

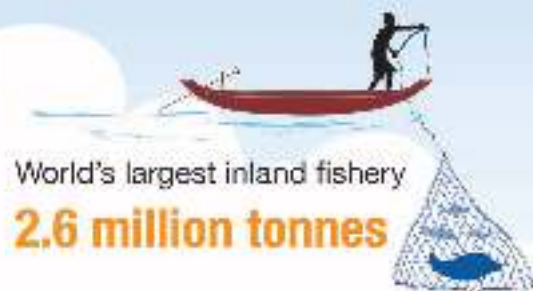
The Future of the Mekong's Aquatic Resources: Bending the Curve for Fisheries and Biodiversity



Dr. Zeb Hogan, University of Nevada, Reno

THE AMAZING FISH AND FISHERIES OF THE MEKONG RIVER

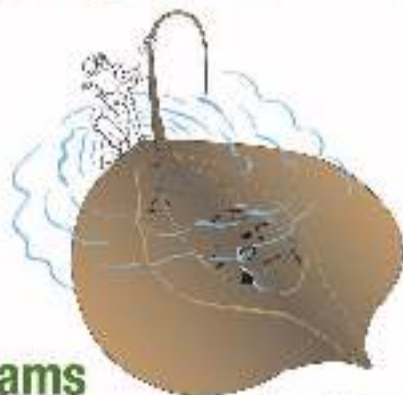
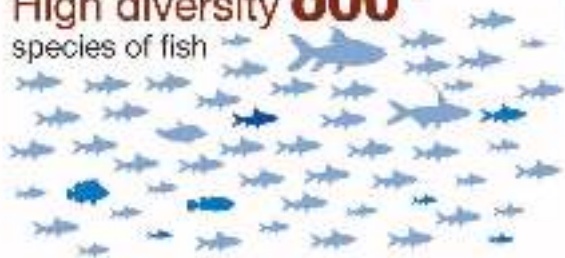
Sustainable Fisheries and Healthy Rivers Provide for People and Protect Biodiversity



World's largest inland fishery

2.6 million tonnes

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



Fish provide up to

80%

of annual protein



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**

The Mekong Feeds Millions

Dams Threaten Southeast Asia's Vital Lifeline

The Mekong is the longest river in Southeast Asia and the seventh longest river in the world. The Mekong supports the livelihoods and food security of 7 in 10 of its basin's inhabitants through agriculture and one of the most productive and diverse freshwater fisheries in the world. Their livelihoods are threatened by 12 existing dams in the watershed and a further 120 under construction or planned, including 11 dams that would block the lower mainstream Mekong.



THE WORLD'S LARGEST INLAND FISHERY AT RISK

Inland fisheries in the lower Mekong Basin produce up to **2.6 million tonnes** of fish per year.



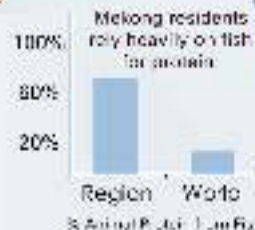
That's **7-22%** of global freshwater production.

Value worth **\$4.2-7.6 billion**.

The world's biological diversity is second only to the Amazon River.

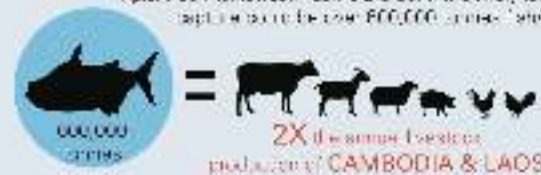


At least **1/3 of fish** are migratory like the Mekong Giant Catfish.



Mainstream dams would devastate fisheries

1 planned mainstream dam is built, the likely loss in fish capture would be over **600,000 tonnes/year**.



Agriculture can only reach potentially **10%** of capture fisheries attracted by dams.



Large amounts of land and water resources would be needed to replace lost fish protein and calories with livestock products.



\$2.74 billion losses from dam development. Services from dam development (livestock, commercial fishing) are \$274 billion, and adding the danger that huge and unanticipated losses will be made.

More than 60 million people live in the Lower Mekong Basin and half of them live within 10 km of the river. The Mekong is a lifeline for over 40 ethnic groups. It is known by many names: near its headwaters it is called the **Turbulent River**. Downstream it is the **Mother of Waters**. And near its delta it is called the **Nine-tailed Dragon**.



DAMMING THE FLOW THREATENS FOOD SECURITY

Seasonal flooding is key to productive farms and fisheries health.



The sediment load of the Mekong could be drastically reduced

However, hydroelectric projects in Cambodia the 35 dams will cut the sediment load to 15-155 million tonnes per year by **50%**.

With the addition of planned mainstream dams the load would be **halved again**.

The dams will cause a net loss in agricultural production

Losses due to inundation by dams, lost nutrients from sediment trapping, and lost wetland gardens total **\$50 million/yr**.

