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SHORT COMMUNICATION

Occurrence and density of *Halobates micans* (Hemiptera: Gerridae) in the eastern South Indian Ocean

Terumi IKAWA[1], Shinobu ONODERA[2], Hidehiko OKABE[3], Sugihiko HOSHIZAKI[4] and Lanna CHENG[5]

Departments of [1]Liberal Arts and Sciences and [2]Childhood Education, Morioka College, Takizawa, Iwate, [3]National Institute of Material Sciences, Tsukuba, Ibaraki, [4]Graduate School of Agricultural and Life Sciences, The University of Tokyo, Tokyo, Japan; and [5]Scripps Institution of Oceanography, University of California at San Diego, La Jolla, California, USA

Abstract

Two species of ocean skaters, *Halobates germanus* and *Halobates micans*, live in the tropical and subtropical waters of the Indian Ocean. From December 1992 to December 1993, *Halobates* was intensively sampled in the easternmost region of the South Indian Ocean (13–18.5°S, 114–121E°), from which there have been a small number of records of *Halobates*. No *H. germanus* was caught, but a total of 1190 *H. micans* were collected, with densities estimated at 13 900–28 100 individuals/km^2. This suggests that *H. micans* lives in the study area at high densities comparable to those in the Atlantic and the Pacific Oceans. We also discuss the possible effects of ocean currents and winds on the geographic distributions of the two *Halobates* species in the eastern South Indian Ocean.

Key words: geographic distribution, ocean current, ocean skater, wind.

Among insects, the only pelagic species are five species of *Halobates* ocean skaters (Cheng 1985). The geographic distributions of these species have been presented by Andersen and Cheng (2004) based on collection records compiled over many years. In the Indian Ocean, *H. micans* Eschscholtz and *H. germanus* White both occur. The former is found mostly in open stretches of the Indian Ocean, whereas the latter is found mostly along the continental and Indonesian coasts. However, in the easternmost area of the South Indian Ocean between Indonesia and Australia (~10–20°S, ~110–125°E), the two species of *Halobates* have rarely been found, and in fact it is not clear whether these two species do actually exist in that region. In the present study, we carried out intensive surveys in the easternmost region of the South Indian Ocean to determine the occurrence and density of *H. micans* and *H. germanus*.

Correspondence: Terumi Ikawa, Department of Liberal Arts and Sciences, Morioka College, Takizawa, Iwate, 020-0183 Japan. Email: address trmi@pop02.odn.ne.jp

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Ocean skaters were collected during a voyage of the R/V Shoyo Maru operated by the National Research Institute for Far Seas Fisheries between 29 December 1992 and 23 February 1993. The dates of sampling, number of tows carried out and areas swept are shown in Table 1. During 29–31 December 1992 (period I), the area around 16°S, 118°E was surveyed via 29 tows (Fig. 1A); during 2–7 January 1993 (period II), the area between 15–17°S and 117–119.5°E was surveyed via 70 tows (Fig. 1B); during 7–9 January 1993 (period III), the sampling was carried out along a line between 14.8°S, 120°E and 15.1°S, 120.2°E via 28 tows (Fig. 1C); during 18–24 January 1993 (period IV), the area between 13°S–18.5°S and 114°E–121°E was surveyed via 29 tows (Fig. 1B); during 19–23 February 1993 (period V), sampling was carried out in an area almost identical to the area in period II via 65 tows (Fig. 1B).

Ocean skaters were collected using a manta net with a mouth opening of 65 cm × 15 cm and a mesh size of 330 μm, which was towed on the sea surface at a speed of 1.0–1.6 knots (~1.9–3.0 km/h) for 10 min. The area swept was calculated by multiplying the width of the mouth opening of the net by the distance towed. Any

Table 1 Summary of *Halobates micans* collected in the eastern South Indian Ocean between December 1992 and February 1993

Sampling period	No. tows		No. insects	Area swept (m^2)	Density (km^2)	Temperature (°C)	
	Positive	(Total)				Sea surface	Air
I (29–31 December 1992)	28	(29)	185	6 600	28 100	28.1	27.5
II (2–7 January 1993)	67	(70)	451	19 100	23 700	27.9	27.4
III (7–9 January 1993)	27	(28)	148	7 200	20 400	29.0	28.5
IV (18–24 January 1993)	28	(29)	181	7 200	25 100	29.0	28.2
V (19–23 February 1993)	61	(65)	225	16 200	13 900	27.8	27.7

