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## NOTES ON THE EARLY DEVELOPMENT OF THE SEA RAVEN, *HEMITRIPTERUS AMERICANUS*

Egg and larval characteristics of the sea raven, *Hemitripterus americanus* (Gmelin), are distinctive. The species ranges from Labrador to Chesapeake Bay but is nowhere abundant (Bigelow and Welsh 1925). Notes on the fertilized eggs (Bean 1897), newly hatched larvae (Warfel and Merriman 1944), and juveniles larger than 45 mm (Huntsman 1922; Bigelow and Welsh 1925; Bigelow and Schroeder 1936) have been recorded. However, there is no available information dealing with specimens between 12 and 45 mm in length. The present paper attempts, in part, to bridge this gap in previous observations of these larvae.

### Methods and Materials

A cluster of nearly 90 eggs was found on the rocky shore of Montauk Point, N.Y. The eggs were collected at the level of the high tide mark at 0930 h on 9 November 1974. They were placed in an open system seawater aquarium at the marine station of Southampton College. In mid-December half of the eggs were transferred to laboratory facilities at the Academy of Natural Sciences of Philadelphia, where they were held in artificial seawater (7°C, 32‰) with a controlled photoperiod of 10.5 h light and 13.5 h darkness. Crude but effective temperature control was achieved by placing the covered rearing container in a water bath. The water bath and rearing container were then placed in a refrigerator. The temperature of the water bath was maintained with a thermostatically controlled aquarium heater. A 7½-W light bulb, controlled by an electric timer, was suspended above the rearing container. Moderate aeration kept the eggs in motion. After hatching, the larvae were maintained in similar conditions but without aeration. The strong current resulting from aeration appeared to be detrimental to the fragile larvae. When the yolk was nearly absorbed, the larvae were presented with food in the form of *Artemia* sp. nauplii and small pieces of *Palaemonetes* sp. and *Littorina* sp. flesh. Only three specimens could be induced to eat the pieces of flesh by placing the food in their mouths. Eventually one specimen ate the *Artemia* sp. nauplii unassisted.

Measurements were made on live material. Egg diameters were measured with dial calipers. Total lengths (TL) of the larvae were measured through a dissecting microscope using an ocular micrometer. Myomere counts were made with the aid of two Polaroid[1] HN 38 × 0.3 inch filters placed above and below the larvae and used in conjunction with a dissecting microscope and substage lamp. Final identification of the larvae was based on a comparison of the largest reared specimen in this study and the specimens collected in the Gulf of Maine by Joanne and Wayne Laroche. All 36 preserved specimens were preserved in 5% buffered Formalin and deposited in the Department of Ichthyology, Academy of Natural Sciences of Philadelphia (ANSP 131947).

### Descriptions

#### Egg and Embryo

Some of the peripheral eggs in the cluster had

[1]Reference to trade names does not imply endorsement by the National Marine Fisheries Service, NOAA.

flattened sides, suggesting the cluster had been part of a larger mass. A small piece of an encrusting sponge, *Halichondria panicea*, was found attached to the eggs. Small tubules (0.14 mm in diameter) were also found on the surface of some of the eggs and were assumed to belong to some species of polychaete. Eggs have been described by Warfel and Merriman (1944). At the time of collection, embryos were already well developed in all of the eggs. Pigmentation on the body consisted of melanophores arranged in vertical bars corresponding to the location of the myomeres. The retina was black and the iris had a silvery appearance. The median fin fold and pectoral buds were formed. The former originated close behind the hindbrain. By 16 December, large melanophores developed on the hindbrain and dorsal half of the yolk sac. The body pigmentation ended abruptly on the caudal peduncle about three-fourths of the total length from the snout. This characteristic pattern, to be referred to as the truncated pigmentation pattern, persisted throughout the development of all specimens. The mouth was formed and open. The single oil globule (ca. 0.8 mm in diameter) inside the yolk sac was located at the anterior confluence of the abdomen and yolk sac.

### Newly Hatched Larvae

The larvae (Figure 1) began hatching on 3 January 1975, 55 days after collecting the already well developed eggs, and continued through 30 January. The newly hatched larvae averaged 12.8 mm TL (range 11.7-12.7 mm). Warfel and Merriman (1944) noted the larvae emerged head first. This was not always true in the case of my material. Nearly one-half of the larvae which were observed hatching emerged tail first. The large ovoid yolk extended forward to or beyond the posterior margin of the eye. The head was not flexed over the anterior of the yolk sac. Body pigmentation became more dense and uniform but was lacking over the forebrain, ventral half of the yolk sac, and the posterior one-fourth of the body. Melanophores lined the base of the dorsal fin fold to the level of the truncated body pigment. A few melanophores were present along the postanal fin fold base, near the posterior margin of the body pigment. The preanal fin fold was barely perceptible. No gas bladder developed. The mouth was very large. The maxillary extended to or slightly behind the middle of the eye. The lower jaw contained four sharply pointed, conical teeth on each side. The fourth tooth was somewhat smaller and located lower on the dentary. Body proportions and total myomeres (38 or 39) were similar to those reported by Warfel and Merriman (1944) at this stage. The larvae remained mostly on the bottom of the container, spending much of the time on their sides possibly as a result of the enlarged yolk sac. Efforts to swim were very awkward and only made when the larvae were disturbed.

