87. With marginal sensory clubs and otoporpae (bristly tracks of ectodermal cells running up the exumbrella from the bell margin) (rare) (plate 57K) . . . . . *Cunina* spp.
— With marginal sensory clubs, but without otoporpae 88
88. With eight to 20 (usually 16) tentacles and stomach pouches; each marginal lappet with up to 20 marginal sensory clubs (plate 51J) . . . . . *Solmissus marshalli*
— With 20–40 tentacles and stomach pouches; each marginal lappet with two to five marginal sensory clubs . . . . . *Solmissus incisa*
89. Without peripheral canal system, without otoporpae (bristly tracks of ectodermal cells running up the exumbrella from the bell margin); with simple annular gonad (plate 51I) . . . . . *Solmaris* spp.
— With peripheral canal system, with otoporpae (bristly tracks of ectodermal cells running up the exumbrella from the bell margin); gonads forming diverticula of the margin of the oral wall of the stomach (rare) (plate 57M) . . . . . *Pegantha* spp.

Key to the Siphonophora

CLAUDIA E. MILLS, STEVEN H. D. HADDOCK, CASEY W. DUNN, AND PHILIP R. PUGH

Plates refer to siphonophore plates 58–60.

This key covers the life stages of some siphonophore species most likely to be encountered near shore, where they might be dipped from harbors and marinas or observed by snorkellers or scuba divers.

1. With a gas-filled float, and with numerous swimming bells arranged below this, followed by a stem region bearing groups of feeding, reproductive, and buoyant zooids (see supplementary key for stem pieces of *Apolemia* species) 2
— Without a gas-filled float, and usually with only one or two swimming bells (see supplementary key for stem pieces of *Rosacea* and *Praya* species) 6
2. Stem elongate with feeding and reproductive zooids along the entire length 3
— Stem reduced and laterally expanded into a bulbous structure, with zooids arranged spirally around it (plate 58C) . . . . . *Physophora hydrostatica*
3. Swimming bells arranged in two rows along opposite sides of stem 4
— Swimming bells numerous and whorled (not in two rows), packed into a characteristic cone-shaped or cylindrical arrangement (plate 58F, 58G) . . . . . *Forskalia* spp.
4. Elongate polyps present between swimming bells; stem with "woolly" appearance; tentacles without side branches (plates 58E, 59A) . . . . . *Apolemia* spp.
— Polyps not present between swimming bells; tentacles with side branches 5
5. Stem densely covered with bracts (most noticeable when removed from the water); gastrozooids few and far between; tentacles all hanging down along one side of stem; stem cannot contract (plates 58A, 59B) . . . . . *Agalma elegans*
— Stem with small inconspicuous bracts; gastrozooids relatively numerous; tentacles emerge from anywhere along the stem (not all from one side); stem can contract when the colony is disturbed (plates 58B, 59D) . . . . . *Nanomia bijuga*
6. Swimming bells rounded, without ridges, without coming to a point; if two bells, then attached side by side 7
— Swimming bells elongate, pointed or faceted; if two bells, then not attached side by side, but slightly offset along the stem 10
7. Single, soft, spherical, colorless, and very transparent swimming bell, up to 8 mm in length; gastrozooids minute (plate 60A) . . . . . *Sphaeronectes gracilis*
— Usually with two robust swimming bells; gastrozooids and tentacles yellow 8
8. Swimming bells with a simple, slender, tubular somatocyst; pair of deeply sinusoidal radial canals on subumbrella (plate 59G, 59H) . . . . . *Rosacea* spp.
— Swimming bells with a complexly branched somatocyst; radial canals on subumbrella branch many times 9
9. No cross-links between branches of radial canals (plates 58D, 58H, 59E) . . . . . *Praya dubia*
— Cross-links between branches of radial canals, forming a meshlike pattern (plate 59F) . . . . . *Praya reticulata*
10. Anterior (upper) swimming bell roughly conical and larger than or approximately equal in size to posterior (lower) one 11
— Anterior (upper) swimming bell polyhedral; posterior (lower) bell considerably larger, with two prominent basal teeth (plate 60B) . . . . . *Abylopsis tetragona*
11. Anterior swimming bell without ridges, with rounded apex 12
— Anterior swimming bell with ridges, with pointed apex 13
12. Anterior swimming bell with divided mouthplate and with four "teeth" on opening of subumbrella; with slender tubular somatocyst about one-third the length of the nectosac; posterior bell with characteristic constriction in middle of subumbrella (plate 60D) . . . . . *Sulculeolaria quadrivalvis*
— Anterior swimming bell with undivided mouthplate and without "teeth" on opening of subumbrella, with carrot-shaped somatocyst about two-thirds the length of the subumbrella; posterior bell reduced, but rarely present (plate 60E) . . . . . *Dimophyes arctica*
13. Ridges on swimming bells spirally twisted and prominently serrated (plate 60F) . . . . . *Eudoxoides spiralis*
— Ridges on swimming bells straight or slightly curved, may or may not show serrations 14
14. Anterior swimming bell very stiff, with five or six ridges at base and only three or four ridges at apex 15
— Anterior swimming bells not as above 16
15. Anterior swimming bell to 20 mm long; somatocyst swollen and fusiform; small claw-shaped hydroecium only open at base (plate 60G) . . . . . *Chelophyes appendiculata*
— Anterior swimming bell to 35 mm long; somatocyst with two prominent lateral swellings, forming a T shape; rounded hydroecium to half bell length, open at base and along one side (plate 60P) . . . . . *Chuniphyes multidentata*
16. Somatocyst of anterior swimming bell extending to at least one-half of its length 17
— Somatocyst of the anterior swimming bell substantially less than one-quarter its length 20
17. Hydroecium one-third to one-half the length of the anterior swimming bell 18
— Hydroecium very shallow; anterior swimming bell to 20 mm long with fusiform somatocyst extending to over one-half its length (plate 60L) . . . . . *Lensia conoidea*

