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NEW RECORDS AND UPDATED DISTRIBUTIONAL DATA FOR  
MARINE MICROMOLLUSKS (MOLLUSCA: GASTROPODA) FROM  
THE MESOPHOTIC DEPTH ZONE OF THE HAWAIIAN ISLANDS

*DAN A. POLHEMUS*



BISHOP MUSEUM PRESS  
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Cover illustration: *Eucyclotoma albomacula* Kay, 1979 from Kure Atoll. See page 12. Photo: Dan A. Polhemus.

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### BERNICE PAUAAHI BISHOP MUSEUM

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*New records and updated distributional data for marine micromollusks (Mollusca: Gastropoda) from the Mesophotic Depth Zone of the Hawaiian Islands.* Dan A. Polhemus. *Bishop Museum Occasional Papers* 133: 1–29 (2020)

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## **New Records and Updated Distributional Data for Marine Micromollusks (Mollusca: Gastropoda) from the Mesophotic Depth Zone of the Hawaiian Islands<sup>1</sup>**

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Micromollusks, defined here as those species with shells less than 1 cm in length, are abundant but generally overlooked components of benthic marine ecosystems across all depth ranges. These small mollusks can form very species-rich local assemblages, often including a significant proportion of locally endemic taxa (Bouchet *et al.* 2002). As such, they represent a potentially useful group for biodiversity assessment and monitoring.

Marine mollusks in general, and micromollusks in particular, are infrequently sampled from the mesophotic depth zone of the ocean, accepted herein as lying between 30 and 150 m depth (Pyle & Copus 2019). This is the range of depth in tropical seas within which the compensation point, where light falls to 1% of irradiance at the surface, is reached. In this zone there is often a faunal shift from scleractinian corals to sponges and octocorals as the main components of benthic ecosystems, and in some areas the development of distinctive mesophotic coral reef ecosystems. Those mollusk samples that are collected from this depth zone are generally acquired by dredging, and thus represent larger species that remain in the dredge as it is hauled to the surface. In addition, it is not possible to observe the exact habitats that the dredge is sampling. These issues may to some extent be addressed by employing divers equipped with a specialized technical breathing apparatus, such as a rebreather, to make targeted collections in specifically chosen deeper water habitats.

The current study provides records of micromollusks from the mesophotic depth zone of the Hawaiian Islands obtained by this latter means. These specimens have precise collection depths and geospatial data associated with them, and as such provide a much more accurate indication of species distributions and depth ranges within the archipelago than has previously been available. This data is also providing us with new insights into the richness and distributions of these species within the Papahānaumokuākea Marine National Monument in the Northwestern Hawaiian Islands.

Three NOAA research cruises to the Northwestern Hawaiian Islands during the years 2014–2016 included micromollusk sampling from mesophotic depths as part of their standard protocols. Similar mesophotic micromollusk sampling was also carried out on a NOAA cruise in the main Hawaiian Islands in 2016. These combined data sets, coupled with more extensive existing museum collections from the shallower euphotic depth range (0–30 m) throughout the Hawaiian Archipelago, have now allowed a more complete understanding of faunal turnover and segregation across the entire 0–100 m depth spectrum.

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This initial report provides records of selected species that were commonly encountered in the mesophotic zone samples and could be readily identified using the existing literature. It should be noted that a large number of additional species are also present in these mesophotic samples, and that some of these, particularly in the family Triphoridae, appear to represent potentially new species, although the current state of taxonomy in the Triphoridae is such that this is not a simple problem to evaluate. It is envisioned that these additional species will be treated in a subsequent publication as identifications are better refined.

### MATERIAL AND METHODS

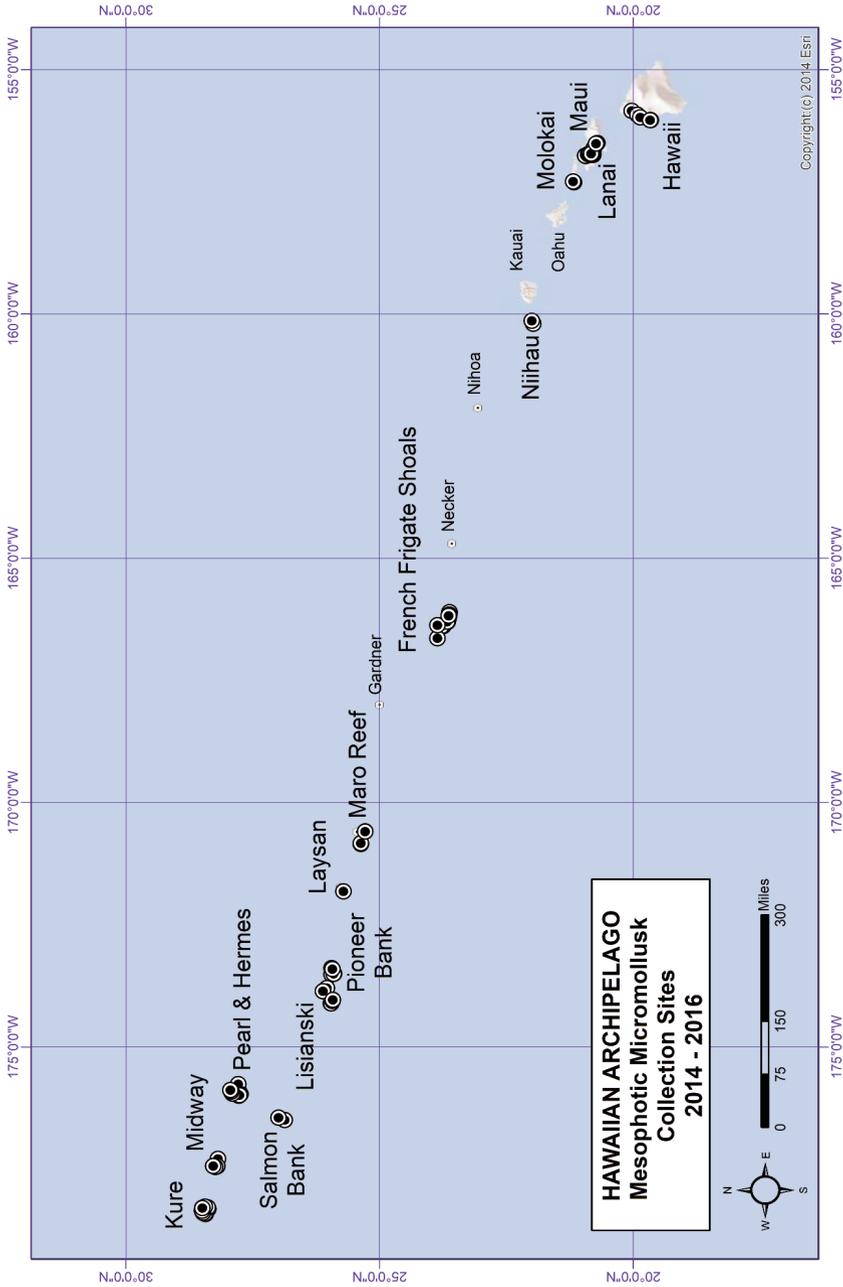
Sampling micromollusks is relatively straightforward, and generally involves collections of sand or other sediments from the bases of vertical walls, beneath overhangs, or within shallow caves, where sponges and other sessile marine organisms that provide food sources and habitat are abundant. These sediment samples often contain numerous shells from micromollusks which have naturally died and fallen to the bottom, accumulating over time. The specimens treated in this report were obtained by technical divers who accessed depths from 50 to 100 m, and collected samples of sediments by scooping up samples into quart-sized zip-closure bags. These were brought to the surface, properly labeled as to location, date and time of collection, frozen aboard ship, and then transported to the Bishop Museum in Honolulu for processing. Each sample was hand-sorted by sifting through a set of screens, with all mollusk shells or significant fragments of such shells retained. The specimens were then examined and sorted under a Wild M3Z stereo dissecting microscope, with the shells being initially segregated to family, and subsequently to genus and species to the extent this could be determined. Because most micromollusks are not collected alive, little is known about their exact ecology or behavior, and analysis of molecular systematic characters is not yet possible for many species. Detailed data for the specific sites sampled on each of the NOAA cruises are provided in Appendix 1; for the sake of brevity only abbreviated data for these localities are provided in the Material Examined sections under each species treated. Other specimen records included to clarify distributions within the Hawaiian Islands, but not originating from the above NOAA cruises, are listed under Additional Material Examined.

All sediment samples were given the prefix "Sand" followed by a sequential number for the order in which they were acquired on a given cruise. When referring to this specimen data, it is important to note both the cruise number and the sample number, since the latter repeat on each separate cruise. Latitude and longitude data are provided in decimal degrees to assist in plotting using geographic information system software. In certain cases the sample numbering at a given island is not sequential, because the ship progressed up the island chain from southeast to northwest and then returned the same way, so that certain islands were visited twice but at different times. The full names of the individual biologists who collected the samples are provided in the Acknowledgments section.

Modern advances in digital imaging technology have now made analysis of micromollusk collections far more tractable. For this study, high resolution photographs of specimens in particularly good condition were produced using a Leica MC170 HD digital camera linked to a Leica M-165C computerized microscope, with stacks of 40–50

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(Next page) **Fig. 1.** Locations of micromollusk sampling sites at mesophotic depths during NOAA research cruises from 2014–2016.



images integrated by photo compositing using Leica Application Suite 4.12.0 confocal stacking software, and post-processing using Photoshop 8.0.

All measurements are given in mm. Taxonomic nomenclature follows that in the online World Register of Marine Species (WoRMS). The specimens treated in this report, which originated from NOAA research cruises, are held in the collections of the Bishop Museum, Honolulu, Hawai'i (BPBM). Supplementary mesophotic material from the island of O'ahu used as a basis for comparisons is held in that collection, or in the D.A. Polhemus collection, Kailua, Hawai'i (DAPC).

## TAXONOMY

Family **Costellariidae** MacDonald, 1860

Genus *Atlantilux* S.-I. Huang, 2015

*Atlantilux rubra* (Broderip, 1836)  
(Figs. 2, 3)

*Tiara rubra* Broderip, 1836: 196.

*Mitra rhodinosphaera* Melvill, 1888: 286. Synonym, Higo *et al.* 1999: 365.

*Mitra rhodochroa* Hervier, 1897: 66. Synonym, Higo *et al.* 1999: 365.

