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OCCURRENCE OF THE CARIBBEAN STOMATOPOD,
BATHYSQUILLA MICROPS, OFF HAWAII, WITH
ADDITIONAL RECORDS FOR *B. MICROPS* AND
B. CRASSISPINOSA

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During the sampling program of the National Marine Fisheries Service (NMFS) aboard the NOAA research vessel TOWNSEND CROMWELL in 1972, one specimen of an unusual stomatopod was taken by trawl off Maui, Hawaiian Islands, at a depth of 731-786 m. It proved to be an adult female of the rare *Bathysquilla microps* (Manning, 1961), then known from only three specimens taken in 732-952 m off southeastern Florida and the Bahamas (Manning, 1969a).

Bathysquilla microps was the second species of bathysquillid to be recognized, the first being *B. crassispinosa* (Fukuda, 1909), originally described from Japan and subsequently recorded from additional localities in the western Indian Ocean. It occurs in depths between 230 and 310 m. A third bathysquillid representing another genus, *Indosquilla manihinei* Ingle and Merrett, 1971, was described from a unique specimen taken off Cosmoledo Atoll, Indian Ocean, in a depth of 420 m. Apparently bathysquillids are restricted to moderate depths of the outer shelf and upper slope (Fig. 2).

The bathysquillids live in far greater depths than the majority of known stomatopods. The deepest record given by Kemp (1913) in his monograph of the Indo-West-Pacific stomatopods was 370-419 fm (677-767 m) for *Squilloides leptosquilla* from the "Investigator" collections. Chopra (1939) described

Eurysquilla sewelli from 695 m in the Gulf of Aden and recorded two species from 1295 m in the same area. However, these two species, *Gonodactylus chiragra* (Fabricius) and *Oratosquilla investigatoris* (Lloyd), are known to live in much shallower water (especially *G. chiragra*, an intertidal species), and their occurrence at this depth is questionable. In a review of the western Atlantic stomatopods, Manning (1969a) recorded 14 species from depths greater than 300 m, and only two of these, *B. microps* (732–952 m) and *Squilla intermedia* Bigelow (291–615 m), occurred in depths greater than 450 m.

In reporting this unusual extension of range, we present here additional northwestern Atlantic records for *B. microps*, based on collections made since 1969 by the National Marine Fisheries Service, additional records for *B. crassispinosa*, and comparative diagnoses and sketches for both of these species.

Terms and indices used in the accounts below have been discussed in Manning (1969a). All measurements are in millimeters; total length (TL) is measured on the midline from the anterior margin of the rostral plate to a line between the apices of the submedian teeth of the telson. Station data for the OREGON II collections are on file in the Department of Invertebrate Zoology (Crustacea), National Museum of Natural History, Smithsonian Institution. All specimens are in the Smithsonian.

The illustrations were prepared by Lilly King Manning.

Bathysquilla crassispinosa (Fukuda, 1909)

Figures 1a–c, 2

Lysiosquilla crassispinosa Fukuda, 1909:61, pl. 5, fig. 4.

Bathysquilla crassispinosa.—Holthuis, 1967:27 [synonymy to 1967].—

Manning 1969a:95, 98.—Holthuis and Manning, 1969:fig. 350–2.—Ingle and Merrett, 1971:197.

Material: Shikoku Island, Tosa Bay, Japan: 1 ♀ TL (total length) 240 mm.—Madagascar; 18°54'S, 43°55'E; 280–310 m; A. Crosnier, leg.; 24 November 1973: 1 ♀ TL 215 mm.

