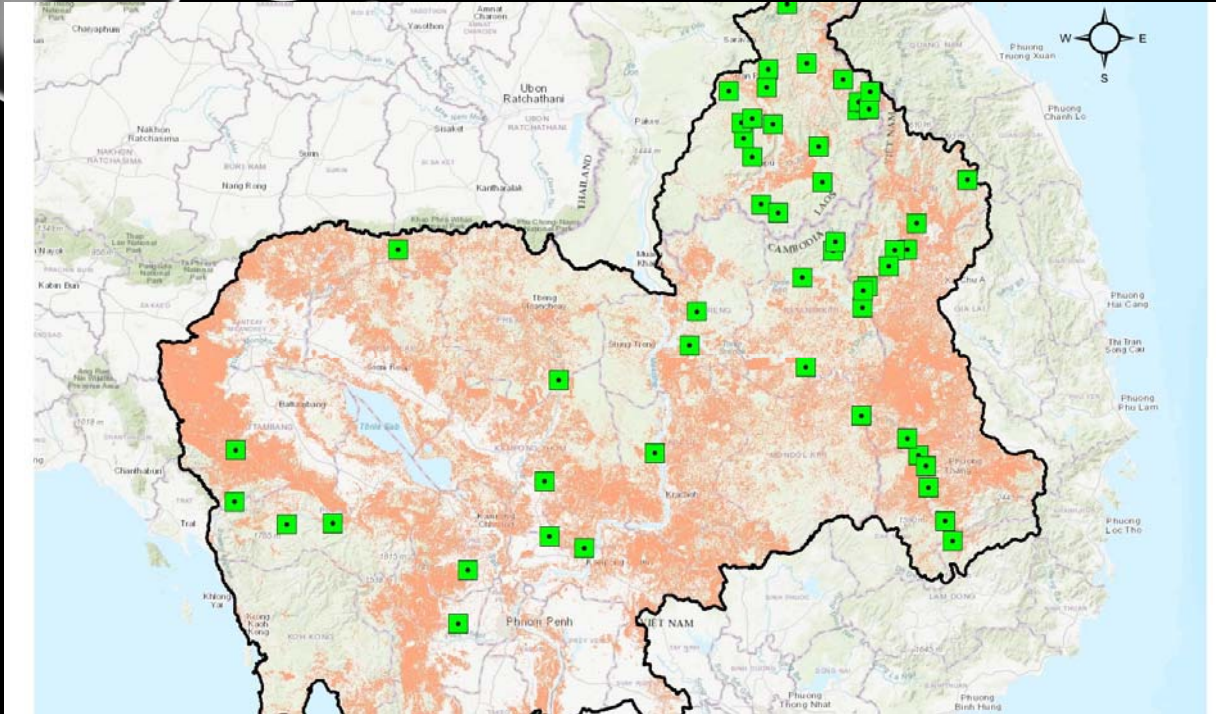
**SAID**  
THE AMERICAN PEOPLE



**អង្គការភាពធនធានធម្មជាតិ  
Wonders of the Mekong**

A Foundation for Sustainable