The Mummichog: Master of Survival

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Photographs by David Snell

Few aquarium hobbyists have even heard of the Mummichog. Others know it only as a bait fish. Yet this determined survivor is not only easy to care for, but an interesting and attractive species worthy of aquarium study.

The Mummichog, *Fundulus heteroclitus*, occurs in the tidal waters of North America, from the Gulf of Saint Lawrence southward to northeastern Florida. The name "Mummichog" comes from an American Indian word that means "they go in great numbers." Reaching a maximum length of about five inches, Mummichog are a shoaling fish that prefer the quieter waters of estuaries and salt marshes. Like many coastal species, they can tolerate a wide range of salinities, ranging from fresh water to sea water.

Mummichog are stouter and thicker bodied than other *Fundulus* species. Both sexes have about 15 alternating light and gray bars along the flanks (Fig. 1). Females are drab grayish brown, but males have numerous iridescent green or blue flecks on the rear flanks. During spawning season, males' undersides and fins may also turn a bright yellow. Color varies from individual to individual and from population to population. Some fish have more intense coloring than others and some males may even have highlights of red and blue in their fins.

I first encountered the Mummichog during the 1960s, as a seven-year-old boy, wandering through the marshes along the Hackensack River, in my home town of Jersey City, New Jersey. My friend and I found them in a freshwater pond. Somehow—I don't remember—we managed to capture a few. I took two of them home, carrying one in each hand. Despite being out of the water for at least 30 minutes, my hapless captives were still alive when I got them home. I filled an old laundry sink with a few inches of water, straight from the tap, and dropped them in. Chlorine didn't appear to bother them too much. They lived for months.

Back then, New Jersey's Hackensack meadowlands were shamefully polluted, both from massive garbage dumps that filled the marshes and the many factories that sprang up along the river. I can remember taking a few steps along the river bank, then looking back and seeing heavy black oil oozing from my footprints.

Yet Mummichog were abundant. Frequently, I saw shoals of at least a thousand in the shallows. Similarly, shoals of Mummichog covered the surface of the toxin-laden ponds that formed at the base of the landfills.

In the wild, Mummichog begin spawning in the early spring, usually at the time of the full or new moon, when tides are at their highest. They'll often lay their eggs among the marsh grasses. Provided the eggs remain damp, they will incubate in the air after the tide goes out, hatching when the high water returns. Mummichog may also lay their eggs inside empty mussel shells, in pits dug out by the female, or directly on the bottom. Spawning continues throughout the warmer weather and ceases in the fall.

In the winter months, Mummichog may burrow into the mud or move to deeper waters.

With their upturned mouths, Mummichog are well adapted to feeding at the water's surface but can obtain their food from anywhere in the water column. Wild Mummichog feed on mosquito larvae, small crustaceans, marine worms, crustaceans, and small fish.

Collecting Mummichog is not difficult, as they can easily be collected with seines and dipnets. They can also be taken in commercial traps sold in bait shops. These are usually made