Diagnosis: Cornea (Fig. 1a) subglobular, fully pigmented, set obliquely on stalk. Rostral plate (Fig. 1a) with distinct median longitudinal groove. Antennal protopod with 2 papillae. Dactylus of claw with 9–10 teeth. Carpus of claw with 2 dorsal spines (Fig. 1b). Intermediate carinae prominent on thoracic and anterior 2 abdominal somites, unarmed. Third to fifth abdominal somites lacking spinules on posterior

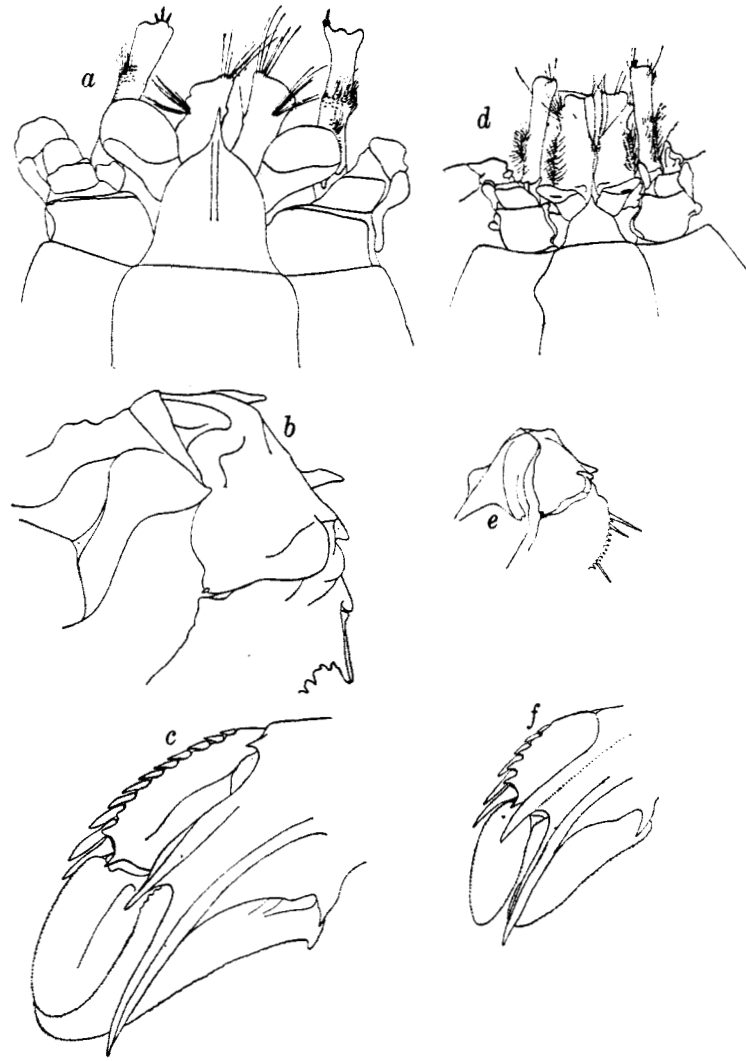


FIG. 1. Front, carpus of claw, and basal prolongation of uropod of:
a-c, *Bathysquilla crassispinosa* (Fukuda), female from Madagascar;
d-f, *Bathysquilla microps* (Manning), female from Hawaii.

margin. Telson with submedian swellings anteriorly, lacking distinct dorsal submedian carinae. Proximal segment of uropodal exopod with distinct distal spine dorsally, with 10–13 movable spines laterally. Basal segment of uropod (Fig. 1c) with spine ventrally at articulation of exopod, endopod with inner basal spine.

Remarks: Although Manning (1969a:95) suggested that the Japanese and South African populations of this species might be distinct, based on discrepancies between published figures, Ingle and Merrett (1971) compared material from the two areas and could find no differences. We observed no differences between our specimens from Japan and Madagascar.

On our specimens of *B. crassispinosa*, the intermediate carinae of the eighth thoracic somite may have a minute, sharp tubercle, but the carinae are not obviously armed posteriorly as in *B. microps*. The posterior segments of the abdomen are more heavily granulated dorsally than in *B. microps*. The merus and propodus of the claw are strongly inflated in large males (TL 285 mm from Tosa Bay, Japan; reported by Ingle and Merrett, 1971), and the strongly curved dactylus has an angular projection as in large males of *Harpiosquilla* (Manning, 1969b), but the antepenultimate tooth of the claw is not reduced as in *B. microps*.

The eyes of *B. crassispinosa*, unlike those of *B. microps* and *I. manihinei*, are relatively large and the cornea is fully pigmented. This must be a reflection of its occurrence in shallower waters than either of the other two bathysquillids.