18. None of the ridges of the anterior swimming bell serrated, without teeth on the opening of the subumbrella; mouthplate divided; hydroecium one-third the length of the bell; somatocyst long and slender, reaching to the apex of the subumbrella (plate 60I) . . . . . *Muggiaea atlantica*
— At least some of the ridges of the anterior swimming bell serrated; with three conspicuous teeth around the opening of the subumbrella; mouthplate undivided 19
19. Anterior swimming bell to 35 mm in length, hydroecium extends one-half the length of the bell, somatocyst long and slender, subumbrella with distinct fingerlike extension at its apex (plate 60J) . . . . . *Diphyes dispar*
— Anterior swimming bell to 14 mm in length, hydroecium extends nearly one-third the length of the bell, somatocyst fusiform, subumbrella tapering apically, without distinct extension (plate 60K) . . . . . *Diphyes bojani*
20. Anterior swimming bell with five ridges and no obvious hydroecium 21
— Anterior swimming bell with numerous ridges; hydroecium relatively deep; inverted heart-shaped somatocyst (plate 60M) . . . . . *Lensia hostile*
21. Anterior swimming bell with spherical, egg-shaped, or flattened somatocyst; shallow hydroecial cavity (plate 60O) . . . . . *Lensia challengeri*
— Anterior swimming bell with oblique, ovate somatocyst; hydroecial cavity reduced to only a slight depression (plate 60N) . . . . . *Lensia hotspur*

Supplementary Key to Some Stem Fragments of Siphonophores

1. Stem with overall "woolly" appearance, with numerous gastrozooids, palpons and bracts; gastrozooids red or white (plates 58E, 59A) . . . . . *Apolemia* spp.
— Stem with distinct and repetitive groups of zooids (called "cormidia"), each with a single bract and gastrozooid; gastrozooids and tentacles yellow 2
2. Bracts hemispherical, gonophores with two mantle canals (plate 59G, 59H) . . . . . *Rosacea* spp.
— Bracts somewhat flattened, gonophores with three mantle canals (plates 58D, 58H, 59E, 59F) . . . . . *Praya* spp.

Note: The characters distinguishing the bracts of *Praya* species are often difficult to make out and are omitted here.

Combined Species List of Hydroids, Hydromedusae, and Siphonophores

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HYDROZOA SUBCLASS ANTHOATHECATA (also known as ANTHOMEDUSAE and ATHECATA)

ORDER FILIFERA

BOUGAINVILLIIDAE

Bougainvillia muscus (Allman, 1863). Hydroid and medusa. Synonyms in Calder, (1988, pp. 24–25). The name replaces *B. ramosa* (van Beneden, 1844), which is an invalid junior homonym. Probably introduced, present in bays and harbors. Remarkable color illustration of hydroid and medusa from Naples in Brinckmann-Voss 1970, plate 9.

*****_Bougainvillia_ spp. Hydroid and medusa. Unidentified hydroids of *Bougainvillia* occur in San Francisco Bay, and may be introduced species. Other *Bougainvillia,* of the same or different species in Bodega Harbor, have been collected and raised by J. T. Rees and C. E. Mills.

Garveia annulata Nutting, 1901. Hydroid. Hydroids conspicuous, with bright orange to yellow colonies and deeper orange gonophores (Torrey 1902; Fraser 1937; Haderlie et al. 1980—color photograph 3.6, plate 15). Rocky intertidal zones of the open coast, especially in late winter and spring, frequent on sponges and coralline algae; also reported subtidally to 117 m; Alaska to the Channel Islands (Fraser 1937, 1946).

Garveia franciscana (Torrey, 1902) (=*Bimeria franciscana*). Hydroid. A robust and conspicuous fouling species, abundant on floats and pilings in areas of low salinity in the San Francisco Bay area. Female gonophores a distinctive blue-purple, with a red-orange spadix. Lower intertidal and shallow subtidal. Reported in harbors from San Francisco Bay to San Diego (Torrey 1902; Fraser 1937, 1948). Introduced, but original provenance unknown.

Rhizorhagium formosum (Fewkes, 1889). Hydroid. Synonyms in Hochberg and Ljubenkov (1998, p. 9). A small and poorly known species, growing on gastropod shells and other hard substrates. Intertidal to 550 m; San Francisco Bay to Baja California (Fraser 1937, 1946; Hochberg and Ljubenkov 1998).

*****Unidentified bougainvillioid(?). Hydroid and possibly medusa. Hand and Jones (see below) described and illustrated a light, flesh-pink, translucent hydroid collected from 10 m off Point Richmond in San Francisco Bay that underwent curious asexual reproduction involving changes in polarity. The tiny polyps (1–1.5 mm in length) supported four to 12 filiform tentacles inserted in a single cycle at the base of the proboscis. Bavestrello et al. (see below) observed a similar hydroid in the Genoa Aquarium that underwent both asexual reproduction and sexual reproduction with medusae and which they placed in the superfamily Bougainvillioidea; see Hand and Jones 1957, Biol. Bull. 112: 349–357; Bavestrello et al. 2000, Sci. Mar. 64 (Suppl. 1): 147–150.

BYTHOTIARIDAE (=CALYCOPSIDAE, a junior synonym)

Bythotiara stilbosa Mills and Rees, 1979. Medusa (hydroid unknown). Known only from newly released medusae collected off docks in Mason's Marina, Bodega Harbor, and raised in the laboratory. Some bythotiarid polyps are symbiotic in tunicates, including *Bythotiara huntsmani* (Fraser, 1911) in Washington and British Columbia. See Mills and Rees 1979, J. Nat. Hist. 13; 285–293. Color photograph in Wrobel and Mills 1998 and 2003, p. 25.

