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# Hydroids (Cnidaria: Hydrozoa) from Guam and the Commonwealth of the Northern Marianas Islands (CNMI)

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**Abstract**—This report provides the first general account of the marine hydroids (Leptolida), excluding Milleporidae and Stylasteridae, of Guam and the Commonwealth of the Northern Marianas Islands (CNMI). The siphonophore *Physalia physalis* is also recorded from the region. Seventeen families and 43 species, a majority of them (80%) leptothecates, are listed in our preliminary assay of the fauna. Of these species, 42 are from Guam and 17 from the CNMI. Of those from the CNMI, 16 were collected from Saipan in the Southern Marianas Islands and one from Maug in the Northern Marianas Islands. The diversity of hydroids from this area, as currently known, is briefly compared with that of several oceanic island systems elsewhere that have been more thoroughly surveyed. From this comparison, we conclude that the shallow-water hydroid fauna of Guam and vicinity is still inadequately known and likely comprises 100 species or more. Reported distributions of species identified here were examined in order to judge whether they might be introduced to the study area. Select species found on artificial substrata in the harbor are evidence of a possible anthropogenic introduction, however, we believe the majority are long-term inhabitants of the study area. We base this on their widespread distribution and their capacity for long-range transport, especially by rafting on phoretic substrata. No endemics were represented.

## Introduction

Approximately 3200 species of hydrozoans are currently recognized worldwide (Schuchert 1998). Neritic hydroids of certain regions (e.g. Europe, South Africa, Russia, eastern North and South America, Japan, Australia, New

Zealand) are considered reasonably well known faunistically and taxonomically. However, the hydroid species composition of most small oceanic islands, with notable exceptions including Bermuda (Calder 1988, 1991, 1997, 2000), the Azores (Rees & White 1966, Cornelius 1992a), the Cape Verde Islands (Ritchie 1908, Medel & Vervoort 1998, 2000, Ansín et al. 2001), Fiji (Gibbons & Ryland 1989, Ryland & Gibbons 1991), the Seychelles (Jarvis 1922, Millard & Bouillon 1973, 1975, Bouillon 1974), and the Galápagos (Fraser 1938a, b, 1948, Calder et al. 2003, are inadequately characterized.

Belk & Hotaling (1971) recorded the freshwater hydrozoan *Craspedacusta sowerbyi* from the western Pacific island of Guam, but the hydroids of the island, and of the Northern Marianas Islands nearby, have not been studied. Objectives of this report are to provide a preliminary account of hydroid species encountered in recent surveys of marine invertebrates conducted primarily but not exclusively around Guam (Paulay et al. 1997, Amesbury et al. 2001, Paulay et al. 2001, Paulay et al. this volume). The known diversity is compared with that of more thoroughly studied islands noted above, and the status of species, whether indigenous, introduced, or cryptogenic, is discussed.

## Materials and Methods

Specimens were collected by snorkeling or SCUBA, mostly over the period from 1997-2000 (Figure 1). Materials were fixed in 10% formalin and preserved in 80% ethanol (except for *Solanderia secunda* and some older material that was occasionally dried after fixation). Vouchers have been deposited in collections of invertebrates at the Royal Ontario Museum (ROMIZ), at the University of Guam Marine Laboratory (UGI), and at the Florida Museum of Natural History (UF). Species of the families Milleporidae and Stylasteridae, although now recognized as athecate hydroids, have been included for convenience with the scleractinians (Randall 2003). The classification system and nomenclature adopted here largely follows Calder (1988, 1991, 1997) and Cairns et al. (2003). Collections were made by LK and identifications were done by DRC, unless noted otherwise. All photos are indicated by numbered records (three-digit film roll followed by one- or two-digit photo number), were taken by Gustav Paulay and can be viewed at the web site http://www.flmnh.ufl.edu:reefs and in the Marine Biodiversity of Guam CD copublication. Synonymies are listed under accepted nomenclature and split lots are noted as follows: catno./catno. (e.g. ROMIZ B3025/UF 48). Where possible, notes are included to aid in locating a given species on Guam and in differentiating it from similar taxa. Collection data for station locations are provided in the Appendix.

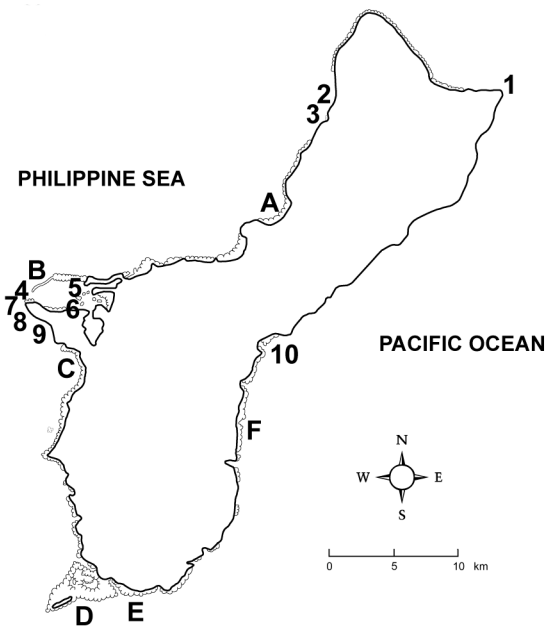


Figure 1. Map of Guam showing hydroid sampling stations. Main stations are numbered and explicitly noted in text (Stations 1-10 and see Appendix). Main stations were either visited multiple times or harbored ›2 species. Minor sampling locations are denoted by letters, are not explicitly noted in text and are as follows: A. Tumon Bay, B. Luminao fore reef, C. Agat Bay, D. Cocos fore reef, E. Fofos Islet, and F. Inarajan. These locales were visited only once and/or yielded ≤2 species.

## Hydroid Species from Guam and the CNMI

Order Anthoathecatae Cornelius, 1992b
Suborder Filifera Kühn, 1913
Family Cordylophoridae von Lendenfeld, 1885
*Corydendrium* van Beneden, 1844a
*Corydendrium parasiticum* (Linnaeus, 1767)

*Sertularia parasitica* Linnaeus, 1767:1315.

**Material examined:** GUAM: UF 179, Station 9a, 1-10 m; UF 125, Apra Harbor, on wreck Tokai Maru, common, 15-20 m, 21 Jan 1997, G. Paulay coll.; UF 126, Apra Harbor, wreck of Tokai Maru, abundant, 18-24 m, 28 Aug 1999, G. Paulay coll., photo: 651:8; UF 127, Station 6b, salmon-pink in life, yellow-beige when fixed. SAIPAN: ROMIZ B3150/UF 116, Tanapag Harbor, end of power barge "Impedance", 7-8 m, 22 Feb 1976, J. Doty coll.

**Distribution:** *Corydendrium parasiticum* is widespread in tropical and subtropical waters of the western and eastern Atlantic, the western and eastern Pacific, and Indian oceans. It seems probable that *Corydendrium parasiticum* was introduced to Guam long ago. It has been reported from other small oceanic

island systems such as the Galápagos in the Pacific, the Seychelles in the Indian Ocean, and Bermuda and the Cape Verde Islands in the Atlantic (Millard 1975, Calder 1988, Hirohito 1988, Calder et al. 2003). Linnaeus (1767) did not provide a specific type locality for the species ("Habitat in Oceano").

**Notes:** This species most commonly exhibits an affinity for artificial substrata in Guam, although it was sometimes found on natural substrata outside the harbor (e.g. Station 9/UF 179). *Corydendrium parasiticum* is a conspicuous species because its stems can be quite tall (≥5 cm) and colonies are often locally abundant when present.

*Turritopsis* McCrady, 1857
*Turritopsis nutricula* McCrady, 1857

*Oceania* (*Turritopsis*) *nutricula* McCrady, 1859:56, pl. 4, figs. 1-10, 12-15, 28A; pl. 5,figs. 11, 16-18; pl. 8, fig. 1.