*Mitra pilsbryi* Hedley, 1899: 468. Synonym, Higo *et al.* 1999: 365.

*Vexillum (Pusia) rubrum* (Broderip): Kay 1979: 331.

*Vexillum rhodochroa* (Hervier): Heros *et al.* 2007: 228.

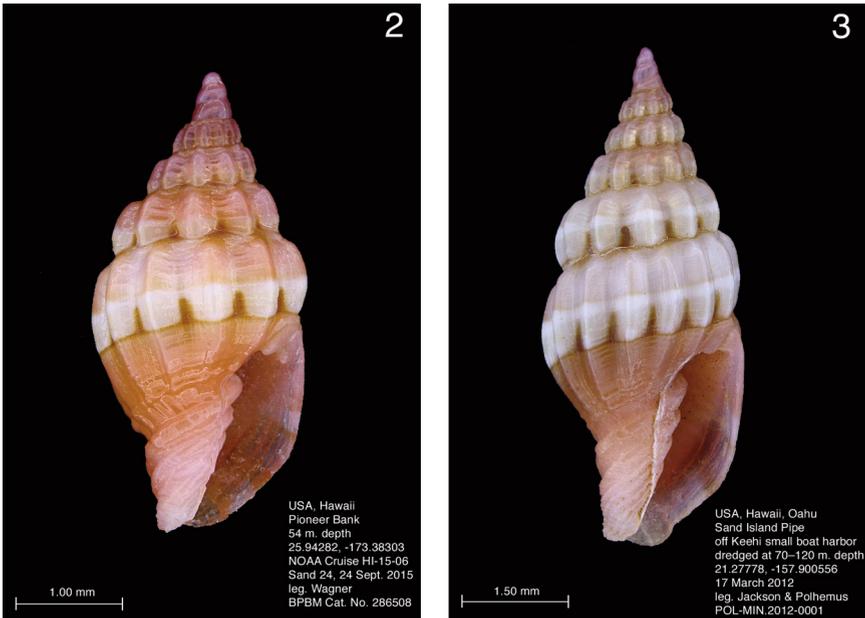
*Vexillum rubrum* (Broderip): Heros *et al.* 2007: 228.

*Atlantilux rubra* (Broderip): Fedosov *et al.* 2017: 613.

**Comments:** Long held under the name *Vexillum rubrum*, this species was transferred to the recently proposed genus *Atlantilux* by Fedosov *et al.* (2017). Although shells of this species were present in a variety of mesophotic samples, as listed below, they may also be found in beach drift on O'ahu, particularly after high surf events, indicating that this species occupies a potentially broad depth range.

**Distribution:** This is a widespread species occurring from the Hawaiian Islands to the Tuamotu and Society island groups in French Polynesia (Tröndlé & Boutet 2009), New Caledonia (Heros *et al.* 2007), the Marshall Islands (OBIS 2017), the Philippines (Poppe 2008b), Japan and Madagascar (Higo *et al.* 1999). The type-locality is not precisely constrained, but appears to be at or near Marutea Sud atoll, in the Gambier group of the Tuamotu Archipelago (Higo *et al.* 1999). The species was previously recorded in the Hawaiian Islands from O'ahu (Severns 2011). **New island or seamount records** are provided here for Maui, French Frigate Shoals, Laysan, Pioneer Bank, Lisianski, Pearl and Hermes Atoll, and Kure Atoll.

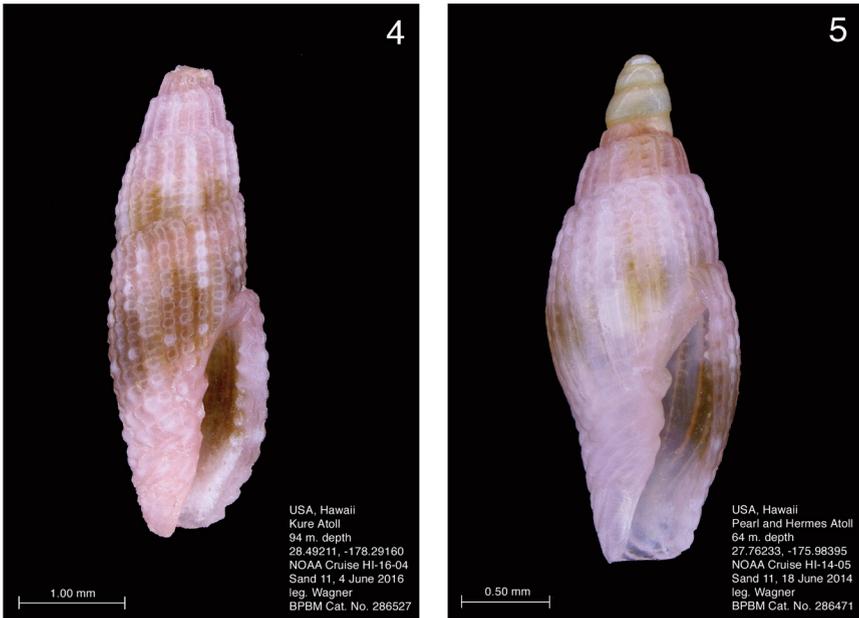
**Recorded depth range:** 0–90 m, based on literature records and new records here. Kay (1979) listed a depth range for this species from 20–60 m., noting that it occurred in coral heads, but provided no specific Hawaiian specimen localities. Severns (2011) listed a depth range of 20–35 m.



**Figs. 2, 3.** Specimens of *Atlantilux rubra* (Broderip, 1836) taken from the Hawaiian Islands at mesophotic depths, showing minor variations in shape and coloration. **2.** Specimen from Pioneer Bank, taken at 54 m depth (BPBM Cat. No. 286508). **3.** Specimen dredged from O’ahu, near Sand Island Pipe, taken at 70–120 m depth.

**Material examined:** HAWAIIAN ISLANDS, **Mau**i: 1 partial shell, Sand 13, HI-16-02, 9 Nov 2015, 52 m. (BPBM Cat. No. 286564); 1 specimen, 7.0 mm, Sand 15, HI-16-02, 10 Nov 2015, 87 m. (BPBM Cat. No. 286568). **French Frigate Shoals:** 2 specimens, 3.8–4.5 mm, Sand 21, HI-14-05, 26 Sep 2014, 62 m. (BPBM Cat. No. 286482); 1 partial shell, Sand 23, HI-14-05, 27 Sep 2014, 61 m. (BPBM Cat. No. 286486). **Laysan:** 1 specimen, 4.5 mm, Sand 18, HI-16-04, 9 Jun 2016, 64 m. (BPBM Cat. No. 286536). **Pioneer Bank:** 1 specimen, 4.3 mm, Sand 22, HI-15-06, 23 Sep 2015, 90 m. (BPBM Cat. No. 286507); 2 specimens, both 4.7 mm, Sand 24, HI-15-06, 24 Sep 2015, 54 m. (BPBM Cat. No. 286508). **Lisianski:** 2 specimens, 2.3–2.6 mm, Sand 5, HI-14-05, 14 Sep 2014, 59 m. (BPBM Cat. No. 286451); 1 partial shell, Sand 6, HI-14-05, 15 Sep 2014, 84 m. (BPBM Cat. No. 286453); 1 specimen, 4.8 mm, Sand 8, HI-14-05, 16 Sep 2014, 73 m. (BPBM Cat. No. 286461). **Pearl and Hermes Atoll:** 1 partial shell, Sand 9, HI-14-05, 17 Sep 2014, 55 m. (BPBM Cat. No. 286463); 1 partial shell, Sand 9, HI-15-06, 13 Sep 2015, 63 m. (BPBM Cat. No. 286494). **Kure Atoll:** 1 partial shell, Sand 12, HI-15-06, 15 Sep 2015, 57 m. (BPBM Cat. No. 286501).

**Other material examined:** HAWAIIAN ISLANDS, **O’ahu:** 1 specimen, 6.7 mm, Sand Island Pipe outfall area, offshore of Keehi small boat harbor, 21.277781, -157.900556, dredged from 70–120 m depth, 17 Mar 2012, H.J. Jackson and D.A. Polhemus (DAPC Cat. No. POL-SHL-2012-0001); 18 specimens, 4.6–6.7 mm, basin east of Sharks Cove, 21.652501, -158.061667, in beach drift after strong wave event, 21 February 2019, D.A. Polhemus (DAPC Cat. No. POL-SHL-2019-0001-L).



**Figs. 4, 5.** Specimens of *Thala hilli* Rosenberg & Salisbury, 2007 from the Northwestern Hawaiian Islands at mesophotic depths. **4.** Adult specimen from Kure Atoll, taken at 94 m depth (BPBM Cat. No. 286527). **5.** Subadult specimen with intact protoconch from Pearl and Hermes Atoll, taken at 64 m depth (BPBM Cat. No. 286471).

Genus *Thala* H. Adams & A. Adams, 1853

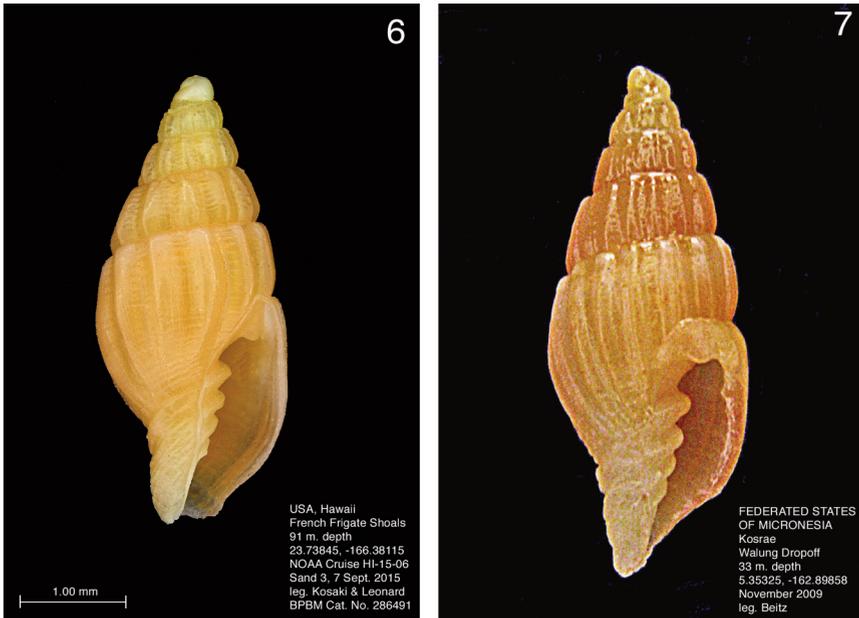
*Thala hilli* Rosenberg & Salisbury, 2007

(Figs. 4, 5)

*Thala hilli* Rosenberg & Salisbury, 2007: 58.

