THE BELO MONTE DAM: GREATEST "NATURAL" DISASTER OF OUR GENERATION?

BY SHANE PUTHUPARAMBIL

In 1989, in the Brazilian town of Altamira, a Kayapo woman spoke passionately to a gathering that had been arranged by various international nonprofits. "We don't need electricity; electricity won't give us food," she said. "We need the rivers to flow freely—our futures depend on them. We need our forests to hunt and gather in. Don't talk to us about relieving our 'poverty'—we are the richest people in Brazil. We are Indians."[1]

Strong-willed and emotional, the Kayapo woman's voice reverberated throughout the international community.[1,2] Protesting the Brazilian government's plans for several hydroelectric projects on the Xingu River, the Kayapo (and other tribes) had forced the World Bank to scrap the loans for the dams and pushed back the building plans for nearly two decades. However, in 2011, the Brazilian environmental ministry (IBAMA) granted licenses to Norte Energia—a Brazilian construction consortium—to start construction on a new project. Today, the world's fourth largest hydroelectric project, known as the Belo Monte Dam, is nearly complete, and the social and environmental concerns of the past are now the nauseating realties of the present.

THE XINGU AND BELO MONTE

The Belo Monte hydroelectric project is positioned on the lower Xingu River, in a particularly fast-flowing region that is commonly referred to as the Volta Grande or "the Big Bend."[3,4] Areas where water is shallow and traveling at high velocities are often referred to as "rapids." The Volta Grande represents some of the largest and most complex rapids on Earth.[5] Prior to human development, this bend was home to hundreds of freshwater fish species, each inhabiting its own unique niche within the river. In fact, a recent survey collected an astounding 450 species from 48 distinct fish families in the Volta Grande, demonstrating the enormous diversity of fish in the river.[6] The Belo Monte hydroelectric complex, which is made up of two dams, was designed to harness the incredible rush of water by redirecting the Big Bend through a series of hydroelectric turbines.[5] This ambitious project would come with costs: creating a 260-mile reservoir, submerging approximately 150 square miles of rainforest in water, harming aquatic ecosystems, and displacing about 30,000 people.[7] In essence, the project destroyed the balance maintained for thousands of years between the indigenous people and their wilderness, resulting in the demise of a region once revered for its cultural and biological diversity.

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IMPACTS ON THE XINGU RIVER

The new dam will have countless negative effects on the overall biology of the river. The Belo Monte complex will ultimately harm the habitats of hundreds of endemic fish species, primarily affecting specialists, species that are intolerant to changing environmental conditions. The dam project will damage each part of the river on which the hydroelectric complex lies: the upper section, middle section, and lower section. Upstream, the dam has already slowed the rapids, and as a result, the substrate—the river bed—will continue to erode significantly. Other effects include an increase in surface temperatures and a lower dissolved oxygen content in the water. Downstream of the powerhouse, the overall water flow will continue to decrease, and the quality of the water will worsen due to the sedimentation, erosion, and increased temperatures of the system upstream.[6] The construction of the Belo Monte dam raises several environmental concerns, as evidenced by a large decline in the populations of endemic fish.

Because many of these fish live only in the Xingu River, projects like the dam can jeopardize the existence of entire species. Almost all species of rapid-dwelling fish have severely diminished in number, particularly due to the decrease in water flow and increase in surface temperatures. Numerous catfish of the species *Baryancistrus xanthellus* were found dead in the upstream section shortly after the dam's reservoir was filled in 2016. Downstream of the Belo Monte complex, researchers found that the generalist species, fish that easily adapt to immense changes in the environmental conditions of a system, replaced non-tolerant specialist species.[6] The extinction of specialist rapid-dwelling species, especially in a region where divergent evolution is highly active, will be an immense loss not only to science, but also to the fishermen and nearby cities that rely on the ornamental fish trade to drive the local economy.

Figure 1 (left): *Rapids typical of the Volta Grande, characterized by the vegetation along the banks and the huge partially submerged boulders. Fishermen find plecos, medium-sized suckermouth catfish, wedged between crevices formed by the rocks and boulders.*

Figure 2 (right): *The main dam shortly before its completion.*

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IMPACTS ON FISHERMEN

Besides the impacts on the ecological and geological structure of the Volta Grande, the Belo Monte hydroelectric complex will also cause great harm to the ornamental fishing industry. Ornamental fishermen collect the colorful fish from the Xingu River to export for the global pet trade, but after the construction of the dam, the number of fish trading companies dropped from 25 to 4. This illustrates the challenge that ornamental fishermen endured before eventually going bankrupt and leaving the industry. In 2014, Van Hall Larenstein University conducted a survey of the remaining fishermen. The researchers found that the abundance of the collectable fish and the overall health of these fish has notably declined. In addition, the decreased water levels exposed key fishing grounds along Volta Grande to overfishing. Hence, fishermen have to collect fish in deeper parts of the river where the current is stronger. Consequently, it often takes significantly more time to collect a sellable quantity.[8] The ornamental fishery as a whole is becoming increasingly insufficient to support the families of the fishermen, so much so that many decide to go and work in construction or cattle ranching elsewhere. This adds to the snowball effect often induced by environmental destruction, as activities such as ranching, farming, and construction often involve clearing forests and damaging other natural resources.

