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Preliminary List of Deep-Sea Coral Taxa in the U.S. Line and Phoenix Island Regions (v. 2021)

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This annex to the U.S. Pacific Islands chapter in “The State of Deep-Sea Coral and Sponge Ecosystems of the United States” (Parrish et al. 2017) provides a list of deep-sea coral taxa in the Phylum Cnidaria, Classes Anthozoa and Hydrozoa, known to occur in U.S. waters around the U.S. Line Islands (Jarvis, Palmyra, and Kingman) and U.S. Phoenix Islands (Howland and Baker Islands) in the Central Pacific (Figure 1). Much of the U.S. waters surrounding these Central Pacific features are incorporated in the Pacific Remote Islands Marine National Monument. Most of these records are derived from observations and collections conducted during new deep-sea explorations in 2017 (Kelley et al. 2019a&b) as part of the National Oceanic and Atmospheric Administration (NOAA) Campaign to Address Pacific monument Science, Technology, and Ocean NEeds (CAPSTONE). CAPSTONE was a 3-year campaign from 2015 to 2017 designed to provide critical new information on the deep-water resources within the U.S. national marine monuments and sanctuaries located throughout the Pacific (Kennedy et al. 2019, Parke et al. 2021). In 2019, the Ocean Exploration Trust E/V *Nautilus* conducted further deep-sea remotely-operated vehicle (ROV) explorations in the region. These coral records are available in NOAA’s National Database of Deep-Sea Corals and Sponges (<https://deepseacoraldata.noaa.gov/>)

For the purposes of this list, deep-sea corals are defined as azooxanthellate, heterotrophic coral species occurring in waters 50 m deep or more. We provide details on the reported depth distribution of each species (Table 1). This list

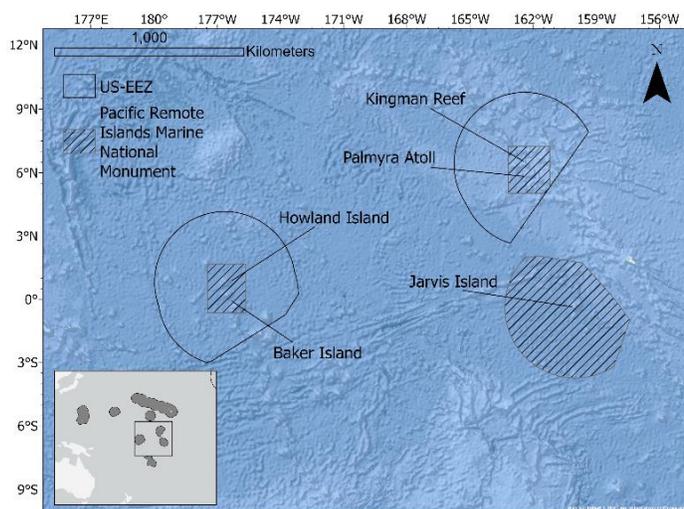


Figure 1. The U.S. exclusive economic zone (EEZ) surrounding the U.S. Line Islands (Jarvis, Palmyra, and Kingman) and U.S. Phoenix Islands (Howland and Baker). The shaded areas are units of the Pacific Remote Islands Marine National Monument.

is based largely on surveys that were conducted deeper than 250 m. Therefore, the list does not include many species that occur in shallower waters.

Taxon identifications should be considered preliminary, as most were made from video without collected samples.

Taxonomic names are generally those currently accepted in the World Register of Marine Species (WoRMS), and are arranged by order, and alphabetically within order by family, genus, and species. Data sources (references) listed are those principally used to establish geographic and depth distribution.

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Cover Photo: A large acanthogorgiid gorgonian and a yellow stony coral (*Enallopsammia rostrata*), at 440m depth on the south slope of Palmyra Atoll in the Pacific Remote Islands Marine National Monument. Image credit: NOAA Ocean Exploration

Table 1. List of reported deep-sea coral taxa in the Phylum Cnidaria, Class Anthozoa and Class Hydrozoa from U.S. waters around the U.S. Line Islands and Phoenix Islands. Blue shaded fields indicate newly described species since 2017. Most records represent video observations. “NR” indicates a lack of reported depth information. References are numbered to correspond with citations following the table, along with notes (in superscript letters) pertaining to individual taxa. Distribution: JI = U.S. EEZ surrounding Jarvis Island; PK = U.S. EEZ surrounding Palmyra Atoll and Kingman Reef; HB = U.S. EEZ surrounding Howland & Baker Islands.