Calycopsis nematophora Bigelow, 1913. Medusa (hydroid unknown). Apparently a Pacific oceanic species that is occasionally found near shore (illustration in Arai and Brinckmann-Voss 1980, p. 68).

Calycopsis simulans (Bigelow, 1909). Medusa (hydroid unknown). Apparently a Pacific oceanic species that is occasionally found near shore. Color photograph in Wrobel and Mills 1998 and 2003, p. 25.

Heterotiara anonyma Maas, 1905. Medusa (hydroid unknown). An oceanic species of the Pacific, Atlantic, and Indian Oceans that is occasionally found near shore (illustration in Arai and Brinckmann-Voss 1980, p. 70).

Sibogita geometrica Maas, 1905. Medusa (hydroid unknown). An oceanic species of the Pacific, Atlantic, and Indian Oceans that is occasionally found near shore.

***** = Not in key.

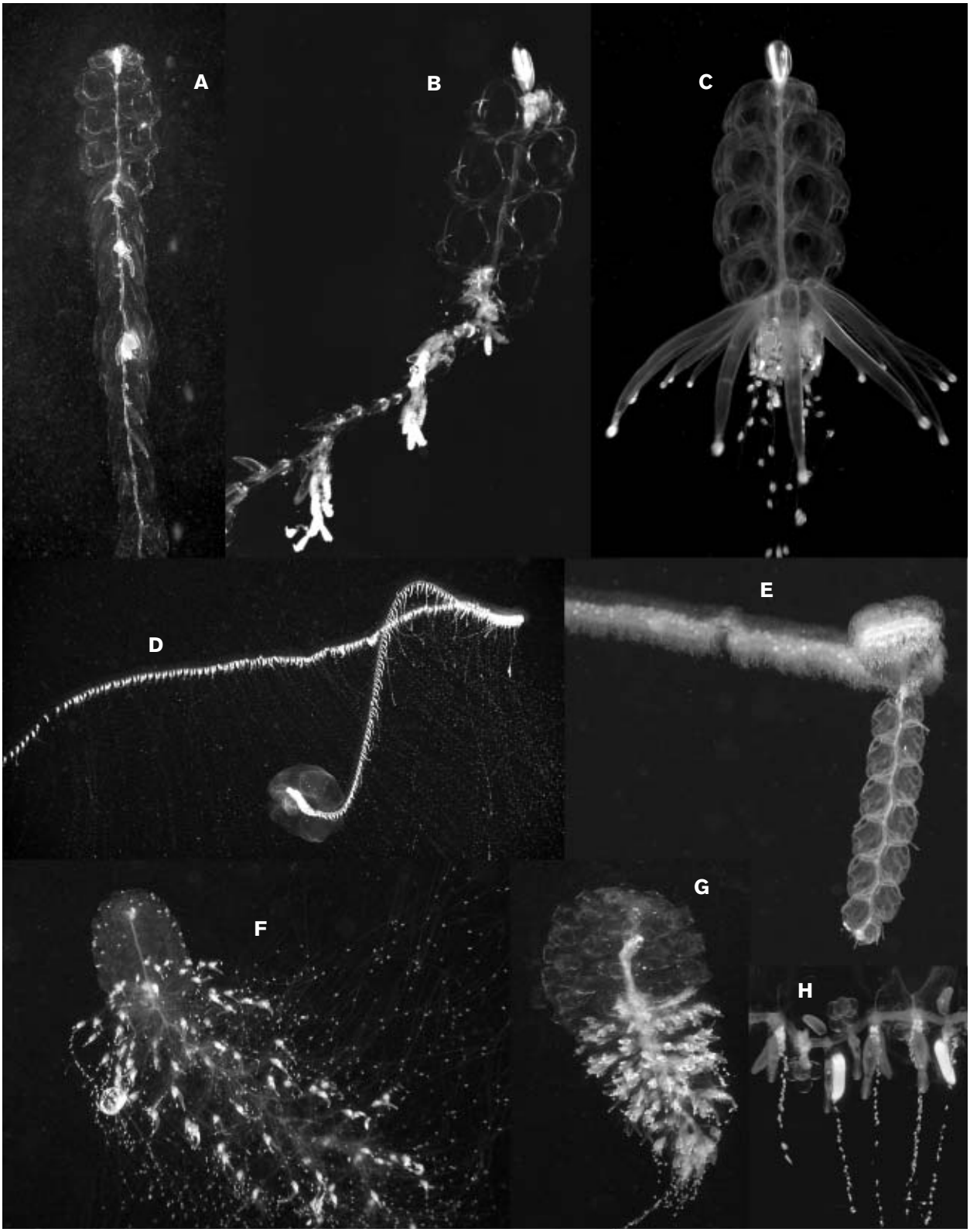

PLATE 58 Whole siphonophores, live. A, *Agalma elegans*; B, *Nanomia bijuga*; C, *Physophora hydrostatica*; D, *Praya dubia*; E, *Apolemia* sp.; F, *Forskalia* sp. 1; G, *Forskalia* sp. 2; H, *Praya dubia*, close-up of portion of the stem (A, F, G, photographs by Casey W. Dunn; B, H, photographs by Claudia E. Mills; C, photograph by Steven H. D. Haddock; D–E, in situ photograph from Monterey Bay Aquarium Research Institute [MBARI]).