Komai (1938:270) noted that "the ground color is of the bright orange-red very commonly found in deep-sea crustaceans. The color is especially bright on the exposed thoracic and abdominal somites particularly on the anterior and posterior margins of each somite. The carapace, raptorial limbs and telson are relatively light in color. On the ventral side the pleopods are crimson-red."

Bathysquilla crassispinosa is a large stomatopod, attaining a total length of almost 300 mm; only two other stomatopods, *Lysiosquilla maculata* (Fabricius) and *Harpiosquilla raphidea* (Fabricius), are known to grow to this size. Females of *B. crassispinosa* 200–297 mm long have been recorded in the literature; males appear to be only slightly smaller, with total lengths ranging from 245 to 280 mm.

Our specimens have 2–3 movable and 10–12 fixed propodal spines. The propodal indices are similar to those of *B. microps* 076–078 in two large males examined (TL 250–285 mm) and 070 in a female 215 mm long.

A feature which apparently has escaped notice in the past is the presence, in both species of *Bathysquilla*, of a minute movable tooth at the inferodistal angle of the outer surface of the carpus of the claw (Figs. 1b, e). So far as we are aware such spines are found in no other stomatopods.

Distribution (Fig. 2): Indo-West-Pacific region, from Japan,

the western Indian Ocean, and off South Africa, in depths ranging from 230 to 310 m. Records include JAPAN: Sagami Sea (Fukuda, 1909, 1910); deep part of Sagami Sea (Komai, 1938); off Owase, ca. 300 m (Komai, 1927); Shikoku Island, Tosa Bay (Ingle and Merrett, 1971); Shikoku Island, Tosa Bay, 230–295 m.—MADAGASCAR: 18°54'S, 43°55' E, 280–310 m.—MOZAMBIQUE: 25°12'S, 34°04'E; 230–295 m (Ingle and Merrett, 1971).—SOUTH AFRICA: Off Natal, north of Durban, 150 fm (275 m) (Calman, 1923; Gordon, 1929; Ingle and Merrett, 1971); off Durban, 29°42'S, 31°29'E, 132 fm (242 m) (von Bonde, 1932; Barnard, 1950; Ingle and Merrett, 1971).

Bathysquilla microps (Manning, 1961)

Figures 1d–f, 2

Lysiosquilla microps Manning, 1961:693, fig. 5, pls. 10–11.

Bathysquilla microps.—Holthuis 1967:28 [references].—Manning 1969a: 95, Figs. 26–28.

Material: Gulf of Mexico, Bay of Campeche, Mexico; 700 fm (1281 m); OREGON II Station 10957: 1 ♂ TL 112.5 mm.—Gulf of Mexico, south of Panama City, Florida; 395 fm (723 m); OREGON II Station 10635: 1 ♀ TL 175 mm.—North Atlantic, off Surinam; 681–769 m; OREGON II Stations 10604, 10620, 10796: 1 ♂ TL 187 mm, 2 ♀ TL 173–220 mm.—Off French Guiana; 604–769 m; OREGON II Stations 10614, 10616, 10803, 10816, 10822: 4 ♂ TL 176–255 mm, 2 ♀ TL 183–195 mm.—Pacific Ocean, near Maui, Hawaiian Islands; 21°04'N, 156°09'W; 731–786 m (400–430 fm); 12.5 m shrimp trawl; TOWNSEND CROMWELL Station 61–66; 26 October 1972: 1 ♀ TL 201 mm.

Diagnosis: Cornea (Fig. 1d) indistinctly bilobed, set very obliquely on stalk, pigmented part reduced to small, transverse bar. Rostral plate (Fig. 1d) not grooved longitudinally. Antennal protopod with 2 papillae. Dactylus of claw with 13–15 teeth (14 in Maui specimen). Carpus of claw (Fig. 1e) with 1 dorsal spine. Intermediate carinae of body prominent, armed posteriorly on eighth thoracic and usually on second to sixth abdominal somites, also on first somite in Hawaiian specimen. Third to fifth abdominal somites variously ornamented with spinules on posterior margin. Telson with distinct dorsal submedian carinae. Proximal segment of uropodal exopod unarmed dorsally, with 6–8 (6 only in Maui specimen) movable spines laterally. Basal segment of uropod (Fig. 1f) unarmed ventrally at articulation of exopod, endopod unarmed on inner margin.