**Comments:** This uncommon species, endemic to the Hawaiian Islands, was described from Midway Atoll based on specimens taken at 15–18 m depth. Additional paratypes came from beach drift on Kaua'i (Ha'ena) and O'ahu (Pūpūkea), and from dredged material taken off O'ahu from Sand Island at 70 m, and Pokai Bay at 110–130 m (Rosenberg & Salisbury 2007). Based on these records the species occurs in both the euphotic and mesophotic zones, with occasional specimens washing up in beach drift. The new records reported below both come from mesophotic depths, and further clarify the range of this species in the Northwestern Hawaiian Islands.

**Distribution:** Previously recorded from O'ahu, Kauai, and Midway Atoll (Rosenberg & Salisbury 2007). **New island records** for Maro Reef, Pearl and Hermes Atoll, and Kure Atoll.



**Figs. 6, 7.** Specimens of *Vexillum beitzii* Salisbury & Gori, 2013 from the Northwestern Hawaiian Islands and Kosrae at mesophotic depths. **6.** Specimen from French Frigate Shoals, taken at 91 m depth (BPBM Cat. No. 286491). **7.** Holotype specimen from Kosrae, Walung Dropoff, taken at 33 m depth (photo courtesy R. Salisbury).

**Recorded depth range:** 0–130 m (Rosenberg & Salisbury 2007). The new mesophotic material falls within this previously recorded depth range.

**Material examined:** HAWAIIAN ISLANDS, **Maro Reef:** 1 specimen (adult), 4.5 mm, Sand 5, HI-16-04, 29 May 2016, 45 m depth (BPBM Cat. No. 286519). **Pearl and Hermes Atoll:** 1 specimen (subadult), 3.0 mm, Sand 12, HI-14-05, 18 Sep 2014, 64 m depth (BPBM Cat. No. 286471). **Kure Atoll:** 1 specimen (adult), 4.8 mm, Sand 11, HI-16-04, 4 Jun 2016, 91 m depth (BPBM Cat. No. 286527).

Genus *Vexillum* Röding, 1798

*Vexillum beitzii* Salisbury & Gori, 2013

(Figs. 6, 7)

*Vexillum beitzii* Salisbury & Gori, 2013: 90.

**Comments:** A small, bright orange *Vexillum* species from mesophotic samples in the Northwestern Hawaiian Islands proved difficult to identify based on existing treatments of the Hawaiian marine mollusk biota (Kay 1979; Severns 2011). Photographs of this species were sent to Dr. Richard Salisbury, a world expert on the group, who determined the species in question to represent *Vexillum beitzii*, originally described from 7 specimens

collected around the island of Kosrae in the Federated States of Micronesia, and previously known only from the type-locality (Salisbury & Gori 2013). The new specimens from French Frigate Shoals therefore represent the first records for the Hawaiian Islands, and for this atoll, respectively.

**Distribution:** Previously recorded from Kosrae, Federated States of Micronesia (Salisbury & Gori 2013). **New archipelagic record** for Hawaii; **new island record** for French Frigate Shoals.

**Recorded depth range:** 25–91 m, based on the literature and new records presented here. The holotype from Kosrae was taken at 38 m depth from sand in a small coral cave at the Walung dropoff, with paratypes from two other sites at 25 m and 33 m depth (Salisbury & Gori 2013). The new collections from the Northwestern Hawaiian Islands come from considerably deeper sites, thus more than doubling the known depth range of this species.

**Material examined:** HAWAIIAN ISLANDS, **French Frigate Shoals:** 1 specimen, 4.5 mm, Sand 3, HI-15-06, 7 Sep 2015, 91 m depth (BPBM Cat. No. 286491); 1 specimen, 4.4 mm, Sand 22, HI-16-04, 12 Jun 2016, 85 m depth (BPBM Cat. No. 286544).

*Vexillum interruptum* (Anton, 1838)

*Mitra interrupta* Anton, 1838: 68.

*Vexillum interruptum* (Anton): Heros *et al.* 2007: 228

**Comments:** This is a widespread Indo-Pacific species that is relatively common at euphotic depths in the main Hawaiian Islands. Several samples from mesophotic depths have now been obtained from the Northwestern Hawaiian Islands as well.

**Distribution:** Previously recorded in the Hawaiian Islands from O‘ahu (Severns 2011). **New island records** for Maro Reef and Pearl and Hermes Atoll.

**Recorded depth range:** 0–64 m, based on literature records and new records here. Kay (1979) listed a depth range for this species from 0–10 m, but provided no specific Hawaiian specimen localities. Severns (2011) listed an O‘ahu specimen from 16 m.

**Material examined:** HAWAIIAN ISLANDS, **Maro Reef:** 1 specimen, 4.5 mm, Sand 5, HI-16-04, 29 May 2016, 45 m depth (BPBM Cat. No. 286520). **Pearl and Hermes Atoll:** 1 partial shell, Sand 11, HI-14-05, 18 Sep 2014, 64 m depth (BPBM Cat. No. 286468).

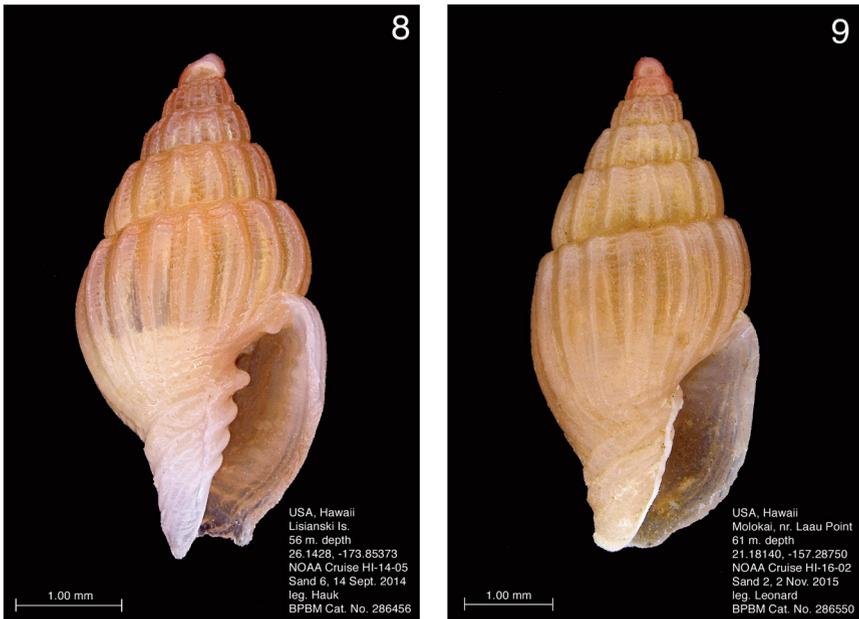
*Vexillum salisburyi* Cernohorsky, 1976  
(Figs. 8, 9)

*Vexillum salisburyi* Cernohorsky, 1976: 114.

*Vexillum capricornia* Hedley: Misidentification, Kay 1979: 325.

**Comments:** This species occurs at both euphotic and mesophotic depths, and shells may occasionally be found in beach drift after strong surf events.

**Distribution:** Originally described from a type-series of over 60 specimens taken at Pūpūkea, O‘ahu (Cernohorsky 1976), and subsequently recorded from the Northwestern Hawaiian Islands at Lisianski (Hemmes *et al.* 1991). **New island or seamount records** are provided here for Hawai‘i, Maui, Lāna‘i, Moloka‘i, French Frigate Shoals, and

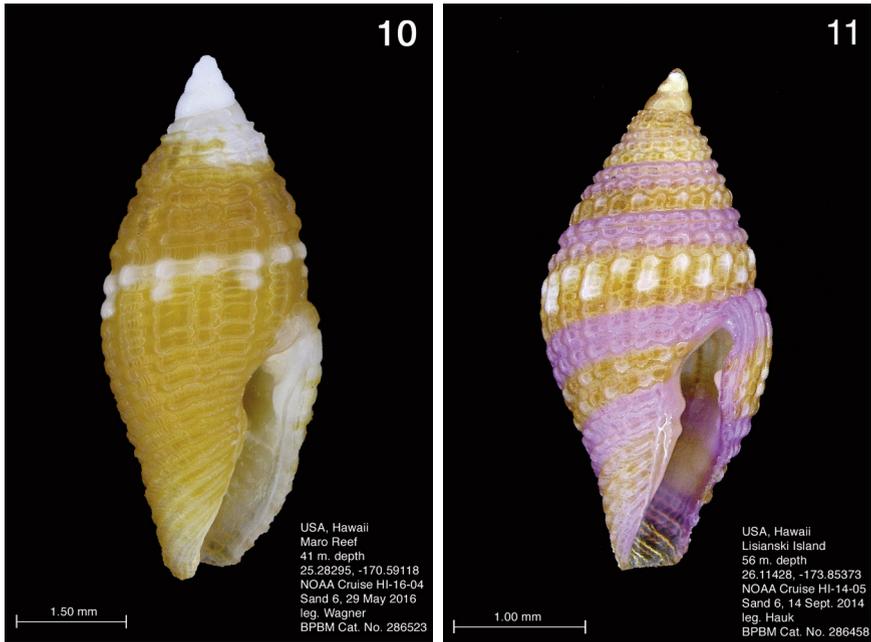


**Figs. 8, 9.** Specimens of *Vexillum salisburyi* Cernohorsky, 1976 taken from the Hawaiian Islands at mesophotic depths. **8.** Subadult specimen from Lisianski Island, taken at 58 m depth (BPBM Cat. No. 286456). **9.** Adult specimen from Molokai, off La'au Point, taken at 61 m depth (BPBM Cat. No. 286550).

Pioneer Bank. This species is not currently recorded from the furthest northwestern Hawaiian atolls of Pearl and Hermes, Midway or Kure.

**Recorded depth range:** 0–84 m, based on literature records and new records here. The type-series was taken from beach drift (Cernohorsky 1976). Kay (1979) listed a depth range for this species of 0–10 m (under the name *V. capricornia* Hedley), but provided no additional precise specimen localities in the Hawaiian Islands. The current collections from the mesophotic zone significantly expand the documented depth range for this species.