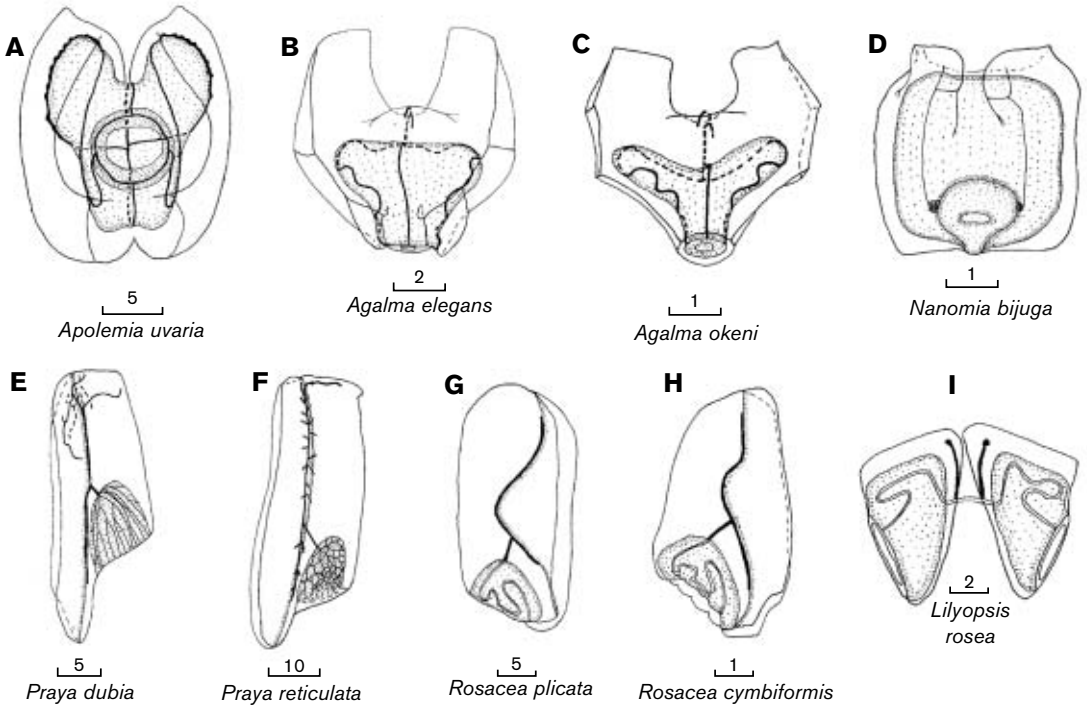

PLATE 59 Nectophores.Views from above (looking down the stem from the float–B, C) and distal views (stem running down the plane of the page–A, D) of nectophores of physonect siphonophores (A–D) and lateral views of nectophores of calycophoran siphonophores (E–I); scale bars in mm. For additional drawings of posterior nectophores, bracts, and gonophores, see Pugh (1999). A, *Apolemia uvaria*; B, *Agalma elegans*; C, *Agalma okeni*; D, *Nanomia bijuga*; E, *Praya dubia*; F, *Praya reticulata*; G, *Rosacea plicata sensu* Bigelow, 1911; H, *Rosacea cymbiformis*; I, *Lilyopsis rosea* (all from Pugh 1999).

EUDENDRIIDAE

Eudendrium californicum Torrey, 1902. Hydroid. Once a common intertidal and subtidal species in areas of open rocky coast, but apparently less frequent in recent decades. British Columbia to southern California, 4–115 m (Fraser 1937, 1946; Haderlie et al. 1980—see color photograph 3.7, plate 15).

Eudendrium spp. Hydroid. Species of this genus are characterized by typically styloid gonophores, trumpet-shaped hypostomes, and absence of desmonemes in the cnidome. Identification based on gross morphology alone is questionable and should include examination of cnidocysts. Various species of *Eudendrium* have been reported from the region, but the absence of information on cnidocyst complement makes these identifications uncertain (see Marques et al. 2000a, Zool. Meded., Leiden 74: 75–118; Marques et al. 2000b, J. Zoology, London 252: 197–213).

HYDRACTINIIDAE

Clava multicornis (Forsskål, 1775) (=*C. leptostyla L.* Agassiz, 1862). Hydroid. Additional synonyms in Edwards and Harvey 1975, J. Mar. Biol. Assoc. U.K. 55: 879–886. This species is included in the family Hydractiniidae here following Schuchert (2001a); molecular studies show that *Clava* and hydractiniids should be assigned to the same family. A cold-water species largely inhabiting the intertidal zone of bays and estuaries, sometimes forming large colonies due to stolonal growth. Hydranths and male gonophores pink, those of the female purple. Whether this well-known Atlantic hydroid still occurs in San Francisco Bay (its only known West Coast location) is uncertain. First reported in 1895 from San Francisco Bay (to which it was introduced in ship fouling), it is unclear when it was last seen in the Bay. Light et al. (1954) noted that it was "abundant on Fruitvale and Bay Farm Island bridges, Oakland, in spring," but we find no further actual records in the past 50 years. We did not find it in surveys of San Francisco Bay between 1993 and 2004.

Hydractinia armata Fraser, 1940. Hydroid. Female gonophores bearing only a single egg. Found in association with *H. milleri* (Fraser 1946), on coralline algae in tide pools at Moss Beach, a rocky intertidal site on the open coast just south of San Francisco Bay first visited by S. F. Light and his students in the 1920s and 1930s, and in later decades the most popular tide pool site for hundreds of thousands of school children from central California schools. It would be interesting to determine if these millions of little feet have obliterated this hydroid from Moss Beach.

Hydractinia laevispina Fraser, 1922. Hydroid. Female gonophores bearing only a single egg. British Columbia to central California in the low subtidal to at least 20 m deep; on kelp off Coast Guard breakwater in Monterey Harbor (Light et al. 1954).

Hydractinia milleri Torrey, 1902. Hydroid. Female gonophores bearing only a single egg. Colonies often growing in patches, sometimes covering several square centimeters on rocks exposed to breakers of the open sea (Torrey 1902). British Columbia to central California in the lower intertidal (Fraser 1937, 1946; Haderlie et al. 1980).

