Practical Fish Keeping Magazine—**Questions asked by Matt Clarke**
Donovan P. German responses

Which catfish groups have been observed eating wood?

Two genera in the family Loricariidae: *Panaque* and *Hypostomus*.
Hypostomus is a rather large genus with at least thirty described species, and the only ones known to eat wood are in the "*Hypostomus cochliodon*" group, which comprises about seven described species. There are approximately ten described species in the genus *Panaque* and they are split into two lineages: the small and large *Panaque*. The small clade includes the popular *Panaque maccus* (the clown pleco), whereas the large clade includes the popular *P. nigrolineatus*, the royal pleco.

Outside of the family Loricariidae, no catfishes (order Siluriformes), or any fish species for that matter, is known to regularly ingest wood.

What happens when catfish are fed on wood?

Well, that depends on the species. In my studies, I fed *Panaque nigrolineatus* and *Pterygoplichthys disjunctivus* (formerly of the genus *Liposarcus*) wood in the laboratory and both species lost weight, were in negative nitrogen balance (i.e., they were burning their own protein reserves to survive), and generally didn't do well on wood alone. This is not to take away from the point that species of *Panaque* do consume a large amount of decaying wood (~70% of their daily intake) in the wild, but they cannot survive on wood alone. See my paper "Inside the guts of wood-eating catfishes: can they digest wood?" in the Journal of Comparative Physiology B (DOI 10.1007/s00360-009-0381-1) to see a discussion of what I think wood-eating catfishes actually get from wood and detritus. They don't efficiently digest cellulose (in fact, no fish species has ever been shown to efficiently digest cellulose) or hemicellulose, which are the main constituents of wood. The catfish are very efficient at digesting wood degradation products (i.e., the small disaccharides produced by microbes degrading the wood in nature) and likely microbes found on degrading wood. I provide more evidence of this in another article [German DP, and Bittong RA (2009) Digestive enzyme activities and gastrointestinal fermentation in wood-eating catfishes. Journal of Comparative Physiology B (DOI 10.1007/s00360-009-0383-z)]. Both of the cited articles are "open access" and can be downloaded by anyone, even without a subscription to the journal.

So, the take home messages here are: 1) Only specific catfish species from the family Loricariidae (suckmouth catfishes, or "plecos") are known to consume wood, not all catfishes; 2) The wood-eating loricariids need something more than just wood (e.g., feces from other fish species, algae discs) to meet their dietary needs in captivity; 3) The type of wood fed to the fish is likely important—these fish consume decaying wood of riparian trees in the Amazonian basin, not pine or something completely exotic. People adding wood to their tanks for *Panaque* should get degraded wood from a river or creek, and preferably from a non-polluted area. Another thing that needs to be investigated is the effect of tannins (secondary compounds produced by trees like oaks) on these fishes. Loricariids are most diverse and abundant in non-tannin-stained water (i.e., water that is not naturally the color of tea), so tannin-laden wood could be a problem over time. Although, I observed no health problems in *P. nigrolineatus* that had been consuming degraded water oak for over two years.

Are they really wood-eaters, or do they eat the wood while grazing for other foods?

This is another great question. Most loricariids that have been studied to date are actually grazers, consuming what's known as the Epilithic Algal Complex (EAC), which is a loose assemblage of bacteria, cyanobacteria, filamentous green algae, diatoms, and detritus that grows on hard substrates in aquatic systems. However, the fish in the genera *Panaque* and *Hypostomus* do have enlarged teeth, dig into the wood, and consequently consume a considerable amount of wood (~70% of their daily intake). The catfishes do not efficiently digest that wood and really only digest the soluble degradation products (e.g., disaccharides) produced by microbes degrading the wood in nature. I have another manuscript that I am

about to submit for publication in which I used a chemical tracer technique called “stable isotopes” to trace what the carbon and nitrogen sources are for the fish in the laboratory and in nature. The fish can definitely get carbon from wood detritus—again, by digesting wood-degradation products and microbes found on wood—but they get their protein (traced via the nitrogen) from detritus, and perhaps even from animal material. So, they dig into the wood to get a food resource (wood-degradation products and detritus) that the other fish cannot.

Can they digest the wood at all?

See my answers above. If the wood is degraded, they can assimilate the degradation products produced by microbes degrading the wood in the wild or in a tank.

Some food manufacturers have started added lignin to catfish foods. Is there any point to this?

The answer to this lies in what lignin is. It is a heavily ringed, non-carbohydrate polymer that trees and other woody plants use as a “cement” to keep cellulose and other fibers bound together. Lignin is so difficult to degrade that not even a cow or porcupine can do it with the aid of the microbes residing in their digestive tracts (and neither can wood-eating catfishes). When you see a tree decaying in a forest, the lignin is the last thing to be broken down because only a select few microorganisms can actually degrade lignin. Even then, the lignin retains much of its structure as it becomes organic matter in the soil. Thus, some of the oldest carbon one can find in soils likely started out as lignin. So, to cut to the chase on this, it makes absolutely no sense to add lignin to fish feed. It is insoluble and is nothing more than “filler”, like sand, that is added to make more bulk. However, given the ability of lignin to covalently bond to carbohydrates, it could possibly reduce the digestibility of a food. So, it may be a detriment to fish to add this to food.
One other point is that the degradation of lignin, in addition to being an extremely slow process, requires oxygen, as the enzymes that digest lignin use oxygen in the process. Catfish guts, especially the wood-eating species (German and Bittong 2009), are not oxygenated, so lignin degradation cannot occur in their guts.