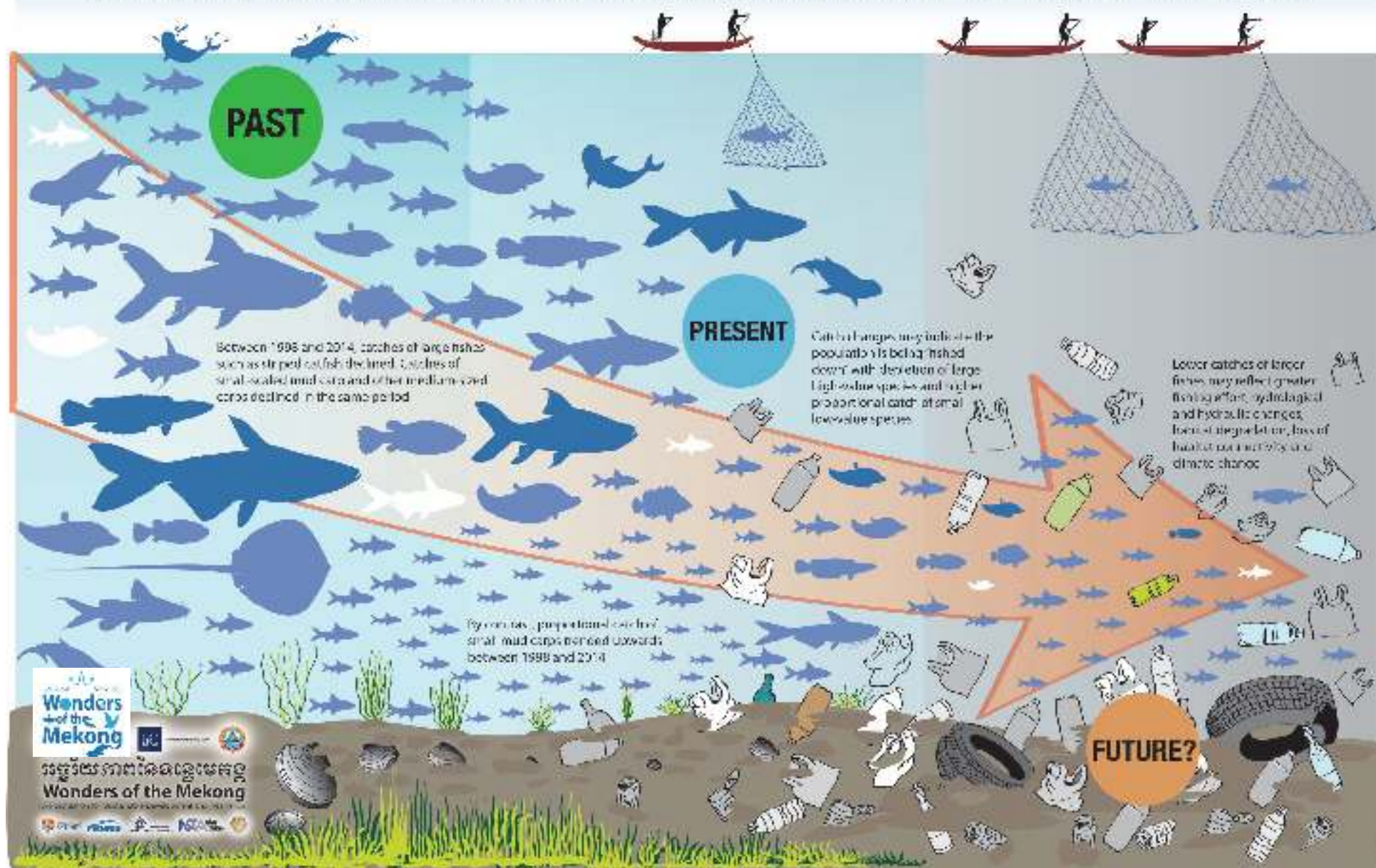


SOURCES

1. The Mekong River Basin: A Guide to the River and its People, 2014.
2. The Mekong River Basin: A Guide to the River and its People, 2014.
3. Mekong Fisheries: The Current Situation, 2014.
4. The Mekong River Basin: A Guide to the River and its People, 2014.
5. The Mekong River Basin: A Guide to the River and its People, 2014.
6. The Mekong River Basin: A Guide to the River and its People, 2014.
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8. The Mekong River Basin: A Guide to the River and its People, 2014.
9. The Mekong River Basin: A Guide to the River and its People, 2014.
10. The Mekong River Basin: A Guide to the River and its People, 2014.