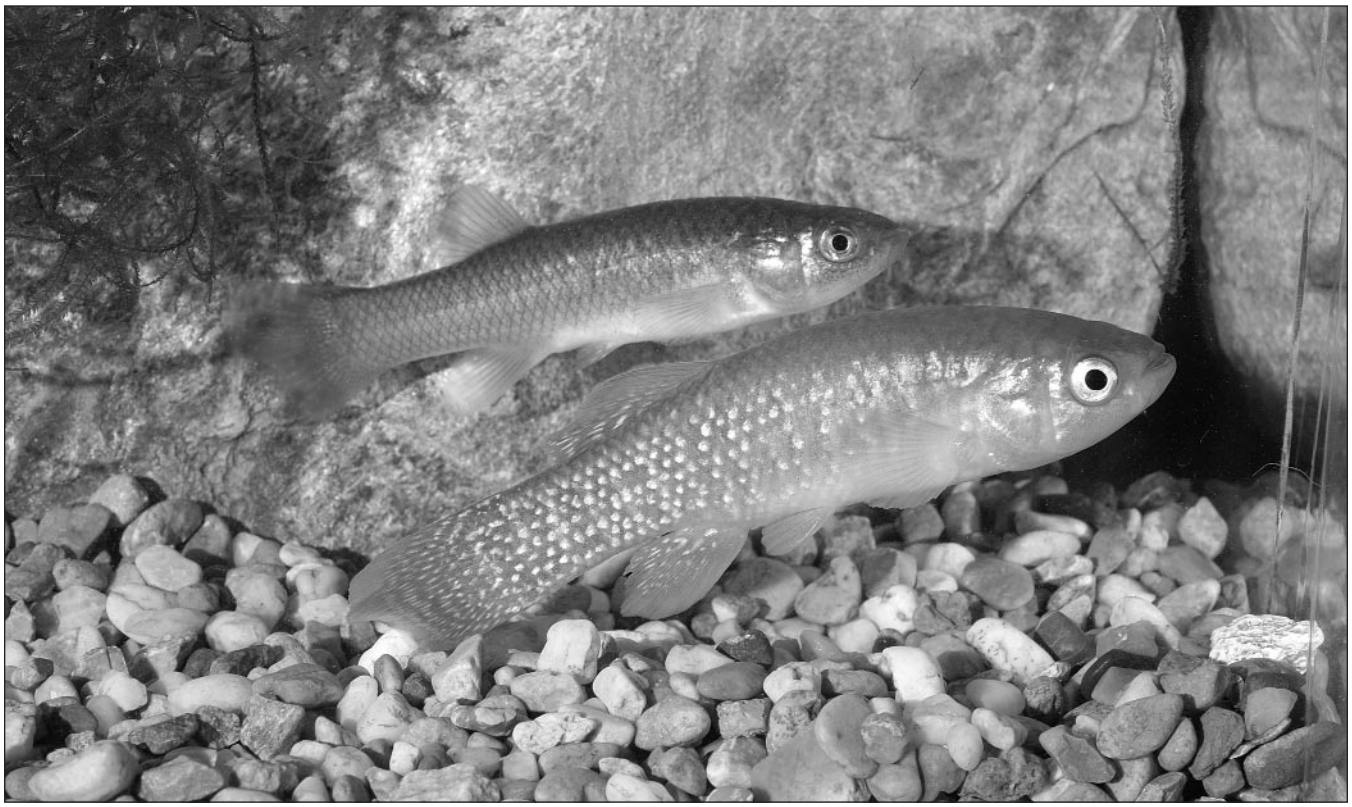

Fig. 1.
A pair of the author's Mummichog. Females lack the iridescent sequins of the male.

of wire mesh and shaped like a cylinder with two funnel-shaped entrances (Fig. 2). The fish swim into the wide opening of the funnel, and then have difficulty finding their way back out. Mummichog aren't fussy eaters, and will readily enter traps baited with fish, crab meat, and even bread.

Those who aren't equipped to do their own collecting might opt to purchase some from a local bait shop. Depending on what part of the country they're in, shop owners may refer to the Mummichog as bull minnows, killies, or other regional names.

All wild fish should be quarantined before they're introduced into an established tank, but extra precautions should be taken with fish purchased from a bait shop. Most bait tanks are overcrowded and don't receive many water changes. Fish kept under such stressful conditions are especially susceptible to disease.

Mummichog in the Aquarium

Mummichog are as undemanding in the aquarium as they are adaptable in the wild. Through the years, I've kept them with little effort on my part, other than adding a half teaspoon to a full teaspoon of marine salt per gallon. Researchers I've spoken to keep them at a salinity of 15 to 20 ppt. The Mummichog I've kept did best in hard water. At low levels of hardness, they tend to develop grayish white circles on their backs, in front of the dorsal fins.

Mummichog can be a little rough on their tank mates, so it's best to keep them with other slightly aggressive fish, such as Butterfly Splitfin, *Ameca splendens*, or Flagfish, *Jordanella floridae* (Fig. 3).

Mummichog are easy to feed, and will devour almost all kinds of live, frozen and prepared foods.

Hal Fairfield published his account of spawning Mummichog in the December 1985 issue of *American Currents*.

He kept three Mummichog in a 10-gallon tank, to which he added a half teaspoon of rock salt per gallon. The water in the tank was hard, at 11 DH, with a pH ranging from 8.0 to 8.5. He also changed 20% of the tank's water every week.

Fairfield fed the Mummichog a varied diet of fish, live brine shrimp, flake food, crushed snails, and beef. To prepare them for spawning, he also fed them chopped earthworms.

When the water temperature reached 68-70°F, the male fish's colors began to intensify. The females' colors didn't

Fig. 2.
Mummichog can be collected in cylindrical traps sold in most bait shops. They will enter the trap in pursuit of fish strips, crab meat, and even slices of bread.

Fig. 3.
Mummichog can be a little aggressive and are best kept with other fishes that can stand up for themselves, such as this Flagfish, *Jordanella floridae*.

change, but their abdomens thickened as the fish became heavy with eggs. Fairfield added a floating spawning mop made of acrylic yarn to the tank, and the fish soon began laying eggs. He recommended checking the spawning mop every other day, and collecting the eggs before the parents could eat them.

After removing them from the mop, Fairfield incubated the eggs in a margarine tub to which he had added the fungicide acriflavine. The fry hatched in about two weeks at 67°F. Fairfield wrote that while warmer temperatures seemed to speed up hatching, they also resulted in fewer hatches.

The fry are free swimming in about 24 hours, and at this point accepted baby brine shrimp and microworms. If these first foods are not available, they will also accept finely powdered flake food or hard boiled egg yolk. If uneaten, egg yolk will soon foul the water, so great care should be taken not to over feed with this food.

Although a spawning mop can make it easier to collect the eggs, a mop isn't essential for spawning these fish. When I was about 10 years old, a pair I brought back from the Meadowlands spawned in a one-gallon plastic tank without any gravel or plants. Researchers who study Mummichog also strip the eggs and sperm from Mummichog by gently pressing on the fish's abdomen and pushing their fingers toward the fish's ventral fins.

