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AND

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## Freshwater Rotifera (Monogononta) from Hawai'i—a preliminary checklist

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### Introduction

Except for some groups of insects and molluscs, Hawaiian freshwater invertebrates have received little serious study so far. This is evident from previous compilations by the Hawaii Biological Survey (Eldredge & Miller, 1997), and particularly true of micrometazoa such as Rotifera, which are virtually unstudied taxonomically. Only a few records from the Honolulu resulted from early European workers following voyages or expeditions in the early 20th century (Turner, 1996).

In conducting a first systematic inventory within and among islands, taxocenes from various regions and all vegetation zones of Hawai'i have been examined. Included were a variety of habitats from 81 streams, pools (natural and artificial), freshwater and mixo-haline, ephemeral and perennial ponds and lakes, thermal pools, reservoirs, cave waters, phytotelmata, peat bogs, marshes, and taro fields. This sampling takes into account the great physiographic and climatic variation of the higher main islands with their sequentially younger geological ages (e.g., Kay, 1994). The list below of 140+ monogonont species has been compiled from predominantly live material that was studied from 51 sampling sites within two days after collection from each site. Most likely additional species and more species records will turn up upon analysis of the preserved material, thus the current list must be considered preliminary. Future analysis will include ecology and zoogeography of Hawaiian Rotifera and hitherto unknown species will be described.

### Material

Samples were collected on the southeastern islands of Kaua'i, O'ahu, Moloka'i, Maui, and Hawai'i. With the exception of Nihoa and Lāna'i, only the main ('windward') islands are high enough to capture enough moisture to generate streams, lacustrine and palustrine habitats. Collecting localities are listed in Appendix I.

### Recorded species

Virtually all species are new state records since only four monogonont rotifers were previously known from O'ahu (Turner, 1996). The following list includes all species so far recorded on Hawai'i along with their localities of discovery (cf. Figs. 1–5), previously known non-Hawaiian distribution, and major habitat requirements.

#### *Anuraeopsis fissa* (Gosse)

#### **New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in eutrophic lakes and ponds, also in potamoplankton; occasionally in bog ponds and inland saline waters; warm stenothermic.

*Material examined:* **MOLOKA'I:** Meyer Lake (Mo5); **HAWAI'I:** pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

#### *Aspelta angusta* Harring & Myers

#### **New state record**

Zoogeography and ecology: Holarctic. Benthic and periphytic in littoral of lakes, bogs, streams; rare.

*Material examined:* **O'AHU:** brook along Poamoho Trail (O6), Waiāhole Str (O11); **KAUA'I:** Kaula 'īkinana Str (K4), Limahuli Str (K11), Hanalei River (K13); **MAUI:** Kahakuloa Str (Ma5), 'Īao Str (Ma11).

***Aspelta curvidactyla* Berzins**

**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. Benthic, periphytic, in littoral of lakes, ponds, streams; rare.

*Material examined:* **KAUA'I:** Hanakāpī'ai Str (K9); **HAWAI'I:** Wailoa Str (B1).

***Aspelta* sp. [undescribed species]**

**New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i. Among *Sphagnum*.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I:** *Sphagnum* sp. at 'Wailuku Pond' (B6).

***Asplanchna brightwelli* (Gosse)**

**New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in eutrophic ponds and lakes, in fresh and brackish water.

*Material examined:* **MAUI:** Wai'ale Res. (Ma10).

***Asplanchna girodi* (De Guerne)**

**New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in warm ponds, also lakes and inland saline waters.

*Material examined:* **HAWAI'I:** pond at Pu'u Iki (B11), Ahu Noa Marsh (B12).

***Beauchampia crucigera* (Dutrochet)**

**New state record**

Zoogeography and ecology: Cosmopolitan. Sessile on submerged plants in stagnant and slowly running waters.

*Material examined:* **O'AHU:** Inoa'ole Str (O8).

***Brachionus plicatilis* (Müller)**

**New state record**

Zoogeography and ecology: Cosmopolitan. Common plankter in brackish and inland saline waters; warm stenothermic.

*Material examined:* **MAUI:** Coot Pond (Ma7), Keālia Pond (Ma8), Kanahā Pond (Ma9).

***Brachionus quadridentatus* (Hermann)**

**New state record**

Zoogeography and ecology: Cosmopolitan. Benthic and semiplanktonic in lakes and ponds, also in brackish waters.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18); **HAWAI'I:** pond at Pu'u Iki (B11), Wai a Pele (Green Lake) (B13).

***Bryceella stylata* (Milne)**

**New state record**

Zoogeography and ecology: Holarctic. Common in peat bogs, among *Sphagnum* and terrestrial mosses, leaf litter, tree holes. Also on sand in littoral of lakes, ponds and streams; oligothermic.

*Material examined:* **MAUI:** Wai'ele'ele (Ma12).

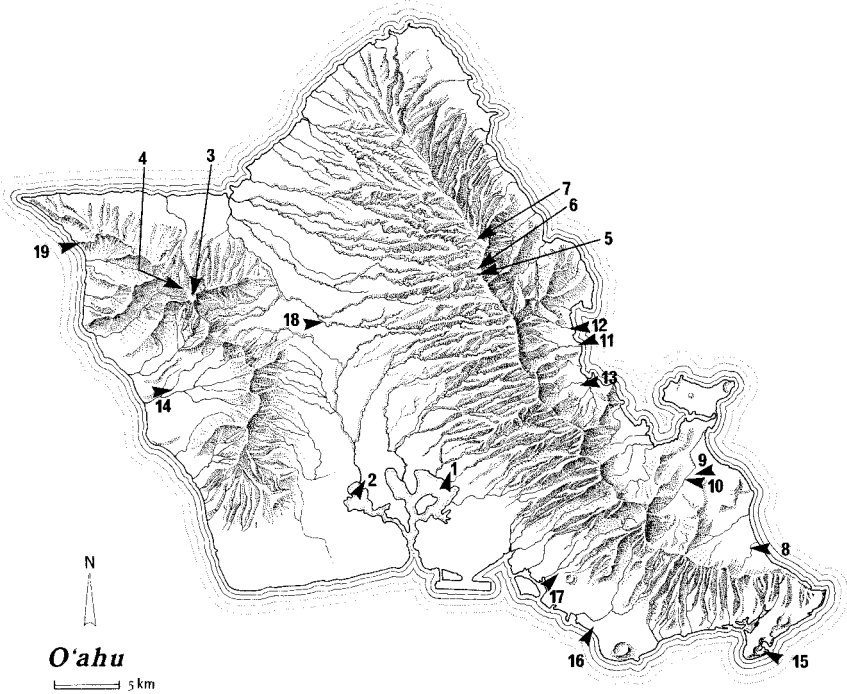


Fig. 1. Collecting stations on O'ahu.

*Cephalodella apocolea* Myers

**New state record**

Zoogeography and ecology: Cosmopolitan. Common in periphyton and among aquatic vegetation in lakes, ponds and streams, also in psammon and peat bogs; eurythermic.

*Material examined:* O'AHU: 'Poamoho Lake' (O5); KAUA'I: Kaa'u'ikinana Str (K4), Limahuli Str (K11), Hanalei River (K13).

*Cephalodella bryophila* (Pawlovski)

**New state record**

Zoogeography and ecology: Palearctic. Among *Sphagnum* and terrestrial mosses, also in leaf litter; rare.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

*Cephalodella delicata* Wulfert

**New state record**

Zoogeography and ecology: Holarctic. Benthic on mud and sand, among periphyton in lakes, ponds, ditches, and streams. Also in peat bogs, brackish and inland saline waters; eurythermic.

*Material examined:* MAUI: 'Iao Str (Ma11).

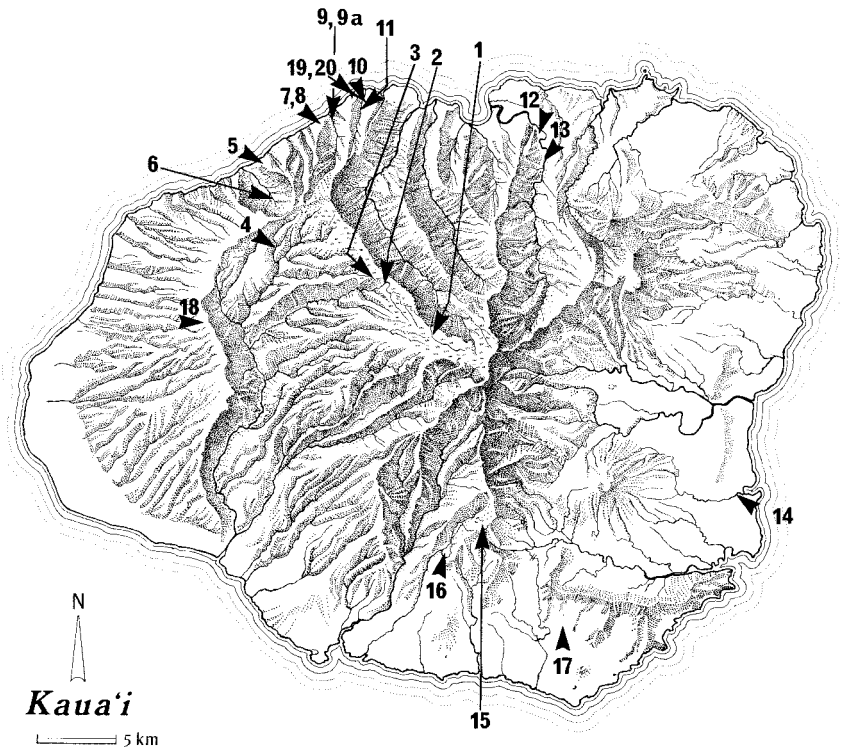


Fig. 2. Collecting stations on Kaua'i.

*Cephalodella eva* (Gosse)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. In periphyton and among aquatic vegetation in running and stagnant waters, also in littoral psammon and peat bogs; eurythermic.

*Material examined:* **KAUAI:** Kua'ikinana Str (K4).

*Cephalodella forficata* (Ehrenberg)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in periphyton of stagnant and running waters; also in psammon and peat bogs.

