

## Note

## Scyphomedusa *Aurelia limbata* (Brandt, 1838) found in deep waters off Kushiro, Hokkaido, Northern Japan

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The scyphomedusa *Aurelia limbata* (Brandt, 1838) is known as an epipelagic species distributed along the Pacific coastal areas of Japan from the Tohoku region to Hokkaido, the Okhotsk Sea, the Bering Sea (Uchida 1954; Wrobel and Mills 1998; Kishinoue 1910; Kramp 1961; Larson 1990), and the northern part of the Japan Sea (Pogodin 1998). The life cycle of this species has been reported to be the same as that of *Aurelia aurita* (Uchida and Nagao 1963), which is observed only near the surface in coastal areas. There are also no observations of aggregations of *A. limbata*. This report describes new observations of *A. limbata* made from the ROV *Dolphin 3K*.

Two observational surveys were conducted with the ROV *Dolphin 3K* off Kushiro, Hokkaido (Fig. 1) on September 7, 2000. The *Dolphin 3K* stayed close to the bottom as it surveyed from a depth of 321 m (42°36.399'N, 143°59.345'E, 10:43) to 144 m (42°37.056'N, 143°58.545'E, 12:20) during Dive 3K-484 and from 330 m (42°35.312'N, 143°58.155'E, 14:00) to 173 m (42°36.012'N, 143°57.446'E, 15:49) during Dive 3K-485. The abundance, sex ratio, and behavior of *A. limbata* was observed and recorded on Digital Betacam videotape using the CCD and Super Harp cameras on the ROV. Environmental data (depth, temperature, salinity, dissolved oxygen and sigma-t) were collected using a CTD-DO meter (SEABIRD, SBE-19).

Temperature and salinity were 16.8–17.1°C and 33.0–33.4 PSU at the surface. A thermocline and halocline existed in the upper 130 m depth layer. The temperature and salinity just below these clines were approximately 3°C and 33.2 PSU. Temperature stabilized between 2.0–2.7°C and the salinity increased gradually to 33.7 PSU with depth (Fig. 2). Dissolved oxygen was 5.5–6.5 ml/l at the surface. Maximum oxygen concentration was at 120–130 m depth, and the oxygen concentration decreased steadily to 3.1 ml/l near the bottom (330 m) (Fig. 2). Sigma-t was 24.1 at the surface and increased rapidly to 26.5 at 120–130 m. Sigma-t continued to increase gradually

to reach 26.8 at the bottom (330 m) (Fig. 2). The water mass in this area may be derived from Oyashio Water (Fujimura & Nagata 1991).

*A. limbata* medusae were observed in the benthopelagic layer at bottom depths between 200–250 m. *A. limbata* aggregated in the benthopelagic layer 0.8–3.2 m from the bottom. Physico-chemical parameters where *A. limbata* occurred were as follows: for Dive 3K-484, temperature was 2.0°C, salinity was 33.4 PSU, dissolved oxygen was 4.83–4.88 ml/l, and sigma-t was 26.7; for Dive 3K-485, temperature was 2.1°C, salinity was 33.3 PSU, dissolved oxygen was 5.38–5.52 ml/l, and sigma-t was 26.6. We observed four individuals on Dive 3K-484 and 23 individuals on Dive 3K-485. The maximum

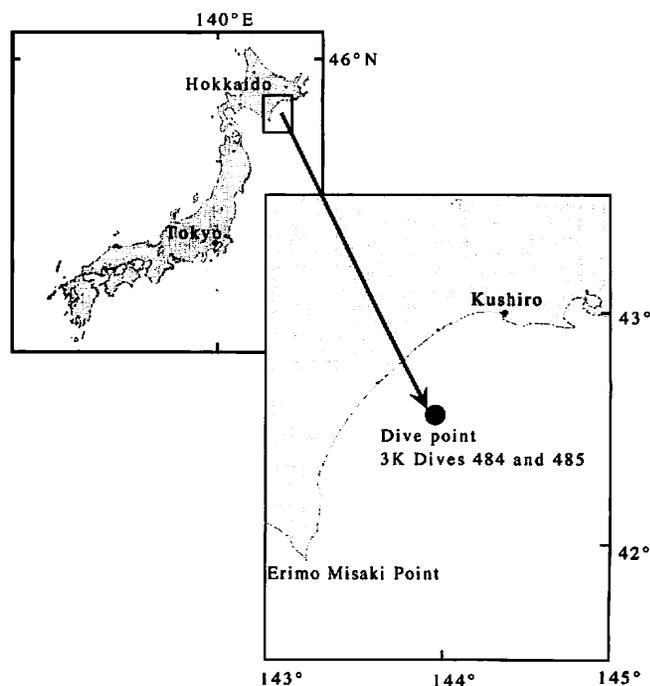


Fig. 1. Map of the survey point.