Development and Resilience

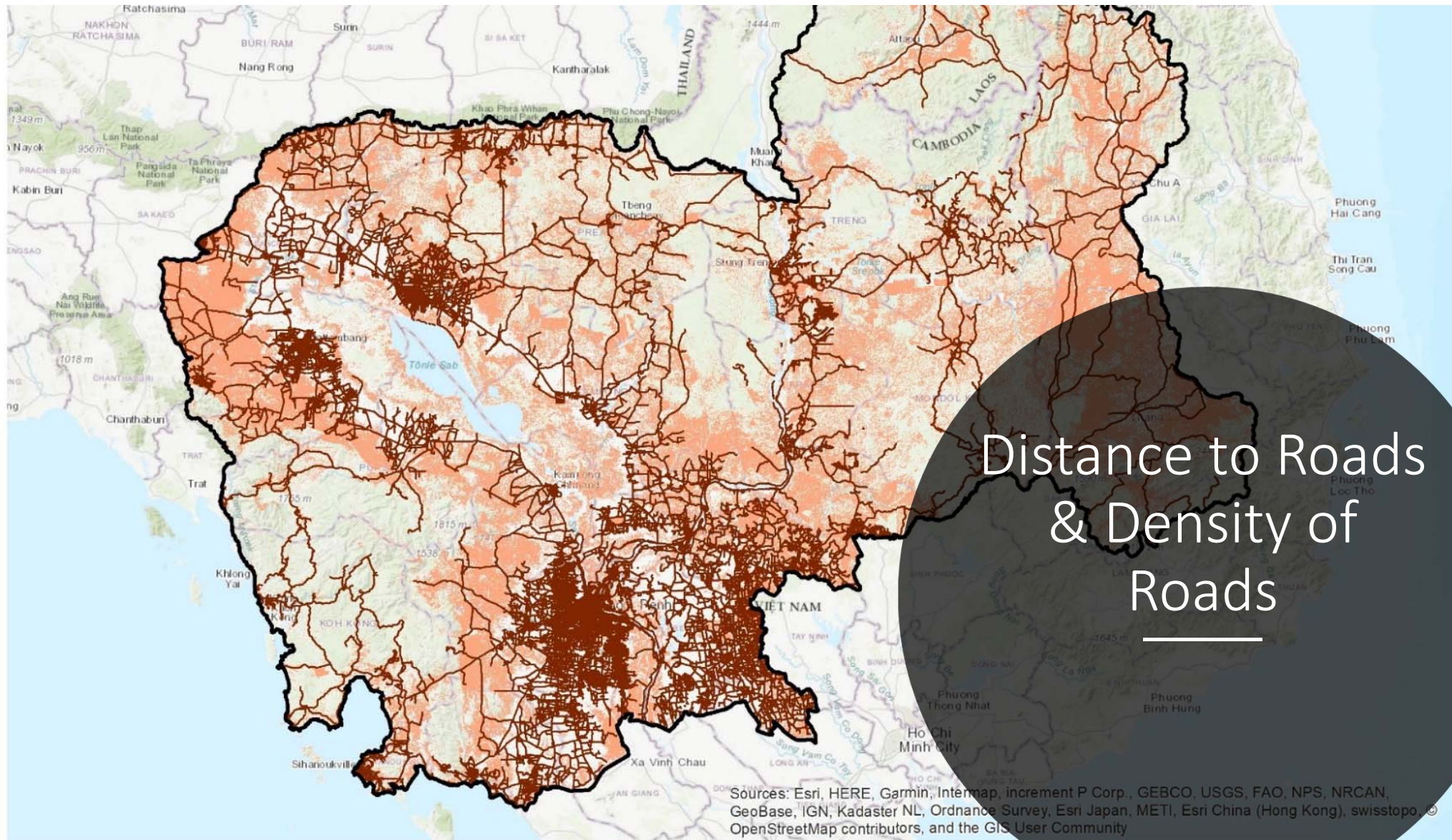


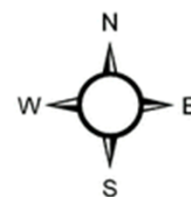
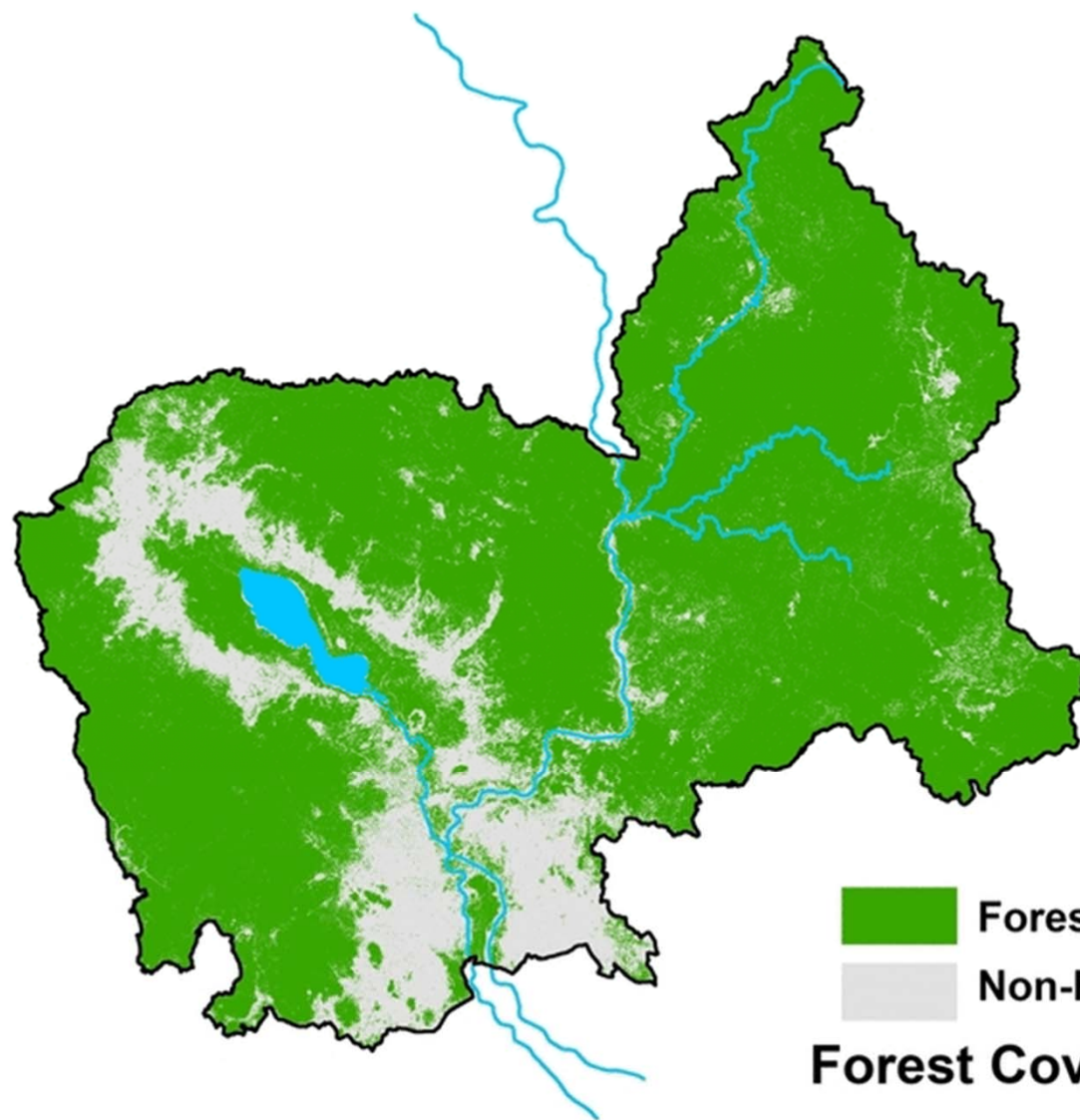