*Material examined:* **O'AHU:** 'Poamoho Lake' (O5); **KAUAI:** bog pool in Kana'ele Swamp (K15); **MAUI:** 'East Bog' Kaho'olewa Ridge (Ma1), *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4), Wai'anapanapa (Ma13).

*Cephalodella forficula* (Ehrenberg)

**New state record**

Zoogeography and ecology: Cosmopolitan. Common on mud in limnosaprobic environments.

*Material examined:* **O'AHU:** Inoa'ole Str (O8); **HAWAII:** Wai a Pele (Green Lake) (B13).

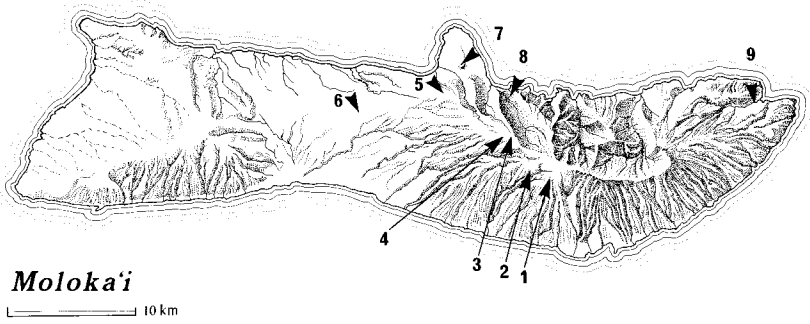


Fig. 3. Collecting stations on Moloka'i.

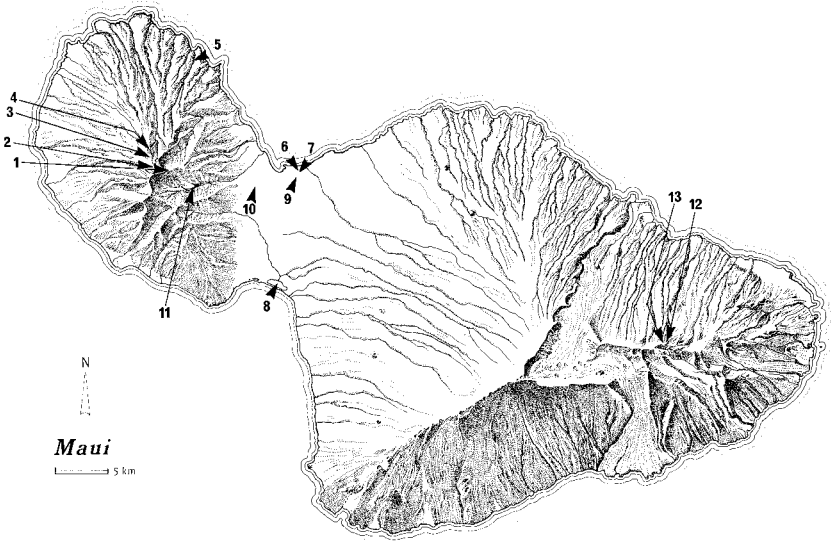


Fig. 4. Collecting stations on Maui.

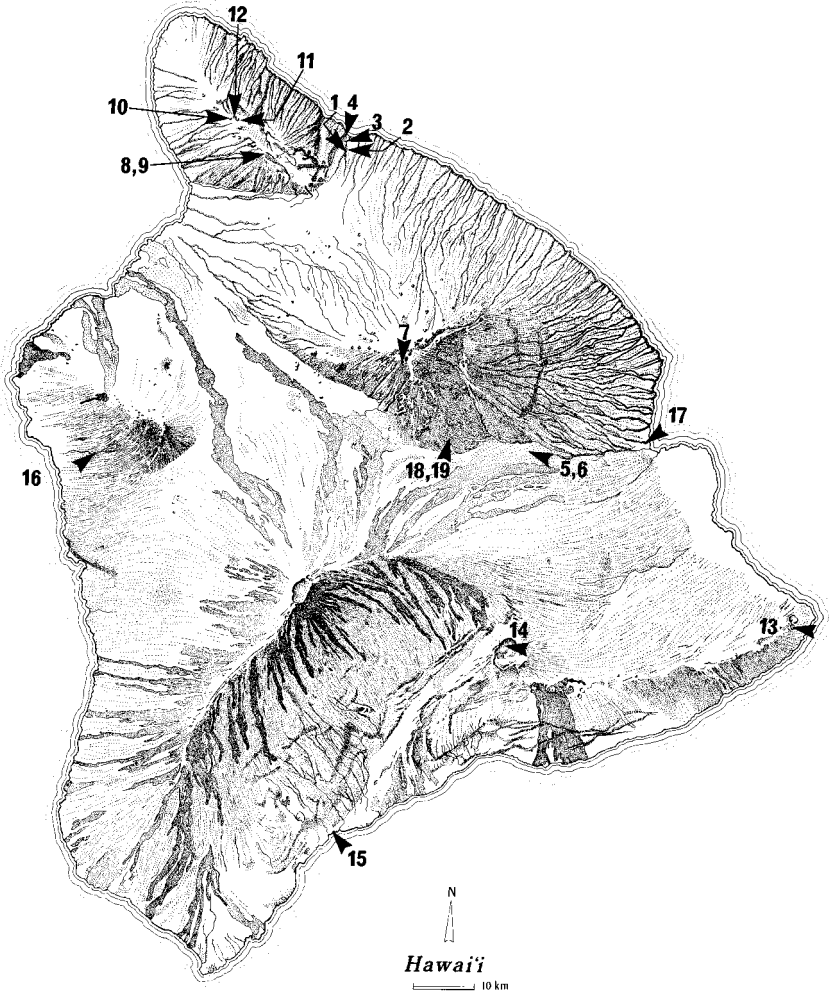


Fig. 5. Collecting stations on Hawai'i.

***Cephalodella gibba*** Ehrenberg**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

*Material examined:* O'AHU: Waiāhole Str (O11), Fong's Taro Farm, Kahulu'u (O13); KAUA'I: Hanakāpī'ai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama'ulu Str (K14); HAWAI'I: Wailoa Str (B1), Lake Waiau (B7).

***Cephalodella gracilis*** (Ehrenberg)**New state record**

Zoogeography and ecology: Probably cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

*Material examined:* O'AHU: Kahana Iki Str (O10), Waiāhole Str (O11), Fong's Taro Farm, Kahulu'u (O13); KAUA'I: Koai'e Str (K2), mosses on Kalalau Trail (K8), Hanakāpī'ai Str (K9), Diego's Taro Farm, Hanalei (K12); MAUI: Ditch on Pu'u Kukui boardwalk (Ma2); HAWAI'I: Vincent's Taro Farm, Waipi'o (B2), *Sphagnum* sp. at 'Wailuku Pond' (B6), *Sphagnum palustre*, Pu'u O'Umi NAR (B9).

***Cephalodella* cf. *hoodi*** (Gosse)**New state record**

Zoogeography and ecology (*C. hoodi*): Probably cosmopolitan. Among littoral vegetation of stagnant and running waters, also in psammon, peat bogs and inland saline waters; rare.

*Material examined:* KAUA'I: bog pool in Kana'ele Swamp (K15).

***Cephalodella incila*** Wulfert**New state record**

Zoogeography and ecology: Holarctic. In periphyton and among aquatic vegetation of stagnant and running waters, also in bogs.

*Material examined:* O'AHU: brook along Poamoho Trail (O6), Waiāhole Str (O11); MAUI: 'Īao Str (Ma11); HAWAI'I: Wailoa Str (B1).

***Cephalodella intuta*** Myers**New state record**

Zoogeography and ecology: Cosmopolitan. In periphyton and among aquatic vegetation of stagnant and running waters, also in bogs and marshes.

*Material examined:* HAWAI'I: 'Wailuku Pond' on Red Lepo Trail (B5), pond at Pu'u Iki (B11), Ahu Noa Marsh (B12).

***Cephalodella megalcephala*** (Glascott)**New state record**

Zoogeography and ecology: Cosmopolitan. Benthic on mud and littoral sand of lakes and streams, among periphyton in fresh and brackish waters.

*Material examined:* KAUA'I: Hanakāpī'ai Str (K9).

***Cephalodella nana*** Myers**New state record**

Zoogeography and ecology: Probably cosmopolitan. Among *Sphagnum*, in peat bogs.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

***Cephalodella* sp. 1** [undescribed species]**New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* O'AHU: Waiāhole Str (O11).

***Cephalodella* sp. 2** [undescribed species]**New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* O'AHU: Waikane Str (O12).



***Cephalodella* sp. 3 [undescribed species]      New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* **KAUAI:** Hanalei River (K13); **MAUI:** Kahakuloa Str (Ma5), Wai'ale Res. (Ma10).

***Cephalodella* sp. 4 [undescribed species]      New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* **KAUAI:** Hanalei River (K13); **HAWAII:** Wailoa Str (B1).

***Cephalodella* sp. 5 [undescribed species]      New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* **MAUI:** Ki'owaiokiha (Violet Lake) (Ma3).

***Cephalodella stenroosi* Wulfert      New state record**

Zoogeography and ecology: Holarctic. Common on mud and among littoral vegetation in limnosaprobic, stagnant waters; also in inland saline waters.

*Material examined:* **MAUI:** Wai'ale Res. (Ma10).

***Cephalodella sterea* (Gosse)      New state record**

Zoogeography and ecology: Cosmopolitan. Among periphyton and aquatic vegetation, on mud and sand in stagnant and running waters, also in peat bogs and inland saline waters.

*Material examined:* **KAUAI:** Diego's Taro Farm, Hanalei (K12); **HAWAII:** pond in Lālākea Swamp (B4).

***Cephalodella ventripes* (Dixon–Nuttall)      New state record**

Zoogeography and ecology: Probably cosmopolitan. Periphytic and among aquatic vegetation of stagnant and running waters, also in psammon and peat bogs.

*Material examined:* **KAUAI:** Limahuli Str (K11), Hanalei River (K13); **HAWAII:** Wailoa Str (B3).

***Collotheca ferox* Penard      New state record**

Zoogeography and ecology: Palearctic. Sessile on submerged plants in stagnant waters, also peat bogs; very rare.

*Material examined:* **HAWAII:** pond in Lālākea Swamp (B4).

