

## Description of a new *Synidotea* species (Crustacea: Isopoda: Valvifera: Idoteidae) from Hawaii

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**Abstract.**—This paper provides the first description of a Hawaiian isopod of the genus *Synidotea*, *S. oahu* n. sp. This species is most similar to *S. laevidorsalis* (Miers, 1881) and *S. harfordi* Benedict, 1897. A list of *Synidotea* species described to date with biogeographic information, and a list of all marine isopods described from the Hawaiian Islands, are provided.

This paper provides the first description of a *Synidotea* species from the Hawaiian Islands. The isopod genus *Synidotea* Harger, 1878 currently contains 57 species, including the species herein described (see Table 1). The following characters define this genus: penes fused forming penial plate, fifth oostegites absent, and sexually dimorphic mouthparts (Poore 2001). In addition, *Synidotea* species possess the following combination of characters: antennae 2 flagellum multiarticulate, maxillipedal palp triarticulate, pleon with one partial suture, pereonites 2–4 coxal plates not visible in dorsal aspect and (unlike most other valviferan genera) pereonites 5–7 tergite-coxal plate sutures can be either present or absent.

The Californian species of *Synidotea* were reviewed by Menzies & Miller (1972), who also included a biogeographic account of the genus that, at the time, contained 36 species. The phylogeny and biogeography of the 22 idoteid genera, including *Synidotea*, were discussed by Brusca (1984). Poore (2001) redefined and inferred the phylogeny of the families within the Valvifera.

Most *Synidotea* species occur in the Arctic and in boreal waters (39 of the 57 described species); 13 species have been described from tropical/subtropical waters. To date, only one other *Synidotea* species has been described from the islands of the trop-

ical Pacific, *S. pacifica* Nobili, 1906 from the Tuamotu Islands. *Synidotea oahu* n. sp. is one of only 29 marine isopods known from the Hawaiian islands (see Table 2). The only other known Hawaiian valviferan is *Colidotea edmondsoni* Miller, 1940.

Nine species in this genus belong to the *Synidotea hirtipes* species-group (Monod 1931, Menzies & Miller 1972): *S. hirtipes* (H. Milne Edwards, 1840), *S. laevidorsalis* (Miers, 1881), *S. laticauda* Benedict, 1897, *S. harfordi* Benedict, 1897, *S. marplatensis* Giambiagi, 1922, *S. brunnea* Pires & Moreira, 1975, *S. keablei* Poore & Lew Ton, 1993, *S. grisea* Poore & Lew Ton, 1993, and *S. oahu* n. sp. Members of the *S. hirtipes* species-group share the following distinguishing characters: pereon smooth, frontal margin of head entire or slightly excavate, and posterior border of pleotelson with median excavation. Because *S. oahu* n. sp. possesses these characters I herein consider it a member of this group. Species boundaries within the *S. hirtipes* group have been disputed in the literature. Chapman & Carlton (1991, 1994) argued that *S. laevidorsalis* is a widespread species, which has been widely introduced to many coastlines from Japan by the shipping industry. Chapman & Carlton (1991, 1994) have thus suggested the synonymy of seven of the nine species within this group. However, their taxonomic justification for the synonymies



Fig. 1. Holotype, dorsal view.

was weak, based entirely on an analysis of length-width ratios of various body parts of the dorsal aspect of these species. Poore (1996) refuted the synonyms; through careful comparison of the pleotelson, penial plate and pereopod 1, he clearly demonstrated that the populations described from various Indo-Pacific coastlines represent valid and separate species. He also noted that the species boundaries are further sup-

ported by different ecological distributions of the species in this group. This case underscores the importance of detailed, accurate taxonomy in the pursuit of successfully identifying translocated species. Taxonomists are accustomed to the challenging task of recognizing species boundaries within groups that contain many similar species; oftentimes differences between species, although solid and obvious once made explicit, are not apparent to the untrained eye.

Order Isopoda Latreille, 1817  
 Suborder Valvifera Sars, 1882  
 Family Idoteidae Samouelle, 1819  
 Genus *Synidotea* Harger, 1878  
*Synidotea oahu*, new species  
 Figs. 1–6

*Type material examined.*—Holotype, ovigerous female, USNM 1009176. Hawaii: Oahu Is., 0.8 km from town of Kailua, collected from small batches of seaweed by Ray Greenfield, August 20, 1950. Paratype, female, USNM 99384. Hawaii: Oahu Is., Ewa Beach, 32 km from Honolulu, collected from seaweed by Ray Greenfield, August 1, 1954.

*Etymology.*—The specific epithet *oahu* derives from the poetic vowel-rich Hawaiian language, providing this binomen, *Synidotea oahu*, with every vowel in the English alphabet. In Hawaiian, *oahu* means “the gathering place.” *Oahu* is also the name of the second largest island in the Hawaiian archipelago and the type locality of this species. This word is used here as a noun in apposition.

*Diagnosis.*—Cephalon dorsal surface with a weak, transverse depression in front of eyes. Pereonites 1–7 with mesial, broadly rounded grooves on dorsal surface. Maxilla 1 mesial lobe with two unique, stout, distally-serrate robust setae with mesial setules. Mandibles (both right and left) with four-toothed incisors and four-toothed lacinia mobili with additional large serrate spine-like process. Ratio of head width to

Table 1.—Described species in the genus *Synidotea* Hager, 1878.

