A store on Tonle Sap in Cambodia. (Photo: Erica Gies)

# A Giant Lake That Sustains Millions of People Is in Danger

Dams, overfishing, and pollution threaten Cambodia's Tonle Sap, the largest lake in Southeast Asia and one of the world's most productive fisheries.

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Erica Gies' work has appeared in *The New York Times*, *The Guardian*, *Scientific American*, *The Economist*, and other outlets.

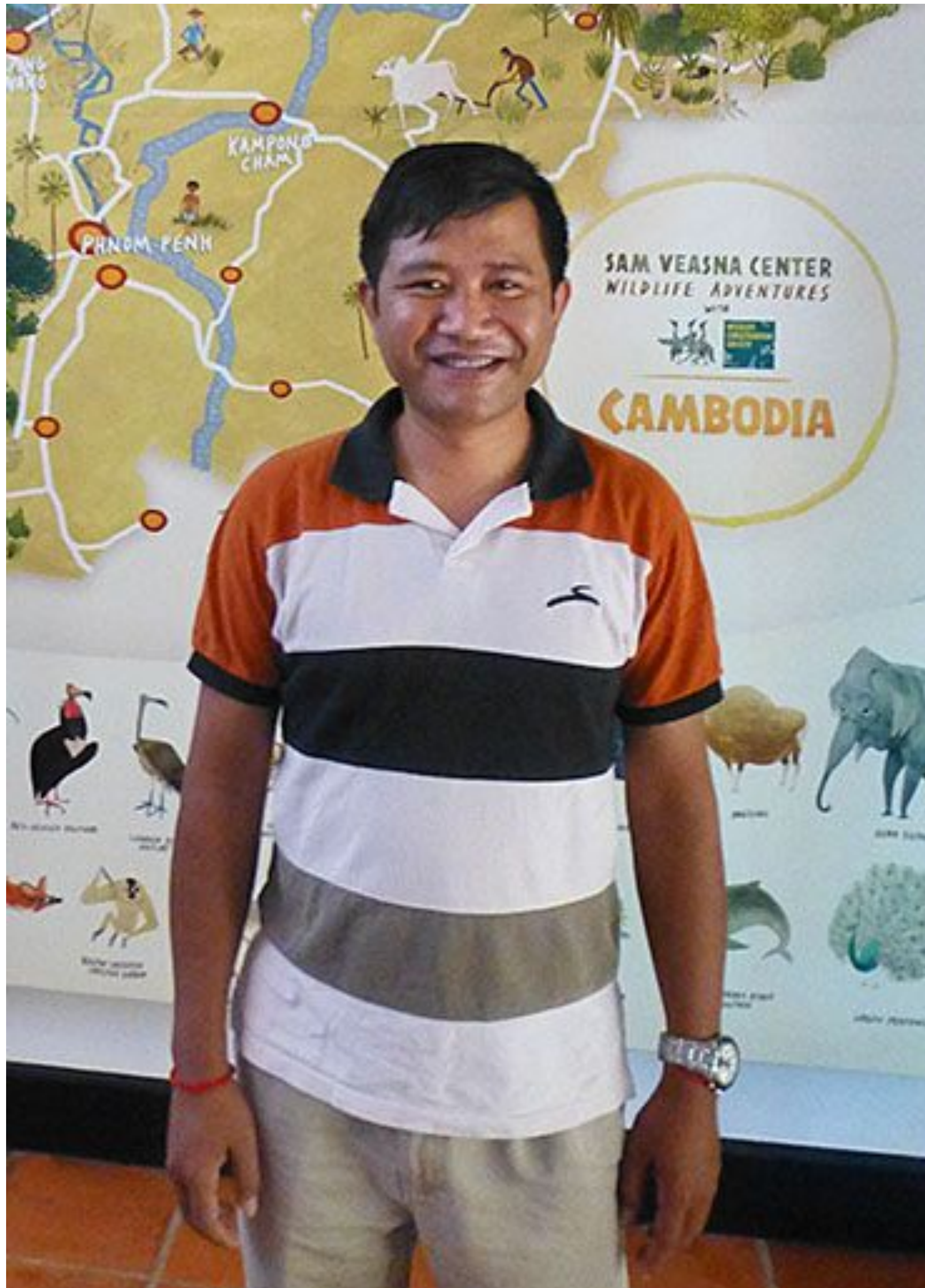
SIEM REAP, Cambodia–Before dawn we set out in a small wooden boat across the largest inland lake in Southeast Asia, Tonle Sap in Cambodia. As orange began to tint the sky, the lake appeared as a sea that stretched to the horizon. Because Tonle Sap's water levels pulse with the seasons, it is known as the beating heart of Asia. The lake feeds the legendary Mekong River, but during the monsoons, the Mekong floods, backing up into Tonle Sap, which expands six times to 6,178 square miles and inundates forests, shrubland, and grassland.