***Collotheca ornata* (Ehrenberg)      New state record**

Zoogeography and ecology: Cosmopolitan. Sessile on diverse substrates in stagnant and slowly running, also brackish and inland saline, waters; also in peat bogs.

*Material examined:* **MAUI:** Ki'owaiokiha (Violet Lake) (Ma3); **KAUAI:** Koai'e Str (K2), Kuaikina Str (K4).

***Collotheca ornata cornuta* (Dobie)      New state record**

Zoogeography and ecology: Cosmopolitan. Sessile on diverse substrates in stagnant and slowly running waters, also in inland saline waters and peat bogs.

*Material examined:* **MAUI:** 'East Bog' Kaho'olewa Ridge (Ma1), Ditch on Pu'u Kukui boardwalk (Ma2), Wai'ele'ele (Ma12), Wai'anapanapa (Ma13); **HAWAII:** Ahu Noa Marsh (B12).

***Colurella adriatica*** Ehrenberg**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running waters; euryhaline.

*Material examined:* **MAUI:** Coot Pond (Ma7), Kanahā Pond (Ma9), 'Īao Str (Ma11).

***Colurella denticauda*** Carlin**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. Periphytic and among submerged vegetation in stagnant and running waters; rare.

*Material examined:* **KAUA'I:** Hanakāpī'ai Str (K9); **HAWAI'I:** Wailoa Str (B1).

***Colurella hindenburgi*** Steinecke**New state record**

Zoogeography and ecology: Cosmopolitan. Acidophilic soft water species, common in peat bogs and among mosses in lakes and streams; also in psammon and edaphon.

*Material examined:* **KAUA'I:** Kauaikinana Str (K4), Hanalei River (K13); **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4), Kahakuloa Str (Ma5), Wai'ale Res. (Ma10); **HAWAI'I:** Wailoa Str (B3), 'Wailuku Pond' on Red Lepo Trail (B5), *Sphagnum* sp. at 'Wailuku Pond' (B6), bog pool in Pu'u O 'Umi NAR (B8), *Sphagnum palustre*, Pu'u O 'Umi NAR (B9), Waiakanonula Marsh (B10), pond at Pu'u Iki (B11).

***Colurella obtusa*** (Gosse)**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, also brackish and inland saline, waters.

*Material examined:* **O'AHU:** Inoa'ole Str (O8), Waiahole Str (O11), Fong's Taro Farm, Kahulu'u (O13); **KAUA'I:** Hanakāpī'ai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13); **MAUI:** Kahakuloa Str (Ma5); **HAWAI'I:** Wailoa Str (B1), Vincent's Taro Farm, Waipi'o (B2), Wailoa Str (B3) 'Wailuku Pond' on Red Lepo Trail (B5), Wai a Pele (Green Lake) (B13).

***Colurella uncinata bicuspidata*** (Ehrenberg)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic in stagnant and slowly running, also brackish and inland saline waters.

*Material examined:* **O'AHU:** Inoa'ole Str (O8), Waiahole Str (O11); **KAUA'I:** Hanalei River (K13); bog pool in Kana'ele Swamp (K15); **HAWAI'I:** Vincent's Taro Farm, Waipi'o (B2); Wailoa Str (B3), Wai a Pele (Green Lake) (B13).

***Cyrtonia tuba*** (Ehrenberg)**New state record**

Zoogeography and ecology: Cosmopolitan. In small stagnant waters, peat bogs and marshes; also inundation areas and psammon; sporadic.

*Material examined:* **KAUA'I:** Hanama'ulu Str (K14).

***Dicranophorus grandis*** (Ehrenberg)**New state record**

Zoogeography and ecology: Probably cosmopolitan. In periphyton and among aquatic vegetation of stagnant and running waters.

*Material examined:* **O'AHU:** Inoa'ole Str (O8), Fong's Taro Farm, Kahulu'u (O13); **KAUA'I:** Diego's Taro Farm, Hanalei (K12); **MAUI:** 'Īao Str (Ma11); **HAWAI'I:** Vincent's Taro Farm, Waipi'o (B2), pond at Pu'u Iki (B11), Wai a Pele (Green Lake) (B13).

***Dicranophorus* sp. 1 [undescribed species]      New state record**

Zoogeography and ecology: Probably this undescribed species also occurs on arctic Svalbard (De Smet, pers. comm.). Among moss.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

***Dorria dalecarlica* Myers      New state record**

Zoogeography and ecology: Previously only known from the northeastern U.S., a further unpublished record from southern Australia (Shiel, pers. comm.). Among moss in mountain streams.

*Material examined:* KAUA‘I: Kaua‘ikinana Str (K4), Limahuli Str (K11), Hanalei River (K13).

***Elosa worallii* Lord      New state record**

Zoogeography and ecology: Probably cosmopolitan. In peat bogs and marshes, especially among *Sphagnum*; acidophilic.

*Material examined:* HAWAI‘I: *Sphagnum palustre*, Pu‘u O ‘Umi NAR (B9), Waiākanonula Marsh (B10).

***Encentrum sores* Wulfert      New state record**

Zoogeography and ecology: Palaearctic region (Europe). Among wet *Sphagnum* in ditches, springs and peat bogs; rare.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4).

***Epiphanes senta* (Müller)      New state record**

Zoogeography and ecology: Cosmopolitan. Common in small eutrophic and polytrophic water bodies; eurythermic.

*Material examined:* HAWAI‘I: Lake Waiiau (B7).

***Euchlanis dilatata* (Ehrenberg)      New state record**

Zoogeography and ecology: Cosmopolitan. Benthic and semiplanktonic in all kinds of stagnant and running water bodies, also peat bogs, brackish and inland saline waters.

*Material examined:* KAUA‘I: Diego’s Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama‘ulu Str (K14), bog pool in Kana‘ele Swamp (K15); MAUI: Wai‘ele‘ele (Ma12), Wai‘anapanapa (Ma13); HAWAI‘I: pond at Pu‘u Iki (B11).

***Euchlanis incisa* Carlin      New state record**

Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running waters, also peat bogs.

*Material examined:* KAUA‘I: Hanama‘ulu Str (K14).

***Filinia novaezealandiae* Shiel & Sanoamuang      New state record**

Zoogeography and ecology: Tropicopolitan. Planktonic in lakes and ponds, also reported from irrigation channels and rice fields; warm stenothermic.

*Material examined:* HAWAI‘I: pond at Pu‘u Iki (B11).

***Floscularia janus* (Hudson)      New state record**

Zoogeography and ecology: Probably cosmopolitan. Sessile on diverse substrates in stagnant and slowly running waters, also peat bogs.

*Material examined:* HAWAI‘I: bog pool in Pu‘u O ‘Umi NAR (B8).

***Hexarthra mira* (Hudson)****New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in lakes and ponds, also brackish and inland saline waters.

*Material examined:* MAUI: Wai'ele'ele (Ma12).

***Hexarthra oxyuris* (Sernov)****New island record**

Zoogeography and ecology: Cosmopolitan. Planktonic in inland saline and brackish waters; euryhaline. Previously reported from a brackish pool on O'ahu by Hauer (1941), sub *Pedalia fennica* (Levander).

*Material examined:* MAUI: Keālia Pond (Ma8).

***Hexarthra cf. polychaeta* Bennetch****New state record**

Zoogeography and ecology (*H. polychaeta*): Previously only known from a moderately alkaline quarry pond in the northeastern U.S., not seen since discovery. Planktonic in freshwater ponds.

*Material examined:* MAUI: Wai'ale Res. (Ma10).

***Keratella tropica* (Apstein)****New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in lakes, ponds and slowly running, also inland saline, waters; warm stenothermic.

*Material examined:* MOLOKA'I: Meyer Lake (Mo5); MAUI: Wai'ale Res. (Ma10).

***Lecane aculeata* (Jakubski)****New state record**

Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running waters, also ricefields; warm stenothermic.

*Material examined:* O'AHU: Wahiawā Res. (Lake Wilson) (O18).

***Lecane agilis* (Bryce)****New state record**

Zoogeography and ecology: Probably cosmopolitan. Common among *Sphagnum* in peat bogs.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); HAWAI'I: *Sphagnum* sp. at 'Wailuku Pond' (B6).

***Lecane arcuata* (Bryce)****New state record**

Zoogeography and ecology: Cosmopolitan. Among mosses and submerged vegetation in stagnant and running waters, also on mud, in peat bogs, marshes, springs, and phytotelmata; eurythermic.

*Material examined:* KAUA'I: Mosses on Kalalau Trail (K8); HAWAI'I: Waiakanonula Marsh (B10).

***Lecane bifurca* (Bryce)****New state record**

Zoogeography and ecology: Cosmopolitan. In periphyton and among macrophytes of stagnant and slowly running fresh waters, also in peat bogs; eurythermic.

*Material examined:* O'AHU: Wahiawā Res. (Lake Wilson) (O18); MAUI: Wai'ale Res. (Ma10), Wai'anapanapa (Ma13); HAWAI'I: Wai a Pele (Green Lake) (B13).

***Lecane bulla* (Gosse)****New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters, occasionally in plankton.

*Material examined:* **O'AHU:** bog pond on Mt. Ka'ala (O4), 'Poamoho Lake' (O5), acidic pool on Ko'olau Summit Trail (O7), Inoa'ole Str (O8), Waikane Str (O12), Wahiawā Res. (Lake Wilson) (O18); **KAUAI:** Diego's Taro Farm, Hanalei (K12), Hanalei River (K13), Hanama'ulu Str (K14), bog pool in Kana'ele Swamp (K15); **HAWAII:** Vincent's Taro Farm, Waipi'o (B2), Wailoa Str (B3), pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

***Lecane clara*** (Bryce)

**New state record**

Zoogeography and ecology: Cosmopolitan. Common in acidic waters in bogs, among *Sphagnum*, also in littoral periphyton and psammon of lakes and streams.

*Material examined:* **KAUAI:** bog pool in Kana'ele Swamp (K15); **MAUI:** Ki'owaiokiha (Violet Lake) (Ma3), 'Āao Str (Ma11); **HAWAII:** bog pool in Pu'u O 'Umi NAR (B8).