## Distance to Hydropower Dams

- 54 hydropower dams
- Threats:
  - Fragment rivers
  - Disrupt seasonal water cycle
  - Inundate
  - Reduce species habitat
  - Retain sediment and nutrient retention in dam reservoirs





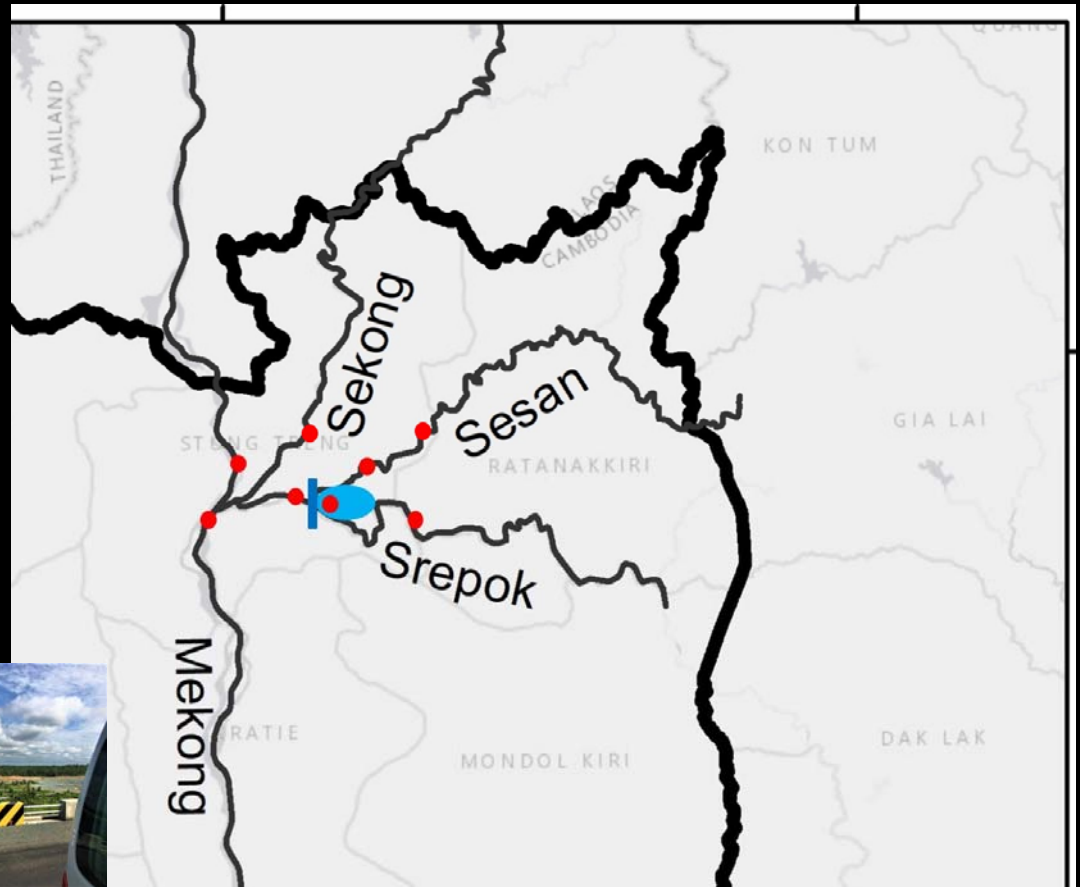


 Forest  
 Non-Forest  
**Forest Cover 1988**

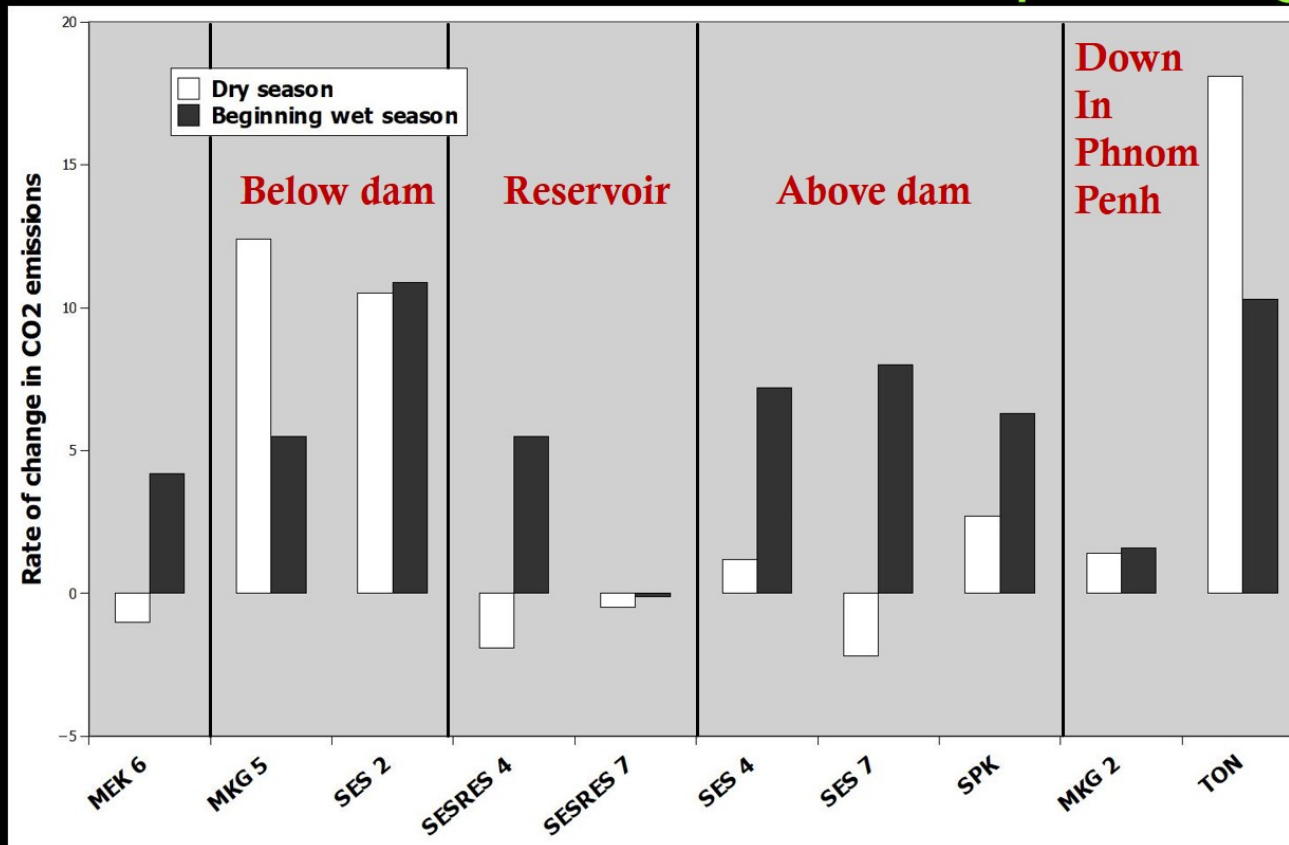