**Material examined:** GUAM: ROMIZ B3026/UF 128, Station 4.

**Distribution:** *Turritopsis nutricula* is widespread in tropical, subtropical, and temperate waters of the western and eastern Atlantic, Indian Ocean, and western and eastern Pacific. The species has been reported from small oceanic islands including Hawaii and the Galápagos in the Pacific, the Seychelles in the Indian, and Bermuda in the Atlantic ocean (Millard & Bouillon 1973, Cooke 1977, Calder 1988, Hirohito 1988, Calder et al. 2003). The type locality is Charleston Harbor, South Carolina, USA.

**Notes.** This leptolid is known at present from a single location in the study area: a mooring buoy at the entrance to Apra Harbor. Hydroids from Guam were embedded in an algal/sponge matrix attached to an artificial substratum. This association with sponge substrata is consistent with many published accounts of *Turritopsis nutricula* elsewhere (e.g. Calder 1988).

Family Bougainvilliidae Lütken, 1850
*Silhouetta* Millard & Bouillon, 1973
*Silhouetta uvacarpa* Millard & Bouillon, 1973

*Silhouetta uvacarpa* Millard & Bouillon, 1973:25, figs. 3A-D; pls. 2, 3.

**Material examined:** GUAM: UF 108, Apra Harbor, Western Shoals, under coral overhang, 20 m, 7 May 1998.

**Distribution:** This is the first published record of *Silhouetta uvacarpa* from the Pacific. It has been reported previously from the North Atlantic at Bermuda and the Azores (Calder 1988, Cornelius, 1992a) and from the Indian Ocean (Millard & Bouillon 1973), and its distribution may be wider than reported. The type locality is the island of Silhouette in the Seychelles.

**Notes:** *Silhouetta uvacarpa* is known at Guam from a single specimen collected inside Apra Harbor. When observed *in situ*, *S. uvacarpa* somewhat resembles the solitary tubulariid *Ectopleura pacifica*. However, the two species

are easily distinguished microscopically because the tentacles are scattered on the hydranth in *S. uvacarpa* rather than being organized into aboral and oral whorls as in *E. pacifica*.

Family Eudendriidae L. Agassiz, 1862
*Eudendrium* Ehrenberg, 1834

**Notes:** Species of *Eudendrium* lacking gonophores and/or hydranths are generally difficult to reliably identify to species. Records of such specimens were not included in this account.

*Eudendrium racemosum* (Gmelin, 1791)

*Sertularia racemosa* Gmelin, 1791: 3854.

**Material examined:** GUAM: UF 52, S.W. Cocos Barrier reef, near small pass, 1 m, under rock, 19 Mar 2000, G. Paulay coll., photo 785:8; UF 111, Asan, War-in-the-Pacific Park, ~10 m, 18 Nov 1998, J. Starmer coll.; ROMIZ B3132/UF 112, Station 9a, 1-10 m; ROMIZ B3368/UF 171, Orote Peninsula, Dry Dump, 13º 25.37 N, 144º 38.4 E, 0-20 m, 16 Feb 2000; ROMIZ B3369/UF 158, Orote Peninsula, off new rock fall, 13º 25.13 N, 144º 38.51 E, ~30 m, exposed, 20 Jan 2000.

**Distribution:** *Eudendrium racemosum* occurs from the Iberian Peninsula in the eastern Atlantic, to the Seychelles in the Indian Ocean, to Japan and Australia in the western Pacific (Millard & Bouillon 1973, Hirohito 1988). The type locality of the species is the Mediterranean Sea, where it is reportedly common (Hirohito 1988).

**Notes:** This hydroid was found locally in both exposed and sheltered habitats. Hydranths of the species are often violet-blue in color, and are conspicuous because they appear relatively large in contrast with the slender stems. In nature, this species resembles small, fine, and sparsely branched colonies of *Pennaria disticha*.

Suborder Capitata Kühn, 1913
Family Porpitidae Goldfuss, 1818
*Porpita* Lamarck, 1801
*Porpita porpita* (Linnaeus, 1758)

*Medusa porpita* Linnaeus, 1758:659.

**Material examined:** GUAM: UF 63, Tumon beach, Nov 1994, G. Paulay coll.; Photo (only): 572:13, Inarajan, washed up near shore, dead, 12 Mar 1999, G. Paulay.

**Distribution:** *Porpita porpita* is a circumglobal, open ocean species and occurs in tropical and temperate seas (Calder 1988). The type locality is the Indian Ocean.

**Notes:** *Porpita porpita*, a pleustonic and presumably colonial anthoathecate, is sporadic in occurrence locally. At Guam it is usually found washed up in association with *Janthina*, *Physalia* and *Glaucus* on beaches along the east coast after strong winds or seas.

Family Tubulariidae Fleming, 1828
*Ectopleura* L. Agassiz, 1862
*Ectopleura pacifica* Thornely, 1900

*Ectopleura pacifica* Thornely, 1900:452, pl. 44, figs. 1, 1a.

**Material examined:** GUAM: ROMIZ B3031/UF 53, Station 4, photo: 512:20; UF 123, Station 5b [with pycnogonids]; UF 131, Station 5a.

**Distribution:** The known distribution of *Ectopleura pacifica* extends from the western Pacific (type locality: New Britain), including Japan (Hirohito 1988), into the Indian Ocean (Petersen 1990). Petersen (1990) referred material assigned to this species from Bermuda by Calder (1988) to a new species, *E. mayeri*.

**Notes:** This species is currently known from Guam only on artificial substrata (mooring buoys) within Apra Harbor. This might be taken in part as evidence that it has been recently introduced to the island. *Ectopleura pacifica* is a relatively small and delicate tubulariid (see notes on *S. uvacarpa* above), with a medusa stage having two opposite marginal tentacles.

Family Solanderiidae Marshall, 1892
*Solanderia* Duchassaing & Michelin, 1846
*Solanderia secunda* (Inaba, 1892)

*Dendrocoryne secunda* Inaba, 1892:98, figs. 111-113.

**Material examined:** GUAM: ROMIZ B3147/UGI 6608, Pati Point, under overhang, 10-15 m, 27 May 1997, J. Starmer coll., photo 407:19; UF 129, Orote Point, seaward slope, tan color, 42 m, 22 Feb 1969, R.H. Randall coll.; UF 104, Lace Coral Cave, with *Protaeolidiella* and egg masses, 4 Nov 1999, 13º 34.39 N, 144º 49.41 E, ~15 m, photos 815:11,12; UF 74, E. of Fofos Islet, fore reef, at edge of overhang, 30 m, 17 Feb 1995, G. Paulay coll.; UF 75, N.W. coast of Guam, Spring Lagoon, under overhang, 3-5 m, 7 Oct 1999. MAUG: UF 73, Maug I., W. side of Island, 30 m along steep vertical wall, 5 Jun 1992, T. Pitlik coll.

**Distribution:** *Solanderia secunda* is the most widespread species of its genus, ranging throughout the Indo-west Pacific and occurring from the Red Sea (Port of Sudan, Gulf of Eilat, Sinai Peninsula, and Dahlak Archipelago) to the Indian Ocean (Seychelles, La Réunion, Mozambique, Madagascar and Kenya) and throughout the Pacific Ocean (Sagami Bay and Bonin Islands (Japan), Ifalik Atoll (Caroline Islands, FSM), Bismarck Sea (Papua New Guinea), Philippines, Guam, Takapoto (French Polynesia) and Queensland (Australia)) (Hirohito 1988, Bouillon et al. 1992). The type locality is Japan.

