The Smallest-Mouth Buffalo

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Within the buffalo suckers (*Ictiobus* spp.), the form and size of the mouth vary substantially and are diagnostic for the different species (Douglas, 1974; Robison and Buchanan, 1988). The bigmouth buffalo (*I. cyprinellus*) has an oblique, thin-lipped, large mouth, and the upper jaw is equal in length to that of the fish's snout. The black buffalo (*I. niger*) has a slightly oblique, thick-lipped, small mouth, and the upper jaw is equal (or slightly greater) in length only to the diameter of the fish's eye (Fig. 1). The smallmouth buffalo (*I. bubalus*) has an almost horizontal, fleshy-lipped mouth (Fig. 2). Its mouth is smaller than that of the black buffalo. Some remarkable specimens of buffalo, however, have mouths that are even smaller. These fish could be called "smallest-mouth" buffalo, since the size of their mouth openings are so minuscule that they are sometimes presumed to be non-functional. Most observations of such fish are made from dead specimens, but we recently had the opportunity to observe a live buffalo with this unusual condition.

A Living Anomaly

The hoopnet that Bill Lancaster pulled from the Big Sunflower River on 7 Aug. 2000 was heavy with fish. It held five bigmouth buffalo and ten smallmouth buffalo. This was hardly noteworthy. The murky waters of Mississippi delta streams are often inhabited by dense populations of these suckers. What was unusual was that one of the smallmouth buffalo was missing a substantial part of its face.

It was mid-morning and the fish was still alive, so Bill put it back in the net, carefully returned it to the water, and notified us. He knew that we would want to study its behavior and add it to our collection of retired research fishes which are used in public outreach programs and as points of interest for visiting officials. We set up a 347-liter Ferguson flume (Hoover et al., 1999), treated the water with Stress Coat (Aquarium Pharmaceuticals, Inc.; Chalfont, PA), and as soon as possible began the long drive to Indianola, Mississippi. We met Bill on the banks of the river late that afternoon and he showed us the fish (Fig. 3). Where the prominent, thick-lipped mouth of a normal smallmouth buffalo should have been, there was only a tiny hole.

After some hasty photography, the fish was placed in approximately 60 liters of river water in a plastic live-well, 38 cm wide and 72 cm long, with 37 cm high curved sides (to minimize injury to the fish). Water temperature was 31.5°C, so a small amount of ice was added. The fish was driven back to Vicksburg, with stops every 20-30 minutes to add a few more handfuls of ice. Water temperature dropped slowly to 26°C by the end of the two-hour trip. At 2130 the buffalo was transferred to the flume. A day in the net at the bottom of the hot river, and a bumpy trip back to town, had not been kind to the fish. Its fins were ragged and skin was missing from its snout and dorsal keel. Much of its protective slime coat was gone. For the first 45 minutes in the flume, it lay unmoving in the corner.

Midnight came and the buffalo perked up. At 0030, it began swimming and exploring the tank. It found the inflow port, oriented headfirst into the flow, and held its position in the current. It was behaving like a buffalo and we began videotaping its behavior. Although this may be the first time that videography of such a specimen has been obtained, it was not the first time such a specimen was captured or studied.

Previous Specimens and Speculations

In 1875, Joseph Leidy, famed physician and naturalist, exhibited to members of the Academy of Natural Sciences in