**Hydractinia* spp. Hydroid. Additional species of *Hydractinia* occur in the region (R. Grosberg pers. comm.).

* = Not in key.

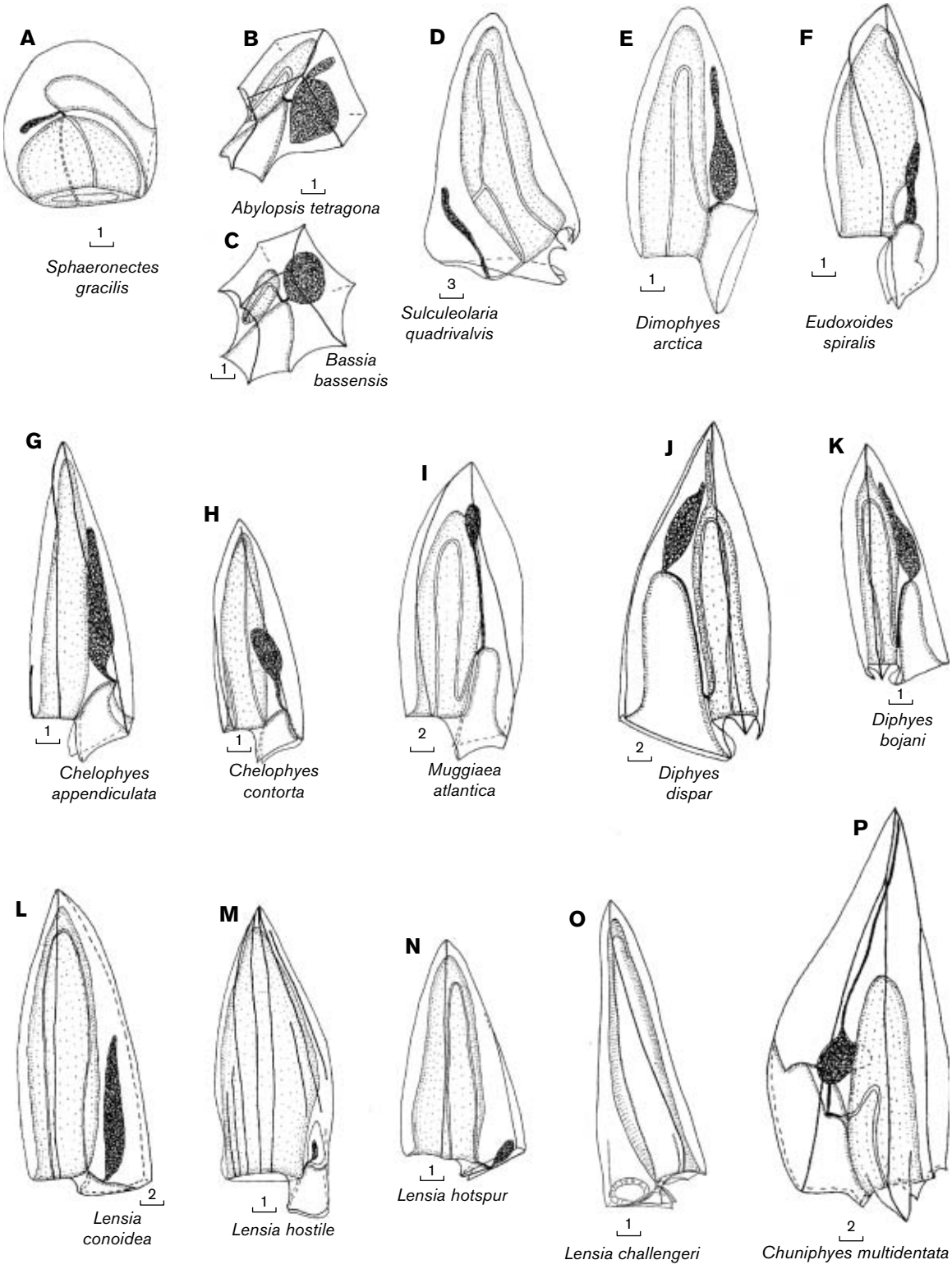

PLATE 60 Lateral views of anterior nectophores of calycophoran siphonophores; scale bars in mm. For additional drawings of posterior nectophores, bracts, and gonophores, see Pugh (1999). A, *Sphaeronectes gracilis*; B, *Abylopsis tetragona*; C, *Bassia bassensis*; D, *Sulculeolaria quadrivalvis*; E, *Dimophyes arctica*; F, *Eudoxoides spiralis*; G, *Chelophyes appendiculata*; H, *Chelophyes contorta*; I, *Muggiaea atlantica*; J, *Diphyes dispar*; K, *Diphyes bojani*; L, *Lensia conoidea*; M, *Lensia hostile*; N, *Lensia hotspur*; O, *Lensia challengeri*; P, *Chuniphyes multidentata* (all from Pugh 1999, except O, from Totton 1954, with permission, Discovery Rep. 27, 1–162, text figures 24B, 43C, 54A, 54D, 65A, 66B).

tide to 128 m (Fraser 1937, 1946). Our harbor-dwelling *Obelia* hydroids are probable ship fouling introductions. They are commonly fed upon by several nudibranch species.

Orthopyxis compressa (Clark, 1877) (=*Eucopella compressa*). Hydroid and ephemeral medusa. Discussion of synonomies and taxonomic confusion in Arai and Brinckmann-Voss (1980: 101–104). Colonies stolonal, with perisarc of varied thickness, sometimes thin but often very thick; pedicels smooth. Alaska to San Diego, 5–37 m (Fraser 1937). Common on larger hydroids or on red algae. Medusae are shed sequentially at dusk, with females released about 15–20 minutes before males from nearby colonies; the medusae live free for less than one hour, only long enough to shed gametes (see Miller 1978. J. Exp. Zool. 205: 385–392, misidentified as *O. caliculata*).