Species and author	Biogeographic region	Ocean (recorded distribution)	Depth (meters)
<i>S. angulata</i> Benedict, 1897	Boreal	NE Pacific (British Columbia to California)	6–117
<i>S. bathyalis</i> Gurjanova, 1955	Arctic, Boreal	Arctic Sea, NW Pacific	196–430
<i>S. berolzheimeri</i> Menzies & Miller, 1972	Boreal	NE Pacific (California)	intertidal
<i>S. bicuspidata</i> (Owen, 1839)	Arctic, Boreal	NE Pacific (Bering Sea, Alaska), Arctic, N Atlantic (Labrador)	6–250
<i>S. birsteini</i> Kussakin, 1971	Boreal	NW Pacific	910–2820
<i>S. bogorovi</i> Gurjanova, 1955	Arctic, Boreal	NW Pacific (Sea of Okhotsk)	2300
<i>S. brachnikovi</i> Gurjanova, 1933	Arctic	NW Pacific (Sea of Japan)	5–25
<i>S. brunnea</i> Pires & Moreira, 1975	Tropical	SW Atlantic (Brazil)	intertidal
<i>S. calcarea</i> Schultz, 1966	Warm Temperate	NE Pacific (S California)	813
<i>S. cinerea</i> Gurjanova, 1933	Arctic	NW Pacific (Sea of Okhotsk)	12–22
<i>S. consolidata</i> (Stimpson, 1857)	Boreal	NE Pacific (Alaska to California)	intertidal–20
<i>S. cornuta</i> Rafi & Laubitz, 1990	Boreal	NE Pacific (British Columbia)	intertidal
<i>S. epimerata</i> Richardson, 1909	Arctic	NW Pacific (Sea of Okhotsk)	20–80
<i>S. erosa</i> Benedict, 1897	Boreal	NE Pacific (Alaska)	869
<i>S. ezoensis</i> Nunomura, 1991	Boreal	NW Pacific (Japan)	intertidal
<i>S. fecunda</i> Javed & Yasmeen, 1994	Tropical	Indian (Pakistan)	intertidal
<i>S. fluvialilis</i> Pillai, 1954	Tropical	Indian (India; Chilka Lae, Quillon, Cochin)	estuarine
<i>S. francesae</i> Brusca, 1983	Subtropical	NE Pacific (upper Gulf of California)	intertidal
<i>S. grisea</i> Poore & Lew Ton, 1993	Warm Temperate	SW Pacific (New South Wales, Victoria)	7–10
<i>S. hanumantharai</i> Kumari & Shyamasundari, 1983	Tropical	Indian (India)	intertidal
<i>S. harfordi</i> Benedict, 1897	Boreal/Warm Temperate	NW Pacific (Sea of Japan), NE Pacific (S California, Baja California)	intertidal–12
<i>S. hikigawaensis</i> Nunomura, 1974	Boreal	NW Pacific (Japan, Korea)	3–4
<i>S. hirtipes</i> (H. Milne Edwards, 1840)	Tropical/Warm Temperate	SE Atlantic (S Africa, Namibia), Indian (Red Sea)	5–200
<i>S. indica</i> Javed & Yasmeen, 1994	Tropical	Indian (Pakistan)	intertidal
<i>S. ishmarui</i> Nunomura, 1991	Boreal	NW Pacific (Japan)	intertidal
<i>S. keablei</i> Poore & Lew Ton, 1993	Warm Temperate	SW Pacific (New South Wales)	8–18
<i>S. laevidorsalis</i> (Miers, 1881)	Boreal	NW Pacific (Japan)	15–17
<i>S. laevis</i> Benedict, 1897	Boreal	NE Pacific (Alaska)	52–66
<i>S. lata</i> Gurjanova, 1933	Boreal	NW Pacific	intertidal–20
<i>S. laticauda</i> Benedict, 1897	Boreal	NE Pacific (California, Washington)	intertidal–12.5
<i>S. littoralis</i> Pires & Moreira, 1975	Tropical	SW Atlantic (Brazil)	intertidal
<i>S. longicirra</i> Gurjanova, 1933	Arctic	NW Pacific (Sea of Okhotsk)	30–141

Table 1.—Continued.

