

MARINE RECORD

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First record of two sublittoral amphipods from Hawai'i



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Abstract

The first record of two genera of sublittoral amphipods, *Autonoe* Bruzelius, 1859 and *Periocolodes* G.O. Sars, 1892, is provided for Hawai'i. The specimens most closely match *Autonoe seurati* (Chevreux 1907) and *Periocolodes aequimanus* (Kossmann, 1880). They were collected from an autonomous reef monitoring structure deployed in Honolulu Harbor, O'ahu. Both species are likely recent introductions.

Keywords: Aoridae, *Autonoe*, Oedicerotidae, *Periocolodes*, Honolulu Harbor, O'ahu

Introduction

The first major review of the sublittoral amphipods of the Hawaiian Islands (Barnard 1971; Barnard 1970) expanded the known species from ~40 to ~120. In 1992 the Hawaii Biological Survey (HBS) initiated an ongoing natural history inventory of the Hawaiian Archipelago to locate, identify, and evaluate all species within the state (Evenhuis and Miller 2015). As of 1995, the HBS checklist contained 181 amphipods (Eldredge and Miller 1995). That list was last expanded to 201 with the discovery of a new species in 2006 (Longenecker and Bolick 2007).

In 2019, the aquatic invasive species team from the State of Hawai'i's Division of Aquatic Resources began using autonomous reef monitoring structures (ARMS) to monitor state harbors. ARMS are standardized structures designed to passively sample understudied marine cryptofauna (Global ARMS Program 2017). The first ARMS unit to be processed included specimens of two amphipod genera not previously reported from Hawai'i.

Methods

A modified ARMS, consisting of four plates rather than the standard nine, was deployed 10 July 2018 in Honolulu Harbor on the island of O'ahu, Hawai'i, USA. The unit was placed at 3.66 m depth on hard substrate at

21.30466° N, 157.870861°W, and retrieved 12 August 2019. All crustaceans retained on a 2-mm sieve were received by the author on 23 April 2020.

The two amphipod species reported herein were dissected and observed following the procedure outlined in Barnard (1971). Generic determination was accomplished with a guide to the families and genera of marine amphipods (Barnard and Karaman 1991a; Barnard and Karaman 1991b). Tentative species determination was accomplished by reference to the publications cited in the species accounts, below. All specimens were deposited at Bishop Museum.

Results

SYSTEMATICS

Phylum ARTHROPODA von Siebold, 1848

Class MALACOSTRACA Latreille, 1802

Order AMPHIPODA Latreille, 1816

Suborder SENTICAUDATA Lowry & Myers, 2013

Family AORIDAE Stebbing, 1899

Genus *Autonoe* Bruzelius, 1859

Material examined: Collection sites described in methods (4 unsexed individuals, 1 female, BPBM S18524).

Specimen morphology most closely matched the descriptions and illustrations of *Autonoe seurati* (Chevreux 1907) by Chevreux (1907a), Ledoyer (1984), and Myers (2009). Photographs of the gnathopods and a whole female are presented in Fig. 1.

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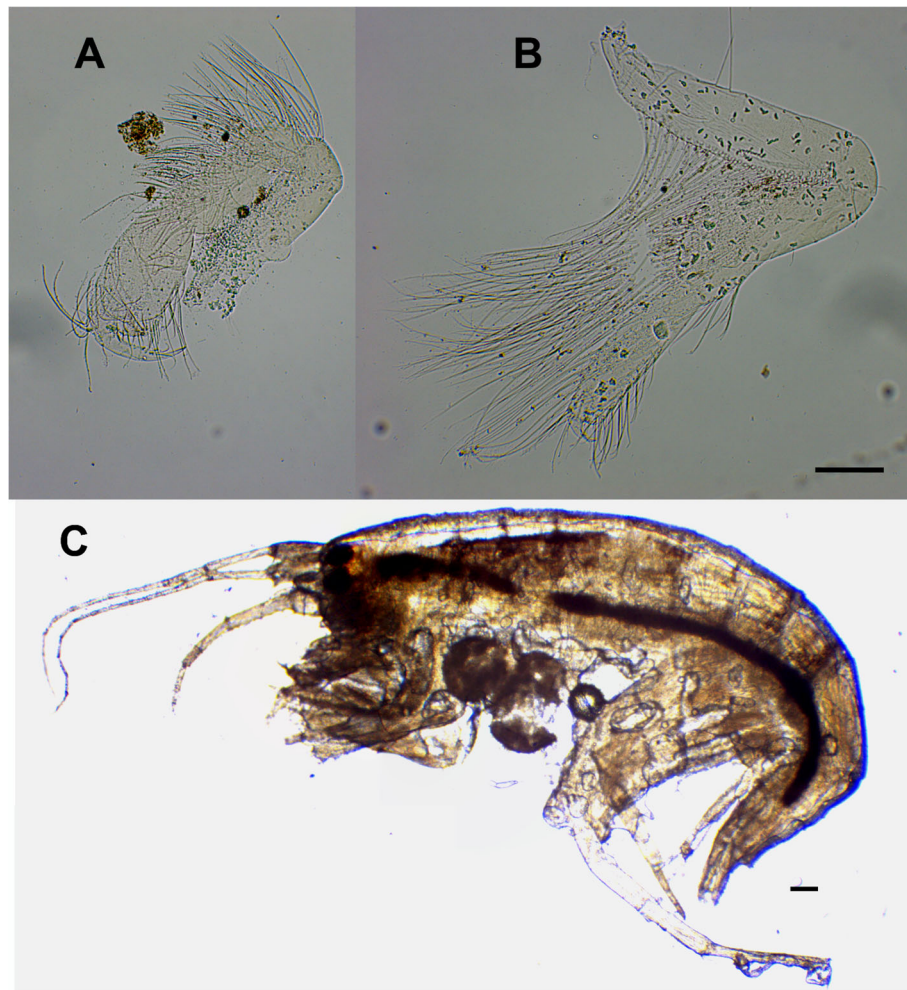


