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Enlarged Chromatophores in an Actively Swimming Ophichthid Leptocephalus Observed over Deep Water off Kona, Hawaii

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Leptocephali can be collected with large trawls, or can be collected or occasionally seen in coastal areas (Miller 2009, Miller et al. 2009), but they are rarely seen or photographed in the deep ocean. Recently, an actively swimming leptocephalus larva of the Ophichthidae was observed and filmed as it swam in front of the photographer (MJD) at night on 16 September 2008 (1 d after new moon). The larva was observed over water about 1500 m deep, about 5 km offshore of the Kona Coast of the Island of Hawaii (19°36'39"N, 156°03'49"W). It was observed at a ~14 m depth at about 21:00, and was filmed with an underwater video camera (high-definition Sony (Tokyo, Japan) HC7 with a macro lens, Light & Motion (Monterey, CA USA) Bluefin housing, Light & Motion Sunray 1000 LED video lights) using mini DV tape film. The larva was apparently ~120 mm in length. Frame captures were later made using the Sony Vegas Pro 8 HD video editing program. The original video can be viewed at: http://www.australianmuseum.net.au/movie/Ophichthid-leptocephalus-Kona-Hawaii/.

The curvatures of the gut and chromatophore locations indicate that this is an ophichthid leptocephalus of the subfamily Ophichthinae (Leiby 1989) (with 16 known species from the Hawaii region, McCosker 2002). However, the size and shape of the paired chromatophores on each of the 8 gut swellings and the 6 postanal paired midline chromatophores (Fig. 1) appear different from those of collected ophichthid leptocephali. The chromatophores appeared greenish-yellow when exposed to bright light, even though in freshly captured leptocephali, they appear black or dark brown and have been assumed to be melanophores. What appears to be the same species of leptocephalus of a similar size (also 8 gut swellings and 6 postanal chromatophores) was also filmed in the same area on 14 Sept. 2009 (same video camera, with a 90° wide-angle lens, Sunray 2000 LED video lights), but it did not show enlarged chromatophores above the gut (Fig. 2) and was swimming less aggressively.

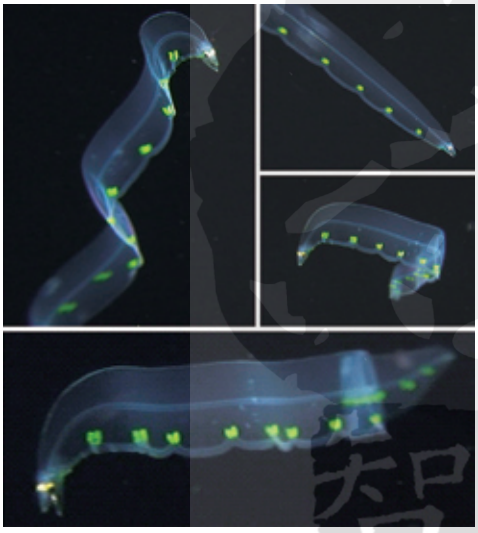

Fig. 1. Photographs showing enlarged paired chromatophores in an ophichthid leptocephalus actively swimming at night.

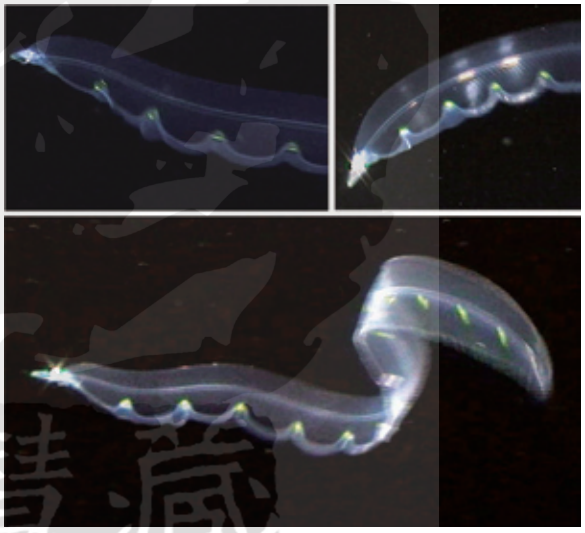

Fig. 2. Photographs showing a different ophichthid leptocephalus with smaller, slightly reflective chromatophores. The upper right and bottom photos were lightened for clarity.

Chromatophores have not been studied in leptocephali, but 1 explanation for these observations is that the chromatophores in figure 1 were in an expanded state after stimulation by the nervous/endocrine system as in other fishes (Fujii 2000), such as in response to a potential predator, or perhaps during daytime. Chromatophore units often contain both absorptive (xanthophores and melanophores) and reflective (iridophores) layers, so they function to reflect specific wavelengths of light (Grether et al. 2004), as suggested by figure 1. If this is true in some ophichthid larvae, then the chromatophores in figure 2 might not have been stimulated to enlarge, even though they have the ability to do so. The 2nd possibility is that the species of leptocephalus in figure 1 has evolved much-larger chromatophores, presumably as a predator-avoidance adaptation, and the larva in figure 2 is actually a different species with similar morphological features, but smaller chromatophores.

Darkly colored melanophores were hypothesized to function in breaking up the visual outline of a leptocephalus, to reduce the ability of visual predators to clearly see them (Miller 2009). However, the interaction of the enlarged chromatophores with bright light in figure 1 suggests that these pigment spots may have more-specific light-absorptive and -reflective properties that function in ways other than simply being dark spots. Future research needs to examine what wavelengths of light are absorbed or reflected by these chromatophores, and if they actually expand and contract in some species, to help understand their function in leptocephali. http://zoolstud.sinica.edu.tw/Journals/49.3/324.pdf

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