**Notes:** This is the only species of the genus, recently revised and reduced in size from 13 to 6 described species (Bouillon et al. 1992), known thus far from Guam. Its colonies are tree-like, with a chitinous internal skeleton. Polyps of *Solanderia secunda* are club-shaped, with numerous capitate tentacles scattered over the surface. *Solanderia secunda* was observed in cryptic habitats, such as overhangs or in crevices on walls, from 3-30 m. In nature, this hydroid closely resembles the gorgonian *Ifalukella* (photo 407:14-18), also found on Guam. The two are distinguishable *in situ* by their modes of branching. *S. secunda* branches in one plane and *Ifalukella* tends to branch in more than one plane. The cryptic aeolid *Protaeolidiella* preys upon *S. secunda* in Guam, although it is often difficult to locate this nudibranch in the field (photo 815-12). It is easier to inspect colonies for their egg masses- fine white coils, found wrapped around distal branch tips (photo 815-11).

Family Pennariidae McCrady, 1859
*Pennaria* Goldfuss, 1820
*Pennaria disticha* Goldfuss, 1820

*Pennaria disticha* Goldfuss, 1820:89.

**Material examined:** GUAM: ROMIZ B3025/UF 117, Station 5a; UF 57, Station 4, photo: 513:34; UF 119, Apra Harbor, Station 5b; UF 121, Orote Peninsula, northern tip, in crevice, 3-6 m, 27 Feb 1998, G. Paulay coll.; UF 118, Apra Harbor, Inner Harbor mooring buoy, 3-5 m, 16 Sept 1998; UF 120, Agat, Rizal Beach, ~3 m, exposed, 18 Mar 1999, J. Starmer coll.; UF 122, Station 6a; UF 154, Agat reef flat, 0-1 m, 06 Jun 2001. SAIPAN: UF 162, Station 11.

**Distribution:** This familiar species is circumglobal in tropical and warm-temperate waters (Gibbons & Ryland 1989). It has been reported from many other small oceanic islands including the Seychelles, Fiji, Hawaii, the Galápagos, Bermuda, the Azores, the Cape Verdes, and the Fernando de Noronha Archipelago (Cooke 1977, Calder 1988, Gibbons & Ryland 1989, Cornelius 1992a, Migotto 1996, Calder et al. 2003). The type locality is the Gulf of Naples, Italy.

**Notes:** *Pennaria disticha*, found in many locales on Guam, is easy to identify in the field in part due to its large size. Cormoids resembling ostrich quills sometimes attain a height of up to 30 cm. The perisarc on the stems is dark and horny-looking. Branching is pinnate, and hydranths are large and white (appearing pinkish when gonophores are ripe). Given its ubiquitous distribution, general abundance, and ability to raft on floating objects, we suspect that it has long been a part of the biota of Guam and neighboring islands. However, it may well expand its range to some localities via human-facilitated dispersal. This is supported by our recent discovery of *P. disticha* on the bottom of a floating dry dock, the *Machinist*, towed to Guam from Hawaii in July 1999. This cnidarian is fed upon by the aeolid *Caloria indica* in some areas. To date, this association has

not been observed on Guam, although the nudibranch occurs there (Clay Carlson, pers. comm.).

*Pennaria wilsoni* Bale 1913

*Pennaria wilsoni* Bale 1913:116.

**Material examined:** GUAM: ROMIZ B3370/UF 177, Station 10c, on coral head.

**Distribution:** This species appears restricted to the western Pacific, having been reported only from Australia (type locality) and Fiji (Gibbons & Ryland 1989) thus far.

**Notes:** *Pennaria wilsoni* resembles *P. disticha* and has been sometimes considered conspecific with it. This species differs in colony form and in having a single distal whorl of capitate tentacles (Hirohito 1988).

Order Leptothecatae Cornelius, 1992b
Family Haleciidae Hincks, 1868
*Hydrodendron* Hincks, 1874
*Hydrodendron mirabile* (Hincks, 1866)

*Ophiodes mirabilis* Hincks, 1866:422, pl. 14, figs. 1-5.

**Material examined:** GUAM: UF 49, Station 10c, on algae (*Turbinaria* sp.).

**Distribution:** *Hydrodendron mirabile* is circumglobal in tropical and temperate waters, and has been reported from various oceanic islands including Bermuda, the Azores, and the Cape Verdes (Medel & Vervoort 2000, Calder 2000). The type locality is England.

**Notes:** Hydranths of *Hydrodendron mirabile* are a highly visible and striking blue color. This species, which may be confused with a small bryozoan also having bright blue zooids, is often found lining alpheid (*Alpheus deuteropus*) burrows on live coral colonies.

*Nemalecium* Bouillon, 1986
*Nemalecium lighti* (Hargitt, 1924)

*Halecium lighti* Hargitt, 1924:489, pl. 4, fig. 13.

**Material examined:** GUAM: ROMIZ 3360/UF 51, Outer Cocos Lagoon, west side, on rock, 15 m, 25 Jan 2000, V. Bonito coll. SAIPAN: UF 212, Station 12.

**Distribution:** *Nemalecium lighti* has been reported from the Indo-west Pacific (type locality: Port Galera Bay, Mindoro, Philippines) and from the warm western Atlantic from Bermuda to Brazil (Calder 1991, Migotto 1996).

**Notes:** This species, known from one record on Guam (ROMIZ 3360/UF 51), was common at Station 12 (UF 212) at Saipan. Remarkable and heavily

armed nematodactyls among the tentacles differentiate hydroids of this genus from morphologically similar species of the genus *Halecium*.

Family Plumulariidae McCrady 1859
*Dentitheca* Stechow, 1920
*Dentitheca habereri* (Stechow, 1909)

*Plumularia habereri* Stechow, 1909:77, pl. 6, fig. 4.

**Material examined:** GUAM: ROMIZ B3342/UF 65, Station 1.

**Distribution:** This large species occurs in waters of Japan (type locality: Sagami Bay), Indonesia (Hirohito 1995), Fiji (Ryland & Gibbons 1991) and the Atlantic (van Gemerden-Hoogeveen 1965, Colin 1978, Florez Gonzalez 1983, Bandel & Wedler 1987).

*Monotheca* Nutting, 1900
*Monotheca pulchella* (Bale, 1882)

*Plumularia pulchella* Bale, 1882:30, pl. 15, fig. 6.

**Material examined:** SAIPAN: ROMIZ B3019, Saipan, the Grotto outside wall, 15º 12' N, 145º 43' E, 10 m, 13 May 1998, M. Puglisi coll.

**Distribution:** *Monotheca pulchella* ranges from Australia (type locality), New Zealand, and Japan in the western Pacific westward to South Africa (western Cape to Natal), and on to the Vema Seamount in the southeast Atlantic (Millard 1975). This species is known in the study area only from Saipan at this time.

*Plumularia* Lamarck, 1816
*Plumularia spiralis* Billard, 1911

*Plumularia spiralis* Billard, 1911:69, fig. 12.

**Material examined:** GUAM: ROMIZ B3021/UF 132, Orote Peninsula, Blue Hole, on wall, 67 m, 5 Jun 1998, M. Puglisi coll.; UF 77, Station 9a, 30 m, G. Paulay coll.; UF 78, Luminao fore reef, in rubble, stubby growth form, 20 m, 17 Aug 1998; UF 80, Station 1; UF 79, Station 3, stubby growth form, 16 Aug 2000, V. Bonito coll.. SAIPAN: ROMIZ B3013/UF 76, Station 11; UF 211, Station 12.

**Distribution:** *Plumularia spiralis* is an Indo-west Pacific species, known from Indonesia (type locality), Korea, and Japan, and into the Indian Ocean as far west as the Seychelles (Millard & Bouillon 1973, Hirohito 1995).

**Notes:** Cormoids of this hydroid have a characteristic spiral growth form, as suggested by the specific name, with dark perisarc and fine branching. Stems may be quite delicate, and are elongate (10-15 cm) in populations from exposed habitats. Specimens exhibiting a stubbier growth form (stems ~3 cm) were collected from more cryptic habitats. This species was most frequently found on deep fore reefs exposed to strong currents.

*Plumularia strictocarpa* Pictet, 1893

*Plumularia strictocarpa* Pictet, 1893:55, pl. 3, figs. 47-49.