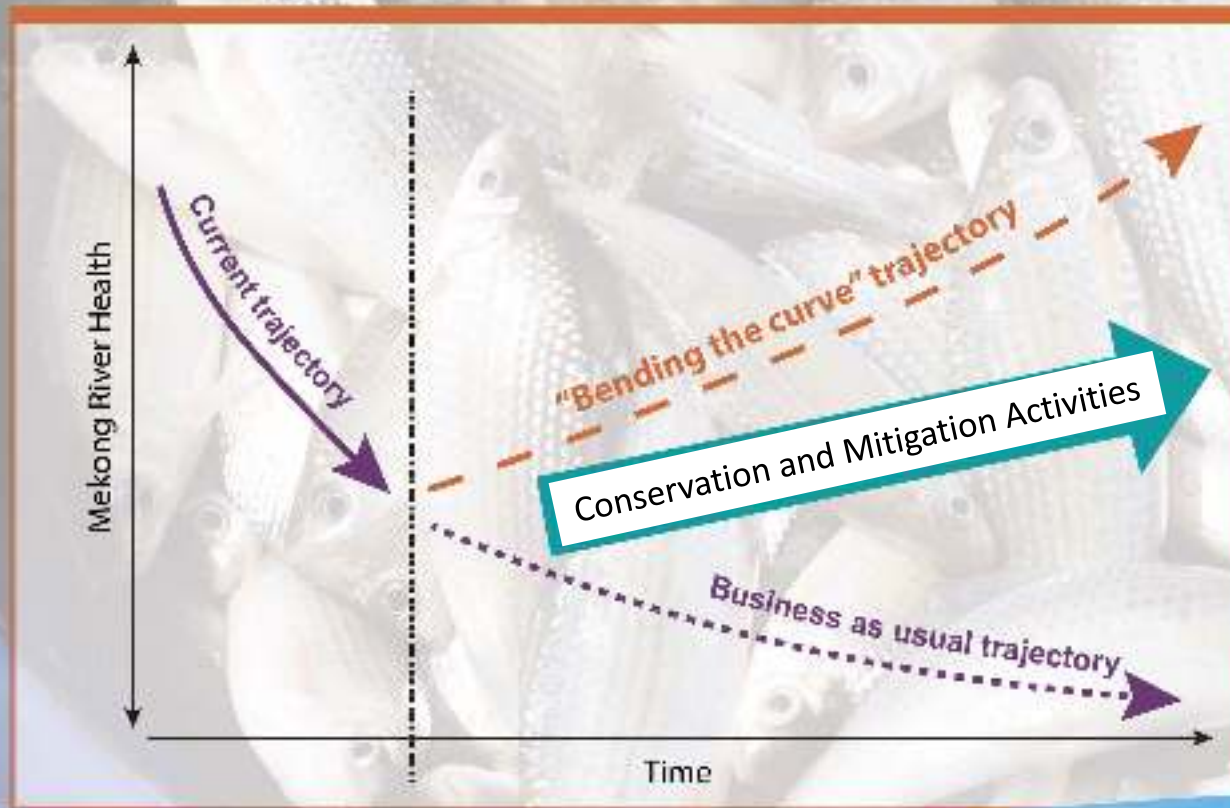
FISHING DOWN THE FOOD CHAIN

DECLINES IN CATCHES OF LARGE AND MEDIUM-SIZED SPECIES IN THE MEKONG RIVER BASIN



Wonders of the Mekong

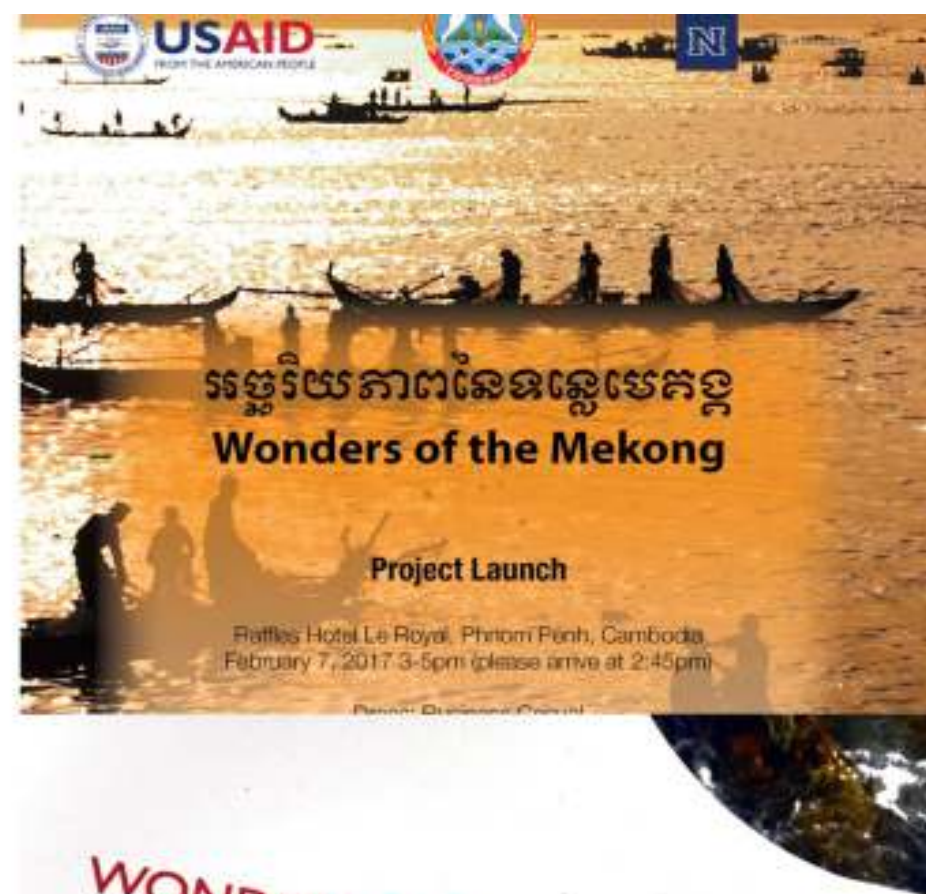
Bending the Curve for Conservation



- 1 Collaborative science
(add knowledge)
- 2 Community-engaged field research
(empower communities)
- 3 Conservation action
(Protect biodiversity)
- 4 Training and capacity building
(develop skills / leadership)
- 5 Educational exchanges
- 6 Outreach and media partnerships
(local impact / global reach)

Wonders of the Mekong Approach

- Collaborative, community-engaged science
- Training, capacity building (especially university and student support), and exchanges
- Outreach and media products for broader impact



WONDERS OF THE MEKONG
A FOUNDATION FOR SUSTAINABLE DEVELOPMENT AND RESILIENCE

The Wonders of the Mekong project will conduct applied research, build capacity, and develop outreach and communications products to highlight the economic, ecological, and cultural values of biodiversity and ecosystem services associated with the Lower Mekong River. The outputs and resulting products, developed as an integrated package, will lead to better 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 over 70 million people. From the tributary headwaters to the fertile delta and "rice bowl," the Mekong supports almost 1000 species of freshwater fish, birds, and plants. The river's flood plains and flooded forests provide critical habitats for many species.

- 1 Increased understanding by the public and government in Cambodia about value of a healthy Mekong River and its watershed and biodiversity;
- 2 Enriched body of scientific information of the importance of the Mekong's natural ecosystem services and the consequences of their degradation;
- 3 Improved capacity within Cambodia's educational institutions, government, and civil society organizations to conduct research and promote the active participation of citizen scientists;
- 4 Increased demonstration the importance of conservation through the development of new and effective ways to mobilize public understanding of and appreciation for the biodiversity values at risk from unsustainable development in the Mekong region.



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.

The map displays the Mekong River system in Cambodia. The main river is shown in blue, flowing from the north to the south. Several tributaries are highlighted in different colors: the Sekong River in orange, the Sesan River in green, the Srepok River in yellow, and the Tonle Sap River in red. The Tonle Sap Lake is shown in dark blue. The map also includes a legend, a north arrow, and a scale bar. The legend identifies the Mekong River, Sekong River, Sesan River, Srepok River, Tonle Sap River, Tonle Sap Lake, and the Cambodian Mekong. The map shows the river's path through various provinces, including Battambang, Pursat, Kampong Thom, Kampong Cham, and Kampong Speu. The Tonle Sap Lake is located in the north, and the Tonle Sap River flows from it into the Mekong River. The map also shows the border with Vietnam to the east and Laos to the north.

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

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.

Map showing the Mekong River and its tributaries (Sekong, Sesan, Srepok) flowing into the Tonle Sap Lake. The map highlights the Cambodian Mekong region, including the Tonle Sap River and the Tonle Sap Lake. The map also shows the surrounding countries (Laos, Vietnam) and the Mekong River basin.

Legend:

- Mekong River
- Sekong River
- Sesan River
- Srepok River
- Tonle Sap River
- Tonle Sap Lake
- Cambodian Mekong


Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Collaborative Science: Research Results

- 50+ open-access, peer-reviewed studies published since 2017
- Most studies authored by Cambodian scientists
- Most studies involved Cambodian students as part of their degree
- Many studies involved community participation

Open Access Communication

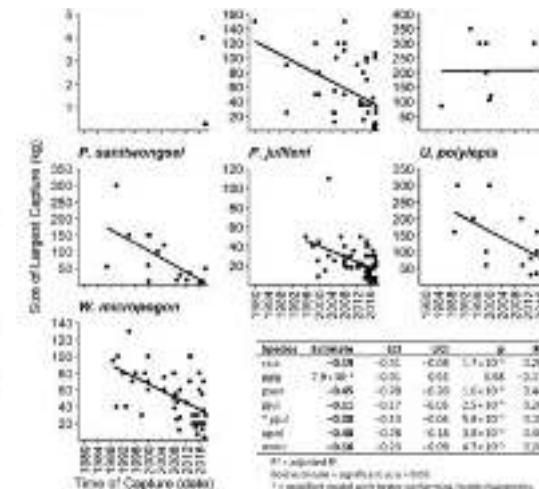
World Heritage, Hydropower, and Earth's Largest Freshwater Fish

by Dana Lee ^{1,*} , Jackman C. Eschenroeder ^{1,*} , Lee J. Baumgartner ² , Bunyeth Chan ^{3,4} , Sudeep Chandra ^{5,8} , Sella Chea ⁵ , Sothea Chha ⁷ , Chheana Chhut ⁵ , Elizabeth Everest ^{5,8} , Radong Hom ⁸ , Kong Heng ⁸ , Stefan Lovgren ⁵ , Sinsamout Ounboundisane ⁹ , Wayne Robinson ² , Lykheang Seat ⁶ , Sobot Soth ⁸  and Zeb S. Hogan ^{5,6} 

