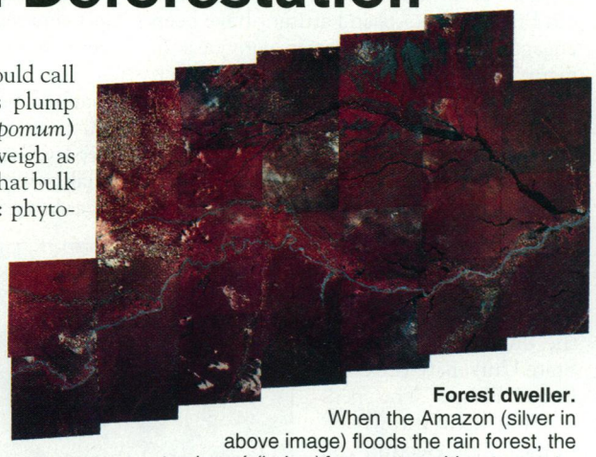
BRAZIL

Homely Fish Draws Attention To Amazon Deforestation

MANAUS, BRAZIL—No one would call the tambaquí photogenic. This plump Amazon fish (*Colossoma macropomum*) can measure a meter long and weigh as much as 30 kilograms, attaining that bulk on a remarkable vegetarian diet: phytoplankton filtered through special gills in immature fish, and waterborne seeds, which adults crush with heavy molars. But in spite of its odd eating habits and surprising girth, some ecologists and river experts think the tambaquí has star quality.



GEOPIC/EARTH SATELLITE CORP.

Forest dweller. When the Amazon (silver in above image) floods the rain forest, the tambaquí *(below)* forages on rubber-tree nuts.

MICHAEL GOULDING

The tambaquí is already celebrated in Brazil for its delightful, fruity taste, whether grilled or stewed, which has put it on many restaurant menus. Indeed, this fish has become so popular that it has nearly been fished out of the waters around Manaus, where the Rio Negro and the Amazon converge, according to biologist Carlos Araujo-Lima of Brazil's Instituto Nacional de Pesquisas da Amazônia (INPA) in Manaus. Yet he and a group of other researchers based in Manaus would like the tambaquí to become still more widely known, although not just for its taste. They are promoting the tambaquí as a symbol of the imperiled state of the flooded forest—a submarine habitat that forms during the Amazon's wet season and is home for half the year to adults of this species.

One aim of these researchers is to conduct environmental studies. Araujo-Lima and his colleagues are building a new research project around the tambaquí, aiming to make a "rigorous and quantitative" survey of the effects of deforestation in the Amazon flood plain on fish populations. But they also have a policy goal. By making the tambaquí a poster child for the flooded forest, they hope to rally support for saving this unusual environment and studying its other inhabitants.

Besides Araujo-Lima, leaders of the tambaquí project include Efrem Ferreira of INPA; Michael Goulding, an ecologist and director of the U.S. Rainforest Alliance's Amazon Rivers Project; and Jeffrey Richey, a hydrologist at the University of Washington, Seattle, who has been a leader of Amazon River surveys since the early 1980s. Their working hypothesis is that the tambaquí can thrive only if adults continue to have access to the flooded forest, where they bulk up on rubber-tree seeds. The decline in the fish population near Manaus, the group thinks, is due not just to overfishing but also to the disappearance of the feeding grounds below Manaus as ranchers cut the trees to create meadows where cattle and water buffalo, sometimes knee-deep in water, feed on grass.

Richey and Goulding are still seeking private funding for the work, but they have taken the first steps toward testing their hypothesis by acquiring images from the Landsat satellite and radar scans taken aboard the Space Shuttle. Next, they plan to correlate the space images with a series of field studies to determine how much of the flooded forest has been lost and where. At the same time, Araujo-Lima and others will use data collected in the markets of Manaus—home to about 800 fishing boats—as a basis for estimating changes in the fish population.

Goulding, author of *Amazon: The Flooded Forest* (1990), hopes that the tambaquí's popularity on dinner menus will ultimately prove its salvation: Companies that want to exploit the tambaquí, he thinks, may be persuaded to save the flooded forest as a fish habitat. Already, Goulding says, fish farms around the world have begun to experiment with raising captive tambaquí. Because they are vegetarian and grow fairly quickly, tambaquí farming could become a big business. And Goulding hopes investors will conclude that the cheapest way to raise these fish is to keep them in the flooded forest.

Besides drawing attention to the tambaquí's plight, however, Araujo-Lima and his colleagues hope that their tambaquí project will give a boost to other, ongoing research on the Amazon's incompletely understood aquatic life. Although Brazilians have collected data on native fish, Araujo-Lima says, these reports have been written in Portuguese and have not been widely circulated. Even the number of species is still a matter of "some controversy," says Araujo-Lima. The standard estimate in the 1980s was that the Amazon held 1200 to 1500 species of fish, but more recent surveys of the middle and lower reaches of a single tributary have identified about 400 species. If all the small fish including catfish are counted, Araujo-Lima believes, the total number of species in the Amazon may rise as high as 4000.

To establish a baseline of knowledge, the Museum of Zoology at São Paulo is putting together a compendium of Amazonian aquatic studies. Meanwhile, Araujo-Lima, Bruce Forsberg of INPA, and other researchers in the Amazon are investigating the life cycles and feeding patterns of fish that live in both the flooded forest and the main river channel. Explains Araujo-Lima, "We are studying the food chains supporting fish production, using stable isotopes" to monitor which types of vegetation—grass, leaves, seeds, and decayed tree parts—are most important for various types of fish along a 2000-kilometer stretch of the river.

The work builds on earlier hydrological surveys of the Amazon and tributaries by Richey and two researchers based in Piracicaba, Brazil: Reynaldo Victoria and Luiz Martinelli. In a series of trips along the river funded in part by the U.S. National Science Foundation, they analyzed the quantities of carbon and oxygen moving through the Amazon basin. The measurements have yielded reliable estimates of flow rates throughout the river system. And those, in turn, help the fish specialists trace species to their spawning grounds. For example, says Araujo-Lima, if he takes a young fish out at Manaus, he can calculate from its known growth rate how far it has traveled down river, allowing him to estimate where it was hatched.

The value of these studies might once have been lost on anyone but an ichthyologist. But Araujo-Lima says he hopes the tambaquí project will persuade both devotees of the rain forest and potential investors in commercial projects that the Amazon's fish resources are worth studying and preserving. If so, this ungainly fish will have lived up to its star billing.

–Eliot Marshall