Orthopyxis everta (Clark, 1876) (=*Eucopella everta*). Hydroid. Retains gametes. Colonies stolonal, with perisarc of varied thickness, pedicels wavy or annulated. British Columbia to San Diego, 2–77 m (Fraser 1937). Sometimes abundant on kelp.

Orthopyxis integra (Macgillivray, 1842). (=*Eucopella caliculata,* =*Agastra mira*). Hydroid and ephemeral medusa. Synonyms in Cornelius (1982, p. 61; 1995, p. 235). Colonies largely stolonal. Alaska to southern California, low tide to 439 m (Fraser, 1937, 1946); cosmopolitan species.

SUBCLASS LIMNOMEDUSAE

OLINDIIDAE (formerly as OLINDIASIDAE)

Aglauropsis aeora Mills, Rees and Hand, 1976. Hydroid and medusa. Medusae collected primarily washed up on open beaches from Bodega Bay to Monterey Bay; minute polyp without tentacles known only from the laboratory. See Mills et al. 1976, Wasmann J. Biol. 34: 23–42. Color photograph in Wrobel and Mills 1998 and 2003, p. 36.

Craspedacusta sowerbii Lankester, 1880 (=*C. sowerbyi,* a misspelling). Hydroid and medusa. Introduced; now worldwide in fresh water, including in the upper Sacramento River near Redding, and in quarry lakes and reservoirs in many other areas in California. See Russell (1953) for detailed discussion. The simple, well-known hydroid, without tentacles, looks very much like that raised in the laboratory only through the primary polyp stage of both *Aglauropsis aeora* and *Maeotias marginata*.

Eperetmus typus Bigelow, 1915. Medusa (hydroid unknown). Distinguished from *Aglauropsis aeora* by the smaller number of thicker tentacles and presence of centripetal canals. From Alaska to Washington, where it becomes uncommon; rare sightings in Coos and Yaquina Bays. Usually pale pink. Color photograph in Wrobel and Mills 1998 and 2003, p. 37. Records from Japan are an undescribed *Aglauropsis*; see Mills et al. 1976, Wasmann J. Biol. 34: 23–42.

Gonionemus vertens A. Agassiz, 1862. Hydroid and medusa. In the shallow subtidal, usually seen clinging to algae or eelgrass, but may also be free-swimming near the surface in protected bays. Indigenous from Alaska to Washington, but known from a variety of locations worldwide and might be expected south of Washington. See plate 49Q for tiny, cryptic solitary polyp; color photograph of medusa in Wrobel and Mills 1998 and 2003, p. 37. A virulent-stinging variety or separate species occurs in the Russian Far East. See Edwards 1976, Adv. Mar. Biol. 14: 251–284 for a global review.

Maeotias marginata (Modeer, 1791). (=*Maeotias inexspectata* Ostroumoff, 1896 [misspelled occasionally as *inexpectata*]; see Mills and Rees 2000). Hydroid and medusa. Most medusae found in the San Francisco Bay system are males, but a few females discovered in 1998 allowed for the culture of embryos. Hydroids of *Maeotias* are known only from juvenile polyps raised under laboratory conditions (Rees and Gershwin 2000); these are miniscule and morphologically simple, with a cluster of cnidocysts around the mouth and without tentacles. A brackish to freshwater species, introduced to the San Francisco Bay area by the 1980s or 1990s, with an unconfirmed observation in 1959 (see Mills and Rees 2000). Color photograph in Wrobel and Mills 1998 and 2003, p. 29. A hydroid identified as this species by Mills and Sommer (1995) from the San Francisco area is *Moerisia* sp. instead (see Mills and Rees 2000).

Vallentinia adherens Hyman, 1947. Medusa (hydroid unknown). Occurs near shore, clinging to algae (see Hyman 1947, Trans. Am. Microsc. Soc. 66: 262–268); known only from the Pacific Grove area (where it is found on the kelp *Macrocystis* off Hopkins Marine Station [between the breakwater and Point Piños], Freya Sommer personal communication), and Santa Barbara (Wrobel and Mills 1998 and 2003); rare. Color photograph in Wrobel and Mills 1998 and 2003, p. 37.

SUBCLASS SIPHONOPHORA

ORDER PHYSONECTAE

AGALMATIDAE

Agalma elegans (*pro parte* M. Sars, 1846)—Sars' original description included more than one species, and authorship is thus noted as *pro parte*. A cosmopolitan species, which can be found anywhere from Alaska to Mexico. Easily distinguished from *A. okeni* as it has a long stem with leaflike bracts, while in *A. okeni* the stem is short so the bracts, with two (young) or four (mature) distal facets, interlock with each other. Pacific, Indian, and Atlantic Oceans and the Mediterranean.

*****Agalma okeni* Eschscholtz, 1825. This second cosmopolitan species of *Agalma* (siphonophore plate 59C) is also present on our coast, but more likely to be encountered off southern California and Baja California. Further distinguished from *A. elegans* by the distinctive ridges on the swimming bells, and Y-shape of the subumbrella when viewed from above. Pacific, Indian, and Atlantic Oceans and the Mediterranean.

Nanomia bijuga (delle Chiaje, 1841). Probably the most common physonect off the West Coast, thought to be responsible in some regions for the deep scattering layer (Barham 1963, Science 140: 826–828; Barham 1966, Science 151: 1399–1403), but occurs to the surface; Pacific, Indian, and Atlantic Oceans and the Mediterranean. Color photograph in Wrobel and Mills, 1998 and 2003, p. 46.