***Lecane closterocerca*** (Schmarda)

**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters.

*Material examined:* **O'AHU:** Inoa'ole Str (O8), Waikane Str (O12); **KAUAI:** Kauaikinana Str (K4), Limahuli Str (K11); **MAUI:** Kahakuloa Str (Ma5), 'Āao Str (Ma11); **HAWAII:** Wailoa Str (B3), pond in Lālākea Swamp (B4), Lake Wai'au (B7).

***Lecane decipiens*** (Daday)

**New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs and phytotelmata.

*Material examined:* **O'AHU:** acidic pool on Ko'olau Summit Trail (O7), Wahiawā Res., Lake Wilson (O18); **HAWAII:** 'Wailuku Pond' on Red Lepo Trail (B5).

***Lecane elegans*** Harring

**New state record**

Zoogeography and ecology: Tropicopolitan, but also recorded from the Palaearctic. Among submerged vegetation in stagnant and slowly running fresh waters.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Lecane flexilis*** (Gosse)

**New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged mosses and macrophytes in stagnant and running fresh waters; also common in peat bogs; eurythermic.

*Material examined:* **KAUAI:** Koai'e Str (K2); **MAUI:** 'Āao Str (Ma11), Wai'anapanapa (Ma13); **HAWAII:** 'Wailuku Pond' on Red Lepo Trail (B5).

***Lecane hamata*** (Stokes)

**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters, also in phytotelmata; eurythermic.

*Material examined:* **O'AHU:** bog pond on Mt. Ka'ala (O4), Inoa'ole Str (O8), Kahana Iki Str (O10), Fong's Taro Farm, Kahulu'u (O13), Wahiawā Res. (Lake Wilson) (O18); **KAUAI:** rock pool on Kalalau Trail (K7), mosses on Kalalau Trail (K8), Diego's Taro Farm, Hanalei (K12); **HAWAII:** Vincent's Taro Farm, Waipi'o (B2), Wailoa Str (B3), pond in Lālākea Swamp (B4), Waiakanonua Marsh (B10).

***Lecane hastata*** (Murray)



**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic in fresh and inland saline waters.

*Material examined:* **MAUI:** Coot Pond (Ma7).

***Lecane hornemanni*** (Ehrenberg)**New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters, occasionally in slightly saline inland waters and peat bogs; warm stenothermic.

*Material examined:* O'AHU: 'Poamoho Lake' (O5).

***Lecane inermis*** (Bryce)**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland saline and brackish waters, also in peat bogs, psammon and thermal springs; thermophilic.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); HAWAII: Vincent's Taro Farm, Waipi'o (B2).

***Lecane lauterborni*** Hauer**New state record**

Zoogeography and ecology: Probably cosmopolitan. Common among mosses in stagnant and running fresh waters, especially among *Sphagnum* in peat bogs; eurythermic.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); HAWAII: bog pool in Pu'u O 'Umi NAR (B8).

***Lecane ludwigii*** (Eckstein)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation of stagnant and slowly running fresh waters, also at slightly saline conditions; thermophilic.

*Material examined:* O'AHU: Wahiawā Res. (Lake Wilson) (O18).

***Lecane luna*** (Müller)

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland and coastal saline and brackish waters, also psammon; less common in peat bogs and acidic waters. Previously reported from brackish ditches and pools on O'ahu (Weber, 1906).

*Material examined:* O'AHU: Inoa'ole Str (O8), Kahana Iki Str (O10).

***Lecane lunaris*** (Ehrenberg)**New island record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh, inland saline and brackish waters; also common in peat bogs; eurythermic. Previously reported from brackish ditches and pools on O'ahu (Weber, 1906).

*Material examined:* O'AHU: brook along Poamoho Trail (O6), Waiāhole Str (O11); KAUA'I: Koai'e Str (K2), Kawaiikina Str (K4), Hanakāpī'ai Str (K9), Limahuli Str (K11), Hanalei River (K13); MAUI: Kahakuloa Str (Ma5), 'Īao Str (Ma11), Wai'ele'ele (Ma12), Wai'anapanapa (Ma13).

***Lecane lunaris f. perplexa*** (Ahlstrom)**New state record**

Zoogeography and ecology: Cosmopolitan. Ecology insufficiently known, probably similar to that of *L. lunaris* typica.

*Material examined:* MAUI: Wai'ale Res. (Ma10).

***Lecane monostlya*** (Daday)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters; also in phytotelmata; warm stenothermic.

*Material examined:* O'AHU: Wahiawā Res. (Lake Wilson) (O18).

***Lecane papuana*** (Murray)**New state record**

Zoogeography and ecology: Cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters; warm stenothermic.

*Material examined:* **HAWAII:** Vincent's Taro Farm, Waipi'o (B2).

***Lecane paxiana*** Hauer**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic and Ethiopian region. Rare, ecology insufficiently known.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18); **MAUI:** 'Īao Str (Ma11).

***Lecane perpusilla*** (Hauer)**New state record**

Zoogeography and ecology: Eastern Hemisphere (Palaearctic, Australian, Oriental region). Among submerged mosses, especially *Sphagnum* in peat bogs; oligothermic.

*Material examined:* **O'AHU:** Acidic pool on Ko'olau Summit Trail (O7); **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

***Lecane pyriformis*** (Daday)**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters, also in peat bogs, inundation areas and phytotelmata; eurythermic.

*Material examined:* **HAWAII:** Vincent's Taro Farm, Waipi'o (B2).

***Lecane quadridentata*** (Ehrenberg)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running, fresh and slightly brackish waters, occasionally in peat bogs; warm stenothermic.

*Material examined:* **HAWAII:** Vincent's Taro Farm, Waipi'o (B2).

***Lecane signifera*** (Jennings)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Lecane* sp. 1 [undescribed species]****New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i. Periphytic and among submerged vegetation in stagnant fresh waters. Current records indicate a wide ecological range.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAII:** steam vent pool in Kīlauea Caldera (B14).

***Lecane* sp. 2 [undescribed species]****New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Lecane stichaea*** Harring**New state record**

Zoogeography and ecology: Cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

***Lecane subulata*** (Harring & Myers)**New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.

*Material examined:* **O'AHU:** *Sphagnum palustre*, Mt. Ka'ala summit bog (O3); **KAUAI:** bog pool on Mōhihi Wai'ālae Trail (K3); **HAWAII:** bog pool in Pu'u O 'Umi NAR (B8), *Sphagnum palustre*, Pu'u O 'Umi NAR (B9).

***Lepadella acuminata*** (Ehrenberg)**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, inland saline, and brackish waters; also in psammon, springs, peat bogs, leaf litter, edaphon and phytotelmata; eurythermic.

*Material examined:* **KAUAI:** Koai'e Str (K2), Kauaikinana Str (K4), rock pool on Kalalau Trail (K7), mosses on Kalalau Trail (K8); **MAUI:** Ki'owaiokiha (Violet Lake) (Ma3), Wai'ale Res. (Ma10), Wai'anapanapa (Ma13); **HAWAII:** Vincent's Taro Farm, Waipi'o (B2), 'Wailuku Pond' on Red Lepo Trail (B5), bog pool in Pu'u O'Umi NAR (B8), Ahu Noa Marsh (B12).

***Lepadella desmeti*** Segers & Chittapun**New state record**

Zoogeography and ecology: Neotropical and Oriental region. Ecology insufficiently known, seems to prefer peat bogs and marshes.

*Material examined:* **O'AHU:** Fong's Taro Farm, Kahulu'u (O13); **MAUI:** Ki'owaiokiha (Violet Lake) (Ma3); **HAWAII:** Ahu Noa Marsh (B12).

***Lepadella elongata*** Koste**New state record**

Zoogeography and ecology: Circumtropical, recorded from Neotropical, Ethiopian and Oriental region. Among submerged vegetation in stagnant and slowly running fresh water; warm stenothermic.

*Material examined:* **HAWAII:** pond in Lālākea Swamp (B4).

***Lepadella minuta*** (Weber & Montet)**New state record**

Zoogeography and ecology: Discontinuous range including Palearctic, Ethiopian and Neotropical region. Periphytic and among submerged vegetation in stagnant and running fresh waters, occasionally in psammon; eurythermic.

*Material examined:* **KAUAI:** Hanalei River (K13); **HAWAII:** Wailoa Str (B3), Wai a Pele (Green Lake) (B13).

***Lepadella ovalis*** (Müller)**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and running, fresh, brackish, and inland saline waters; less common in peat bogs and inundation areas.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Lepadella patella*** (Müller)**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running, fresh, brackish and inland saline waters; also in peat bogs, phytotelmata and edaphon; eurythermic.

Localities: **O'AHU:** Kahana Iki Str (O10), Waikane Str (O12), Fong's Taro Farm, Kahulu'u (O13); **KAUAI:** Hanakāpi'ai Str (K9), Limahuli Str (K11), Diego's Taro Farm, Hanalei (K12), Hanalei River (K13); **MAUI:** Kahakuloa Str (Ma5); **HAWAII:** Wailoa Str (B3), Vincent's Taro Farm, Waipi'o (B2), 'Wailuku Pond' on Red Lepo Trail (B5).



***Lepadella* cf. *quinquecostata* (Lucks)      New state record**

Zoogeography and ecology (*L. quinquecostata*): Probably cosmopolitan. Among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs and phytotelmata.

*Material examined:* **HAWAI'I:** Wai a Pele (Green Lake) (B13).

***Lepadella* sp. near *acuminata* (Ehrenberg)      New state record**

*Material examined:* **O'AHU:** 'Poamoho Lake' (O5), brook along Poamoho Trail (O6), acidic pool on Ko'olau Summit Trail (O7); **KAUA'I:** bog pool in Kana'ele Swamp (K15); **HAWAI'I:** bog pool in Pu'u O 'Umi NAR (B8).

***Lepadella* sp. near *rottenburgi* (Lucks)      New state record**

*Material examined:* **KAUA'I:** Hanama'ulu Str (K14); **MAUI:** Kahakuloa Str (Ma5).

***Lepadella* sp. 1 [undescribed species]      New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* **HAWAI'I:** bog pool in Pu'u O 'Umi NAR (B8).

***Lepadella* sp. 2      New state record**

*Material examined:* **O'AHU:** Inoa'ole Str (O8).