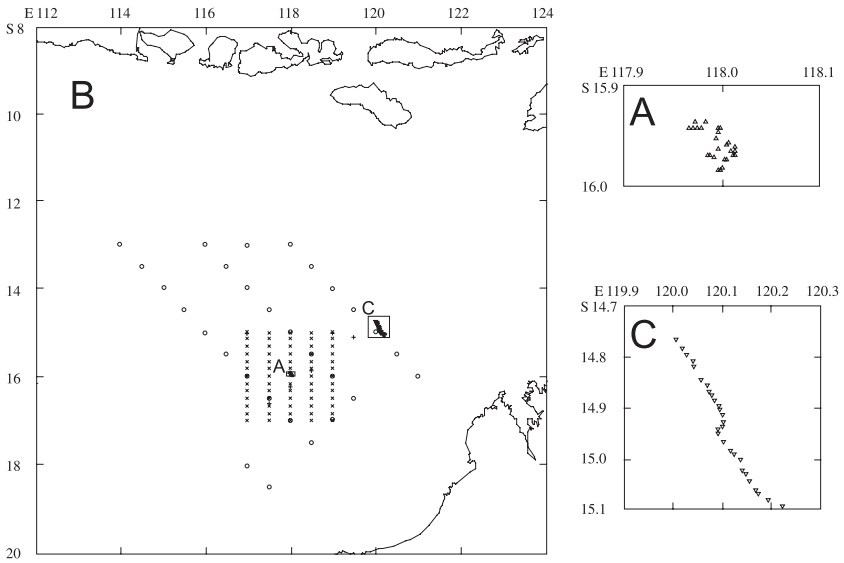

Figure 1 Study area. (A) Triangles, sampling points in period I (29–31 December 1992). (B) Crosses, sampling points in period II (2–7 January 1993); circles, sampling points in period IV (18–24 January 1993); x-marks, sampling points in period V (19–23 February 1993). (C) Inverted triangles: sampling points in period III (7–9 January 1993). There is a great deal of overlapping of x-marks and crosses, but the crosses are not displayed in the figure. The sampling regions shown enlarged in (A) and (C) are also shown in (B).

insects collected were stored in 10–15% formalin in seawater and later identified in the laboratory.

The sea-surface temperature during the five sampling periods ranged from 27.8 to 29.0°C, at which temperatures high densities of *Halobates* have been known to occur (Cheng 1985). During the five sampling periods, a total of 1190 *H. micans* were caught (Table 1), with an estimated density ranging from 13 900 to 28 100 individuals/km^2. This is comparable to densities found for *H. micans* populations in other oceans, for example 43 000 individuals/km^2 in the eastern Atlantic Ocean (calculated by Andersen & Cheng 2004 using data gathered by Cheng & Schulz-Baldes 1981) and 3000 individuals/km^2 in the western Pacific Ocean (Ikawa *et al.* 2002). These findings show that *H. micans* occurs in high densities in the study area, at least during December–February. Thus, the present study extended the known distribution range of *H. micans* further east in the Indian Ocean.

Halobates germanus was not caught in the present study. The zero catch of *H. germanus* might be explained by the distribution patterns of *Halobates* species and the effects of winds and ocean currents. Different species of pelagic *Halobates* do co-occur, but areas of high density rarely overlap (Cheng & Shulenberger 1980; Ikawa *et al.* 2002). This is consistent with the finding that only *H. micans* was caught in the present study. Generally speaking, the distribution range of *H. germanus* is more coastal than that of *H. micans* (Cheng 1989; Andersen & Cheng 2004). Therefore, *H. germanus* may be abundant only in regions closer to the Indonesian and/or Australian coasts than in our present study area.

The distribution range of pelagic *Halobates* may also be affected by seasonal changes in winds and currents (Ikawa *et al.* 2002, 2004), so even if the distribution ranges of *H. micans* and *H. germanus* are separate in the South Indian Ocean, it is possible that their interspecific boundary shifts accordingly. Around the study area,

winds and currents are dominantly westward in the boreal summer, but veer toward the east during the boreal winter (Hellerman & Rosenstain 1983; Defense Mapping Agency 1988). Therefore, if the range of *H. germanus* lies closer to the coasts than that of *H. micans* in the South Indian Ocean, their distributional boundary may possibly extend offshore in the boreal summer but return eastward to the Australian and Indonesian coasts in the boreal winter. Such a seasonal shift in the distribution ranges of *Halobates* could account for the zero-catch of *H. germanus* seen in the present study.

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