Fig. 1 *Autonoë seurati* gnathopods 1 (a), 2 (b), and whole female (c). Scale bar = 0.1 mm

Suborder AMPHILOCHIDEA Boeck, 1871
 Family OEDICEROTIDAE Lilljeborg, 1865
 Genus *Periocolodes* G.O. Sars, 1892

Material examined: Collection sites described in methods (37 unsexed individuals, BPBM S18514).

Specimen morphology most closely matched the descriptions and illustrations of *Periocolodes aequimanus* (Kossmann 1880) by Esquete et al. (2010), Myers (1990), and Schellenberg (1928). Photographs of the gnathopods and a whole individual are presented in Fig. 2.

Discussion

Tentative species-level determinations were made herein. However, despite the Hawaiian marine amphipod fauna being well described and the sample location being well studied, it is possible that one or both are undescribed species. For instance, *Periocolodes aequimanus* tentatively reported from Australia (Barnard 1931; Lowry and Stoddart 2003) was subsequently described as a new species, *P. talboti* (Hughes

and Lowry 2009). Final determination of the Hawaiian specimens will require further analyses (e.g., comparison with type specimens from the type locality, molecular characterization).

Because they exhibit six of the 10 predicted attributes of introduced peracarid species (Chapman and Carlton 1991), both genera are likely to be recent introductions to Hawai'i. Each attribute is discussed below.

Both genera were previously unknown in the local region. Neither genus was detected in 1997 or 2008 surveys designed to detect nonindigenous marine species introductions in Honolulu Harbor (Coles et al. 2009; Coles et al. 1999).

There is a likely human mechanism of introduction. For centuries, ship fouling has been the primary human mechanism of dispersing marine organisms (Chapman and Carlton 1991); Honolulu Harbor is the Hawai'i's principal seaport.

Both genera were collected with known introductions. Also collected by the ARMS unit were the cryptogenic