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|------------------------------|--|--------------|-----------------|------------|
| Class Anthozoa | | | | |
| Subclass Hexacorallia | | | | |
| Order Antipatharia | | | | |
| Family Antipathidae | <i>Antipathes</i> sp. | HB | 411-424 | 1 |
| | <i>Stichopathes</i> sp. | JI,PK,HB | 217-445 | 1,2 |
| Family Aphanipathidae | cf. <i>Aphanostichopathes</i> sp. ^a | PK,HB | 1139-2279 | 1,2 |
| Family Cladopathidae | <i>Heteropathes</i> sp. cf. <i>H. americana</i> (Opresko, 2005) | PK,HB | 2124-2678 | 1,3 |
| | <i>Heteropathes</i> sp. cf. <i>H. pacifica</i> (Opresko, 2005) | PK | 2137 | 2 |
| | <i>Hexapathes heterosticha</i> Kinoshita, 1910 | PK | 418 | 2,4 |
| | <i>Trissopathes</i> sp. | JI,PK,HB | 1007-2136 | 1,2,3 |
| Family Leiopathidae | <i>Leiopathes</i> sp. | JI, PK | 321-444 | 2,3,5 |
| Family Schizopathidae | <i>Abyssopathes</i> sp. | JI | 4380-4514 | 2 |
| | <i>Alternatipathes</i> sp. ^b | JI,PK | 4568-4571 | 2,3 |
| | <i>Bathypathes pseudoalternata</i> Molodtsova, Opresko & Wagner, 2022 ^c [not <i>Alternatipathes alternata</i> (Brook, 1889)] | PK,HB | 1312-2171 | 2,5,6 |
| | <i>Bathypathes</i> spp. ^d | JI,PK,HB | 343-2287 | 1,2,3,5 |
| | <i>Dendropathes intermedia</i> (Brook, 1889) ^e | JI,PK | 399-920 | 5 |
| | <i>Lillipathes</i> sp. | JI,PK,HB | 462-1348 | 3 |
| | <i>Parantipathes</i> sp. | JI,PK,HB | 416-2387 | 1,2,3,5 |
| | <i>Schizopathes</i> sp. | PK | 2742 | 3 |
| | <i>Stauropathes</i> sp. | PK | 841-2734 | 2,3 |
| | <i>Umbellapathes</i> sp. cf. <i>U. helioanthes</i> Opresko, 2005 ^f | HB | 564-617 | 1 |
| Family Stylopathidae | <i>Tylopathes</i> sp. | PK,HB | 938-1069 | 3 |
| Order Scleractinia | | | | |
| Family Caryophylliidae | <i>Caryophyllia</i> (<i>Caryophyllia</i>) <i>concreta</i> Kitahara Cairns & Miller, 2010 | PK | 921 | 4 |
| | <i>Desmophyllum dianthus</i> (Esper, 1794) | HB | 435 | 1 |
| Family Dendrophylliidae | <i>Balanophyllia</i> sp. | JI | 288 | 3 |
| | <i>Eguchipsammia fistula</i> (Alcock, 1902) ^g | JI | 300-350 | 5 |

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|-------------------------------|--|--------------|-----------------|------------|
| Family Dendrophylliidae cont. | <i>Enallopsammia rostrata</i> (Pourtalès, 1878) | Jl,PK,HB | 298-1524 | 1,2,3,5 |
| Family Flabellidae | <i>Javania</i> sp. | PK | 305-312 | 2,3 |
| | <i>Polymyces wellsii</i> Cairns, 1991 | Jl,HB | 429-777 | 1,5 |
| Family Oculinidae | <i>Madrepora oculata</i> Linnaeus, 1758 | Jl,PK,HB | 393-523 | 1,2,5 |
| Order Zoantharia | | | | |
| Family Parazoanthidae | <i>Kulamanamana haumea</i> Sinniger, Ocaña & Baco, 2013 (= <i>Gerardia</i> sp.) | Jl,PK | 319-500 | 1,2,3,5,7 |