**Material examined:** GUAM: ROMIZ B3033/UF 46, Station 10b, under rock; ROMIZ B3346/UF 178, Station 10a, G. Paulay coll., 273:8; ROMIZ B3357/UF 149, Station 3, inshore of 13º 35.15, 144º 49.93,17 Jul 2000, G. Paulay coll.; UF 168, Orote Peninsula, 13º 25.57,144º 38.36, 15 Feb 2000. SAIPAN: UF 139, Saipan, Ladder Beach, exposed on coral spur and groove formation, 1-5 m, 22 May 2001.

**Distribution:** This small species is circumglobal in tropical and subtropical waters (Calder 1997, Calder et al. 2003), and its broad distribution includes a number of oceanic islands, including Seychelles, Fiji, Galapagos, Bermuda (Millard & Bouillon 1973, Ryland & Gibbons 1991, Calder 1997, Calder et al. 2003). The type locality is Ambon, Indonesia.

**Notes:** *Plumularia strictocarpa* is common on phoretic substrata in the open ocean, including floating seaweeds (Sargassaceae), plastics, and tarballs (Calder 1995, 1997).

Family Halopteridídae Millard, 1962

*Antennella* Allman, 1877

*Antennella secundaria* (Gmelin, 1791)

Sertularia secundaria Gmelin, 1791:3854.

**Material examined:** GUAM: ROMIZ B3348/UF 147, Orote Peninsula, northernmost tip, ~20 m, 10 Feb 2000, 13º 26.96 N 144º 37.15 E, G. Paulay coll.; ROMIZ B3133, Station 9a, 1-10 m, G. Paulay coll.; ROMIZ B3353/UF 71, Station 7.

**Distribution:** *Antennella secundaria* is circumglobal in tropical and subtropical waters, often populating remote oceanic islands, such as Fiji, French Polynesia, Bermuda, Seychelles (Millard & Bouillon 1973, Vervoort & Vasseur 1977, Ryland & Gibbons 1991, Calder 1997). The type locality is the Mediterranean Sea.

*Halopteris* Allman, 1877

*Halopteris plagiocampa* (Pictet, 1893)

*Plumularia plagiocampa* Pictet, 1893:56, pl. 3, fig. 50.

**Material examined:** GUAM: ROMIZ B3130, Station 9a, 20 m; ROMIZ B3363/UF 61, Bile Bay, off shore, 0.5 km, ~25 m, 23 Apr 1999, G. Paulay coll. photo: 581:8.

**Distribution:** According to Schuchert (1997), the known distribution of this species is limited to the western Pacific (Indonesia and Japan). The type locality is Ambon, Indonesia.

*Halopteris polymorpha* (Billard, 1913)

*Plumularia polymorpha* Billard, 1913:24, figs. 14, 15.

**Material examined:** GUAM: ROMIZ B3023/UF 132, Orote Peninsula, Blue Hole, on wall, 67 m, 5 Jun 1998, M. Puglisi coll.; ROMIZ B3030/UF 59, Station 4, photo: 522:12,13; ROMIZ B3354/UF 68, Station 7, photo: 763:35,36; UF 109, Spring Lagoon, under overhangs, ~5 m, 7 Oct 1999; UF 110, Station 4.

**Distribution:** This species is reported from the Indo-west Pacific from South Africa and the Seychelles eastward to Indonesia and French Polynesia. It is also known from Brazil in the East Atlantic (Schuchert 1997). The type locality is Borneo, Indonesia.

**Notes:** *Halopteris polymorpha* is found inside and outside Apra Harbor, on both artificial and natural substrata. It is the common small, delicate, translucent-white, "fern-like" plumularioid encountered on the fore reefs of Guam. Cormoids are ~3 cm in height or less. *Halopteris polymorpha* belongs to a group of species in the genus having alternate branches (hydrocladia), and is thus immediately distinguishable from *H. plagiocampa* and related species having opposite branches (Schuchert 1997).

Family Aglaopheniidae Marktanner-Turneretscher, 1890

*Gymnangium* Hincks, 1874

*Gymnangium eximium* (Allman, 1874)

*Taxella eximia* Allman, 1874:179.

**Material examined:** GUAM: ROMIZ B3141, Asan, off War-in-the-Pacific Park fore reef, 13º 28 N 144º 33 E, ~10 m, 18 Nov 1998, J. Starmer coll.

**Distribution:** *Gymnangium eximium* occurs from the Red Sea and Indian Ocean (type locality: Sri Lanka) eastward to the western Pacific as far as French Polynesia and Fiji (Ryland & Gibbons 1991).

**Notes:** This species most closely resembles its congener *G. hians*, but differs in having stems that are branched rather than unbranched.

*Gymnangium gracilicaule* (Jäderholm, 1903)

*Lytocarpus gracilicaulis* Jäderholm, 1903:299, pl. 14, figs 3, 4.

**Material examined:** GUAM: ROMIZ 3367, Station 3, 13º35.82, 144º 49.84, 27 Jun 2000.

**Distribution:** The known distribution of *Gymnangium gracilicaule* extends from east Africa, the Red Sea, and western Australia in the Indian Ocean to the western Pacific, including Japan and Indonesia (Millard 1975, Rees & Vervoort 1987, Hirohito 1995, Watson 1997). Its type locality is the China Sea.

*Gymnangium hians* (Busk, 1852)

*Plumularia hians* Busk, 1852:396.

**Material examined:** GUAM: UF 55, Station 8, photo: 768:6; UF 64, Station 1; UF 67, S. of Pati Pt., fore reef, under slight overhang, exposed area, 4-8 m, 27 May 1997, G. Paulay coll., photo: 406:36; UF 70, Station 7; Photo only: Station 7, 763:32 (dark morph) SAIPAN: ROMIZ B3014, Station 11.

**Distribution:** *Gymnangium hians* is an Indo-west Pacific species, occurring from the Red Sea and east Africa eastwards to Hawaii (Millard 1975) and including other oceanic island systems, e.g. the Seychelles, French Polynesia, Fiji (Millard & Bouillon 1973, Vervoort & Vasseur 1977, Ryland & Gibbons 1991). Records from the Caribbean are believed to be incorrect. The type locality is the Torres Strait.

**Notes:** This conspicuous leptothecate is locally abundant within the study area in high energy environments. It most commonly resembles a "golden" quill, approximately 2 -7 cm in height, with a single, erect stem. A rare darker morphotype has also been found (Station 7, photo: 763:32). When present, gonothecae are conspicuous, paired, white-pink globular structures, located solely along the stem.

*Lytocarpia* Kirchenpauer, 1872
*Lytocarpia brevirostris* (Busk, 1852)

Plumularia brevirostris Busk, 1852:397.

**Material examined:** GUAM: ROMIZ 3356, Station 3, inshore of 13º 35.15, 144º 49.93, 18 Jul 2000, G. Paulay coll.; ROMIZ 3366/UF 45, Station 8, photo: 768:5; UF 176, Orote Peninsula, in overhang, cave/crevice, 10-20 m, 1 May 2000; UF 182, Station 3, 13º 58' N, 144º 83' E, 16 Aug 2000, V. Bonito; UF 183, Orote Peninsula, in crevice, 3 m, 07 June 2000. SAIPAN: ROMIZ B3020, the Grotto outside wall, 15º 12' N, 145º 43' E, 10 m, 13 May 1998, M. Puglisi coll.

**Distribution:** This species has been discovered at locations from South Africa to Australia (type locality) and Indonesia, and eastwards to Fiji (Millard 1975, Ryland & Gibbons 1991).

**Notes:** Colonies of *Lytocarpia brevirostris* superficially resemble those of certain species of *Gymnangium*, appearing like a small golden quill with a monosiphonic stem (in young colonies) and alternating hydrocladia. However, gonophores are protected by globular corbulae instead of being naked.

*Macrorhynchia* Kirchenpauer, 1872
*Macrorhynchia filamentosa* (Lamarck, 1816)

Plumularia filamentosa Lamarck, 1816:128.