**Material examined:** HAWAIIAN ISLANDS, **Hawaii:** 3 specimens, 5.2–5.5 mm, Sand 17, HI-16-02, 11 Nov 2015, 83 m (BPBM Cat. No. 286572); 1 specimen, 5.6 mm, Sand 18, HI-16-02, 12 Nov 2015, 88 m (BPBM Cat. No. 286573). **Maui:** 1 specimen, 5.4 mm, Sand 14, HI-16-02, 9 Nov 2015, 58 m (BPBM Cat. No. 286566). **Lāna'i:** 1 specimen, 5.2 mm, Sand 6, HI-16-02, 4 Nov 2015, 90 m (BPBM Cat. No. 286556). **Molokai:** 1 specimen, 2.2 mm, Sand 1, HI-16-02, 2 Nov 2015, 61 m (BPBM Cat. No. 286546); 1 specimen, 6.2 mm, Sand 2, HI-16-02, 2 Nov 2015, 61 m (BPBM Cat. No. 286550). **French Frigate Shoals:** 3 specimens, 3.7–3.9 mm, Sand 22, HI-14-05, 26 Sep 2014, 57 m (BPBM Cat. No. 286483); 1 specimen, 3.5 mm, Sand 20, HI-16-04, 11 Jun 2016, 79 m (BPBM Cat. No. 286541). **Pioneer Bank:** 1 specimen, 4.5 mm, Sand 24, HI-15-06, 24 Sep 2015, 54 m (BPBM Cat. No. 286509). **Lisianski:** 1 specimen, 5.1 mm, Sand 6, HI-14-05, 14 Sep 2014, 56 m (BPBM Cat. No. 286456).



**Fig. 10.** Specimen of *Mitromorpha iki* (Kay, 1979) from Maro Reef, taken at 41 m depth (BPBM Cat. No. 286523).

**Fig. 11.** Specimen of *Mitromorpha salisburyi* (Cernohorsky, 1978) from Lisianski Island, taken at 56 m depth (BPBM Cat. No. 286458).

**Other material examined:** HAWAIIAN ISLANDS, **O‘ahu:** 30 specimens, 4.1–5.7 mm, basin east of Sharks Cove, 21.652501, -158.061667, in beach drift after strong wave event, 21 February 2019, D.A. Polhemus (topotypes, DAPC Cat. No. POL-SHL-2019-0002-L).

Family **Mitromorphidae** T. L. Casey, 1904

Genus *Mitromorpha* Carpenter, 1865

**Comments:** Although some Hawaiian mitromorphid species, such as *Lovellona atramentosa* (Reeve) and *L. peaseana* Finlay, may be found regularly in beach drift, others such as *Mitromorpha iki* and *M. salisburyi*, treated below, appear to be found only at mesophotic depths.

***Mitromorpha iki*** (Kay, 1979)  
(Fig. 10)

*Mitrolumna iki* Kay, 1979: 349.

*Anarithma metula* (Hinds) Drivas & Jay, 1986: 8. *M. iki* as synonym.

*Mitromorpha (Anarithma) metula* (Hinds) Cernohorsky 1988: 66. *M. iki* as synonym.

*Anarithma iki* (Kay): Chang 1999: 6.

*Mitromorpha iki* (Kay): Severns 2011: 352.

**Comments:** This species appears to be confined to the mesophotic zone, with all published records coming from 60 m or deeper. Some authors have treated this species a synonym of the widespread *Anarithma metula* (Hinds), but current workers consider it a valid taxon (Severns 2011; Salisbury, *in litt.*).

**Distribution:** Apparently endemic to the Hawaiian Islands, being originally described from specimens taken at Kepuhi, O'ahu (Kay 1979); also recorded from Necker, Maro Reef and Lisianski (Hemmes *et al.* 1991), and Maui (Sysoev *in* Severns 2011). **New island or seamount records** are reported herein for Lāna'i, Moloka'i, French Frigate Shoals, Pioneer Bank, Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll.

**Recorded depth range:** 60–91 m, based on literature records and new records here. The type-series came from 60 m depth (Kay 1979), and Severns (2011) figured a specimen taken at 80 m. The current mesophotic collections extend the documented depth range for this species to 91 m.

**Material examined:** HAWAIIAN ISLANDS, **Maui:** 1 specimen, 4.3 mm, Sand 7, HI-16-02, 5 Nov 2015, 88 m (BPBM Cat. No. 286557). **Lāna'i:** 1 specimen, 3.2 mm, Sand 6, HI-16-02, 4 Nov 2015, 90 m (BPBM Cat. No. 286555); 1 specimen, 3.5 mm, Sand 11, HI-16-02, 8 Nov 2015, 75 m (BPBM Cat. No. 286562). **Moloka'i:** 1 specimen, 3.5 mm, Sand 1, HI-16-02, 2 Nov 2015, 61 m (BPBM Cat. No. 286547). **French Frigate Shoals:** 1 specimen, 3.2 mm, Sand 4, HI-14-05, 12 Sep 2014, 64 m (BPBM Cat. No. 286449); 1 specimen, 3.1 mm, Sand 22, HI-14-05, 26 Sep 2014, 57 m (BPBM Cat. No. 286484); 1 specimen, 3.8 mm, Sand 2, HI-16-04, 26 May 2016, 83 m (BPBM Cat. No. 286518). **Maro Reef:** 1 specimen, 3.5 mm, Sand 6, HI-16-04, 29 May 2016, 41 m (BPBM Cat. No. 286523). **Pioneer Bank:** 1 specimen, 5.4 mm, Sand 8, HI-15-06, 12 Sep 2015, 79 m (BPBM Cat. No. 286493). **Lisianski:** 1 specimen, 3.0 mm, Sand 7, HI-14-05, 15 Sep 2014, 84 m (BPBM Cat. No. 286457). **Pearl and Hermes Atoll:** 1 specimen, 3.4 mm, Sand 20, HI-14-05, 23 Sep 2014, 69 m (BPBM Cat. No. 286481); 1 specimen, 1 specimen, 3.4 and 2.1 mm, Sand 10, HI-15-06, 13 Sep 2015, 70 m (BPBM Cat. No. 286496). **Midway Atoll:** 2 specimens, 4.3 and 4.8 mm, Sand 13, HI-14-05, 20 Sep 2014, 65 m (BPBM Cat. No. 286475). **Kure Atoll:** 2 specimens, 3.5 and 3.6 mm, Sand 11, HI-16-04, 4 Jun 2016, 91 m (BPBM Cat. No. 286528).

***Mitromorpha salisburyi*** (Cernohorsky, 1978)  
(Fig. 11)

*Mitrolumna salisburyi* Cernohorsky, 1978: 66.

*Mitromorpha (Anarithma) salisburyi* (Cernohorsky): Cernohorsky 1988: 71.

*Mitromorpha salisburyi* (Cernohorsky): Higo *et al.* 1999: 389.



**Fig. 12.** Specimen of *Euicyclotoma albomaculata* Kay, 1979 from Kure Atoll, taken at 94 m depth (BPBM Cat. No. 286526).

**Comments:** *Mitromorpha salisburyi* appears to be confined to mesophotic depths in Hawai'i, with all of the new records listed here coming from depths below 50 m. Kay (1979) and Higo *et al.* (1999) considered this species to be a synonym of *Mitromorpha (Mitrolumna) alphonsiana* (Hervier, 1899), which has certain similarities in coloration, but subsequent authors (Cernohorsky 1988; Severns 2011) have not supported this interpretation.

**Distribution:** Originally described from 5 specimens taken at Maili Point, O'ahu (Cernohorsky 1978), and subsequently recorded from Maui (Sysoev *in* Severns 2011), as well as the Tuamotu (Cernohorsky 1988) and Marquesas (Tröndlé & Cosel 2005) archipelagoes in French Polynesia. **New island or seamount records** from the Hawaiian Archipelago are provided herein for Lāna'i, French Frigate Shoals, Pioneer Bank, Lisianski, Pearl and Hermes Atoll, Midway Atoll and Kure Atoll. The geographic range of this species is now documented to span the entire length of the Hawaiian Archipelago.

**Recorded depth range:** 52–91 m, based on literature records and new records here. The type-series was taken at 58 m (Cernohorsky 1978), and Severns (2011) figured a specimen taken at 70 m. The current mesophotic collections extend the documented depth range for this species to 91 m at Kure.

**Material examined:** HAWAIIAN ISLANDS, **Maui:** 1 partial shell, Sand 13, HI-16-02, 9 Nov 2015, 52 m (BPBM Cat. No. 286563). **Lāna'i:** 1 specimen, 4.6 mm, Sand 11, HI-16-02, 8 Nov 2015, 75 m (BPBM Cat. No. 286561). **French Frigate Shoals:** 1 specimen, 3.8 mm, Sand 20, HI-16-04, 11 Jun 2016, 79 m (BPBM Cat. No. 286542). **Pioneer Bank:** 3 specimens, 3.9–5.0 mm, Sand 24, HI-15-06, 24 Sep 2015, 54 m (BPBM Cat. No. 286510). **Lisianski:** 1 specimen, 4.1 mm, Sand 6, HI-14-05, 14

Sep 2014, 56 m (BPBM Cat. No. 286458). **Pearl and Hermes Atoll:** 1 specimen, 3.9 mm, Sand 10, HI-14-05, 17 Sep 2014, 59 m (BPBM Cat. No. 286465); 1 specimen, 5.0 mm, Sand 10, HI-15-06, 13 Sep 2015, 70 m (BPBM Cat. No. 286497); 1 specimen, 4.3 mm, Sand 8, HI-16-04, 1 Jun 2016, 61 m (BPBM Cat. No. 286525). **Midway Atoll:** 1 specimen, 4.6 mm, Sand 12, HI-14-05, 19 Sep 2014, 59 m (BPBM Cat. No. 286472); 3 specimens and specimens (growth series), 2.5–4.8 mm, Sand 13, HI-14-05, 20 Sep 2014, 65 m (BPBM Cat. No. 286476). **Kure Atoll:** 1 partial shell, Sand 11, HI-16-04, 4 Jun 2016, 91 m (BPBM Cat. No. 286529).