### Further Development

Near the end of January, the larvae were observed to be positively phototactic. The yolk of many of the larvae was absorbed by the end of the first week in February. The peritoneum appeared silvery through the skin. The pigmentation became uniform olive grey over the body (Figure 2). Specimens ranged between 14.0 and 17.0 mm TL on 6 February. Those longer than 16.1 mm had rudimentary caudal rays. The larvae were more

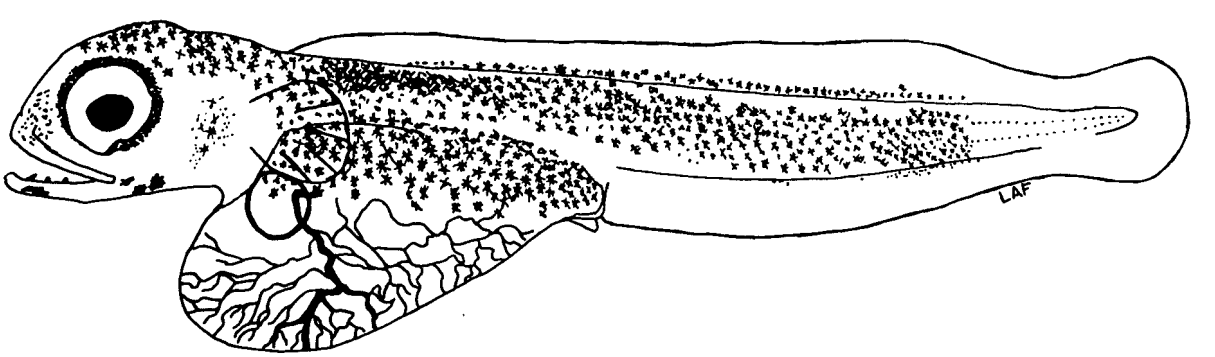


FIGURE 1.—*Hemitripterus americanus*. Prolarva (newly hatched), 8 January 1975: 12.6 mm TL.

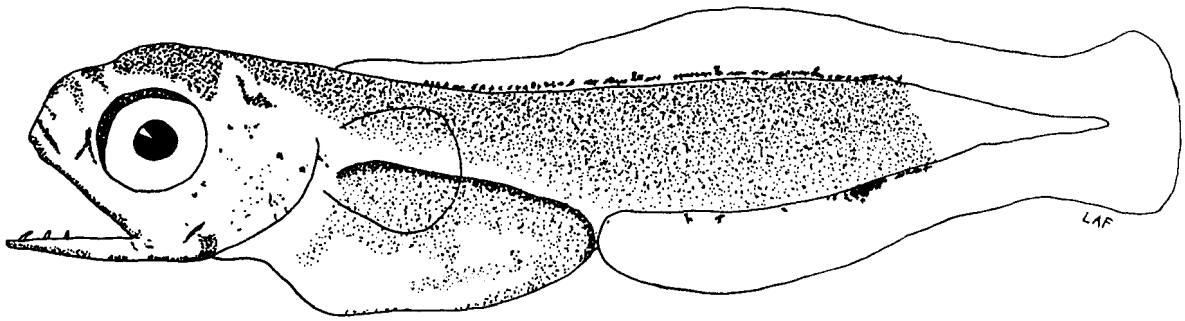

FIGURE 2.—*Hemitripterus americanus*. Early postlarva, 17 February 1975: 15.5 mm TL.

active by this time, but still spent most of the time on the bottom. By 2 March, the larvae were no longer attracted to light.

Toward the end of March, the caudal fin had 8 or 9 ray rudiments. Rays began to develop in the second then first dorsal fins followed by the pectoral fins. The caudal peduncle remained unpigmented. Spines began to form on the preoperculum. Greyish-tan fleshy tabs developed dorsally behind the head and around the occiput.

By 20 April, the largest specimen (Figure 3) had 14 and 11 elements in the first and second dorsal fins, respectively. The anal had 10 rays and the caudal had 12, at about 20 mm TL. Both the dentary and premaxilla had 15 teeth on each side. The preopercular spines became more prominent. The hypural plate began to form. The ratio of the head length to total length was 3.6; of the predorsal length to total length, 3.8; and of the eye diameter to head length, 2.7. The iris became less silvery. Dense pigmentation developed on the interradial membrane of the first dorsal fin between elements 1 through 4 and 8 through 12. Similar pigmentation developed in the second dorsal fin (between elements 3 and 7) and the postanal fin fold (between elements 3 and 6). Few melanophores were scattered between these dense areas of pigment. This larva utilized much of the water column during active periods and spent little time on the bottom.


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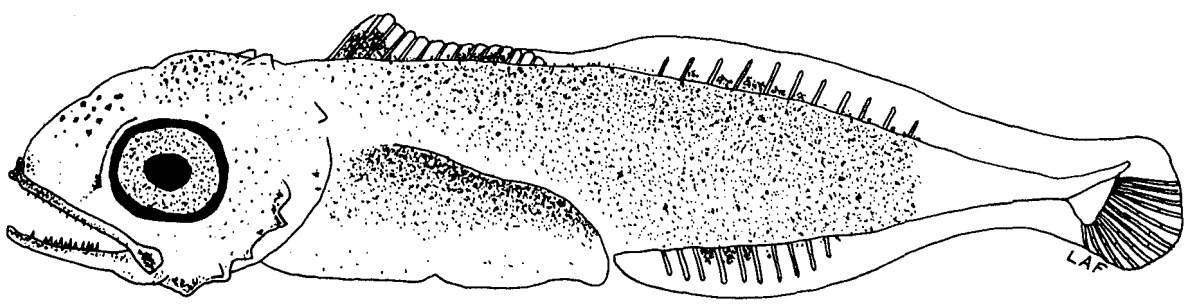

FIGURE 3.—*Hemitripterus americanus*. Postlarva, 20 April 1975: ca. 20 mm TL (the pectoral fin has been deleted for the sake of clarity).

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