**Material examined:** GUAM: ROMIZ B3351/UF 170, Station 7.

**Distribution:** The known range of *Macrorhynchia filamentosa* extends from South Africa westwards to Vema Seamount in the southeast Atlantic (Millard 1966), and eastwards to Australia, the type locality (Millard 1975).

### *Macrorhynchia philippina* Kirchenpauer, 1872

*Macrorhynchia philippina* Kirchenpauer, 1872:19.

**Material examined:** GUAM: ROMIZ B3128, south of Pati Point, fore reef under overhang, 15-20 m, 27 May 1997, G. Paulay coll.; ROMIZ B3340/UF 175, Station 1; UF 156, Talofofo Bay, fore reef, 15 m, 22 Jun 2001, R. Ritson-Williams coll.. SAIPAN: UF 210, Station 12.

**Distribution:** *Macrorhynchia philippina* has a circumglobal distribution and is often abundant in tropical, subtropical, and warm-temperate waters (Calder 1997). A shallow neritic species for the most part, it has been reported from a number of oceanic islands including Seychelles, Philippines, Fiji, Hawaii, Galápagos, Bermuda (Millard & Bouillon 1973, Ryland & Gibbons 1991, Calder 1997, Hoover 1998, Calder et al. 2003) in lower latitudes worldwide. As implied by its specific name, the type locality is the Philippines.

**Notes:** This is a distinctive species when alive, as noted by others (Gibbons & Ryland 1989), due to the vividly contrasting color pattern of a dark stem and strikingly white hydrocladia. Colonies are also relatively large (up to ~10 cm), thick, and feathery, and branches are droopy. By these characters, *Macrorhynchia philippina* is easily distinguished from *M. phoenicea*, the only other conspicuous large aglaopheniid reported thus far from high-energy habitats around Guam.

### *Macrorhynchia phoenicea* (Busk, 1852)

*Plumularia phoenicea* Busk, 1852:398.

**Material examined:** GUAM: ROMIZ B3131/UF 56, Station 9a, 20 m; ROMIZ B3341, Station 7; UF 66, Station 1. SAIPAN: ROMIZ B3017/UF 105, Station 11.

**Distribution:** *Macrorhynchia phoenicea* is an Indo-west Pacific species, ranging from South Africa eastwards as far as Hawaii (Hirohito 1995). The Torres Strait, Australia, is the type locality of the species (Millard 1975).

**Notes:** Colonies are large and conspicuous, with stems that are often extremely tall (~30 cm). Although encountered infrequently, it is locally abundant in certain high-energy environments (e.g. Pati Point). Colonies are usually profusely branched and dark to light red-brown in color. Gonophores are conspicuous when present. *Macrorhynchia phoenicea* resembles a large flattened feather, and with *M. philippina* are the two largest aglaopheniids known from Guam.

## Family Lafoeidae A. Agassiz, 1865

### *Zygophylax* Quelch, 1885

### *Zygophylax antipathes* (Lamarck, 1816)

*Sertularia antipathes* Lamarck, 1816:115.

**Material examined:** GUAM: ROMIZ 3343/UF 164, off Cocos west side, 13º 25 N, 144º 64 E, dredged, 128-165 m, 31 Jan 2000, G. Paulay coll.; UF 146, off Agat Marina, 13º 38 N, 144º 64 E, dredged, 91 m, 31 Jan 2000, G. Paulay coll.

**Distribution:** *Zygophylax antipathes* is believed, with some question, to range from southern Africa and the Seychelles eastward to Indonesia (Millard, 1975). The type locality, according to Lamarck (1816), is "…les mers australes ou de la Nouvelle-Hollande".

**Notes:** *Zygophylax antipathes* was collected via dredging in Guam, consistent with published bathymetric data (6-110 m, Millard 1975).

### *Zygophylax rufa* (Bale, 1884)

*Campanularia rufa* Bale, 1884:54, pl. 1, fig. 1.

**Material examined:** GUAM: UF 157, Orote Peninsula, 13º 25.57 N, 144º 38.36 E, 1-9 m, 15 Feb 2000; UF 160, Station 3, 13º 34.98 N, 144º 49.85 E, 16 Aug 2000, V. Bonito coll.; ROMIZ B3350/UF 161, Station 3, 13º35.15 N, 144º 49.93 E, 17 Jul 2000, G. Paulay coll.; Photo only: Orote Peninsula, in cave, 2-8 m, 22 Nov 1999, photo: 734:25. SAIPAN: ROMIZ B3149, in Grotto on walls, 7-8 m, 22 Feb 1976, J. Doty coll; UF 107, in Grotto on walls, 3-13 m, 20 Nov 1998, J. Starmer coll.

**Distribution:** *Zygophylax rufa* is known only from the western Pacific. Records extend from Australia (type locality: Holburn Island) to French Polynesia (Vervoort & Vasseur 1977), and include Fiji (Gibbons & Ryland 1989).

**Notes:** This species is known locally from protected habitats (e.g., caves and crevices) and is often abundant in these environments. Stems are usually not more than ~4 cm in height. Cormoids are of a distinctive dark brown/mahogany-red coloration, as noted by others (Ryland & Gibbons 1991), hence its specific name. This species has alternate branches, and the translucent-white hydranths are visible *in situ*.

## Family Campanulariidae Johnston, 1836

### *Clytia* Lamouroux, 1812

### *Clytia hemisphaerica* (Linnaeus, 1767)

*Medusa hemisphaerica* Linnaeus, 1767:1098.

**Material examined:** GUAM: UF 43, 81, Station 5b.

**Distribution:** This species has been reported circumglobally in tropical, subtropical, and temperate waters (Calder 1991), including those around small oceanic islands (e.g. Fiji, Hawaii, Galápagos, Bermuda, Azores, Seychelles) (Millard & Bouillon 1973, Cooke 1977, Gibbons & Ryland 1989, Calder 1991, Cornelius 1992a, Calder et al. 2003). The type locality is the coast of Belgium.

**Notes:** Hydroids assigned to the genus *Clytia*, and the status of species such as *C. hemisphaerica* and *C. gracilis*, are in need of taxonomic revision. It seems likely that more than a single species is represented in materials dealt with under both of these names.

### *Clytia latitheca* Millard & Bouillon, 1973

*Clytia latitheca* Millard & Bouillon, 1973:55, figs. 7H-L.

**Material examined:** GUAM: ROMIZ B3365/UF 82, Apra Harbor, Inner Harbor mooring buoy, 3-5 m, 16 Sep 1998; ROMIZ B3364/UF 48, Station 9a, 1-10 m.

**Distribution:** *Clytia latitheca* was described less than three decades ago from the Seychelles, and has been reported infrequently. Nevertheless, its range appears to be wider than generally recognized. It has been identified from the Atlantic in the Bermuda region (Calder 1993). Hydroids identified as *Obelia serrulata* (Bale 1888) from New Britain by Thornely (1900) are also believed to be this species.

### *Clytia linearis* (Thornely, 1900)

*Obelia linearis* Thornely, 1900:453, pl. 44, fig. 6.

**Material examined:** GUAM: ROMIZ B3027/UF 60, Station 4, on dead bivalve shells; UF 152, Apra Harbor, 1-2 m, on mooring buoy, on calcareous substratum (*Plicatula* sp. valves), 11 Jun 1998; ROMIZ B3024/UF 131, Station 5a; ROMIZ B3361/UF 58, Apra Harbor, on mooring buoy, 1-3 m, 25 Nov. 1998; ROMIZ B3362/UF 44, Station 9b, G. Paulay coll., photo: 653-28.

**Distribution:** *Clytia linearis* is circumglobal in tropical and subtropical waters (Calder 1991), and its reported range includes a number of small oceanic islands (Fiji, Galápagos, Bermuda, Cape Verde Islands) (Gibbons & Ryland 1989, Calder 1991, Medel & Vervoort 2000, Calder et al. 2003). The type locality is New Britain, Papua New Guinea.

