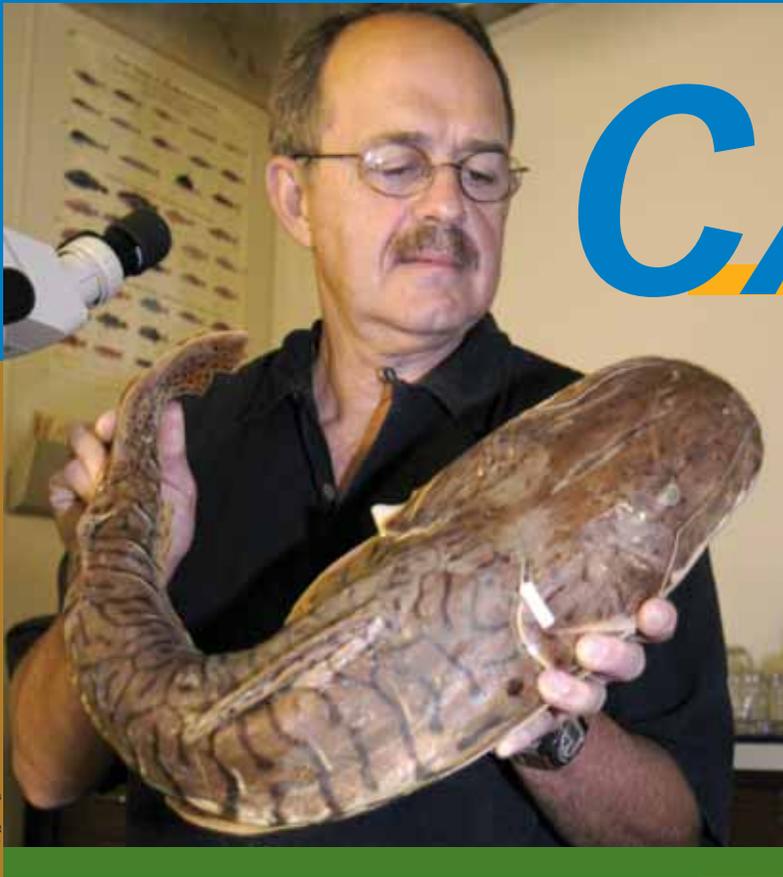


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CATFISH



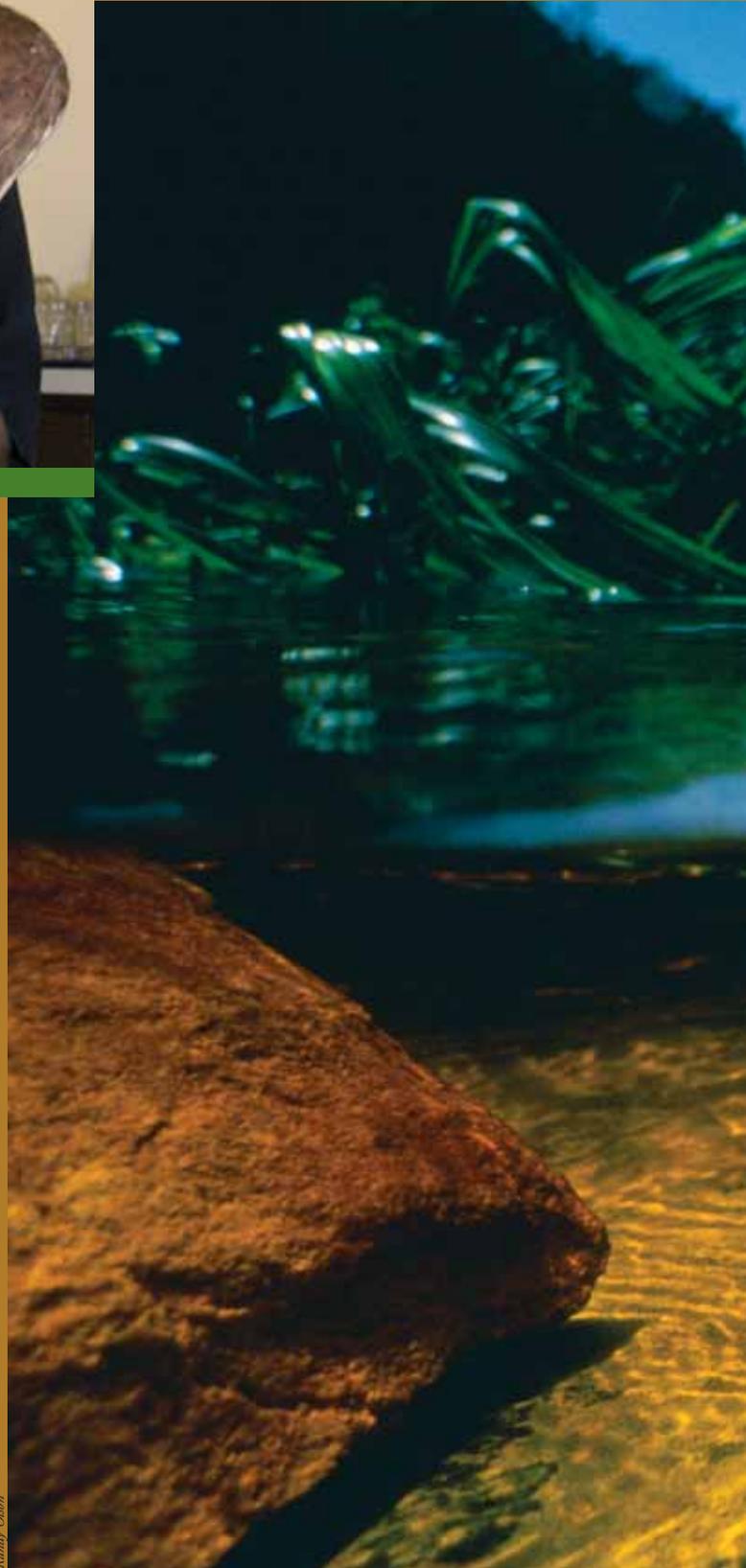
Jeff Gage

Ichthyologist Larry Page with a Tiger Catfish.

SOME CATFISH BREATHE AIR AND SQUIGGLE ACROSS LAND. OTHERS STUN PREY WITH SHOCKS REACHING 400 VOLTS. STILL OTHERS SUBSIST ON WOOD, LIKE TERMITES.

Catfish are found on every continent except Antarctica. They range from fingernail-length miniatures to sedan-length monsters. They are among the most diverse and common fishes, comprising one in four freshwater species.

Despite nearly three centuries of exploration and research and the recognition of more than 2,700 species, an estimated 1,750 catfish species remain unknown to science. But not for long. Backed by a \$4.7 million grant from the National Science Foundation, scientists at the University of Florida's Florida Museum of Natural History have begun leading a five-year effort to discover and describe all catfish species. The only one of four similar projects in the NSF's Planetary Biodiversity Inventory program that focuses on vertebrates, the project will tap 230 scientists from around the globe, with many hauling nets and buckets into some of the world's most remote waters. The other NSF projects focus on plants, insects and microscopic organisms called Eumycetozoa or, more commonly, slime molds.



Randy Olson

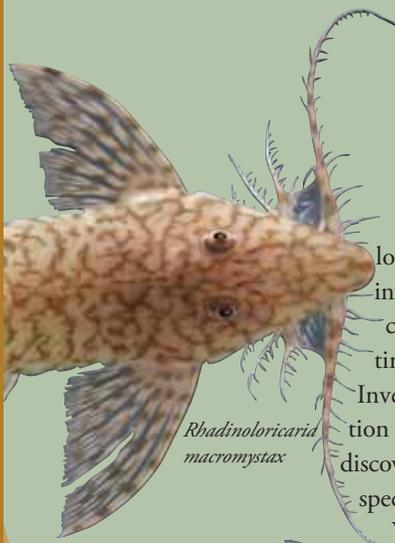