Species and author	Biogeographic region	Ocean (recorded distribution)	Depth (meters)
<i>S. magnifica</i> Menzies & Barnard, 1959	Boreal	NE Pacific (California)	55-91
<i>S. marmorata</i> (Packard, 1867)	Boreal	N Atlantic (Labrador)	14-360
<i>S. marplatensis</i> Giambiagi, 1922	Tropical	S Atlantic (S Brazil, Argentina)	intertidal-30
<i>S. media</i> Iverson, 1972	Boreal	NE Pacific (California)	183
<i>S. minuta</i> Rafi & Laubitz, 1990	Boreal	NE Pacific (British Columbia)	intertidal
<i>S. muricata</i> (Harford, 1877)	Arctic, Boreal	N Pacific (Bering Sea)	45-150
<i>S. nebulosa</i> Benedict, 1897	Boreal	NE Pacific (Alaska)	intertidal-380
<i>S. neglecta</i> Birstein, 1963	Boreal	NW Pacific	1693
<i>S. nipponensis</i> Nunomura, 1985	Boreal	NW Pacific (Japan: Toyama Bay)	?
<i>S. nodulosa</i> (Kroyer, 1846)	Arctic, Boreal	NE Pacific (Alaska, British Columbia), NW Pacific (Sea of Okhotsk), Arctic, N Atlantic (Greenland)	5-343
<i>S. oahu</i> n. sp.	Subtropical	Central Tropical Pacific (Hawaii: Oahu Is.)	intertidal
<i>S. otsuchiensis</i> Nunomura, 1985	Boreal	NW Pacific (Japan)	shallow
<i>S. pacifica</i> Nobili, 1906	Tropical	Central Tropical Pacific (Tuamotu Is.)	?
<i>S. pallida</i> Benedict, 1897	Boreal	NE Pacific (Alaska)	1380-1641
<i>S. pettiboneae</i> Hatch, 1947	Boreal	NE Pacific (British Columbia, Washington)	intertidal-55
<i>S. picta</i> Benedict, 1897	Boreal	NE Pacific (Alaska)	10-40
<i>S. pulchra</i> Birstein, 1963	Boreal	NW Pacific	2887-2917
<i>S. Ritteri</i> Richardson, 1904	Boreal	NE Pacific (California)	intertidal
<i>S. sculpta</i> Gurjanova, 1955	Arctic	NW Pacific (Sea of Okhotsk)	60-284
<i>S. setifer</i> Barnard, 1914	Tropical	SW Indian (S. Africa)	7-80
<i>S. submarmorata</i> Kussakin & Mezhev, 1979	Boreal	NW Pacific (Russia: Kurile Is.)	50-425
<i>S. tuberculata</i> Richardson, 1909	Arctic	NW Pacific (Sea of Okhotsk)	120-135
<i>S. variegata</i> Collinge, 1917	Tropical	Indian (India, Sri Lanka), SW Indian (South Africa, Mozambique, Madagascar)	1-20
<i>S. watsonae</i> Poore & Lew Ton, 1993	Subantarctic	Southern Ocean (W. Australia, Victoria)	7-35
<i>S. worlensis</i> Joshi & Bal, 1959	Tropical	Indian (India: Bombay)	intertidal

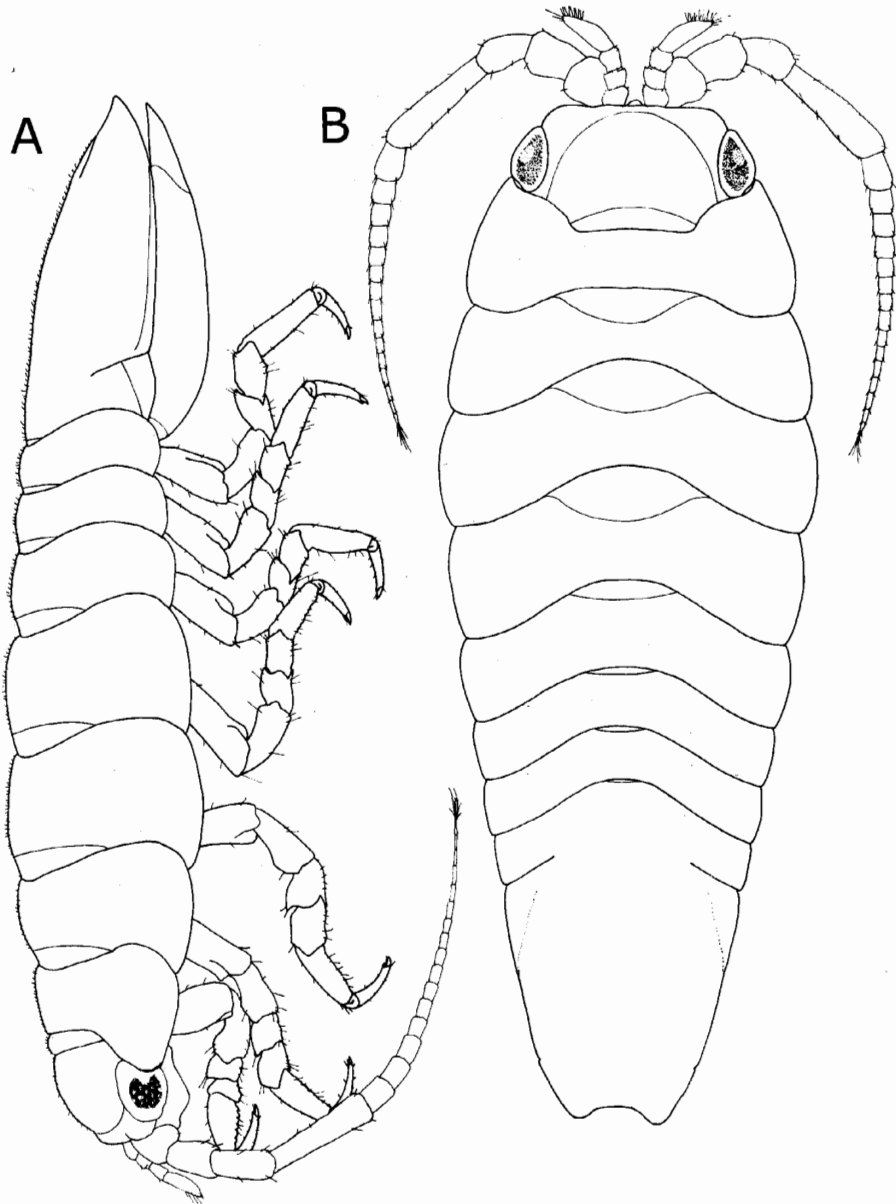


Fig. 2. Paratype. A, lateral view; B, dorsal view.

pereonite 4 width is 0.69. Pleotelson (fused pleonites and telson) 1.26 times longer than wide (measured along lateral margin, from posterior margin of coxa of pereonite 7 to distal-most tip of telson).

