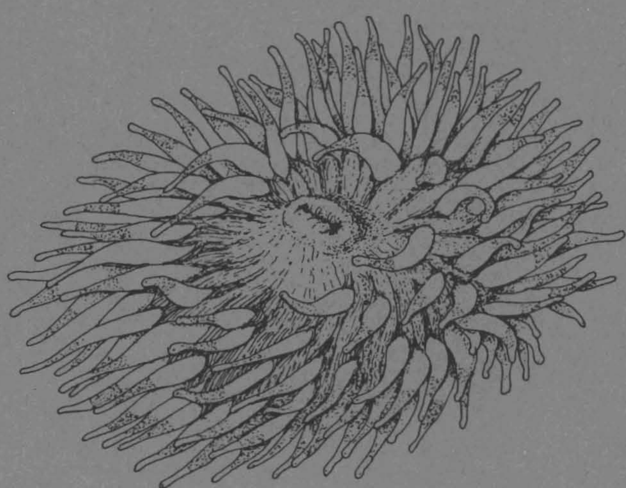
NOAA Technical Report NMFS 141 December 1998

Marine Flora and Fauna of the Eastern United States

Anthozoa: Actiniaria, Corallimorpharia, Ceriantharia, and Zoanthidea

Kenneth P. Sebens



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Foreward

This NOAA Technical Report NMFS is part of the subseries "Marine Flora and Fauna of the Eastern United States" (formerly "Marine Flora and Fauna of the Northeastern United States"), which consists of original, illlustrated, modern manuals on the identification, classification, and general biology of the estuarine and coastal marine plants and animals of the eastern United States. The manuals are published at irregular intervals on as many taxa of the region as there are specialists available to collaborate in their preparation. These manuals are intended for use by students, biologists, biological oceanographers, informed laymen, and others wishing to identify coastal organisms for this region. They can often serve as guides to additional information about species or groups.

The manuals are an outgrowth of the widely used "Keys to Marine Invertebrates of the Woods Hole Region," edited by R. I. Smith, and produced in 1964 under the auspices of the Systematics Ecology Program, Marine Biological Laboratory, Woods Hole, Massachusetts. Geographic coverage of the "Marine Flora and Fauna of the Eastern United States" is planned to include organisms from the headwaters of estuaries seaward to approximately the 200-m depth on the continental shelf from Maine to Florida, but can vary somewhat with each major taxon and the interests of callaborators. Whenever possible, representative specimens dealt with in the manuals are deposited in the reference collections of major museums.

The "Marine Flora and Fauna of the Eastern United States" is being prepared in collaboration with systematic specialists in the United States and abroad. Each manual is based primarily on recent and ongoing revisionary systematic research and a fresh examination of the plants and animals. Each manual, treating a separate major taxon, includes an introduction, glossary, uniform originally illustrated key, annotated checklist (with information, when available, on distribution, habitat, life history, and related biology), references to the major literature of the group, and a systematic index.

Manuals are available from the National Technical Information Service, United States Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, either as a paper copy or microfiche, for a charge. Manuals are not copyrighted, and so can be photocopied from the NOAA Technical Report NMFS Circulars and Reports available in most libraries and listed at the end of this manual.

Note to recipients of NOAA Technical Report NMFS 141, "Marine Flora and Fauna of the Eastern United States. Anthozoa: Actiniaria, Corallimorpharia, Ceriantharia, and Zoanthidea," by Kenneth P. Sebens: Please insert this Errata sheet in all copies of the report.

Errata

NOAA Technical Report NMFS 141

Replace Acknowledgments, p. 66-67, with:

Acknowledgments

Preparation of this manual was supported in part by a grant from the National Science Foundation to the Editorial Board of the "Marine Flora and Fauna of the Eastern United States." The author thanks Frederick M. Bayer and Steven Cairns for providing access to the U.S.N.M. collections, Ardis Johnston for help with specimens and curating at the Museum of Comparative Zoology, Harvard University, Kathy Durante for nematocyst determinations, Mel Carriker for encouragement and editing, Ronald W. Hardy and Sharyn Matriotti for careful editing, J. C. den Hartog and D. G. Fautin for helpful reviews of the manuscript, and Melody Chen, Elaine Cole, Susan Thornton, Julia Miles, Cecile Villars, Trish Dahill, Ellie Valminuto, and Karen Vandersall for preparation of the manuscript. Barbara Hecker (Lamont-Doherty Geological Observatory) supplied an excellent recent collection of anemones and photographs procured under the auspices of the U.S. Bureau of Land Management. Ruth D. Turner made valuable suggestions on the manuscript. Most drawings were done by Tom Siebert from specimens at the M.C.Z. and at the U.S.N.M. and from photographs supplied by Barbara Hecker and by the author. Figures 1-6 were done by Sarah Jordan. Figures 10, 11, 12, 15, 24, 44, and 54 are by the author.

Corrections to tables and figures:

Table 2. p. 12. *Adamsia sociabilis*. Shift both "SHH" and "NJR" one column left.

Table 2. p. 13. *Ceriantheopsis americanus*. Move "OS" from sphincter type column to Bottom no. column.

Table 2, p. 13. *Corynactis delawarei*. Add "R" below "BR" in column 6.

Table 3, p. 14. *Haloclava producta*. Remove "MB 50-112" from third column.

Table 2, p. 16. *Corynactis delawarei*. Move "H 69-85" left one column.

Figure 33, p 32. Change *Aiptasiogeton* to *Aiptasia*.

Index, p. 64. *Actinauge verrilli*. Add p. 11, 15, 31.

Index, p. 65. *Daontesia praelonga*. Change p. 56 to 51.

Index, p. 65. *Diadumene leucolena*. Remove p. 55.

Index, p. 65. *Drillactis pallida*. Remove p. 56.

Index, p. 66. Hexacorallia, not italics.

Index, p. 66. Thenaria. Add p. 37.

Marine Flora and Fauna of the Eastern United States Anthozoa: Actiniaria, Corallimorpharia, Ceriantharia, and Zoanthidea

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ABSTRACT

This key includes 60 species of sea anemones and their relatives in the orders Actiniaria, Corallimorpharia, Ceriantharia, and Zoanthidea. Species from the intertidal zone, continental slope, and deep sea are included over a geographic range from Atlantic Canada to approximately South Carolina. In addition to the illustrated key itself, characteristics of each species are summarized in tabular form, including morphology, distribution, and types and sizes of cnidae. Ecological and taxonomic information on each species are also included in an annotated species list.

Introduction

Anthozoans of the orders Actiniaria, Ceriantharia, and Corallimorpharia are all commonly referred to as "sea anemones." However, only the actiniarians are considered true sea anemones. The others are more appropriately termed "cerianthids," collectively, or "tube anemones" and "false corals", respectively. Zoanthids, sometimes called "colonial anemones" or "encrusting anemones", resemble the other three groups at the level of the individual polyp but typically form connected colonies. Corallimorpharians and, to a lesser extent actiniarians, share their basic anatomy with scleractiniarian coral polyps, from which they may have evolved; they are essentially corals without skeletons. The cerianthids and zoanthids have diverged much farther from the actinarians, corallimorpharians, and scleractinians in both external and internal anatomy.

Anthozoans are primarily carnivorous and are important constituents of many benthic marine communities owing to their biomass and predatory activities. The tropical reef corals (Scleractinia) are a good example of an abundant and ecologically important anthozoan group, but sea anemones and cerianthids can be equally important; they are often the most conspicuous large organisms in deep-sea photographs or community samples. As a rule, anemones with short knoblike or long thick tentacles prey on relatively large benthic invertebrates such as sea urchins, gastropods, bivalves, or crustaceans that crawl or swim into their grasp (Sebens, 1987; Shick, 1991). A strong sphincter muscle around the margin, just below the tentacles, allows some anemones (e.g. most Actiniidae) to cover the retracted tentacles that hold their prey and to close the upper column over the prey, preventing its escape. Initial prey capture is effected by the cnidae, nematocysts and spirocysts, microscopic capsules that eject threads and darts that either stick to or penetrate the prey. Short thin tentacles (e.g. in Metridiidae) and the long thin streaming tentacles (of cerianthids) are specialized for capturing zooplankton. The prey either swim into contact with the tentacles or are carried into the tentacle crown by water currents. Anemones with tentacles of intermediate length and thickness (e.g. many Actiniidae) may prey on both benthic invertebrates and zooplankton.

Sea anemones inhabit sandy, muddy, or rocky habitats and sometimes attach themselves to the hard parts or products of other organisms, such as worm tubes, hermit crab shells, crab claws, gastropod and bivalve shells, gorgonian corals, and sea pens. A broad flat base on an anemone generally indicates a hard substrate

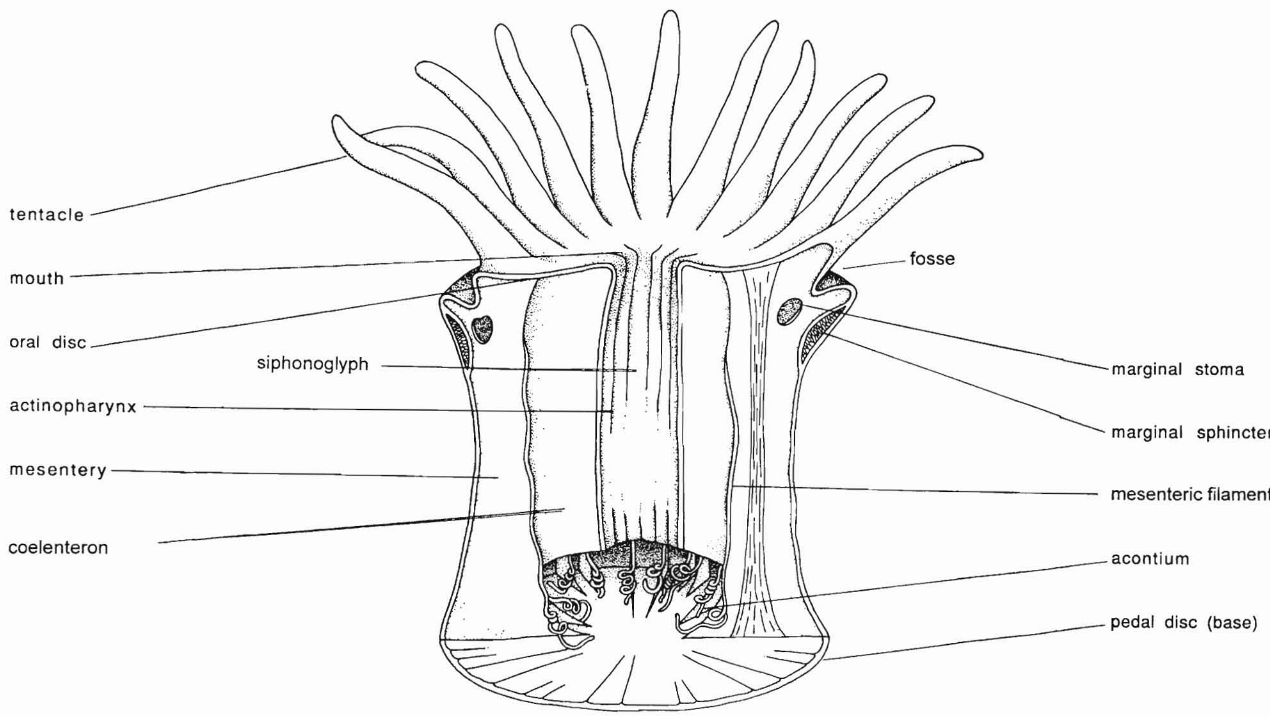

Figure 1
Anatomy of a generalized sea anemone (Actiniaria).

origin. This type of base can also wrap around cylindrical structures such as polychaete tubes or gorgonian branches, and can even meet and adhere to itself on the other side (amplexicaulous base). The sand or mud burrowing anemones and the cerianthids have rounded or almost pointed bases that can be used to burrow and to anchor themselves into the substrate. These anemones have elongate, sometimes almost wormlike, bodies capable of peristaltic burrowing movements. Cerianthids represent the only group that consistently builds a permanent tube; only a few species of burrowing anemone (Actiniaria) have this ability. The cerianthid tube is a long soft black or brown construction, composed of ptychocyst nematocysts, that collapses when a specimen is collected. Its shiny, smooth inner surface allows a large cerianthid to withdraw rapidly into the sediment to depths of a meter or more, providing some protection from predators.

Morphology

An anthozoan polyp (Fig. 1) is basically a cylinder (the column) surrounding a second cylinder (the actinopharynx), which is supported in a central position by radial mesenteries (the mesenteries are paired in actiniarians, zoanthids, and corallimorpharians, unpaired in cerianthids). The distal (oral) end of the actinopharynx forms the mouth and lips. One or more thickened ciliated grooves (siphonoglyphs) can run the length of the actinopharynx. The siphonoglyphs pump water into the body cavity (coelenteron) which is compartmentalized by the mesenteries and which includes the hollow center (lumen) of each tentacle. Corallimorpharians lack siphonoglyphs, as do scleractinian corals. Most actiniarians have two siphonoglyphs although three or four have been observed in certain species. The aboral end of the column is closed and forms the base, which has an opening (pore) only in the cerianthids. The oral end of the column gives rise to the tentacles and the oral disc that surrounds the mouth. Tentacles of all species are contractile, i.e. able to bend or shorten by muscular contraction. Many species can also retract the tentacles, covering them completely or almost so by contracting the marginal sphincter, a circular muscle that surrounds the margin or upper edge of the column of these anemones (Fig. 1, 2).

The column may end simply at the tentacles with no demarcation or, in some Actiniaria, it may be divided into recognizable regions: the scapus (lower or entire column); the scapulus (upper column, thinner-walled and often smooth); and the capitulum (column just below the tentacles). The column of actiniarians can bear distinctive sculpturing including tubercles, vesicles,

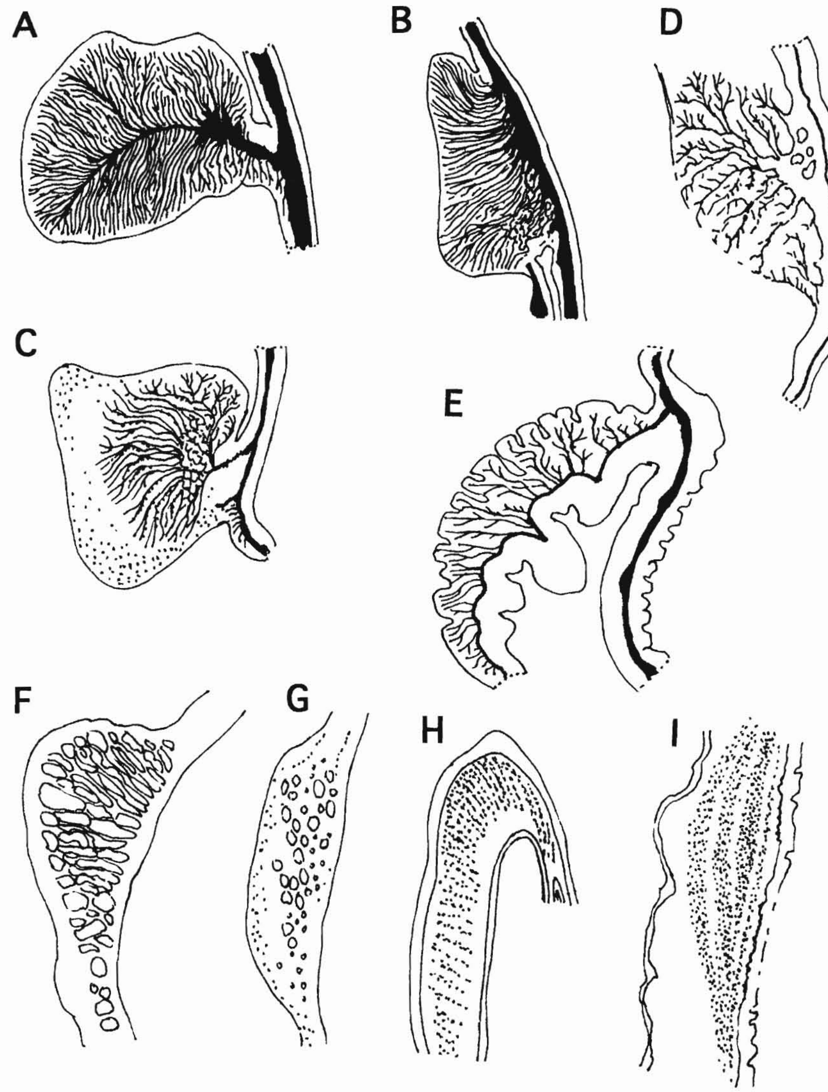

Figure 2
Types of marginal sphincters, redrawn from Carlgren, 1949. Endodermal: (A) pinnate circumscribed; (B) restricted diffuse; (C) circumscribed; (D) restricted diffuse (or palmate); and (E) diffuse. Mesogleal: (F) reticulate; (G) alveolar; (H) transverse stratified; and (I) longitudinally stratified.

adhesive verrucae, or raised tenaculi (see definitions). Corallimorpharians and cerianthids have smooth columns, as do many zoanthids, except for a few species with tubercles. Zoanthid columns also incorporate sand, sponge spicules, and other foreign material, which give them a textured appearance.

Internally, the mesenteries are important structural elements that also help to identify species. They are either perfect (connected to column wall and actinopharynx) or imperfect (not connected to actinopharynx). Some or all mesenteries bear gonads. The free edge of a large mesentery bears a filament that is trilobed in cross section along its upper (distal) portion and single-lobed toward the base (proximal) in the Actiniaria and Zoantharia. In certain Actiniaria the basal region of the mesentery forms an acontium, a thread-like structure that is free of the mesentery except at one end. Acontia move by means of ciliary beating, muscular contraction, and hydrostatic pressure within the coelenteron, and can be ejected through the mouth, through pores in the body wall (cinclides), or through temporary lesions. Their only known function is to

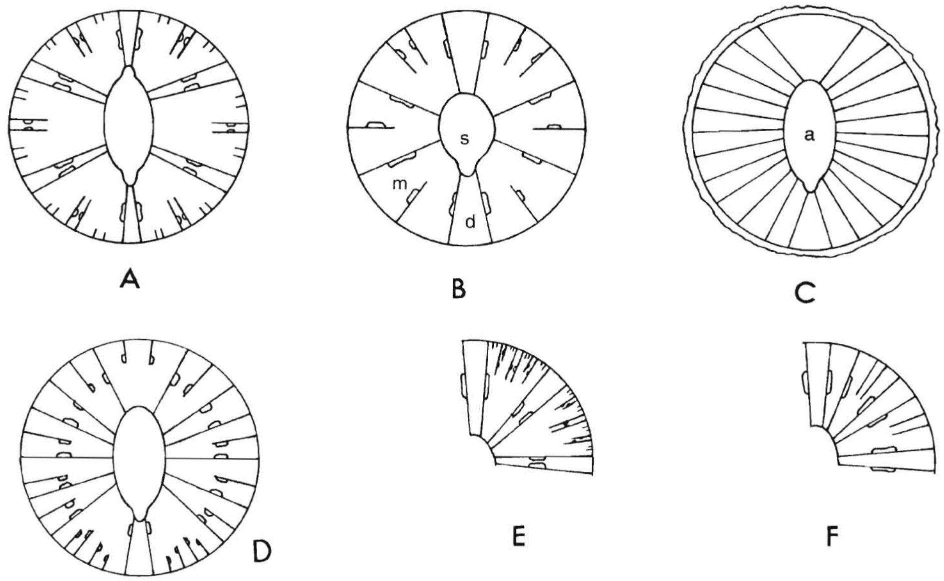

Figure 3
Schematic mesenteric arrangements. (A) Actiniaria—most common arrangement; (B) *Edwardsia*, an abasilarian anemone; (C) Ceriantharia; (D) Zoanthidea; (E) Actiniaria, *Actinostola*, illustrating "*Actinostola* rule" that third and higher cycles of mesenteries have members of pair unequal; (F) Actiniaria, Endocoelantheae: *Halcurias*; new cycle of mesenteries arises in endocoels of older pairs. a = actinopharynx; d = directive pair; s = siphonoglyph; m = retractor muscle.

deter predation by adhering to a predator's body and stinging it with nematocysts. The mesenteric filaments secrete digestive enzymes and digest (by phagocytosis) pieces of prey that have been partially digested extracellularly. Cerianthids and zoanthids have mesenteric arrangements very different from those of actinians and corallimorpharians (Fig. 3).

The column wall, tentacles, and actinopharynx of anthozoans consist of three tissue layers: the epidermis (or ectoderm), the mesoglea, and the gastrodermis (or endoderm). Mesenteries have only the latter two layers: a central mesogleal lamella covered on both sides by gastrodermis. The mesoglea consists of layers of collagenous fibers running in several directions. By acting antagonistically to the hydrostatic pressure within the coelenteron, the mesoglea enables an anthozoan to maintain its shape. Shick (1991) has provided a thorough review of sea anemone morphology and biology.

Cnidae: Nematocysts, Spirocysts, and Ptychocysts

The microscopic capsules (organelles) produced by specialized cells (cnidocytes) in anthozoans are termed cnidae. All anthozoan tissues, in all body regions, (except the mesoglea) can contain cnidae. These structures either penetrate or adhere to prey organisms. Nematocysts are double-walled structures used for feeding, as defense against potential predators, and in competition among anthozoans. Spirocysts, the second category of cnidae found in the Hexacorallia, are generally confined to the tentacles and the oral disc but sometimes occur in the column and base. They have a single wall, and their threads do not penetrate prey; instead they adhere to the surface of prey. They are important for the capture of prey with hard shells or exoskeletons, such as certain crustaceans, bivalves, and gastropods. Ptychocysts, the third category, are unique to ceriantharians; they are used to build the tube that lines the burrow.

Nematocysts of the Actiniaria are often reliable specific characters. Their types, sizes, and distribution among the tissues are consistent, although there is considerable intraspecific variability in sizes and in relative numbers of types among individuals. Although these structures are a great aid to systematists, they are not necessary for identification of most specimens. Nematocysts can, however, be examined as a final check for species identification. Table 1 gives the distribution for types of cnidae among the anthozoan orders, and Table

Table 1

Cnidae of several anthozoan orders, following Schmidt (1972a, 1972b) and other sources. Terminology follows Weill (1934) and Carlgren (1949), with additions and alternative designations of Schmidt (1972a; 1972b) and Mariscal et al. (1977). Abbreviations: S = spirocyst; A = atrich; H = holotrich; MB = microbasic b-mastigophore and basitrichs (b-rhabdoids); MP = microbasic p-mastigophore (p-rhabdoids) types A [MPA], B [MPB], C [MPC] and D [MPD], PT = ptychocyst. Note: microbasic amastigophores are equivalent to p-rhabdoids B and C.