A native stalks a Suckermouth Armored Catfish in Guyana.

HUNTERS

BY AARON HOOVER

A composite image. The top half shows a person in a boat on a river, with tall grasses in the foreground and a blue sky with clouds. The bottom half shows a close-up of a catfish underwater, resting on a sandy bottom. The water is clear, and the fish's features are visible.

**SCIENTISTS WORLDWIDE
AIM TO IDENTIFY ALL
THE REMAINING SPECIES
OF CATFISH, BEFORE
IT'S TOO LATE**



Rhadinoloricaria macromystax

Practical considerations have long forced scientists to limit investigations to small geographical areas or a few species at a time. The Planetary Biodiversity Inventory seeks to turn this tradition on its head, shooting for the discovery and description of all species within certain groups. Jim Woolley, program director of the NSF's biodiversity surveys and inventories program,

says the goal is a comprehensive accounting before it's too late.

"I think it's clear to people that we are losing habitats and losing biodiversity much faster than we can get a handle on it," he says. "We want to greatly stimulate the rate and pace at which species discovery is being conducted. This program was designed to tackle projects on a scale never before attempted."

The University of Florida-led project is headed by Larry Page, an adjunct curator of fishes at the Florida Museum of Natural History and principal scientist emeritus at the Illinois Natural History Survey.

