



Piranhas & Pacus

Concept

Piranhas are fierce little fish that swarm around animals unlucky enough to fall into the river, then tear them to bits...right? Actually, some piranhas eat fruits, nuts, and seeds. Piranhas are more diverse than you might think.

Materials

cast of mega-piranha jaw
pacu jaw
piranha jaw

Background

These three fish are all related to one another. The mega-piranha is extinct now, but it has a lot in common with present-day relatives like the pacu and the red-bellied piranha. They belong to an order of fish called Characiformes, or characins, and within that order, are part of a subfamily called Serrasalminae. Dozens of species are part of this group, and their body shapes and diets vary. You might be familiar with some Serrasalminae such as the infamous red-bellied piranha, the large herbivorous pacu, or the beautiful silver dollar.

Piranhas are an ancient lineage with fossils as old as 13 million years. In Argentina, Dr. Alberto Cione discovered a fossilized jaw of a "mega-piranha", a species fish that lived 6-9 million years ago. The mega-piranha was a big fish, probably 1 meter (3 feet) in length. No one is sure what it ate, but it may have been a plant eater like its living relative, the pacu. Although it is now extinct, its skeleton helps us understand more about its present-day relatives. Judging from its teeth, it may fit in between the pacu and the meat-eating piranhas on the evolutionary chain. Pacus have two rows of flat teeth; piranhas have one row of razor-sharp teeth. The mega-piranha has a zig-zag row of teeth, suggesting that the two rows of teeth in the pacus became compressed into one row in the evolution of piranhas. If this is so, the mega-piranha shows us what fish looked like at the mid-point of that long, slow process.

Red-bellied piranha, *Pygocentrus nattereri*

This species is one of the few piranhas that deserve their fierce reputation. These schooling predators usually target fishes, especially dead or dying ones, but sometimes also attack birds, small mammals, and other critters that fall into the water. If you look at the piranha's jaw, you can see the serrated row of sharp teeth it uses to slice out bite-size pieces from its prey. Under normal conditions, they are not dangerous to humans. However, the ebb and flow of the Amazon River creates floodplain lakes away from the main channel that dry up at the end of the dry season. Starving piranhas trapped in these shrinking lakes without food and with little oxygen can become extremely frenzied and attack anyone that comes in the water.

Pacu (or tambaqui), *Colossoma macropomum*

This fish looks quite a bit like a piranha, and but much bigger! The pacu may grow to three feet in length and weigh more than 60 lbs! But don't worry... they are herbivores, relying on a diet of fruits and nuts that fall from the flooded trees. They may spend the entire dry season without food, but when the floodwaters invade the forest, they do most of their eating and growing during the months of the wet

season, when trees are producing lots of fruit. If you look at their double row of flat teeth, you can see how that may help them crush hard-shelled nuts – much like our own molars. Due to their size and sweet-tasting meat, pacu are an important food fish for people who live in the Amazon basin – imagine how tasty they are!

“Mega-piranha”, *not named yet*

Fossils are rare in the Amazon, and in the rest of the tropics in general. A warm, wet climate is about the worst you can have if you want to find fossils. This rare fossil jaw turned up in Argentina a couple of years ago, it belonged to a fish that lived 6 to 9 million years ago. If you look closely at the teeth, they form a zig-zag shape. This may indicate that mega-piranhas are between pacus and piranhas in the evolutionary chain. If this is so, the zig-zag shape shows the middle point in the process where the double row of teeth rearranged themselves to form a single row.

Extensions

The largest extant piranha is the black piranha *Serrasalmus rhombeus*, which is just over one foot long. A large pacu may grow to three feet. So why is the mega-piranha so big? Why do animals go extinct? How are herbivores and carnivores morphologically different?