Declines in the Mekong's Megadiverse Larval Fish Assemblages: Implications for Sustainable Development

Samuel Chhary ^{1,4,5,6}, Zeb S. Hogan ^{1,4,5,6}, Bunyeth Chan ^{1,4,5,6}, Sudeep Chandra ⁵, Ransong Thach ⁵, Kallea Lee ^{1,4,5,6}, Sobot Soth ⁸ and Peng Hui Ng ^{1,4,5,6}

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Fish biodiversity declines with dam development in the Lower Mekong Basin

2023 Scientific Reports

Ratha Sor^{1,2,3}, Peng Bun Ngor^{3,4}, Sovan Lek⁵, Kimsan Chann⁶, Romduol Khoeun⁶, Sudeep Chandra⁷, Zeb S. Hogan⁷ & Sarah E. Null¹

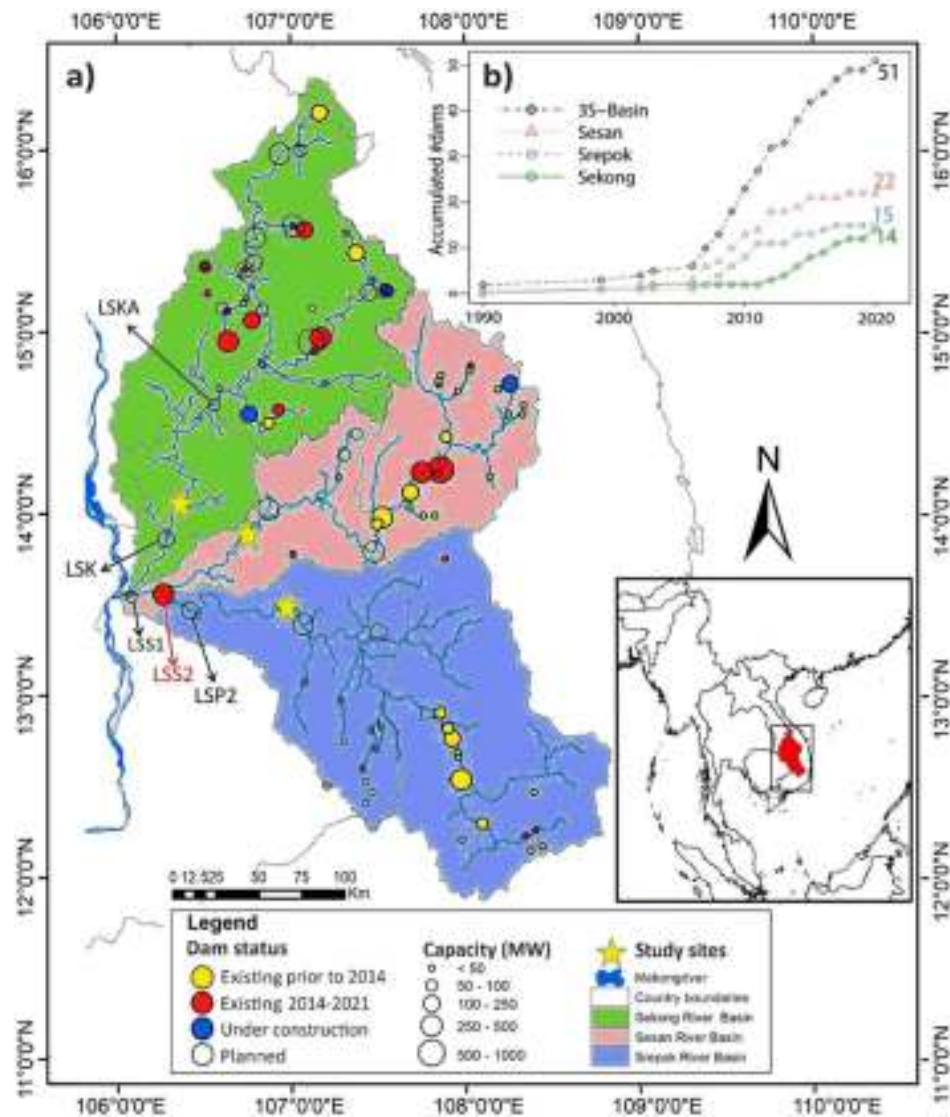


Figure 1. (a) Sampling sites and hydropower dams built in the 3S Basin and (b) number of dams from 1990 to 2021. Data source: Mekong Dam Monitor platform¹³. Lower Sesan 2 Dam (LSS2) began operations in 2018, and thus did not exist during the study period. (LSK Lower Sekong Dam, LSKA Lower Sekong A Dam, LSS1 Lower Sesan 1 Dam, LSP2 Lower Srepok 2 Dam). Map was created using ArcMap 10.4.1.