APOLEMIIDAE

Apolemia spp. This genus is quite diverse on our coast, with several undescribed species (the name *"Apolemia uvaria"* has been applied rather indiscriminately in past West Coast literature). The colonies are often tens of meters long and in deep water, but many-centimeter-long fragments can be encountered near shore at the surface. They have an overall "fuzzy" appearance, with red or white gastrozooids, and pack a substantial sting. The flimsy, jelly-filled bracts also contain patches of stinging cells on their upper surfaces. Species occur in the Pacific, Indian, and Atlantic Oceans and Mediterranean. Color photograph in Wrobel and Mills 1998 and 2003, p. 45.

***** = Not in key.

FORSKALIIDAE

Forskalia spp. Several species of *Forskalia,* which are difficult to distinguish, might be encountered along our coast. Divers sometimes liken the overall aspect of *Forskalia* to a Christmas tree: conical, widening at the base, with fine tentacles coming out from within the overall shape. They are active, strong swimmers, often spiraling around as they move. When disturbed they may release clouds of pigmented, bioluminescent material. Species occur in the Pacific, Indian, and Atlantic Oceans and the Mediterranean. Color photograph in Wrobel and Mills 1998 and 2003, p. 46.

PHYSOPHORIDAE

Physophora hydrostatica Forsskål, 1775. Colonies are typically several centimeters high and the compact complexity, symmetry, and pastel blue and pink colors of this worldwide species are sure to engender wonder in anyone who sees it; Pacific, Indian, and Atlantic Oceans and the Mediterranean. Color photograph in Wrobel and Mills 1998 and 2003, p. 46.

ORDER CALYCOPHORAE

ABYLIDAE

Abylopsis tetragona (Otto, 1823). This distinctive species is likely to be encountered only at the southern end of the range of this book; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

**Bassia bassensis* (Quoy and Gaimard, 1833). Another polyhedral species (siphonophore plate 60C) similar to *Abylopsis tetragona,* which is also likely to be encountered only at the southern end of the range of this book; the ridges of the swimming bells have a bluish tinge; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

CLAUSOPHYIDAE

Chuniphyes multidentata Lens and van Riemsdijk, 1908. An abundant midwater species that is occasionally encountered at the surface in central California; Pacific, Indian, and Atlantic Oceans.

DIPHYIDAE

Chelophyes appendiculata (Eschscholtz, 1829). One of the most common epipelagic temperate and tropical oceanic siphonophore species and likely to be seen anywhere along the Pacific West Coast including Baja California; Pacific, Indian, and Atlantic Oceans and the Mediterranean. When present in substantial numbers, this species has enough sting to be quite bothersome to divers and snorkellers.

**Chelophyes contorta* (Lens and van Riemsdijk, 1908). Perhaps a near-shore, rather than oceanic species (siphonophore plate 60H) (Totton 1965), with a somewhat more southern distribution that *C. appendiculata,* so to be expected only in the southern range of this book, continuing down into Mexico; appears to have an Indo-Pacific distribution (Bouillon et al 2004).

Dimophyes arctica (Chun, 1897). In spite of its name, this is a cosmopolitan species found in all oceans including the Arctic and Antarctic and can be encountered anywhere along the Pacific coast of North America.

Diphyes bojani (Eschscholtz, 1829). Might be encountered anywhere along the California and Baja California coasts; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

Diphyes dispar Chamisso and Eysenhardt, 1821. More likely to be encountered in the southern range of this book, continuing down Baja California, but has worldwide distribution in warmer waters. Color photograph in Wrobel and Mills 1998 and 2003, p. 47.

Eudoxoides spiralis (Bigelow, 1911). Epipelagic species found usually south of about 40°N on our coast; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

Lensia challengeri Totton, 1954. Can be encountered anywhere along the Californian and Baja Californian coast; found throughout the Pacific, usually south of about 40°N, usually near shore.

Lensia conoidea (Keferstein and Ehlers, 1860). Cosmopolitan species and likely to be seen anywhere along the Pacific West Coast including Baja California.

Lensia hostile Totton, 1941. A typically deep-water species found off California; Pacific, Indian, and Atlantic Oceans.

Lensia hotspur Totton, 1941. Can be encountered anywhere from Oregon to Baja California; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

**Lensia* spp. Several other little *Lensia*s are found off the West Coast; only the most common species have been included in the key.

Muggiaea atlantica Cunningham, 1892. A coastal species of the temperate Pacific, Indian, and Atlantic Oceans and the Mediterranean that can be found throughout the study area. In some localities, *M. atlantica* can be replaced by *M. kochi* at different times of year, which might be related to water temperature, but the two species appear to be mutually exclusive. *M. atlantica* has been collected in Bodega Harbor. Photograph in Wrobel and Mills 1998 and 2003, p. 47.

Sulculeolaria quadrivalvis Blainville, 1834. The looping radial canals and lack of ridges are distinctive of this genus among the Diphyidae; Pacific, Indian, and Atlantic Oceans and the Mediterranean. Color photograph in Wrobel and Mills 1998 and 2003, p. 47.

PRAYIDAE

**Desmophyes annectens* Haeckel, 1888. Shaped like *Praya* and *Rosacea,* but with minute red pigment flecks around the opening of the subumbrella in the swimming bells in life, and with four straight radial canals; large, spherical, white somatocyst. Uncommon; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

**Lilyopsis rosea* Chun, 1885. An uncommon prayid species (siphonophore plate 59I) with a large subumbrellar cavity, which has been seen in central California; Pacific, and Atlantic Oceans and the Mediterranean.

Praya dubia (Quoy and Gaimard, 1827). These siphonophores are often tens of meters long and in deep water, but several cm-long pieces of the colonies may be encountered near shore at the surface. The bright yellow color of the gastrozooids is striking; they have a substantial sting. Pacific, Indian, and Atlantic Oceans.