	Tentacles	Column (scapus)	Actinopharynx	Mesenteric filaments
Ceriantharia				
(Cerianthidae)	S,MB,A	S,MB,PT,H	S,MB,A	MB,A
(Aracnanthidae)	S,MB,MPB,A	S,MB,MP,PT	S,MB,MPB,A	MB,MPB
Zoanthidea				
(*Epizoanthus* and most other Zoantharia)	S,MB,H	S,MB,H	MB,MPA,H	MPA,H
(*Palythoa*)	S,MB,H	S,MB,MPA,H	MB,MPA,H	MB,MPA,H
Corallimorpharia (and Scleractinia)	S,MB,MPD,H	S,MB,MPD,H	S,MB,MPD	MPD,H
Actiniaria (suborder Endomyaria)	S,MB	S,MB	S,MB,MPA	S,MB,MPB,MPA
Actiniaria (other suborders)	S,MB,MPB, H,MPC	S,MB,MPB,A	S,MB,MPB, MPA	S,MB,MPA
Antipatharia	S,MB	S,MB	MB	MB,MPA
Octocorallia	MB	MB	MB	MB

3 provides the most recent data on spirocysts, nematocyst, and ptychocyst types and size ranges for the species in this key. Cnidae are much easier to examine and identify in live or newly dead specimens than in preserved ones. They are small (10–150 µm long) and are thus best observed with a high-powered compound microscope (1,000×, oil immersion). Phase contrast or Nomarski interference optics are great aids in nematocyst identification because they make the small spines and barbs on the thread much more visible.

Cnidae can be observed by making smears from each tissue type. A scalpel or razor blade is scraped across the surface of the column, tentacle, or actinopharynx and is then wiped on a microscope slide. Fragments of acontia, mesenteries, and mesenteric filaments can be removed with fine forceps and then transferred to and smeared on a slide. A cover slip is placed on the slide and then pressed with a fingertip or blunt object, such as the wooden end of a dissecting pin. The tissue should be smeared thin enough so that there is only a single layer of cnidae when observed under the microscope. In unpreserved specimens, the pressure on the cover slip will cause many of the capsules to eject their threads. Osmotic shock from a drop of freshwater introduced at one edge of the cover slip also causes thread ejection, as does a very dilute solution of methylene blue dye. This dye becomes concentrated in the capsules and may, if it becomes too dense, actually obscure the internal structure; therefore caution is needed if it is to be used. Preserved tissues are usually stiffer and must be macerated before they are smeared onto a slide. Investigators familiar with cnidae may wish to check these important species-specific characters and should refer to references by Weill (1934), Carlgren (1940; 1949), Cutress (1955), Schmidt (1969; 1972a; 1972b), Westfall (1965; 1966), Mariscal (1974; 1977a; 1977b; 1984) and Conklin et al. (1977) to gain familiarity with nemotocyst identification. Shick (1991) has reviewed nematocyst function and toxins in sea anemones.

In addition to determining the various categories of cnidae correctly, which can be difficult with the average light microscope, there may be further complications. First, there is often great inter-individual variability in the density of nematocysts in a given tissue type. An individual may be missing a characteristic type of cnidae from a given tissue. Some of this variability may be due to the location where the sample was taken, population differences, or the presence of specific prey, competitors or predators that may induce the formation of certain categories of cnidae. Similarly, sizes of cnidae can vary between individuals and populations; larger nematocysts of a given type tend to occur in larger individuals within a species. With cnidae, small differences on the order of 10–20% of maximum or minimum capsule length should not be considered definitive for separation among species. Larger differences, and the presence or absence of a specific category of cnidae in several specimens, are more reliable. Several specimens should be examined whenever possible given the known variability among individuals. Nematocysts identified as "rare" in the literature (or in Table 3 of this key) are not likely to be appropriate for positive identification. They may be rare for several reasons, including contamination of one tissue surface by another during collection, dissection, or handling. Fortunately, only a small piece of tissue is necessary for study of the cnidom, thus it is usually possible to examine another sample from the same specimen, even if a permanent slide has not been prepared.

Categories of Cnidae

Spirocysts—Spirocysts are single-walled capsules with a tightly packed spiral tube that fills the interior (Fig. 4). The capsule is relatively uniform in diameter, sometimes slightly wider at the proximal end and more pointed at the distal end. There is often a pronounced curvature to the whole capsule, especially in large spirocysts. The tube has no barbs or spines and is thick in relation to the thread of nematocysts. Upon firing, the tube everts, and rod-shaped bodies (tubules) packed inside the tube hydrate to form a long sticky filament that wraps loosely around the tube. This filament then breaks up to become an anastomosing network of strands. Such cnidae correspond to the category of "glutinants" in the older literature. Certain atrichous nematocysts resemble spirocysts but have much thinner threads, are usually symmetrical, double-walled, and lack pronounced curvature.

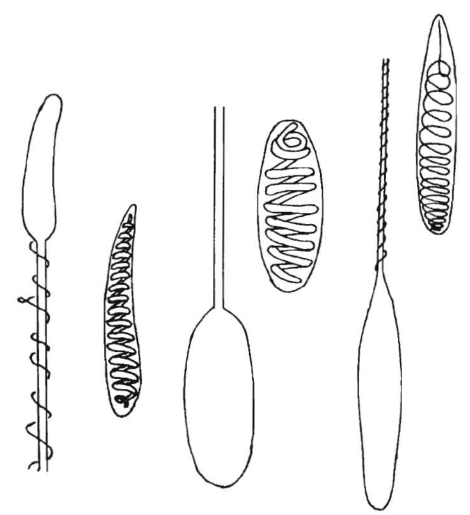

Figure 4
Categories of cnidae (a) spirocyst; (b) nematocyst, atrich (form of holotrich); (c) nematocyst, holotrich. (Figs. 2–4 redrawn from Schmidt, 1972a). See also Figures 5 and 6.

Ptychocysts—Previously thought to be atrichous nematocysts, this group was recognized as a distinct category of cnidae only recently (Mariscal et. al., 1977). These large structures (to over 100 µm) are by far the most abundant cnidae in the column of cerianthids and are used to construct the smooth lining of their permanent burrow. They are roughly symmetrical, about twice to three times as long as wide, and contain an irregularly coiled tube (Fig. 4). The tube may evert from a position that is distinctly off center on one end of the capsule. This tube (or thread) is not helically folded; instead it has a variable number of pleats arranged circumferentially, but not lengthwise. The discharged tube appears very wide, about one fourth the capsule diameter, and varies in diameter along its length. The tube has no spines, barbs, or rod-shaped bodies and it shows fine ridges running lengthwise. The tip is closed, unlike that of nematocysts.

Nematocysts

Haplonemes: Atrichs and Holotrichs—This group of nematocysts is characterized by a tube (thread) that lacks a basal "shaft" portion and is either loosely or very regularly coiled within the symmetrical capsule (Fig. 4). Tubes with a noticeable change in diameter in the section proximal to the capsule are termed "anisorhizas," although both forms change tube diameter from the most proximal to most distal portions. Holotrichs have small barbs along the entire tube which atrichs appear to lack under the light microscope. Electron microscopy has determined that atrichs actually have very small spines along the tube and must therefore be considered a special form of holotrich.

Heteronemes: Basitrichs and b-Mastigophores—Heteroneme nematocysts have a distinct demarcation between a thicker basal "shaft" and a thinner distal "thread" or "tube" (Fig. 5, 6). The arrangement of barbs and spines along the two portions often differs as well. In this first group of heteronemes, the shaft has a comparatively gradual transition to the tube, resulting in a smooth appearance of this zone in the unexploded state (Fig. 2). Thus, no "funnel" shape is produced as in p-mastigophores and amastigophores. Basitrichs have a thin straight shaft and a tightly coiled tube along most of the capsule length. b-mastigophores (Fig. 6) have a wider shaft, sometimes with several types of barbs along it, and a loosely coiled tube within the capsule, probably shorter than that of the basitrich tube. Small basitrichs (<12 µm), found in some tentacles and columns of actiniarians, have often been neglected in published descriptions. Similarly, very large basitrichs are sometimes scattered in the tips of tentacles

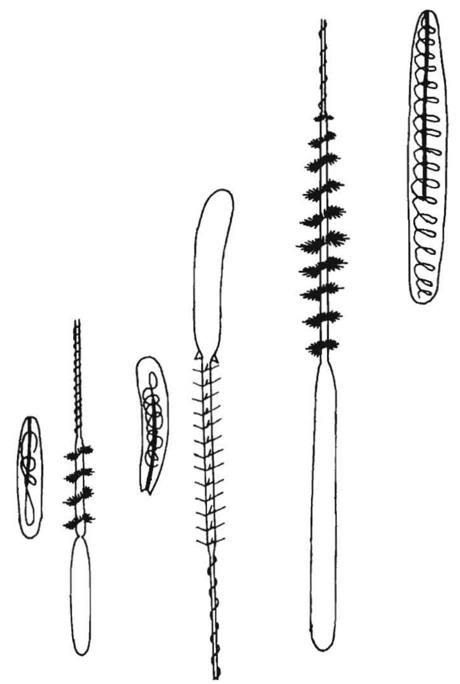

Figure 5
Categories of cnidae (nematocysts): (a–c) bastrichs, three forms in unexploded and exploded condition.

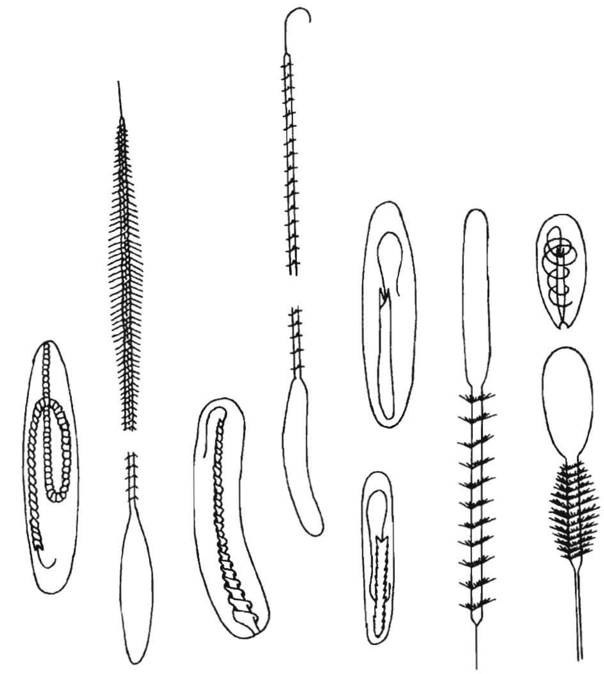

Figure 6
Categories of cnidae (nematocysts): (a and b) microbasic b-mastigophores; (c and d) microbasic p-mastigophores, each in unexploded and exploded condition (c includes two shapes of unexploded capsule).

and thus may be missed in tentacle scrapings (e.g. *Urticina*[1]). Schmidt (1972a, 1972b) has illustrated the broad diversity in this group and the gradation from basitrichs to b-mastigophores; he terms both "b-rhabdoids."

Heteronemes: p-Mastigophores and Amastigophores—This group differs from the group of basitrichs and b-mastigophores by having a sharp transition from shaft to tube, which produces a distinctive "funnel" shape in the unexploded state (Fig. 6). The tube is rarely tightly coiled and is sometimes reduced to a fragment or is absent. The reduced condition defines the amastigophores; the tube in this group is never "armed" with barbs. The p-mastigophores have a tube at least as long as the shaft, and the tube is usually armed. Both groups can have very long shafts, up to several times the capsule length, that coil loosely within the capsule. When the shaft is over three times the capsule length, the condition is termed "macrobasic." The more common situation, where the tube is less than this length, is termed "microbasic." Note that both types of nematocysts in this group can form terminal "darts" composed of fused tube spines; these darts can penetrate prey surfaces, such as crustacean exoskeletons. There is some confusion in the literature between amastigophores and b-mastigophores because some of the former have small "funnels" that can be hidden if the shaft is long. Schmidt (1972a; 1972b) has suggested that the above terms be replaced by new terms for four categories of funnel-bearing heteronemes: p-rhabdoids (types A, B, C, D). His argument is that neither the shaft length nor the tube length are characters that show an abrupt transition.

Specimen Preservation and Examination:

Most sea anemones contract tightly when collected. If they are preserved in such a state, their tentacle number, column divisions, column texture, and mesenteric arrangements are difficult or impossible to determine. A solution of 7.5% by weight $MgCl_2$ or $MgS0_4$ dissolved in distilled or tap water, then mixed with an equal

[1] Hand, C. 1976. Bodega Bay Marine Laboratory, Univ. Calif., Bodega Bay, CA 94923. Personal commun.

volume of sea water, usually relaxes them quite well. The mixture should be kept refrigerated and the anemones left in it 12–18 hours at 1–5°C (i.e. in a refrigerator or cold room). The coelenterons of large specimens should be flushed with the solution by means of either a large syringe or a plastic poultry baster. Small anemones will relax in a few hours; larger ones may take overnight to do so. A relaxed anemone does not look like an expanded one because of the lack of hydrostatic pressure. The marginal sphincter, if present, relaxes and the tentacles are thus not hidden, as in contracted specimens, and the column will also be free of strong contraction furrows. If the animal is kept at a cold temperature, the chance that it will begin to deteriorate, if it dies, is lessened. Tropical and subtropical anemones often relax completely when kept in a refrigerator (at ≤5°C) even without an anaesthetic solution.

Once the anemone has been relaxed, it should be transferred to 10% chilled formalin in seawater (i.e. 1 part 37% formaldehyde solution to 9 parts seawater; the coelenteron should be flushed if needed) and left to fix overnight or longer, at 1–5°C, if possible. At this point, the specimens can be stored at room temperature. After a week or more, they should be transferred to 70% ethanol for permanent storage. If specimens are to be used for histological study, Bouin's solution, rather than formalin in seawater, is often recommended.

The tentacles of contracted preserved specimens can be examined by bisecting the anemone longitudinally (oral to aboral) through the actinopharynx. The specimen should be pinned to a wax layer in the bottom of a glass dish, then immersed in water to allow internal structures to separate. Mesenteries, acontia, tentacles, siphonoglyphs, and sometimes the marginal sphincter are easily observed by this method. The number of mesenteries that reach below the actinopharynx can also be checked, although the mesenteries in the oral (distal) half of the specimen will not be fully visible. To see the mesenteric arrangement, a transverse section should be cut just below the oral disc. The oral end of the specimen can then be flipped over to examine and count the mesenteries. Cuts can be made cleanly, even in small specimens, by using two pieces of a double-edged razor blade that has been snapped in half (the two halves are slid against each other as the cut is made). Large anemones can be dissected with a stout single-edged razor blade or scalpel.

Using the Key

Given the lack of hard structures and other readily visible characters, anemones and their relatives are notoriously difficult to identify. One must spend the time necessary to get to know their anatomy well before proceeding with identification. This key can be used three ways. For each method, begin by listing the obvious characteristics of the specimen, including the size, shape, number of tentacles, type of base, and column texture. The first method is to work from the beginning of the key, making choices based on the description, until further information is needed (e.g. hand sections). Once a final species determination has been made, make certain the specimen looks like the drawing, taking into account the effects of preservation and degree of contraction. If the identification is questionable, use Table 2 to confirm that the specimen's characteristics are within the listed ranges. Dichotomous keys are problematic because they rely heavily on few characters and ignore some useful information. If the specimen does not match some of the characteristics noted in Table 2, check other species close to the first selection in Table 2 and refer back to the illustrations of these other species. For example, a wrong turn can be made in the key because the specimen was judged to have "prominent tubercles" when, compared with other related species, the tubercles are really rather small.

The second method for using the guide is to dismiss the branching key entirely and scan the pictures, listing those species that resemble your specimen, again considering its condition. Examine Table 2 to find the species that conforms most closely in all characteristics. Consider habitat, depth, and geographic range, remembering that some species have not been collected frequently and known ranges are probably smaller than real ranges. However, for shallow-water species, it would be very unlikely to find a species known only from Maine and the Arctic in North Carolina, and vice versa. If a convincing match is not found by this method, return to the branching key. The correct species may have been missed because the specimen did not resemble the drawing.

The third method is to go directly to Table 2 and scan the columns for unique characteristics of the specimen or list all species with the same generic characteristics, such as depth, geographic range, base type, and number of tentacles. Examining the drawings of these species may help eliminate a few choices. Be careful not to exclude a species on the basis of depth or geographic range if, for example, the specimen was collected only slightly outside the reported range. The correct species can be overlooked by any of these methods if some characteristic of the specimen is not recognized. For example, a hand section may not show a sphincter when a diffuse mesogleal sphincter is present. Finally, Table 3 should be used if characteristics of the cnidae are needed to distinguish among two or more related species. If a species has not been found that fits the specimen's characteristics, one should go back to each characteristic to see if there was a possibility for misinterpretation.

Table 2

Morphological and ecological characteristics of the species. Abbreviations are given below for entries in each column, left to right.

Maximum length, maximum width: measures (in cm) are the maximum published; alive (L), or preserved (P). Width refers to column or base, whichever is appropriate.

Color: Color of tentacles (Tent.), oral disc (O. disc), column, and lips including the upper portion of the actinopharynx (LIPS) of live specimens unless denoted by *.blue (B), black (BK), brown (BR), clear (CL), cream (CR), flesh (F), green (G), gray (GR), maroon (M), orange (O), pink (P), purple (PR), red (R), salmon (S), tan (T), violet (V), white (W), yellow (Y). Patterns in table include spots (s), lines (l), and bands around tentacles (b) next to color of that pattern.

Reproduction: Monoecious or hermaphrodite (both sexes in one individual (M)), dioecious or gonochoric (separate male and female animals (D)), (S) sexually reproducing type unknown, brooding internally to planula larva stage (BP), brooding to tentacled juvenile stage (BJ), brooding externally to tentacled juvenile stage (BE). Asexual reproduction includes longitudinal fission (F), pedal (basal) laceration (L), and transverse fission (TF).

Tentacles: Tentacle number (no.) is given for an average large specimen, usually close to the maximum. The second number (below) is the number of cycles of tentacles. N = nonretractile tentacles, never fully concealed by margin. For cerianthids, tentacle number refers to marginal tentacles. L=length.

Column: Texture: Periderm on part of column (PE), thin mucus sheath with adherent particles (MS), smooth column (S), vertically striated (ST), with conical, flattened or hemispherical tubercles (TB), with tenaculi (TE), with a sand encrusted tunic (zoanthids) or periderm (SA)), with adhesive verrucae in vertical (longitudinal) rows, at least on the top half of the column (V), nonadhesive vesicles in vertical rows (VV), small scattered nonadhesive vesicles (SV), tightly packed nonadhesive vesicles sometimes tending to form rows near the margin (VP), vertical wrinkles (WV), horizontal wrinkles (WR), sunken pits (PT). Note that wrinkles typically form on contracted and preserved specimens but disappear on expansion. Texture on top only (T), on bottom only (B). Division: Column not divided, (S), column forms scapus and scapulus (SS), column forms scapus and capitulum (SC), forms carcinoecium to house hermit crab (CA).

Base type: Base folded around tubular substrata, meeting itself and often adhering to itself (amplexicaulous base,(AM)), broad adhesive base, wider than the column just above the base (AB), small adhesive base, narrower or equal to the column just above the base (SB), broad adhesive base formed into an inverted cuplike cavity enclosing mud (CB). Physa of burrowing forms (P). Round or bulblike base of cerianthids (R), with a pore (RP). Base with a chitinous cuticle (CU).

Number of siphonoglyphs: A single number is given if that is the common condition. When it is variable (0,1,2,3,4), often as a result of asexual reproduction, this condition is denoted as 'V'.

Sphincter type: No sphincter (N), alveolar (A), diffuse (D), circumscribed (C), pinnate (P), palmate (PL), reticular (RS), transversely stratified (TS). Tissue location denoted as: mesogloeal (M), endodermal (E).

Mesenteries: "Top" is just below oral disc. "Bottom" is just below proximal end of actinopharynx. Numbers are pairs for a typical large specimen, usually close to maximum size. Perfect mesenteries (P), connected to actinopharynx, total number of mesentery pairs (A), number of sterile mesenteries in the first, second, or third order (S), number of directives (D) given if not same as number of siphonoglyphs. If the bottom of the column (just below actinopharynx) has the same number of mesenteries it is denoted 'same', otherwise only the differences are noted. When mesenteries are not paired (cerianthids, zoanthids), number of individual mesenteries is given (I).

Substrate type: Cobble or gravel (C), gorgonians (G), hydroid stems (H), mud, silt and clay (M), solid rock or boulders (R), sand (S), shell (SH), hermit crab-occupied shell, or crab carapace (SHH), hermit crab abdomen (SHA), sponge (SP), *Sargassum* plants (SR), worm tubes (W), algae (A).

Geographic range: The range is given from the northernmost point to the southernmost. If the species occurs elsewhere than the east coast of North America, the general range is given as its northern limit

General ranges:

NHM northern hemisphere, shallow water (<30 m)

ARC circumarctic boreal, shallow or deep water

EUR European artic, Scandinavia, British Isles, shallow or deep water

DSA deep water (>30 m) North and South Atlantic

DSN deep water (>30 m) North Atlantic only

LIS	Long Island Sound	NJR	New Jersey	MAS	northern Massachusetts
NOV	Nova Scotia, ocean side	DEL	Delaware	FLA	Florida
BFD	Bay of Fundy	VIR	Virginia	CCD	Cape Cod
MNE	northern Maine	NCA	North Carolina	CAR	Caribbean
MNN	southern Maine	SCA	South Carolina	GRN	Greenland

(For deep water areas, the coastal point at the same latitude is given.)

Primary sources: These are the two or three publications where most of the tabulated data were found. Individual entries may be from another source (see Annotated Systematic List) or from studies of museum specimens made by the author for this guide.

Data begins on next page.

