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Regions

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Scientists sound alarm over hydropower’s impacts on tropical fish biodiversity

A group of 40 scientists have published an article in the journal Science that summarizes the negative impacts of the global hydropower boom on the rich biodiversity and unique ecosystems of tropical rivers.



Fishermen along the Mekong River in Thailand. Scientists say that the Mekong River has around 850 known species of fish, which are being threatened by the proliferation of hydropower dams along the river. Image: Nuigiolia / Shutterstock.com

The Amazon, Congo and Mekong rivers host one-third of Earth’s freshwater fish species, many of them found nowhere else — and this rich biodiversity is “being ravaged” by the development of hydroelectric dams.

The authors of an article published in the journal Science last week argue that advocates of hydropower often overestimate the economic benefits of dams and underestimate or deliberately downplay the severe impacts on biodiversity and critically important fisheries.



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Past research has shown that the carbon emissions from hydroelectric dams greatly exceeds official estimates, and now an international group of 40 scientists are seeking to shine a light on how hydropower, often touted as “sustainable” development, could mean disaster for tropical fish biodiversity.

The Amazon River has 2,300 known species of fish, 16 per cent of the world’s known freshwater species, and more are being discovered every year, the authors of the Science article note. The Congo Basin, meanwhile, ranks second with 1,000 species, and the Mekong comes in at third with 850.

Poor planning and unsustainable infrastructure projects contributed to an average 76 per cent population decline among freshwater species over the last four decades, according to Michele Thieme, a World Wildlife Fund scientist and co-author of the article.

Most existing dams are relatively small and located in upland tributaries, but as many as 450 new hydroelectric dams are already planned or in construction on the Amazon, Congo, and Mekong rivers. Without more careful assessment and holistic planning at the river basin level, the authors say, these new hydropower projects will cause species extinctions and basin-wide fisheries declines.

For instance, the article notes that major dams are usually built where rapids and waterfalls boost hydropower potential, but these are precisely the same sites where many unique fish species that have adapted to live in fast water are found.

“Far too often in developing countries, major hydropower projects are approved and begun before any serious assessments of environmental and socioeconomic impacts have been conducted,” Dr. Kirk Winemiller, a fisheries scientist at Texas A&M AgriLife Research in College Station, TX and lead author of the article, said in a statement.

Winemiller and his co-authors acknowledge that hydropower projects can help address critical energy needs in developing countries, but they cite numerous instances in which decisionmakers have failed to take into account their full costs over time.

While geographic data on distributions of tropical fish populations and other aquatic species are incomplete, according to the article, recent research has shown that site selection makes a huge difference in conserving biodiversity.

Nonetheless, the scientists found that some developing countries lack protocols to guide hydroelectric dam construction, while many countries even exempt small dams from any formal decision-making process altogether.

They bring up Brazil as an example, and the Belo Monte hydropower complex, nearing completion on the Xingu River, in particular. The lower stretch of the Xingu provides habitat for about four dozen fish species that are found nowhere else on Earth. When it comes online, Belo Monte will rank third in the world with its installed capacity of 11,233 megawatts, but it also “may set a record for biodiversity loss owing to its location,” Winemiller said.

As many as 334 new dams have been proposed in the Amazon basin alone.

The Science article also highlights an example from Thailand, where it was found that maintaining food security amidst the impacts to local fisheries of the 88 new dams planned to be built by 2030 would require the expansion of agricultural land by anywhere from 19 to 63 per cent.

It’s not just rivers and surrounding ecosystems that take a hit, either, as financial returns from hydropower projects have usually fallen short of expectations.

The authors found that an estimated 75 per cent of large dams ended up costing almost twice as much as the figures used to justify their creation, and that economic projections frequently exclude or underestimate the costs of environmental mitigation. In making the latter point, they point to the example of the Three Gorges Dam and the fact that China ended up having to spend nearly \$26 billion to moderate its ecological impacts.

But a lack of transparency during dam approval processes makes it unclear whether funders of these projects and the public are ever fully informed about these economic risks, as well as the long-term impacts on tropical river systems. Winemiller says he and his co-authors wrote the Science article specifically to call attention to the need for better planning when it comes to hydropower projects.

“We wrote the paper to bring global attention to this problem,” Winemiller said, “partly in hopes of stimulating research on tropical rivers, and partly to stimulate better approaches for hydropower development that balance true costs and benefits in the context of cumulative impacts.”

To truly achieve sustainability, Winemiller and his co-authors write, assessments of new projects must go beyond local impacts and account for synergies with existing dams, as well as land cover changes and likely climatic shifts.

“We call for more sophisticated and holistic hydropower planning, including validation of technologies intended to mitigate environmental impacts,” they write. “Should anything less be required when tampering with the world’s great river ecosystems?”

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