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|---------------------------------|--|--------------|-----------------|------------|
| Class Anthozoa | | | | |
| Subclass Octocorallia | | | | |
| Order Alcyonacea | | | | |
| Family Acanthogorgiidae | <i>Acanthogorgia</i> sp. | Jl,PK,HB | 307-2215 | 1,2,5 |
| Family Alcyoniidae ^h | <i>Anthomastus tahinodus</i> d'Hondt, 1988 | PK,HB | 1583-2216 | 1,3 |
| | <i>Pseudoanthomastus</i> sp. | PK,HB | 1410-2013 | 3,5 |
| Family Anthothelidae | <i>Anthothela</i> sp. | Jl | 592-613 | 5 |
| Family Chrysogorgiidae | <i>Chrysogorgia chryseis</i> Bayer & Stefani, 1988 | Jl,PK,HB | 1140-2150 | 1,2,3 |
| | <i>Chrysogorgia geniculata</i> (Wright & Studer, 1889) | Jl,PK,HB | 580-2659 | 1,2,5 |
| | <i>Chrysogorgia stellata</i> Nutting, 1908 | PK | 2137-2268 | 2,3 |
| | <i>Chrysogorgia</i> sp. 8 (<i>sensu</i> Untiedt et al. 2021) | HB | 2227 | 1,4,8 |
| | <i>Chrysogorgia</i> sp. 34 (<i>sensu</i> Untiedt et al. 2021) | HB | 1720 | 1,4,8 |
| | <i>Iridogorgia bella</i> Nutting, 1908 | Jl,PK,HB | 928-1956 | 1,2,3,5 |
| | <i>Iridogorgia magnispiralis</i> Watling, 2007 | Jl,PK,HB | 939-2217 | 1,2,5 |
| | <i>Metallogorgia melanotrichos</i> (Wright & Studer, 1889) | Jl,PK,HB | 682-2044 | 1,2,3,5 |
| | <i>Ramuligorgia militaris</i> (Nutting, 1908) (= <i>Pleurogorgia militaris</i> Nutting, 1908) | PK | 1999-2748 | 2,3 |
| | <i>Rhodaniridogorgia</i> sp. ⁱ | Jl,PK,HB | 499-2054 | 1,2,3,4 |
| Family Clavulariidae | <i>Clavularia</i> sp. ^j | Jl,PK, | 610-784 | 5 |
| | <i>Telesto</i> sp. | Jl | 629-765 | 2 |
| Family Coralliidae | <i>Hemicorallium ducale</i> (Bayer, 1955) | HB | 2155-2189 | 1 |
| | <i>Hemicorallium laauense</i> (Bayer, 1956) (= <i>Corallium laauense</i>) | Jl,PK,HB | 460-595 | 1,3,5 |
| | <i>Pleurocorallium porcellanum</i> (Pasternak, 1981) (= <i>Corallium kishinouyei</i> Bayer, 1996) | Jl,HB | 904-1315 | 1,2 |