Family **Raphitomidae** Bellardi, 1875

Genus *Eucyclotoma* Boettger, 1895

*Eucyclotoma albomacula* Kay, 1979

(Fig. 12)

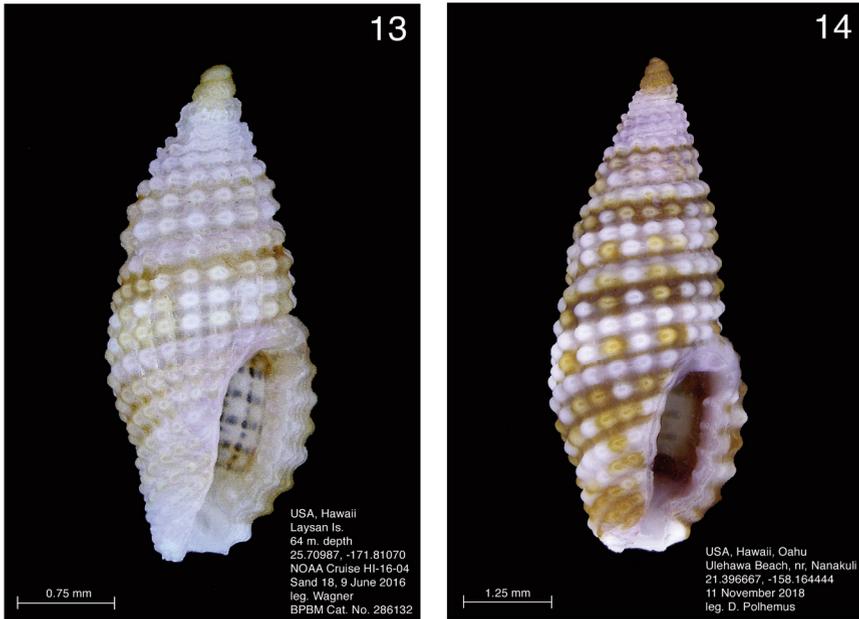
*Eucyclotoma albomacula* Kay, 1979: 358.

**Comments:** This is a rarely collected species, apparently endemic to Hawaiian Islands and confined to mesophotic depths below 50 m, but occurring in that zone throughout the archipelago.

**Distribution:** Apparently endemic to Hawai'i, with previous records from the type-locality at Kepuhi, O'ahu (Kay 1979), and subsequently from additional dredge hauls off O'ahu and Maui (Burch *et al.* 1988). **New island or seamount records** are provided herein for Lāna'i, Ni'ihau, French Frigate Shoals, Laysan, Salmon Bank, Pearl and Hermes Atoll, Midway Atoll, and Kure Atoll.

**Recorded depth range:** 59–195 m, based on literature records and recent collections. Kay (1979) described the species based on specimens taken at 60 m, Burch *et al.* (1988) recorded the species from dredge hauls taken at 60–195 m, and Severns (2011) noted a depth range of 100–130 m. The current mesophotic collections fall within this set of depths.

**Material examined:** HAWAIIAN ISLANDS, **Lāna'i:** 1 specimen, 6.0 mm, Sand 5, HI-16-02, 4 Nov 2015, 91 m (BPBM Cat. No. 286553); 2 specimens, 3.9–4.0 mm, Sand 11, HI-16-02, 8 Nov 2015, 75 m (BPBM Cat. No. 286560). **Ni'ihau:** 1 specimen, 4.6 mm, Sand 28, HI-15-06, 29 Sep 2015, 59 m (BPBM Cat. No. 286514). **French Frigate Shoals:** 1 specimen, 7.0 mm, Sand 22, HI-16-04, 12 Jun 2016, 85 m (BPBM Cat. No. 286545). **Laysan:** 1 specimen, 2.5 mm, Sand 18, HI-16-04, 9 Jun 2016, 64 m (BPBM Cat. No. 286537). **Salmon Bank:** 1 partial shell, Sand 17, HI-15-06, 18 Sep 2015, 91 m (BPBM Cat. No. 286504); 2 specimens, 2.7–3.5 mm, Sand 18, HI-15-06, 18 Sep 2015, 82 m (BPBM Cat. No. 286505). **Pearl and Hermes Atoll:** 1 specimen, 2.8 mm, Sand 10, HI-14-05, 17 Sep 2014, 59 m (BPBM Cat. No. 286464); 6 specimens, 2.3–2.6 mm, Sand 11, HI-14-05, 18 Sep 2014, 85 m (BPBM Cat. No. 286469); 1 partial shell, Sand 16, HI-14-05, 1 Sep 2014, 85 m (BPBM Cat. No. 286479); 2 specimens, 2.5–3.0 mm, Sand 9, HI-15-06, 13 Sep 2015, 63 m (BPBM Cat. No. 286495); 1 specimen, 2.5 mm, Sand 11, HI-15-06, 14 Sep 2015, 55 m (BPBM Cat. No. 286500); 2 specimens, 2.2–2.8 mm, Sand 15, HI-16-04, 5 Jun 2016, 98 m (BPBM Cat. No. 286533). **Midway Atoll:** 1 specimen, 2.2 mm, Sand 12, HI-14-05, 19 Sep 2014, 59 m (BPBM Cat. No. 286473); 6 specimens and specimens, 2.9–5.7 mm, Sand 13, HI-14-05, 20 Sep 2014, 65 m (BPBM Cat. No. 286477); 1 partial shell, Sand 19, HI-15-06, 19 Sep 2015, 84 m (BPBM Cat. No. 286506). **Kure Atoll:** 1 specimen, 2.0 mm, Sand 16, HI-15-06, 17 Sep 2015, 88 m (BPBM Cat. No. 286503); 1 specimen, 6.1 mm, Sand 10, HI-16-04, 4 Jun 2016, 94 m (BPBM Cat. No. 286526); 1 specimen, 6.8 mm, Sand 11, HI-16-04, 4 Jun 2016, 91 m (BPBM Cat. No. 286530); 1 specimen, 5.4 mm, Sand 13, HI-16-04, 4 Jun 2016, 91 m (BPBM Cat. No. 286532).



**Figs. 13, 14.** Specimens of *Kermia pumila* (Mighels, 1845) taken from the Hawaiian Islands at mesophotic depths. **13.** Specimen from Laysan Island, taken at 64 m depth (BPBM Cat. No. 286132). **14.** Topotypic specimen from O'ahu, Ulehawa Beach, taken in beach drift.

Genus *Kermia* W.R.B. Oliver, 1915

*Kermia pumila* (Mighels, 1845)  
(Figs. 13, 14)

*Pleurotoma pumila* Mighels, 1845: 23.

*Pleurotoma reticulata* Garrett, 1857: 102. Synonym, Kay 1979: 362.

Invalid junior homonym of *Pleurotoma reticulata* T. Brown 1827, and *Pleurotoma reticulata* Bronn 1831.

*Clathurella violacea* Pease, 1868: 218. Synonym, Higo *et al.* 1999: 407.

Lectotype designated by Johnson 1994: 27.

*Mangelia digitale* Reeve, 1846: Plate 8, sp. 70. Synonym, Kilburn 2009: 230.

*Pleurotoma clandestina* Deshayes, 1863: 110. Synonym, Higo *et al.* 1999: 407.

*Philbertia* (*Kermia*) *pumila* (Mighels); Cernohorsky 1978: 162.

*Kermia pumila* (Mighels); Kay 1979: 362.

**Comments:** Originally described from an unspecified locality on O'ahu, this species has been widely but sporadically reported from the Cook Islands, Fiji, Okinawa, Reunion, the Seychelles and South Africa (Kilburn 2009), the Society and Tuamotu groups in French Polynesia (Tröndlé & Boutet 2009), and from Maui in the Hawaiian Islands (Sysoev *in* Severns 2011). It is not clear if all of these widespread populations are con-



**Fig. 15.** Specimen of *Mastonia gracilis* (Pease, 1871) from Maui, taken at 87 m depth (BPBM Cat. No. 286559).

specific, and the name *Kermia clandestina* (Deshayes), with a type-locality of Reunion, is available for the Indian Ocean populations should they eventually prove to be distinct. This species is relatively common in beach drift on O‘ahu, and such specimens can be considered topotypic (Fig. 14).

**Distribution:** Widely distributed in the Indo-Pacific (Kay 1979; Kilburn 2009; Sysoev *in* Severns 2011). A **new island record** is provided herein for Laysan.

**Recorded depth range:** 0–70 m, based on literature records and new records here. Kay (1979) indicated this species was common in tidepools and on fringing reefs, but provided no exact Hawaiian island records. Kilburn (2009) and Higo *et al.* (1999) both listed a depth range of 0–20 m for this species, while Severns (2011) noted that it occurred off Maui at 20–70 m, thus documenting its presence in the mesophotic zone. The single example from Laysan falls within this previously documented depth range, and the absence of this species from other recent mesophotic samples indicates it may be a more typical habitat of the euphotic zone.

**Material examined:** HAWAIIAN ISLANDS, **Laysan:** 1 specimen, 3.8 mm, Sand 18, HI-16-04, 9 Jun 2016, 64 m (BPBM Cat. No. 286132).

**Other material examined:** HAWAIIAN ISLANDS, **O‘ahu:** 5 specimens, 3.9–4.3 mm, Ulehawa Beach Park, north end, 21°43′48″N, 158°09′52″W, in beach drift, 11 Nov 2018, D.A. Polhemus (topotypes, DAPC Cat. No. POL-SHL-2018-0001-L).



**Figs. 16, 17.** Specimens of *Triphora chrysolitha* Kay, 1979 taken from the Hawaiian Islands at mesophotic depths. **16.** Specimen from French Frigate Shoals, taken at 85 m depth (BPBM Cat. No. 286517). **17.** Specimen from Lānaʻi, taken at 91 m depth (BPBM Cat. No. 286554).

Family **Triphoridae** Gray, 1847

Genus *Mastonia* Hinds, 1843

*Mastonia gracilis* (Pease, 1871)

(Fig. 15)

*Triphoris gracilis* Pease, 1871: 777.

*Mastonia gracilis* (Pease): Kay 1979: 138.

**Comments:** This species was originally described from an unspecified locality on Kauai (Pease 1871), and is common in the main Hawaiian Islands as far northwest as Niʻihau, but was not seen in the current set of mesophotic samples from the Northwestern Hawaiian Islands.

**Distribution:** Previously recorded in the literature from Kauai (Pease 1871). **New island records** are provided here for Hawaiʻi, Maui, Molokaʻi and Niʻihau.