That ebb and flow has created an ecological wonderland, home to otters and rare birds like the endangered milky stork, the Bengal florican, the Sarus crane, and the giant ibis (the national bird of Cambodia). As we cross the lake, our charming guide, Kunthea, a young woman who works for Sam Veasna Center, a local conservation and ecotourism organization, points overhead to oriental darters and spot-billed pelicans, threatened elsewhere but common here.

*(Map: Getty Images)*

Fish also flourish in Tonle Sap. The lake and the entire Lower Mekong Basin is the largest inland fishery in the world, the source of 18 percent of the planet's freshwater fish catch, according to the Consortium of International Agricultural Research Centers. In Cambodia, fish supply 81 percent of the animal protein its citizens eat and is a staple for the hundreds of thousands of people who live on the lake in more than 170 floating villages. As we chugged by, girls combed out

their hair on rocking porches, amphibious little boys hopped from boat to house with smooth grace, ducks quacked in a floating pen, and a family in a boat pulled up to a floating store selling rice, rope, and other necessities. Life in these villages looks bucolic but perhaps not long for this world.




*Johnny Orn, director of Sam Veasna Center. (Photo: Erica Gies)*

This fecund ecosystem faces a litany of threats: overfishing, pollution, dams, and the conversion of floodplain habitats to rice fields and rubber plantations. Considering the scale of the challenges, it can seem like the lake is living on borrowed time. But there are glimmers of hope. Conservation supported by eco-tourism has succeeded in bringing species back from the brink. Scientists are studying dam and fish dynamics and pushing Mekong countries to consider the whole river basin when building dams. Local activists have had some success in changing government policies on land concessions and halting illegal logging.

Cambodia is a country still emerging from the shadow of the genocidal reign of the Khmer Rouge from 1975 to 1979 that resulted in the death of 2 million people, or a quarter of Cambodia's population, before the regime was overthrown by Vietnam. No survivors escaped unscathed. The 41-year-old director of Sam Veasna Center, Orn Sambovannak, goes by Johnny, a name he was given by an English teacher at a United Nations refugee camp in which he lived from ages four to 18. Soon after, he was captured by the remnant Khmer Rouge, jailed, and then forced to fight for it for three years. When he was finally freed, he walked 55 miles home through the land-mine-studded forest.

*People gather at a fish market near the lake's bank at dawn. (Photo: Erica Gies)*

Today, land mines laid during civil war and unexploded ordnance from U.S. carpet bombing during the Vietnam War haunt Cambodia, killing or maiming more than 100 people a year. Travelers are advised to stick to well-marked paths. Four million people a year come to see Angkor Wat, the largest religious complex on the planet, and stay in Siem Reap, which throbs with a backpackers' party scene. Siem Reap is just an hour's drive from the northeast side of Tonle Sap, yet ecotourism is nascent. The Sam Veasna Center takes about 1,200 people a year to its wildlife conservation sites, including Tonle Sap Biosphere Reserve. It's hard to overstate the extent to which the Khmer Rouge devastated Cambodia in nearly every way: infrastructure ruined; families, health, and standard of living

decimated; government institutions dismantled. Rebuilding has been a slow process. Tourism is one economic bright spot that also celebrates Khmer culture (the people of Cambodia are mostly Khmer) and natural heritage.

**THE FISH LIFE**

People who live on the lake are at a far remove from Siem Reap's drink specials, pounding beats, and elephant-print harem pants. Their lives revolve around fishing, but these days they are catching fewer and smaller fish. Overfishing may be part of the problem, but it's hard to quantify because scientists haven't been counting the vast numbers of fish that people catch and feed to their families, said Simon Mahood, a Cambodia-based ecologist and senior technical adviser for the Wildlife Conservation Society, which partners with Sam Veasna Center on conservation.

The national government's fisheries administration is advocating fish farms as a way to help feed a growing population, and some people on Tonle Sap have small pens, lively with fish, adjacent to their floating houses. Yet across Cambodia, aquaculture produces just 20 percent of the overall catch, underlining the importance of protecting and managing wild fish stocks that supply the other 80 percent, said Eric Baran, senior scientist for WorldFish, an international research organization. Baran is based in Phnom Penh and collaborates with government agriculture and fisheries offices.

Water levels in the lake are decreasing, which also affects fish stocks. This year's El Niño had a stark impact, said Orn. "Normally in August the water level should be at least five meters," he said, "but it's approximately two to three meters." In the rainy season the lake is typically 12 meters deep.

*A man with fish traps stacked on his boat motors along the bank of the lake. (Photo: Erica Gies)*

“These guys on the floating villages don’t have other options,” said Mahood. “You catch fish or you catch fish. This year, a lot of those people couldn’t catch fish.” As a result, he said, many are leaving the lake for factories or labor jobs in Phnom Penh or Thailand. “Things don’t always happen gradually with change,” said Mahood. “There are tipping points. Once people have a very bad year, a lot of them just won’t come back because they don’t want to take the risk. It may not be enjoyable working in a factory, but it’s a guaranteed income. Fishing is not.”

