

Rhythmic Activity of Freshwater Eels Driven by Daily and Lunar Cycles during their Spawning Migration

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Freshwater eels are catadromous fishes that spawn over deep water at tropical latitudes, with their larvae being transported to coastal waters before entering estuarine and freshwater growth habitats (Tesch 2003; Aoyama 2009). The spawning area of the Japanese eel, *Anguilla japonica*, was found to be along the southern West Mariana Ridge by collecting preleptocephali, eggs and spawning-condition adults (Tsukamoto et al., 2011). However, the behavior and swimming route during their spawning migration have remained a mystery. The behaviors of the oceanic migration of Japanese eel have been observed since 2008 (Manabe et al., 2011). In this study, we released 22 eels attached with pop-up satellite transmitting tags from the coastal zone of Japan, from adjacent to the Ogasawara Islands, and within the spawning area of the Japanese eel, and we analyzed their swimming behavior.

We observed the swimming depth and water temperature in the coastal zone of Japan (Nov. and Dec. 2011, 16 eels), adjacent to the Ogasawara Islands (Oct. 2014, 3 eels) and the spawning area (May 2014, 3 eels) using MiniPAT pop-up archival transmitting tags made by Wildlife Computers Inc., and analyzed the diel vertical migration of Japanese eels.

81% of all released tags were popped up and had successful transmission of the data in the 3 areas. We focused on the data that recorded long and clearly diel vertical migrations. At night, the swimming depth while the moon appeared in the sky was deeper than when the moon was not present in the sky in all 3 areas. In daytime, the maximum depths were recorded near the timing of the sun culmination in each day. We estimated that temperature is the determinant of the deeper limit of swimming depths because the change of water temperature was small even if depths changed. The start of descent and ascent were at about an hour before sunrise and about the same time as sunset. Therefore, Japanese eels have a diel vertical migration with the controlling factors of their swimming depths being light intensity from both the sun and moon, and also temperature at their deepest depths. Their diel vertical migration may be a survival strategy behavior for avoidance of predators, and the changes of temperature they experience may help to regulate their sexual maturation while swimming towards their spawning area.

References:

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