**Recorded depth range:** 7–100 m, based on previous literature records and new collections reported here. Kay (1979) gave a depth range of 0–60 m; Severns (2011) indicated 10–100 m; and Hemmes *et al.* (1997a) stated that the species had been taken at 7 m, but considered it uncommon. None of the above authors, however, provided any specific island locality records within the Hawaiian Islands.



**Figs. 18, 19.** Specimens of *Triphora thanumi* Kay, 1979 taken from the Hawaiian Islands at mesophotic depths. **18.** Specimen from Lisianski Island, taken at 56 m depth (BPBM Cat. No. 286454). **19.** Specimen dredged from O'ahu, near Sand Island Pipe, taken at 70–120 m depth.

**Material examined:** HAWAIIAN ISLANDS, **Hawai'i:** 2 specimens, 3.5 (missing protoconch), 3.8 mm, Sand 18, HI-16-02, 12 Nov 2015, 88 m (BPBM Cat. No. 286574). **Maui:** 1 specimen, 4.9 mm, Sand 14, HI-16-02, 9 Nov 2015, 58 m (BPBM Cat. No. 286567); 1 specimen, 5.3 mm, Sand 15, HI-16-02, 10 Nov 2015, 87 m (BPBM Cat. No. 286569). **Moloka'i:** 1 specimen, 4.1 mm, Sand 1, HI-16-02, 2 Nov 2015, 61 m (BPBM Cat. No. 286548). **Ni'ihau:** 1 specimen, 3.2 mm, Sand 28, HI-15-06, 29 Sep 2015, 59 m (BPBM Cat. No. 286515).

Genus *Triphora* Blainville, 1828

*Triphora chrysolitha* Kay, 1979  
(Figs. 16, 17)

*Triphora chrysolitha* Kay, 1979: 143.

**Comments:** *Triphora chrysolitha* was originally described from specimens taken at a depth of 60 m off Makaha, O'ahu (Kay 1979), and is a relatively consistent element in the recent mesophotic samples. It appears to be common in that depth range throughout the length of the Hawaiian Archipelago.

**Distribution:** Previously recorded from O'ahu and Hawai'i Islands (Kay 1979; Hemmes *et al.* 1997c). **New island or seamount records** provided herein for Maui, Lāna'i, French Frigate Shoals, Laysan, Lisianski, Pioneer Bank, Pearl and Hermes Atoll, Midway Atoll and Kure Atoll.

**Recorded depth range:** 2–101 m, based on literature records and new collections reported here. Kay (1979) noted this species as being common at depths of 10–60 m, and Hemmes *et al.* (1997c) stated that specimens had been taken at depths ranging from 2–80 m. The current mesophotic sampling recovered specimens at depths between 54–101 m.

**Material examined:** HAWAIIAN ISLANDS, **Maui:** 1 specimen, 5.8 mm, Sand 3, HI-16-02, 3 Nov 2015, 91 m (BPBM Cat. No. 286551); 1 specimen, 6.0 mm, Sand 7, HI-16-02, 5 Nov 2015, 88 m (BPBM Cat. No. 286558); 2 specimens, 4.9 (missing protoconch), 5.2 mm, Sand 16, HI-16-02, 10 Nov 2015, 76 m (BPBM Cat. No. 286570). **Lānaʻi:** 1 specimen, 3.9 mm, Sand 5, HI-16-02, 4 Nov 2015, 91 m (BPBM Cat. No. 286554). **French Frigate Shoals:** 1 specimen, 3.4 mm, Sand 4, HI-14-05, 12 Sep 2014, 64 m (BPBM Cat. No. 286450); 1 specimen, 5.7 mm, Sand 1, HI-16-04, 26 May 2016, 85 m (BPBM Cat. No. 286517). **Laysan:** 2 specimens, 3.8–5.1 mm, Sand 18, HI-16-04, 9 Jun 2016, 64 m (BPBM Cat. No. 286538). **Pioneer Bank:** 1 partial shell, Sand 24, HI-15-06, 24 Sep 2015, 54 m (BPBM Cat. No. 286511). **Lisianski:** 1 specimen, 3.7 mm, Sand 7, HI-14-05, 15 Sep 2014, 84 m (BPBM Cat. No. 286459); 1 specimen, 4.8 mm, Sand 16, HI-16-04, 7 Jun 2016, 101 m (BPBM Cat. No. 286535). **Pearl and Hermes Atoll:** 3 specimens, 3.5–5.0 mm, Sand 10, HI-14-05, 17 Sep 2014, 59 m (BPBM Cat. No. 286466); 1 specimen, 4.9 mm, Sand 16, HI-14-05, 1 Sep 2014, 85 m (BPBM Cat. No. 286480); 1 specimen, 3.6 mm, Sand 10, HI-15-06, 13 Sep 2015, 70 m (BPBM Cat. No. 286498); 2 specimens, 3.6–4.4 mm, Sand 15, HI-16-04, 5 Jun 2016, 98 m (BPBM Cat. No. 286534). **Midway Atoll:** 1 specimen, 5.5 mm, Sand 12, HI-14-05, 19 Sep 2014, 59 m (BPBM Cat. No. 286474); 1 specimen, 3.9 mm plus 3 partial shells, Sand 13, HI-14-05, 20 Sep 2014, 65 m (BPBM Cat. No. 286478). **Kure Atoll:** 1 specimen, 3.5 mm, Sand 12, HI-15-06, 15 Sep 2015, 57 m (BPBM Cat. No. 286531).

*Triphora thaanumi* Kay, 1979

(Figs. 18, 19)

*Triphora thaanumi* Kay, 1979: 149.

**Comments:** This species, which is easily recognized by its extremely distinctive color pattern of reddish flecks lying in small depressions on the whorls, was taken sporadically in the samples from mesophotic depths.

**Distribution:** Described from material taken at Kahe Point, Oʻahu (Kay 1979), and also previously recorded from Hawaiʻi island (Hemmes *et al.* 1997d). **New island records** are provided herein for French Frigate Shoals, Maro Reef, Lisianski, and Pearl and Hermes Atoll.

**Recorded depth range:** 6–84 m, based on literature records and new collections reported here. The holotype was taken at 6 m depth, and Kay (1979) indicated that specimens had been obtained from depths ranging between 6–30 m. Hemmes (1997d) stated that specimens had been taken at 7–80 m depth on Oʻahu and Hawaiʻi islands, and Severns (2011) gave a depth range of 30–80 m but with no specific island records. The current mesophotic samples add slightly to the known lower depth bound for the species.

**Material examined:** HAWAIIAN ISLANDS, **French Frigate Shoals:** 1 partial shell, Sand 23, HI-14-05, 27 Sep 2014, 61 m (BPBM Cat. No. 286487); 1 partial shell, Sand 4, HI-15-06, 8 Sep 2015, 82 m (BPBM Cat. No. 286492). **Maro Reef:** 1 specimen, 4.0 mm, Sand 6, HI-16-04, 29 May 2016, 41 m (BPBM Cat. No. 286524). **Lisianski:** 1 specimen, 5.0 mm, Sand 5, HI-14-05, 14 Sep 2014, 59 m (BPBM Cat. No. 286452); 1 specimen, 3.9 mm, Sand 6, HI-14-05, 14 Sep 2014, 56 m (BPBM Cat. No. 286454); 1 partial shell, Sand 7, HI-14-05, 15 Sep 2014, 84 m (BPBM Cat. No. 286460). **Pearl and Hermes Atoll:** 1 specimen, 3.9 mm, Sand 10, HI-14-05, 17 Sep 2014, 59 m (BPBM Cat. No.



**Fig. 20.** Specimen of *Triphora tuberculata* (Pease, 1871) from Maro Reef, taken at 45 m depth (BPBM Cat. No. 286521).

286467); 3 specimens, 3.9–5.9 mm, Sand 10, HI-15-06, 13 Sep 2015, 70 m (BPBM Cat. No. 286499).

**Other material examined:** HAWAIIAN ISLANDS, **O‘ahu:** 1 specimen, 8.0 mm, Sand Island Pipe outfall area, offshore of Keehi small boat harbor, 21.277780, -157.900556, dredged from 70–120 m depth, 17 Mar 2012, H.J. Jackson and D.A. Polhemus (DAPC Cat. No. POL-SHL-2012-0002).

*Triphora tuberculata* (Pease, 1871)

(Fig. 20)

*Triphoris tuberculatus* Pease, 1871: 776.

*Triphora tuberculata* (Pease): Kay 1979: 150.

**Comments:** *Triphora tuberculata* was originally described from an unspecified locality on Kaua‘i (Pease 1871), and appears to be an uncommon element in the Hawaiian triphorid biota.

**Distribution:** Previously recorded in the literature from Kauai, O‘ahu and Hawai‘i islands (Pease 1871; Hemmes *et al.* 1997c). **New island record** provided herein for Maro Reef.

**Recorded depth range:** 7–60 m. Kay (1979) noted a depth range of 0–60 m for this species; Hemmes *et al.* (1997c) note that specimens had been taken at Puhi Bay, Hawai‘i island at 7–10 m depth; and Hemmes *in* Severns (2011) gave a depth range of 16–50 m, but without any specific island records.



**Fig. 21.** Specimen of *Viriola abbotti* (F. Baker & Spicer, 1935) from Maui, taken at 89 m depth (BPBM Cat. No. 286559).

**Fig. 22.** Specimen of *Euthymella bilix* (Hinds, 1843) from Lisianski Island, taken at 84 m depth (BPBM Cat. No. 286455).

**Material examined:** HAWAIIAN ISLANDS, Maro Reef: 1 specimen, 5.0 mm, Sand 5, HI-16-04, 29 May 2016, 45 m (BPBM Cat. No. 286521).

Genus *Viriola* Jousseaume, 1884

*Viriola abbotti* (F. Baker & Spicer, 1935)

(Fig. 21)

*Triphora abbotti* Baker & Spicer, 1935: 39.

*Viriola samoana* Cernohorsky, 1977: 130. Synonym, Marshall 1983: 48.

*Viriola abbotti* (Baker & Spicer): Kay 1979: 139.

**Comments:** *Viriola abbotti* was originally described from Ofu, Samoa (Baker & Spicer 1935), and has also been recorded from the Marquesas, Tuamotu and Society island groups in French Polynesia (Tröndlé & Boutet 2009, as *Euthymella bilix*), the Philippines (Poppe 2008) and Hawai'i (Kay 1979). *Viriola samoana* Cernohorsky, described from the Apolima Strait west of Upolu Island, Samoa (Cernohorsky 1977), is a synonym of this

species (Marshall 1983). Although common in the main Hawaiian Islands, this species was not recovered from any of the current mesophotic samples taken in the Northwestern Hawaiian Islands.