# Quantifying Sesan 2 Dam impacts to river water quality

- Water Quality
- Sediment particle size
- Nutrients
- Gases

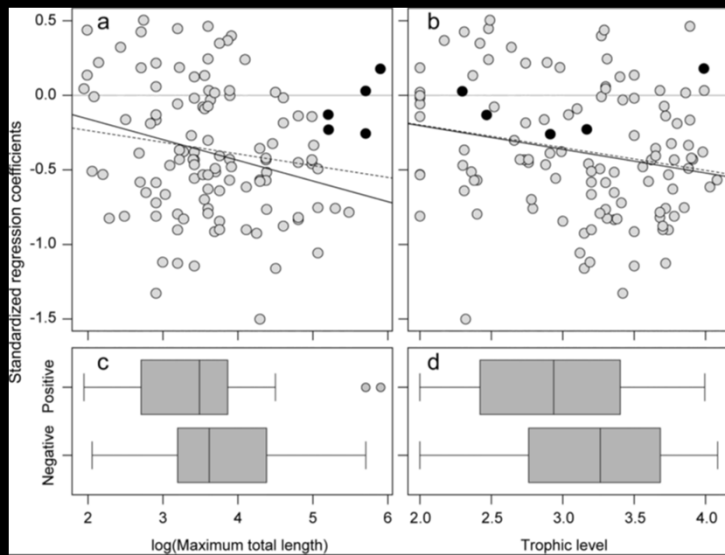


CO2 gas emissions were highest below the reservoir during the wet and dry seasons compared to within and above the reservoir with some locations sequestering carbon depending