**Notes:** *Clytia linearis* was found during this study primarily in Apra Harbor, often indirectly associated with artificial substrata (e.g. growing on dead bivalve shells that were attached to mooring buoys). The hydroid also grows in bushy colonies on the calcareous alga *Halimeda*, with stems sometimes reaching 5 cm in height. The record from the dry dock *Machinist* suggests that the species may sometimes be dispersed via human-mediated transport. Nevertheless, the record from Orote Peninsula indicates that it has likely been a long-time resident of Guam.

### *Clytia noliformis* (McCrady, 1859)

*Campanularia noliformis* McCrady, 1859:194, pl. 11, fig. 4.

**Material examined:** GUAM: UF 54, Station 4, on artificial substratum.

**Distribution:** *Clytia noliformis* is known from tropical and subtropical waters of the western and eastern Atlantic Ocean, Indian Ocean, and eastern Pacific Ocean (Calder 1991). This is the first report of the species in the western Pacific. The type locality of *C. noliformis* McCrady, 1859 is Charleston Harbor, South Carolina, but that of the proposed neotype of the species is Castle Harbor, Bermuda (Lindner & Calder 2000).

*Obelia* Péron & Lesueur, 1810
*Obelia bidentata* Clark, 1875

*Obelia bidentata* Clark, 1875:58, pl. 9, fig. 2.

**Material examined:** GUAM: ROMIZ B3024/UF 131, Station 5a.

**Distribution:** This species is distributed circumglobally in tropical, subtropical, and temperate waters (Calder 1991), and is often reported from oceanic islands (e.g. Seychelles, New Britain, Fiji, Hawaii, Bermuda, Azores, and the Cape Verde Islands) (Millard & Bouillon 1973, Gibbons & Ryland 1989, Cornelius 1992a, Medel & Vervoort 2000). The type locality is Long Island, New York.

*Obelia dichotoma* (Linnaeus, 1758)

*Sertularia dichotoma* Linnaeus, 1758:812.

**Material examined:** GUAM: UF 163, Station 6a.

**Distribution:** *Obelia dichotoma* is reportedly widespread in tropical and temperate waters of the Atlantic, Pacific, and Indian oceans (Calder 1991, Hirohito 1995). The type locality is England.

**Notes:** As with *Clytia*, taxonomic revision of the nominal species of *Obelia*, including *O. bidentata* and especially *O. dichotoma*, is warranted.

Family Thyroscyphidae Stechow, 1920
*Thyroscyphus* Allman, 1877
*Thyroscyphus fruticosus* (Esper, 1793)

*Spongia fruticosa* Esper, 1793:188.

**Material examined:** GUAM: ROMIZ B3032/UF 93, Apra Harbor, Sasa Bay, mooring chain, 13º 27' N, 144º 38' E, 0-4 m, 4 Aug 1998; UF 72, Apra Harbor, Inner Harbor, on wharf wall, adjacent to the dry dock *Machinist*, ~1 m, 22 Sep 1999; UF 90, S. of Ritidian Point, outer reef slope, under overhang, in rubbly environment, 30-35 m, 7 May 1999; UF 47, N.W. coast of Guam, Spring Lagoon, under overhang, 3-5 m, 7 Oct 1999. SAIPAN: ROMIZ B3016/UF 91, Station 11; UF 94, Tanapeg Harbor, west side of Baker dock, 22 Feb 1976, J. Doty coll.

**Distribution:** *Thyroscyphus fruticosus* has been recorded from the Mediterranean eastward through the Indo-west Pacific region as far as Fiji

(Millard 1975, Gibbons & Ryland 1989). The type locality is in the Indian Ocean.

**Notes:** This is one of the most conspicuous hydroids around Guam because of its abundance, especially within Apra harbor, and its relatively large size (often up to 7 cm high). Colonies were collected from areas outside the harbor as well, however, and from both artificial and natural substrata, suggesting a long-established population. Colonies are yellow and "bushy" with cone-shaped, smooth hydrothecae.

Family Syntheciidae Marktanner-Turneretscher, 1890
*Synthecium* Allman, 1872
*Synthecium samuense* Billard, 1925b

*Synthecium samuense* Billard, 1925b:132, figs. 7A-E, pl. 7, fig. 3.

**Material examined:** GUAM: UF 95, Station 9a, 20 m; UF 96, Luminao fore reef, in rubble, 20 m, 17 Aug 1998.

**Distribution:** *Synthecium samuense* is known only from the western Pacific, including Indonesia (type locality: Semau Island, Timor), New Caledonia, Fiji, and French Polynesia (Vervoort & Vasseur 1977, Gibbons & Ryland 1989).

**Notes:** Stems of this species are small (<4 cm) and sparse. This species, like others of the genus, have hydrothecae that are opposite to subopposite, with entire margins. The species is well described by Vervoort & Vasseur (1977) and Gibbons & Ryland (1989).

Family Sertulariidae Lamouroux, 1812
*Dynamena* Lamouroux, 1812
*Dynamena disticha* (Bosc, 1802)

*Sertularia disticha* Bosc, 1802:101, pl. 29, fig. 2.

**Material examined:** GUAM: ROMIZ B3022/UF 132, Orote Peninsula, Blue Hole, on wall, 67 m, 5 Jun 1998, M. Puglisi coll.

**Distribution:** *Dynamena disticha* is circumglobal in tropical, subtropical, and temperate waters (Calder 1988). Originally described from pelagic *Sargassum* in the North Atlantic Ocean, it has been reported from oceanic islands including Fiji, Hawaii, Galápagos, Bermuda, Seychelles, Azores, Canary Islands, Cape Verde Islands and Fernando de Noronha (Millard & Bouillon 1973, Cooke 1977, Gibbons & Ryland 1989, Calder 1991, Migotto 1996, Medel & Vervoort 1998, Calder et al. 2003).

*Dynamena moluccana* (Pictet, 1893)

*Sertularia moluccana* Pictet, 1893:50, pl. 2, figs. 42, 43.

**Material examined:** GUAM: ROMIZ B3028/UF 100, Station 5a; UF 97, Apra Harbour, on sunken barge, 0-2 m, 14 Apr 1998; UF 99, Cocos Island, outer

wall, 15 m, 24 Apr 1998; UF 103, S.E. Cocos Islet, fore-reef, yellowish in life, on large *Rumphella* sp. colony, 27 m, 28 Oct 1995, G. Paulay coll.; UF 151, Station 8; UF 102, Station 9a, 20 m; UF 101, Station 9b, 10-13 m, G. Paulay coll., photo: 653:29; UF 150, Orote Peninsula, 13º 25.13 N, 144º 38.51 E, 30 m, exposed, 20 Jan 2000; UF 98, Station 1; UF 148, Cocos Island, fore reef, under overhang, 25 m, 14 Jun 2001. SAIPAN: ROMIZ B3015, Station 11; UF 167, Station 12.

**Distribution:** *Dynamena moluccana* has been reported as such only from the type locality of Ambon, Indonesia (see Calder 1991).

**Notes:** This species was conspicuous in waters around Guam and Saipan because of its abundance. *Dynamena moluccana* is easily recognizable in having stems that are often large and yellowish with opposite, "drooping" branches. We believe that some records (e.g. Millard 1975 from Port Elizabeth, South Africa to Inhaca, Mozambique and Gibbons & Ryland 1989 from Fiji) of *Dynamena cornicina* may be based on this species. Thus, it seems likely that *D. moluccana* is more widely distributed than records indicate.

### *Sertularella* Gray, 1848
### *Sertularella diaphana delicata* Billard, 1919

*Sertularella delicata* Billard, 1919: 21, fig. IIIA.