*Description.*—Body length: ovigerous female holotype, 8 mm, non-ovigerous fe-

male paratype, 7.5 mm. Body yellowish tan in alcohol.

Cephalon dorsal surface with a weak, transverse depression in front of eyes. Frontal margin straight. Eyes bulge outward, forming part of contour of lateral margin of head. Ratio of head width to pereonite 4

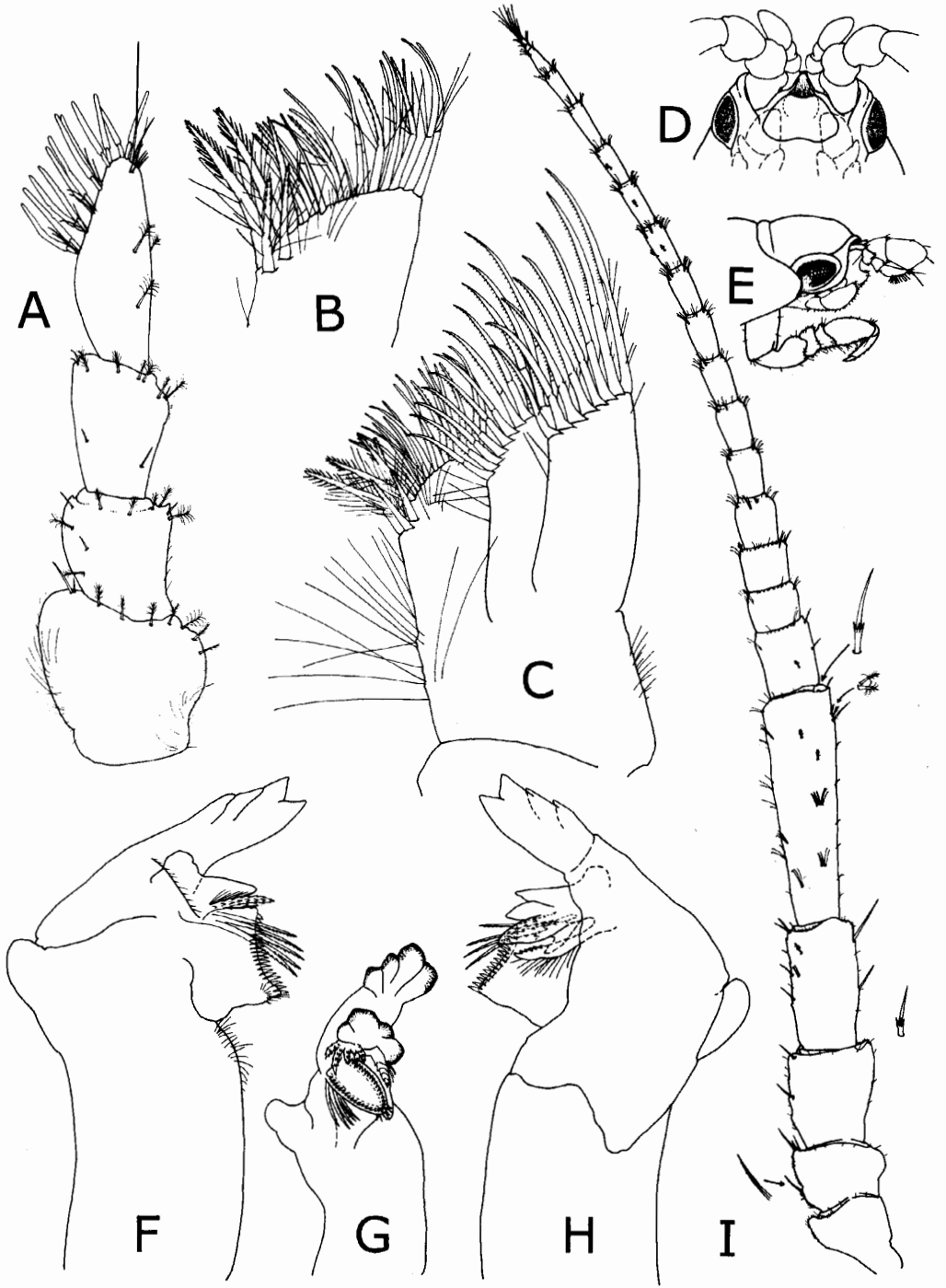


Fig. 3. Holotype. A, right antenna 1; B, left maxilla 2 close-up of inner lobe; C, left maxilla 2; D, head, ventral view; E, head, lateral view; F, left mandible, dorsal view; G, left mandible, mesial view; H, left mandible, ventral view, I, right antenna 2.

Table 2.—A list of all marine isopods reported to occur in the waters surrounding the Hawaiian Islands.