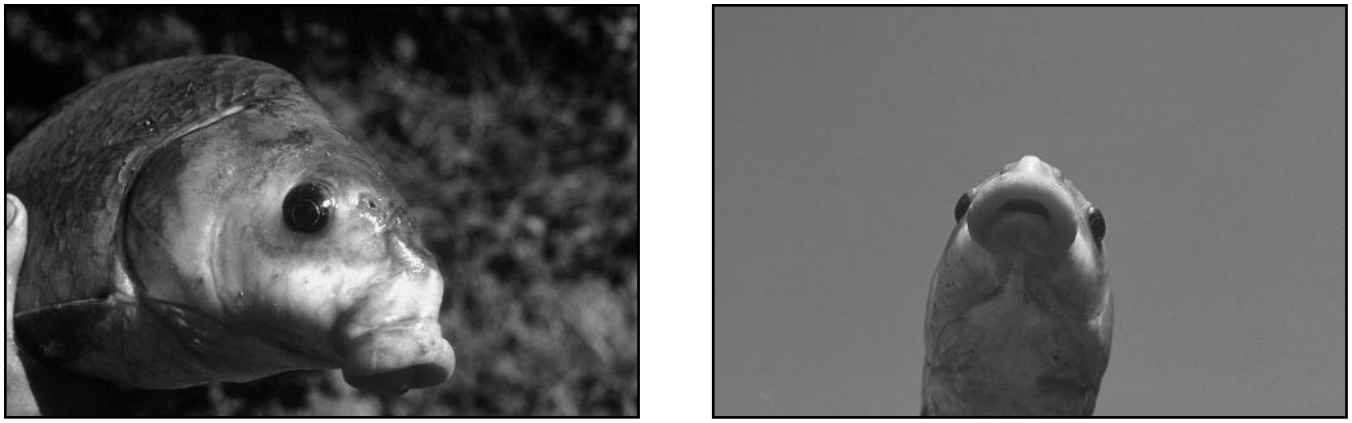

Fig. 1.
Left: oblique lateral view of black buffalo (*Ictiobus niger*) from Big Sunflower River, MS. Right: Ventral view of head of same specimen.

Philadelphia, a "mouthless fish" collected in the Ouachita River in Arkansas (Leidy, 1875). It was a 38 cm smallmouth buffalo, with upper and lower jawbones absent, with skin expanded tightly around the snout and facial bones. The mouth was represented only by a "small oval aperture [6 mm] fore and aft and [3 mm] in diameter." Professor Leidy believed that the condition resulted from abnormal development and not from "accidental violence." He concluded that the mouth of such a specimen was of sufficient size to bring in enough water for respiration, but could not understand how the fish obtained food, given the importance of the mouth's "prehensile" capabilities during foraging. He speculated that fish with this degree of impairment or greater (i.e., with no oral aperture) would obtain water for respiration and for food by "alternating outward and inward movements of the opercula."

A similar specimen was collected from Moon Lake, Mississippi in 1950 (Fuller, 1951). Initially identified as a bigmouth buffalo, the fish was 54 cm total length and had no mouth opening. The fish was described as active and age was estimated at 3 years. Because no scars were discernible, it was assumed that the condition existed since birth. Algae was present in gills indicating that the fish was filter feeding as it ventilated. Presumably, the specimen was preserved shortly after its capture. The fish was sent to Fannye Cook, founder of the Mississippi Game and Fish Museum and Laboratory, and apparently she forwarded it to ichthyologist Reeve Bailey at the University of Michigan (Bailey, 1951). Dr. Bailey was hesitant to identify the buffalo to species since the form of the mouth constituted the definitive diagnostic character. He conceded that the condition "was of long standing . . . possibly even from birth" but referred to it as an "injury." He also suggested that respiration and feeding took place by taking water in through the upper edge of the gill cleft, circulating it in the pharynx, and then expelling it from the lower part of the gill cleft.

In 1967, yet another mouthless buffalo was collected, this time from the Tensas River in Louisiana. It was sent to Neil Douglas and deposited in the fish collection of the University of Louisiana at Monroe, Museum of Zoology (George et al., 1996). It was 41 cm total length, at least four years old, and identified as a smallmouth buffalo based on body shape. This specimen was missing all external mouthparts and had no orifice. X-rays showed asymmetric absence of certain facial bones indicating that the condition resulted from traumatic head injuries, with subsequent recovery and probably some modification of respiratory and feeding behaviors.

These specimens exhibit varying degrees of oral atresia, the permanent closure of the mouth cavity by tissue growth. In extreme cases, such as the Moon Lake and Tensas River buffalo, a mouth opening does not exist and the specimens are referred to as "astomatous." In other cases, such as the Ouachita River and Big Sunflower River buffalo, a tiny orifice is present and the specimens are termed "microstomatous." How such fish survive is largely a topic of conjecture unless direct observations of a living specimen can be made.