I've found that after about six months Mummichog will lose their spawning color. Keeping the fish at cooler temperatures for a few months will allow them to rest so that they can begin the spawning cycle again. Mummichog can be wintered in an outdoor pond, provided the pond doesn't freeze solid. A few Mummichog can also be wintered successfully in a picnic cooler. Simply bring the cooler inside on extremely cold nights when it might freeze solid. If the water temperature stays at 50°F or lower, the fish will only need to eat a small amount once a month or so.

Masters of Survival

Not all Mummichog can survive in polluted environments. The species is highly variable genetically, with some having a better resistance to pollution than others do, explained Judith Weiss, an Estuarine Ecologist at Rutgers University's Newark College of Arts and Sciences in Newark, New Jersey. Those lacking such resistance don't survive in polluted areas. Over time, resistant fish have given rise to entire populations that can withstand pollution's effects.

Some of the Mummichog's adaptations to pollution appear in the early phase of its life cycle, Weiss said. Mummichog eggs from a Hackensack River creek polluted with mercury had thicker coverings and were less permeable than were eggs from Mummichog at a cleaner location in Long Island. Presumably, this reduced permeability let in fewer toxic chemicals.

Similarly, embryos of the Hackensack Mummichog were less likely to develop disfiguring abnormalities when exposed to mercury than were the Long Island Mummichog embryos. Weiss said that the Hackensack embryos matured into larvae much faster than did the Long Island embryos.

She explained that embryos pass through sensitive periods —times during their development when they are particularly vulnerable to environmental influences like toxic compounds. With their faster development, the Hackensack Mummichog

Fig. 4.
A view of the Chesapeake Bay Bridge from Sandy Point State Park in Annapolis, Maryland.
Although Mummichog prefer protected inlets, they can also be found in the open waters of the bay.

embryos spend less time in the stage of embryonic life when they're susceptible to toxins.

The Mummichog were not immune to the harmful effects of their toxic environment, however. In later studies, Weiss and her colleagues found that Mummichog from the polluted site did not grow as fast as did the Mummichog from the clean site, nor did they live as long.

The environmental toxins also affected the fish's behavior. They were much slower than Mummichog from the clean site, and had difficulty catching their major prey, the tiny grass shrimp that inhabit East Coast salt marshes. Since they couldn't catch the shrimp, the Mummichog were subsisting on detritus—decaying plant and animal matter. Because they lacked an effective predator, the grass shrimp were larger and appeared healthier than grass shrimp from the clean site.

Further research showed that the Mummichog from the polluted site had low levels of the brain chemical serotonin. In human beings, lower serotonin levels are correlated with depression.

Mummichog in the Elizabeth River in Norfolk, Virginia, have developed numerous defenses against cancer-causing chemicals. Richard Di Giulio and his colleagues at Duke University in Durham, North Carolina, studied Mummichog near Atlantic Wood, the site of a wood treatment plant. Di Giulio, an environmental toxicologist, said that the Atlantic Wood site is contaminated with creosote, a compound used to protect wood from water damage. Creosote, Di Giulio explained, contains cancer-causing compounds known as polycyclic aromatic hydrocarbons (PAHs).

In laboratory studies, Di Giulio and his coworkers found that Mummichog from Atlantic Wood could withstand levels of PAHs that killed Mummichog from other unpolluted locations.

The Atlantic Wood Mummichog had developed numerous biochemical defenses against cancer. The researchers found that these fish produced increased amounts of glutathione and glutathione s-transferase, both compounds involved in removing cancer-causing com-

Fig. 5.
Mummichog are often found in calmer estuaries and lagoons.
This is the Severn River outside Annapolis, Maryland—prime Mummichog habitat.

pounds from the body. Similarly, the Mummichog also produce higher levels of antioxidants—chemical compounds that protect against the cellular damage caused by toxic compounds.

Still, said Di Giulio, the Atlantic Hole Mummichog do not escape all of their environment's harmful effects. After they reach two years of age, they begin to develop numerous liver tumors. Moreover, they don't survive low oxygen levels as well as Mummichog from cleaner sites do.

Unappreciated at Home

I attended the NANFA annual meeting in Ohio in 2000. I was talking with a fishkeeper from England, telling him about this marvelous little fish from the U.S. coastal marshes. But the fish's reputation must have preceded it. He already knew about Mummichog. He replied in his strong British accent:

"Folks back home would tear your arm off for a Mummichog," he said.

I hope I've helped you to appreciate a fish that's all but unknown in its own land, but apparently appreciated abroad. Given some space and minimal care, the Mummichog can be an attractive and interesting addition to any tank.

For further reading, check out Hal Fairfield's account on breeding the Mummichog on the Web site of the North American Native Fishes Association, at www.nanfa.org, and on the Native Fish Conservancy's site at www.nativefish.org. Another site, www.mummichog.org, contains information on the Mummichog's life history, genetics and its role as a laboratory animal.

Mummichog

Fundulus heteroclitus (Linnaeus 1766)
Family: Fundulidae

Mummichogs like each other's company. The middle fish is a female, the other two are males. Photograph by David Snell