Remarks: The Hawaiian specimen of *B. microps* agrees in almost all respects with our material from the western Atlantic. The only major difference that we observed was that the Hawaiian specimen has armed intermediate carinae on the first abdominal somite, whereas the intermediate carinae of this somite are unarmed in all of our Atlantic specimens. This single difference in one specimen is not, in our opinion, enough to warrant recognizing a separate Hawaiian subspecies.

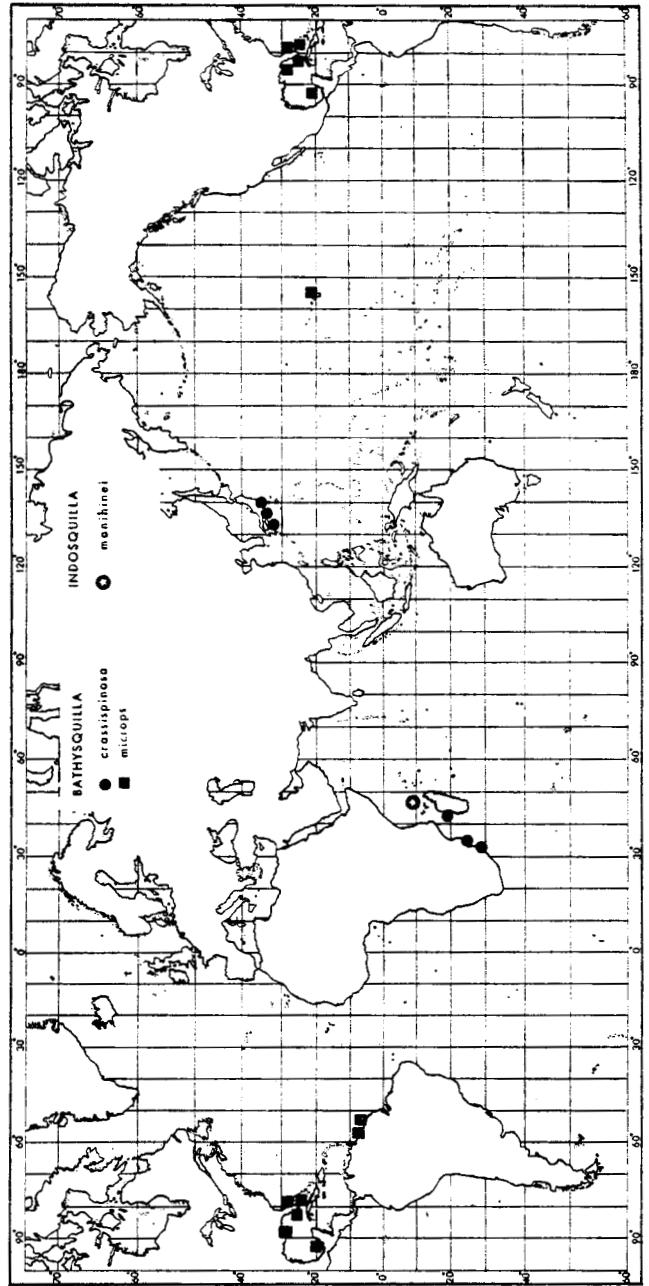


FIG. 2. Known distribution of bathysquillids.

The propodal index for five female *B. microps* (TL 173–220 m) ranges from 074–078; it is 074 in the female from Hawaii. Propodal indices of males of *B. microps* from the Atlantic (TL 68–255 mm) range from 074 to 092, the higher indices being found in the smaller specimens. The female from Hawaii has 2–3 proximal movable spines and 12–13 fixed spines on the opposable margin of the propodus of the claw. In Atlantic specimens, there are 2 movable proximal spines and 11–15 fixed spines; of 20 claws examined, 16 were armed with 13–14 teeth. The dactylus of the claw is armed with 13–15 teeth in Atlantic specimens, 14 in the female from Hawaii.