Table 2 (continued)

Species	Max. length (cm)	Max. width (cm)	Colors: Tent.	Colors: O. disc.	Colors: Column	Colors: Lips	Repro-duction	Tentacle: No.	Tentacle: Length (cm)	Column: Texture	Column: Div.	Base type	No. of Siphono-glyphs	Sphincter type	Mesentery Pairs: Top no.	Mesentery Pairs: Bottom no.	Depth (m)	Substrate type	Geogr range	Primary sources
Gonactinia prolifera	0.6L	0.1L	CL,W P	CL,W P	CL,W P	—	S,TF	16	0.6L	S	S	SB	2	N	4P,A 4S	4P,A 4S	0-100	SH,A W	EUR MNE	Manuel 1981 Chia et al. 1989
Halcurias pilatus	8P	4P	W	W	W	W O	D?	70 3N	5P	WR	S	AB	1	N	10P-68A 2D-0S	14A	700-816	R	DEL DSA	McMurrich 1893, 1898 Sebens (unpubl.)
Actinernus nobilis	7.5P	10P	BR PR	BR PR	W O	BR	D	<120 2N	3P	S	S	SB	2	N	—	—	350-2284	M	NOV DEL	Carlgren 1921 Sebens (unpubl.)
Edwardsia sipunculoides	12L 4.5P	0.5L 0.4P	Y,P W,s	Y P	Y,P BR	R P	—	24-36 2N	1L 0.2P	SV WR	SS	P	2	N	6P,A	6P 36A	87-117	M,S C	ARC MAS	Verrill 1922 1864-1866
Edwardsia sulcata	4P	0.4P	—	—	Y,GR	Y,W	—	16	<0.5P P	SV,WR PE	SS	P	1	N	—	—	0-110	S	MNE MAS	Verrill 1864-1866 Widersten 1976
Edwardsia elegans	15L 3P	0.5L 1P	P,CL b	P	Y,BR s	Y	—	16 N	0.1P	SV,PE WR	SS	P	2	N	4P,A	4P,A	0-117	S C	BFD SCA	Verrill 1922
Paraedwardsia arenaria	6P	1P	—	—	—	—	D	16 2	<0.5,P	PE,SA TE	SC	P	2	N	8P 16A	—	666-2000	S	DSN	Carlgren 1921
Fagesia lineata	3.0L 1.2P	0.6L 0.4P	CR W	CR BR	CR,BR P	CR BR	S TF	40 3N	0.5L	S	SS	P	2	N	4P,A	4P,A	0-23	R W	CCD NCA	Verrill 1864-1866
Nematostella vectensis	2L 1P	0.2L 0.1P	CL,W b	CL W	CL W	CL W	S TF	9-18 2N	1L	S MS	SS	P	1	N	4P 8A-0S	SAME	+2-0	M C	EUR CCD	Manuel 1981 Hand 1957
Drillactis pallida	10L	6L	W,GR G	W,GR Y	W,GR	Y	—	12-24 N	1.6L	S SV	SS	P	2	N	—	—	0	S	CCD	Verrill 1922
Haloclava producta	20L 7P	3L 2P	GR,Y CL,W	Y,GR W	Y,GR W	—	—	20	2L	VT ST	SC	P	1	N	10P 10A	SAME	+1-15	S,M SH	CCD SCA	Verrill 1864-1866, 1898 Widersten 1976 Hargitt 1912
Peachia parasitica	8L	1.4L	P,BR F	P,BR F	P,BR F	F	—	12 2	1.2L 0.5P	SV,WR WV	S	P RP	1	N	6P-10A 6S	SAME	0-91	S C	MNE CCD	Verrill 1864-1866, 1922 Wildersten 1976
Halcampa duodecimcirrata	3.8L 1.2P	0.5L 0.3P	S,BR s,b	S	S	W	—	12 2N	0.5L	S MS	SC	P	2?	N?	6P-12A 0S	SAME	10-600	M S	BFD CCD	Verrill 1922 Widersten 1976
Pseudactinia melanaster	2.0L	4.0L	BR,Y M	BR,Y M,W,l	BR,Y M	W	F	200 >3	1.5L	S	S	SB	0	D	24P-60A ?S	SAME	0-?	SR R	NCA CAR	Field 1949 den Hartog 1985
Bunodosoma cavernata	5L	5L	Y,G BR,b	Y,G BR	Y,G BR,s	—	—	96 5	1.5P	VP	S	AB	2	C,E	12P-44A 12S	SAME	+1-8	R	NCA CAR	Verrill 1864-1866 Field 1949 Carl. & Hedg. 1952

continued

Table 2 (continued)

Species	Max. length (cm)	Max. width (cm)	Colors: Tent.	O. disc.	Column	Lips	Repro-duction	Tentacle: No.	Length (cm)	Column: Texture	Div.	Base type	No. of Siphono-glyphs	Sphincter type	Mesentery Pairs: Top no.	Bottom no.	Depth (m)	Substrate type	Geogr. range	Primary sources
Bolocera tuediae	25L	25L	CR,Y O,P	CR,Y O,P	CR,Y O,P	R,O M	D	<260 5N	8P	S WR	S	SB	2	D,E	>6P-?A >2S	SAME	20-2000	R SH	EUR NCA	Carlgren 1921, 1922 Manuel 1981
Epiactis fecunda	5.6P	6.2P	—	—	—	—	BE	90	1P	PT,T WR,B	SC	AB	2	C,E	36P-44A 0S	SAME	25-400	R S	NWF MAS	Verrill 1899b, 1922
Urticina crassicornis	6L	10L	CR,P B,G	CR,P B,G	R,G T	P GR	D BJ	160 5	2P	VS	SC	AB	2	C,E	40-80P >80A,10S	SAME	+2-366	R C	ARC CCD	Hand 1955b, Widersten 1976
Aulactinia stella	5L	4L	G,BR W,F	G,BR W,F,l	G,BR F	O	S BJ	72 5	2.5L	V	S	AB	2	PL	24A	48A	+1-1	R	ARC MNN	Verrill 1864-1866 Carlgren 1921 Verrill 1922
Aulactinia capitata	15L 5P	4L 3P	BR,GR G,W,s	BR,G GR	BR,G GR	—	—	<110	1P	V,T WR,B	S	SB	2	—	—	—	0-?	S	NCA CAR	Verrill 1864-1866
Sicyonis obesa	8P	12P	W PR	W PR	W	—	—	70 3N	3P	S	S	SB	2	A,RS M	16P-34A 16S	67A	1239-2908	M	CCD VIR	Carlgren 1934, 1921 1949
Paranthus rapiformis	8L 4P	2.5L 1P	GR,W BR	GR,BR W,l	Y BR	GR,Y W,BR	—	180 5	2.5L 0.3P	S	S	SB	2	D,M	24P->48A 0S	SAME	+1-12	S	LIS CAR	Verrill 1899b Widersten 1976
Actinoscyphia saginata	4P	10.5 P	BR	BR	W	BR R	—	<160 2N	3.5P	S	S	SB	2	M	6P->160A 6S	SAME	699-4700	W M	EUR NCA	Verrill 1882 Carlgren 1934
Liponema multicornis	6P	9P	R BR	R O	R O	R O	—	600-900 20N	4.5L 1.8P	S	S	SB	2	D	—	—	80-872	R SH	EUR CCD	Carlgren 1921 Sebens (unpubl.)
Actinostola callosa	20L	25L	S,O BR	S,O BR	S,O CR	S,O BR	D	<300 6-7N	2.5L <2P	WR,B VV,TB	S	AB CB	2	RS	24P,A 12S	SAME	90-1296	M,S W	DSA NCA	Carlgren 1921 Widersten 1976
Stomphia coccinea	5L	6L	P,O b	P,O R,s	P,O	P,O	—	>80 4-5	2L 1.5P	S,WR WV	S	AB	2	D,M	16-24P 144A 16-24S	16-24P 120A	10-400	R,C SH	ARC CCD	Carlgren 1921 Widersten 1976
Antholoba perdix	10L 3P	25L 6P	Y,O BR,b	Y,PR BR	Y,O BR	BR R	—	400 6N	4L 1P	WR	S	AB	2	A,D,M,	48P 192A 2S	12P-192A 2S	111-400	R,S SH	CCD CAR	Verrill 1883, 1899b Widersten 1976
Hormathia nodosa	10L 8P	10L 5P	BR,O F,P	BR,O F,P	BR,O F,P	BR,O F,P	—	96 5	1P	TB,WR PE	SS	AB	2	A,RS TS,M	6P-48A 6S	SAME	54-600	C,G SH,R	ARC CCD	Verrill 1922 Carlgren 1942
Actinauge verrillii	15L 7P	10L 5P	S,BR P	O,R BR	S,F P	—	—	96	2P	TB PE	SS	AB CB	2	TS M	6P-?A 6-8S	6P 6-8S	128-2840	M,S W,R	GRN DEL	Carlgren 1942 Dunn 1983

continued

Table 2 (continued)

Species	Max. length (cm)	Max. width (cm)	Colors: Tent.	Colors: O. disc.	Colors: Column	Colors: Lips	Repro-duction	Tentacle: No.	Tentacle: Length (cm)	Column: Texture	Column: Div.	Base type	No. of Siphono-glyphs	Sphincter type	Mesentery Pairs: Top no.	Mesentery Pairs: Bottom no.	Depth (m)	Substrate type	Geogr range	Primary sources
Actinauge longicornis	13L 6P	9L 3P	P,PR	W,P PR	W,P	O,BR R	—	96	6.5L 1P	WV,TB WB	SS	CB AB	2	TS M	>16P->48A 6S	48A,6S	200-600	M W	CCD CAR	Carlgren 1921
Phelliactis americana	6P	9P	—	—	—	—	—	190 4	1P	TB PE	SS	AB	2	A M	12P,99A 8-12S	—	238-366	C	NOV CCD	Widersten 1976
Paracalliactis involvens	3P	5P	S,P	S,P	S,P	O	—	96 3	0.5P	S	SS	AB CU	2	M	6P-48A 6S	SAME	200-4000	SHH SHA	CCD VIR	McMurrich 1893
Allantactis parasitica	10P	4P	PR CR	R	Y,BR R	PR	—	96	0.5P	S	S	AB	2	TS M	6P-48A 6S	SAME	2-1448	SHH	ARC MNN	Carlgren 1921, 1942
Calliactis tricolor	8L 3P	5L 2P	B,F,O,R GR,W,b	B GR	BR GR,1	P Y	D	200 5	1.4L 0.5P	V,T S	S	AB	2	M	6P->48A 6S	48A	0-30	SH SHH	NCA CAR	Verrill 1864-1866 McMurrich 1898
Adamsia sociabilis	1.4L 0.5P	1L 1P	P	CL,P	CL 1	P	D	— 9	0.3L 0.2P	S	S	AB CU	2	M	12P->300A 12S	96A 12S	136-738	SHA	NOV SHH	Verrill 1882, 1883 NJR
Chondrophellia coronata	4.4P	2P	O	O	*O,GR BR,Y	—	—	96	0.4P	WV,TB PE	SS	AB	2	M A	6P-48A	6P-<48A	600-2448	R	DSN	Verrill 1883 Carlgren 1942
Amphianthus nitidus	3P	2P	R	P,PR F	P,R G,W	—	L	150 4-5	0.3P	S,TB	S	AM	2	M D	12P,?A 0S	SAME	234-605	H,SP W,G	NOV DEL	Verrill 1864, 1899b Widersten 1976 Manuel 1981
Amphianthus mirabilis	0.4P	1.2P	—	—	—	—	S,A?	96 4-5	0.3P	S	SS	AM	2	M	6P,48A 0S	—	360-620	G,W	NOV SCA	Verrill 1883, 1899b, 1922
Stephanauge nexilis	2.5P	5P	S BR	BR R,O	S F	—	S	202 6	0.6P	S,TB	SS	AM	2	A M	6P,172A 0-2S	128A	150-547	P,SP W	ARC CCD	Carlgren 1942 Widersten 1976
Stephanauge acanellae	1.5P	2.5P	S,O BR	S,O P,BR	S,O P	—	S	140 N	1.5P	S TB	SS	AM	2	A M	6P,100A 0S	48A	443-2430	G	ARC NJR	Carlgren 1942 Verrill 1883
Stephanauge spongicola	2.5L 1.2P	2.0L 1.1P	P F	P F	P F	—	S	110 4-6	0.3P	S PE	SS	AM AB	1-4	RS M	8-12P,34A 0S,2-4D	SAME	129-578	H,SP R,W	NOV NCA	Verrill 1883 Widersten 1976
Sagartiogeton verrilli	4L 1.5P	3.5L 2P	O,S F,PR	O PR	S F	—	D	96	3L 0.9P	S TE,PE	SS	AM AB	2	A,D RS,M	12-18P, 124A 0S	SAME	135-1416	W,SH R	ARC DEL	Carlgren 1921, 1942 Widersten 1976
Aiptasia eruptaurantia	2.5L 1P	1.5L 0.5P	BR,G GR	PR,BR G,Y,1	F,P,G R,s(R)	—	—	170 5	1.5L	S	SS	AB	2	M	6P,48A 0S,4D	SAME	0-?	R SH	NCA	Field 1949 Carlgren 1952

continued

Table 2 (continued)

Species	Max. length (cm)	Max. width (cm)	Colors: Tent.	Colors: O. disc.	Colors: Column	Colors: Lips	Repro-duction	Tentacle: No.	Tentacle: Length (cm)	Column: Texture	Column: Div.	Base type	No. of Siphono-glyphs	Sphincter type	Mesentery Pairs: Top no.	Mesentery Pairs: Bottom no.	Depth (m)	Substrate type	Geogr range	Primary sources
Actinothoe modesta	6.4L	1.5L	GR l	W Y	W F	—	—	100	1L	S MS	SS	AB	2	M	—	—	0-?	S C	LIS CCD	Verrill 1864-1866 Hargitt 1912
Daontesia praelonga	2.2P	1.3P	—	—	—	—	D	50	0.6P	TE CU	SS	AB CB,CU	2	A M	12P,48A 0S	SAME	1041-1960	M	EUR DEL	Carlgren 1942
Metridium senile	30L 10P	15L 8P	W,CR O,BR	W,CR O,BR	W,CR O,BR	P	D L	>1000	1L 0.5P	S	SC	AB	1-3	M A	3-15P,>190A 0-15S	>96A 6P,6S	2-234	R	ARC NJR	Carlgren 1942 Hand 1956 Manuel 1981
Aiptasia pallida	3L 1P	2L 1P	CR,W BR,s	CR BR	CR BR	CR BR	D L	96 N	3L 0.3P	S	SS	AB	2	M	5-6P,24A 4D	SAME	+1-22	R,SP A,SH	NCA CAR	Carlgren 1952 den Hartog 1985
Haliplanella luciae	4L	2.5L	G CL	G BR	BR b	W BR,Y	D F	100	<1L	S	SC	AB	0-3	N	3-9P,>96A 0-6S	>48A	+3-16	R	NHM CAR	Hand 1956 Widersten 1976
Diadumene leucolena	3L	0.8L	W CL,G	G	P CR,W	P G,W	D,L	<200 6	2L	S,VV	SC	AB	2	N	6P->96A 0S	>48A	0-?	R SH	MAS SCA	Hand 1956
Epizoanthus incrustatus	1.5P	0.6P	—	—	—	—	—	>48	0.4P	SA	CA,S	—	1	—	—	—	57-774	SHH W	DSN DEL	Verrill 1864, 1883
Epizoanthus paguriphilus	2.0P	1.2P	O S	GR BR	GR BR	—	—	70	0.4P	S	CA,S	—	1	—	—	—	454-1152	SHH	DSN DEL	Verrill 1882 Manuel 1981
Cerianthus borealis	23P	5P	BR,S W,b	BR Y	BR,G P,GR	—	M	150-200 N	15L 5P	S WV	S	RP	1	N	?	10A	0-500	M S,C	DSN DEL	Verrill 1873b, 1922 Widersten 1976 Shepard et al. 1986 species B
Ceriantheopsis americanus	36L 20P	2L 2P	BR,W PR	Y W,l	BR F	—	M	71-125 N	—	S WV	 S	RP	1	N 0S	92I 0S	92I	0-70	M	CCD FLA	Widersten 1976 Shepard et al. 1986
Cerianthid I (undescribed)	>15L	>2L	BK R	—	—	—	—	— N	>20L	S	S	RP?	1	N	—	—	>1000	M	DSN	Shepard et al. 1986 Species A
Cerianthid II (undescribed)	6P	0.8P	PR BK	— —	PK BK	— —	—	<40 N	1.5P	S	S	RP?	1	N	—	—	1600-1900	M	DSN	Hecker (unpubl.)
Cerianthid III (undescribed)	—	—	W PR,s	—	W	—	—	—	—	S	S	RP?	1	N	—	—	200-300	M	DSN —	Shepard et al. 1986 Species C
Cerianthid IV (undescribed)	—	—	G,Y	— —	— —	— —	—	—	—	S	S	RP?	1	N	—	—	200-300	M	DSN	Shepard et al. 1986 Species D
Corynactis delawarei	0.8P	1P	—	—	BR	—	F	90	0.5	S	S	AB	1	?	6P-60A	—	>200	R,W SH	DSN	Widersten 1976

Table 3

Nematocyst and spirocyst size ranges and distributions in anthozoan tissues, compiled from several sources. Only lengths (µm) are presented, as ranges from smallest to largest observed in that tissue. No information is available on the nematocysts of a few species. Abbreviations are as follows: * rare nematocyst type in that particular tissue (may or may not be contamination from other tissue surfaces), ± size range unknown, CL whole column or distal part, SP scapus, SC scapulus, S spirocysts. Nematocysts are categorized as follows: B, basitrich; H, holotrich (includes atrichs); MA, microbasic or macrobasic amastigophore; MB, microbasic b-mastigophore; MP, microbasic p-mastigophore; MU, microbasic mastigophore of undetermined type; PT, ptychocyst; N, any nematocyst where type was not specified. Some authors do not report abundance of cnidae. Small basitrichs (<15 µm) have been omitted by some authors. Species for which no data are available are omitted from this table.

Species	Tentacles	Column	Actino- pharynx	Mesent. filaments	Other tissues	Sources
Halcurias pilatus	B 18-43 S 16-48	B 16-45* S 17-44	B 18-42 MP 17-32* S 17-42*	B 26-42* MP 18-36 S 22-33*	Acontia MP 19-35 B 26-39* S 19-46*	Sebens (unpubl.) (5 spec.)
Actinernus nobilis	B 22-29 S ≤ 67 N 38-61	B 24-38 S 31-48 N 25-36	B 34-41 S ≤ 67	B 27-43 MP 22-42* S 25-49*		Carlgren, 1921 this study (mes.) (5 specs.)
Edwardsia sipunculoides	B 19-26 S 10-25	SP/MB 42-71,90-110 SC/B 14-16	B 16-26 MP 24±*	B 19-24 MP 21-33,23-32 type 2		Widersten, 1976
Edwardsia elegans	B 22+* S 5-15*	CL/B 37-87,10+* MU 62-97*	B 15-32 MP 17-37 MB 22-32*	B 17-29 MP 16-25 MB 20-22*		Sebens (unpubl.) (4 spec.)
Nematostella vectensis	B 10-13,20-25 S 11-21	B 10-13	B 14-18 MU 18-25	B 14-18 MU 18-25	Nematosomes B 14-17 MU 17-22	Hand, 1955
Haloclava producta	B 11-20 MB 50-112 S none	B 20-25 MB 50-112	B 14-17,38-57 S 43±*	B 14-25,55-75 B 70-83		Widersten, 1976 Sebens (unpubl.) (tent.,5 spec.)
Peachia parasitica	B 27-39 S 23±*	B 27-34	B 40-46 S 19-23	B 27-45 MP 28±*		Widersten, 1976
Halcampa duodecimcirrata	B 12-20* S 14-25	SP/B 22* SC,S 25-49 S 28+*	MP 24-32 S 17-25	B 12-14 MP 22-23		Widersten, 1976
Pseudactinia melanaster	B 16-34	B 16-21 H 34-40	B 16-28 MP 18-20	B 16-37 MP 18-23		Carlgren & Hedg., 1952
Bunodosoma cavernata	B 16-20 S ?	B 13-21 H 18-23,34-47	B 12-23 MP 17-19	B 13-16,24-35 MP 18-20		Carlgren & Hedg., 1952
Bolocera tuediae	B 21-37,52-87 S 31-74	B 16-21,33-63	B 50-79 MP 23-33	B 20-22,50-74 MP 20-35		Widersten, 1976
Epiactis fecunda	B 25-29 S 27-38	B 16-24	B 33-39 S 29-39*	B 26+* S 30+*		Sebens (unpubl.) (1 spec.)
Urticina crassicornis	B 10-14,20-37 S 17-71	B 6-37,79-83 S 22-69	B 12-26,49-109 MP 23-30 S 28-41*	B 11-34,49-91 MP 20-64		Widersten, 1976 Sebens (unpubl.) (3 spec.)
Aulactinia stella	B 17-31 S 13-31	B 17-31 S 27±*	B 24-38	B 18-44,9±* MP 25-46 S 15±*		Carlgren, 1921 Sebens (unpubl.) (5 spec.)
Aulactinia capitata	B 12-26,35-45 S 9-27	B 10-39 MP 17-24* S 12-23*	B 16-38 MP 14-20 S 12-20*	B 16-41 MP 15-20 S 12-20*		Sebens (unpubl.) (5 spec.)
Sicyonis obesa	N 37-49 S ≤ 70	N 24-28	N 26-29 34-36			Carlgren, 1934
Paranthus rapiformis	B 22-25 MP 22-27 S 15-26	B 16-26 MP 16±* S 33-60	B 25-30 MP 19-30	B 22-32 MP 13-15 20-26 S 49-57		Widersten, 1976 Carlgren & Hedg., 1952

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Table 3 (continued)

Species	Tentacles	Column	Actino-pharynx	Mesent. filaments	Other tissues	Sources
Actinoscyphia saginata	B 19-38 S 68±*	B 17-35,45-77 S 21-60	B 22-36	B 26-31		Carlgren, 1934 Sebens (unpubl.) (3 spec.)
Liponema multicornis	B 22-60 N 96-192 S 22-60	B 19-28	B 31-47	B 18-44 S 25-37		Carlgren, 1921 Sebens (unpubl.) (1 spec.)
Actinostola callosa	B 26-41 MB 43-56 S 27-64	B 19-35 S 25-57	B 21-32 MP 22-28	MP 20-29		Widersten, 1976
Stomphia coccinea	B 14-25 MB 31-53 S 19-50	B 12-20 31-38	B 14-23 MP 18-27 S 22-57	B 10-22 MP 17-29		Widersten, 1976 Carlgren, 1921
Antholoba perdix	B 15-16, 23-36 S 19-46	B 20-28	B 14-27 MP 15-31	B 14-28 MP 14-31		Widersten, 1976
Hormathia nodosa	B 17-34 S 23-56	SP/B 8-11 21-24 S 17-25	B 16-35 MP 23-33	B 14-16 28-31 MP 21-23	Acontia B 32-40	Widersten, 1976 Carlgren, 1942
Actinauge verrillii	B 23-36 S ≤ 60	SP/B 11-13 MP 24-28 SC/B 11-18	B 14-19,26-42 MP 21-36	B 13-18 MP 24-31	Acontia B 14-22 31-43	Carlgren, 1942
Actinauge longicornis	B 19-27 S ≤ 36	SC/B 16-21	B 19-31 MP 21±*	B 11±* MP 17-20	Acontia S 28-35	Carlgren, 1942
Phelliactis americana	B 34-43,17-21* S 38-75	SP/B 25-44,14+* S 27-60	B 37-42,16+* MP 30-39	B 12-22,33-48 MP 28-34	Acontia B 16-23 32-52	Widersten, 1976
Paracalliactis involvens	B 13-42 S 16-41	B 18-27 MA 12-22 B ≥ 8*	B 21-42 MP 19-23* MA ≤ 46*	B 18-41,9-10* MP 14-24* S 13-24*		Sebens (unpubl.) (5 spec.)
Allantactis parasitica	B 26-40	B 24-34	B 26-42	B 13-17 MP 21-34	Acontia B 16-23 31-44 S ≤ 60	Carlgren, 1942
Calliactis tricolor	B 21-24	B 12-14	B 21-27	B 11-13 MP 19-24	Acontia B 21-27	Carlgren & Hedg. 1952
Adamsia sociabilis	B 8-19 S 9-15* MP 12-13*	B 12-22 S 12-18* MP 13±*	B 10-15* MP 9-22* MB 14-19*	B 8-14* MP 10-14 MB 12-18		Sebens (unpubl.) (5 spec.)
Chondrophellia coronata	B 22-32 S 19-50	SC/B 18-23	B 22-34 MP 26-29	B 16-18	Acontia B 30-53	Carlgren, 1942
Amphianthus nitidus	B 19-30 MP 19-29 S 19-47	B 8-13,29-35 MP 17-27 S 29-61	B 24-25 MP 23-26 MP 27±*	B 9±* MP 22-28	Acontia B 42-57 14±*	Widersten, 1976 Carlgren 1934
Stephanauge nexilis	B 9-20 MP 17-23 S 25-49	SP/B 12±* MP 12-20	B 15-18 MP 17-24	B 14-28 MP 16-27	Acontia B 31-37 MP 43-93	Widersten, 1976 Carlgren, 1942
Stephanauge acanellae	B 12-16, S 36-41 MP 20-21	B 13-14 MP 17-24	B 16-20 MP 18-23	B 10-16,20-23 MP 17-21		Carlgren, 1942
Stephanauge spongicola	B 11-33 H 39-49* S 17-34	B 21-27,31-39 H 19-20,39-45	B 14-32 MP 17-26	B 12-15 MP 13-26	Acontia B 13-16,33-45	Widersten, 1976