**Material examined:** GUAM: UF 174, Station 9a, 20 m; ROMIZ B3352/UF 172, Station 7, photo: 763:31; ROMIZ B3349/UF 166, Orote Peninsula, northwest tip, 13º 26.96 N, 144º 37.15 E, 10-20 m, 10 Feb 2000, G. Paulay coll. SAIPAN: UF 136, Ladder Beach, exposed on coral spur and groove formation, 1-5 m, 22 May 2001; UF 215, Station 12.

**Distribution:** Although *Sertularella diaphana* is circumtropical in distribution, the subspecies reported here is known only from the western Pacific, having been originally described from Borneo (Billard 1919). It was later reported from Fiji by Gibbons & Ryland (1989), as a variety of *S. diaphana*, and from Australia by Watson (2000), as *S. diaphana*, in part.

**Notes:** We recognize this subspecies as valid, but note that Calder (1991), Vervoort (1993), and Watson (2000) included it as fully synonymous with *S. diaphana*. This hydroid is fed upon in some areas by the aeolid nudibranch *Cuthona sibogae* (C. Carlson pers. comm.), however, it is presently unknown from the study area (C. Carlson and P. J. Hoff, this volume).

### *Tridentata* Stechow, 1920
### *Tridentata borneensis* (Billard, 1925a)

*Sertularia borneensis* Billard, 1925a:649, fig. ID.

**Material examined:** GUAM: ROMIZ B3029/UF 42, 85, Station 4.

**Distribution:** *Tridentata borneensis* was originally described by Billard (1925a) from Indonesia. Gibbons & Ryland (1989) listed the species (as

*Sertularia borneensis*) from Fiji, and inferred from their synonymy of the species that it was also present in the Philippines, Great Barrier Reef, Marshall Islands, and French Polynesia.

**Notes:** This species was very abundant at Station 4, with extensive hydrorhizal "lattices" that were most conspicuous on *Halimeda*. Rigid, linear colonies, with upright cormoids perpendicular to the substratum and usually not more than ~ 3 cm in height, characterize the growth form. The synonymy of *Tridentata borneensis* was discussed briefly in Calder (1991).

### *Tridentata distans* (Lamouroux, 1816)

*Dynamena distans* Lamouroux, 1816:180, pl. 5, figs. 1a,B.

**Material examined:** GUAM: ROMIZ B3345/UF 130, Station 2.

**Distribution:** This ubiquitous species is circumglobal in tropical and temperate waters (Calder 1991). Among other oceanic islands, it has been reported from Hawaii, the Galápagos, Bermuda, the Azores, Madeira, the Canary Islands, the Cape Verdes, and the Fernando de Noronha Archipelago (Cooke 1977, Calder 1991, Migotto et al. 1992, Cornelius 1992a, Medel & Vervoort 1998, Calder et al. 2003), among others. The type locality is the open Atlantic Ocean, on *Sargassum* and other flotsam (Lamouroux 1816).

### *Tridentata malayensis* (Billard, 1925a)

*Sertularia malayensis* Billard, 1925a:649, fig. IE.

**Material examined:** GUAM: UF 130, Station 2. SAIPAN: ROMIZ B3018, the Grotto outside wall, 15º 12' N, 145º 43' E, 10 m, 13 May 1998, M. Puglisi coll.

**Distribution:** *Tridentata malayensis* is known so far only from the western Pacific, with records from Indonesia (type locality), Japan (Hirohito 1995), French Polynesia (Vervoort & Vasseur 1977), and Fiji (Gibbons & Ryland 1989).

### *Tridentata turbinata* (Lamouroux, 1816)

*Dynamena turbinata* Lamouroux, 1816:180.

**Material examined:** GUAM: UF 86, Luminao fore reef, under and on rubble, 5 m, 20 Oct 1998, UF 88, Luminao fore reef, under and on rock/rubble, 20 m, 17 Aug 1998; ROMIZ B3344/UF 89, Piti, Tepungan Channel, on rubble, 2 m, 4 Nov 1998; UF 130, Station 2; ROMIZ B3355/UF 69, Station 7. SAIPAN: UF 137, Ladder Beach, exposed on coral spur and groove formation, 1-5 m, 22 May 2001.

**Distribution:** *Tridentata turbinata* is a widely distributed species in tropical and subtropical waters of the western and eastern Atlantic, Indian Ocean, and western and eastern Pacific (Calder 1991). The type locality was listed as

"Australasie" (Lamouroux 1816). Other oceanic islands where it has been found include Fiji, French Polynesia, Galápagos, Bermuda, Canary Islands and Seychelles (Millard & Bouillon 1973, Vervoort & Vasseur 1977, Gibbons & Ryland 1989, Calder 1991, Medel & Vervoort 1998, Calder et al. 2003).

**Notes:** Colonies of *Tridentata turbinata* from Guam had unusually tall cormoids, attaining lengths of ~10 cm.

Suborder Filifera
Family Pandeidae Haeckel, 1879
*Timoides* Bigelow, 1904
*Timoides agassizii* Bigelow, 1904

*Timoides agassizii* Bigelow, 1904:254, pl. 3, figs. 10, 11.

**Material examined:** GUAM: UF 370, Apra Harbor, over Western Shoals, 1 m, Aug 2000, Y. & K. Paulay, photo: 840:1

**Distribution:** *Timoides agassizii* is Indo-west Pacific in distribution. The type locality is the Maldive Islands.

**Notes:** This medusa was identified by Lisa-ann Gershwin during an examination of cubozoan and scyphozoan medusae from the study area.

Order Siphonophora
Family Physaliidae Brandt, 1835
*Physalia* Lamarck, 1801
*Physalia physalis* (Linnaeus, 1758)

*Holothuria physalis* Linnaeus, 1758:657.

**Material examined:** GUAM: UF 62, Pago Bay, stranded on shore near University of Guam Marine Lab., R.W. Hetzel, 8 Aug 1970. The photo was provided by Rob Myers (RFM-94).

**Distribution:** This most familiar of all siphonophore species is supposedly circumglobal in warm oceans (Totton 1960).

**Notes:** Although not a hydroid, this species was included as part of this report. Along with *Porpita porpita*, *Physalia physalis* is a pleustonic hydrozoan that washes up on the east coast of Guam after strong winds or seas in association with *Janthina*, *Porpita*, and *Glaucus*. It is more common than *P. porpita* and strands in greater numbers on Guam. There is some question whether Indo-Pacific populations of this siphonophore should be assigned to a different species.

## Discussion

Seventeen families and 43 species, a majority of them (80%) leptothecates, are recorded in this preliminary assessment of the hydroid fauna (exclusive of Milleporidae and Stylasteridae) from the Marianas. In total, 42 species were

collected from Guam and 17 from the Commonwealth of the Northern Mariana Islands, 16 are reported from Saipan and one from Maug. *Silhouetta uvacarpa* and *Clytia noliformis* are recorded for the first time from the western Pacific. Previously, *S. uvacarpa* had been recorded from the North Atlantic and from the Indian Ocean (Calder 1988), and *C. noliformis* from tropical and subtropical waters of the western and eastern Atlantic Ocean, Indian Ocean, and eastern Pacific Ocean (Calder 1991). Species were added regularly to our list of the known fauna from Guam as this project advanced, indicating that much remains to be done before hydroids of the region can be considered well-known. Comparisons of the fauna with those of more thoroughly surveyed oceanic islands (e.g. Seychelles, Fiji, Galápagos, Bermuda, Azores) suggest that the diversity of species found thus far likely represents scarcely half of the total that might be expected to occur on the island. Our estimate is that 100 species or more are likely present in shallow neritic waters of the study area.