There are 7–8 movable spines on the proximal segment of the uropod in Atlantic specimens, 6 in the female from Hawaii.

Bathysquilla microps may be a slightly smaller species than *B. crassispinosa* which attains a total length of almost 300 mm. Males of *B. microps* have total lengths of 68–255 mm, and females ranging from 44.5 to 220 mm are known.

The color of the female specimen from Hawaii is similar to that of Atlantic specimens, based on photographs by J. E. Randall, Bernice P. Bishop Museum, D. Opresko, University of Miami, and B. Rohr, NMFS. On the Hawaiian specimen the anterior part of the body, from about the level of the antennae and including the eyes, is white; the rostral plate, like the carapace, is pink. The proximal portion of the propodus of the claw is white, the distal portion is pink, and the dactylus is orange. The proximal half of the walking legs is whitish, the distal part is pink. The remainder of the body is pink with orange carinae on the posterior portion of the body. Atlantic specimens show a similar pattern, but specimens have been taken in two color phases, red and orange.

Of the more than 300 shrimp trawl stations effected in the Hawaiian Islands by NMFS during the period 1967–72, the *Bathysquilla* capture occurred at the deepest successful station. Of the total of 300 stations, about 55 were in the 300–800 m depth range. Thus, it would appear that the minimum depth inhabited by *Bathysquilla* in the Hawaiian Island is about 750 m. At this depth the bottom temperature is approximately 5° C. An account of the recent NMFS surveys and the general ichthyological results are given by Struhsaker (1973).

Taxa of fishes associated with the Hawaiian capture of *Bathysquilla* were: sharks (*Apristurus*, *Etmopterus*); the eel families Congridae and Nettastomatidae; Halosauridae; Neoscopelidae; Ogcocephalidae; Ophidioidei; Macrouridae (*Hymenocephalus*, *Malacocephalus*, *Matacocephalus*, *Nezumia*, *Trachonurus*, *Ventrifossa*); Cynoglossidae. The ophidioid fishes represent a species previously recorded only from the western Pacific and the Indian Ocean (Cohen, 1974). Also taken in the haul were three or four species of pandalid shrimps and 25 kg of discarded military ordnance.

During the 1902 expedition to the Hawaiian Islands of the U.S. Fish Commission steamer ALBATROSS, no specimens of *Bathysquilla* were

taken. Of the 257 beam trawl stations occupied during that expedition, 88 were in the 700–2800 m depth range. Bigelow (1931) reported on the stomatopods collected during that expedition and recorded only three species which occurred on the upper slope: *Echinosquilla guerinii* (White) in 55–335 m, *Odontodactylus brevisrostris* (Miers) in 55–439 m, and *O. hawaiiensis* Manning (as *O. japonicus*) in 110–278 m. Townsley (1953) recorded *E. guerinii* from depths of 92–220 m; all of the other stomatopods reported by Townsley from Hawaii were taken in comparatively shallower water.

Distribution (Fig. 2): Western Atlantic, from localities near Florida, in the Gulf of Mexico, and off northern South America, in depths between 604 and 1281 m, and off Maui, Hawaiian Islands in 731–786 m. Records include: BAHAMAS: Santaren Channel (24°24'N, 80°00'W), 732–860 m (Bullis and Thompson, 1965; Manning, 1969a).—FLORIDA: Off Cape Canaveral (28°03'N, 78°44'W), 915–952 m, and southeast of Tortugas (24°11'N, 83°21.5'W), 732 m (Manning, 1961, 1969a; Bullis and Thompson, 1965); south of Panama City (28°12'N, 86°09'W), 723 m.—MEXICO: Bahia de Campeche (21°31'N, 96°46'W), 1281 m.—SURINAM: 07°49'N, 54°22'W, 732 m; 07°47'N, 54°05'W, 769 m; 07°53'N, 54°04'W, 681–732 m.—FRENCH GUIANA: 07°37'N, 53°32'W, 723 m; 07°35'N, 53°32'W, 604–769 m; 07°32'N, 53°22'W, 641–659 m; 07°18'N, 52°59'W, 668–705 m; 07°06'N, 52°44'W, 668 m.—HAWAII: Off Maui (21°04'N, 156°09'W), 731–786 m.

