

# Catfish inventory has Smithsonian scientist exploring rivers and streams the world over

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**N**ative to sub-Saharan Africa, the electric catfish can temporarily paralyze enemies with a shock of 350 volts. In South America, the candiru, a small voracious blood-sucking catfish, attacks other fish and occasionally humans. In Suriname, talking catfish grunt loud protests when pulled out of the water.

Few vertebrates rival the diversity and

global distribution of catfish. They are found on every continent except Antarctica, and fossils show that they once even thrived there.

Scientists have identified 2,743 different species—ranging in size from the giant Mekong catfish of Vietnam to the tiny transparent glass catfish popular among aquarists—and are still counting. It is estimated that there are as many as 1,750

species of catfish in the world yet to be discovered.

For the last 18 years, Richard Vari of the Smithsonian's National Museum of Natural History has been studying and describing new species of catfish collected from South America, Africa and Asia. He and other taxonomists hope to piece together the complex family tree of the catfish and establish the evolutionary ties



Richard Vari with some of the catfish specimens from a working ichthyology collection maintained by the Vertebrate Zoology Department of the National Museum of Natural History (James Di Loreto photo)

Opposite: *Cetopsis parma*, the heavy bodied fish, is a member of the catfish family Cetopsidae. *C. parma* is native to the northern and western portions of the Amazon basin in Brazil, Ecuador and Peru. The specimen shown here is about 6 inches long. Richard Vari and two colleagues named this species in 2001.





that link them to all other species of fish.

In addition, Vari collects life history data on these new species, such as what they eat, where they live, whether there are morphological differences between sexes, what they look like as juveniles and if they are exploited for food by humans. This information may someday prove critical to wildlife experts trying to manage or re-establish populations of these fish in the event of human encroachment or natural or man-made disasters.

### **Catfish inventory**

Recently, Vari joined a new initiative of the National Science Foundation known as the All Catfish Species Inventory. With this project, 200 scientists around the world will spend the next five years trying to collect and describe every catfish species on Earth.

With mass extinctions occurring in many parts of the world, the National Science Foundation has made it a priority to try to inventory at least some of the Earth's existing biodiversity before it disappears.

Catfish are a logical choice for such an ambitious project, Vari explains. "They are a major food source for people in many parts of the world. Virtually all catfish species are edible."

Their global distribution also makes them an ecologically significant species. Scientists in the United States, for example, have long used the presence and health of the bullhead catfish, a bottom feeder, as a gauge of pollution in streams and rivers nationwide.

### **'Whale catfish'**

With grants from the Catfish Inventory, Vari plans to document the evolutionary relationships among the Cetopsidae, a group of small South American catfish that resemble whales and are called "whale catfish."

"Members of the Cetopsidae range from having small eyes to having very small eyes to, in one case, lacking any indication of eyes at all," Vari says. "They also are often called 'bagre ciego,' meaning 'blind catfish.'" Recent research by Vari and his colleagues has established 20 new species of this catfish family.

For the inventory, Vari also intends to collect and study "various groups of Asian catfish—from eastern Pakistan to Thailand, down the Malay Peninsula and onto Borneo—all of which are exploited for food through their range," he says.

Why have catfish been so successful in adapting to such diverse environments around the world? "Catfish have elaborations of their sensory systems, including the whiskerlike barbels on either side of their mouth that earned them the name 'catfish.' These allow them to sense potential food items in the environment," Vari explains.

Also, along with other groups of largely freshwater fish, catfish have modifications on the backs of their heads, on the tops of their vertebral columns and on their swim bladders that increase their ability to sense vibrations, including sound, Vari says. This gives them an advantage in eluding predators and finding prey.

### **Phylogenetic studies**

Naming a new catfish species or family can take place years after a specimen is collected. Traditionally, new species and relationships between species are determined through visual similarities in morphology, although DNA analysis is being used more frequently. Only after careful examination of a specimen's skeleton, cartilage, fins, muscles and other body structures do their distinguishing characteristics emerge. For his research, Vari uses the National Museum of Natural History's fish collection, the largest in the world, with approximately 3.5 million specimens.

One common technique Vari uses to study fish bone and cartilage is to dissolve a specimen's muscle and soft tissue with an enzyme solution. He then treats the specimen with stains that turn its bones red and its cartilage blue. "We often focus on bones and cartilage in our phylogenetic studies. Preparing the fish in this way makes it easy to compare specimens side by side," he says.

In a recently published phylogenetic study of all known members of one catfish group, for example, Vari and colleagues consulted hundreds of specimens representing the genera of all known catfish families.

It is a slow, labor-intensive process, but Vari's work is providing essential information about a prolific group of fish that is an important environmental indicator and part of the human diet in many areas of the world. ❖