Suborder family	Species and author	Recorded distribution
<b>ANTHURIDEA</b>		
Anthuridae	<i>Amakusanthura inornata</i> (Miller & Menzies, 1952) <i>Mexanthura hieroglyphica</i> Miller & Menzies, 1952 <i>Paranthura bellicauda</i> Miller Menzies, 1952 <i>Paranthura ostergaardi</i> Miller & Menzies, 1952	Hawaiian Islands Hawaiian Islands Hawaiian Islands Hawaiian Islands
<b>ASELLOTA</b>		
Janiridae	<i>Caecijaera horvathi</i> Menzies, 1951 <i>Carpis algicola</i> (Miller, 1941)	Hawaiian Islands, California, Cuba, Thailand Hawaiian Islands, Caribbean, Gulf of Mexico, India, Aldabra Atoll Comoro Is., Red Sea, Mauritius
Joeropsidae	<i>Hawaianira peleae</i> Miller, 1967	Hawaiian Islands
Munnidae	<i>Joeropsis hawaiiensis</i> Miller, 1941	Hawaiian Islands
Stenetriidae	<i>Uromunna acarina</i> (Miller, 1941) <i>Hansenium medipacificum</i> (Miller, 1941)	Hawaiian Islands Hawaiian Islands
<b>EPICARIDEA</b>		
Boypriidae	<i>Entophilus omnitectus</i> Richardson, 1903 <i>Gigantione hawaiiensis</i> Danforth, 1967 <i>Ionella murchisoni</i> Danforth, 1970 <i>Scyracepon hawaiiensis</i> Richardson, 1910 <i>Faba glabra</i> Nierstrasz Brener a Brandis, 1930 <i>Zonophryxus retrodens</i> Richardson, 1903	Hawaiian Islands, Madagascar Hawaiian Islands Hawaiian Islands Hawaiian Islands Hawaiian Islands Hawaiian Islands
<b>CRYPTONISCIDAE</b>		
Dajidae	<i>Aega deshaysiana</i> (H. Milne Edwards, 1840)	Hawaiian Islands, Pacific Costa Rica, Japan, Cape Verde, Tristan da Cunha, NW Africa, Seychelles, Azores, Antilles Is., Mediterranean
<b>FLABELLIFERA</b>		
Aegidae	<i>Aega quadratasinus</i> Richardson, 1903 <i>Rocinela hawaiiensis</i> Richardson, 1904 <i>Creniola breviceps</i> (Schioedte & Meinert, 1881) <i>Cymothoa recta</i> Dana, 1853 <i>Glossobius anctus</i> Bruce & Bowman, 1989 <i>Ichthyoxenus puihi</i> (Bowman, 1962) <i>Mothocya melanosticta</i> (Schioedte & Meinert, 1884)	Hawaiian Islands Hawaiian Islands Hawaiian Islands Hawaiian Islands Hawaiian Islands, W Australia, Queensland, Japan Hawaiian Islands Hawaiian Islands, S Australia, Japan, Mozambique, S Africa, Red Sea
<b>CYMOTHOIDEAE</b>		

Table 2.—Continued.

Suborder family	Species and author	Recorded distribution
Limnoriidae	<i>Paralimnoria andrewsi</i> (Calman, 1910)	Hawaiian Islands, Samoa, Japan, Christmas Is., Andaman Is., Aldabra Atoll, Caribbean
Sphaeromatidae	<i>Cymodocella hawaiiensis</i> Bruce, 1994	Hawaiian Islands
	<i>Neonaesa rugosa</i> Harrison & Holdich, 1982	Hawaiian Islands, Society Islands, New Guinea, Queensland
VALVIFERA		
Idoteidae	<i>Colidotea edmondsoni</i> Miller, 1940	Hawaiian Islands
	<i>Synidotea oahu</i> n. sp.	Hawaiian Islands

width is 0.69. Antenna 1 with triarticulate peduncle and uniaarticulate flagellum with six pairs of jointed aesthetascs. Antennae 2 extended to third pereonite; with five-articulate peduncle, article 5 at least twice as long as any other peduncular article; flagellum with 15–17 articles, terminal two articles very small.

Maxilliped with a triarticulate maxillipedal palp, single coupling hook on the left maxilliped only (holotype). The paratype has one coupling hook on both left and right maxilliped. Maxilla 1 mesial lobe with two stout distally-serrate robust setae with mesial setules; lateral lobe with ten serrate robust setae and many simple setae along lateral and mesial margins. Maxilla 2 with plumose, simple and comb setae as figured. Mandibles with four-toothed incisors and large molar processes with short spines surrounding margins. Lacinia mobilis of left and right mandible four-toothed with an additional large serrate spine-like process.

Pereonites 1–7 with mesial, broadly rounded grooves on dorsal surface, otherwise dorsal surface and lateral margins smooth, without rugae, tubercules, or scales. Pereonite 3 widest. Lateral margins of pereonite 1–3 evenly convex, 4–7 straighter but not sharply angulate. Pereopods setose. Pereopod 1 with dactyl as long as propodus; two stout setae arise from base of unguis; distal lateral surface of propodus covered with serrate setae. Pereopods 2–7 with setation patterns as figured.

