Is tilapia a human-made freak that we should avoid — or an evolutionary rockstar?

Posts were appearing on my Facebook feed warning against the dangers of eating tilapia. So I decided to do a little research.

My dad was a seafood wholesaler at the Fulton Fish market, and as a kid I'd encountered all manner of fish, at the dinner table and from working one summer at his stall. I knew about porgies, red snapper, flounder, and crabs galore, and that gefilte fish was a mixture of carp, whitefish, and pike. My dad even dealt in turtles and he'd send the occasional mystery species uptown to the American Museum of Natural History for identification.

But I was flummoxed when great bags of shrink-wrapped tilapia fillets began appearing in the supermarket a few years ago.

What the heck is tilapia?

I like it a lot, because it's blandness doesn't evoke the odors of my fishy childhood. I especially wondered what it was when I read about two high school students who used DNA fingerprinting to identify mislabeled fish in New York City sushi restaurants and seafood markets and found pricy white tuna to be Mozambique tilapia.

Viral internet meme

So when badmouthing talipia started showing up on Facebook, warning against the evils of fish farming, I finally googled it – and quickly discovered that tilapia are evolutionary rock stars and I'd indeed heard of them. They're cichlid fishes! Any bionerd will instantly recognize their place in natural history.

So I pulled out the introductory biology textbook that began my writing career, and of course there they were, the famed cichlids.

From African lakes to aquaculture

Both within and between the African Great Lakes, over hundreds of thousands of years, geologic activity and time separated cichlid populations, allowing genetic changes to accumulate and persist. This is the essence of evolution – natural selection favoring traits that ease survival to reproduce.

I wrote in my intro biology textbook:

> *In Cameroon, their speciation is probably the consequence of ecological isolation. Some populations feed exclusively on the lake bottom, whereas others prefer the regions near roots of aquatic plants, or closer to the surface. Because the members of each population do not come into contact, no gene exchange occurs. As changes in the genes of each population accumulate, they become more reproductively isolated. Over many years, the populations have become distinct species.*

Cichlids also diverged into new species when separated into different bodies of water. I wrote, *"As new lakes formed, they isolated populations of the fishes, and the animals eventually accumulated sufficient genetic changes to constitute new species. The approximate times when DNA sequences diverged (calculated from the mutation rates), according to mitochondrial DNA sequence comparison, coincide with geographic evidence of when earthquakes occurred. The earthquakes may have formed the lakes that separated the ancient gene pools of cichlid fishes."*

About 1,650 cichlid fish species are recognized, with possibly 2000 to 3000 existing. The number of tilapia species is about 70.

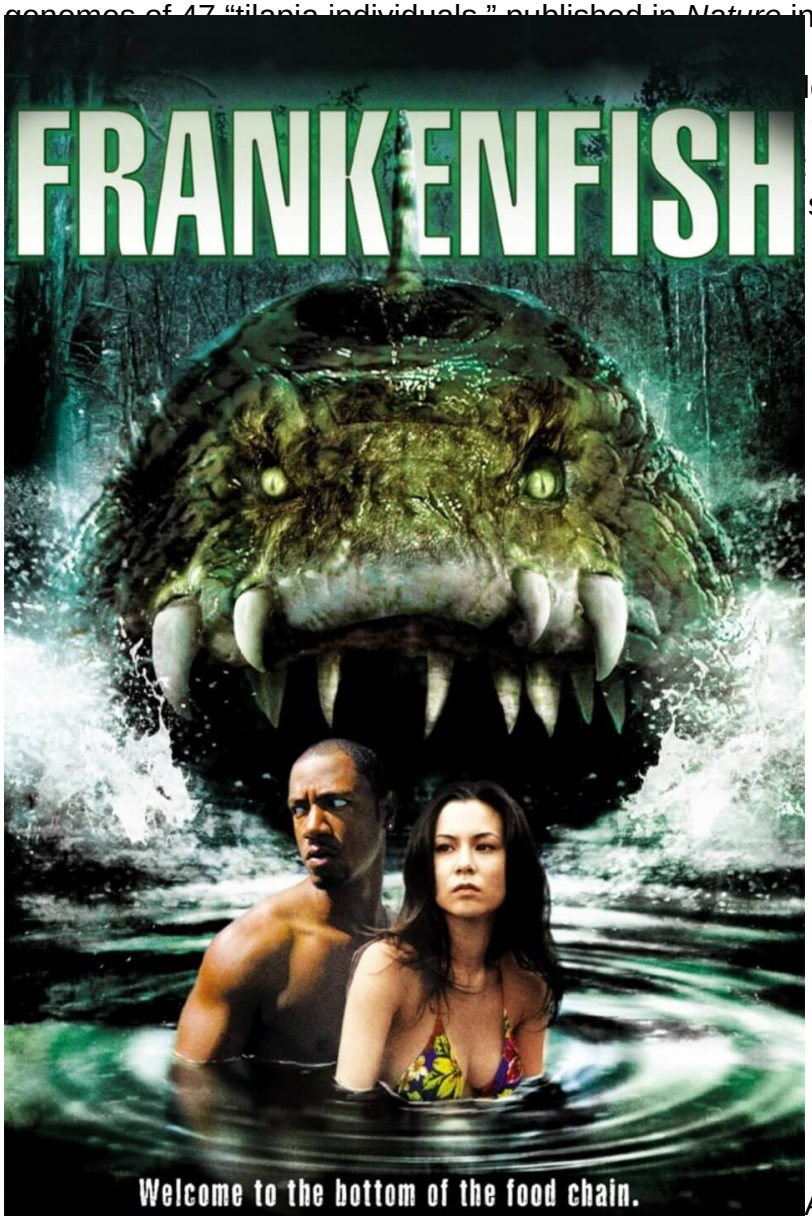
The scientific literature on the celebrated cichlids is vast. I was thrilled to find "Sympatric speciation suggested by monophyly of crater lake cichlids," because one of the trio of authors is famed Swedish evolutionary biologist Svante Pääbo, of Neanderthal fame. That's from 1994, but the paper trail reaches back to at least 1972.