GENERAL DISCUSSION

The discovery of a population in Hawaii of a species previously known from the western Atlantic raises many interesting questions, none of which can be answered with our current state of knowledge. Since bathysquillids represent an old stomatopod stock (see below), it seems likely that the Hawaiian and American populations are relicts of a more widely distributed species, but that the Atlantic populations colonized the Pacific or that the reverse occurred cannot be ruled out. It seems likely that two distinct populations now occur in the two areas, for gene flow between deepwater benthic populations in the western Atlantic and the central Pacific must be minimal, but if genetic differences exist they are not strongly reflected in morphological features. Too, geographically intermediate populations may well exist; the fauna of the upper slope is not that well known in most areas of the world.

Several species or species groups of slope fishes exhibit distributions similar to that of *B. microps*. The macrourid *Hymenocephalus aterrimus* is known only from the tropical western Atlantic and Hawaii in depths of 450–900 m. Marshall and Iwamoto (1973) state that there are virtually no differences between the populations in the two oceans except for a tendency for a slightly greater interorbital width in the Hawaiian specimens. They did not feel that subspecific or other recognition of the populations were required. Iwamoto (1974) recently described a new

subgenus and species of macrourid presently known only from the Gulf of Mexico, the Caribbean (732–1062 m), and the Hawaiian Islands (623–705 m). He apparently did not find any morphological differences in the two populations of *Nezumia* (*Kuronezumia*) *bubonis*. This subgenus also comprises a second species which occurs in the South China Sea (Iwamoto, 1974).

The plectognath fish genus *Hollardia* is represented in the tropical western Atlantic by *H. meadi* (Bahamas, Cuba, and Barbados: 135–450 m) and *H. hollardi* (Bermuda, Florida Keys, Gulf of Mexico, Caribbean: 225–915 m). Tyler (1968), in describing *H. goslinei* from Hawaiian waters (365 m), states that it and *H. hollardi* are closely related and have differentiated along the same lines in several important respects, while *H. meadi* differentiated less from the ancestral type, remaining more generalized than the other two species. He also discussed the peculiar distribution of the genus and speculated that the migration of the hollardiins into what is now the tropical western Atlantic must have been eastward through the Pacific with *goslinei* being the only presently known Pacific remnant with the extinction of eastern Pacific populations after the reemergence of Central America.

Finally, the Hawaiian endemic bothid flatfish *Chascanopsetta prorigera* was recently reported from the central western Atlantic by Guthertz (1967) on the basis of a still unpublished manuscript. Preliminary comparison of material from the two regions indicates to us that the western Atlantic population deserves recognition as a distinct species. However, these two forms are very close morphologically, and together constitute a distinctive group within the genus.

Such broad distributional patterns are generally rare within the stomatopods. Of approximately 300 species now recognized, only one, *Heterosquilla mccullochae* (Schmitt), can be considered to be pantropical, occurring in the eastern Pacific, the western Atlantic, and the Indo-West-Pacific regions. Five other species occur in both the Atlantic and the Indo-West-Pacific region but not in the eastern Pacific. Broad horizontal distribution patterns also appear to be rare, in general, in inhabitants of the upper slope (Ekman, 1953; Briggs, 1974).

Briggs (1974:435) has pointed out that "many ancient, phylogenetic relicts have accumulated in the slope habitat," and documented this with material recently reported in the literature on a variety of animal groups. The bathysquillids also represent one of these groups, an old stomatopod stock that occurs on the upper slope. The stomatopods are not well represented in the fossil record (Holthuis and Manning, 1969), and there is little evidence to indicate what are old or primitive characters in the group. However, the primary distinction between the single fossil family, Sculdidae, and the four recent families, is the presence of an unsegmented exopod in the sculdids. As Ingle and Merrett (1971) noted, one of the characteristics of *Indosquilla manihinei* is its uropodal exopod, with the distal segment indistinctly sutured rather than distinctly

articulated as in all other recent stomatopods. It seems likely that the bathysquillids do represent an ancient stomatopod stock.

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