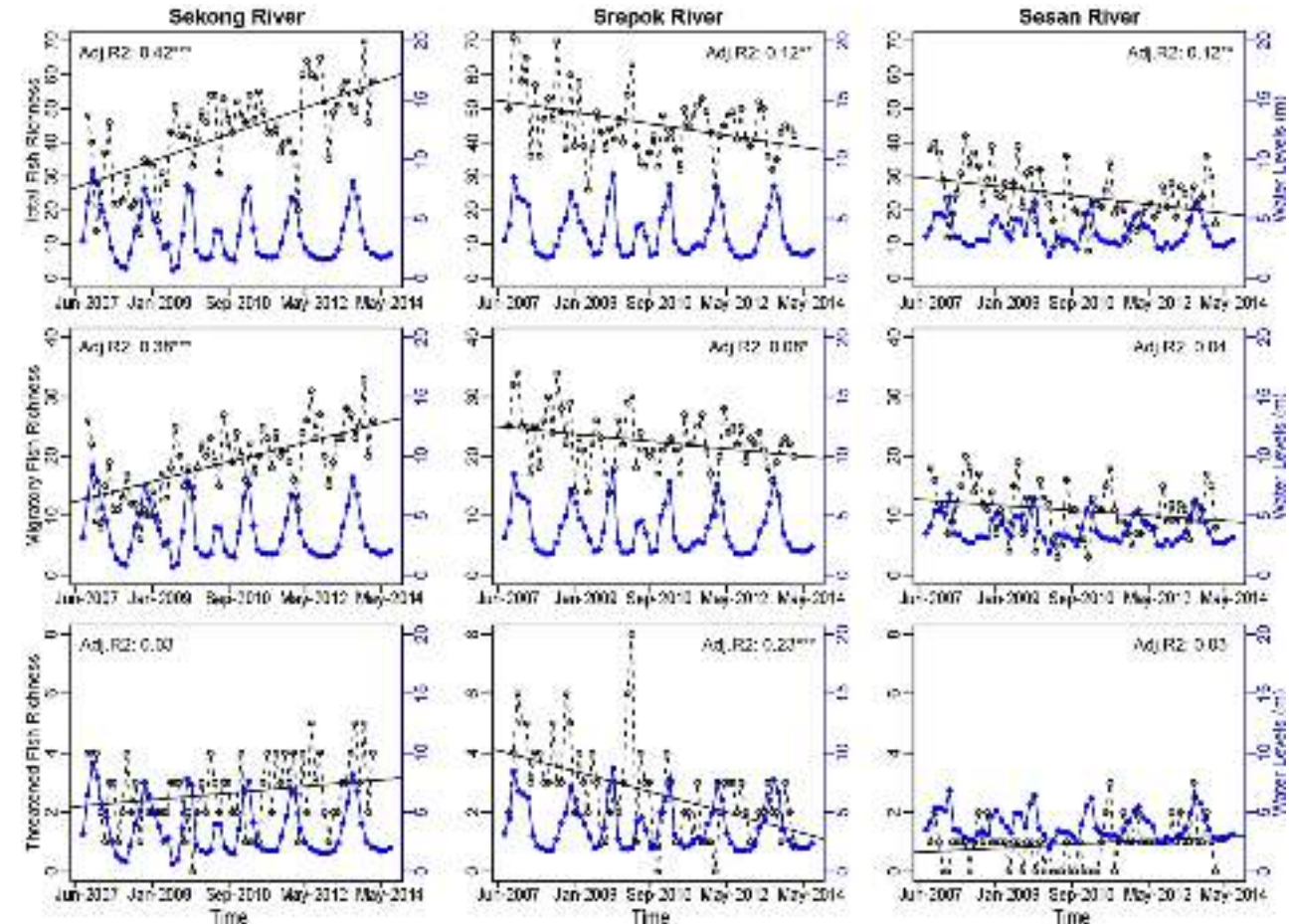
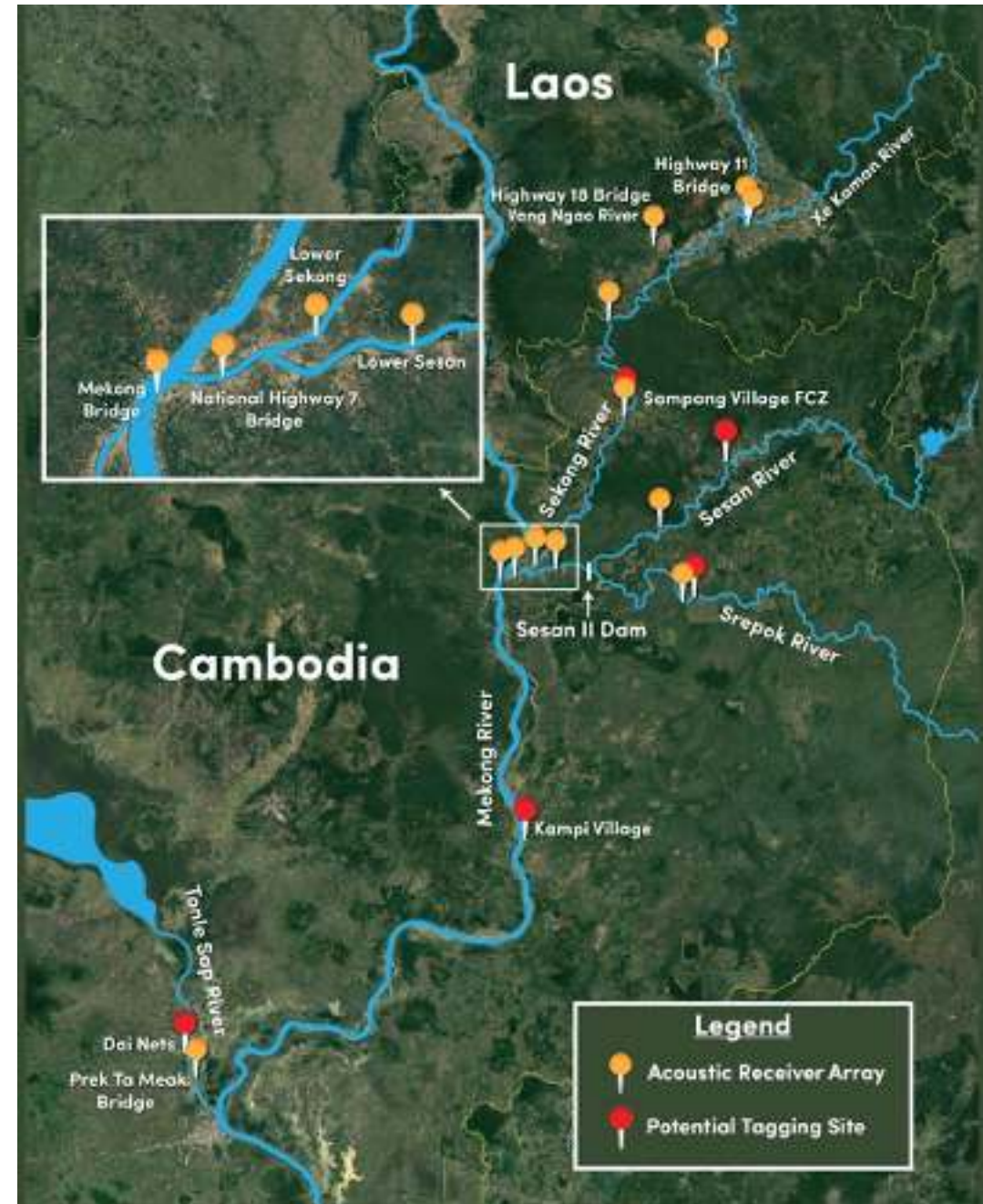