The species reported here from Guam and vicinity are decidedly widespread in distribution. A group of 15 is considered to be circumglobal in warm or temperate neritic waters: *Corydendrium parasiticum, Turritopsis nutricula, Pennaria disticha, Hydrodendron mirabile, Clytia hemisphaerica, Clytia linearis, Clytia noliformis, Obelia bidentata, Obelia dichotoma, Dynamena disticha, Tridentata distans, Tridentata turbinata, Plumularia strictocarpa, Antennella secundaria, Macrorhynchia philippina*. Colonies of most of these are small, and a majority is known to occur on pelagic substrata such as *Sargassum* and other flotsam (Calder 1995). Another 11 species are considered Indo-west Pacific in distribution: *Ectopleura pacifica, Solanderia secunda, Zygophylax antipathes, Plumularia spiralis, Gymnangium eximium, Gymnangium gracilicaule, Gymnangium hians, Lytocarpia brevirostris, Macrorhynchia filamentosa, Monotheca pulchella, Macrorhynchia phoenicea*. Colonies in this group tended to be larger, in some cases significantly so, than those regarded as circumglobal. Species known from the Indo-west Pacific region as well as the eastern Atlantic include *Eudendrium racemosum* and *Thyroscyphus ramosus,* while *Nemalecium lighti, Clytia latitheca, Dentitheca habereri,* and *Halopteris polymorpha* have been reported from the western Atlantic and Indo-west Pacific regions. Eight species are known only from the western Pacific at present: *Pennaria wilsoni, Zygophylax rufa, Synthecium samuense, Dynamena moluccana, Sertularella diaphana delicata, Tridentata borneensis, Tridentata malayensis, Halopteris plagiocampa*. *Porpita porpita* and *Physalia physalis*, pleustonic species with worldwide distributions, were excluded from consideration. So too was *Silhouetta uvacarpa*, a poorly known species recorded so far from the Indo-west Pacific and the Atlantic. None of the species found during this study is new, and none is endemic to Guam or neighboring islands.

Type localities, while not definitive in establishing situal origins of species, are nevertheless of interest in appraising biogeographic affinities of a fauna. For the benthic hydroids reported here, numbers of species and their type localities were as follows: for localities in Indonesia, the Philippines, and the South China

Sea—13; for Australia and New Guinea—10; for the Mediterranean and the eastern Atlantic—6; for the Indian Ocean—5; for the western Atlantic—5; for Japan—2. The type locality of one species (*Corydendrium parasiticum*) was undetermined. These numbers are what might be expected of a hydroid assemblage inhabiting an oceanic island system within the western Pacific region. Underscoring the wide geographic ranges noted above is the reported presence of most species at several other remote oceanic island systems. Nearly half (20 of 42 species) are known to occur in both Fiji and the Seychelles, and at least 25% in French Polynesia, Hawaii, and the Galápagos. Even more remarkably, 19 of the species are reported from Bermuda in the western North Atlantic.

Dispersal by planktonic medusa stages cannot be invoked as the primary explanation for such wide distributions of these species. More than 75% of those species reported here have fixed gonophores or short-lived medusa stages in their life cycles. Instead, rafting of the benthic hydroid stages on phoretic substrata may be responsible for their long-range dispersal, as noted earlier by Cornelius (1992a, b) and Calder (1993, 2000). Cornelius observed that hydroids have an extraordinary capacity for long-range transport in being substratum generalists and in being quite small. Moreover, they are often found on pelagic algae and other flotsam in the open ocean (Calder 1995). A recurrent group of widely distributed species, known to raft and inhabiting a number of remote islands, were termed a "species club" by Cornelius (1992b). Several of the species that he listed as elements of this "club" (*Pennaria disticha, Obelia* spp*., Clytia hemisphaerica, C. linearis, Dynamena disticha, Tridentata distans, Antennella secundaria*) were found at Guam. The preponderance of species with fixed gonophores over those with free medusae at Guam and neighboring islands is in accord with the "Paradox of Rockall" hypothesis of Johannesson (1988). This hypothesis holds that the pelagic larval life of species inhabiting oceanic islands is likely to be brief. Once a species has colonized an oceanic island, short-lived meroplanktonic stages (or even benthic ones) offer a biological advantage in minimizing dispersal and probable loss, and maximizing the likelihood of a population being maintained.

Hydroids are an important component of marine fouling assemblages, and they may also be transported in ballast water, so dispersal of some species over long distances by shipping is likely. However, as Guam is primarily an importing economy, ballast transport is unlikely, while hull transport is very likely (Paulay et al. 2003). Indeed, three of those reported here (*Pennaria disticha, Clytia linearis*, *Obelia dichotoma*) were discovered during this study on a floating dry dock (*Machinist*). Now in Apra Harbor, Guam, this large vessel was recently (July 1999) towed from Pearl Harbor, Hawaii, where it had been based since 1991. Further, some species found on both natural and artificial substrata in Guam (e.g. *Thyroscyphus fruticosus, Dynamena moluccana*) are larger and more abundant in harbor environments. This might be taken as evidence of a possible anthropogenic introduction. Currently, the hydroid fauna in Guam, and indeed

that of most of the entire western Pacific region, is too poorly known to establish unequivocally what species might be non-indigenous, except in a very rough sense (Paulay et al. 2002).

Molecular techniques have been used successfully to characterize a number of invasive marine taxa including plants, crustaceans, molluscs and ascidians (Duda 1994, Ayres et al. 1999, Bagley & Geller 2000, Grosholz 2001). These powerful tools can be used to describe the population genetic signatures characteristic of successful invaders (Holland 2000) and pinpoint the origin of invasives (Southward et al. 1998). They can also be used in concert with other information to identify and describe the indigenous taxa or biota. This is necessary to determine whether a species is invasive or not, but is often an extremely difficult task when invasives are cryptic or the fauna is poorly known (Grosholz 2002). Characterizing an indigenous fauna requires careful taxonomic work and combing through obscure literature for information on reproduction (e.g. dispersal ability), distribution, and ecology. A rapidly diminishing but vitally important cadre of taxonomists generally harbors this information. They are our best guides as we apply molecular tools to the identification of cryptic species, as well as to understanding, and ultimately controlling, marine invasions.

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## Appendix: Station data for main hydroid sampling stations

St. = Station number; stations 1-10 from Guam (cross-referenced to Figure 1), 11-12 from Saipan.
De. = depth in meters
Co. = collector: B = V. Bonito, P = G. Paulay, S = J. Starmer & M. Puglisi

| St. | Locale | Microhabit | De. | Date | Lat (N) | Long (E) | Co. |
|---|---|---|---|---|---|---|---|
| 1 | Pati Point | on high current wall | 25 | 25.VI.2000 | | | B |
| 2 | Pugua patch reef | S.W. side | 1-9 | 27.VI.2000 | 13º35.81' | 144º49.90' | |
| 3 | Haputo | fore reef, under overhang | 1-15 | | | | |
| 4 | Apra Harbor | buoys at harbor entrance | <3 | 8.VIII.1998 | 13º27' | 144º38' | |
| 5 | Apra Harbor | on mooring buoy | <4 | 14[a]/21[b].IV 1998 | | | |
| 6 | Apra Harbor | Dry dock *Machinist* from Hawaii | 1-3 | 12.VII[a]/27.IX[b].1999 | | | |
| 7 | Orote Peninsula | High current zone | 1-2 | 16.II.2000 | 13º26.36' | 144º37.33' | P |
| 8 | Orote Peninsula | Barracuda Rock | 0-20 | 22.II.2000 | 13º25.99' | 144º37.98' | |
| 9 | Orote Peninsula | Shark's Pit, by or on pinnacle | 1-30 | 25.XI.1998[a]/ 30.VIII.1999[b] | | | |
| 10 | Pago Bay | In front of Marine Lab, fore reef | ~3 | 1.I.1996[a], 25.VIII.1998[b], 20.IX.1998[c] | | | |
| 11 | Off Objan Beach | fore reef , under overhang | 7-20 | 11.V.1998 | 15º12' | 145º43' | S |
| 12 | Off Agingan Point | exposed on fore reef | 10-33 | 10-11.VIII.2001 | 15º7.11' | 145º41.20' | |

[a-c] refer to specific collection dates at Stations 5, 6, 9 and 10 and are cross-referenced in the text.