"Larry and the other principal investigators were clearly in a position to pull this off," Woolley says. "It was clear that they had really drawn the community together and that they were in a position for some very efficient and effective collaborations."

The Academy of Natural Sciences in Philadelphia, the California Academy of Sciences, Auburn University and Cornell University are the project's other principal participants.

Species Surprises

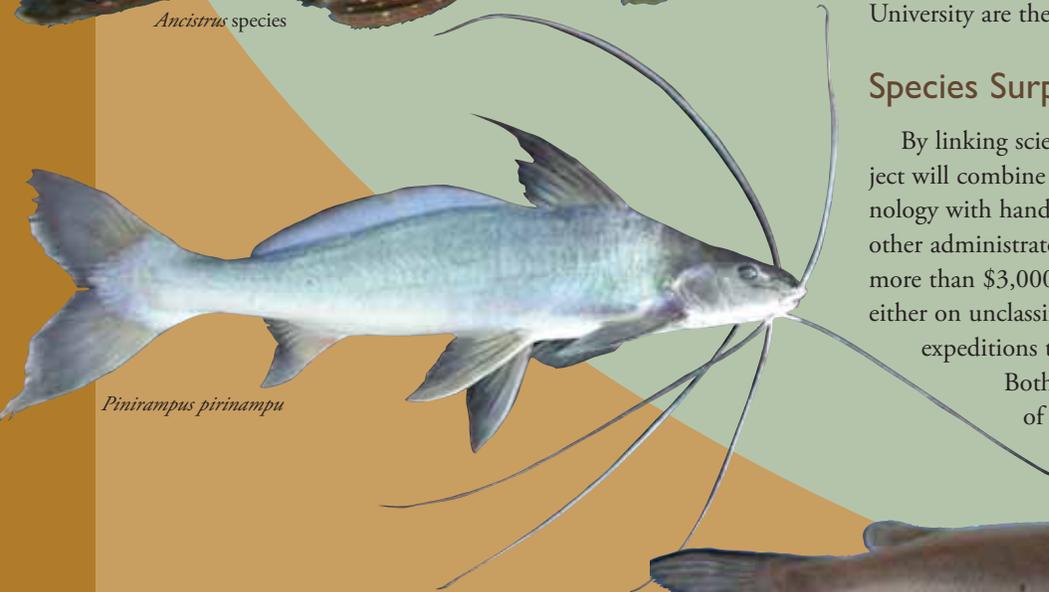
By linking scientists and databases via the Internet, the project will combine modern computer and communications technology with hands-on collecting expeditions. Page and the other administrators will distribute small grants, usually no more than \$3,000, to affiliated scientists worldwide for research either on unclassified specimens housed in museums or on expeditions to hunt for new species.

Both avenues are expected to bear fruit in the form of peer-reviewed publications describing new species. Surprisingly, it's not always the dustiest museum specimen or most remote waters that yield the best finds.

Six years ago, Rocio Rodiles was a doctoral student at the Mexican research institute Eco-Sur working on her thesis research to inventory all of the fish in the Lacantun River in southern Mexico near the Guatemala border. The Lacantun is a tributary of the Usumacinta, which is very well studied because of its geographic location at the junction of North and Central America. Rodiles was fishing with hook and line when she reeled in a large, greenish catfish she had never seen before.