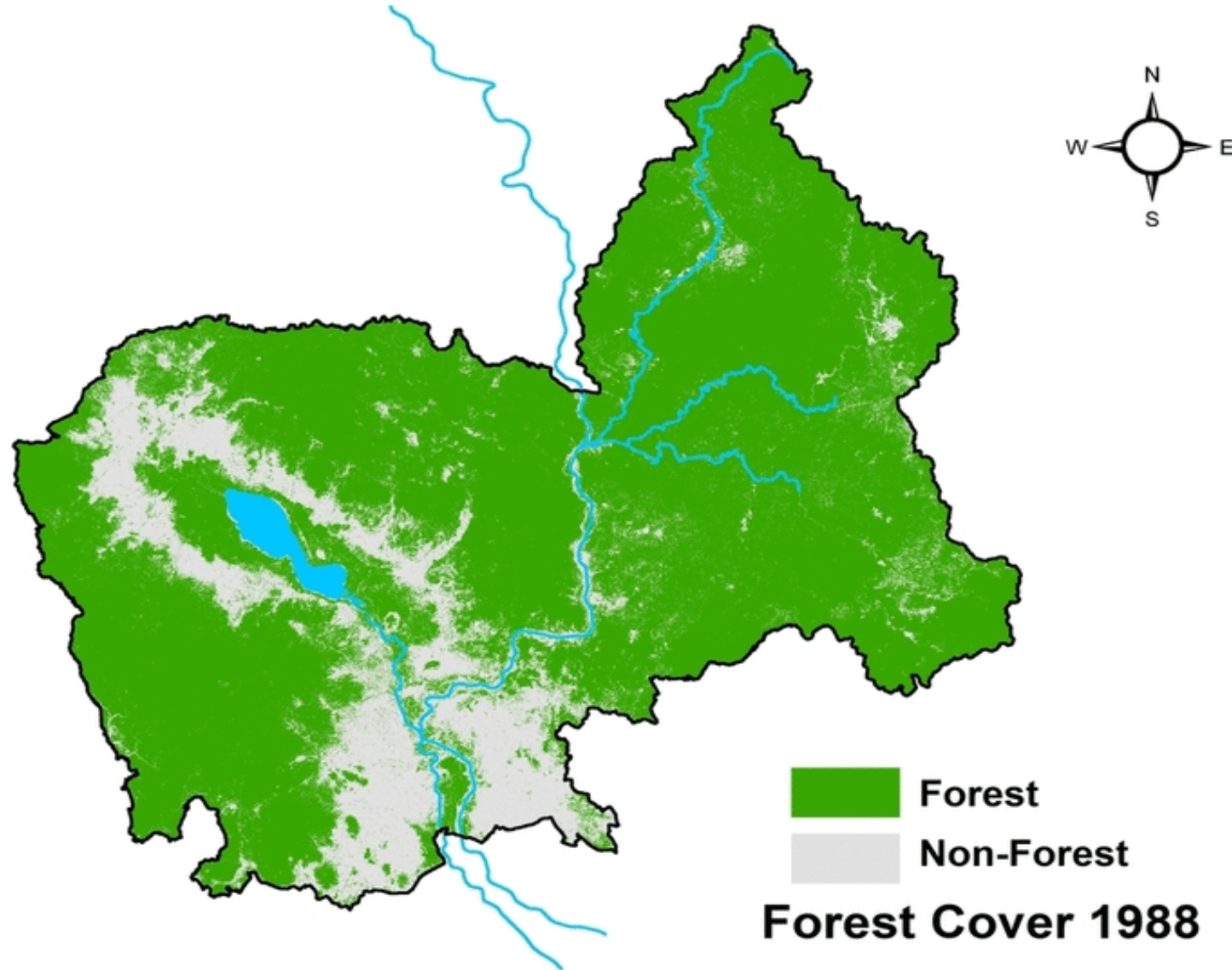
Figure 4. Monthly water levels from 2007 to 2014 (blue lines) and monthly fish biodiversity richness (number of species/sample, black dashed lines) in the Sekong, Srepok, and Sesan Basins. Asterisks *P < 0.05, **P < 0.01, ***P < 0.001. Figure was created using R statistical programming language version 4.0.1.

Evaluating transboundary migration of species

- Examine fish migration patterns in the Mekong River and important tributaries in the 3S Basin
- Formed a Telemetry Working Group to facilitate transboundary collaboration and data sharing across Cambodia and Laos PDR
- Tag fish with acoustic transmitters and detected at acoustic receiver arrays located throughout the study area
- Capacity building and training components to promote future use of telemetry infrastructure



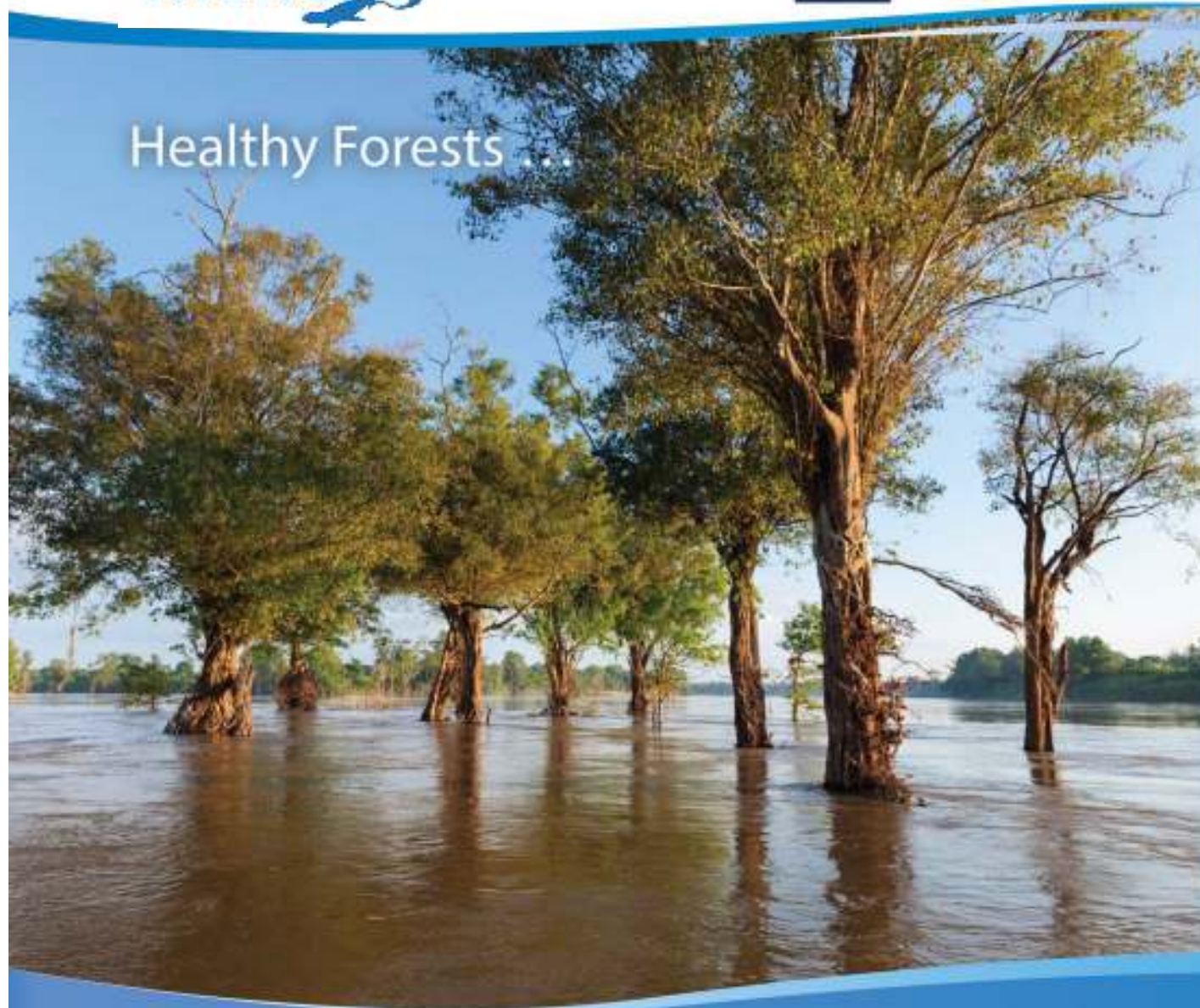
41% loss of forests since 1998 in the lower Mekong river basin with a major loss of flood forest and conversion to crops in the Tonle Sap Lake Basin