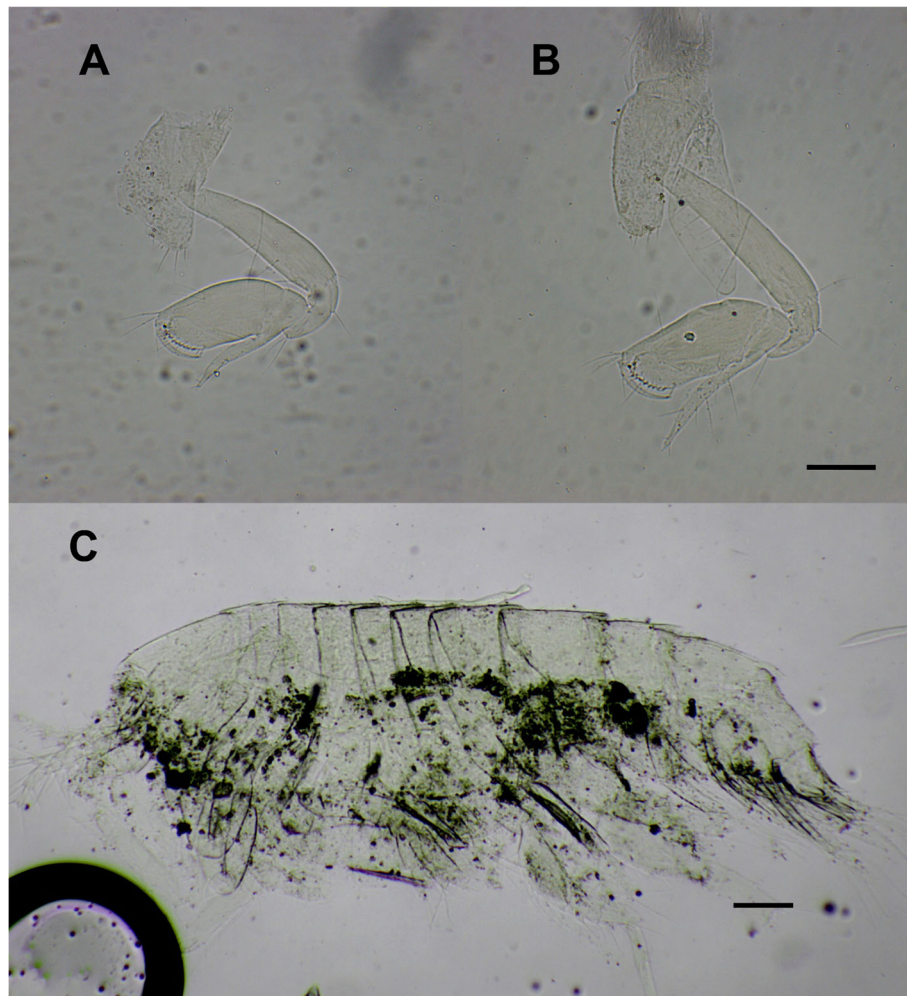


Fig. 2 *Periculodes aequimanus* gnathopod 1 (a), 2 (b), and whole individual (c). Scale bar = 0.1 mm

tanaid *Chondrochelia dubia* (Krøyer 1842) and unidentified cumaceans. The latter were unknown in Hawai'i prior to 1996, suggesting that all cumaceans are introduced (Carlton and Eldredge 2009).

Both genera are associated with new or artificial environments. Dredge and fill activities have resulted in extensive modifications to and very little natural substrate remaining in Honolulu Harbor (Coles et al. 2009). Additionally, the ARMS unit from which the genera were collected are anthropogenic structures.

Assuming the species determinations herein are correct, both species have a disjunct global distribution. *Autonoe seurati* was described from the Pacific Ocean at French Polynesia (Chevreux 1907b). It was subsequently reported from Fiji (Schellenberg 1938) and New Caledonia (Ledoyer 1984). It was tentatively identified (Moore 1988), and later confirmed (Myers 2009) from Australia. *Periculodes aequimanus* was described from the Red Sea (Kossmann 1880). It was later reported from the

Suez Canal (Schellenberg 1928), then from the Mediterranean coast of France (Ledoyer 1972). It was subsequently reported throughout Mediterranean waters (Esquete et al. 2010). It was tentatively identified from Brazil (Serejo 1998), and confirmed to occur in Atlantic waters when reported from Spain (Esquete et al. 2010). *Periculodes aequimanus* was first reported from the Pacific when found in the Cook Islands (Myers 1990).

Neither genus has a sufficient life history adaptation for global dispersal. It is well known that all peracarid crustaceans brood their young to a juvenile stage (Strathmann and Strathmann 1982). Thus, neither genus has the ability to undergo long-range larval dispersal.

Two additional attributes, post-introduction range expansion and discontinuous regional distribution, could not be assessed by the identification of amphipods collected from a single ARMS unit. Monitoring Hawai'i's other harbors, as well as non-harbor habitats, would allow the evaluation of those attributes.

Conclusions

Two genera of sublittoral amphipods, *Autonoe* and *Periocolodes*, are reported from Hawai'i (and the North Pacific) for the first time. Both are likely to have been introduced since 2008. Additional monitoring of Hawai'i's harbors and nearby habitats would help to clarify whether the amphipods are introduced and, if so, detect whether they are expanding their range.

Abbreviations

ARMS: Autonomous Reef Monitoring Structure; HBS: Hawaii Biological Survey

Acknowledgements

Holly Bolick obtained and managed both sources of funding that permitted this publication. This is contribution 2021-001 to the Hawaii Biological Survey.

Author's contributions

KL performed taxonomic work and prepared the manuscript. The author(s) read and approved the final manuscript.

Funding

Taxonomic work was funded by the State of Hawaii, Department of Land and Natural Resources, Division of Aquatic Resources through the "Taxonomic identification and potential genetic analysis support for the DAR Aquatic Invasive Species (AIS) team's Autonomous Reef Monitoring Structure (ARMS) Harbor Monitoring Project", manuscript preparation was funded by the Charles H. & Margaret B. Edmondson Charitable Trust.

Availability of data and materials

All specimens are deposited at Bishop Museum.

Declarations

Ethics approval and consent to participate

Not applicable.

Consent for publication

Not applicable.

Competing interests

The author declares that he has no competing interests.

Received: 30 December 2020 Accepted: 24 March 2021

Published online: 14 April 2021

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