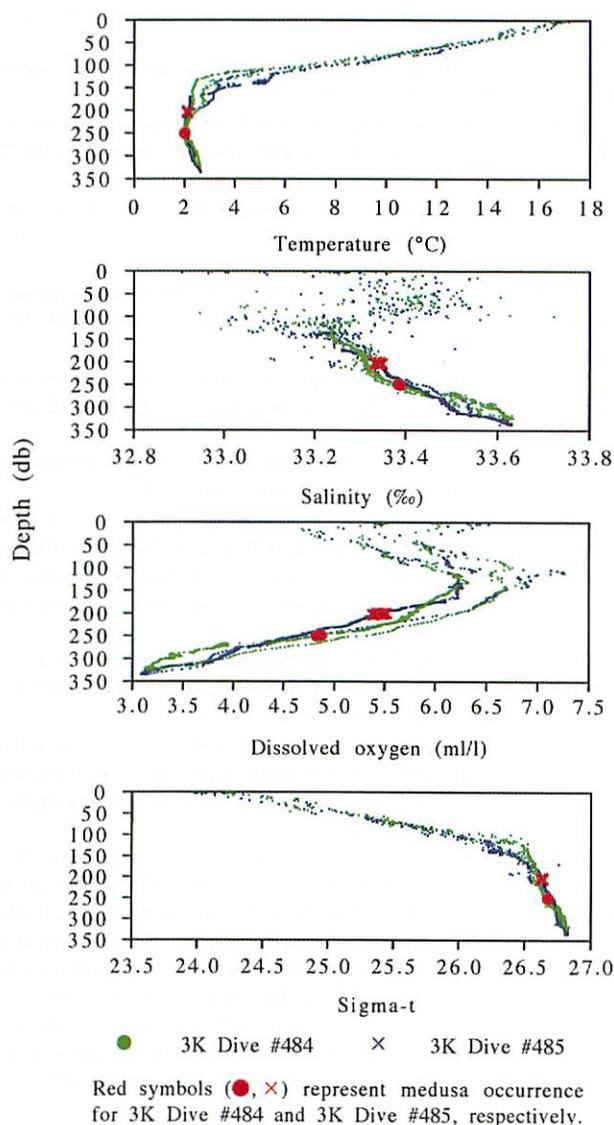


Fig. 2. Vertical profiles of environmental factors.

number of individuals observed in the same video frame image was four (Fig. 3). *A. limbata* swam against the tidal current, with an obliquely upward orientation of its aboral surface (Fig. 3). Individuals swam vigorously, with strong bell contractions at a rate of 20 to 26 beats/min. (24 beats/min. average). No weak individuals were observed. The diameter of medusae was approximately 25–30 cm. The ratio of males to females that could be identified as such was approximately 1:3. Most of the females had planulae, which appeared golden-yellow and were located in the brood pouches on the oral arms (Fig. 4). During these ROV dives, *A. limbata* medusae were also observed at the surface.

The sea bottom over which *A. limbata* occurred was covered in a mixture of sand and mud. Many ophiuroids were distributed randomly over the whole surface of the sea floor and sea urchins occurred sporadically within the ophiuroid aggregations. There were many calcareous polychaete tubes at 144 m depth. There was also a boulder zone at 144 m depth. Other



Fig. 3. Videograph of a group of *Aurelia limbata* medusae.

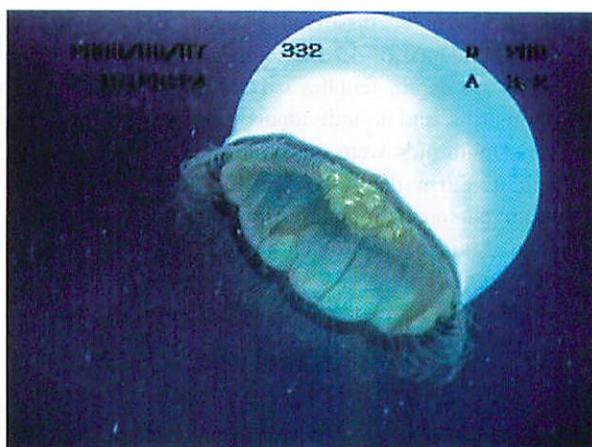


Fig. 4. Videograph of a female medusa of *Aurelia limbata* which has planulae colored golden yellow in the brood-pouch on the oral arm.

pelagic animals that were observed frequently were euphausiid shrimps, chaetognaths, *Bolinopsis infundibulum*, *Euphysa* sp. and walleye pollock (*Theragra chalcogramma*).

*A. aurita*, a close relative of *A. limbata*, has been reported at shallow depths (<25 m) (Yasuda 1970; 1971; 1972; 1973a, b; 1974; Mackie et al. 1981; Papathanassiou et al. 1987). There are no reports on the distribution of the genus *Aurelia* in deeper waters. These submersible observations, however, demonstrate that the range of *A. limbata* extends to at least 250 m. Individuals were highly active and females carried attached planulae. This has broad implications for the extent and geographic range over which planulae in this species may develop into polyps. In fact, scyphopolyps that are tentatively identified as *Sanderia malayensis*, an epipelagic species, were found at depths of 80–100 m in Kagoshima Bay (Miyake, unpublished). There were many calcareous polychaete tubes and rocks at 144 m depth at the present site. These may be good substrata for planula attachment. This information should prove valuable in

our efforts to understand where and when blooms of the genus *Aurelia* may occur.

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### STOP-PRESS

*Aurelia limbata* individuals were observed at even greater depths and higher abundances during ROV *Dolphin 3K* Dive 537 over the Kushiro Deep Sea Valley (42°51'N, 144°18'E) on August 1, 2001. Medusae occurred at depths between 242 and 432 m where the physico-chemical environmental parameters were temperature: 1.6–1.9°C; salinity: 33.40–33.53 PSU; sigma-t: 26.72–26.80; dissolved oxygen: 3.9–5.2 ml/l. The maximum abundance of 15 individuals/video frame was observed at 370 m depth, females carried planulae on the bases of their oral arms, and no individuals were observed in the surface layer. Ophiuroids were observed preying on a moribund individual at 320 m depth on *Shinkai 2000* Dive 1292 (T. Yanagimoto, personal communication) attesting to the possible importance of this medusa to benthic-pelagic coupling and as a food source at this site.

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