The Belo Monte Dam has cost the wildlife and people of the Xingu River considerably, and the full, long-term consequences of its construction will not be known for years to come. Scientists have been making extensive efforts to document the effects of the dam on the Xingu River, with the hope that this information can persuade governments to pursue sustainable means of energy generation and to avoid making the same mistakes again.[5] With other megadams being planned for construction on other international rivers such as the Mekong, the Congo, and the Tapajos, the question arises: given the effects of damming on both people and biodiversity, should these dams be constructed? From what we have seen so far, the construction of dams in areas of exceptional biodiversity bears a large burden, yet the recent election of Brazilian president Jair Bolsonaro, a pro-dam advocate, has made the development of alternatives unlikely. That being said, it becomes even more clear that in order to preserve the Amazon, a new, truly sustainable and renewable energy source, is greatly needed.

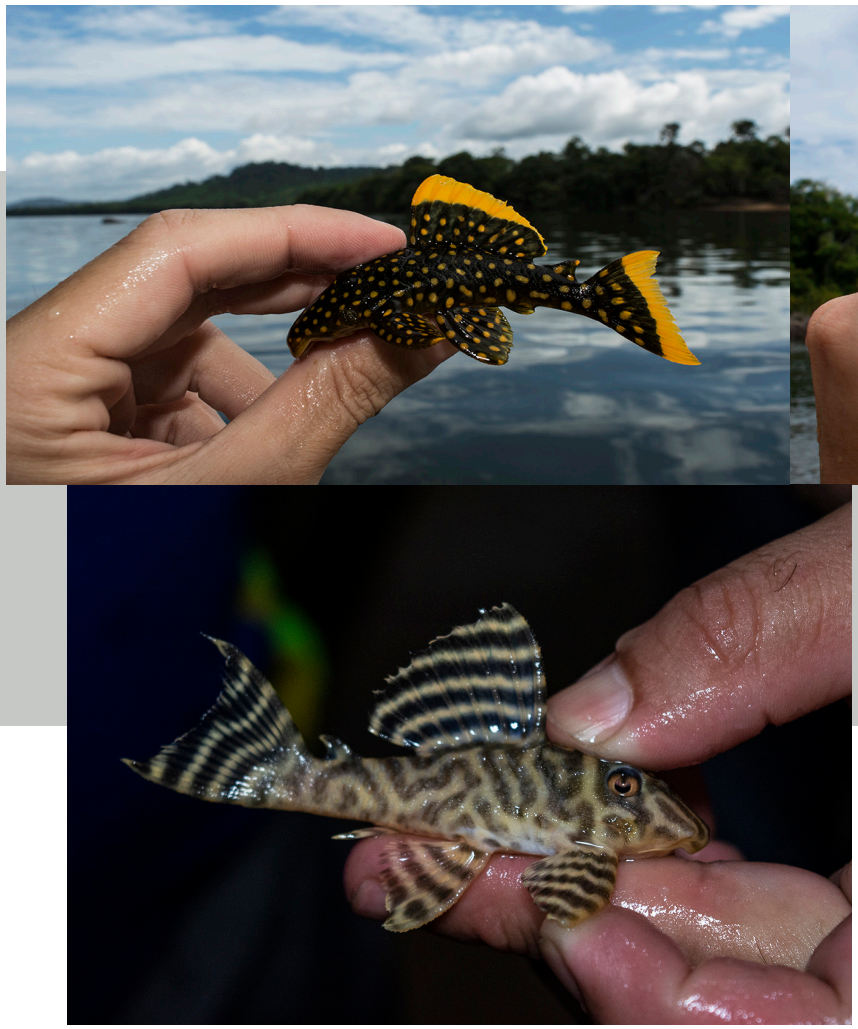

Figure 3: *Several different species of rapid-dwelling pleco catfish found in or near the Volta Grande, including the Gold Nugget pleco (Baryancistrus xanthellus).*

Figure 4: *Daniel, a young fisher in training, holding some gold nugget plecos that he collected.*

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Special thanks to Michael J. Tuccinardi for providing the stunning photographs for use in this article.