**Distribution:** Previously recorded in the literature from Hawai‘i, but without precise island localities. **New island records** are provided here for Hawai‘i, Maui, Moloka‘i and Ni‘ihau.

**Recorded depth range:** 0–88 m, based on literature and new records reported here. Kay (1979) noted that in the Hawaiian Islands this species was common in beach drift and at depths to 50 m. Hemmes *et al.* (1997b) stated that the species was found in shallow water, while Severns (2011) illustrated a specimen taken at 80 m. None of the above authors provided any specific island locality records. The new mesophotic collections from the main Hawaiian Islands now extend the known depth range in this archipelago to 88 m.

**Material examined:** HAWAIIAN ISLANDS, **Hawai‘i:** 1 specimen, 6.4 mm, Sand 19, HI-16-02, 12 Nov 2015, 67 m (BPBM Cat. No. 286575). **Maui:** 1 specimen, 8.2 mm, Sand 4, HI-16-02, 3 Nov 2015, 72 m (BPBM Cat. No. 286552); 1 specimen, 7.4 mm, Sand 7, HI-16-02, 5 Nov 2015, 88 m (BPBM Cat. No. 286559); 1 specimen, 7.2 mm, Sand 16, HI-16-02, 10 Nov 2015, 76 m (BPBM Cat. No. 286571). **Moloka‘i:** 1 specimen, 6.9 mm, Sand 1, HI-16-02, 2 Nov 2015, 61 m (BPBM Cat. No. 286549). **Ni‘ihau:** 1 specimen, 8.3 mm (missing protoconch), Sand 28, HI-15-06, 29 Sep 2015, 59 m (BPBM Cat. No. 286516).

**Other material examined:** HAWAIIAN ISLANDS, **O‘ahu:** 3 specimens, 6.8–8.5 mm, Hale‘iwa Trench, offshore of Hale‘iwa Ali‘i Beach Park, north wall, 21°35′38″N, 158°06′43″W, 3 Aug 2013, from sediment sample taken by SCUBA at 6–18 m, D.A. Polhemus (DAPC Cat. No. POL-SHL-2013-0001-L); 1 specimen, 6.8 mm, Hale‘iwa Trench, offshore of Hale‘iwa Ali‘i Beach Park, south wall, 21°35′38″N, 158°06′35″W, 3 Aug 2013, from sediment sample taken by SCUBA at 6–26 m, D.A. Polhemus (DAPC Cat. No. POL-SHL-2013-0002).

### *Viriola bayani* Jousseaume, 1884

*Viriola bayani* Jousseaume, 1884: 267.

**Comments:** This obligately mesophotic species was originally described from New Caledonia, and occurs from there northeastward to the Hawaiian Islands (Kay 1979).

**Distribution:** Previously recorded in Hawai‘i from O‘ahu at 150–200 m (Hemmes *et al.* 1997b). **New island or seamount records** provided herein for French Frigate Shoals, Maro Reef and Pioneer Bank.

**Recorded depth range:** 45–200 m, based on previous literature records and new collections reported here. In Hawai‘i, specimens have been taken in deep water dredge samples at depths of 60–200 m (Kay 1979; Hemmes *et al.* 1997b). The new records here also fall within this depth range, indicating that *V. bayani* is confined to the mesophotic zone.

**Material examined:** HAWAIIAN ISLANDS, **French Frigate Shoals:** 1 specimen, 9.3 mm, Sand 1, HI-15-06, 6 Sep 2015, 83 m (BPBM Cat. No. 286489). **Maro Reef:** 1 specimen, 13.3 mm (missing protoconch), Sand 5, HI-16-04, 29 May 2016, 45 m (BPBM Cat. No. 286522). **Pioneer Bank:** 1 specimen, 12.6 mm, Sand 25, HI-15-06, 24 Sep 2015, 80 m (BPBM Cat. No. 286513).

Genus *Euthymella* Thiele, 1929

*Euthymella bilix* (Hinds, 1843)  
(Fig. 22)

*Triphoris (Ino) bilix* Hinds, 1843: 185.

*Triphoris (Inella) bilix* (Hinds): Bayle 1879: 35. Subgenus *Ino* preoccupied by crustacean genus *Ino* Schrank, 1803.

*Viriola bilix* (Hinds): Kay 1979: 140.

*Euthymella bilix* (Hinds): Marshall 1983: 52.

*Viriola (Viriola) bilix* (Hinds): Higo *et al.* 1999: 204.

*Euthymella bilix* (Hinds): Poppe 2008a: 724.

**Comments:** This seems to be a relatively uncommon species in Hawaiian waters, occurring at both euphotic and mesophotic depths. It has been variously placed in the genera *Viriola* or *Euthymella* (see above), but the latter assignment is currently accepted.

**Distribution:** The type-series was dredged from 20 m in the Straits of Malacca (Albano *et al.* 2019), and the species is also recorded from the Society Islands in French Polynesia (Tröndle & Boutet 2009), and in the Hawaiian islands, from O‘ahu and Hawai‘i (Hemmes *et al.* 1997b). **New island record** provided herein for Lisianski.

**Recorded depth range:** 7–100 m., based on previously published literature records (Kay 1979; Hemmes *et al.* 1997b; Hemmes *in* Severns 2011). The one recently collected specimen from mesophotic depths in the Northwestern Hawaiian Islands comes from an intermediate point within this documented depth range.

**Material examined:** HAWAIIAN ISLANDS, **Lisianski:** 1 specimen, 9.0 mm, Sand 6, HI-14-05, 14 Sep 2014, 56 m (BPBM Cat. No. 286455).

Genus *Viriolopsis* B.A. Marshall, 1983

*Viriolopsis fallax* (Kay, 1979)  
(Figs. 23, 24)

*Viriola fallax* Kay, 1979: 140.

*Viriolopsis fallax:* Marshall 1983: 50.

**Comments:** *Viriolopsis fallax* is one of the most commonly encountered triphorids in Hawai‘i, ranging across both the euphotic and mesophotic depth zones. According to Hemmes *et al.* (1997b), there is a complex of cryptic species being held under this name, but no subsequent studies have as yet validated this hypothesis.

**Distribution:** Originally described from specimens taken at Miloli‘i, on Hawai‘i Island, at a depth of 10 m, *V. fallax* is a widespread species also recorded from Australia, the Solomon Islands, and the Mozambique Channel (Marshall 1983). **New island or seamount records** in the Hawaiian Islands are provided here for Maui, French Frigate Shoals, Laysan, Pioneer Bank, Lisianski, and Pearl and Hermes Atoll.

**Recorded depth range:** 0–88 m, based on previous literature records and new collections reported here. Kay (1979) gave a depth range of 0–60 m; Severns (2011) illustrated a specimen taken at 7 m in sediment; and Hemmes *et al.* (1997b) stated that the species was



**Figs. 23, 24.** Specimens of *Virioloopsis fallax* (Kay, 1979) taken from the Hawaiian Islands at mesophotic depths. **23.** Specimen from Laysan Island, taken at 64 m depth (BPBM Cat. No. 286539). **24.** Specimen dredged from O'ahu, near Sand Island Pipe, taken at 70–120 m depth.

found in shallow waters. None of the above authors, however, provided any specific island locality records within the Hawaiian Islands. The current collections from the mesophotic zone extend the lower limit of the depth range for this species.

**Material examined:** HAWAIIAN ISLANDS, **Mau:** 1 partial shell, Sand 13, HI-16-02, 9 Nov 2015, 52 m (BPBM Cat. No. 286565). **French Frigate Shoals:** 1 specimen, 3.1 mm, Sand 2, HI-14-05, 11 Sep 2014, 88 m (BPBM Cat. No. 286446); 1 specimen, 3.2 mm, Sand 3, HI-14-05, 12 Sep 2014, 81 m (BPBM Cat. No. 286447); 1 partial shell, Sand 4, HI-14-05, 12 Sep 2014, 64 m (BPBM Cat. No. 286448); 1 specimen, 5.1 mm, Sand 22, HI-14-05, 26 Sep 2014, 57 m (BPBM Cat. No. 286485); 1 specimen, 5.0 mm, Sand 23, HI-14-05, 27 Sep 2014, 61 m (BPBM Cat. No. 286488); 1 specimen, 3.7 mm, Sand 1, HI-15-06, 6 Sep 2015, 83 m (BPBM Cat. No. 286490); 1 specimen, 3.4 mm, Sand 19, HI-16-04, 11 Jun 2016, 79 m (BPBM Cat. No. 286540); 1 specimen, 3.0 mm, Sand 20, HI-16-04, 11 Jun 2016, 79 m (BPBM Cat. No. 286543). **Laysan:** 9 specimens, 3.2–4.1 mm, Sand 18, HI-16-04, 9 Jun 2016, 64 m (BPBM Cat. No. 286539). **Pioneer Bank:** 1 specimen, 5.5 mm, Sand 24, HI-15-06, 24 Sep 2015, 54 m (BPBM Cat. No. 286512). **Lisianski:** 2 specimens, 4.5–4.9 mm, Sand 8, HI-14-05, 16 Sep 2014, 73 m (BPBM Cat. No. 286462). **Pearl and Hermes Atoll:** 1 specimen, 3.1 mm, Sand 11, HI-14-05, 18 Sep 2014, 85 m (BPBM Cat. No. 286470).

**Other material examined:** HAWAIIAN ISLANDS, **O'ahu:** HAWAIIAN ISLANDS, **O'ahu:** 1 specimen, 4.5 mm, Sand Island Pipe outfall area, offshore of Ke'ehi small boat harbor, 21.277780, -157.900556, dredged from 70–120 m depth, 17 Mar 2012, H.J. Jackson and D.A. Polhemus (DAPC Cat. No. POL-SHL-2012-0003).