Dr. Pääbo and his associates described two tiny crater lakes in Cameroon that are not fed by rivers or streams. One lake, Barombi Mbo, houses 11 species of the fish and the other, Bermin, has 9, all of the fish "tilapiines," or "tilapia-like cichlids." The researchers compared a 340-base mitochondrial DNA sequence among the 20 species, which revealed that each lake held a monophyletic collection: a single origin, each lake colonized just one time.

A fish to fear?

Attempts to expand tilapia began in the 1980s. In 1987 the Genetically Improved Farmed Tilapia project started with eight African and Asian tilapia founder populations. "The GIFT population has experienced intense artificial selection," wrote a team of researchers from China and Singapore who sequenced the

genomes of 47 “tilapia individuals” published in *Nature* in 2015.



leties that reflect artificial selection (selective fish. A list of a dozen or so genes that showed reproduction, growth, and development; stress.

Are the cichlids from the 1994 paper the same species as the ones I haul out of my freezer from Wal-Mart? Probably, because the names from the “aquaculture for tilapia” entry in Wikipedia indeed match three of the species in the 1994 paper.

Tilapia are ideal for fish farms for several reasons:

- They reproduce, develop, and grow fast, reaching saleable size by 7 months.

- They're omnivores, satisfied with cheap veggies and algae.
- Crowding doesn't appear to bother them.
- They thrive in water that's salty, fresh, or brackish.

They're so well adapted to aquaculture that there's no need to genetically modify them, although it's been done. Going GM just complicates matters because the fish must be rendered infertile. As far as I can tell it just isn't necessary. Sometimes nature can't be improved upon.

But still come the panic pieces. Bellows the meme that initially caught my attention:

"Stop eating this fake ass fish! This fish is boneless, has no skin and can't be overcooked. You can't find tilapia in the wild. It's being harvest (sic) in artificial fish farms. … eating tilapia is worse than eating bacon or a hamburger. … This fish is a mutant: it's killing our families."

The bonelessness and skinlessness claim may come from this statement in Wikipedia: *"Whole tilapia can be processed into skinless, boneless, fillets."*

As for the fish farms, rumors and reports claim that tilapia farms in China use manure – from various sources, mostly pigs and geese. This Snopes report is particularly nauseating.

Despite the fertilizer issue, I love tilapia, because it's nutritious and has turned around my childhood fish aversion.

My sister and I were not only served malodorous seafood often, but we even kept two giant lobsters in the bathtub as pets until one day we came home from school to find our otherwise kind mother murdering them in a vat of boiling water. That trauma is why I won't eat lobster. I also have bad memories of fish sticks – no one really knew what they were. But when I see those bags of tilapia fillets at Wal-Mart – protein-packed and enough to serve 20 or so children for about $12 – I can't help but appreciate the elegant boneless and skinless white fish descended from the famed lakes of Africa.

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A version of this article was originally published on PLOS Blog's website as "Tilapia: Freak Farmed Fish or Evolutionary Rock Star?" and has been republished here with permission.

This article previously appeared on the GLP September 12, 2018.