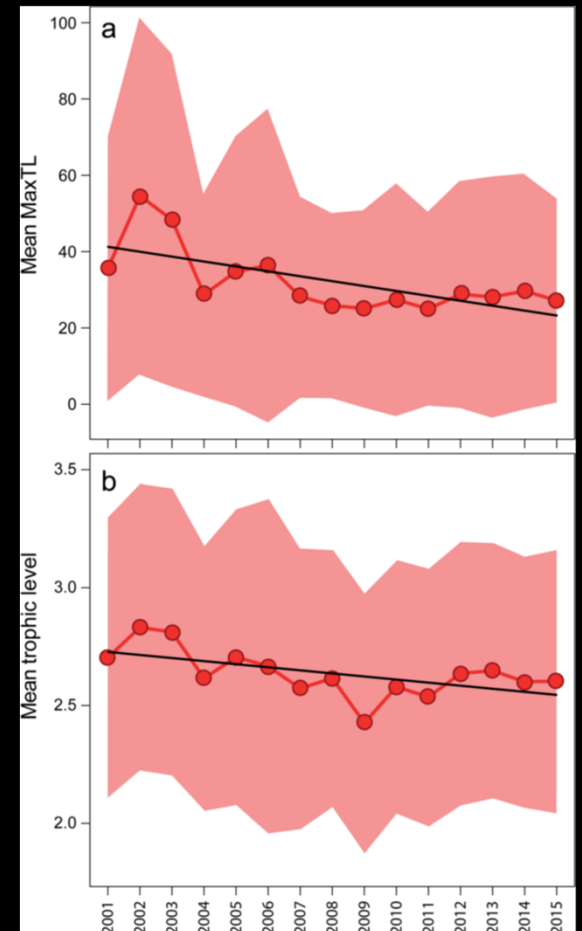
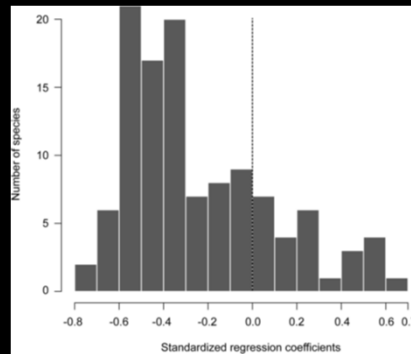




# Indicators of fish size and feeding level declines in the Dai Fishery- Tonle Sap River



Standardized regression coefficients of 116 fish species, *Dai* fishery, season: 2000/01 to 2014/15



Community weighted mean by max. length and trophic level

## Concern over losing large bodied and endangered fishes



3 m, 300kg



1.8 m, 300kg



150cm, 70kg



65cm, 5kg



30cm, 1kg



130cm, 44kg



100 cm, 18kg



# Endangered Fishes Further in Decline-> Illegal Trade/ Market Driven Decline?

- Regular catches of endangered fish (Mekong giant catfish, giant barb, seven-striped barb, and stingray) from 2000-2008. These catches were reported to the Cambodia Fisheries Administration and part of a buy, tag, and release program.
- A gap in regular monitoring between 2008-2016.
- A renewed effort in monitoring since the beginning of the Wonders of the Mekong Project, with almost no fish being reported. In addition, in November 2019 WOM/ Cambodian IFRDI conducted surveys to determine hotspots of occurrence and catch of endangered species and while fishermen reported knowledge of the species, none of them reported catching the species, including fishermen with over 30 years of experience. This either indicates the fish have disappeared (essentially gone extinct) or that catch is no longer being reported.
- We suspect that the fish are still present but no longer reported due to increased value of the fish and growth of illegal harvest and trade. This was partially confirmed through work with colleagues in Vietnam who reported that endangered fish were being caught in Cambodia and sold in luxury restaurants in Vietnam. This work was documented in a National Geographic magazine story.

# Illegal Fishing and Trade Findings -> Tonle sap endangered fishes end up in restaurants in Vietnam



## Critically Endangered Giant Fish on Menu at Luxury Restaurants in Vietnam

A 300-pound giant Mekong catfish illegally caught in Cambodia's Tonle Sap Lake is displayed at a restaurant in Hanoi, Vietnam. The fish was served to customers celebrating the 2018 Lunar New Year.