Pleotelson 1.26 times longer than wide; dorsal surface evenly convex; posterior border with median excavation. Pleopods 1 and 2 with plumose marginal setae on endopods and exopods, both rami without sutures. Pleopods 1–3 with coupling setae on mesial margin of peduncle. Pleopods 3–5 with plumose marginal setae on exopods only; the number of setae decrease from pleopods 3 to pleopods 5; exopods with partial sutures on lateral margins, Uropod with an oblique ridge and 3 plumose setae at mesial junction of protopod and exopod. Uropod exopod length to width ratio is 0.96.



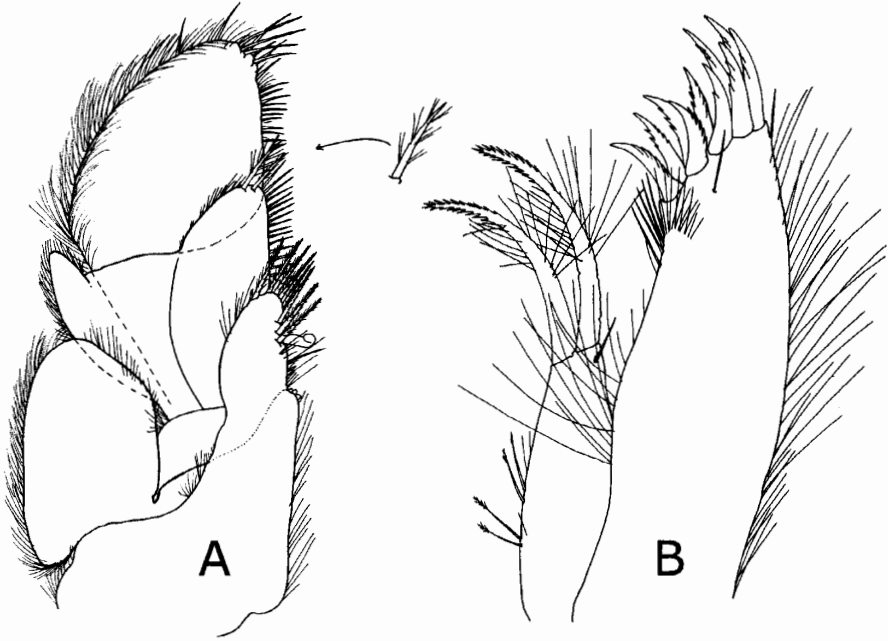


Fig. 4. Holotype. A, left maxilliped; B, left maxilla 1.

*Discussion.*—*Synidotea oahu* males are unknown. This species superficially resembles other members of the *S. hirtipes* species-group, particularly *S. laevidorsalis* and the widely distributed species *S. harfordi*. These three species are possibly closely related, however, a phylogenetic analysis of this large genus is needed to test this hypothesis.

*Synidotea oahu* differs from *S. harfordi* and *S. laevidorsalis* most strikingly in its smaller body size (*S. oahu*, 7.5–8.0 mm; *S. laevidorsalis*, 12.3–35 mm, *S. harfordi*, 18 mm). Menzies & Miller (1972) noted that *Synidotea* species follow a general trend of increasing body size with increasing latitude. Wallerstein & Brusca (1982) showed the same trend for all intertidal idoteids occurring in the northeast Pacific. Species within *Synidotea* range in length from the 3 mm tropical Pacific *S. pacifica*, to the 32 mm *S. bicuspidata* and 35 mm *S. laevidorsalis* from Arctic and boreal waters. *Synidotea oahu* fits this pattern, with a body size

of 7.5–8 mm, the average body size for tropical *Synidotea* (Menzies & Miller 1972).

*S. oahu* also differs from other members of the *S. hirtipes* species-group in the following characters: *S. oahu* has unique stout distally-serrate robust setae with mesial setules on the mesial lobe of maxilla 1 and a four-toothed mandibular incisor, whereas *S. harfordi* and *S. laticauda* both have a two-toothed mandibular incisor. *Synidotea oahu* also differs from *S. harfordi* in its broadly rounded median dorsal impressed lines on pereonites 2–4, whereas in *S. harfordi* these lines are distinctly triangulate. Also, the dactyl of pereopod 1 in *S. oahu* is nearly as long as the propodus, whereas in *S. harfordi* it is much longer than the propodus.