2020 Water



Healthy Forests ...



... Increase
Fish Diversity
and Catch





Larger Flood Pulse = More Fish


Free-flowing Rivers Sustain Threatened Biodiversity

- The life cycles of the endangered species like the Mekong giant catfish and river catfish are adapted to the flood pulse
- Young are born at the beginning of rainy season and carried downstream to flood plain habitats
- Juveniles mature in flood plain habitat adults migrate back the main river to spawn





Drought and Climate Change ...



... Lead to increases in forest fires,
increases in land conversion, and
decreases in fish harvest and diversity

■
Loss of habitat for fish and
biodiversity

■
Decreases in abundance of traditional
food sources and livelihoods

■
Less resiliency to future environmental
shocks

Capacity Building

Building one of the largest groups of Mekong experts in the world
and the largest cohort of female scientists studying aquatic
resource management in the region



Students have
participated in grant
programs, received
international fellowships,
served as invited experts
at international meetings
and workshops, and now
serve in leadership
positions within
government and civil
society

Future environmental
leaders of Cambodia
and other Mekong
countries





Capacity Building: Training for over 5000 students, NGO staff, community-members, and government staff

“training, tools, and technology to support science-based natural resource management”



University Partnerships and the Center Center of Excellence on Fisheries and Aquatic Science for Sustainability (CEFASS)



Mekong conservation heroes recognised

NATIONAL

Publication date
02 November 2022 | 20:21
ICT

Reporter : Ry Sochan

More Topic



Six Cambodian conservationists have been recognized as “Mekong Conservation Heroes” by the Wonders of the Mekong project for their environmental activities. Their actions include work on endangered species such as the Irrawaddy dolphin, Mekong giant catfish, and giant softshell turtle, as well as outreach and community-based efforts to protect Cambodia’s globally significant forests and fisheries.

An award ceremony to honor the heroes will be held on November 3 at the Himawari Hotel in Phnom Penh. It will recognise each hero, by screening a short video about each of their work.

The heroes programme was developed by the USAID-funded Wonders of the Mekong project to shine a light on inspiring individuals who are working in the lower Mekong basin to study, protect, or raise awareness about the its unique ecosystem, biodiversity, habitats, and cultural heritage.

A healthy Mekong is necessary to support communities, wildlife, and economic activity across Cambodia, US Ambassador W. Patrick Murphy said.



Ms. Chea Seila
2018 Mekong Conservation Hero

- NexGen Fellow
- International Visitor Leadership Program Participant
- PhD Candidate
- Expert on Mekong issues
- Leader of Endangered Fish Program
- Community Outreach
- IVLP Impact Award Recipient

Wonders of the Mekong Communications Products

Goal: Increase the public and government's awareness of the Mekong River, its ecosystems, and biodiversity



National Geographic Partnership **LOCAL VOICES, GLOBAL REACH**



WONDERS OF THE MEKONG

Can the Amazon of
Southeast Asia Be
Saved?

▶ WATCH



ENVIRONMENT
WONDERS OF THE MEKONG

Southeast Asia May Be
Building Too Many Dams
Too Fast

▶ READ



WONDERS OF THE MEKONG

Enormous Fish Make
One of the World's
Largest Migrations

▶ WATCH



WONDERS OF THE MEKONG

Angkor Wat's Collapse
From Climate Change
Has Lessons for Today

▶ WATCH



ENVIRONMENT WONDERS OF THE MEKONG

River sanctuaries help giant fish recover in Southeast Asia

▶ READ



ANIMALS
WONDERS OF THE MEKONG

Cambodia's river
dolphins at highest
population in 20 years

▶ WATCH



ANIMALS WILDLIFE WATCH

How the world's largest
snake hunt hurts
Southeast Asia's bigge...

▶ WATCH



ENVIRONMENT
WONDERS OF THE MEKONG

Baby Giant Mekong
Catfish are Hard to Find

▶ READ



ANIMALS
WONDERS OF THE MEKONG

In Cambodia, giant
turtles come back from
the brink

▶ WATCH

Wonders of the Mekong

Stingray Case Study

Combining research, capacity building, and communications for local, regional, and global impact



Figure 1. (a) The extent of the proposed Phnom Penh–Kampong Cham road and the planned location of the two proposed capture sites, as well as the location of previously reported capture sites in the Rong and DM sub-basins. (b) The location of the capture sites relative to the Mekong River and the city of Kampong Cham. The map shows the location of the capture sites relative to the Mekong River and the city of Kampong Cham. The map shows the location of the capture sites relative to the Mekong River and the city of Kampong Cham.



Feb 7

Species conservation action plan being developed for giant freshwater stingray

A new flagship giant fish species for the Mekong

Scientists and conservationists have agreed to develop a species conservation action plan for the endangered giant freshwater stingray (*Potamorhina henryi*). The plan aims to identify critical habitats and develop measures that ensure giant stingray populations.

According to the plan, the species is critically endangered. The plan aims to identify critical habitats and develop measures that ensure giant stingray populations.