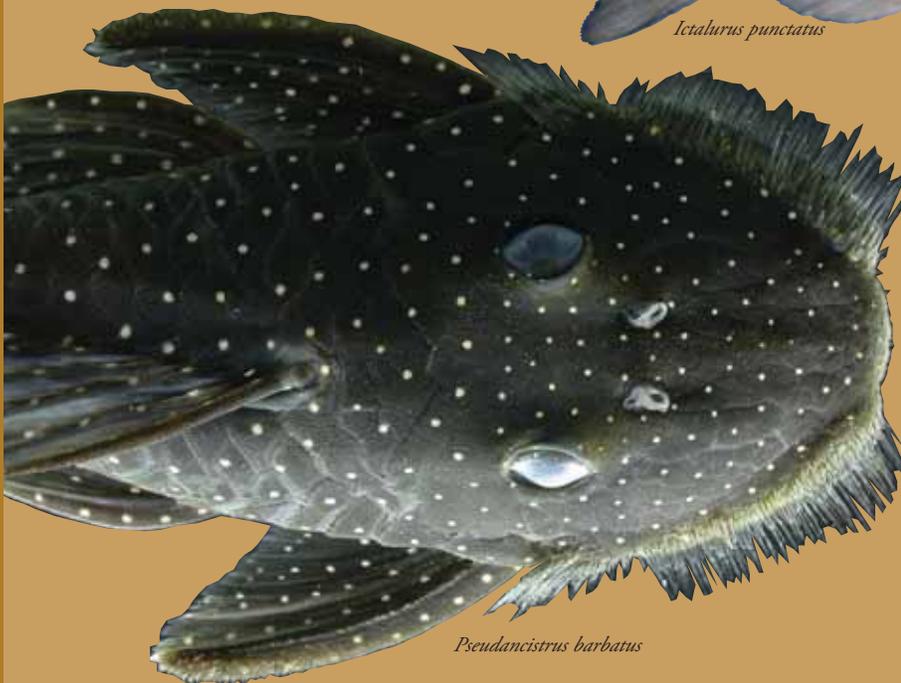
Ancistrus species



Pimirampus pirinampu



Ictalurus punctatus



Pseudancistrus barbatus

“The first time I saw it, I didn’t know what kind of catfish it was,” says Rodiles, now a post-doctoral fellow at the Academy of Natural Sciences in Philadelphia.

The fish looked like it belonged to the ictalurids, the family of North American catfish, but it had enough unusual features — such as the large pores on its head — to prompt Rodiles to take a closer look. When comparisons of the fish with known species of catfish failed to produce a match, she contacted University of Texas ichthyologist Dean Hendrickson. Together, the two discovered other characteristics that seemed to set the Chiapas fish apart from the ictalurids. For example, it has six instead of seven or more pelvic fin rays — the supporting, bony elements of fins — and a very different pelvic skeletal structure.

Curiously, Rodiles and Hendrickson found that the fish didn’t fit into any of the South American catfish families, either. After several years of study and discussion, they and other ichthyologists are now leaning toward placing the catfish in its own, entirely new family, says John Lundberg, curator and ichthyology department chair for the Academy of Natural Sciences of Philadelphia and co-investigator on the catfish inventory. The catfish has enough evolutionarily primitive features to suggest that it is only remotely related to North American catfishes, he adds.

Rodiles’ discovery is unusual, in part because the area where the fish was found is so well studied and in part because biologists have already described most large fishes for the simple reason that they tend to stick out more than others. Indeed, Rodiles says, the indigenous people who live near the Lacantun River were familiar with the Chiapas catfish, which they called “bagre,” as a so-so dinner entrée. Catfish inventory researchers expect that most new species they find will not be so distinctive, with some only identifiable through obscure differences such as the placement of certain bones.

Nevertheless, Lundberg wouldn’t rule out other such major finds during the inventory. “Most of the new fish we find will not have a very large body size, and some of them are going to look like catfish species that we know,

but there’s always a chance of getting something highly unusual,” he says.

Scientists are planning expeditions in South America, Asia and Africa, which together are home to the bulk of the world’s catfish. Destinations include rivers and streams in such forbidding locales as Angola, Myanmar and Congo.

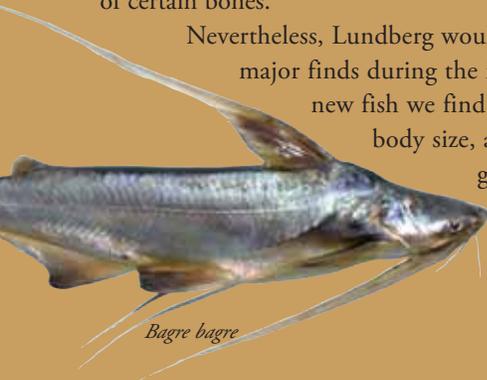
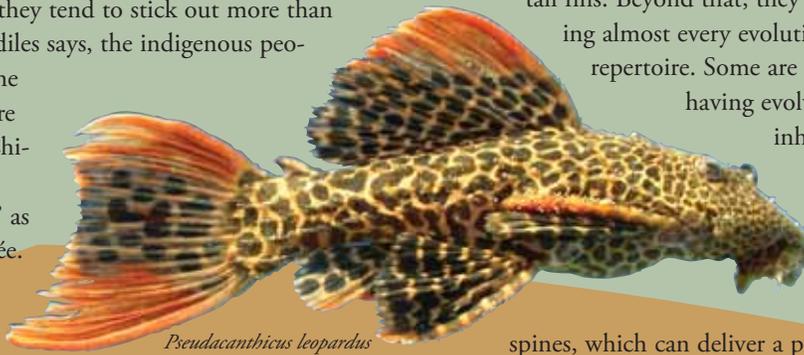
“The Congo River in Africa is very poorly collected because it’s very difficult to get in there due to the civil war, and because of the crocodiles,” Page says. “But we’re making the contacts there, and we plan to go in.”