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Table 3 (continued)

Species	Tentacles	Column	Actino-pharynx	Mesent. filaments	Other tissues	Sources
					Acontia	
Sagartiogeton	B 13-29	SP/B 9-12,16-22	B 24-32	B 27±*	B 37-43	Widersten, 1976
verrilli	MA 16-44	MA 15±*,24-35	MP 23-31	MP 26-31	MA 57-64	
	S 22-36			S 22-34		Carlgren, 1942
					Acontia	
Aiptasia	B 20-26*	B 13-20	B 18-20*	B 16-17	B 31-40	Carlgren, 1952
eruptaurantia	MA 30-44	MA 24-29	MP 14-16	MP 14-17,32-49	MP 59-73	
	S 15±		MA 21-31	MU 21-31		
					Acontia	
Daontesia	B 26-34	SC/B 18-22	B 24-31	B 12-17*,21-28*	B 45-58	Carlgren, 1942
praelonga	S 24-60		MP 24-34	MP 21-34		
					Acontia	
Metridium	B 12-31	B 10-30	B 17-43	B 11-21	B 8-14	Carlgren, 1942
senile	MA 16-36	MP 23-31	MP 17-53	MP 8-48	MA 28-92	Hand, 1955b
	MB 12-32	MA 11-35	MB 26-39	MA 17-22	MB 32-80	
	S 12-30	S 11-27	MA 31+*		S ≤29	
					Acontia	
Aiptasia	B 13-20 (3 types)	B 10-20 (3 types)	B 9-18 (2 types)	B 10-17*	B 17-35 (2 types)	Carlgren &
pallida	MP 24-35 (3 types)	MP 17-25 (2 types)	MA 17-31 (3 types)	MP 10-18 (2 types)	MP 48-75 (3 types)	Hedg., 1952
				30-40		
					Acontia	
Haliplanella	B 11-20	B 9-17,19-23	B 12-32	B 9-19	B 14-21	Hand, 1955b
luciae	MP 19-27	MP/MA 10-24	MP 19-27	MP 9-28	MP 29-56	Widersten, 1976
	MA 10-15		MP/MA 21-23	MA 17-28	MA 13-20	
	S 14-23			S 13-17*		
					Acontia	
Diadumene	B 13-22	B 9-14	B 15-24	B 8-13	B 11-20	Hand, 1955b
leucolena	MA 19-31	MA 13-22	MA 22-31	MP 8-31	MP 22-52	
	S 10-23					
Epizoanthus	MB 22-23, H 22-24	H 22-24	MP 22±*	MB 11-21		Widersten, 1976
incrustatus	MP 22-33, H 34-40		H 21-25,38-41	H 23-26		
				MP 20-28		
Epizoanthus	H 17-30*	H 20-31*	MB 16-26	B 19-22*		Sebens (unpubl.)
paguriphilus			H 14-29*	MB 17-23*		(3 spec.)
				H 18-32*		
				MP 26±*		
	Marginal				Labial Tent.	
Cerianthus	MB 21-61	H 22-44*,61+*	MB 29-54	MB 17-57	MB 18-64	Widersten, 1976
borealis	H/PT 10-36		S 22-60*	S 24-43	H/PT 55-64*	Sebens (unpubl.) (2 spec.)
	S 20-56				S 18-54	
	Marginal				Labial Tent.	
Ceriantheopsis	MB 16-19	MB 20-33*,S*	MB 14-18, 21-23	MB 19-21,26-33	MB 16-33	Widersten, 1976
americanus	H/PT 9-13	H/PT 29-36,59-75	MB 21-32	H/PT 21±*	S 14-27	Mariscal et al., 1977
	S 12-27					
					Acrospheres	
Corynactis	MB 19-24	H 38-53	MP 22±*, H 12±*	MP 24-44	MB 31-34,69-72	Widersten, 1976
delawarei	MP 36±*	S 19-27	H 28-46	H 34-35,37-78	MP 33-82	
	H 15±*		S 17-23	S 31+*		H 69-85
	S 19-38					

Identification Key

Class: Anthozoa
Subclass: Hexacorallia (Zooantharia)

I Colonial form, or with bases of at least some polyps connected . . . . II[2]

I Not colonial form (some species in aggregations); column without sand or other foreign material actually embedded in it, although such material may adhere to the outside III

II(I) Column rough and rigid due to sand and other foreign material embedded in it; tentacles without acrospheres; one siphonoglyph; sphincter present . . . . **order Zoanthidea**

II(I) Column smooth without embedded sand; tentacles with acrospheres; siphonoglyph absent; sphincter weak or absent . . . . **order Corallimorpharia**

III(I) Tentacles of two distinct kinds and cycles (oral and marginal); one siphonoglyph; inhabiting permanent tube; mesenteries unpaired . . . . **order Ceriantharia**

III(I) Tentacles of one or more kinds and cycles; permanent tube usually absent[3]; mesenteries paired . . . . **order Actiniaria**

Order Zoanthidea

1 Inhabits deep water (60–700 m), encrusts shells or rocks; polyps small (to 1.5 cm tall, 0.6 cm wide contracted) . . . . ***Epizoanthus incrustatus***

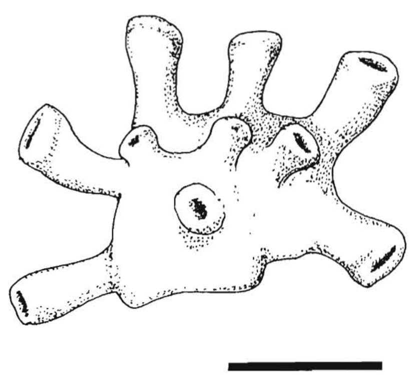

Figure 7
Epizoanthus incrustatus. Side view of colony, contracted (preserved) specimen. Scale: 1 cm.

[2] Many Corallimorpharia, and a few Actiniaria, have polyps connected only temporarily following fission and are otherwise separate, not colonial.

[3] One or more species of burrowing Actiniaria produce a permanent tube.

1 Inhabits deep water (500–1,100 m), encrusts shells with hermit crabs; polyps large (to 2.0 cm tall, 1.2 cm wide contracted) . . . . *Epizoanthus paguriphilus*

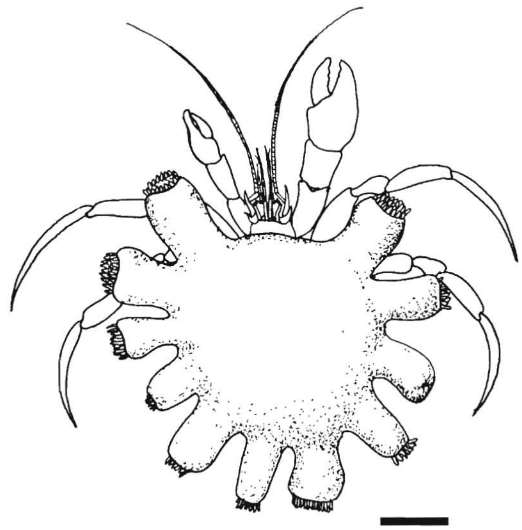

Figure 8
Epizoanthus paguriphilus. Dorsal view, contracted (preserved) specimen, redrawn from Verrill (1883). Scale: 1 cm.

Order Corallimorpharia

1 Single polyp or attached polyps in groups of two or more; acrospheres present; tentacles retractile; inhabits deep water (>200 m) . . . . *Corynactis delawarei*

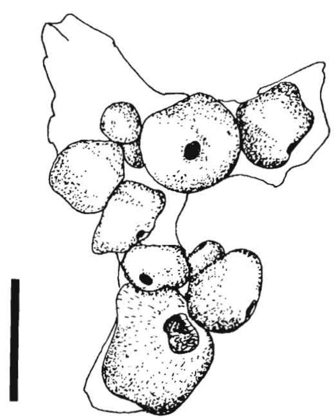

Figure 9
Corynactis delawarei. Connected polyps on shell fragment, contracted specimen. Scale: 1 cm.

Order Ceriantharia

1 Polyp with ≤80 marginal tentacles (depth ≥1,500 m) 2

1 Polyp with >80 marginal tentacles (depth ≤500 m) 3

2(1) Polyp with ≤50 tentacles in large specimens; tube opening flush with, or just below, substrate . . . . **cerianthid I (undescribed)**

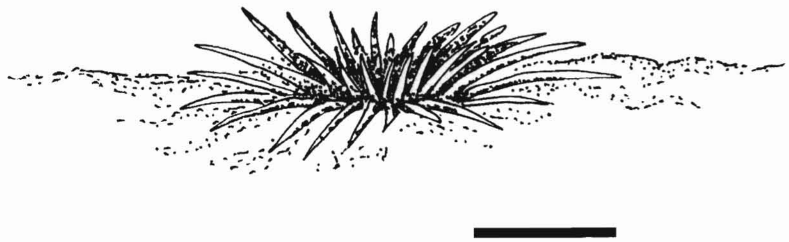

Figure 10
Cerianthid I. Expanded tentacle crown, from in situ photograph by B. Hecker (Lamont-Doherty Geol. Obs., NY). Scale: 5 cm.

2(1) Polyp with >50 tentacles in large specimen; tube protrudes several cm above substrate . . . . **cerianthid II (undescribed)**

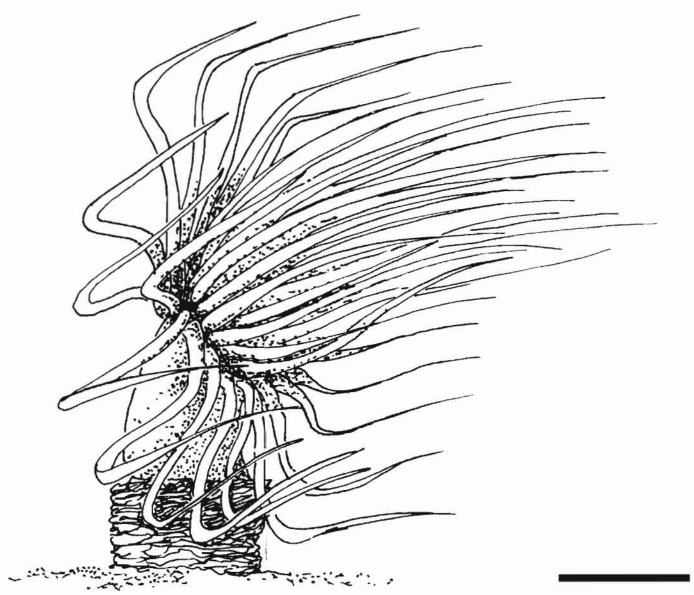

Figure 11
Cerianthid II. Expanded tentacle crown, from in situ photograph (Shepard et al., 1986). Scale: 5 cm.

3(1) Polyp with marginal tentacles of equal length in uniplanar array; tube opening up to 20 cm above substrate (depth ≥200 m) . . . . **cerianthid III (undescribed)**

3(1) Marginal tentacles of unequal length, in multiplanar array **4**

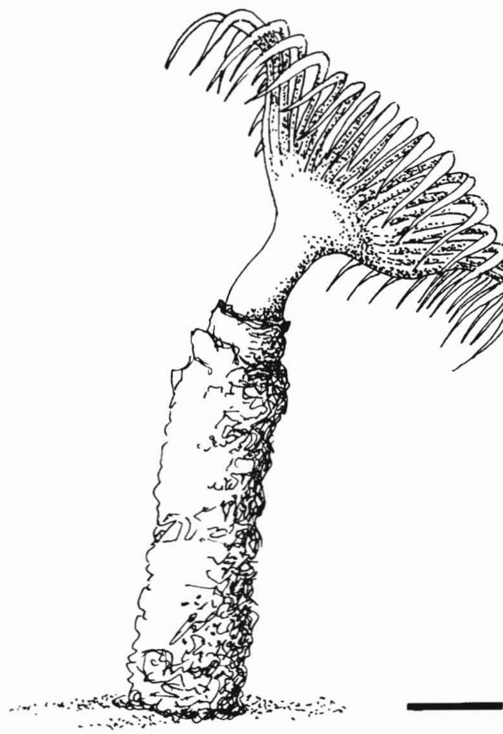

Figure 12
Cerianthid III. Expanded tentacle crown, from in situ photograph by B. Hecker (see Fig. 10). Scale: 5 cm.

4(3) Tentacles greenish yellow; tube flush with substrate; tentacle number unknown, but may be >80 (depth 200–400 m; no photographs available) . . . . **cerianthid IV (undescribed)**

4(3) Tentacles dark colored or banded; tube flush or above substrate (depth 0–500 m) **5**

5(4) Marginal tentacles number to 125 in large specimens, unbanded; spirocysts of marginal tentacles 27 µm length; Cape Cod south to Caribbean (depth ≤70 m) . . . . ***Ceriantheopsis americanus***

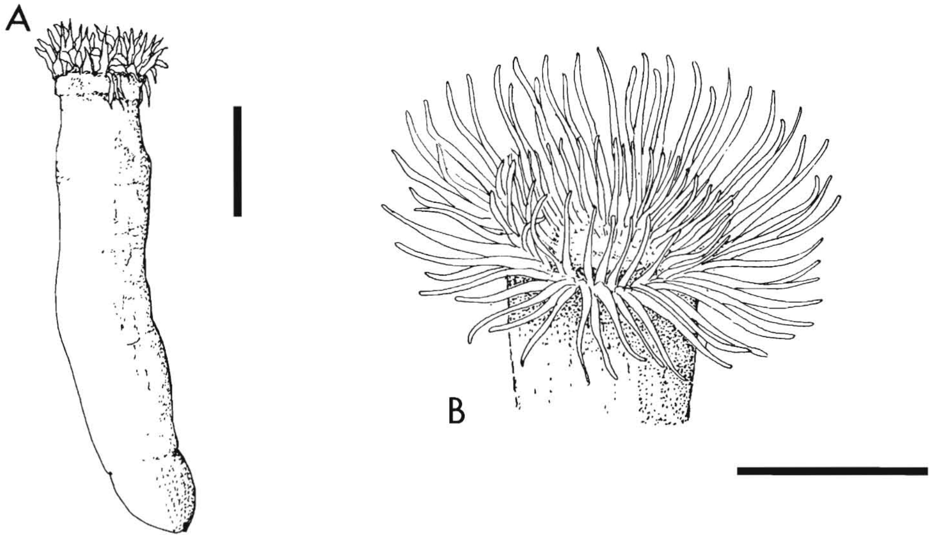

Figure 13
Ceriantheopsis americanus. (A) Contracted (preserved) specimen. (B) Expanded tentacle crown, redrawn from Field (1949). Scale: 5 cm.

5(4) Marginal tentacles number 150–200, banded; spirocysts of marginal tentacles to 56 µm length; Cape Hatteras north to Arctic (depth 0–500 m) . . . . ***Cerianthus borealis***

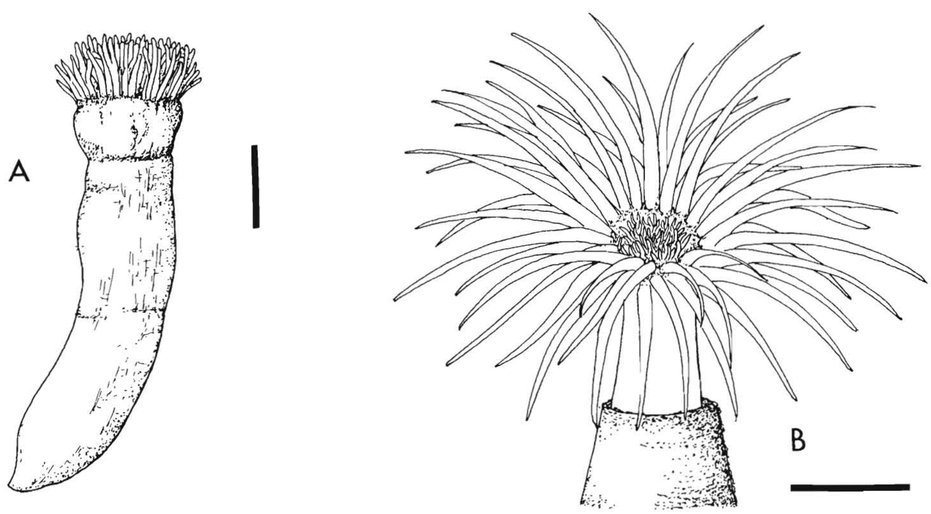

Figure 14
Cerianthus borealis. (A) Contracted (preserved) specimen. (B) Expanded tentacle crown, from in situ photograph by B. Hecker. (see Fig. 10) Scale: 5 cm.

Order Actiniaria

1 Polyp with rounded or pointed nonadhesive base (not disc-like); one siphonoglyph 2

1 Polyp with flattened or cuplike adhesive base; one or more siphonoglyphs 11

Suborder Nynantheae

Tribe Athenaria: one siphonoglyph; no adherent base; burrowing in mud, sand, or gravel

2(1) Scapus with hard sand-encrusted cuticle; also with tenaculi .... ***Paraedwardsia arenaria***

2(1) Scapus without hard sand-encrusted cuticle; with or without tenaculi 3

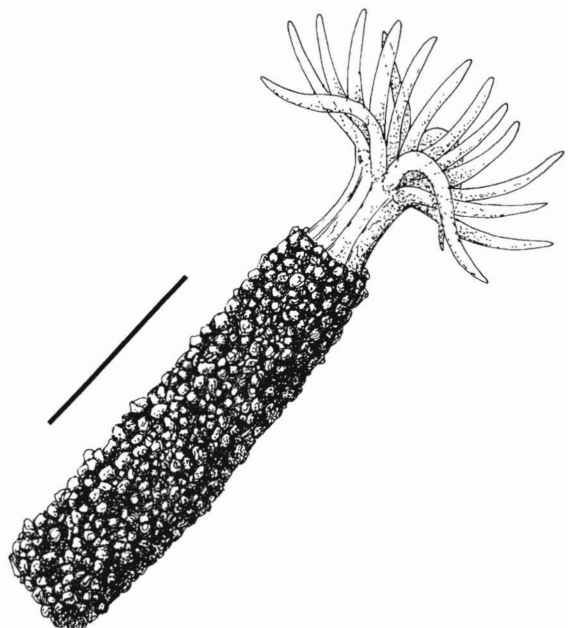

Figure 15
Paraedwarsia arenaria. Expanded specimen with sand-encrusted scapus. Scale: 3 cm.

3(2) Tentacle number ≥20 4

3(2) Tentacle number <20 7

4(3) Two distinct body regions (scapus, scapulus); scapus with periderm .... ***Fagesia lineata***

4(3) Single body region **5**

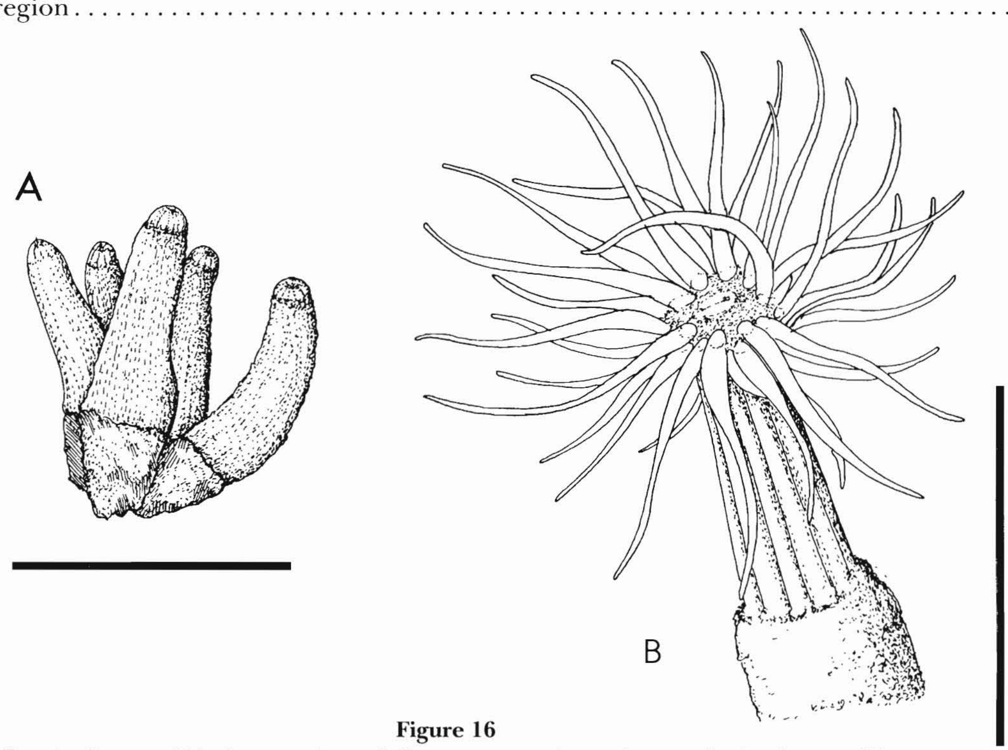

Figure 16
Fagesia lineata. (A) Aggregation of five contracted specimens. Scale: 1 cm. (B) Expanded tentacle crown and scapulus. Scale: 1 cm.

5(4) Tentacle number 20; 20 rows of papillae; adhesive on column .... ***Haloclava producta***

5(4) Tentacle number >20 .... **6**

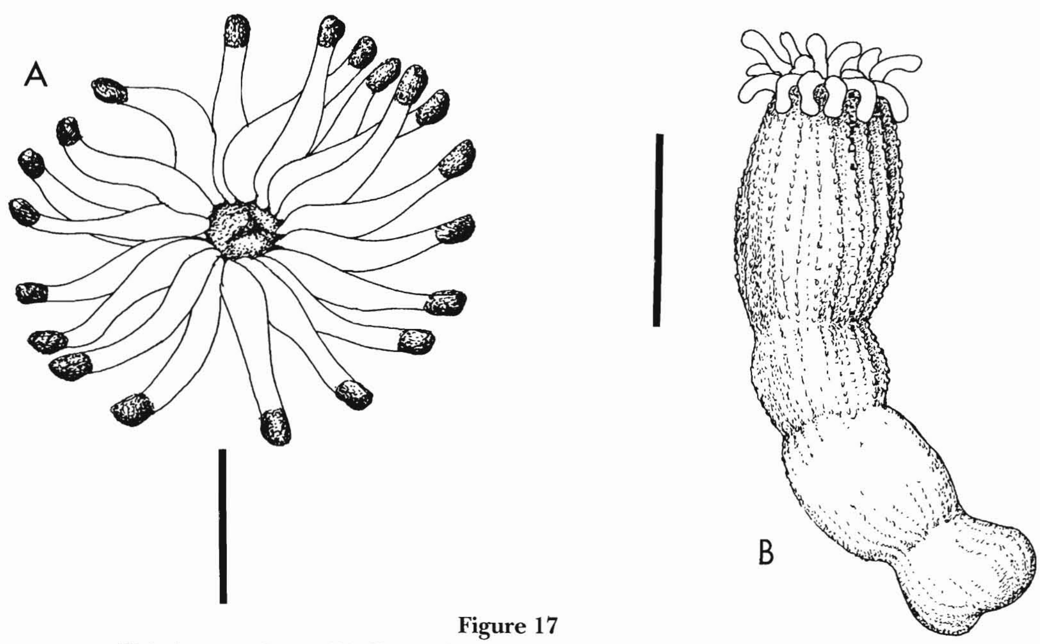

Figure 17
Haloclava producta. (A) Expanded tentacle crown, redrawn from Hargitt (1914). Scale: 5 mm. (B) Partically contracted specimen. Scale: 5 mm.

