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SOME *HALOBATES* FROM THE PACIFIC OCEAN

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Abstract

Some collections of *Halobates* species from the Pacific Ocean, consisting of *H. micans*, *H. sericeus* and *H. germanus*, are described, together with notes on their biology.

Introduction

Halobates (Heteroptera: Gerridae) is the only known genus of insects with representatives living in the open ocean. All 39 described species are marine. Most are more or less confined to inshore waters, but seven of them are found only in the open ocean. Although *Halobates* has been known to science since the early 1800's, we still know very little about its biology. The taxonomy of the genus was reviewed by Herring in 1961, and the distributions of the Pacific species were studied by Savilov (1967).

Of the seven open-ocean species of *Halobates*, five have been found in the Pacific Ocean. Three of these will be discussed in this paper, the other two species, *H. splendens* Witlaczil and *H. sobrinus* White, being known only from off the coasts of the American continents.

Material

The material used in this study was collected at various times from 1967 to 1969 on cruises of the R/V HAKUHO MARU of the Ocean Research Institute, University of Tokyo. The station numbers and dates are given below:

December 1967	—	H 13-9; H 12-18; H14-1; H14-3; H 14-14; H 14-16.
May 1968	—	H 27B; H 29B; H 46-1; H 48-3; H 51-2; H 53-2; H 54-5; H54-21.
August 1969	—	H 67-1.

September 1969	—	H 88; H 90-2; H 90-12; H 91-1; H 93-8; H 95; H 98; H 101-2; H 103-2; H 112-2.
October 1969	—	H 115-6; H 117-8; H 118-2; H 119-7; H 119-9; H 120-1; H 120-2; H 123-1; H 128-2.
November 1969	—	H 131-1; H 131-2.

There are altogether 36 samples containing *Halobates*, of three species, *H. micans* Eschscholtz, *H. germanus* White, and *H. sericeus* Eschscholtz. About half of the insect samples consist of adults only; the others comprise also nymphs of various stages. The sample size varies from one to 363 specimens; the majority contain less than ten specimens. Twenty-nine of the samples consist of specimens of a single species; seven are mixtures of two species. *H. sericeus* was the commonest species found in 20 stations, in three of which it occurred together with *H. micans*. *H. germanus* was collected from 11 stations, together with *H. micans* in four of them. *H. micans* was collected from 12 stations; it was found with either of the two other species at 7 of the stations. The locations of the stations, together with the species recorded, are given in Figure 1.

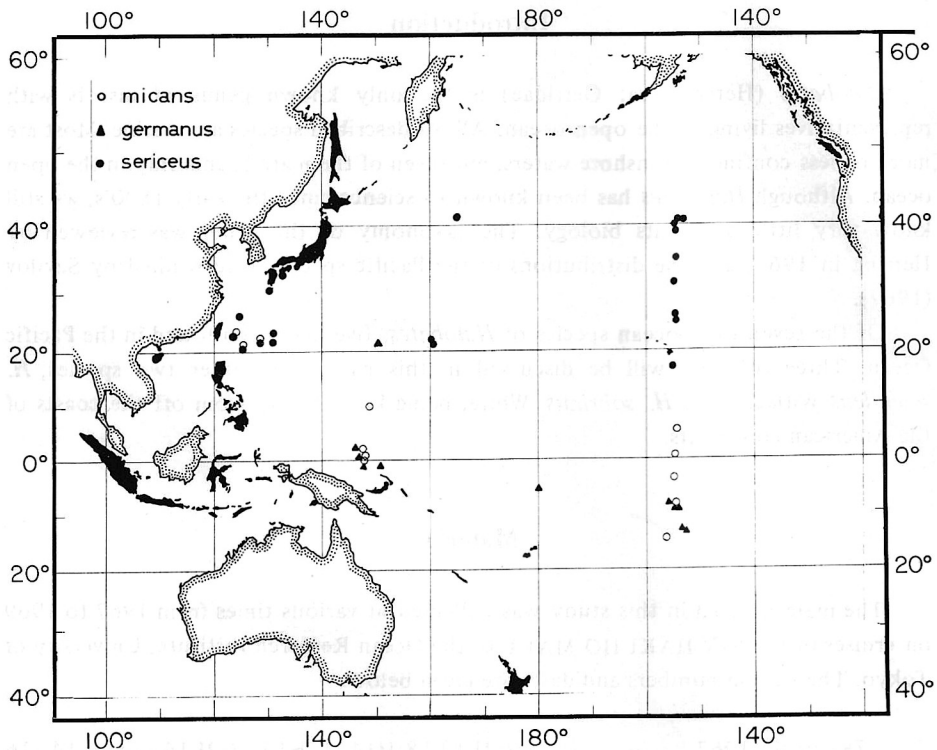


Figure 1

Station localities where *Halobates micans*, *H. germanus*, and *H. sericeus* were collected.

