

Live Coloration and Schooling Behavior of Juvenile Sharptail Mola, *Masturus lanceolatus* (Tetraodontiformes: Molidae), Off South Florida

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Abstract - We present the first published in-situ photographs of a juvenile *Masturus lanceolatus* (Sharptail Mola). The photographed individual, about 76 mm TL, was one of 13–15 Sharptail Mola observed schooling together during a blackwater SCUBA dive at night off the coast of Florida near Palm Beach on 25 February 2021. The photographed individual was metallic blue dorsally, fading to a more silver color ventrally, with dark brown spots. The school of Sharptail Mola was 3–9 m below the surface of the water over a bottom depth of 198 m. Individuals were 2–5 body lengths apart and swam rapidly using synchronous side-to-side dorsal and anal fin flexures. We compare the photographed specimen to 2 literature records of juvenile Sharptail Mola from waters off Florida.

Introduction. Blackwater diving is a growing recreational hobby that is also resulting in new scientific discoveries (Nonaka et al. 2021). At night, divers using SCUBA hover over deep water to observe and photograph pelagic organisms. During a blackwater dive off Palm Beach, south Florida, W. Stearns observed and photographed a *Masturus lanceolatus* (Liénard) (Sharptail Mola). The Sharptail Mola is a poorly known species of Molidae found circumglobally in tropical and temperate seas (Sawai et al. 2020). In the western North Atlantic, most adult records are stranded individuals on beaches from Florida to North Carolina; 2 records of juvenile Sharptail Mola are known from waters off Florida (Gudger 1939, Perugia 1889). Herein, we provide the first published in-situ photographs of a juvenile Sharptail Mola (Fig. 1), and we discuss its anatomy, coloration, and behavior in comparison with other juvenile records.

Methods. Blackwater dives take place at night in epipelagic environments. A weighted line suspended by a surface buoy is dropped from the dive boat. Underwater lights are attached to the line to illuminate the water column from the surface down to 15–16 m. The lights provide a radius of 6–9 m of illumination and serve as a reference for the diver(s) and an attractant for small organisms. In south Florida, blackwater divers typically drift with the Gulf Stream 1–18 m below the surface and over bottom depths ≥ 150 m.

Stearns observed and photographed the juvenile Sharptail Mola off the coast of Palm Beach, FL (approximately 26.7°N, 80.0°W), on 25 February 2021 at 21:22 hours. Palm Beach is on the western edge of the Gulf Stream. As measured by Stearns on site, the water temperature was 23.3 °C, and there was a northbound current of 2.5 knots. The school of Sharptail Mola was observed 3–9 m below the surface; the bottom depth was 198 m. The lunar phase was waxing gibbous and was 2 days before the full moon that occurred on 27 February 2021; however, lunar illumination was dim on the night the fish were observed due to cloud cover.

Stearns used a Nikon D850 DSLR camera fitted with a 60-mm Nikkor Micro Lens (Nikon, Tokyo, Japan). The camera was set to aperture f/22, shutter speed 1/180 s, and