**LAND GRABS**

Another big threat, both to fisheries and to biodiversity, is habitat loss. Around 2000, the national government began granting 99-year land leases to foreign companies to log forests to grow sugarcane and rubber. In addition to removing critical habitat, some of these projects have changed the hydrology in Tonle Sap’s catchment. Water seeps into the denuded ground instead of funneling into a river that supplies the lake. “Most of them cut down the trees and sell the trees, and just leave it and don’t grow anything,” said Orn. Reforms this year have led the government to take back some land concessions and reduce the terms on

others, although some activists question whether these reforms have any teeth.

Water is also being withdrawn all along the Mekong to irrigate crops–

rubber and sugar in northeast Thailand, rice in Tonle Sap's floodplain in Cambodia, and rice in Vietnam, which needs more and more water to keep saltwater intrusion from sea level rise at bay, said Mahood.

**DAMMED IF THEY DO**

With Asian countries developing rapidly, energy demand is increasing, and countries along the Mekong are building or planning dozens of hydroelectric projects–12 dams for the main stem of the river and 78 on its tributaries.

Dams are problematic on the Mekong. That's because 189 species of fish migrate through the river. They complete their life cycles in rhythm with the seasonal flood pulses, which dams weaken, according to a paper published this year in the journal *Science* by 40 aquatic biologists, including Baran. Migratory fish in the Mekong supply 800,000 tons of food a year, said Baran–90 times the freshwater fish yield of the United States.

Putting so many dams in a single river system has cumulative effects, wrote the scientists. They advocate for new analytical methods that can weigh these impacts and allow decision makers to optimize both hydropower and the natural

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ecosystem that supplies fish and sediment to

**A Dam Is Built in 'Paradise'**

fertilize cropland. The method can identify the proposed dams that might not produce much energy but would have an outsize impact on fish movement and biodiversity.

Because it seems likely that many of the dams will be built, another group of scientists recently teamed up with engineers to try to make the dams less harmful to fish. Typically, engineers site and plan a dam and bring in aquatic ecologists at the end to try to mitigate environmental impacts in some small way. This team, though, came up with an obvious solution that had never been tried: Bring in the scientists first so the engineers can mitigate impacts throughout the planning process.

These innovations offer hope. But so far governments across the region are not acting on them, Baran said.

**FOR THE BIRDS**

*Kunthea, a bird guide, leads a boat tour. (Photo: Erica Gies)*

Against this depressing backdrop, our guide Kunthea told us how local conservationists have helped secure the remarkable recovery of the white-shouldered ibis, the red-headed vulture, the slender-billed vulture, and the white-rumped vulture. We'd reached the edge of open water on Tonle Sap, and our little boat plied a narrow path through water hyacinths and freshwater mangroves standing waist-high in the water. A blue-tailed bee-eater darted by, landing on a water-borne shrub, so we could admire its aqua-blue, green, and gold plumage. Farther away, a painted stork rustled in a tree and a black-shouldered kite gave us a sharp eye. The Royal Government of Cambodia and the Secretariat of the Ramsar Convention designated this area, called the Prek Toal Core Bird Reserve, as a Wetland of International Importance (also known as a Ramsar Site) in December of last year, recognizing its environmental, social, and economic importance.

We pulled up to a dead end in front of a large endemic persimmon tree sporting

two bamboo platforms. On the bottom one, close to the water, a couple of park rangers rested on mats, smoking cigarettes. We climbed a stick ladder fastened to the tree and emerged above the treetops onto the second platform. Kunthea brought a scope and showed us the flock of open-billed storks nesting in trees a short distance away.

*An open-billed stork perches in a tree-top. (Photo: Erica Gies)*

That we could see such congregations of water birds was thanks largely to Sam Veasna Center and its partners at the Wildlife Conservation Society. They've achieved that protection by making conservation economically viable for local people, hiring boat owners to ferry us and feed us lunch at a floating restaurant in the lake town of Prek Toal. They also hire former hunters as guides for most sites. "They know how to find the birds and other animals, and also they have a lot of knowledge about the species," said Orn.

To ensure the entire community is on board with conservation, not just the people participating in tourism, conservationists pay $30 per tourist to a village

development fund. To make the benefits of conservation more tangible, they've put a price on the live heads of key species. "If a villager sees a species we are trying to conserve, we pay them $5 for spotting it," said Orn. Humans have harvested eggs in the past. "If you agree to guard that nest until the chick fledges successfully, every day we pay $5."

These creative practices just earned the Sam Veasna Center a spot as a finalist in the 2016 World Responsible Tourism Awards at the World Travel Market in London.

Too soon our journey on this captivating water world was over, and our minivan sped past woven huts on stilts, yards studded with chickens, and then concrete industrial buildings and the tuk-tuks, comfortable hotels, and myriad restaurants and shops of Siem Reap. Whether Tonle Sap will survive the next couple of decades relatively intact is uncertain. But Orn is optimistic. "I'm quite a positive guy," he said. Change is difficult to predict, but it can happen suddenly, he said. The old politicians are dying, and "Cambodian youth, they want to change."

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