Discussion

The localities from which specimens of *Halobates* were collected fall more or less within the ranges of distribution of these three species as delimited by Savilov (1967). *H. sericeus* was found between latitudes 15°N to 40°N ; one collection was obtained at 41°N , probably the northern-most record for this species. *H. micans* seems to be more or less restricted to the equatorial zone between 10°N and 10°S , extending northwards only within the influence of the warm Kuroshio current to the south of Japan, where it coexists with *H. sericeus*. *H. germanus* probably occurs in this part of the ocean too, although it was not found in the present collections from this area. It occurs between latitudes 20°N and 20°S , coexisting with *H. micans* in equatorial waters.

Although the collections were made in different years, most of them came from the same general area (except those collected in May 1968, which will be discussed separately); and it therefore seems reasonable to discuss them together.

The samples collected in May 1968 consist of *H. micans* and *H. sericeus*; three of the eight samples include specimens of both species. (Although *H. germanus* is not represented in these samples, it has been collected from this area by Miyamoto and Senta, 1960.) In addition to adults, nymphs of both species are present, though only 4th and 5th instars have been found. Judging from the appearance of the external genitalia, several of the adults of *H. sericeus* had mated. Of the 64 adults of this species collected, 38 are females and only 26 were males, giving a rather unequal sex ratio, as was observed for the same species, from the same area, by Miyamoto and Senta (1960).

Most of the remaining samples were collected from the area along the longitudes 150°E and 155°W . Nymphs and adults of all three species were caught, but no first instar nymph has been found in any of the samples. Since individuals of this stage are very small, measuring only about 1 mm in body length, they may be easily missed by the casual collector. Fourth and fifth instar nymphs are represented in all the months for which samples are available, but younger nymphs were collected only in September and October. As indicated by the total number of adult males and females, the sex ratios of all three species depart considerably from unity:

H. micans: 15 males, 36 females

H. sericeus: 113 males, 141 females

H. germanus: 31 males, 45 females.

Similar preponderances of females have been found in *H. micans* collected from Melanesia (Cheng, 1971) and the Atlantic Ocean (Cheng, 1972) and also in a related marine gerrid, *Rheumatobates aesturarius* (Cheng and Lewin, 1971).

The numbers of adults and nymphs of each species collected in each month are given in Table I. As can be seen from the Table, the sample size of most of the monthly collections is rather small. Although one cannot draw conclusions from such data with regards to range of distribution, seasonal variation in population size, etc., even such limited information is useful in adding to our knowledge of these interesting and unique oceanic insects.

TABLE I

Species	Month (1967-69)	Adults		Nymphal instars				
		Male	Female	I	II	III	IV	V
<i>H. sericeus</i>	May	26	38	0	0	0	3	13
	August	0	0	0	0	0	3	0
	September	108	138	0	21	118	81	45
	November	5	3	0	0	0	0	1
<i>H. micans</i>	May	1	1	0	0	0	0	3
	September	8	14	0	0	0	2	3
	October	1	5	0	0	2	2	5
	December	6	17	0	0	0	7	8
<i>H. germanus</i>	October	12	8	0	0	1	6	11
	December	19	37	0	0	0	1	1

Little experimental study has been carried out on their biology or life history. Murray (1879), in his narrative of the CHALLENGER voyage, reported that these insects had been observed to feed on the body fluids of *Physalia*, *Velella* and other pelagic coelenterates. This has subsequently been confirmed by other oceanographers (Savilov, 1967). However, we still do not know if these coelenterates serve as the regular food of the *Halobates* during all stages of its life history. It is quite possible that the nymphs may have different feeding habits. Such points could only be elucidated by field observations and feeding experiments.

These ocean striders do not possess wings at any stage in their life history, and thus spend all their time on the surface of the ocean. The eggs are laid on various floating objects such as wood, shells, seeds, feathers and even lumps of tar. Moulting probably takes place at or by such floating objects, which provide some support for the insects. Species of *Halobates* are known to have five nymphal stages. The duration of each stage probably varies with the species as well as with environmental conditions such as temperature. The life history of the oceanic *Halobates* has not been studied. They have not yet been reared successfully in the laboratory, so studies on their biology have to be carried out in the field on board research vessels. Such difficulties are partly responsible for the paucity of knowledge on their biology.

The insects are strongly attracted by light and can be collected easily at night by dip netting. In some areas of the ocean they have been seen to occur in large numbers. Savilov (1967) found that he could easily collect 400-500 specimens in 15 or 20 minutes. Remains and even complete specimens of *Halobates* have been found in the guts of the sea birds *Procelsterna cerulea* and *Pterodroma alba* (Ashmole and Ashmole, 1967; Cheng, unpublished data). One specimen has also been found among the stomach contents of a baby anchovy (Dr. Loukashikin, personal communication). It is not known how often these insects are taken by such predators, nor what other predators they have in nature among surface-feeding invertebrates, fishes or sea birds.

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