

Dams and Fish/Shrimp Migrations in Mesoamerica— Worldwide Implications

INTRODUCTION

There are ever so many reasons to question dam proposals in developing countries. Issues of social justice and indigenous rights are often raised. Shaky economic assumptions are frequently exposed. The ecological damage is well-documented. An endless list of site-specific issues can arise—for example, the submergence of archaeological resources of the Rio Usumacinta watershed in Guatemala and Mexico or the Ilisu valley in Turkey should proposed dams go forward.

But there is only one issue that applies across the board, to every dam ever proposed: all dams act as barriers to the movement of aquatic animals, and “fish ladder” type technology is, at best, a partial solution. No discussion of any dam scheme is complete without an assessment of which species of fish and other aquatic creatures need to move up and down the river past the dam site. Yet, except in those cases involving high-profile commercial or recreational fisheries, this issue often goes unremarked.

No dam assessment is complete without an effort to collect all relevant biological information. By “relevant” we mean not only the environmental impact studies which are often mandated for the areas directly impacted by the dam, reservoir, and associated infrastructure, but information about long reaches of river up and downstream of the dam site. Most dam proposals do not include such studies.

This is a global issue, but applies with particular force to islands and narrow land masses, such as the Mesoamerican isthmus, where rivers are characteristically short. The experience in the Changuinola/Teribe watershed of Bocas del

Toro Province, Panama, described herein, details the critical nature of this problem. As aquatic conservation biologists, we are embarrassed that so many of our professional colleagues are asleep on this issue. River activists concerned with dams have also largely neglected to take advantage of this universal issue. It is time for a worldwide wake-up call on this critical problem.

DAM PROPOSALS IN PANAMA

Our involvement in dam issues in Mesoamerica grew out of a stream biomonitoring program in the Talamanca region of Costa Rica where, so far, we are not faced with specific dam proposals. In November 2004, the biomonitoring team was asked to give a series of workshops for leaders of the Naso and Ngobe indigenous groups from Bocas del Toro Province, just across the Rio Sixaola in Panama. Our original focus was on issues like deforestation, organic pollution, and overfishing—the kinds of problems rural communities have a hand in creating and can learn to resolve.

But just prior to the workshops, a historic event occurred. The Naso (the only hereditary monarchy in the Western Hemisphere) deposed their king for signing off on a proposal for a hydroelectric dam to be built on a tributary of the Rio Teribe, in Naso territory. We soon learned that the

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neighboring Ngobe tribe, located just over the hill along the Rio Changuinola (to which the Teribe is tributary), were facing three dam proposals. All this was in an area so remote that some of the workshop attendees had to walk three days to reach the nearest bus stop.

The cultural rights and economic issues were being addressed by the Naso, Ngobe, and Alianza para la Conservacion y el Desarrollo, a small Panamanian non-governmental organization; there was little for us to do at that level beyond being sympathetic. But fundamental biological issues were not being raised, a fact later confirmed when we reviewed the weak environmental impact assessments for the four dams.

So we modified our workshops to include a strong emphasis on the role of barriers to the movement of aquatic animals. A key word to understand in this situation is “diadromy.” Some

aquatic animals are relatively sedentary; others are highly migratory. Some migrate within freshwater, but for many, free transit between fresh and salt waters is an essential feature of their life cycle. Such animals are referred to as “diadromous.” You might be familiar with the spawning migrations of the diadromous salmon of the U.S. Pacific Northwest and

The diadromous *Joturus pichardi* (hog mullet, also known as bobo in Costa Rica, bocachica in Panama, or cuyamel in northern Central America) is the most highly esteemed freshwater food fish in the greater Talamanca region. There are no complete studies of its life history.



the role of dams in decimating many of these salmon runs. But from an ecosystem point of view, it can be argued that diadromy is even more important in places like Panama than in the North Pacific.