***Lepadella triba* Myers      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs.

*Material examined:* **KAUA'I:** bog pool in Kana'ele Swamp (K15); **HAWAI'I:** pond in Lālākea Swamp (B4).

***Lepadella triptera* (Ehrenberg)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh, brackish and inland saline waters; occasionally in peat bogs.

*Material examined:* **HAWAI'I:** Vincent's Taro Farm, Waipi'o (B2).

***Limnias melicerta* Weisse      New state record**

Zoogeography and ecology: Cosmopolitan. Sessile on submerged plants in stagnant fresh waters; also in peat bogs and phytotelmata.

*Material examined:* **HAWAI'I:** pond in Lālākea Swamp (B4), Wai a Pele (Green Lake) (B13).

***Lindia pallida* (Harring & Myers)      New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in peat bogs, especially among *Sphagnum*; acidophilic.

*Material examined:* **O'AHU:** *Sphagnum palustre*, Mt. Ka'ala summit bog (O3); **KAUA'I:** bog pool on Mōhihi Wai'alae Trail (K3); **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4); **HAWAI'I:** bog pool in Pu'u O 'Umi NAR (B8), *Sphagnum palustre*, Pu'u O 'Umi NAR (B9), Ahu Noa Marsh (B12).

***Lindia truncata* (Jennings)      New state record**

Zoogeography and ecology: Probably cosmopolitan. In periphyton and among algal

colonies in stagnant and slowly running fresh waters; also reported from peat bogs and saltwater psammon.

*Material examined:* MAUI: Wai'ale Res. (Ma10).

***Microcodides chlaena*** (Gosse)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in stagnant and running fresh waters, in peat bogs and occasionally in hyporheon of streams.

*Material examined:* O'AHU: 'Poamoho Lake' (O5), pond in Kawainui Marsh (O9), Kahana Iki Str (O10); KAUA'I: bog pool in Kana'ele Swamp (K15); HAWAI'I: 'Wailuku Pond' on Red Lepo Trail (B5).

***Monommata astia*** Myers

**New state record**

Zoogeography and ecology: Probably cosmopolitan. In stagnant fresh waters, acidophilic.

*Material examined:* HAWAI'I: bog pool in Pu'u O Umi NAR (B8).

***Monommata dentata*** Wulfert

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in acidic and alkaline, stagnant and slowly running freshwaters; also in peat bogs and inland saline waters; eurythermic.

*Material examined:* O'AHU: pond in Kawainui Marsh (O9); KAUA'I: Hanama'ulu Str (K14), bog pool in Kana'ele Swamp (K15).

***Monommata maculata*** (Harring & Myers)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Among submerged vegetation in stagnant and running fresh waters; eurythermic.

*Material examined:* O'AHU: Brook along Poamoho Trail (O6), acidic pool on Ko'olau Summit Trail (O7); MAUI: 'East Bog' Kaho'olewa Ridge (Ma1), Ki'owai O Kiha (Violet Lake) (Ma3), Wai'ele'ele (Ma12), Wai'anapanapa (Ma13); HAWAI'I: bog pool in Pu'u O Umi NAR (B8).

***Monommata* sp. 1** [undescribed species]

**New state record**

Zoogeography and ecology: Possibly endemic to Hawai'i.

*Material examined:* KAUA'I: Hanalei River (K13), Hanama'ulu Str (K14); HAWAI'I: Wailoa Str (B3), 'Wailuku Pond' on Red Lepo Trail (B5).

***Mytilina ventralis*** (Ehrenberg)

**New state record**

Zoogeography and ecology: Cosmopolitan. Common among submerged vegetation in stagnant and slowly running fresh waters, occasionally in peat bogs and brackish pools.

*Material examined:* O'AHU: Fong's Taro Farm, Kahulu'u (O13); KAUA'I: Diego's Taro Farm, Hanalei (K12), bog pool in Kana'ele Swamp (K15) (f. *macracantha*); HAWAI'I: Vincent's Taro Farm, Waipi'o (B2) (f. *macracantha*).

***Notommata allantois*** Wulfert

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Common in peat bogs; also in marshes and vegetated stagnant water bodies.

*Material examined:* HAWAI'I: Vincent's Taro Farm, Waipi'o (B2).

***Notommata contorta*** (Stokes)

**New state record**

Zoogeography and ecology: Discontinuous range including Palearctic, Nearctic and Australian region. Periphytic and among submerged vegetation in stagnant and slowly

running fresh and inland saline waters; occasionally in peat bogs.

*Material examined:* **KAUA'I:** Hanalei River (K13); **HAWAI'I:** 'Wailuku Pond' on Red Lepo Trail (B5).

***Notommata cyrtopus*** (Gosse)

**New state record**

Zoogeography and ecology: Cosmopolitan. Eurytopic in stagnant and running fresh waters; also in peat bogs and inland saline waters; eurythermic.

*Material examined:* **KAUA'I:** bog pool in Kana'ele Swamp (K15); **MAUI:** Kahakuloa Str (Ma5); **HAWAI'I:** Wailoa Str (B1).

***Notommata pseudocerberus*** de Beauchamp

**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; occasionally in peat bogs.

*Material examined:* **HAWAI'I:** Wailoa Str (B3).

***Notommata thopica*** Harring & Myers

**New state record**

Zoogeography and ecology: Previously only known from the northeastern U.S., not seen since discovery. Ecology insufficiently known.

*Material examined:* **HAWAI'I:** 'Wailuku Pond' on Red Lepo Trail (B5).

***Notommata tripus*** Ehrenberg

**New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and running fresh waters, also in peat bogs.

*Material examined:* **O'AHU:** Kahana Iki Str (O10).

***Pedipartia gracilis*** (Myers)

**New state record**

Zoogeography and ecology: Previously only known from the northeastern U.S., not seen since discovery. Among *Sphagnum* and in hygropsammon.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

***Platylas quadricornis brevispinus*** (Daday)

**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Benthic and semiplanktonic in stagnant and slowly running fresh waters.

*Material examined:* **KAUA'I:** Hanama'ulu Str (K14), bog pool in Kana'ele Swamp (K15).

***Polyarthra* cf. *vulgaris*** Carlin

**New state record**

Zoogeography and ecology (*P. vulgaris*): Cosmopolitan. Planktonic in freshwater lakes and ponds, also in potamoplankton and inland saline (soda) lakes.

*Material examined:* **MAUI:** Wai'ale Res. (Ma10); **HAWAI'I:** pond at Pu'u Iki (B11).

***Polyarthra* sp.**

**New state record**

*Material examined:* **MAUI:** Wai'ale Res. (Ma10).

***Proales fallaciosa*** Wulfert

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Common on mud and among decomposing debris in limnosaprobic environments; also in peat bogs and inland saline waters; eurythermic.

*Material examined:* **O'AHU:** Waiāhole Str (O11); **MAUI:** Wai'anapanapa (Ma13); **HAWAI'I:** Ahu Noa Marsh (B12).

***Proales minima*** (Montet)

**New state record**

Zoogeography and ecology: Holarctic. Among submerged mosses, in limno- and potamopsammon; also in peat bogs.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4), Kahakuloa Str (Ma5), Wai'ele'ele (Ma12).

***Proales similis*** de Beauchamp

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Benthic in inland saline, marine and brackish waters.

*Material examined:* **MOLOKA'I:** Kauhakō Lake (Mo7).

***Proalides cf. wulferti*** Sudzuki

**New state record**

Zoogeography and ecology: Previously known from the Palaearctic region only, but may have been confused with *P. tentaculatus* de Beauchamp. Planktonic in freshwater ponds and lakes, also in inland saline waters.

*Material examined:* **MAUI:** Coot Pond (Ma7), Kanahā Pond (Ma9).

***Proalinopsis caudatus*** (Collins)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. In peat bogs and marshes; acidophilic.

*Material examined:* **HAWAI'I:** 'Wailuku Pond' on Red Lepo Trail (B5), bog pool in Pu'u O 'Umi NAR (B8).

***Ptygura velata*** (Gosse)

**New state record**

Zoogeography and ecology: Probably cosmopolitan. Sessile on submerged plants in stagnant and slowly running fresh waters, also in peat bogs.

*Material examined:* **O'AHU:** brook along Poamoho Trail (O6).

***Ptygura* sp.**

**New state record**

*Material examined:* **HAWAI'I:** Wailoa Str (B1).

***Sphyrrias lofuana*** (Rousselet)

**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Among submerged vegetation in ponds and littoral of lakes; warm stenothermic, rare.

Localities: **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Squatinella lamellaris lamellaris*** (Müller)

**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Ethiopian and Neotropical region. Periphytic among submerged plants in fresh waters, also in bogs.

*Material examined:* **O'AHU:** Wahiawā Res. (Lake Wilson) (O18).

***Squatinella lamellaris mutica*** (Ehrenberg)

**New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and

Ethiopian region. Periphytic among submerged plants in fresh waters, also in peat bogs.

*Material examined:* **KAUAI:** Diego's Taro Farm, Hanalei (K12); **HAWAII:** Wailoa Str (B3).

***Squatinnella microdactyla*** (Murray) **New state record**

Zoogeography and ecology: Holarctic. In peat bogs among *Sphagnum*, rare.

*Material examined:* **MAUI:** *Sphagnum wheeleri* on Pu'u Kukui boardwalk (Ma4).

***Synchaeta oblonga*** Ehrenberg **New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in freshwater lakes and ponds, also in bogs, brackish and inland saline waters, potamoplankton.

*Material examined:* **MAUI:** Wai'ale Res. (Ma10).

***Taphrocampa clavigera*** (Stokes) **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Nearctic and Ethiopian region. In peat bogs, among *Sphagnum*, rare.

*Material examined:* **HAWAII:** bog pool in Pu'u O 'Umi NAR (B8).

***Testudinella patina*** (Hermann) **New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic in stagnant and running, fresh, brackish, inland saline and sea water, also in peat bogs and inundation areas; eurythermic.

*Material examined:* **O'AHU:** Inoa'ole Str (O8), pond in Kawainui Marsh (O9); **HAWAII:** Wailoa Str (B3), pond in Lālākea Swamp (B4), 'Wailuku Pond' on Red Lepo Trail (B5), pond at Pu'u Iki (B11).