6(5) Tentacle number 20–36; body >5 cm long when preserved; column with periderm..***Edwardsia sipunculoides***

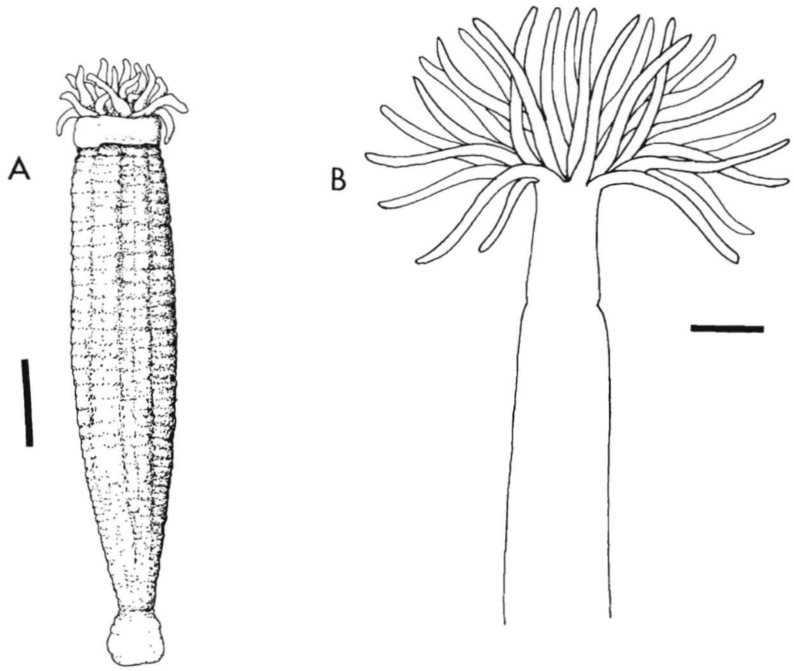

Figure 18
Edwardsia sipunculoides. (A) Contracted specimen. Scale: 5 mm. (B) Expanded tentacle crown. Scale: 5 mm.

6(5) Tentacle number 12–24; column smooth; periderm absent; body <5 cm long preserved .... ***Drillactis pallida*** or ***Halcampoides*** **sp. (Field, 1949)**

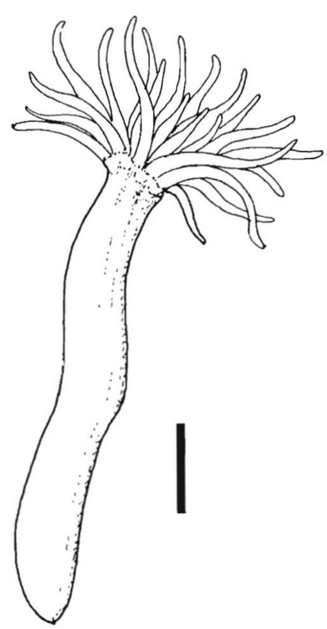

Figure 19
Drillactis pallida. Expanded individual, redrawn from Verrill (1922). Scale: 5 mm.

7(3) Column with papillae (tenaculi); tentacle number 8–12 . . . . ***Halcampa duodecimcirrata***

7(3) Column without papillae, tentacle number ≥12 . . . . **8**

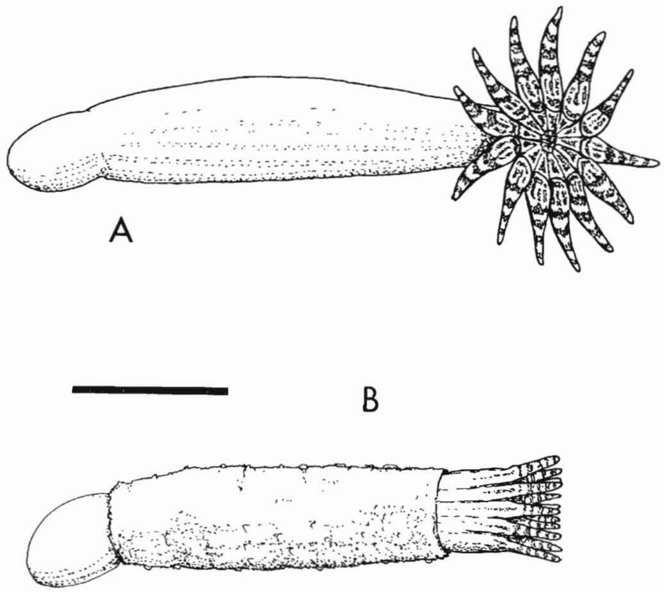

Figure 20
Halcampa duodecimcirrata. (A) Expanded individual. Scale: 5 mm. (B) Partially contracted specimen, same scale, both redrawn from Verrill (1922).

8(7) Tentacle number 12; cinclides present; body <3 cm long contracted; mouth with conchula . . . . ***Peachia parasitica***

8(7) Tentacle number ≥12; column smooth; cinclides absent; conchula absent **9**

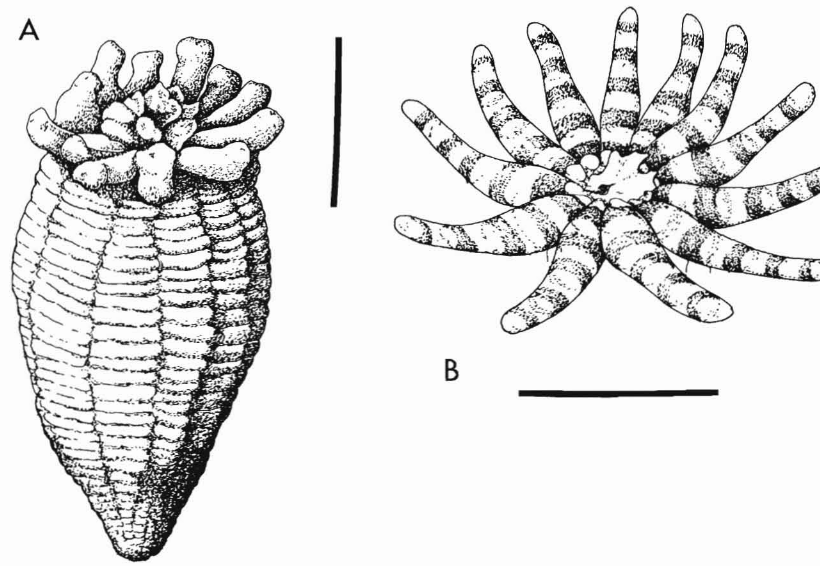

Figure 21
Peachia parasitica. (A) Contracted specimen. Scale: 5 m. (B) Expanded tentacle crown, redrawn from Verrill (1922). Scale: 1 cm.

9(8) Tentacle number 9–18; column smooth; no periderm, but with some loosely adherent material or thin sheath on scapus; tentacles usually banded; nematosomes (40 mm diameter) present in coelenteron . . . . ***Nematostella vectensis***

9(8) Tentacle number 16; periderm on scapus; nematosomes absent **10**

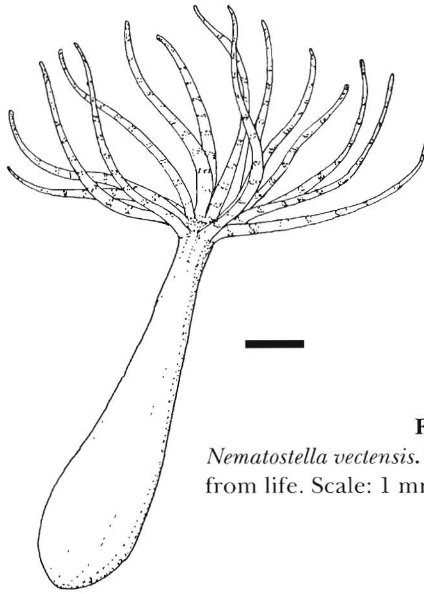

Figure 22
Nematostella vectensis. Expanded individual, drawn from life. Scale: 1 mm.

10(9) Tentacle number 16; 8 longitudinal grooves on column; periderm on scapus . . . . ***Edwardsia elegans***

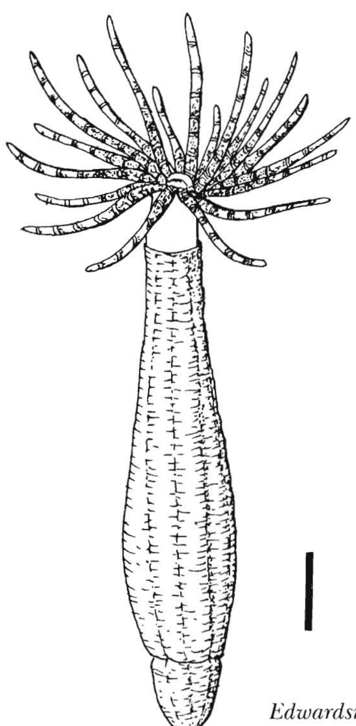

Figure 23
Edwardsia elegans. Expanded individual, redrawn from Verrill (1922). Scale: 1 cm.

10(9) Tentacle number 16; 12 body ridges; periderm on scapus . . . . ***Edwardsia sulcata***

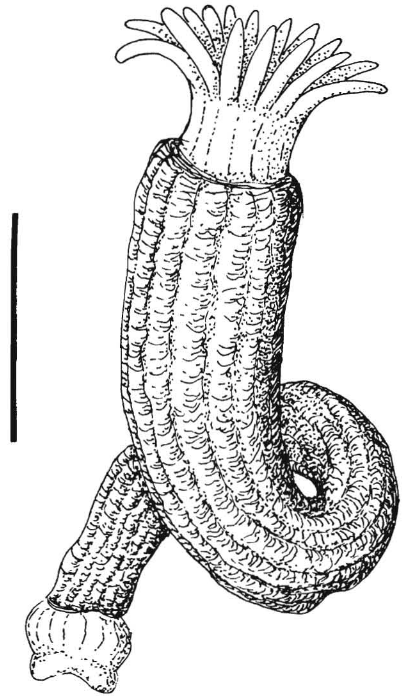

Figure 24
Edwardsia sulcata. Expanded individual. Scale: 1 cm.

11(1) Acontia present **12**

11(1) Acontia absent **31**

Tribe Thenaria: Families with Acontia Present

12(11)· Base attached to hermit crab shell or forms enclosure around hermit crab abdomen ., ... **13**

12(11) Base not attached to hermit crab shell or enclosing hermit crab abdomen **16**

13(12) Base forms enclosure around hermit crab abdomen (taking the place of a shell); base with cuticle **14**

13(12) Base attached to existing shell inhabited by hermit crab; base without cuticle **15**

14(13) Column folded around hermit crab abdomen to form a conical base; tentacles oriented downward; ≤300 mesentery pairs; moderate depths (<250 m) . . . . ***Adamsia sociabilis***

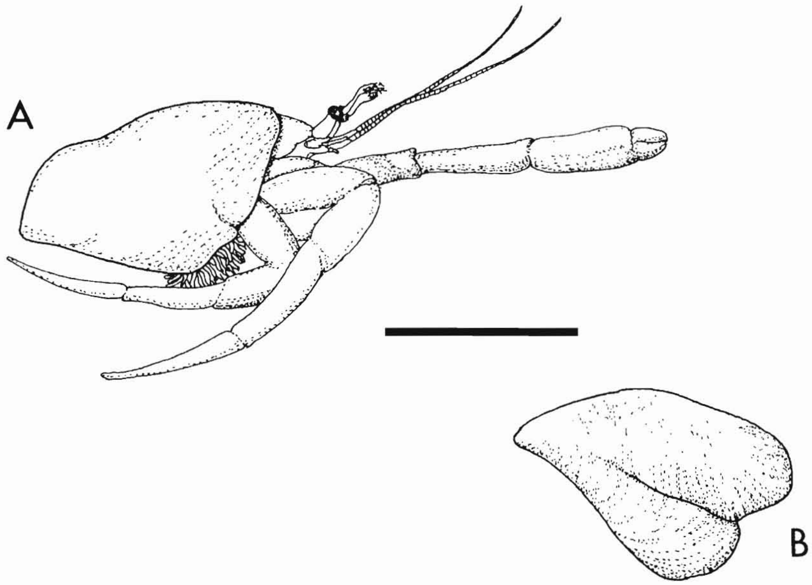

Figure 25
Adamsia sociabilis. (A) Partially contracted specimen on hermit crab abdomen, tentacles downward. (B) Dorsal view. Scale: 1 cm.

14(13) Column not folded to form a cone; deeply concave base forms cavity for hermit crab abdomen; tentacles oriented laterally; ≤50 mesentery pairs; deep water (200–4,000 m) . . . . ***Paracalliactis involvens***

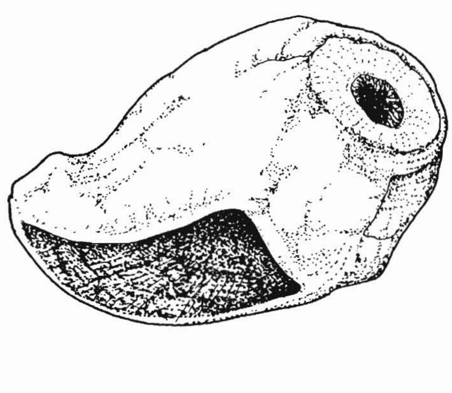

Figure 26
Paracalliactis involvens. Contracted (preserved) specimen. Scale: 1 cm.

15(13) Tentacle number ≤96; north Atlantic south of Cape Hatteras in deep water (≥1,450 m) . . . . ***Allantactis parasitica***

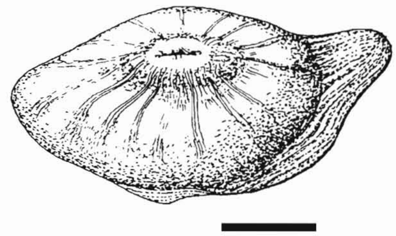

Figure 27
Allantactis parasitica. Contracted (preserved) specimen. Scale: 1 cm.

15(13) Tentacle number ≤200; south of Cape Cod in shallow water (≤10 m) . . . . ***Calliactis tricolor***

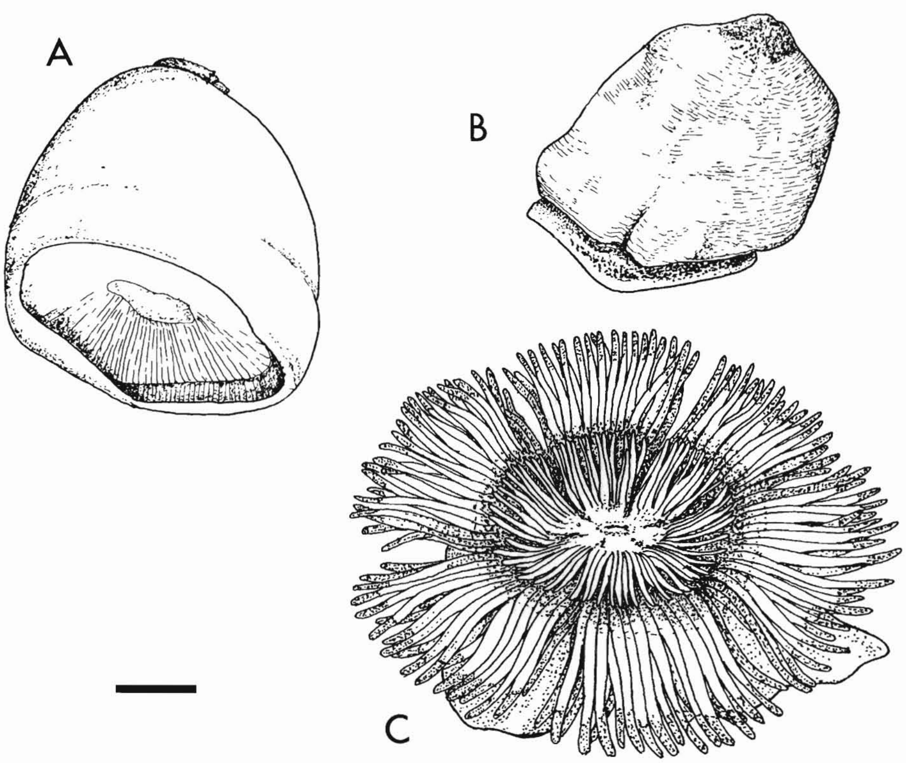

Figure 28
Calliactis tricolor. (A) Contracted specimen, base. (B) Contracted specimen, side. (C) Expanded tentacle crown. Scale for all: 1 cm.

16(12) Column wall thick (≥4 mm at mid-column on large specimen); column tubercles present **17**

16(12) Column wall thin (<4 mm at mid-column on large specimen); column tubercles absent **20**

17(16) Pedal disc not cuplike; tubercles in rows. . . . . ***Hormathia nodosa***

17(16) Pedal disc cuplike (strongly concave); scapulus distinct and ridged on contracted specimens. . . . .'. . **18**

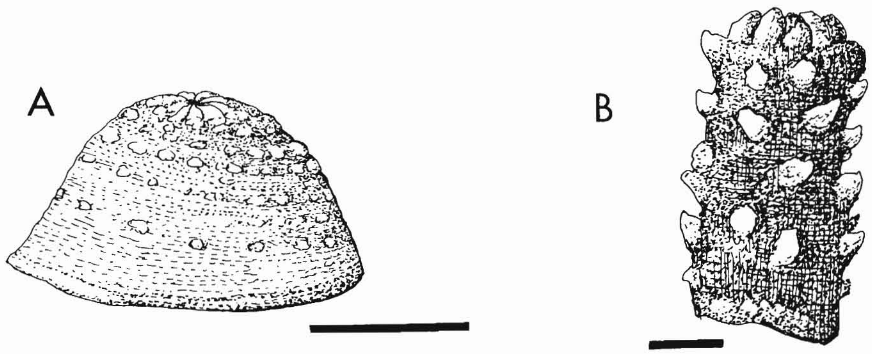

Figure 29
Hormathia nodosa. (A) Contracted specimen with moderately developed tubercles. Scale: 1 cm. (B) Contracted specimen with well-developed tubercles. Scale: 1 cm.

18(17) Scapus with rounded tubercles in up to 48 vertical rows; tentacles number up to 190. . . . ***Phelliactis americana***

18(17) Tubercles irregularly arranged on scapus; tentacles number <100 . . . . **19**

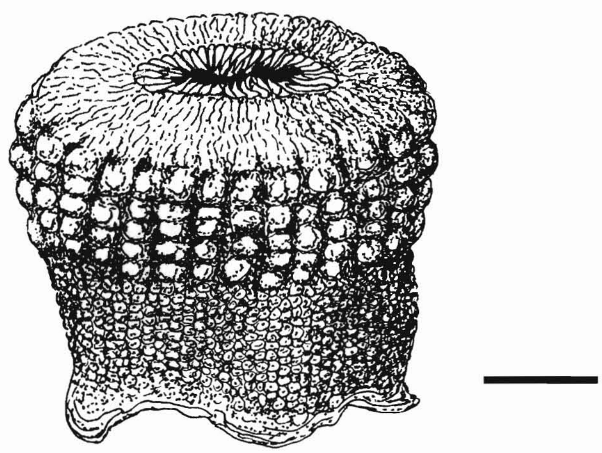

Figure 30
Phelliactis americana. Contracted (preserved) specimen. Scale: 1 cm.

19(18) Tubercles low and irregularly arranged on scapus . . . . ***Actinauge longicornis***

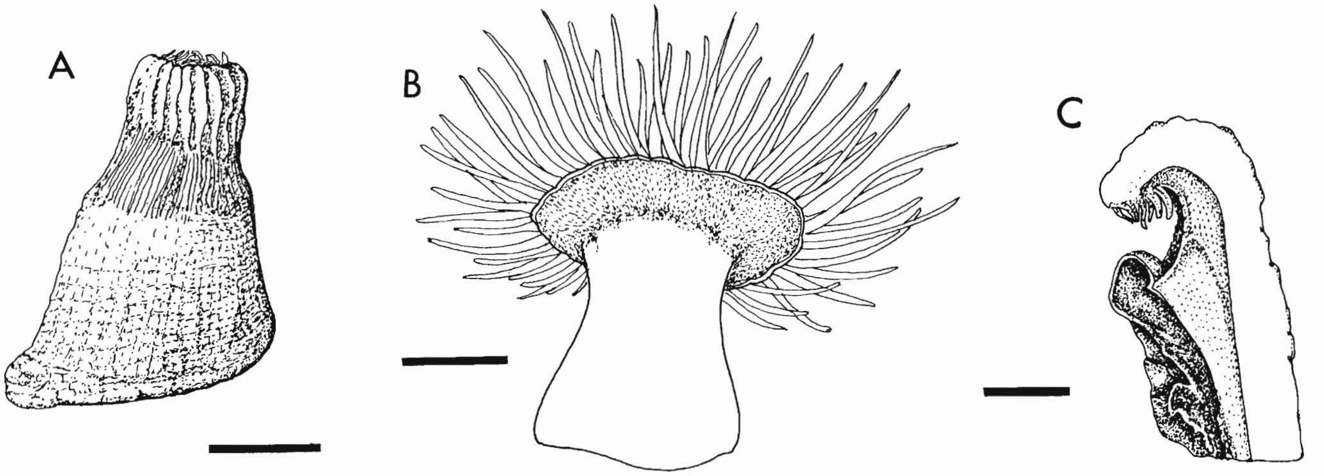

Figure 31
Actinauge longicornis. (A) Contracted specimen. Scale: 5 cm. (B) Expanded individual, from B. Hecker photo (see Fig. 10). Scale: 5 cm. (C) Section through margin showing tentacles. Scale: 1 cm.

19(18) Tubercules on scapus prominent, covering most of column . . . . ***Actinuage verrilli***

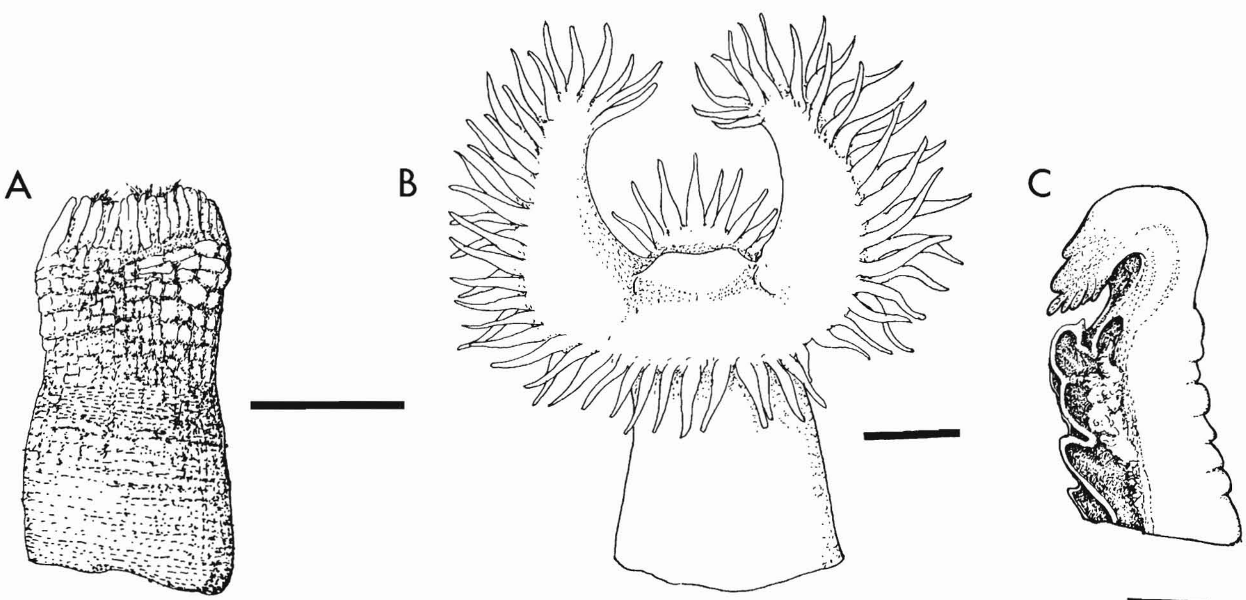

Figure 32
Actinauge verrilli. (A) Contracted specimen. Scale: 5 cm. (B) Expanded individual, from B. Hecker photo (see Fig. 10). Scale: 5 cm. (C) Section through margin showing tentacles and sphincter.