Because the Mesoamerican isthmus is so narrow, but also because during geological time this region was frequently cut off from the large North and South American land masses, relatively few purely freshwater fish were able to colonize the area. A high percentage of the "freshwater" fauna of the isthmus is obliged to spend part of its life in the ocean and estuaries. Seemingly paradoxically, the higher one goes in a watershed, the greater the dominance of diadromous forms. In our research in Costa Rica, we have found that 70–94% of individual fish (and all of the usually abundant shrimps) in small upland streams far from the sea are diadromous species.

A DIADROMOUS DIET

The diadromous species happen to include almost all the larger bodied fish utilized as food by the Naso and the Ngobe. As for ecological importance, anyone who has ever observed the phenomenon of the "tismiche," when giant mixed schools of larval shrimp and gobies pass upstream like dark clouds, cannot doubt the importance of diadromy in maintaining the food chain of rivers draining into the Caribbean. We have no hard numbers, but it is certain that the greater part of the animal biomass (the total weight of living animals) is composed of diadromous species.

There was no documentation of the fish and shrimp communities in the upper reaches of the Changuinola-Teribe watershed, but we were able to train Naso and Ngobe biodiversity field workers to do biological surveys in the upper

watershed. Their findings backed our assumptions about the high proportion of diadromous species. For example, in the reach that would be impounded by the proposed Bonyic Dam, 95% of the fish and all of the shrimp were diadromous. (These findings contributed to a decision by the Inter-American Development Bank to discontinue consideration of funding Bonyic, citing "potential impacts on stream ecosystems," but that is just one source of financing for one of the dams.)

Most of the sites monitored by the indigenous field workers were within the La Amistad International Peace Park and Biosphere Reserve, a World Heritage site. The first stated purpose of the creation of La Amistad was to "protect a significant sample of the biological diversity of one of the richest faunal and floral zones which still remains relatively unaltered in the Republic of Panama." Construction of the lowermost dam on the Changuinola, known as Chan-75, would eventually compromise that biodiversity by eliminating all diadromous species from 848 km of permanent streams within La Amistad. Not every river can claim an internationally renowned protected area in its watershed, but the potential for ecosystem damage is similar in every case.

THE CURRENT CRISIS IN MESOAMERICA

When we began to look for precedents, we were startled to find no research at all from Mesoamerica (which still has relatively few dams). We did discover relevant studies from the West Indian islands of Puerto Rico, Guadeloupe, and Curaçao, where the native diadromous fauna is similar to that of Mesoamerica—and where it has been decimated in all three cases. Perhaps the best example is from Puerto

Rico, which, as part of the United States, was a victim of early enthusiasm for dam construction. Most major rivers in Puerto Rico are dammed, with the result that the majority of the freshwater fish and shrimps have disappeared from many of the island's river stretches above dams. This situation has provided a "laboratory" for predicting ecosystem effects elsewhere in the region. Changes documented by researchers in Puerto Rico, in addition to the virtual disappearance of fish and shrimp, include increases in sedimentation and algal growth and dramatic changes in the aquatic insect community upstream, with severe damage to fisheries downstream.

A recent study by Conservation Strategy Fund documented plans for no less than 381 new dams between southern Mexico and the Panama/Colombia border. These and other infrastructure projects are clearly part of the "globalization" phenomenon, fueled by the various hemispheric free trade agreements.

WORLDWIDE IMPLICATIONS

River protectors everywhere need to connect the dots, and spread the word about how damming rivers with diadromous species is creating a global biodiversity crisis. Concern over the role of dams as barriers to animal migration is a valid component of every anti-dam case. Even far inland, or in rivers already blocked by some dams where diadromy is not an issue, there is the matter of "potamadromy" (migrations within freshwater). No dam study is complete without collecting all the available biological information on migratory species, no biologist is exempt from responsibility for making this information publicly available, and no activist should be reluctant to be the first to raise this issue.

Map of Puerto Rico showing major rivers, sites of large dams (>15 m high) and the area of the island (22%) where the native freshwater fish and shrimp fauna has been essentially eliminated due to the barrier effect of dams and reservoirs.