***Trichocerca (Diurella) intermedia*** (Stenroos) **New state record**

Zoogeography and ecology: Probably cosmopolitan. Periphytic and among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs and psammon; eurythermic.

*Material examined:* **KAUAI:** Kaua'ikinana Str (K4); **MAUI:** Kahakuloa Str (Ma5), Wai'anapanapa (Ma13); **HAWAII:** Wailoa Str (B3), pond in Lālākea Swamp (B4), Ahu Noa Marsh (B12).

***Trichocerca (Diurella) montana*** Hauer **New state record**

Zoogeography and ecology: Discontinuous range including Palaearctic, Australian and Neotropical region. In peat bogs and among littoral vegetation, especially mosses, in stagnant fresh waters.

*Material examined:* **O'AHU:** 'Poamoho Lake' (O5); **MAUI:** Wai'ale Res. (Ma10); **HAWAII:** pond in Lālākea Swamp (B4).

***Trichocerca (Diurella) relict*** Donner **New state record**

Zoogeography and ecology: Probably cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters; also in peat bogs and marshes; eurythermic.

*Material examined:* **O'AHU:** Fong's Taro Farm, Kahulu'u (O13); **KAUAI:** Diego's Taro Farm, Hanalei (K12), 15; **HAWAII:** Vincent's Taro Farm, Waipi'o (B2), pond in Lālākea Swamp (B4), Ahu Noa Marsh (B12).

***Trichocerca (Diurella) similis* (Wierzejski)      New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in freshwater lakes and ponds, also in potamoplankton and in humic acidic bog ponds.

*Material examined:* MAUI: Ki'owai O Kiha (Violet Lake) (Ma3), Wai'e'ele (Ma12).

***Trichocerca (Diurella) tenuior* (Gosse)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, occasionally planktonic, among submerged vegetation in stagnant and running fresh waters; also in peat bogs, inundation areas and psammon; eurythermic.

*Material examined:* MAUI: Kahakuloa Str (Ma5), Wai'ale Res. (Ma10).

***Trichocerca (Diurella) tigris* (Müller)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters; also common in peat bogs.

*Material examined:* HAWAII: Wailoa Str (B3).

***Trichocerca (Trichocerca) pusilla* (Lauterborn)      New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in meso- and eutrophic lakes and ponds, in potamoplankton; occasionally in bog ponds and brackish water.

*Material examined:* MOLOKA'I: Meyer Lake (Mo5), Kualapu'u Res. (Mo6); MAUI: Wai'ale Res. (Ma10); HAWAII: pond in Lālākea Swamp (B4), pond at Pu'u Iki (B11), Wai a Pele (Green Lake) (B13).

***Trichocerca (Trichocerca) rattus* (Müller)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; occasionally in bog ponds, inland saline, brackish and coastal sea water.

*Material examined:* KAUAI: Diego's Taro Farm, Hanalei (K12).

***Trichocerca (Trichocerca) scipio* (Gosse)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic among submerged vegetation in stagnant and slowly running fresh waters; also in peat bogs.

*Material examined:* HAWAII: bog pool in Pu'u O 'Umi NAR (B8).

***Trichocerca (Trichocerca) stylata* (Gosse)      New state record**

Zoogeography and ecology: Cosmopolitan. Planktonic in lakes and ponds.

*Material examined:* MAUI: Wai'ale Res. (Ma10).

***Trichotria tetractis* (Ehrenberg)      New state record**

Zoogeography and ecology: Cosmopolitan. Periphytic and epibenthic, among submerged vegetation in stagnant and running fresh waters, also in peat bogs; eurythermic.

*Material examined:* KAUAI: Limahuli Str (K11), Hanalei River (K13), Hanama'ulu Str (K14); HAWAII: Vincent's Taro Farm, Waipi'o (B2), pond in Lālākea Swamp (B4).

***Tripleuchlanis plicata* (Levander)**

Previously reported from brackish ditches and pools on O'ahu (Weber, 1906), but not found during this survey. Zoogeography and ecology: Cosmopolitan. In stagnant and slowly running, fresh, brackish and sea water.

***Wierzejskiella vagneri* Koniar****New state record**

Zoogeography and ecology: Palearctic. Among *Sphagnum* and in peat bogs; also in periphyton of freshwater streams and in edaphon.

*Material examined:* MAUI: *Sphagnum wheeleri* on Pu‘u Kukui boardwalk (Ma4); HAWAII: Wailoa Str (B1), Waiākanonula Marsh (B10).

***Wulfertia* cf. *kindensis* Koste & Tobias****New state record**

Zoogeography and ecology (*W. kindensis*): Previously only known from the Oriental Region (Myanmar), not seen since discovery. Ecology insufficiently known.

*Material examined:* HAWAII: Wailoa Str (B1).

***Wulfertia ornata* Donner****New state record**

Zoogeography and ecology: Discontinuous range including Palearctic, Nearctic and Ethiopian region. Periphytic among submerged vegetation and benthic on mud and algal mats in stagnant fresh waters.

*Material examined:* HAWAII: Lake Wai‘au (B7).

**Zoogeographical remarks**

This first inventory obviously supports the dominance of Rotifera currently believed to be true cosmopolites (66 %). This is not surprising, since effective dispersal mechanisms are a prerequisite to reach localities as remote as this Pacific archipelago. However, the discovery of at least 11 undescribed species (8%) to some degree testifies for a distinct rotifer fauna on Hawai‘i. Considering the non-Hawaiian distribution of all other taxa, it appears that most have highly disjunct distributions known previously from only two or three major zoogeographical regions (*Aspelta curvidactyla*, *Colurella denticauda*, *Dorria dalecarlica*, *Lecane paxiana*, *Lepadella desmeti*, *Lepadella elongata*, *Lepadella minuta*, *Notommata contorta*, *Platylas quadricornis brevispinus*, *Sphyrias lofuana*, *Squatinella lamellaris*, *Taphrocampa clavigera*, *Trichocerca montana*, *Trichocerca relicta*, *Wulfertia ornata*). Several species were hitherto believed to have a more restricted range and were so far only known from a limited number of localities in the Holarctic (*Aspelta angusta*, *Bryceella stylata*, *Cephalodella delicata*, *C. incila*, *C. stenroosi*, *Proales minima*, *Squatinella microdactyla*), the Palearctic (*Cephalodella bryophila*, *Collotheca ferox*, *Encentrum sores*, *Wierzejskiella vagneri*), or the Nearctic region (*Hexarthra polychaeta*, *Notommata thopica*, *Pedipartia gracilis*). The occurrence of such rare species in Hawai‘i (and in their proper habitat) highlights both their ability to passively reach even the remotest places on earth and the key criterion of proper habitat conditions for any establishment of colonizing species. Interestingly, no species restricted to the Australian region (to which Hawai‘i is frequently assigned within the Polynesian subregion) has yet been recorded.

To what extent the current rotifer fauna reflects the natural history of colonization is difficult to evaluate since it is likely that nonindigenous introductions by human agency were superimposed on a native fauna. Aquatic micrometazoans such as Rotifera may have been easily introduced along with intentional releases of aquatic organisms, e.g. exotic fish, clams, or ornamental plants. Moreover, tourists are probably powerful vectors to disseminate microscopic rotifer resting stages in their luggage or on their soles. Nevertheless, considering the high ability of passive dispersal in most Rotifera, local ecological circumstances are probably even more significant in determining the final distribution of a species. Current patterns found in the islands were thus probably affected by both human-

induced introductions on the one hand and extinctions on the other hand, since Hawaiian freshwater environments rapidly disappeared or were altered irreversibly in the course of human colonization.

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### Appendix

Collecting localities listed below contain geographical coordinates (Old Hawaiian Datum), altitude (m), limnological classification (in italics) and habitat parameters [T (°C), pH, Electric Conductivity EC ( $\mu\text{S cm}^{-1}$  [25 °C]), depth (m; Mo5, Mo7, Ma12, B7, and B13 after Maciolek, 1982)] and collecting dates. Their geographic position is mapped for



all islands in Figs. 1–5. Species identifications are so far available only from localities marked with an asterisk (\*). Voucher specimens and permanent slide preparations are deposited at the Philadelphia Academy of Natural Sciences and at the University of Salzburg.