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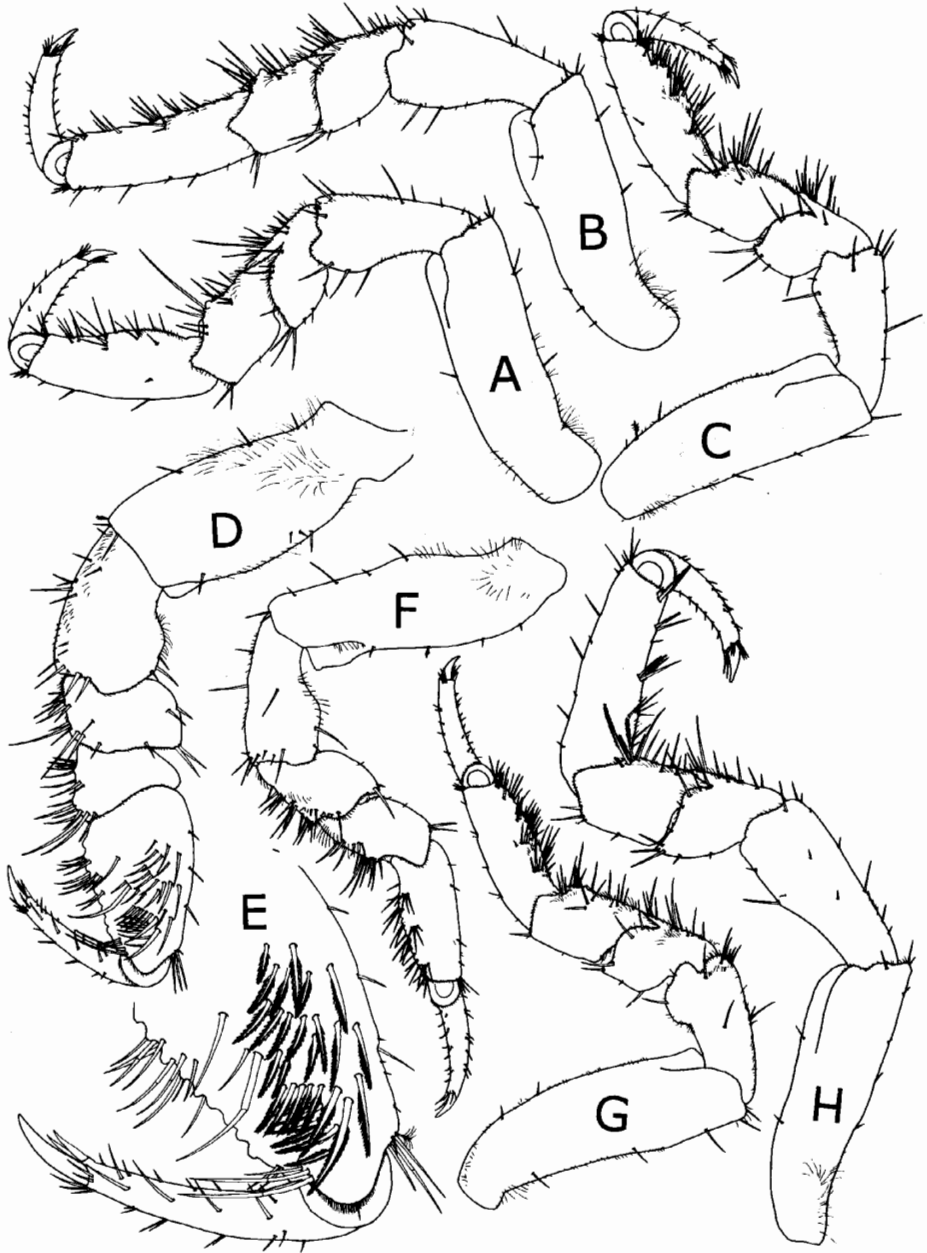


Fig. 5. Holotype. A, right pereopod 5; B, right pereopod 7; C, right pereopod 6; D, right pereopod 1; E, right pereopod 1, close-up of propodus and dactyl; F, right pereopod 2; G, right pereopod 3; H, right pereopod 4.