Scientists use several techniques to collect fish specimens. Probably the most common is netting, with nets ranging from simple dip nets and large seines that several researchers haul through the water at once to gill nets. Others include “electrofishing,” or delivering an electric current to the water to stun fish to the surface, and line fishing with trot lines or similar methods. All are used for catfish, but the fish are often nocturnal, so researchers will often have to work at night, Lundberg says.

Living By Linnaeus

Famous University of Florida naturalist Archie Carr was once quoted saying, “Any damned fool knows a catfish!” And, indeed, scientists have an advantage in that nearly all catfish are identifiable by their “whiskers,” or barbels, their lack of scales and their adipose fin — the small fin between their dorsal and tail fins. Beyond that, they are incredibly diverse, incorporating almost every evolutionary trick in the aquatic species repertoire. Some are armored against predators. Others, having evolved in caves, are blind. Some, inhabitants of fast-flowing streams in the Andes and Himalayas, have modifications to their fins and mouths that allow them to climb and hang onto vertical surfaces. Many have venomous spines, which can deliver a painful and sometimes dangerous toxin to predators or unlucky people. The tiny South American catfish, the Candiru, which makes its living sucking blood from the gills of bigger fish, has been known to squeeze inside the orifices of unfortunate human swimmers.

Such is their diversity and abundance that “they work as a surrogate for freshwater fishes,” Lundberg says,





Larry Page gets nose to nose with a catfish along Guyana's Potaro River.



Hypostomus species

NEARLY ALL CATFISH ARE IDENTIFIABLE BY THEIR “WHISKERS,” OR BARBELS, THEIR LACK OF SCALES AND THEIR ADIPOSE FIN — THE SMALL FIN BETWEEN THEIR DORSAL AND TAIL FIN. BEYOND THAT, THEY ARE INCREDIBLY DIVERSE, INCORPORATING ALMOST EVERY PHYSICAL TRICK IN THE AQUATIC SPECIES REPERTOIRE.

explaining that catfish live in so many habitats and display so many physical and behavioral modifications that they are good representatives of freshwater fish in general.

Catfish predate many modern fish. They all belong to the order Siluriformes, which falls into the biggest and most modern class of fishes, the bony fishes. The most primitive living bony fishes, sturgeon and paddlefish, originated in the Jurassic era 225 million years ago. Catfish appeared well after, with the first fossil catfish dating to the late Cretaceous about 70 million years ago. That's still millions of years before the advent of most familiar fish such as grouper, members of the most advanced order of fishes, the Perciformes.

From an evolutionary perspective, catfish have been enormously successful, branching off into no fewer than 34 families found in almost every freshwater habitat in the world. Their biodiversity aside, that's another reason they're of interest to scientists. Since all but a few species are confined



It takes teamwork to catch these catfish, says Larry Page, holding net. Some members disturb the waters upstream, herding the fish into the scientists' waiting nets.

to freshwater, the distribution of the families and species allows scientists to make inferences about how land masses shifted over the eons.

“You can conduct biogeographic and other studies important to understanding biological diversity on a worldwide basis,” Page says.

More than two centuries ago, Carl Linnaeus pioneered modern taxonomy, establishing the now-familiar zoological nomenclature classing organisms into ever more defined and specific groups of families, genera and species. Science has experienced unimaginable transformation since Linnaeus' era, but his taxonomical system and the methods behind it have remained remarkably unchanged. Linnaeus named the first few catfish in his new system in 1758, including *Siluris glanis*, the Wels catfish, Europe's only native catfish and the world's largest. His methods — collection and preservation of the specimens, careful examination of physical characteristics and comparisons to similar specimens — will be the same ones used by the biologists doing the catfish inventory.

At a time when genetics seems to hold the answers to all biological questions, classic “morphological research” — comparing the physical characteristics of fishes to determine their similarities and differences — remains the most efficient and practical method for new species discovery, Page says.

“You can use genetic data, behavior, ecology, but really it boils down to morphology,” Page says. “The vast majority of individuals who will work with these fishes in any context are going to use morphology — they have to be able to recognize what they have.”

That includes Page, an expert on North American fishes and author of the *Petersen Field Guide to Freshwater Fishes of North America*. For the inventory, he plans to travel to India this spring to seek new species in Sisoridae, a family of catfishes restricted to southern Asia.

“When we looked at all the participants in this project and what they were working on, that catfish family in that part of the world seemed the most poorly covered,” he said. “We're likely to discover a lot of new species. It's all going to be new to me, since I've never been to Asia.”

Larry Page

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Related Web site:

<http://clade.acnatsci.org/allcatfish/>