#### O'AHU:

- O1** – Irrigation channel in Sumida Water Cress Farm at Kalauao Springs, Waimalu (21° 23' 11"N, 157° 56' 49" W, 5 m): Spring-fed *water cress field*, artificially fertilized; pH 7.6, EC 990, d 0.2 [01 Feb 01].
- O2** – Open pond in Waipahu Marsh, Pearl Harbor, Waipahu (21° 22' 52"N, 158° 00' 34" W, 1 m): *mixohaline coastal marsh*; T 25.0, pH 7.8, EC >10000 (sal. 14 ppt), d 0.3 [01 Feb 01].
- O3\*** – Mt. Ka'ala summit bog, among *Sphagnum palustre*, Wai'anae Range (21° 30' 31"N, 158° 09' 02" W, 1180 m): *Sphagnum hummock in montane bog*; T 14.5–16.0, pH 4.0, EC 90 (water squeezed from mosses), [02 Feb 01].
- O4\*** – Bog pond, Mt. Ka'ala summit region, Wai'anae Range (21° 30' 42"N, 158° 08' 57" W, 1180 m): *montane bog pond*; T 17.5–22.0, pH 5.3, EC 40, d ~0.5 [02 Feb 01].
- O5\*** – 'Poamoho Lake', Ewa Forest Reserve, Ko'olau Range (21° 31' 59"N, 157° 55' 33" W, 670 m): *Dystrophic upland lake*, densely covered with floating vegetation; T 20.8, pH 6.4, EC 50, d ~3 (?) [05 Feb 01].
- O6\*** – Brook along Poamoho Trail (upper end), Ko'olau Range (21° 32' 13"N, 157° 55' 31" W, 730 m): *Intermittent upland brook*; T 16.1, pH 5.1, EC 50, d 0.2 [06 Feb 01].
- O7\*** – Acidic pool on Summit Trail, Ko'olau Range (21° 33' 35"N, 157° 55' 37" W, 840 m): *Dystrophic upland pool*; T 15.1, pH 4.4, EC 70, d 0.2 [08 Feb 01].
- O8\*** – Inoa'ole Str, east of Waimānalo, among water ferns (*Salvinia molesta*, *Azolla* sp.) (21° 20' 58"N, 157° 42' 51" W, 5 m): *Polluted drainage ditch*; d ~0.5 [11 Feb 01].
- O9\*** – Open pond in Kawaiū Marsh, among *Eichhornia crassipes*, Kailua (21° 23' 40"N, 157° 45' 39" W, 4 m): *Coastal freshwater marsh*; T 22.4, pH 6.9, EC 260 [12 Feb 01].
- O10\*** – Kahana Iki Str, among *Elodea canadensis*, Kawaiū Marsh, Kailua (21° 23' 12"N, 157° 45' 54" W, 4 m): *Perennial lowland stream*; T 22.8, pH 7.6, EC 180, d ~0.5 [12 Feb 01].
- O11\*** – Waiāhole Str, lower reach (21° 29' 10"N, 157° 50' 50" W, 3 m): *Perennial lowland stream*; T 20.2, pH 7.9, EC 120, d ~0.4 [15 Feb 01].
- O12\*** – Waikane Str, lower reach (21° 29' 45"N, 157° 51' 13" W, 4 m): *Perennial lowland stream*; T 20.8, pH 7.8, EC 180, d ~0.4 [15 Feb 01].
- O13\*** – Fong's Taro Farm, Kahalu'u (21° 27' 26"N, 157° 50' 53" W, 12 m): *Taro cultivation pond (lo'i kalo)*; T 22.7, pH 6.6, EC 310, d 0.1 [15 Feb 01].
- O14** – Lualualei Res., Wai'anae (21° 26' 28"N, 158° 09' 54" W, 10 m): *Ephemeral impoundment*, currently dry [16 Feb 01].
- O15** – 'Ihi'ihilauakea Preserve, Koko Head (21° 16' 03"N, 157° 41' 54" W, 60 m): *Ephemeral coastal wetland*, currently dry [18 Feb 01].
- O16** – Bromeliaceae, Royal Hawaiian Shopping Ctr., Waikīkī (21° 16' 52"N, 157° 49' 49" W, 2 m): *Phytotelmata*; T 20.6–21.9, pH 7.0–7.4, EC 620, d 0.15 [14 Mar 01].
- O17** – Bromeliaceae, Foster's Botanical Garden, Honolulu (21° 19' 11"N, 157° 51' 37" W, 10 m): *Phytotelmata*; T 21.4, pH 6.8–7.2, EC 800–1080, d 0.3 [17 Mar 01].
- O18\*** – Wahiawā Res. (Lake Wilson), Wahiawā (21° 29' 48"N, 158° 03' 03" W, 252 m): *Manmade reservoir, perennial*; d 25 [01 VII 97].
- O19** – Kane'ana Cave, Ka'ena State Park (21° 31' 22"N, 158° 13' 50" W, 12 m): *Intermittent cave puddle*; d <0.02 [02 VII 97].

#### KAUAI:

- K1** – 'Black water Stream' (upper reach of Koai'e tributary) on Mōhihi–Wai'ālae Trail, Alaka'i Swamp (22° 05' 39"N, 159° 33' 15" W, 1300 m): *Dystrophic perennial montane stream*; T 13.6, pH 4.7, EC 30, d 0.4 [22 Feb 01].

- K2\*** – Koai'e Str ('black water'), near Koai'e Cabin, Mōhihi–Wai'ālae Trail, Alaka'i Swamp (22° 06' 58"N, 159° 33' 54" W, 1140 m): *Dystrophic perennial montane stream*; T 13.7, pH 5.8, EC 20, d 0.5 [23 Feb 01].
- K3\*** – Bog pool on Mōhihi–Wai'ālae Trail, Alaka'i Swamp (22° 07'01"N, 159° 34' 11" W, 1250 m): *Montane bog pool*; T 14.3, pH 4.1, EC 70, d 0.2 [23 Feb 01].
- K4\*** – Kaa'ūkinana Str, midreach, Koke'e State Park (22° 08' 09"N, 159° 38' 02" W, 1010 m): *Perennial montane stream*; T 14.4, pH 6.8, EC 30, d 0.3 [24 Feb 01].
- K5\*** – Treehole (*kukui*, *Aleurites moluccana*) with leaf litter, Kalalau Trail, Nā Pali Coast State Park (22° 11' 03"N, 159° 38' 33" W, 19 m): *Phytotelmata*; T 19.9, pH 7.8, EC 600, d 0.05 [28 Feb 01]. **K6** – Kalalau Str in upper Kalalau Valley, Nā Pali Coast State Park (22° 10' 06"N, 159° 38' 15" W, 275 m): *Perennial upland stream*; T 18.8, pH 8.0, EC 100, d 0.4 [01 Mar 01].
- K7\*** – Rock pool on Kalalau Trail, Hono O Nā Pali Natural Area Reserve (NAR), Nā Pali Coast (22° 12' 27"N, 159° 36' 24" W, 180 m): *Stream pool*; T 19.6, pH 8.3, EC 170, d 0.3 [02 Mar 01].
- K8\*** – Mosses on dripping rocks, Kalalau Trail, Hono O Nā Pali NAR, Nā Pali Coast (22° 12' 27"N, 159° 36' 24" W, 180 m): *Wet mosses on dripping rocks*; T 19.9, pH 8.6, EC 180 (water squeezed from mosses) [02 Mar 01].
- K9\*** – Hanakāpi'ai Str, Kalalau Trail, Nā Pali Coast (22° 12' 41"N, 159° 36' 00" W, 5 m): *Perennial lowland stream*; T 20.8, pH 8.1, EC 90, d 0.3 [02 Mar 01].
- K9A** – Pool in Hanakāpi'ai Str, Kalalau Trail, Nā Pali Coast (22° 12' 42"N, 159° 36' 00" W, 5 m): *Stream pool*; d 0.3 [13 VII 97].
- K10** – Taro patch in Limahuli Gardens, National Tropical Botanical Garden (NTBG) (22° 13' 19"N, 159° 34' 46" W, 42 m): *Taro cultivation pond (lo'i kalo)*; T 19.3, pH 8.7, EC 80, d 0.1 [21 Mar 01].
- K11\*** – Limahuli Str, lower reach, NTBG (22° 13' 17"N, 159° 34' 48" W, 45 m): *Perennial lowland stream*; T 18.1, pH 8.2, EC 70, d 0.3 [21 Mar 01].
- K12\*** – Diego's Taro Farm, Hanalei Valley (22° 12' 06"N, 159° 28' 18" W, 6 m): *Taro cultivation pond (lo'i kalo)*; T 23.8, pH 7.5, EC 140, d 0.1 [22 Mar 01].
- K13\*** – Hanalei River, lower reach (22° 11' 01"N, 159° 28' 07" W, 22 m): *Perennial lowland river*; T 19.7, pH 8.4, EC 90, d 0.3 [22 Mar 01].
- K14\*** – Hanama'ulu Str, among *Eichhornia crassipes*, west of Hanama'ulu (21° 59' 48"N, 159° 20' 52" W, 8 m): *Perennial lowland stream*; T 23.7, pH 7.3, EC 190, d 1 [25 Mar 01].
- K15\*** – Bog pool in Kana'ele Swamp, Wahiawa Valley (21° 58' 11"N, 159° 30' 46" W, 620 m): *Upland bog pool*; T 21.1, pH 5.3, EC 40, d 0.5 [26 Mar 01].
- K16** – Alexander Res., Wahiawa Valley (21° 57' 33"N, 159° 31' 40" W, 475 m): *manmade reservoir, perennial*; T 24.8, pH 7.2, EC 50, d 19 [26 Mar 01].
- K17** – Waita Res., Kōloa (21° 55' 15"N, 159° 27' 37" W, 72 m): *manmade reservoir, perennial*; T 28.4, pH 8.0, EC 130, d 7 [26 Mar 01].
- K18** – Lua Res., Waimea Canyon State Park (22° 05' 30"N, 159° 40' 51" W, 980 m): *manmade reservoir, perennial* [12 VII 97].
- K19** – Waikanaloa Wet Cave, Ha'ena State Park (22° 13' 25"N, 159° 35' 00" W, 6 m): *Underground cavern pool*; T 20.6, pH 7.6, EC 450, [14 VII 97, 02 Mar 01].
- K20** – Waikapala'e Wet Cave, Ha'ena State Park (22° 13' 24"N, 159° 34' 56" W, 45 m): *Underground cavern pool*; T 20.5, pH 8.0, EC 150, [14 VII 97, 02 Mar 01].

#### MOLOKA'I:

- Mo1** – Brook south of Kolekole Cabin, Kamakou Preserve (21° 06' 38"N, 156° 53' 59" W, 1190 m): *Perennial montane brook*; T 13.9, pH 5.1, EC 50, d 0.1 [05 Mar 01].
- Mo2** – Pool in Kawelo Str, upper reach west fork, Kamakou Preserve (21° 06' 53"N, 156° 54' 37" W, 1110 m): *Dystrophic montane stream pool*; T 13.1, pH 5.3, EC 40, d 1 [06 Mar 01].
- Mo3** – Wet mosses along boardwalk trail, Pēpē'ōpae Bog, Kamakou Preserve (21° 07' 20"N, 156° 54' 14" W, 1265 m): *Wet mosses in open bog*; T 15.9–23.3, pH 4.0, EC 80 [06 Mar 01].
- Mo4** – Pool on boardwalk, Pēpē'ōpae Bog, Kamakou Preserve (21° 07' 17"N, 156° 54' 25" W, 1230 m): *Montane pool*; T 14.3, pH 6.0, EC 30, d 0.15 [06 Mar 01].

