The Widespread Distribution of the Venomous and Poisonous Blue-lined Octopus *Hapalochlaena* spp., in the East/Japan Sea: Possible Effects of Sea Warming

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Abstract

The geographical distribution of the toxic blue-lined octopus (commonly known as the blue-ringed octopus), *Hapalochlaena* spp., around the East/Japan Sea was investigated. Observation records of the octopus were gathered using commercial search engines on the Internet. A questionnaire to complement and enhance the base data was conducted that targeted fishermen from areas where the octopus was most likely to occur, i.e., the southeast coast and islands of Korea in the East/Japan Sea. Overall, 32 observational records of the octopus were found from Korea and Japan. In Korea, only one record, from 2003, was found on a website; none of the 240 fishermen who participated in the questionnaire reported seeing blue-lined octopus. However, a total of 31 observations of the blue-lined octopus from 2004 to July 2010 were found from 17 different regions in the East/Japan Sea and neighboring waters in Japan. Twenty-two cases were from coastal Honshu Island, and nine were from the west coast of Kyushu Island, Japan. The northern distributional boundary of the blue-lined octopus on the Japanese coast was off Fukui Prefecture around latitude 36º10’ N. Our results indicate that the blue-lined octopus is distributed extensively along the Japanese coast, at a low frequency, in the East/Japan Sea.

Key words: Blue-ringed octopus, Blue-lined octopus, *Hapalochlaena* spp., East/Japan Sea, Climate change, Internet

Introduction

Members of the octopus genus *Hapalochlaena* are characterized by small body size and iridescent blue markings on their dorsal surfaces and arms. *Hapalochlaena* is composed of three octopus species, *H.* fasciata, *H.* lunulata, and *H.* maculosa. All three are commonly called blue-ringed octopus because of their distinctive patterns of iridescent blue rings or lines, but *H.* fasciata is the blue-lined octopus, *H.* lunulata the greater blue-ringed octopus, and *H.* maculosa the lesser blue-ringed octopus (Norman, 1998).

*Hapalochlaena* spp. are equipped with venom in their posterior salivary glands that aids in the capture of prey, and contain tetrodotoxin in their soft tissues (Sheumack et al., 1978; Williams and Caldwell, 2009). Envenomation by these species has been responsible for human fatalities and should be treated urgently (Williamson et al., 1996; Cavazzoni et al., 2008; Williams, 2010). Two people died and 85 patients were hospitalized due to the consumption of blue-ringed octopus in southern Vietnam in 2004 (Agence France-Presse, 2004).

Among the *Hapalochlaena* species, the blue-lined octopus, *H.* fasciata, is commonly found in the waters off the coast of Australia but its range extends through the Pacific Ocean north to Japan (Williamson et al., 1996). *Hapalochlaena fasciata*...
East/Japan Sea could be a significant threat to Koreans and Japanese because the organism possesses a powerful toxin. Furthermore, coastal residents along the East/Japan Sea have no experience with the dangers of this species of octopus. Estimating the geographical distribution of the blue-lined octopus would be useful for public safety. However, there are very few published reports on the geographical distribution of the blue-lined octopus in the East/Japan Sea, except for one specimen that was found on Oki Island, Japan (Kohtsuka, 2006).

Although direct survey techniques, such as visual surveys and fishing data, are more effective for estimating the spatial distribution of octopuses (Pierce and Guerra, 1994; Hill and Wilkinson, 2004; Leite et al., 2009), these methods require extensive field research and funding. We hypothesized that, because Internet use is widespread and there is common access to the Internet in Korea and Japan (International Telecommunication Union, 2010), information on websites may be used as basic data for a large-scale distribution survey of an organism.

In this study, we conducted a survey to determine the geographical distribution of the blue-lined octopus using Internet search engines and a questionnaire. Individual observation records of the blue-lined octopus were gathered from websites in Korea and Japan, and every datum was used to create a large-scale geographical distribution map in the East/Japan Sea.