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**Appendix 1. Details of individual research cruises and associated micromollusk sampling sites reported in this paper.**

**Cruise HI-14-05**

French Frigate Shoals

- Sand 1* – 88 m depth, 11 Sep 2014, 23.63137, -166.18500, Hauk
- Sand 2* – 84 m depth, 11 Sep 2014, 23.63137, -166.18500, Wagner
- Sand 3* – 81 m depth, 12 Sep 2014, 23.77678, -166.38678, Hauk
- Sand 4* – 64 m depth, 12 Sep 2014, 23.66235, -166.29395, Wagner
- Sand 21* – 62 m depth, 24 Sep 2014, 23.85753, -165.63333, Hauk
- Sand 22* – 57 m depth, 24 Sep 2014, 23.85718, -166.36501, Wagner
- Sand 23* – 61 m depth, 27 Sep 2014, 23.63380, -166.17293, Hauk

Lisianski

- Sand 5* – 59 m depth, 14 Sep 2014, 26.03700, -173.79218, Leonard
- Sand 6* – 56 m depth, 14 Sep 2014, 26.11428, -173.85373, Hauk
- Sand 7* – 84 m depth, 15 Sep 2014, 25.92698, -173.05490, Hauk
- Sand 8* – 73 m depth, 16 Sep 2014, 25.92078, -174.03417, Hauk

Pearl & Hermes

- Sand 9* – 55 m depth, 17 Sep 2014, 27.78683, -175.85342, Hauk
- Sand 10* – 59 m depth, 17 Sep 2014, 27.78575, -175.75512, Wagner
- Sand 10a* – 85 m depth, 18 Sep 2014, 27.73977, -175.96153, Hauk
- Sand 11* – 65 m depth, 18 Sep 2014, 27.76233, -175.98395, Wagner
- Sand 15* – 64 m depth, 21 Sep 2014, 27.89973, -175.94963, Hauk
- Sand 16* – 85 m depth, 21 Sep 2014, 27.92140, -175.90828, Wagner
- Sand 17* – 85 m depth, 22 Sep 2014, 27.92207, -175.90708, Hauk
- Sand 18* – 69 m depth, 22 Sep 2014, 27.91805, -175.90692, Wagner
- Sand 19* – 90 m depth, 23 Sep 2014, 27.92218, -175.90703, Hauk
- Sand 20* – 69 m depth, 23 Sep 2014, 27.94000, -175.87908, Wagner

Midway

- Sand 12* – 59 m depth, 19 Sep 2014, 28.19813, -177.43547, Wagner
- Sand 13* – 65 m depth, 20 Sep 2014, 28.23552, -177.45007, Hauk
- Sand 14* – 55 m depth, 20 Sep 2014, 28.27648, -177.43187, Wagner

**Cruise HI-15-06**

French Frigate Shoals

- Sand 1* – 83 m depth, 6 Sep 2015, 23.61695, -166.10082, Wagner
- Sand 2* – 69 m depth, 7 Sep 2015, 23.65476, -166.29764, Wagner
- Sand 3* – 91 m depth, 7 Sep 2015, 23.73845, -166.38115, Kosaki & Leonard
- Sand 4* – 82 m depth, 8 Sep 2015, 23.72670, -166.35482, Wagner
- Sand 5* – 91 m depth, 8 Sep 2015, 23.83972, -166.38172, Kosaki & Hauk

Pioneer Bank

- Sand 6* – 84 m depth, 11 Sep 2015, 25.89528, -173.49687, Wagner
- Sand 7* – 88 m depth, 11 Sep 2015, 25.89913, -173.49757, Kosaki & Hauk
- Sand 8* – 79 m depth, 12 Sep 2015, 25.92928, -173.40385, Kosaki & Hauk
- Sand 22* – 90 m depth, 23 Sep 2015, 25.94243, -173.51053, Kosaki & Hauk
- Sand 23* – 89 m depth, 23 Sep 2015, 25.90612, -173.49920, Wagner

## Pioneer Bank (continued)

*Sand 24* – 54 m depth, 24 Sep 2015, 25.94282, -173.38303, Wagner

*Sand 25* – 80 m depth, 24 Sep 2015, 25.92913, -173.40412, Kosaki & Hauk

## Pearl &amp; Hermes

*Sand 9* – 59 m depth, 13 Sep 2015, 27.76117, -175.98240, Wagner

*Sand 10* – 59 m depth, 13 Sep 2015, 27.76407, -175.98592, Kosaki & Hauk

*Sand 11* – 59 m depth, 14 Sep 2015, 27.77240, -175.99337, Wagner

## Kure

*Sand 12* – 57 m depth, 15 Sep 2015, 28.37568, -178.31120, Wagner

*Sand 13* – 91 m depth, 15 Sep 2015, 28.42732, -178.41370, Kosaki & Hauk

*Sand 14* – 91 m depth, 16 Sep 2015, 28.44397, -178.41022, Kosaki & Hauk

*Sand 14a* – 52 m depth, 16 Sep 2015, 28.38443, -178.27962, Wagner

*Sand 15* – 90 m depth, 17 Sep 2015, 28.47905, -178.38895, Wagner

*Sand 16* – 91 m depth, 17 Sep 2015, 28.49628, -178.34633, Kosaki & Hauk

*Sand 20* – 87 m depth, 21 Sep 2015, 28.44342, -178.26172, Wagner

*Sand 21* – 88 m depth, 21 Sep 2015, 28.49007, -178.29113, Kosaki & Hauk

## Salmon Bank

*Sand 17* – 91 m depth, 18 Sep 2015, 26.87008, -176.49017, Kosaki & Hauk

*Sand 18* – 82 m depth, 18 Sep 2015, 26.99154, -176.44353, Wagner

## Midway

*Sand 19* – 84 m depth, 19 Sep 2015, 28.21883, -177.44893, Wagner

## Ni'ihau

*Sand 26* – 85 m depth, 28 Sep 2015, 21.96677, -160.19898, Wagner

*Sand 27* – 88 m depth, 29 Sep 2015, 21.96738, -159.80258, Kosaki & Hauk

*Sand 28* – 59 m depth, 29 Sep 2015, 21.99562, -160.13973, Wagner

**Cruise HI-16-02**

## Moloka'i

*Sand 1* – 61 m depth, 2 Nov 2015, 21.16475, -157.30217, Leonard

*Sand 2* – 61 m depth, 2 Nov 2015, 21.18140, -157.28750, Wagner

## Maui

*Sand 3* – 91 m depth, 3 Nov 2015, 20.93047, -156.76545, Leonard

*Sand 4* – 72 m depth, 3 Nov 2015, 20.94182, -156.75767, Wagner

*Sand 8* – 79 m depth, 5 Nov 2015, 20.77310, -156.60712, Wagner

*Sand 9* – 58 m depth, 6 Nov 2015, 20.88415, -156.72525, Leonard

*Sand 10* – 61 m depth, 6 Nov 2015, 20.86115, -156.72525, Wagner

*Sand 13* – 52 m depth, 9 Nov 2015, 20.83492, -156.74260, Wagner

*Sand 14* – 58 m depth, 9 Nov 2015, 20.82630, -156.72075, Leonard

*Sand 15* – 87 m depth, 10 Nov 2015, 20.70470, -156.50230, Wagner

*Sand 16* – 76 m depth, 10 Nov 2015, 20.72855, -156.51237, Leonard

## Lāna'i

*Sand 5* – 91 m depth, 4 Nov 2015, 20.78535, -156.73865, Leonard

*Sand 6* – 90 m depth, 4 Nov 2015, 20.78355, -156.74260, Wagner

*Sand 11* – 75 m depth, 8 Nov 2015, 20.80653, -156.72008, Wagner

*Sand 12* – 79 m depth, 8 Nov 2015, 20.80905, -156.74010, Leonard

## Hawaii

- Sand 17* – 83 m depth, 11 Nov 2015, 20.02505, -155.84335, Wagner  
*Sand 18* – 85 m depth, 12 Nov 2015, 19.91457, -155.92473, Wagner  
*Sand 19* – 67 m depth, 12 Nov 2015, 19.85550, -155.97640, Leonard  
*Sand 20* – 85 m depth, 13 Nov 2015, 19.65035, -155.03220, Wagner  
*Sand 21* – 70 m depth, 13 Nov 2015, 19.66267, -155.03262, Leonard

**Cruise HI-16-04**

## French Frigate Shoals

- Sand 1* – 85 m depth, 26 May 2016, 23.63535, -166.21478, Wagner  
*Sand 2* – 83 m depth, 26 May 2016, 23.63811, -166.23203, Hauk  
*Sand 19* – 79 m depth, 11 Jun 2016, 23.66585, -166.30076, Wagner  
*Sand 20* – 81 m depth, 11 Jun 2016, 23.66313, -166.29768, Hauk  
*Sand 21* – 82 m depth, 12 Jun 2016, 23.65851, -166.28051, Hauk  
*Sand 22* – 85 m depth, 12 Jun 2016, 23.65770, -166.27902, Wagner

## Maro

- Sand 3* – 100 m depth, 28 May 2016, 25.36684, -170.84508, Wagner  
*Sand 4* – 85 m depth, 28 May 2016, 25.36497, -170.82807, Leonard  
*Sand 5* – 45 m depth, 29 May 2016, 25.28045, -170.58697, Hansen  
*Sand 6* – 41 m depth, 29 May 2016, 25.28295, -170.59118, Wagner

## Pearl and Hermes

- Sand 7* – 70 m depth, 1 Jun 2016, 27.76402, -175.98612, Hansen  
*Sand 8* – 61 m depth, 1 Jun 2016, 27.76253, -175.98375, Wagner  
*Sand 14* – 93 m depth, 6 Jun 2016, 27.92216, -175.90884, Hauk  
*Sand 15* – 98 m depth, 6 Jun 2016, 27.90952, -175.93586, Wagner

## Midway

- Sand 9* – 94 m depth, 4 Jun 2016, 28.18634, -177.28607, Wagner

## Kure

- Sand 10* – 94 m depth, 4 Jun 2016, 28.48716, -178.37304, Leonard  
*Sand 11* – 91 m depth, 4 Jun 2016, 28.49211, -178.29160, Wagner  
*Sand 12* – 90 m depth, 5 Jun 2016, 28.49177, -178.28795, Wagner  
*Sand 13* – 90 m depth, 5 Jun 2016, 28.49845, -178.34171, Hauk

## Lisianski

- Sand 16* – 101 m depth, 7 Jun 2016, 25.95460, -174.10518, Wagner  
*Sand 17* – 96 m depth, 7 Jun 2016, 25.95322, -174.10398, Hauk

## Laysan

- Sand 18* – 64 m depth, 9 Jun 2016, 25.70987, -171.81070, Wagner

## Ni'ihau

- Sand 23* – 87 m depth, 14 Jun 2016, 21.97090, -160.18905, Wagner  
*Sand 24* – 91 m depth, 14 Jun 2016, 21.97173, -160.18438, Hansen