20(16) Mid-column with vesicles or with cinclides having raised rims **21**

20(16) Mid-column without vesicles or cinclides with raised rims **22**

21(20) Tentacle number ≥64; cinclides with raised edges in 10–12 rows of 2–5 per row; red spots mark cinclides when alive .... ***Aiptasia eruptaurantia***

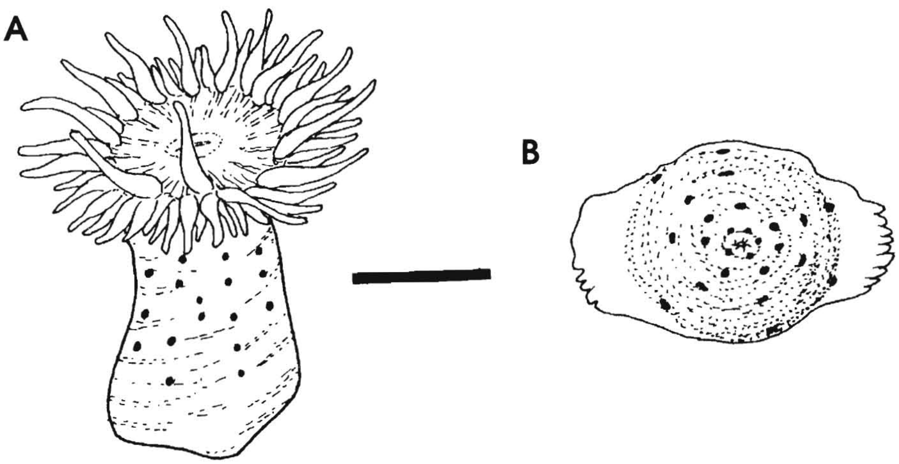

Figure 33
Aiptasiogeton eruptaurantia. (A) Expanded individual and (B) contracted specimen, both redrawn from Field (1949). Scale: 1 cm.

21(20) Tentacle number 60–100; small vesicles irregularly arranged on column; distinctive double-lined pattern on tentacles .... ***Actinothoe modesta***

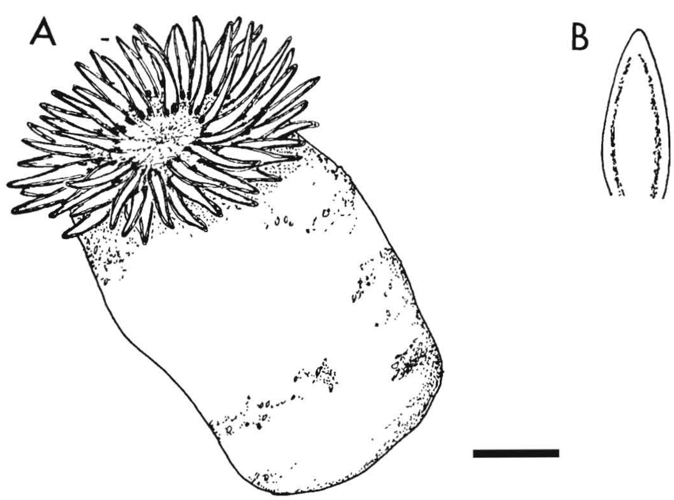

Figure 34
Actinothoe modesta. (A) Expanded individual. Scale: 1 cm. (B) Single tentacle showing lined pattern.

22(20) Column smooth, without periderm or vesicles; base not amplexicaulous **23**

22(20) Column with periderm or with weak vesicles at margin; base amplexicaulous or not amplexicaulous. . . **27**

23(22) Inner tentacles less than twice as long as outer ones; shallow water (usually <100 m); margin plain or sculptured; acontia often numerous **24**

23(22) Inner tentacles more than twice as long as outer ones; deep water (>100 m); no sculpturing at margin; few acontia (occurs on sponges, rocks, hydroids) . . . . ***Stephanauge spongicola***

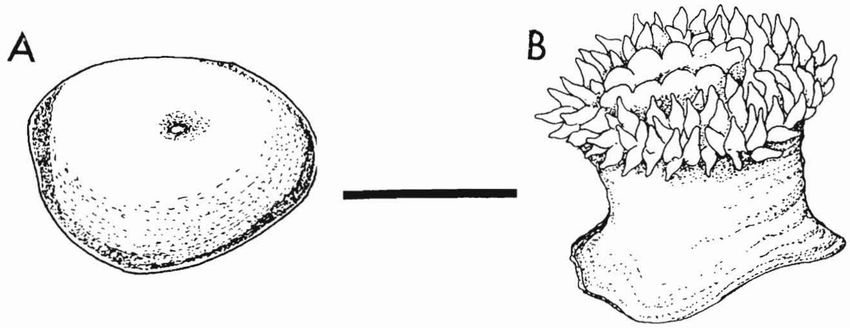

Figure 35
Stephanauge spongicola. (A) Contracted specimen and (B) expanded specimen. Scale: 1 cm.

24(23) Tentacle number to ≥1,000; oral disc lobed in large individuals (note distinct cnidom of acontia, Table 3) . . . . ***Metridium senile***

24(23) Tentacle number <100; oral disc not lobed **25**

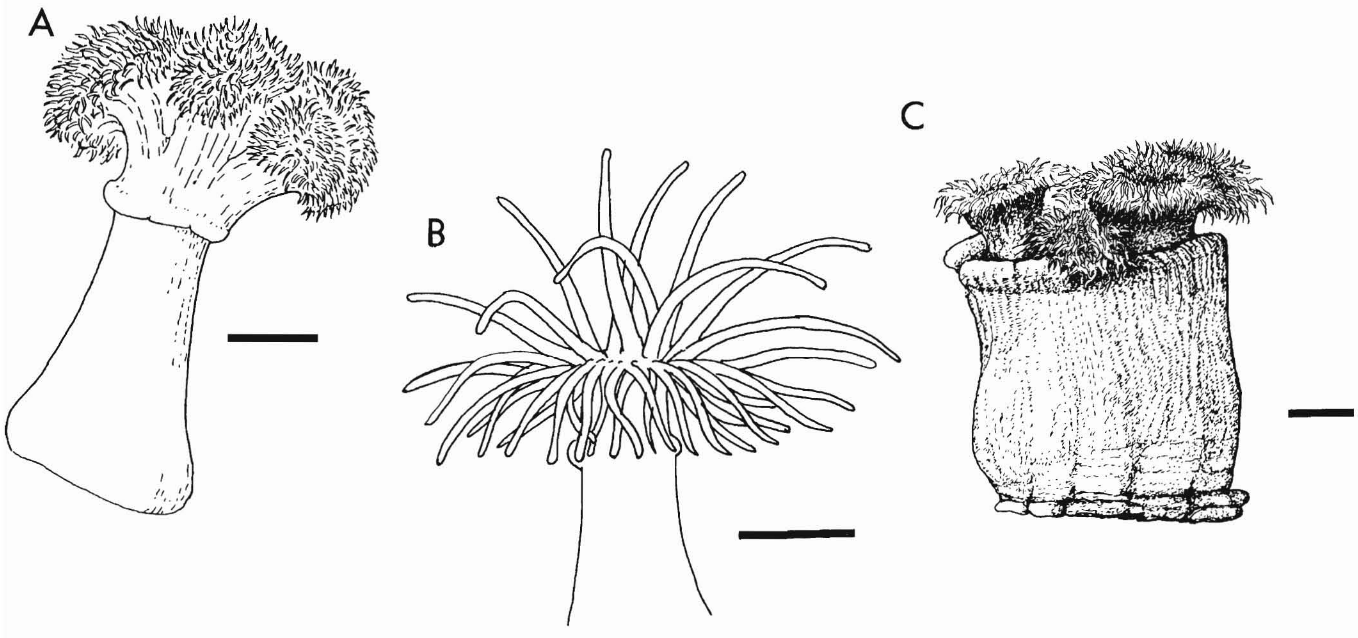

Figure 36
Metridium senile. (A) Expanded (living) individual. Scale: 5 cm. (B) Expanded juvenile. Scale: 1 cm. (C) Partially contracted specimen. Scale: 1 cm.

25(24) Cinclides inconspicuous, scattered; marginal sphincter not distinct; ≤96 mesentery pairs; vertical orange, yellow, or white stripes (rarely absent) on green or brown column when alive (note distinct cnidom of acontia, Table 3) . . . . ***Haliplanella luciae***

25(27) Cinclides conspicuous, in vertical or horizontal rows; distinct marginal sphincter present or absent; ≤96 mesentery pairs **26**

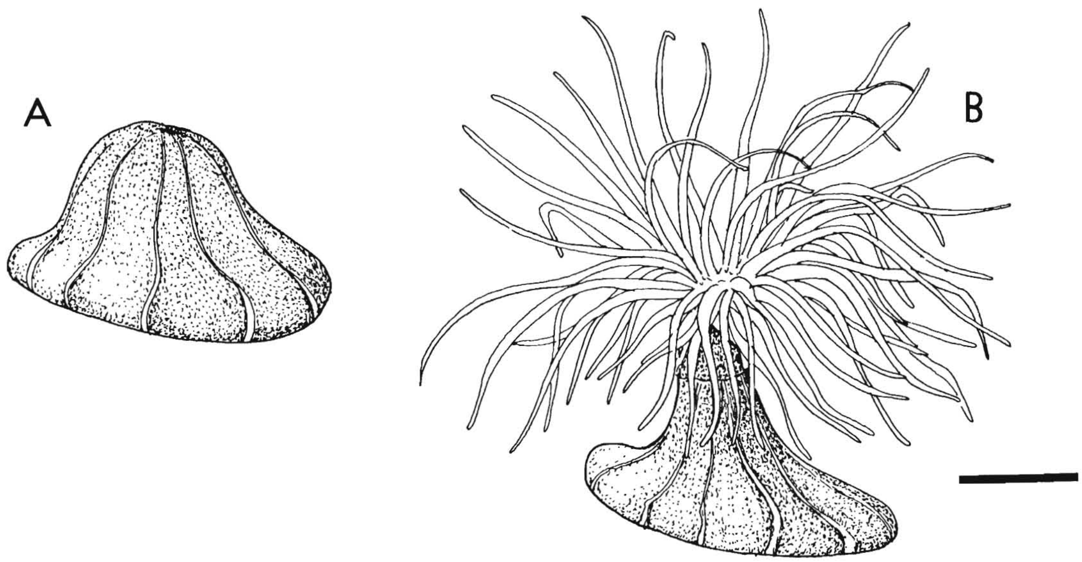

Figure 37
Haliplanella luciae. (A) Contracted and (B) expanded individual. Scale: 5 mm.

26(25) Cinclides in 1–2 bands at mid-column; marginal sphincter weak to moderately strong; ≤24 mesentery pairs; column and tentacles uniform cream to brown (note distinct cnidom of acontia, Table 3) . . . . ***Aiptasia pallida***

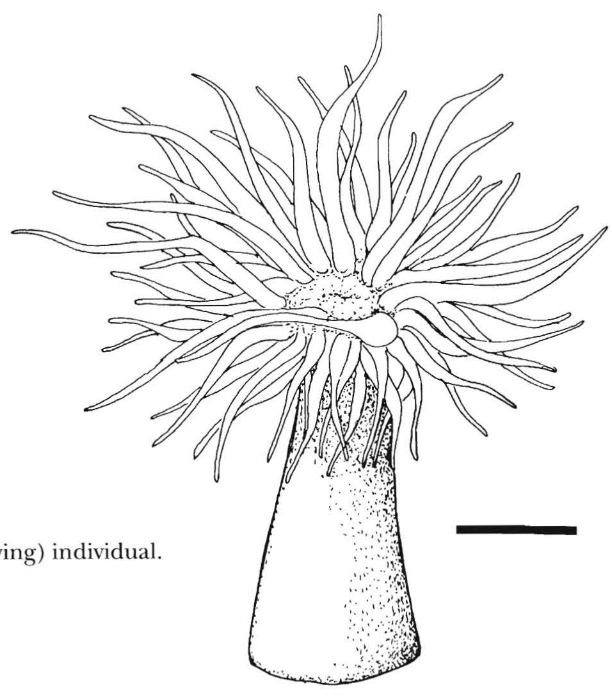

Figure 38
Aiptasia pallida. Expanded (living) individual. Scale: 1 cm.

26(25) Cinclides in distinct vertical rows on scapus; distinct marginal sphincter absent; paired white lines mark mesenteric insertions on column; ≤96 mesentery pairs; one or more white tentacles almost twice as long as others may be present (note distinct cnidom of acontia, Table 2) . . . . ***Diadumene leucolena***

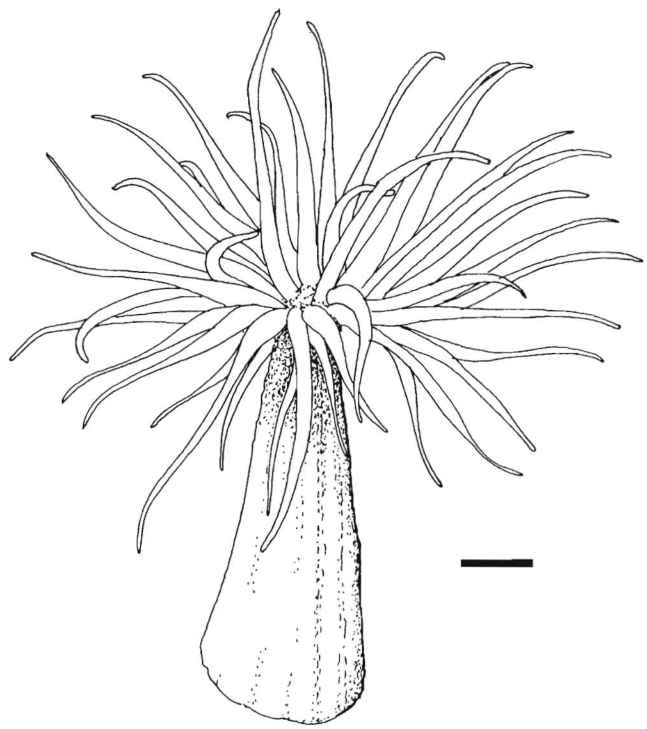

Figure 39
Diadumene leucolena. Expanded (living) individual. Scale: 5 mm.

27(22) Hard tubercles in two rows of 12 each at margin, forming crown on contraction; lower column with dark periderm; base not amplexicaulous . . . . ***Chondrophellia coronata***

27(22) Tubercles at margin weak if present (>12), not hardened; lower column with or without periderm **29**

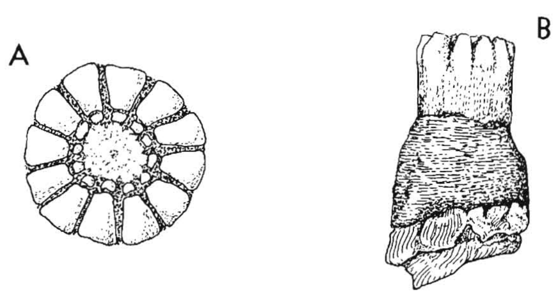

Figure 40
Chondrophellia coronata. Top (A) and side (B) views of contracted specimen. Scale: 1 cm.

29(27) Margin without sculpturing; acontia numerous; inner tentacles about twice the length of outer ones; column with periderm; base attached to worm tubes (*Hyalinoecia artifex*); base not fully amplexicaulous . . . . ***Sagartiogeton verrilli***

29(27) Margin with some sculpturing; acontia present but not numerous; inner tentacle length twice that of outer ones; column without periderm; base attached to pennatulid or gorgonian axis. **30**

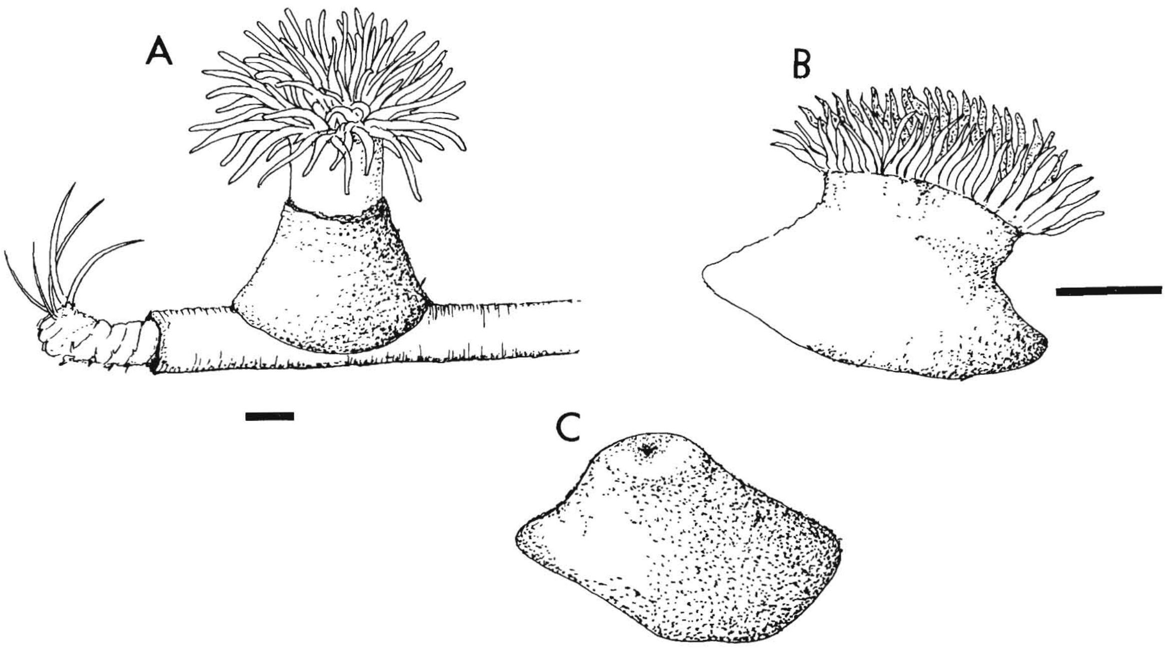

Figure 41
Sagartiogeton verrilli. (A) Expanded individual on worm tube, redrawn from Verrill (1883). (B) Expanded specimen. (C) Contracted specimen. Scale on all: 1 cm.

30(29) Low tubercles in one row on ridges at margin; base attached to pennatulid (*Balticinae*) denuded axis; base amplexicaulous . . . . ***Stephanauge nexilis***

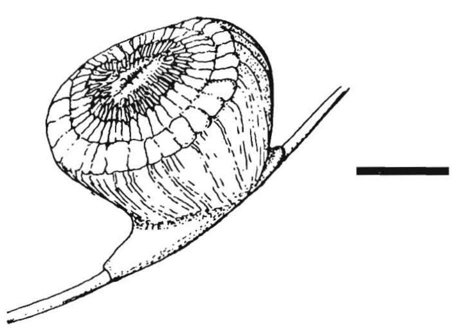

Figure 42
Stephanauge nexilis. Contracted specimen. Scale: 1 cm.

30(29) Vesicles weak, in one row at margin; acontia poorly developed or absent; base attached to gorgonian (*Acanella arbuscula)* axis: base amplexicaulous . . . . ***Stephanauge acanellae***

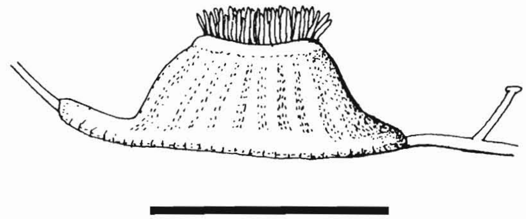

Figure 43
Stephanauge acanellae. Partially contracted specimen. Scale: 1 cm.

31(11) New mesenteries arise in endocoels of existing pairs, so musculature appears reversed from normal plan (longitudinal muscles of directives face apart, those of other pairs face each other, Fig. 3) (suborder Endocoelantheae) **33**

31(11) Mesenteric musculature follows normal plan; new mesenteries arise in exocoels **32**

32(31) Column and tentacles structurally similar, without demarcation; eight perfect mesenteries present; two directive pairs present; only one member of each non directive pair perfect (suborder Protantheae) . . . . ***Gonactinia prolifera***

32(31) Column and tentacles differ in structure, with clear demarcation; four or more perfect mesenteries present; one or two directive pairs present, both of which are perfect except after fission (suborder Nynantheae, tribe Thenaria) **34**

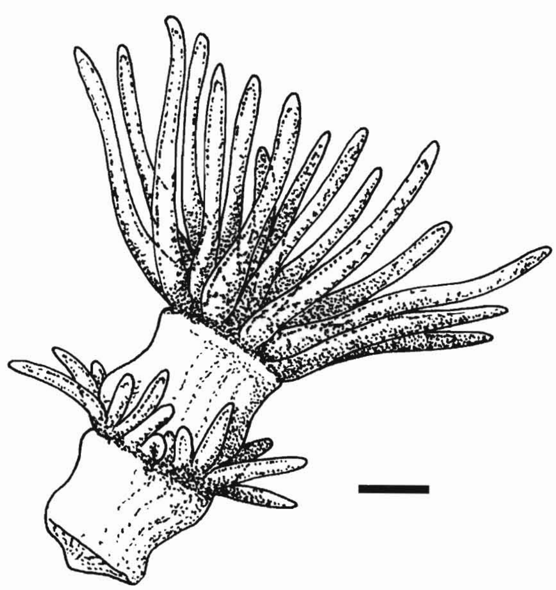

Figure 44
Gonactinia prolifera. Individual undergoing transverse fission, from photo by author. Scale: 1 mm.

33(32) Single siphonoglyph present; more mesenteries present just below oral disc than in rest of column: sphincter absent; column 3–4 times as tall as wide; oral disc somewhat wider than pedal disc . . . . *Halcurias pilatus*

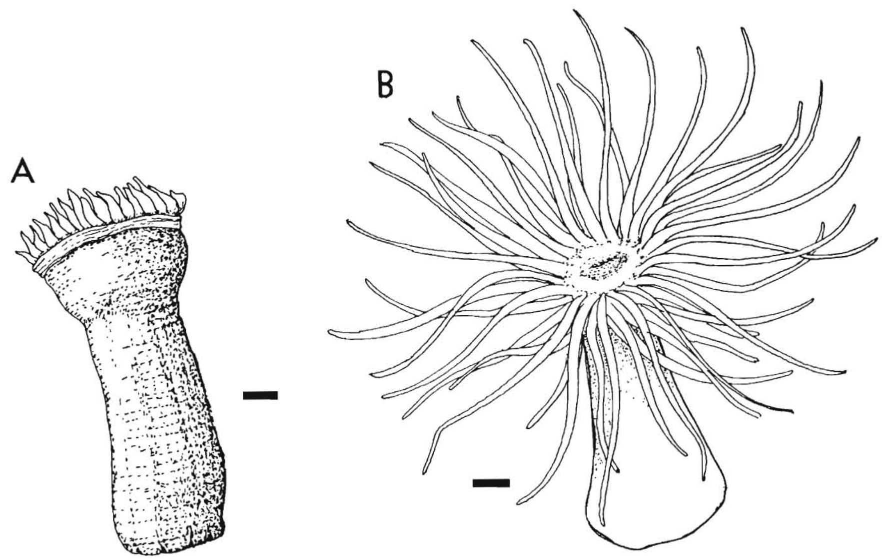

Figure 45
Halcurias pilatus. (A) Contracted specimen; note collar raised above tentacle bases. (B) Expanded individual, from B. Hecker photo (see Fig. 10). Scale: 1 cm.