[www.nationalgeographic.com](http://www.nationalgeographic.com)

-Winner of One World Media Award (London 2019)



At Lang Nghe restaurant, in Danang, Vietnam, customers eat dinner under a poster advertising 300-plus-pound giant barbs and giant catfish. Signs at the entrance entice diners with... [Read More](#)

PHOTOGRAPH BY LINH PHAM, NATIONAL GEOGRAPHIC



A 300-pound giant Mekong catfish illegally caught in Cambodia's Tonle Sap Lake is displayed at a restaurant in Hanoi, Vietnam. The fish was served to customers celebrating the 2018... [Read More](#)

PHOTOGRAPH BY LE HIEU





# Catch and Culture Environment



Fisheries and Environment Research and Development in the Mekong Region

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Endangered species trade

## Growing appetite for giant endangered fish species among Vietnamese diners

By Truong Nguyen \*

**A restaurant in Ho Chi Minh City emerges as a magnet for affluent Vietnamese seeking to feast on critically endangered fishes native to the Mekong basin**

In early February this year, a critically endangered giant barb (*Catlocarpio siamensis*) was seen at a restaurant in Cau Giay District in Hanoi. Nguyễn Hồng Thái, the man identified as the restaurant owner, reportedly said that the 98 kg individual was caught from the Tonle Sap Lake in Cambodia and flown to the Vietnamese capital in anticipation of strong demand during the festive season –



**February 2, 2017:** An unidentified man with a giant barb (*Catlocarpio siamensis*) reportedly bought by a restaurant in Cau Giay District in Hanoi

### Viet Nam approves project to combating illegal trade in endangered species

Viet Nam's Prime Minister Nguyen Xuan Phuc has approved in principle a project designed to prevent and combat illegal trade in endangered species, *Nhan Dan* reported on March 11. The project aims to help the country stop illegal trade in wild animals and plants by identifying gaps in policies and laws as well as proposing

communications campaigns to influence consumer behaviour and raise public awareness of the consequences of wildlife hunting and smuggling, refining laws and strengthening law enforcement to prevent wildlife product purchases, and fostering partnerships at both the local and global levels, the report said.

Wonders of the  
Mekong  
Component 2:  
Training and  
Capacity  
Building







## Training, Workshops, and Formal studies

- Fish migration
- Bioacoustics / G.I.S.
- Grant writing
- Water science field methods
- Royal University of Phnom Penh partnership
  - 4 Cambodian Master of Science Students Supported
  - 4 PhD Students will be supported in 2020



## 2019 Capacity Building Highlights

### Cultivation of an Informed, Involved Civil Society

- Education Guide (K-12)
- Young EcoAmbassadors (university students)
- Mekong Heroes (early career)



iversity - Mammals:

## Wonder of the Mekong: Irrawaddy Dolphins – Critically endangered fresh water dolphins

**Fact:** The Irrawaddy dolphin (*Orcaella brevirostris*) inhabits a 190km stretch of the mainstream Mekong River between Kratie, Cambodia and Khone Falls on the border with Lao PDR. This population of freshwater dolphins is critically endangered with less than 80 animals left in existence (WWF, 2017). There are four separate populations of Irrawaddy dolphins in the Mekong located near Kampi, Koh Pidau, Stung Treng, and Chiteal. In the dry season, the dolphins are confined to just a few deep pools of water (Beasley, Marsh, Jefferson, & Arnold in Campbell, 2009).

Major conservation efforts have been established to help protect these amazing animals. Eco tourism helps to bring awareness of the importance of the animals as well as laws protecting the species. Even with these efforts, it is estimated that 4.8% of dolphins die each year as a result of being caught in fishing gill nets, destructive fishing practicing (using explosives), accidents with boat motors, habitat degradation, disease, pollution, and inbreeding (Beasley, Marsh, Jefferson, & Arnold in Campbell, 2009).

**Fresh water Irrawaddy Dolphins are a unique wonder of the Mekong and need our help to keep them from going extinct.**



Above: an Irrawaddy dolphin at play.



Below left: destructive fishing practices and pollution take their toll on the Irrawaddy dolphin population.

Activity:

### What is a mammal?

Mammals are animals that have a backbone (vertebra), warm blooded, and mammary glands for feeding their young. They also have a neocortex portion of the brain for higher-order brain functions like perception, cognition and learning. Some Common Mammals include even you. But how can we tell? Dolphins possess all of the above, including hair at birth, but the hair falls out. Whales are also mammals.

Freshwater dolphins are critically endangered. Only 80 of them left in the world. This is due to the overall decline of the Irrawaddy Dolphin population by both the loss of their habitat and living in the last population only protected by a source of clean water.

