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HSBC 

CASE STUDY

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SEARCHING FOR THE MEKONG GIANT CATFISH

eDNA reveals fish biodiversity in the Mekong River



SEARCHING FOR THE MEKONG GIANT CATFISH

The iconic Mekong giant catfish (*Pangasianodon gigas*) is one of the world's largest freshwater fish, and one of the hardest to study.



≥ 80%
POPULATION
DECLINE SINCE
1990

Despite being the size of a small car – weighing in at nearly 300 kg and 3 m long – these river behemoths remain elusive. Little is known about their exact population, habitat, and distribution, making conservation planning a challenge. Though once common along the entire length of the Mekong, rapid population declines have made the giant catfish into ghosts in the river: only a handful have been caught by fishermen over the last 15 years. To protect the catfish, scientists need to 'see' the invisible.

Recent scientific advances have now made this possible. Every living creature in the river leaves traces of its DNA in the water from sloughed off scales, excreta, mucus and the like. Using cutting-edge techniques, scientists can isolate this environmental DNA (eDNA) from the water and compare it to genetic databases to create a snapshot of the river's biodiversity at the specific time and place of sampling – and even detect rare species like the giant catfish.

eDNA Sampling



6
LOCATIONS

3
COUNTRIES

In the first ever trial of eDNA sampling on the Mekong River, WWF partnered with France-based laboratory SPYGEN to sample and analyse water from the river from Tonle Sap Lake in central Cambodia, through Laos all the way to Chiang Kong in northern Thailand. Selection of the sites and the field work was conducted with assistance from California-based FISHBIO biologists, as well as Cambodia's Fisheries Administration. Detection of giant catfish eDNA at any of these points would contribute a better understanding of its distribution, migration, spawning habits, and how to manage its conservation. Beyond the catfish, these water samples allow WWF to thoroughly assess the Mekong's fish biodiversity.



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WWF, FISHBIO and Cambodia Fisheries Administration staff collecting water samples to analyse for eDNA.

Fish biodiversity: a human challenge

The Mekong River is key to survival for many communities in the region, who depend on fish for their food and livelihoods. Fishing is a way of life on the river: the Mekong is the world's most productive inland fishery, producing up to 25% of the global freshwater catch. These fish are a staple of the local diet and a major source of protein for the 60 million people in the lower Mekong river basin, made up of Laos, Thailand, Cambodia, and Vietnam.

These fish stocks are threatened by the same things endangering the Mekong giant catfish: overfishing, hydropower dam construction, pollution and habitat degradation from river dredging and blasting for construction. As with the giant catfish, better understanding of where specific fish species live and migrate is necessary for creating effective conservation plans.

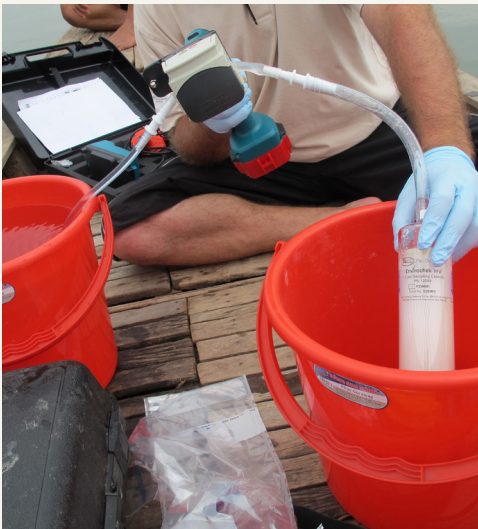
Saving species requires knowing where they are and how many of them there are. From saola in the forests of Laos and Vietnam to Mekong megafauna such as the Mekong giant catfish, this is a common challenge across all of the sites and many of the species WWF-Greater Mekong cares about. eDNA surveys give us great potential to unlock some of the secrets of these sites and species, and thus design effective conservation programs.

-DR. THOMAS GRAY, WWF-GREATER MEKONG REGIONAL LEAD,
SPECIES AND WILDLIFE CRIME

COLLECTING THE eDNA

It took a few tries to figure out proper procedures for opening the immersion samplers, used to collect water without contamination at desired depths. Since fish species often prefer different parts of the water column, it's important to sample near the surface, middle, and deep water. Once the kinks were worked out the operation went smoothly, and all labeled and stored samples were sent to the partner laboratory in France. There, SPYGEN scientists isolated the eDNA and compared it to DNA from samples of Mekong giant catfish obtained from Kasetsart University in Bangkok. Other DNA was compared to a database of fish and aquatic animal DNA in order to identify other species.

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Filtering the water sample to extract eDNA.

A GLIMPSE INTO THE MEKONG RIVER



MEKONG GIANT CATFISH
DETECTED IN 1 LOCATION



64
KNOWN FISH SPECIES

111

UNIDENTIFIED SPECIES

is where the giant catfish comes to spawn before migrating south to Cambodia's Tonle Sap Lake. This migration route is now bisected by the nearly completed Xayaburi Dam, raising concerns for the future of the species.

In the six locations sampled, over 175 species were detected: 64 belonging to fish species whose DNA had previously been archived. The other 111 unidentified forms could represent new species or species not yet sampled by geneticists. While these results only represent a small proportion of the river's known biodiversity (the Mekong River is ranked amongst the top three rivers globally in terms of fish diversity and supports more than 1,000 species) this first test demonstrated the potential of the methodology to inventory species. It is likely further sampling will reveal more of the unique Mekong biodiversity and will help identify hot-spots with high diversity for protection as community fisheries.

The eDNA analysis also gave a glimpse of the non-fish residents of the Mekong, detecting frogs, salamanders, and the globally vulnerable Irrawaddy dolphin (*Orcaella brevirostris*) at various points.

ALSO DETECTED



IRRAWADDY DOLPHIN



FROGS



SALAMANDERS

These eDNA results are helping scientists build a comprehensive picture of life in the Mekong's murky depths. Many of the species detected in the water samples were crowded into the deeper reaches of the water column, away from the surface, and into specific pockets of the river. The most diverse site sampled was by far the Irrawaddy dolphin pool, a popular eco-tourism spot on the border of Laos and Cambodia, two kilometers downstream from the planned Don Sahong dam. This dam would span the deepest of the Mekong's six channels on the Laotian side of the border in this fractured section of the river. This channel is the only reliable year-round passage for migratory fish. The dam's construction and resulting habitat degradation will likely result in the death of the pool's dolphins and disruption of fish migration, endangering local livelihoods. Even these preliminary eDNA results help create a better understanding of biodiversity hotspots like the dolphin pool and strengthen the case for their protection.

FUNDING SUPPORT

Funding for this study came from the HSBC Water Programme, a five year, \$100 million initiative with Earthwatch, WaterAid and WWF to secure healthy flowing rivers in five priority areas around the world, including the Mekong river basin.



Why we are here

To stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature.

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