33(32) Two siphonoglyphs present; sphincter absent; equal number of mesenteries proximally and distally; mesenteries after first 20 pairs have members of pair unequal; column twice as wide as tall; oral disc lobed much wider than pedal disc . . . . *Actinernus nobilis*

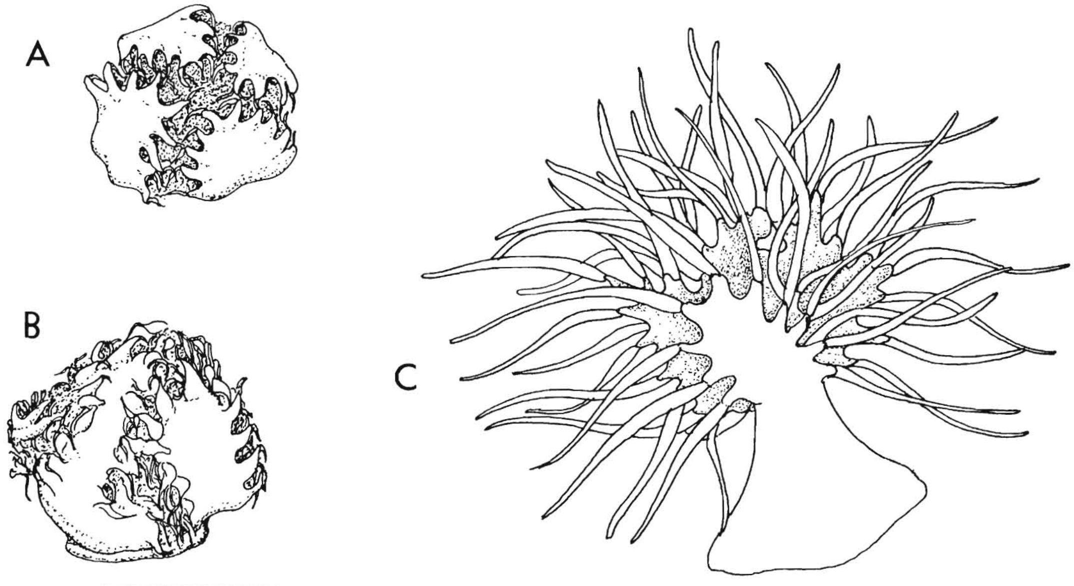

Figure 46
Actinernus nobilis. Top (A) and side (B) views of contracted specimen. (C) Expanded individual, from B. Hecker photo (see Fig 10). Scale: 5 cm.

Tribe Thenaria: Acontia Absent

34(32) Entire column, or lower half, smooth **35**

34(32) Verrucae obvious; tubercles or tenaculi on column **44**

35(34) Column elongate, more than twice as tall as wide; tentacle number ≤180; fine horizontal grooves on column; burrowing habit . . . . ***Paranthus rapiformis***

35(34) Column less than twice as tall as wide; tentacle number variable; not burrowing **36**

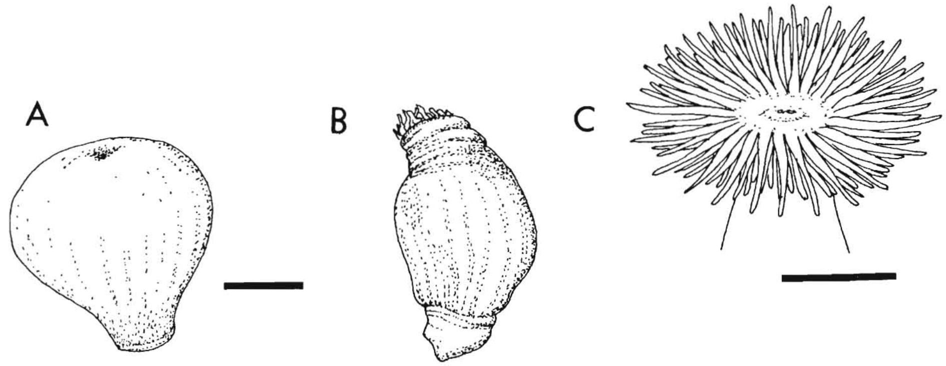

Figure 47
Paranthus rapiformis. Two conformations of preserved specimens (A and B). Scale: 1 cm. (C) Expanded tentacle crown redrawn from Verrill (1899a). Scale: 1 cm.

36(35) *Actinostola* rule applies to mesenteric arrangement (see definitions and Fig. 3) **37**

36(35) Other mesenteric arrangement applies **40**

37(36) Column wall very thick (>5 mm at mid-column in large specimen); tentacles cannot be fully retracted ..**38**

37(36) Tentacles can be fully retracted; column wall thin (<3 mm at mid-column in large specimen); pedal disc wide; tentacle number ≤96, in 2–3 cycles . . . . ***Stomphia coccinea***

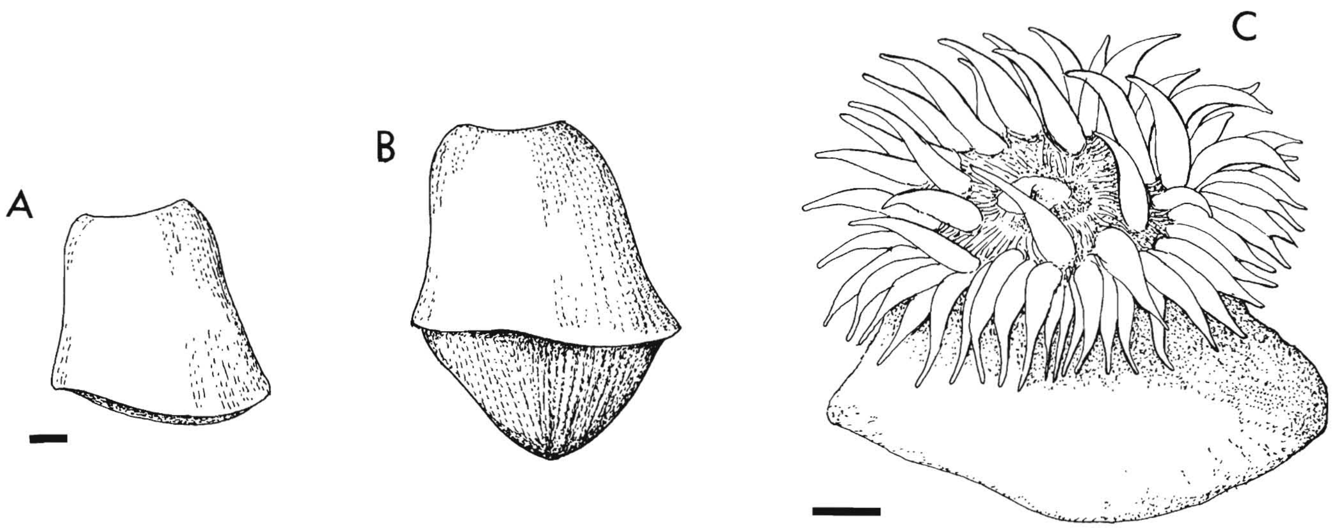

Figure 48
Stomphia coccinea. Two conformations of preserved specimens (A and B). Scale: 1 cm. (C) Expanded tentacle crown redrawn from Verrill (1899a). Scale: 1 cm.

38(37) Upper column with large square tubercles; (column twice as tall [or greater] as wide, preserved) . . . . ***Actinostola callosa***

38(37) Column without tubercles; column about twice as wide as tall, preserved **39**

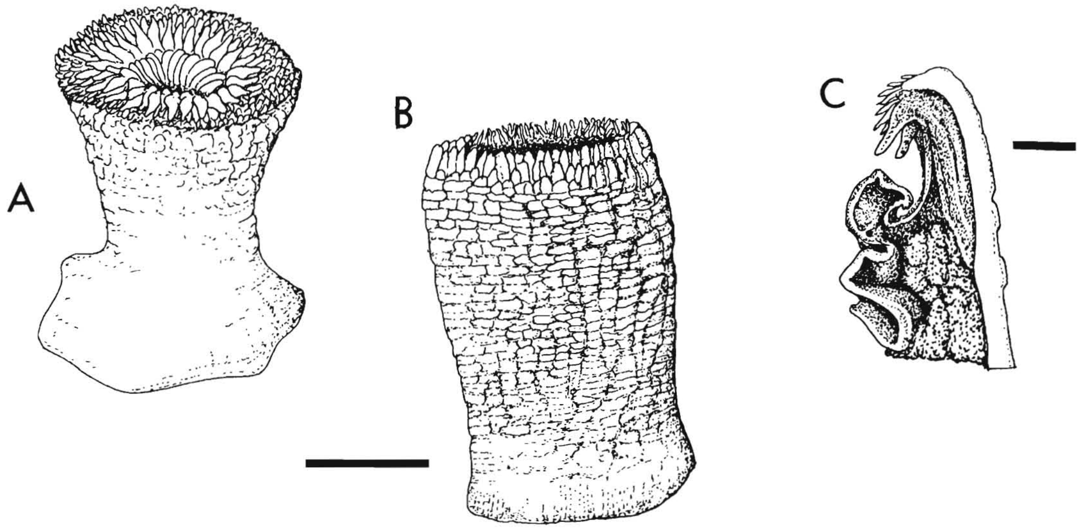

Figure 49
Actinostola callosa. (A) Contracted specimen. Scale: 5 cm. (B) Partially expanded oral disc, redrawn from Verrill, 1883. Scale: 5 cm. (C) Section through margin; note tentacle size and length increases toward mouth. Scale: 1 cm.

39(38) Tentacles at margin wide and conical, ≤60 in number . . . . ***Sicyonis obesa***

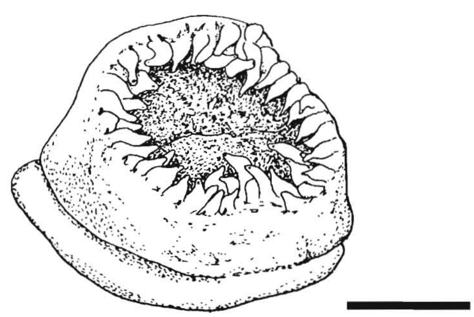

Figure 50
Sicyonis obesa. Partially contracted (preserved) specimen. Scale: 5 cm.

39(38) Tentacles at margin fine, filamentous, ≤160 in number . . . . *Actinoscyphia saginata*

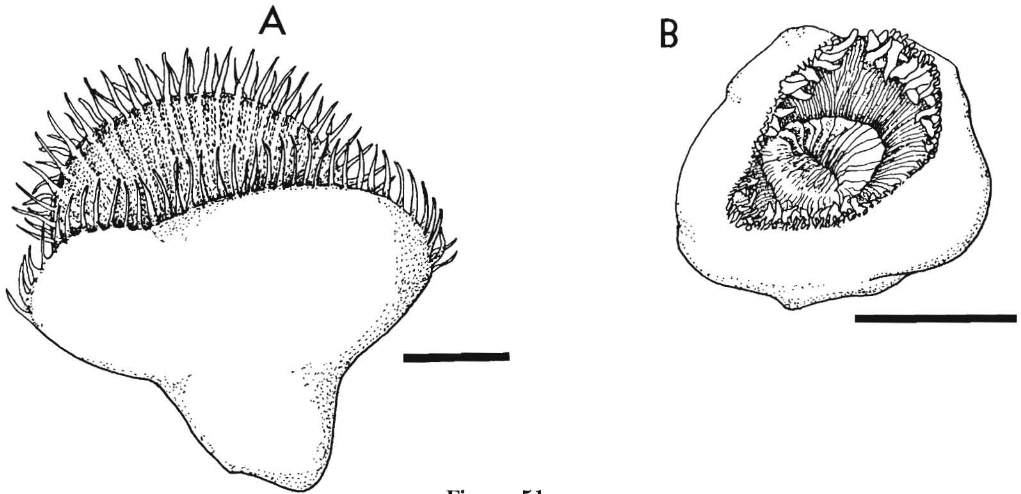

Figure 51
Actinoscyphia saginata. (A) Expanded individual. Scale: 5 cm. (B) Contracted (preserved) specimen. Scale: 5 cm.

40 (36) Column flattened; oral disc much wider than base; tentacles easily detached (deciduous); basal sphincters cover the convex oral disc . . . . *Liponema multicornis*

40 (36) Column height less than or equal to width, preserved 41

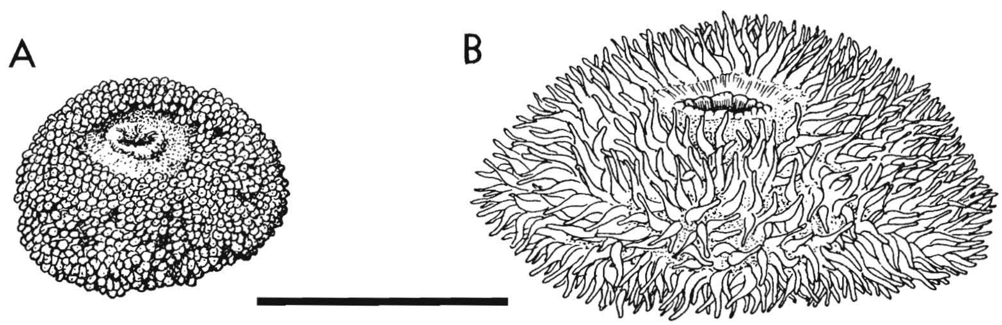

Figure 52
Liponema multicornis. (A) Specimen with tentacles shed. Scale: 5 cm. (B) Expanded (living) specimen, redrawn from Verrill (1922), same scale.

41 (40) Tentacles less than half as long as column, preserved 42

41 (40) Tentacles as long as column or longer, preserved 43

42 (40) Anemone small (<3 cm diameter base); base attached to sponges, gorgonians (e.g. *Paramuricea, Primnoa)* or hydroid stems; folds at parapet; acontia evident .... ***Amphianthus nitidus***

Note: a similar small anemone (<4 cm diameter base) with a row of weak vesicles at the margin, with acontia poorly developed or absent, is found attached to the gorgonian *Acanella* (*Stephanauge acanellae,* see line 30 in key, Fig. 43)

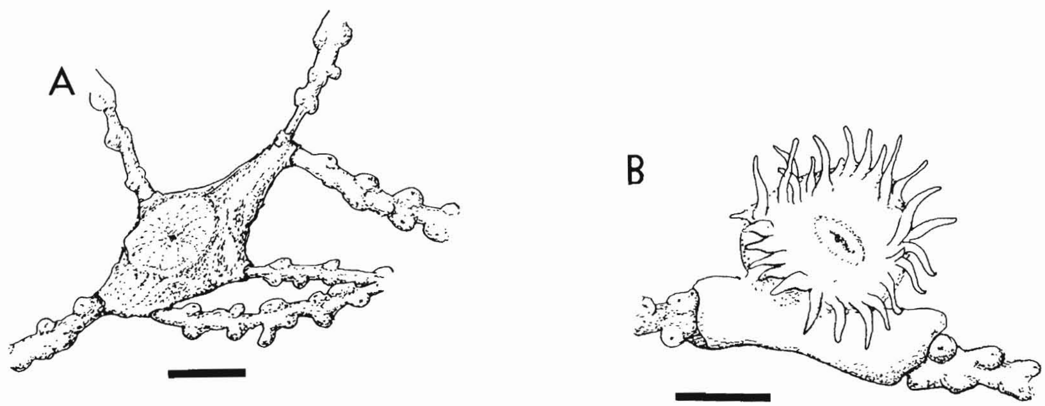

Figure 53
Amphianthus nitidus. (A) contracted specimen on gorgonian branch. Scale: 1 cm. (B) Expanded individual. Scale: 1 cm.

42(40) Anemone small (<3 cm diameter base); base attached to gorgonians (*Paragorgia, Paramuricea*); acontia reduced or absent; cinclides absent .... ***Amphianthus mirabilis***

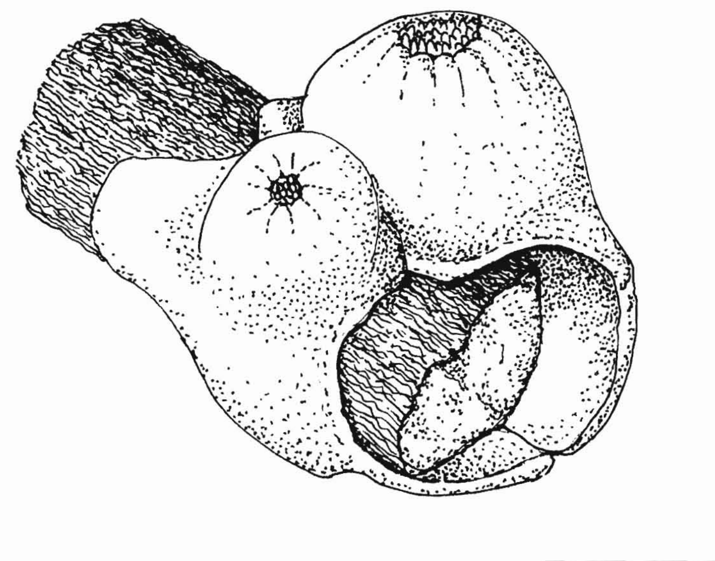

Figure 54
Amphianthus mirabilis. Contracted specimens on gorgonian branch. Scale 1 cm.

43(41) Anemone large (to 5 cm diameter base); tentacle number ≤260; tentacles with basal sphincters; tentacles easily detached (deciduous) and longitudinally ridged. . . . . ***Bolocera tuediae***

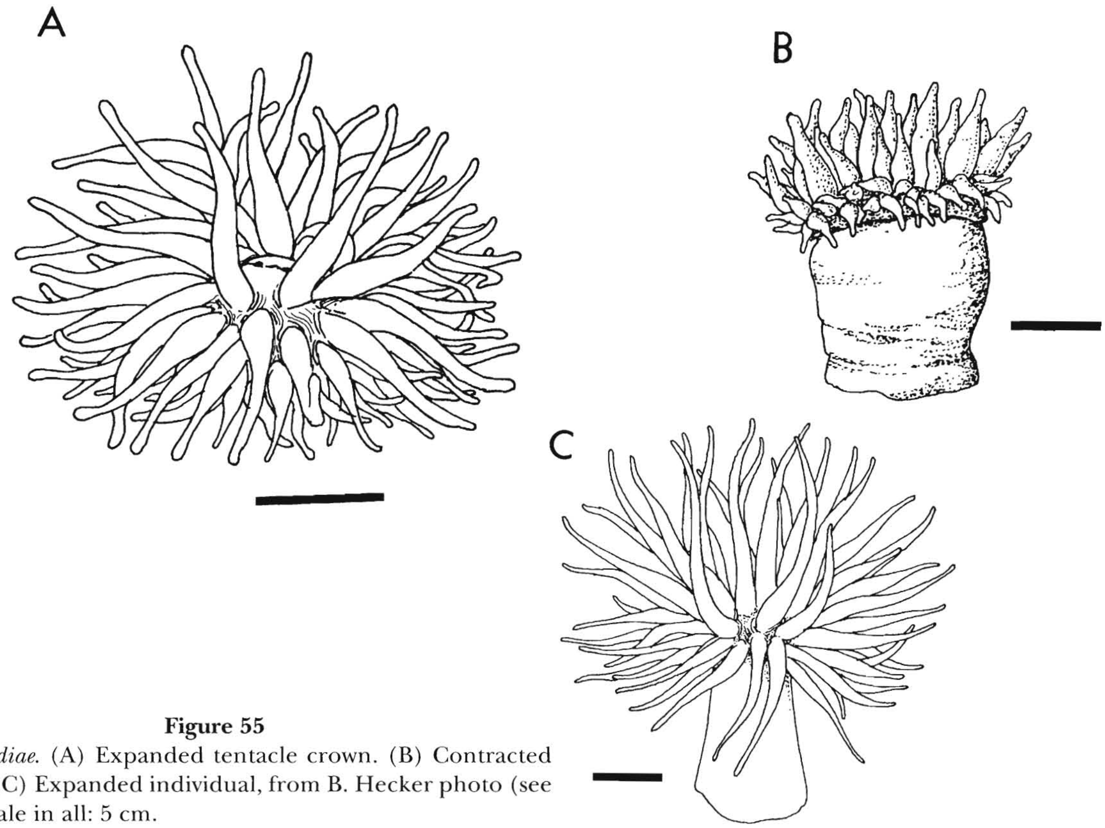

Figure 55
Bolocera tuediae. (A) Expanded tentacle crown. (B) Contracted specimen. (C) Expanded individual, from B. Hecker photo (see Fig. 10). Scale in all: 5 cm.

43(41) Anemone small (to 3 cm diameter base); tentacles as long as column; tentacles without basal sphincters, not deciduous or longitudinally ridged . . . . ***Anemonia sargassensis***

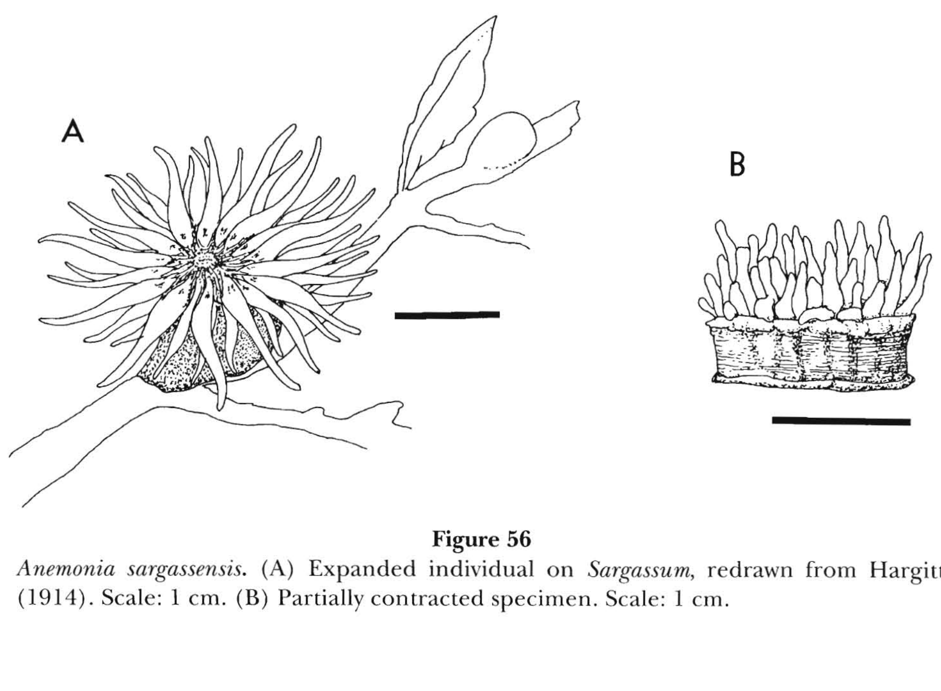

Figure 56
Anemonia sargassensis. (A) Expanded individual on *Sargassum*, redrawn from Hargitt (1914). Scale: 1 cm. (B) Partially contracted specimen. Scale: 1 cm.