# Wonders of the Mekong education guide

An educational guide focused on the Wonders of the Mekong for distribution to Cambodian schools and school children



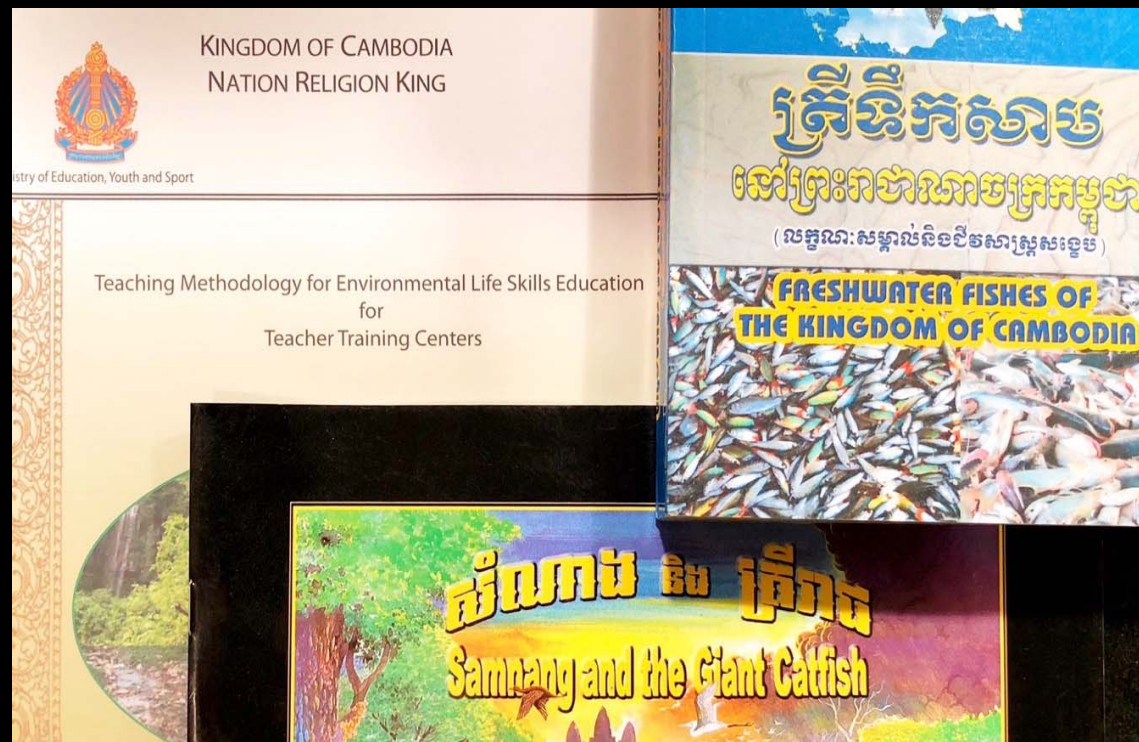
## Young EcoAmbassadors: Inspiring the next Mekong Generation

- 60+ events and field trips
- 100,000 people reached
- Lecture series
- Mekong storytelling summit
- Group projects focused on Mekong issues

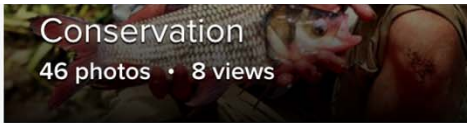


#Mekong Wonders- Mekong Hero Video

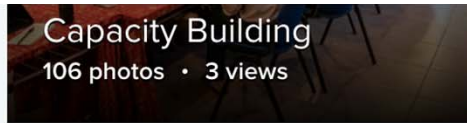
Wonders of the  
Mekong  
Component 3:  
Environmental  
Education /  
Communication  
Products







Conservation  
46 photos • 8 views



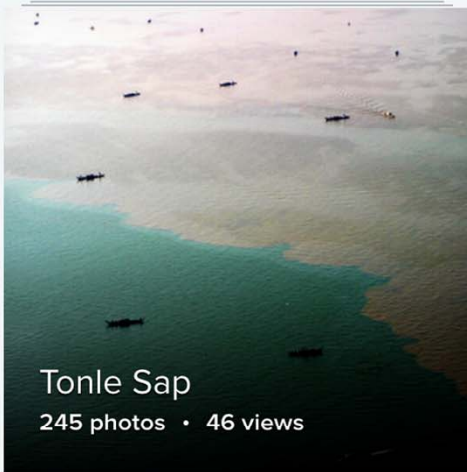
Capacity Building  
106 photos • 3 views



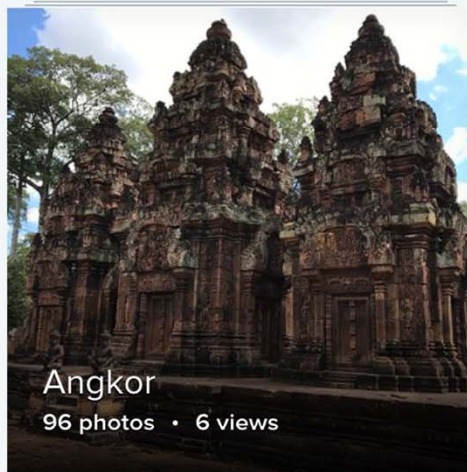
WOM Project Activities  
410 photos • 14 views