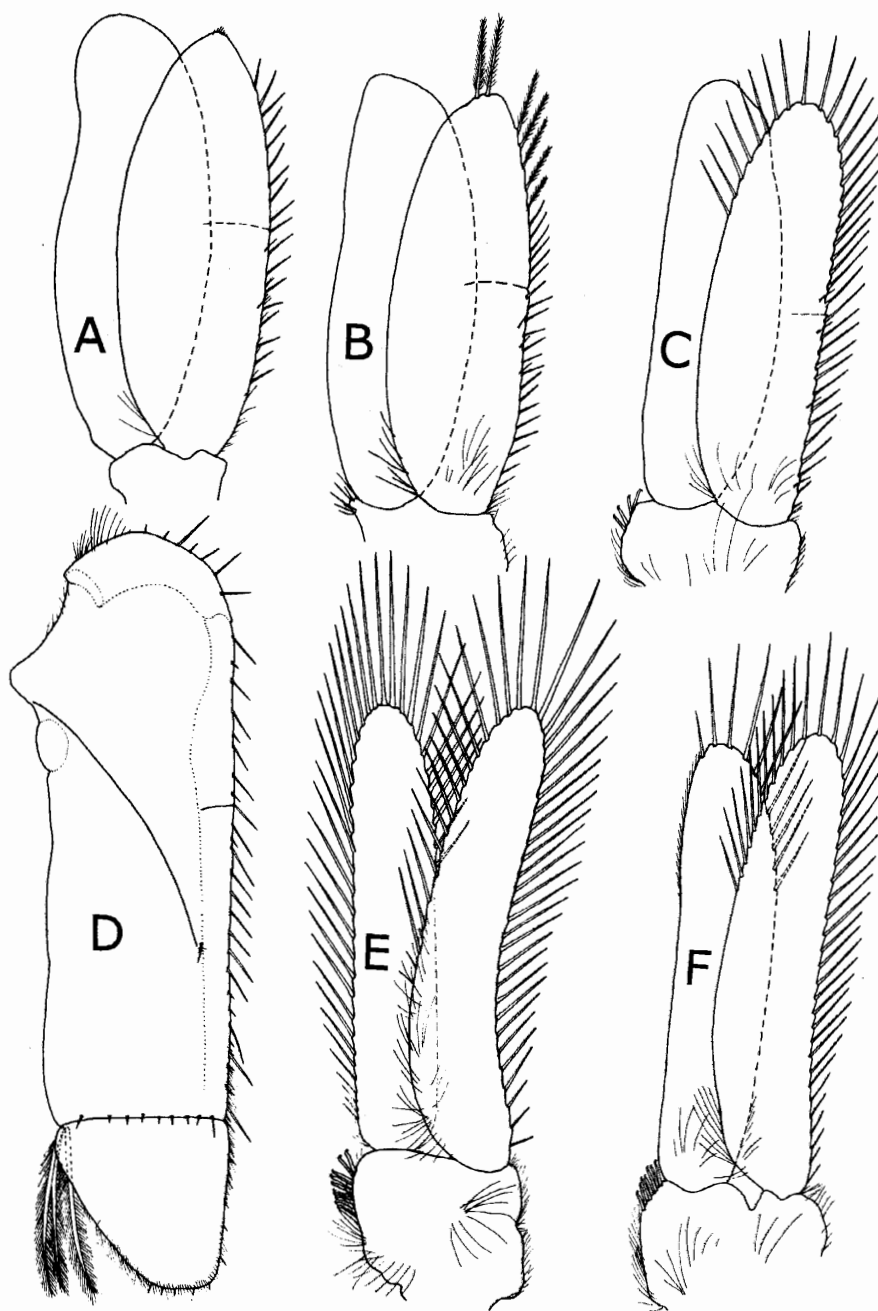


Fig. 6. Holotype, A, right pleopod 5; B, right pleopod 4; C, right pleopod 3; D, right uropod; E, right pleopod 1; F, right pleopod 2.

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### Literature Cited

- Benedict, J. E. 1897. A revision of the genus *Synidotea*.—Proceedings of the Academy of Sciences of Philadelphia 1897:387-404.
- Brusca, R. C. 1984. Phylogeny, evolution and biogeography of the marine isopod Subfamily Idoteinae (Crustacea: Isopoda: Idoteinae).—Transactions of the San Diego Society of Natural History 20(7):99-134.
- Chapman, J. W., & J. T. Carlton. 1991. A test of criteria for introduced species; the global invasion by the isopod *Synidotea laevidorsalis* (Miers, 1881).—Journal of Crustacean Biology 11:386-400.
- , & ———. 1994. Predicted discoveries of the introduced isopod *Synidotea laevidorsalis* (Miers, 1881).—Journal of Crustacean Biology 14:700-714.
- Giambiagi, D. 1922. Cuatro nuevos isopodos de la Argentina.—Physis Buenos Aires 5(20):230-244.
- Harger, O. 1878. Descriptions of new genera and species of Isopoda, from New England and adjacent regions.—American Journal of Science 15(3):373-379.
- Latreille, P. A. 1817. Les Crustacés, les Arachnides, et les Insectes. In G.L.C.F.D. Cuvier Le Règne Animal, distribuée d'après son organisation, pour servir de base à l'histoire naturelle des animaux et d'introduction à l'anatomie comparée. Volume 3 Paris.
- Menzies, R. J., & M. A. Miller. 1972. Systematics and zoogeography of the genus *Synidotea* (Crustacea: Isopoda) with an account of Californian species.—Smithsonian Contributions to Zoology 102:1-33.
- Miers, E. J. 1881. Revision of the Idoteidae, a family of sessile-eyed Crustacea.—Journal of the Linnean Society of London 16:1-88.
- Miller, M. A. 1940. The isopod Crustacea of the Hawaiian Islands (Chelifera and Valvifera).—Occasional Papers of the Bernice P. Bishop Museum, Honolulu 15(26):295-361.
- Milne Edwards, H. 1840. *Histoire Naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux*. Paris: Roret.
- Monod, T. 1931. Tanaidacés et Isopodes subantarctique de la collection Kohl-Larsen du Senckenberg Museum.—Senckenbergiana 13(1):10-30.
- Nobili, G. 1906. Diagnoses préliminaires de Crustacés, Décapodes et Isopodes nouveaux recueillis par M. le Dr. G. Seurat aux îles Tuamotou.—Bulletin du Museum National d'Histoire Naturelle, Paris 12:256-270.
- Pires, A. M. S., & P. S. Moreira. 1975. Two new species of *Synidotea* (Crustacea, Isopoda, Valvifera) from Brazil.—Boletim do Instituto Oceanográfico 24:45-67.
- Poore, G. C. B. 1996. Species differentiation in *Synidotea* (Isopoda: Idoteidae) and recognition of introduced marine species: a reply to Chapman and Carlton.—Journal of Crustacean Biology 16:384-394.
- . 2001. Isopoda Valvifera: diagnoses and relationships of the families.—Journal of Crustacean Biology 21:213-238.
- , & H. M. Lew Ton. 1993. Idoteidae of Australia and New Zealand (Crustacea: Isopoda: Valvifera).—Invertebrate Taxonomy 7:197-278.
- Samouelle, G. 1819. *The entomologists' useful compendium, or an introduction to the knowledge of British Insects*. London: Boys. 496 pp.
- Sars, G. O. 1882. Oversigt af Norges Crustacea.—Forhandlinger i Videnskaps-selskabet i Christiania 18:1-124.
- Wallerstein, B. R., & R. C. Brusca. 1982. Fish predation: a preliminary study of its role in the zoogeography and evolution of shallow water idoteid isopods (Crustacea: Isopoda: Idoteidae).—Journal of Biogeography 9:135-150.