The plan envisages increased regional cooperation for conservation, especially in transboundary rivers

Another priority is to enhance the role of communities and private sector in conservation efforts with particular emphasis on "research partners, experts of biodiversity, and champions of conservation." At the same time, the plan aims to ensure that land-use change, such as infrastructure, industry and urban development, is in harmony with the conservation needs of the species and its ecosystem and does not adversely affect or fragment the populations in critical habitats.

Regional cooperation

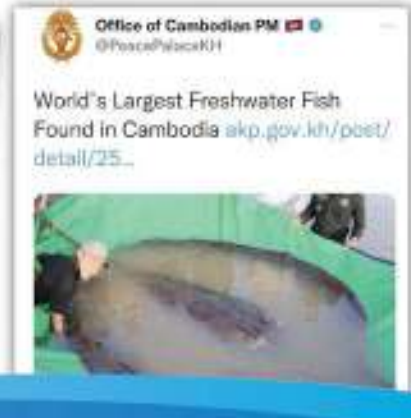
The plan envisages increased regional cooperation for conservation, especially in transboundary rivers, and



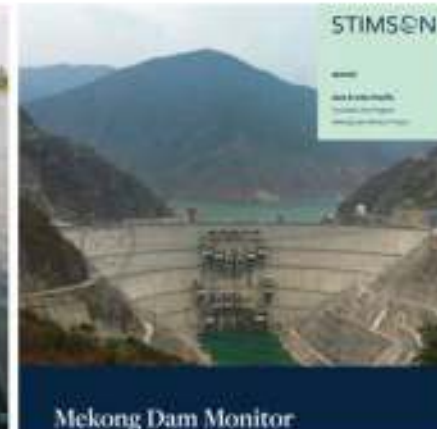
Map showing the distribution of the giant freshwater stingray in the Mekong River basin.

19 City and Culture - Environment | June 10, 2015

Source: IUCN



“Forge innovative partnerships to leverage resources and skills that can magnify results”



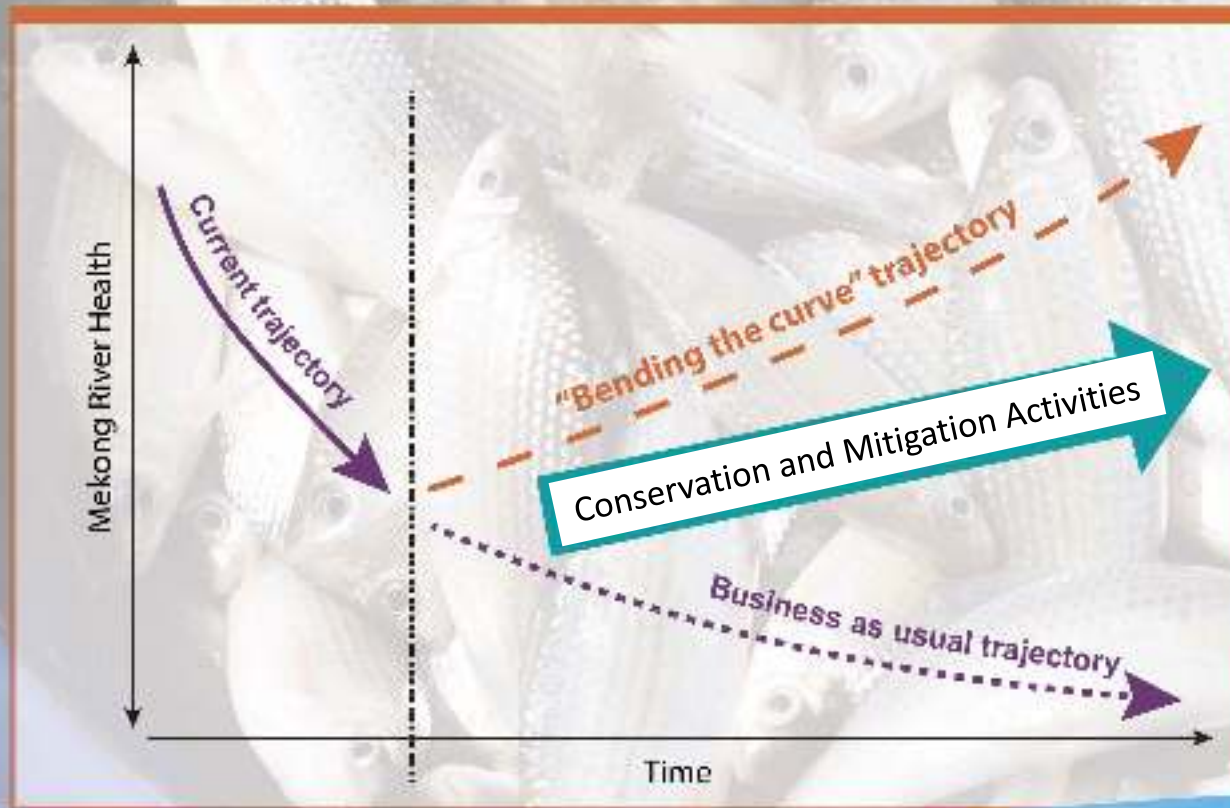
Wonders of the Mekong: Conservation and Policy Impacts

- Increased enforcement of fishing regulations, actions against land grabbing, reiteration of commitment not to build mainstream dams on the Mekong.
- Development of a program to recognize fishermen who release endangered fish, increased community participation in science and conservation.
- Statement to communities Stung Treng section of the Mekong would not be developed for hydropower.
- The PM and other government ministers shared posts and commented on Wonders of the Mekong social media multiple times.
- Through social media, local communities now raise concerns about enforcement issues and the government has been responsive, holding press conferences and meeting with communities to resolve issues.
- The Cambodian and Cambodian media regularly use Wonders of the Mekong as a source of scientific information and unbiased environmental stories.



Wonders of the Mekong

Bending the Curve for Conservation



- 1 Collaborative science
(add knowledge)
- 2 Community-engaged field research
(empower communities)
- 3 Conservation action
(Protect biodiversity)
- 4 Training and capacity building
(develop skills / leadership)
- 5 Educational exchanges
- 6 Outreach and media partnerships
(local impact / global reach)

Wonders of the Mekong: Science and Conservation Surprises

2022 - World's Largest Freshwater Fish

2022 - Rediscovery of presumed extinct fish

2022 - New Species

2023 - Most reports of Mekong giant catfish ever

Increasing fish catches 2020-2023

Growing awareness and pride about Mekong River







For more information:

- Wonders of the Mekong Facebook page (<https://www.facebook.com/MekongWonders>)
- National Geographic website
- Open-access research – special issue of the Journal Water
- Fishbio's Mekong Fish Network
- Contact me: zhogan@unr.edu or zebhogan@gmail.com

THANK YOU!