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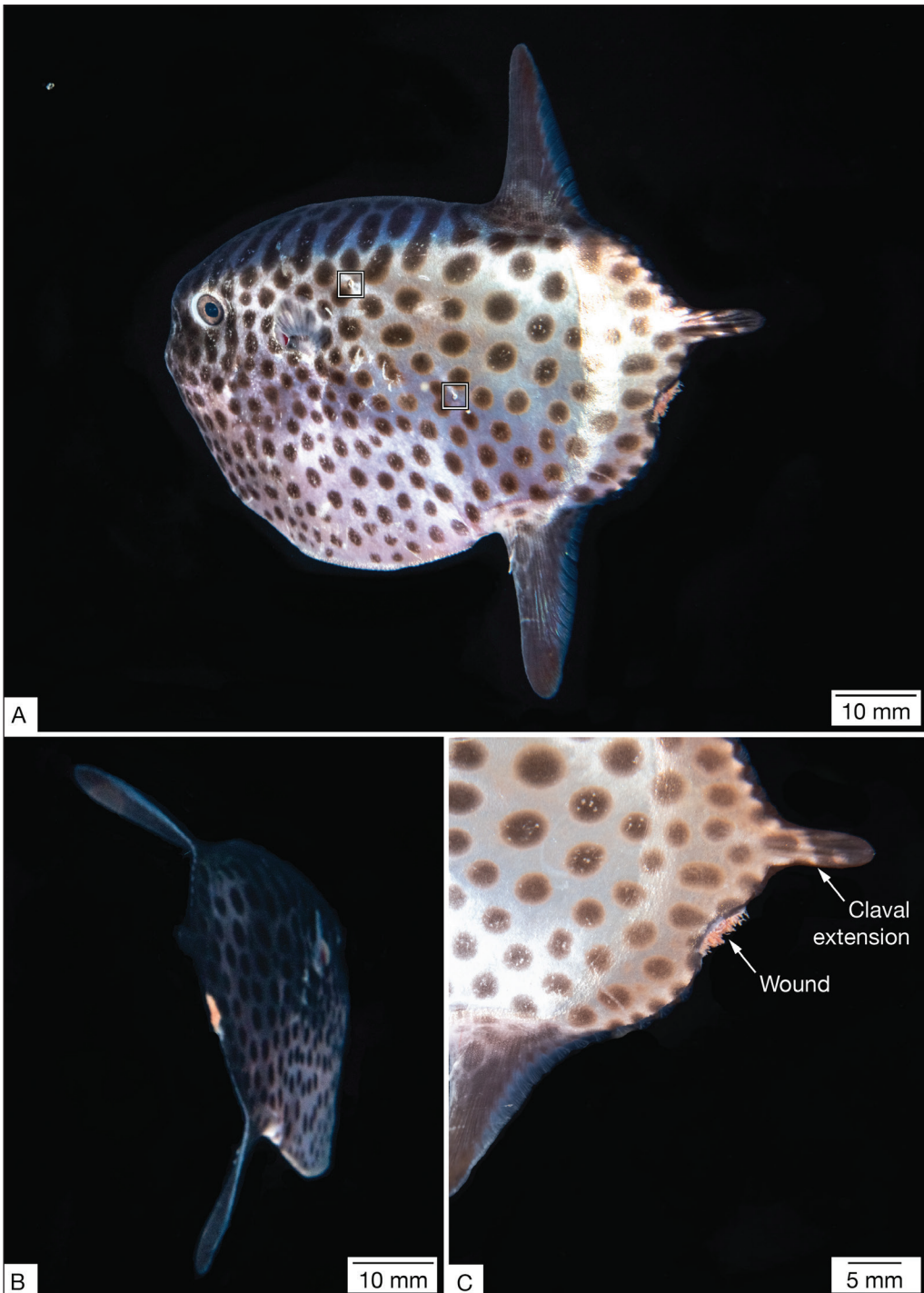


Figure 1. Juvenile *Masturus lanceolatus* (Sharptail Mola), estimated 76 mm TL, photographed off Palm Beach, FL, by W. Stearns on 25 February 2021. (A) Left lateral view showing spotted coloration. Squares indicate the locations of the 2 observable, small, blunt spines. (B) Posterior view showing dorsal and anal fins flexed to the left side. (C) Close-up of clavus showing claval extension and wound.

ISO 400. He used 2 Retra Prime model underwater strobes (Retra UWT, Ltd., Ljubljana-Smartno, Slovenia) on the manual power setting, just above half power. He attracted fishes with 2 Kraken Sports Hydra 5000 Plus WSRU focus lights and 1 Kraken Sports NR-1200 dive light (Kraken Sports, London ON, Canada), which was also used as a spotting light to locate subjects to photograph.

We post-processed images in Adobe Photoshop CC 2021 and prepared plates in Adobe Illustrator CC 2021. Color rendering was based on an average white balance and observations of the fish in-situ by Stearns.

Results. The photographed individual was part of a school of 13–15 Sharptail Mola. The schooling pattern was not highly polarized but was generally close-knit with 2–5 body lengths between individuals. The Sharptail Mola were initially attracted to a buoyed light array 3 m below the surface of the water. The school then swam down to 9 m where Stearns was hovering, swam once around Stearns, and then departed. Swimming speed was rapid; the beat of the dorsal and anal fins was synchronous and had a short, somewhat stiff cadence (Fig. 1B). The school arrived as a group, stayed together, and all individuals departed at the same time. The total encounter lasted ~1 minute. Stearns observed no other fish species nearby at the time.

Only 1 of the 13–15 individuals observed was photographed (Fig. 1). Stearns estimated the fish to be 76 mm (3 in) TL; based on the TL estimate, we used Adobe Illustrator to estimate that the pre-clavial length (PCL) was 55 mm, and that both the clavus and the short claval extension were each ~10 mm long. All individuals in the school were similar in size.