- Mo5** – Meyer Lake (21° 10' 05"N, 156° 59' 06" W, 611 m): *Eutrophic impoundment in natural basin*; T 20.0, pH 5.8, EC 70, d 1.5 [07 Mar 01].
- Mo6** – Kualapu'u Res., Kualapu'u (21° 09' 11"N, 157° 03' 01" W, 246 m): *manmade impoundment, perennial*; T 22.4, pH 7.9, EC 120, d 15 [07 Mar 01].
- Mo7** – Kauhakō Lake, Kalaupapa National Historical Park (21° 11' 27"N, 156° 58' 08" W, 0 m): *Meromictic, mixohaline crater lake*; T 24.0, pH 8.2, EC >10000, d 248 [08 Mar 01].
- Mo8** – Waikolu Str, lower reach, Kalaupapa National Historical Park (21° 10' 18"N, 156° 55' 59" W, 10 m): *Perennial lowland stream*; T 19.0, pH 8.2, EC 110, d 0.4 [10 Mar 01].
- Mo9** – Hālawa Str, lower reach (21° 09' 40"N, 156° 44' 38" W, 5 m): *Perennial lowland stream*; T 21.8, pH 7.5, EC 250, d 1.5 [12 Mar 01].

#### MAUI:

- Ma1\*** – 'East Bog', Kaho'olewa Ridge, Mauna Kahalawai (20° 53' 52"N, 156° 34' 44" W, 1695 m): *Montane bog pool*; T 12.2, pH 5.3, EC 10, d 0.15 [30 Mar 01].
- Ma2\*** – Shallow pool in former ditch on Pu'u Kukui boardwalk, Mauna Kahalawai (20° 53' 46"N, 156° 35' 22" W, 1705 m): *Abandoned drainage ditch*; T 15.5, pH 4.8, EC 45, d 0.05 [05 Apr 01].
- Ma3\*** – Ki'owai O Kiha (Violet Lake), Mauna Kahalawai (20° 54' 27"N, 156° 35' 41" W, 1502 m): *Dystrophic montane bog pond*; T 15.2–19.2, pH 4.8, EC 20, d ~2 [05 Apr 01].
- Ma4\*** – *Sphagnum wheeleri* on Pu'u Kukui boardwalk, Mauna Kahalawai (20° 54' 51"N, 156° 35' 41" W, 1365 m): *Sphagnum hummock in montane bog*; T 18.2, pH 4.0, EC 160 (water squeezed from mosses) [05 Apr 01].
- Ma5\*** – Kahakuloa Str, lower reach (20° 59' 48"N, 156° 33' 03" W, 15 m): *Perennial lowland stream*; T 21.6, pH 7.8, EC 70, d 0.3 [04 Apr 01].
- Ma6\*** – Makaloa Pond, Kanahā Wildlife Sanctuary (20° 53' 52"N, 156° 27' 22" W, 1 m): *Mixohaline 'black water' pool, ephemeral (?)*; T 35.3, pH 9.2, EC >10000, d 0.1 [06 Apr 01].
- Ma7\*** – Coot Pond, Kanahā Wildlife Sanctuary (20° 53' 47"N, 156° 27' 21" W, 1 m): *Mixohaline pond, ephemeral (?)*; T 28.0, pH 9.3, EC >10000, d 0.75 [06 Apr 01].
- Ma8\*** – Keālia Pond, Keālia National Wildlife Refuge (20° 47' 52"N, 156° 28' 33" W, 0 m): *Mixohaline coastal pond*; T 28.4, pH 9.2, EC >10000, d 0.75 [06 Apr 01].
- Ma9\*** – Kanahā Pond, Kanahā Wildlife Sanctuary (20° 53' 32"N, 156° 27' 28" W, 0 m): *Mixohaline coastal pond*; T 21.7, pH 8.8, EC >10000, d 0.75 [11 Apr 01].
- Ma10\*** – Wai'ale Res., Wailuku (20° 52' 53"N, 156° 29' 54" W, 55 m): *manmade reservoir, perennial*; T 22.4, pH 7.9, EC 70, d 5 [11 Apr 01].
- Ma11\*** – 'Āao Str, midreach (20° 53' 06"N, 156° 32' 34" W, 250 m): *perennial upland stream*; T 18.5, pH 8.2, EC 70, d 0.2 [15 Apr 01].
- Ma12\*** – Wai'ele'ele, Haleakalā National Park (20° 44' 21"N, 156° 07' 08" W, 2020 m): *dystrophic montane lake*; T 12.1, pH 6.9, EC 10, d 6.4 [16 Apr 01].
- Ma13\*** – Wai'anapanapa, Haleakalā National Park (20° 44' 16"N, 156° 07' 22" W, 2065 m): *montane pond*; T 13.8, pH 7.0, EC 10, d 2 [16 Apr 01].

#### HAWAI'I ISLAND:

- B1\*** – Wailoa Stream, upper Waipi'o Valley (20° 06' 14"N, 155° 36' 34" W, 11 m): *perennial lowland river*; T 20.7, pH 8.2, EC 90, d 0.4 [19 Apr 01].
- B2\*** – Vincent's Taro Farm, Waipi'o Valley (20° 06' 15"N, 155° 36' 29" W, 10 m): *taro cultivation pond (lo'i kalo)*; T 22.6, pH 7.2, EC 80, d 0.1 [19 Apr 01].
- B3\*** – Wailoa Stream, *Eichhornia crassipes*, lower Waipi'o Valley (20° 07' 06"N, 155° 35' 44" W, 2 m): *Perennial lowland river*; T 21.0, pH 8.0, EC 90, d ~1 [21 Apr 01].
- B4\*** – Pond in Lālākea Swamp, lower Waipi'o Valley (20° 07' 27"N, 155° 36' 06" W, 2 m): *coastal freshwater pond*; T 23.6, pH 8.0, EC 170, d ~2 [21 Apr 01].
- B5\*** – 'Wailuku Pond' on Red Lepo Trail, SW slope of Mauna Kea, Hilo Forest Reserve (19° 42' 31"N, 155° 16' 23" W, 1085 m): *Montane marsh*; T 16.0–21.0, pH 6.5, EC 10, d 0.2 [23 Apr 01].

- B6\*** – *Sphagnum* sp. hummock at ‘Wailuku Pond’ on Red Lepo Trail, Hilo Forest Reserve (19° 42’ 32”N, 155° 16’ 21” W, 1085 m): *Sphagnum hummock in montane marsh*; T 19.5, pH 4.5, EC 40 (water squeezed from mosses) [23 Apr 01].
- B7\*** – Lake Waiau, Mauna Kea Ice Age NAR, summit region of Mauna Kea (19° 48’ 54”N, 155° 28’ 48” W, 3969 m): *Tropical alpine lake*; T 13.0, pH 10.2, EC 160, d 3 [25 Apr 01].
- B8\*** – Bog pool in Pu‘u O ‘Umi NAR, Kohala Mts. (20° 04’ 44”N, 155° 43’ 29” W, 1545 m): *Montane bog pool*; T 15.0, pH 5.7, EC 20, d 0.2 [26 Apr 01].
- B9\*** – *Sphagnum palustre*, Pu‘u O ‘Umi NAR, Kohala Mts. (20° 04’ 43”N, 155° 43’ 29” W, 1545 m): *Sphagnum hummock in montane bog*; T 18.0, pH 4.6, EC 70 (water squeezed from mosses) [26 Apr 01].
- B10\*** – Waiākanonula Marsh, Kohala Mts. (20° 07’ 44”N, 155° 46’ 46” W, 1140 m): *Montane marsh*; T 19.9, pH 4.9, EC 60 [27 Apr 01].
- B11\*** – Pond at Pu‘u Iki, Kohala Mts. (20° 07’ 47”N, 155° 45’ 59” W, 1125 m): *Montane pond*; T 20.7, pH 7.1, EC 40, d >2 m [27 Apr 01].
- B12\*** – Ahu Noa Marsh, Kohala Mts. (20° 07’ 57”N, 155° 46’ 29” W, 1175 m): *Montane marsh*; T 20.9, pH 6.2, EC 30, d 0.2 [27 Apr 01].
- B13\*** – Wai a Pele (Green Lake), Kapoho Crater (19° 30’ 21”N, 154° 50’ 30” W, 1 m): *Freshwater crater lake*; T 26.8, pH 8.3, EC 410, d 6.4 [01 May 01].
- B14\*** – Steam vent pool in Kilauea Caldera, Hawaii Volcanoes National Park (19° 25’ 13”N, 155° 17’ 11” W, 1080 m): *Thermal pool*; T 39.0, pH 4.7, EC 10, d 0.05 [01 May 01].
- B15** – ‘Ice Pond’ at Punalu‘u, Ka‘u District (19° 08’ 23”N, 155° 30’ 24” W, 0 m): *Coastal freshwater pond*; T 24.0, pH 8.0, EC 990, d 1 [04 May 01].
- B16** – Luawai Res., SW slope of Hualalai (19° 38’ 08”N, 155° 55’ 47” W, 775 m): *manmade reservoir, perennial (?)*; T 23.3, pH 8.9, EC 80, d 1 [05 May 01].
- B17** – Pukihāe Str, lower reach, Hilo (19° 44’ 06”N, 155° 05’ 46” W, 12 m): *Perennial lowland stream*; T 22.0, pH 8.1, EC 80, d 0.2 [05 May 01].
- B18** – ‘Waikoloa Pond’, SW slope of Mauna Kea, Pu‘u Ō‘ō Ranch (19° 42’ 12”N, 155° 23’ 34” W, 1740 m): *Pond in montane pasture land* [08 Jul 97].
- B19** – ‘Waikoloa Puddle’, SW slope of Mauna Kea, Pu‘u Ō‘ō Ranch (19° 42’ N, 155° 24’ W, 1760 m): *Road puddle in montane pasture land* [08 Jul 97].

## New helminth records for the orange-spotted day gecko, *Phelsuma guimbeaui* and the gold dust day gecko, *Phelsuma laticauda* (Gekkonidae) from Hawai‘i

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The orange-spotted day gecko, *Phelsuma guimbeaui* Mertens, 1963 is native to the island of Mauritius, in the Indian Ocean (Henkel & Schmidt, 2000). It is now well established in parts of O‘ahu where it was first observed in the mid-1980s and is thought to have become established from escaped pets (McKeown, 1996). The gold dust day gecko, *Phelsuma laticauda* (Boettger) is native to the north of Madagascar, Nosy Bé and the Comoro Islands (Henkel & Schmidt, 2000). It is widespread in localized areas of Hawai‘i, Maui and O‘ahu and was originally released near the University of Hawaii on O‘ahu in 1974 (McKeown, 1996). New host records for helminths of *P. guimbeaui* and *P. laticauda* from Hawai‘i and O‘ahu are given in this note.