Condition, Behavior, and Rarity of Smallest-Mouth Buffalo

Our microstomatous smallmouth buffalo from the Big Sunflower River was moderately large (51 cm) and heavy (1.65 kg). Dorsal rays numbered 27, anal rays 10. Its condition factor (K), an index of robustness used to infer well-being of a fish, was 1.26. This value indicated that it was intermediate in robustness between the slim, astomatous buffalo collected in the Tensas River (K = 1.17) and more ponderous, normal buffalo (K = 1.29-1.53) (Carlander, 1969; George et al.,

1996). Mouth was small (3 mm maximum diameter), elliptical, and oriented at an oblique angle to the long axis of the animal. The left nostril was substantially enlarged. There was no evidence of recent injuries to the face. We concluded that the loss of mouth structures was long-standing.

In the flume, the buffalo demonstrated positive rheotaxis, always orienting headfirst into the current coming from the inflow port of the flume. The fish swam slowly and deliberately, and maintained its position for long periods. Water entered the mouth continuously and rapidly, the mouth opening and closing 100 times/minute or more. Stress to the fish must have been high, though. The fish died mid-morning the day following its capture. Consequently, we were unable to observe feeding and learn whether or not the mouth was functional in that respect. The specimen was retained as part of an ongoing study of similarly deformed fishes in Mississippi delta streams.

Accounts of microstomatous and astomatous specimens of buffalo are extremely rare in the scientific literature. They are absent from some bibliographies (Dawson, 1964), life history summaries (Carlander, 1969), and regional species accounts (Cook, 1959; Robison and Buchanan, 1988; Etnier and Starnes, 1993; Mettee et al., 1996; Pflieger, 1997). These anomalies, however, may be more common in nature than their paucity in the scientific literature would indicate. Professor Leidy noted that such specimens were caught every year in the Ouachita River (Leidy, 1875) and at least two specimens were netted from that drainage in 1985 and 1989 (George et al., 1996). We have seen several such specimens of buffalo from the Big Sunflower River, all collected by Bill Lancaster within the past few years (unpublished data). Unlike Professor Leidy, however, we do not believe that specimens of this type occur because of abnormal development, but that they result from injuries. These injuries may result from violent encounters with head-grabbing predators or from collisions with motorboats.

Is there something peculiar about the waters of the lower Mississippi Basin that promotes the survival of such traumatically injured fish? The loss of major mouth structures (i.e., jaw bones, lips, etc.) necessitates rapid healing. The growth of scar tissue around or over the mouth necessitates a radical switch from suctorial-feeding to filter-feeding sometime before the energy reserves of the body are depleted. Buffalo are resilient animals and it is likely that recuperative capabilities and flexibility in feeding behavior are high. It is also likely, though, that the abilities to heal and to successfully feed on alternative prey are enhanced in the warm, plankton-rich waters of southern, alluvial rivers. Although buffalo are found throughout most of the central United States, we have no records of astomatous or microstomatous specimens in northern latitudes. It is possible that the smallest-mouth buffalo may be a southern phenomenon. Regardless of its geographic distribution, though, this ichthyological anomaly will continue to intrigue collectors.

Fig. 2.
Ventral view of smallmouth buffalo (*Ictiobus bubalus*), from Main Canal, MS, with normal mouth.

Acknowledgments

Christopher Dempsey suggested the name for this specimen. Dena Dickerson wisely advised immediate videotaping of the fish's behavior (which we did) before the fish died (which it did). Our research in Mississippi delta streams is funded by the U.S. Army Engineer Vicksburg District and by the Ecosystem Management and Restoration Research Program. Permission to publish this document was granted by the Chief of Engineers.

Fig. 3. Microstomatous smallmouth buffalo collected in the Big Sunflower River near Indianola, Mississippi, 7 Aug. 2000.

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