Praya reticulata (H. B. Bigelow, 1911). Similar to above species, but with reticulate pattern of canals on the subumbrella. The branching pattern of the somatocyst also distinguishes it. Pacific, Indian, and Atlantic Oceans.

* = Not in key.

Rosacea spp. Several species of *Rosacea* occur off the West Coast of North America and are difficult to identify and often confused with *Praya* spp. Typically, the bracts are hemispherical while those of *Praya* spp. are flattened. A near-shore observer is most likely to run into fragments of one of these colonies, which can reach many meters in length when undamaged and will sting.

SPHAERONECTIDAE

Sphaeronectes gracilis (Claus, 1873, 1874). Sometimes occurs near shore from Monterey Bay south, but can be very difficult to see; Pacific, Indian, and Atlantic Oceans and the Mediterranean.

SUBCLASS NARCOMEDUSAE

AEGINIDAE

Aegina citrea Eschscholtz, 1829. Medusa only. A variable worldwide, oceanic species (that may turn out with molecular study to be a species complex) that may occasionally be seen near shore; sometimes infused with yellow pigment. Color photograph in Wrobel and Mills 1998 and 2003, p. 38. Undescribed aeginids are also present in deep water.

CUNINIDAE

Cunina spp. Medusa only. Worldwide, oceanic species that occasionally come near shore. These are typically 10–60 mm in bell diameter and may be transparent and colorless or have some color. See Kramp (1961, 1968) for specific characters. Color photograph in Wrobel and Mills 1998 and 2003, p. 39.

Solmissus incisa (Fewkes, 1886). Medusa only. A worldwide, oceanic species, this is the larger (to 100 mm bell diameter) and less common *Solmissus*; it can be colorless or sometimes infused with transparent purple color (see Kramp 1961, 1968).

Solmissus marshalli A. Agassiz and Mayer, 1902. Medusa only. A worldwide, oceanic species, this is the smaller and more common of the two *Solmissus* that might be encountered near shore. It is usually colorless and <60 mm in bell diameter (see Kramp 1961, 1968). Color photograph in Wrobel and Mills 1998 and 2003, p. 39.

SOLMARISIDAE

Pegantha spp. Medusa only. Worldwide, oceanic species that occasionally come near shore. These are typically 25–50 mm in bell diameter and may be transparent and colorless or have some color. See Kramp (1961, 1968) for specific characters. Color photograph in Wrobel and Mills 1998 and 2003, p. 38.

Solmaris spp. Medusa only. Worldwide, oceanic and coastal species that are sometimes encountered near shore, sometimes in great numbers. These are small transparent medusae with a rapid pulsation rate. See Kramp (1961, 1968) for specific characters. Color photograph in Wrobel and Mills 1998 and 2003, p. 39.

TETRAPLATIDAE

**Tetraplatia volitans* Busch, 1851. Highly reduced narcomedusa up to about 1 cm long that looks more like a flying worm or pteropod than a jellyfish, with a ringlike constriction fairly near the midpoint dividing the oral and aboral ends, which are connected by four flying buttress–like structures. Oceanic in the upper 900 m, but occasionally found near shore; feeds on zooplankton (see Hand 1955, Pac. Sci. 9: 332–348; color photograph in Wrobel and Mills 1998 and 2003, p. 52, and at http://jellieszone.com/tetraplatia.htm). The two species of *Tetraplatia* have been proposed as both coronate scyphomedusae and as narcomedusae, but a genetic study by Collins et al. (2006) has placed these unusual medusae in the hydrozoan Narcomedusae.

SUBCLASS ACTINULIDAE (=HALAMMOHYDROIDA)

HALAMMOHYDRIDAE

**Halammohydra* sp. Medusa only. Minute (0.5–2 mm), highly reduced medusa (without a polyp phase, although it looks like a polyp), living interstitially in sand; solitary not colonial form. Found on a beach near Moss Landing (as reported by Robert Higgins and James Nybbaken). The entirely ciliated animal consists mostly of a manubrium with two whorls of long, contractile tentacles; there is a statocyst between each pair of tentacles and an aboral adhesive organ. A number of species have been described.

SUBCLASS TRACHYMEDUSAE

GERYONIDAE

Geryonia proboscidalis (Forsskål, 1775). Medusa only. Oceanic warm waters in the Pacific, Atlantic, and Mediterranean; occasionally seen near shore in the southern range of this book; six-part symmetry distinguishes this less-common species from *Liriope tetraphylla*. Color photograph in Wrobel and Mills 1998 and 2003, p. 40.

Liriope tetraphylla (Chamisso and Eysenhardt, 1821). Medusa only. Oceanic, Pacific, Atlantic, and the Mediterranean; occasionally seen near shore throughout the range of this book, sometimes in great numbers in warm water masses; four-part symmetry distinguishes this species from the less-common *Geryonia proboscidalis*. Color photograph in Wrobel and Mills 1998 and 2003, p. 40.

RHOPALONEMATIDAE

Aglantha digitale (O. F. Müller, 1776). Medusa only. A common species in the North Pacific, North Atlantic, and Arctic, typical of the upper 200 m and sometimes found nearshore. This species has two modes of swimming: a general slow swim and a strong escape swim separately mediated by giant axons. Usually colorless, but may have red, pink or orange color on the tentacles. For feeding behavior and diet see Costello and Colin (2002). Color photograph in Wrobel and Mills 1998 and 2003, p. 42.

Aglaura hemistoma Péron and Lesueur, 1809. Medusa only. Oceanic, Pacific, Atlantic, and the Mediterranean; occasionally nearshore, between about 40°N and 40°S, replacing *Aglantha* as the most abundant epipelagic species in warmer waters. It is smaller and more fragile than *Aglantha* and has two modes of swimming (slow feeding mode and fast escape swim). Color photograph in Wrobel and Mills 1998 and 2003, p. 42.

* = Not in key.