The dorsal surface of the body was rounded and smooth, whereas the ventral edge of the keel had large scales. The fish had 2 observable, small (0.5 mm), blunt spines on the left lateral side of its body. One spine was dorsal and slightly posterior to the small pectoral fin, and the second was below the horizontal midline of the fish, anterior to the dorsal and anal fins (Fig. 1A). The fin rays of the dorsal fin, anal fin, and clavus were multi-branched at their distal tips, with 3–6 branches per ray (Fig. 1). There was a wound on the clavus (Fig. 1C) below the claval extension.

The background body color was metallic blue dorsally, and faded to silver ventrally. Dark brown spots were prominent; the spots were more elongate on the dorsal surface of the fish anterior to the dorsal fin and smaller and circular ventrally. The spots continued onto the clavus and claval extension and extended slightly onto the dorsal and anal fins. Most of the surface of the dorsal and anal fins was dark, but faded to transparent along the edges of the fin rays. The pectoral fins were transparent.

Discussion. Adult Sharptail Mola are known from Gulf Stream waters off Florida (e.g., Gudger and MacDonald 1937). Several juveniles have been collected in waters off Florida, including 3 individuals (152, 157, 160 mm TL; AMNH 15962) collected on 17 April 1938, at the edge of the Gulf Stream off Fort Lauderdale, from the stomach of a single *Coryphaena* (Fig. 2A; Gudger 1939). Perugia (1889) also reported 4 Sharptail Mola (35, 39, 42, and 50 mm TL; Fig. 2B) from the stomach of a *Coryphaena* captured off Pensacola in 1882. The illustrations of preserved juvenile Sharptail Mola from Florida (Fig. 2) show some dark spots, but they do not cover the entire body as they do in the specimen photographed in-situ (Fig. 1); this difference may be related to the specimens having been partially digested, or it could represent ontogenetic color changes. Adult Sharptail Mola are spotted, often with irregular brown and silver spots, but the colors are rapidly lost after death (Gudger 1939).

Comparisons with juveniles reported by Perugia (1889) and Gudger (1939) show that the claval filament (10 mm) of our fish (76 mm TL) is intermediate in length (14 mm in the 59-mm TL specimen figured by Perugia, and 5 mm in the 152-mm TL specimen figured by