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|--|---|--------------|-----------------|------------|
| Family Gorgoniidae | <i>Eunicella</i> sp. | Jl | 276-867 | 2,4 |
| Family Keratoisididae ^k (formerly Isididae) | <i>Acanella</i> sp. ¹ | Jl,PK,HB | 328-2062 | 2,3,5 |
| | <i>Acanella weberi</i> Nutting, 1910 | PK | 1678-1861 | 3 |
| | <i>Bathygorgia abyssicola</i> Lapointe & Watling, 2015 | Jl | 4523-4524 | 2 |
| | <i>Eknomisis</i> sp. | PK,HB | 1340-2305 | 1,3 |
| | <i>Isidella trichotoma</i> Bayer, 1990 [= <i>Acanella trichotoma</i> (Bayer, 1990)] | Jl,HB | 1663-1707 | 1,2 |
| | <i>Jasonisis</i> sp. | Jl,PK,HB | 940-2223 | 1,2,3,4 |
| Family Nidaliidae | Nidaliidae sp. | Jl | 949 | 2 |
| Family Paragorgiidae | <i>Paragorgia</i> sp. | Jl,PK,HB | 313-2317 | 1,2,3 |
| Family Plexauridae | <i>Anthomuricea</i> sp. | Jl,PK | 345-1022 | 5 |
| | <i>Paracis</i> sp. | Jl,PK,HB | 350-627 | 1,2 |
| | <i>Paramuricea</i> sp. | Jl,PK | 860-1878 | 2 |
| | <i>Swiftia</i> sp. | Jl,PK,HB | 298-2178 | 1,2,3,4 |
| Family Primnoidae | <i>Callogorgia cracentis</i> Cairns, 2018 | HB | 1090-1760 | 2,4,9 |
| | <i>Callogorgia formosa</i> Kükenthal, 1907 | HB | 323-498 | 1 |
| | <i>Callogorgia</i> sp. | PK | 404 | 5 |
| | <i>Calyptrophora angularis</i> (Nutting, 1908) | PK,HB | 1186-2187 | 1,3,5,10 |
| | <i>Calyptrophora clarki</i> Bayer, 1951 | Jl | 914 | 3,10 |
| | <i>Calyptrophora pileata</i> Cairns, 2009 | HB | 1942 | 3 |
| | <i>Calyptrophora pourtalesi</i> Cairns, 2018 | HB | 437 | 1,4,9 |
| | <i>Calyptrophora wyvillei</i> Wright, 1885 (= <i>Calyptrophora agassizii</i> Studer, 1894) | Jl,PK,HB | 903-1228 | 1,2,3,4 |
| | <i>Candidella gigantea</i> (Wright & Studer, 1889) | PK,HB | 1724-2165 | 1,3 |
| | <i>Candidella helminthophora</i> (Nutting, 1908) | Jl,HB | 691-1703 | 1,2,3 |
| | <i>Narella alata</i> Cairns & Bayer, 2007 | HB | 1193 | 3 |
| | <i>Narella dichotoma</i> (Versluys, 1906) (Includes <i>Narella nuttingi</i> Bayer, 1997) | Jl,PK,HB | 941-1346 | 1,2,3,5 |
| | <i>Narella ferula</i> Cairns, 2018 | PK | 1023 | 2,4,9 |
| | <i>Narella hawaiiensis</i> Cairns & Bayer, 2008 | PK | 1477-1620 | 3 |
| | <i>Narella macrocalyx</i> Cairns & Bayer, 2007 [2008] | PK,HB | 1142-2228 | 1,5 |
| | <i>Narella merga</i> Cairns, 2018 | HB | 2604 | 3 |
| | <i>Narella muzikae</i> Cairns & Bayer, 2007 [2008] | Jl,PK | 368-679 | 2,5 |
| | <i>Narella vermifera</i> Cairns & Bayer, 2008 | HB | 368-560 | 1 |
| | <i>Narella virgosa</i> Cairns, 2018 | Jl | 869-958 | 2,9 |
| | <i>Paracalyptrophora echinata</i> Cairns, 2009 | Jl,HB | 545-1024 | 2,3,4,9 |
| <i>Paracalyptrophora hawaiiensis</i> Cairns, 2009 (= <i>Paracalyptrophora hawaiiensis</i> Cairns, 2009) | Jl,PK | 406-1084 | 2,3 | |

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|---|---|--------------|-----------------|------------|
| Family Primnoidae cont. | <i>Plumarella circumoperculum</i> Cairns, 2010 [= <i>Thouarella regularis</i> (Wright & Studer, 1889)] | Jl | 1775-1908 | 2 |
| Family Primnoidae cont. | <i>Thouarella (Euthouarella) hilgendorfi</i> (Studer, 1879) | Jl | 382-471 | 2 |
| | <i>Thouarella (Euthouarella) tydemani</i> Versluys, 1906 | HB | 1180 | 4 |
| Family Victorgorgiidae | <i>Victorgorgia alba</i> (Nutting, 1908) ⁿ (= <i>Anthothela nuttingi</i> Bayer, 1956) | Jl,PK,HB | 355-1965 | 1,2,3,5 |
| Order Pennatulacea | | | | |
| Family Anthoptilidae | <i>Anthoptilum</i> sp. ° | Jl,PK,HB | 1008-2170 | 2,3,4,10 |
| Family Balticinidae ^p (=Halopteridae) | <i>Balticina</i> sp. (= <i>Halopteris</i> sp.) | Jl,PK,HB | 623-1649 | 1,3,5,10 |
| Family Kophobelemnidae | <i>Kophobelemnon</i> sp. | HB | 1271-1353 | 3 |
| Family Pennatulidae | <i>Pennatula</i> sp. | Jl,PK,HB | 1158-2514 | 2,3 |
| | <i>Ptilella inflata</i> (Kükenthal, 1910) (= <i>Pennatula inflata</i> Kükenthal, 1910) | Jl,PK,HB | 624-1736 | 1,2,3,5 |
| Family Protoptilidae | <i>Protoptilum</i> sp. | Jl,PK,HB | 434-2009 | 1,2,3 |
| Family Scleroptilidae | <i>Calibelemnon symmetricum</i> Nutting, 1908 | PK | NR | 5 |
| Family Umbellulidae | <i>Umbellula</i> sp. | Jl,PK,HB | 1148-2528 | 1,2,3,4 |