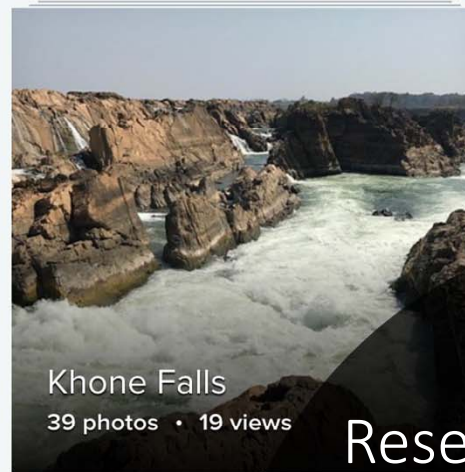
Phnom Penh  
55 photos



Tonle Sap  
245 photos • 46 views



Angkor  
96 photos • 6 views



Khone Falls  
39 photos • 19 views



3S Basin  
75 photos • 2 views

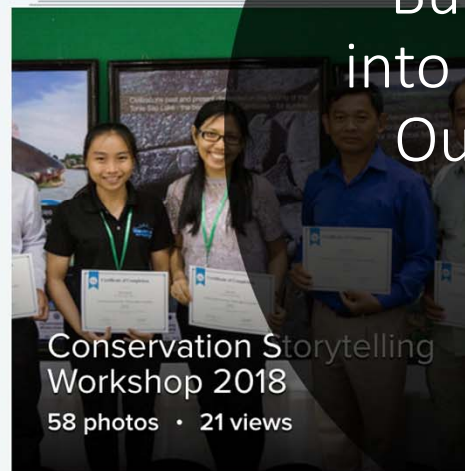
## Research and Capacity Building Integrated into Social Media. And Outreach Products



Suthep Kritsanavarin  
Photos  
95 photos • 21 views



Migratory Fish Workshop  
2018  
46 photos • 46 views



Conservation Storytelling  
Workshop 2018  
58 photos • 21 views



Saving Species  
Workshop November  
2017  
66 photos • 5 views





Research Integrated into Khmer Language Outreach Products for Distribution at Wonders of the Mekong Sponsored Events and Field Activities



## 2020 developments

- Tools for Our Future (water quality limnology station, river connectivity, fisheries change through hydroacoustic measurements)
- Alternatives to Hydropower / Large, Mainstream Dams (Sambor)
- Aquarium Partnership

## HOW REAL-TIME FISH & HYDROLOGY MONITORING CAN IMPROVE FOOD SECURITY & SUSTAINABILITY

### THE NEED FOR HIGH-RESOLUTION BIOLOGICAL INFORMATION IN THE LOWER MEKONG

Lower Mekong capture fisheries are the dominant source of animal protein for the majority of people in the region. This critical resource is for the most part unmonitored, limiting the ability for management and conservation. Furthermore, the river is undergoing dramatic change due to damming and climate disruption.

Robust fishery and water resource management requires monitoring of both the resource (fish) how it responds to environmental variation. The size, geographic scope, and decentralized nature of the fishery makes traditional monitoring using catch records untenable. To determine appropriate management strategies at local and regional scales, it is first necessary to institute a monitoring system that is affordable and supplies continuous data that can be shared openly. Bioacoustics technology is a viable solution.

### PROOF-OF-CONCEPT TESTING JANUARY 2019

In January of 2019, the University of Washington and University of Nevada-Reno conducted a proof-of concept test to see if bioacoustics monitoring of fishes in the Mekong is feasible. The main results of this work are:

- Active acoustics is a viable monitoring technology for automated, fishery independent estimates of fish abundance through time.
- Deployment of sensors in multiple locations will provide the most useful information for fishery management included fishing mortality, size effects, and adaptive management strategies.
- System installation must be paired with in-depth

### NEAR- & LONG-TERM RESEARCH OBJECTIVES

The next phase of the work is to conduct directed studies in a single area coupled with local scientific capacity building. Specifically, the near-term aim is to install paired sensors platforms in the Tonle Sap river upstream and downstream of the Dai fishery and monitor continually for two fishing seasons. These data will provide first-ever information on total fish biomass, fishing mortality, gear selectivity, and presence of large species of conservation concern.

The ultimate long-term goal is to establish a basin-wide biological monitoring network (via acoustics) that is paired with the current hydrologic monitoring network. This will facilitate both direct fishery management and optimization of basin-wide water resources for sustainability.

### IMPORTANCE FOR REGIONAL FOOD SECURITY & SUSTAINABILITY

Adaptive fishery management is required to achieve fishery sustainability in the Lower Mekong such that access to fish as a reliable, affordable food can be maintained. Effective fisheries management, in turn, requires timely biological information and responsive policy structures.

*Bioacoustics is a viable, affordable, open-data platform to collect critical information for adaptive fisheries management and conservation in the Lower Mekong.*

  
UNIVERSITY of  
WASHINGTON



 **Global Water Center**  
University of Nevada, Reno  
Solutions for sustainability  
[unr.edu/water](http://unr.edu/water)