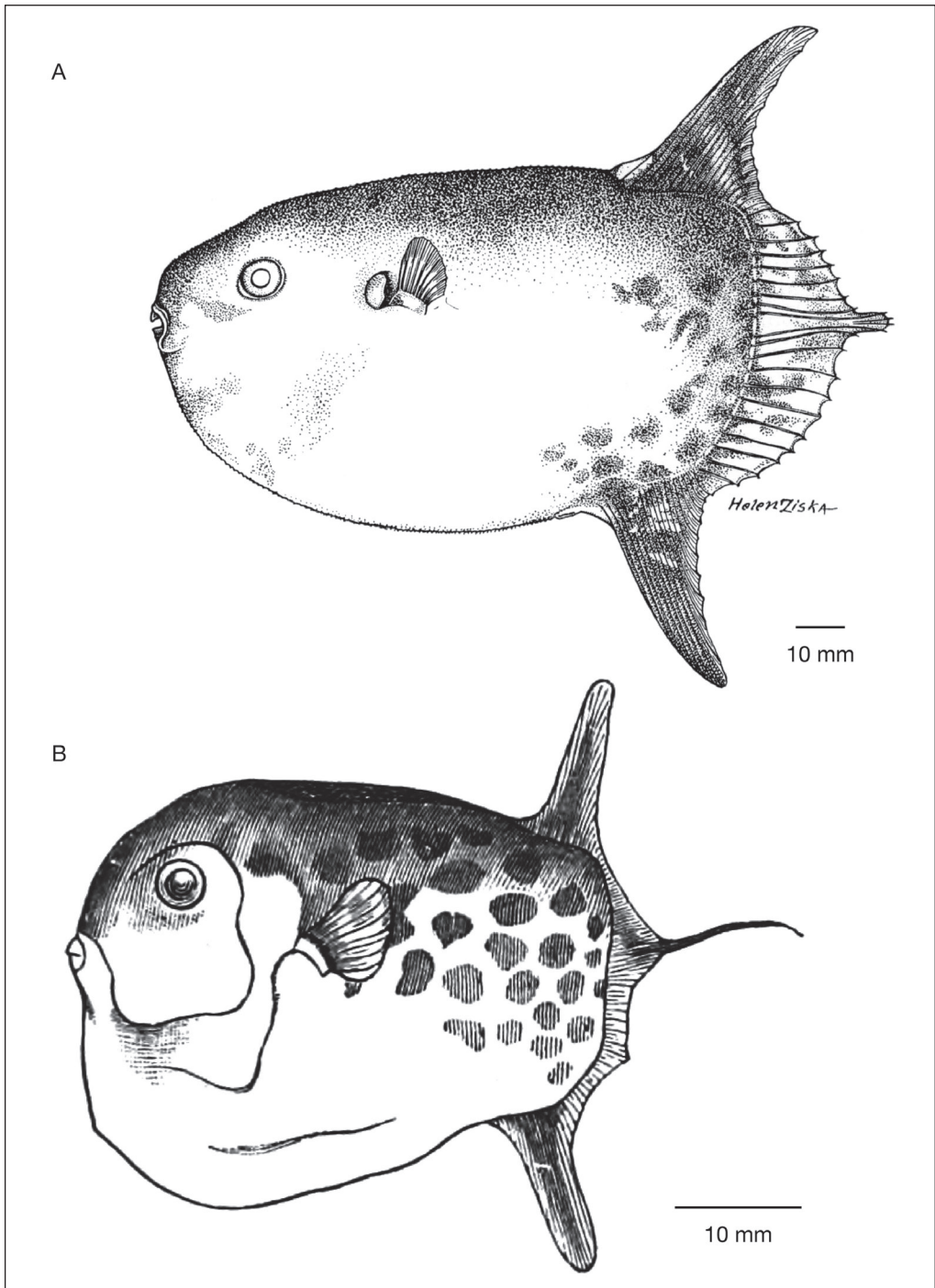


Figure 2. Juvenile records of *Masturus lanceolatus* (Sharptail Mola) from Florida, both collected from the stomachs of *Coryphaena*. (A) 152-mm TL specimen (AMNH 15962) described and figured by Gudger (1939:figure 5); 1 of 3 specimens collected off Fort Lauderdale, Florida in 1938; illustration by Helen Ziska. (B) 59-mm TL specimen described and figured by Perugia (1889:367 [unnumbered figure]); 1 of 4 specimens collected off Pensacola, Florida in 1889; illustrator unknown.

Gudger). This finding supports previous observations (Lyczkowski-Shultz 2005, Sokolovskaya and Sokolovskiy 1975, Thys et al. 2020, Yabe 1950) that the claval extension shortens with increased TL, although it is highly variable.

In larval and early juvenile stages, Sharptail Mola have spines along the edges of its body (e.g., Bemis et al. 2020:figure 2b, Thys et al. 2020:figure 1). As individuals increase in TL, the spines gradually become smaller and blunter. The specimen reported herein was ~55 mm PCL, and only 2 small, blunt spines were visible (Fig. 1A). Thys et al. (2020:figure 1) reported that individuals lose spines between 55–77.5 mm PCL, which includes the estimated length of the specimen shown in Figure 1.

Our observations provide new data that support 2 hypotheses in the literature. First, Gudger (1939) suggested that because the 3 specimens from the stomach of *Coryphaena* are nearly uniform in size, juvenile Sharptail Mola likely form schools, which we confirmed based on in-situ observations. Although adult molids are mostly solitary (Phillips et al. 2020), schooling has also been observed in juvenile *Ranzania laevis* (Pennant) (Slender Mola; Watanabe and Davenport 2020) and *Mola mola* (L.) (Ocean Sunfish; Abe et al. 2012). Second, Thys et al. (2020) predicted that juvenile Sharptail Mola might spend time at or near the surface because they are preyed upon by seabirds. Our observations support that juvenile Sharptail Mola, at least at night, occur in the upper part of the water column, 3–9 m below the surface, well within diving range of seabirds (e.g., Garthe et al. 2014).

Although the waters of south Florida are popular among blackwater divers, this is the first reported sighting of a juvenile molid in-situ in these waters, and since this observation, no further sightings of this species, at any size, have been reported by members of the blackwater diving community. We look forward to future observations of juvenile molids, for much remains to be learned about their biology.

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