| Higher Taxon | Species | Distribution | Depth Range (m) | References |
|------------------------------|-----------------------|--------------|-----------------|------------|
| Class Hydrozoa | | | | |
| Subclass Hydroidolina | | | | |
| Order Anthoathecata | | | | |
| Family Stylasteridae | <i>Lepidopora</i> sp. | PK | 305-428 | 2 |

Notes:

- a. One or more deep-water unbranched black coral morphotypes occurring at depths from 1139-2279 were initially identified as *Stichopathes* sp. Based on Opresko et al. (2021), these appear to belong in the new genus *Aphanostichopathes* in the family Aphanipathidae.
- b. Several deepwater colonies were identified as *Alternatipathes* cf. *alternata*.
- c. Molodtsova et al. (2022) redescribed a black coral in the family Schizopathidae with alternating bilateral pinnules that had previously been identified as *Bathypathes alternata* (now *Alternatipathes alternata*). They reported this coral, *Bathypathes pseudoalternata*, found predominantly at shallower depths than *A. alternata*, from Kingman Reef (PK) and Titov Seamount (HB).
- d. A number of additional morphotypes of *Bathypathes* were reported in addition to *B. pseudoalternata*. Large burnt orange colonies in shallower depths (~500m) near Kingman Reef were tentatively identified as *B. conferta*.
- e. Additional records from Howland Island (NA1114) were identified only as *Dendropathes* sp.
- f. Additional deeper records. Tentatively identified as *Umbellapathes* sp. were also observed at depths from 2087-2153 near Howland and Baker and 1245-1350 near Palmyra.
- g. Also records identified as *Eguchipsammia* sp. from Howland Island and Palmyra Atoll at similar depths.
- h. In addition to *Anthomastus tahinodus* and *Pseudoanthomastus*, there are numerous records identified only as *Anthomastus* or *Anthomastinae* from all three regions between 500-2254. One shallower morphotype at Kingman Reef was identified as *Pseudoanthomastus fisheri* (Bayer, 1952) in 2005, but no specimens were collected.
- i. One video record identified as *Rhodaniridogorgia superba* (Nutting, 1908) at a depth of 852m in the Howland-Baker Region.
- j. One HURL 2005 video record was identified as *Clavularia grandiflora* (Nutting, 1908)
- k. Saucier et al. (2021) have revised the phylogeny of the bamboo corals (formerly Isididae), resulting in five families. The bamboo corals described from the U.S. Line and Phoenix Islands all appear to belong in the new family Keratoisididae. Keratoisidids are among the most numerous and diverse taxa encountered in these regions, but most could not currently be identified to genus. Several older video records identified as *Keratoisis* sp. or *Lepidisis* sp. have been omitted pending revised identifications.
- l. Not *Acanella weberi*.
- m. HURL records from Kingman Reef listed as *Anthomuricea tenuispina* Nutting, 1908.
- n. Moore et al. (2017) have placed *Anthothela nuttingi* Bayer, 1956 (originally *Clematissa alba* Nutting, 1908) in the genus *Victorgorgia* based on morphological characteristics and phylogenetic reconstructions using mitochondrial gene regions.
- o. Specimens of rock sea pens identified as *Anthoptilum* sp., including one collection (USNM 1457400). While most sea pens occur in soft sediments, rock sea pens have specially adapted peduncles that allow them to attach to hard substrata
- p. Pérez et al. (2021) established *Balticinidae* and *Balticina* as the valid family and genus names for the sea pens most commonly identified as *Halipteridae* and *Halipteris*.

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