44(34) Scapus covered by tenaculi; scapulus smooth; deep water (>1,000 m) .... ***Daontesia praelonga***

44(34) Verrucae or vesicles present, but tenaculi absent **45**

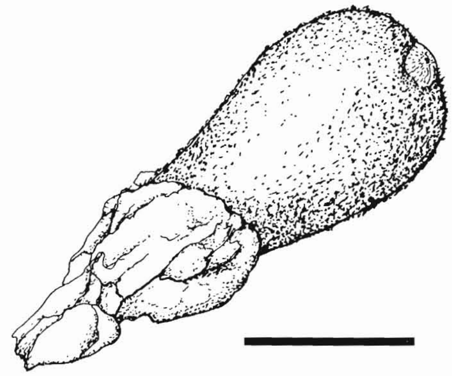

Figure 57
Daontesia praelonga. Contracted specimen with damaged base. Scale: 1 cm.

45(44) Adhesive verrucae present and scattered, or in longitudinal rows **46**

45(44) Vesicles or pits present, covering most of column **48**

46(45) Vesicles small, scattered, nonadhesive; column twice as tall as wide; tentacles number ≤160 in 5 cycles; mesenteric arrangement decamerous; 10–20 oldest mesenteries sterile .... ***Urticina crassicornis***

46 (45) Verrucae distinct and adhesive (some may appear as pitlike cavities) scattered on column or in rows .. **47**

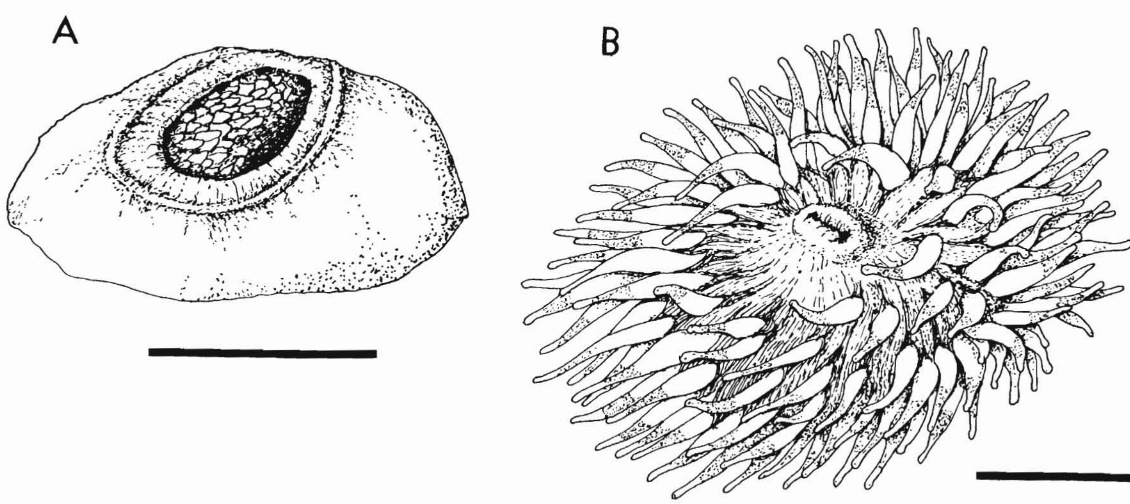

Figure 58
Urticina crassicornis. (A) contracted specimen. (B) Expanded individual. Scale: 5 cm.

47(46) Verrucae present and adhesive; tentacle number 48–96; verrucae color usually contrasts with column color when alive . . . . *Aulactinia stella*

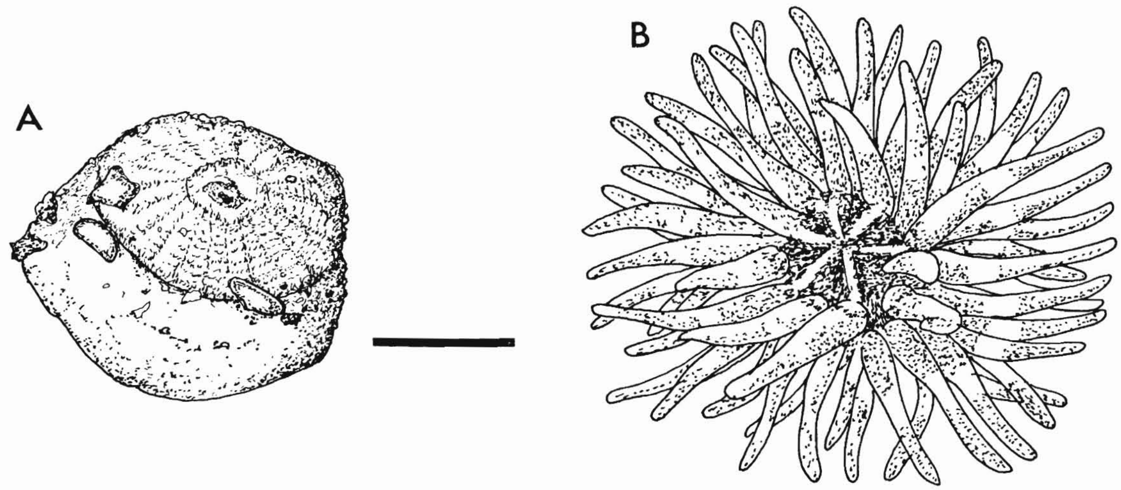

Figure 59
Aulactinia stella. (A) Contracted specimen with adhered shell gravel. (B) Tentacle crown of expanded individual. Scale: 1 cm.

47(46) Verrucae adhesive and in distinct rows on upper third of column only . . . . *Aulactinia capitata*

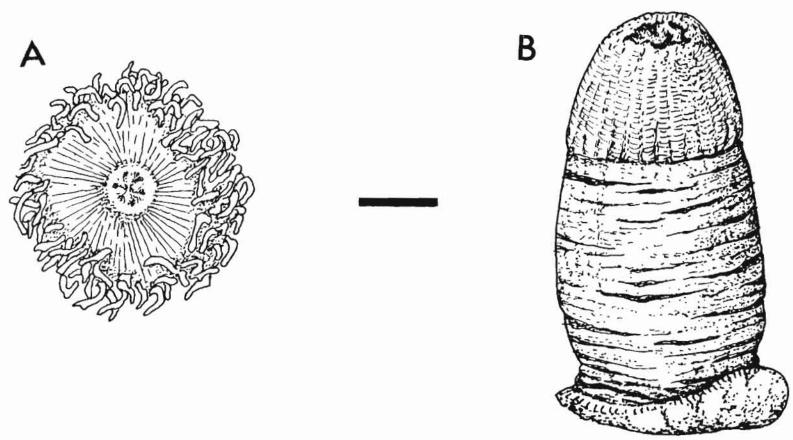

Figure 60
Aulactinia capitata. (A) Partially expanded oral disc of preserved specimen. (B) Contracted specimen. Scale: 1 cm.

48(45) Nonadhesive vesicles cover column **49**

48(45) Pits on column low and flat; column twice as wide as tall (preserved); tentacles number ≤90 . . . . ***Epiactis fecunda***

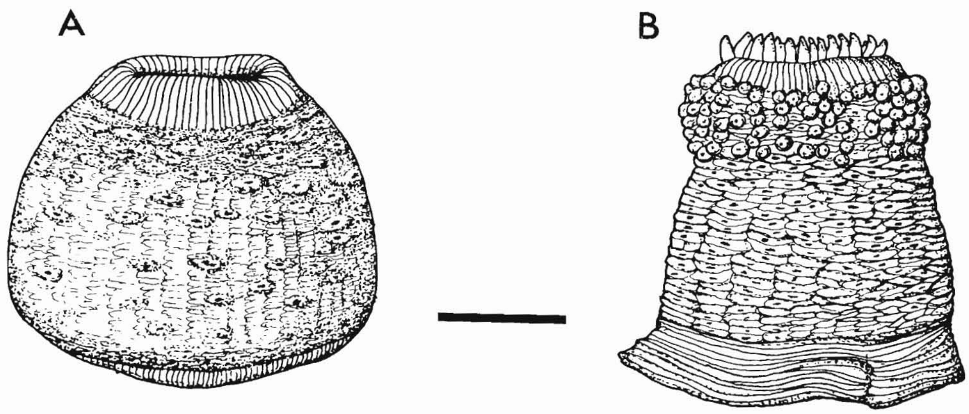

Figure 61
Epiactis fecunda. (A) Contracted specimen showing brood pits on column. (B) Partially contracted specimen, both redrawn from Verrill (1922). Scale: 1 cm.

49(47) Acrorhagi in fosse below outer tentacles; tentacle number ≤96; oral disc as wide as base; column covered by small vesicles or papillae . . . . ***Bunodosoma cavernata***

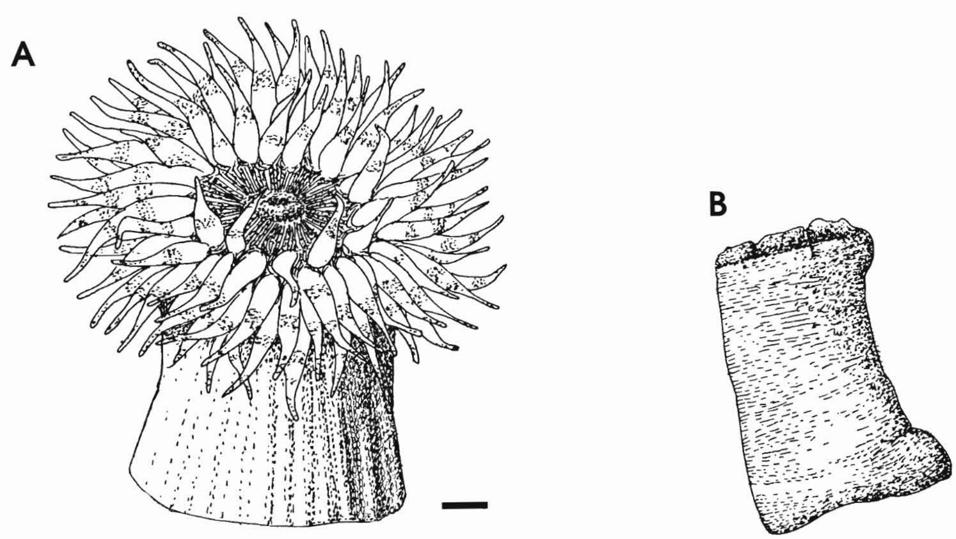

Figure 62
Bunodosoma cavernata. (A) Expanded individual. (B) Contracted (preserved) specimen. Scale: 1 cm

49 (47) Acrorhagi absent; tentacle number ≤400; oral disc twice as wide as base; column covered by small vesicles or papillae . . . . *Antholoba perdix*

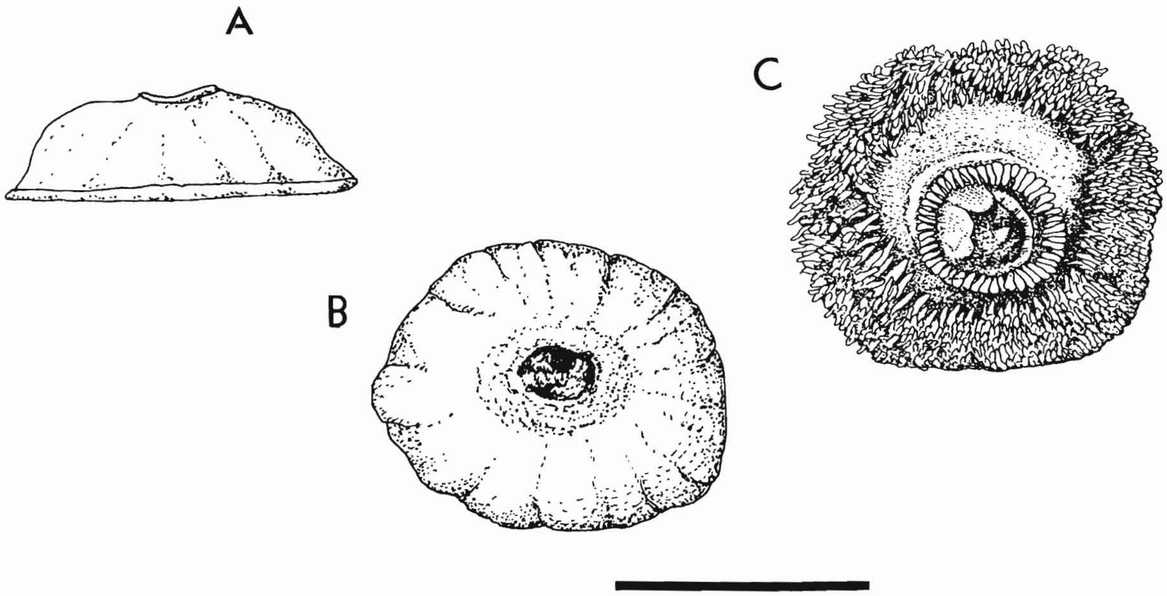

Figure 63
Antholoba perdix. Side (A) and top (B) views of contracted expanded specimen. Scale: 5 cm.

Table 4

Species that may be encountered at the borders of the area covered by this key. The most recent complete description is given at right: (see Carlgren, 1949, for synonymies and generic characteristics for each species).

Species bordering this area to the north (Greenland, Davis Straits, Canada):	
Acthelmis intestinalis (Fabricius, 1780)	(Carlgren, 1942)
Actinostola groenlandica Carlgren, 1899	(Carlgren, 1921)
Amphianthus margaritaceus Danielssen, 1890	(Carlgren, 1942)
Amphianthus vermiculatus Carlgren 1942	(Carlgren, 1942)
Anthosactis jan-mayeni (Danielssen, 1890)	(Carlgren, 1921, 1933)
Bolocera maxima Carlgren, 1921	(Carlgren, 1921)
Bunodactis spetsbergensis Carlgren, 1921	(Carlgren, 1921)
Cactosoma abyssorum Danielssen, 1890	(Carlgren, 1921)
Cerianthus sp. *lloydi* Gosse, 1859	(Carlgren, 1942)
Cribrinopsis similis Carlgren, 1921	(Carlgren, 1921)
Edwardsia andresi Danielssen, 1890	(Carlgren, 1921)
Epiactis nordmanni Carlgren, 1921	(Carlgren, 1933)
Epizoanthus danielseni Carlgren, 1913	(Carlgren, 1933)
Epizoanthus erdmanni Danielssen, 1890	(Carlgren, 1933)
Epizoanthus glacialis Danielsson, 1890	(Carlgren, 1933)
Epizoanthus lindahli Carlgren, 1913	(Carlgren, 1933)
Halcampoides purpurea Danielssen, 1890	(Carlgren, 1921)
Haliactis arctica Carlgren, 1934	(Carlgren, 1934)
Hormathia digitata (Müller, 1776)	(Carlgren, 1933, 1942)
Isozoanthus bulbosus Carlgren, 1913	(Carlgren, 1933)
Isozoanthus davisi Carlgren, 1913	(Carlgren, 1933)
Isozoanthus ingolfi Carlgren, 1913	(Carlgren, 1933)
Kadosactis rosea Danielssen, 1890	(Carlgren, 1933, 1942)
Phelliactis robusta Carlgren, 1928	(Carlgren, 1942)
Parasicyonis groenlandica Carlgren, 1933	(Carlgren, 1933)
Ptychodactis patula Appellöff, 1893 (order Ptychodactiaria)	(Carlgren, 1921, 1934, 1942)
Pycnanthus laevis Carlgren, 1921	(Carlgren, 1921)
Sicyonis tuberculata Carlgren, 1921	(Carlgren, 1921)
Sicyonis ingolfi Carlgren, 1921	(Carlgren, 1921)
Tealidium jungerseni Carlgren, 1921	(Carlgren, 1921)
Species bordering this area on the south: (South Carolina, Georgia, Florida, Bermuda).	
Bunodosoma granuliferum (Lesueur, 1817)	(Corrêa, 1964, den Hartog, 1985)
Condylactis gigantea (Weinland, 1860)	(McMurrich, 1889, Verrill, 1907, Corrêa, 1964, Jennison, 1981, den Hartog, 1985)
Bunodeopsis antilliensis Duerden, 1897	(den Hartog 1985)
Bunodeopsis globulifera (Verrill, 1899b)	(Carlgren 1950, Corrêa 1964)
Actinia bermudensis (McMurrich, 1889)	(Verrill 1898a, 1907, Corrêa 1964, den Hartog, 1985)
Phymanthus crucifer (Lesueur, 1817)	(den Hartog, 1985; Jennison, 1981)
Aiptasia tagetes (Duchassaing and Michelotti, 1866)	(Verrill, 1907; Carlgren and Hedgepeth, 1952)
Actinostella flosculifera (Lesueur, 1817)	(Verrill 1907, den Hartog 1985)
Bartholomea annulata (Lesueur, 1817)	(Verrill 1907, Corrêa 1964, Jennison 1983, den Hartog 1985)
Anthopleura catenulata (Verrill, 1900)	(Verrill, 1907, den Hartog, 1985)
Anthopleura carneola (Verrill, 1907)	(den Hartog, 1985)
Anthopleura vario-armata Watzl, 1922	(Carlgren, 1950; den Hartog, 1985)
Corynactis parvula Duchassaing & Michelotti, 1861	(den Hartog, 1980)
Species bordering this area to the east, in the central North Atlantic (>1,000 m depth):	
Bathyphellia margaritacea Danielssen, 1890	(Carlgren, 1942)
Corallimorphus rigidus Moseley, 1877	(Carlgren, 1928)
Corallimorphus ingens Gravier, 1918	(Carlgren, 1934)
Amphianthus michaelsarsi Carlgren, 1934	(Carlgren, 1934)
Phelliactis hertwigii Simon, 1892	(Carlgren, 1928, 1942)
Actinauge abyssorum Carlgren, 1934	(Carlgren, 1975)
Paracalliactis michaelsarsi Carlgren, 1918	(Doumenc, 1975)
Stephanauge inornata Gravier, 1918	(Carlgren 1942)

Annotated Systematic List

This classification scheme follows that of Carlgren (1949), the most recent complete compilation of genera and species of the orders Actiniaria, Ptychodactiaria, and Corallimorpharia. Full synonymies of most species listed here appear in Carlgren (1949) and in the more recent studies listed; only the most commonly encountered synonyms and the most recent complete descriptions of each species and its biology are given in this account.

Order ACTINIARIA
Suborder Protantheae
Family Gonactiniidae

Gonactinia prolifera (Sars, 1850, p. 142) (see also Stephenson, 1935, p. 25; Carlgren, 1949, p. 18; Manuel, 1981, p. 92)

This small anemone has been reported from scattered locations in the Gulf of Maine: Cashes Ledge, Eastport, Maine (Sebens), New Brunswick, Canada (Logan et al., 1984), low intertidal to 100 m. This is a very small anemone (<8 mm tall, expanded) with 16 or fewer tentacles and no marginal sphincter. Tentacles and column are translucent pink, cream, or white. Asexual reproduction occurs by transverse fission; new tentacles arise part way down the column. Two or three individuals can remain attached for indefinite periods. This anemone can swim by tentacle movement and can walk by alternating tentacle and base contact with the substrate. Reproduction has been described by Chia et al. (1989).

Suborder Endocoelantheae
Family Halcuriidae

Halcurias pilatus McMurrich, 1893, p. 142 (see also McMurrich, 1898, p. 227; McMurrich, 1901, p. 155)

This is a tall slender white anemone with brilliant orange lips and actinopharynx, and a single siphonoglyph. It occurs in large aggregations on vertical cliffs and on boulders at 160–307 m depth along submarine canyons off Maryland and Delaware where it was recently photographed and collected by B. Hecker. It was previously known only from the South Atlantic (McMurrich, 1893). A distinctive feature is that the second and third cycles of incomplete mesenteries (microcnemes) end just below the oral disc. New mesentery cycles occur in endocoels of the first cycle, and there are no basilar muscles in anemones of this suborder. The coelenteron (gastrodermal) side of the actinopharynx is often bright orange even in preserved specimens.

Family Actinernidae

Actinernus nobilis Verrill, 1879, p. 474 (see also Carlgren, 1918, p. 32; Carlgren, 1921, p. 14)

This is a relatively large, short and wide anemone with two siphonoglyphs and a very thick-walled white column formed into four large lobes at the oral disc. Purple tentacles begin wide at the margins of lobes and become narrow distally to form thin filaments. This species is found on rock and shells in deep water (350–2884 m) from Delaware north to at least Nova Scotia. New mesenteries arise in the endocoels of the first cycle and there are no basilar muscles in anemones of this suborder.

Suborder Nynantheae
Tribe Athenaria
Family Edwardsiidae

Edwardsia sipunculoides Stimpson, 1853, p. 7 (see also Verrill, 1922, p. 131; Carlgren, 1931, p. 22; Williams, 1981, p. 346)

A deepwater (87–117 m) elongate burrowing anemone found in Alaska, in the arctic, and south to Massachusetts on the east coast; this species has 24–36 tentacles and eight prominent longitudinal ridges on the column. Nemathybomes are present except in the physa. *E. sipunculoides* is similar in form to *E. sulcata*, but b-mastigophores of its nemathybomes and column are much larger, and there are more tentacles in large specimens.

Edwardsia sulcata Verrill, 1864–1866, p. 29 (see also Widersten, 1976, p. 860; Williams, 1981, p. 346)

This elongate and very large burrowing anemone has 15 tentacles and 12 prominent longitudinal ridges on the column. It is found from the shallow subtidal zone to 110 m and is known from two specimens collected at Chelsea and Gloucester, Massachusetts, (in USNM collection) and six specimens from Mt. Desert Island, Maine (Widersten, 1976). Nemathybomes are numerous except in the physa and there is a strong yellow-brown periderm which is easily removed.

Edwardsia elegans Verrill, 1869, p. 162 (see also Verrill, 1922, p. 129; Carlgren, 1931, p. 17; Williams, 1981, p. 346)

A very large elongate burrowing anemone with 16 tentacles and eight prominent longitudinal ridges on the column, this species occurs in the low intertidal to 117 m depth from the Bay of Fundy south to Cape Cod. Nemathybomes are present except in the physa.

Paraedwardsia arenaria Carlgren, 1921, p. 69 (in Carlgren, 1949) (see also Carlgren, 1921, p. 69)

This is a relatively large burrowing anemone from very deep water in northern Europe and along the east coast of North America south to Cape Hatteras (one specimen, 2,100 m, ident. by K. Sebens, unpubl.). Sand grains completely encrust the cuticle (periderm). Nemathybomes are absent, the scapus develops tenaculi, and there are more mesenteries in the upper than in the lower half of the column.

Fagesia lineata Verrill, 1874, p. 379 (=*Edwardsia leidyi* Mark, 1884, in Verrill, 1898a, p. 496)

This species is found from Northern Massachusetts south to North Carolina and adults form low intertidal to shallow subtidal (to 23 m) tight aggregations by means of transverse fission (Crowell and Oates, 1980). Larvae and juveniles are parasitic on the ctenophore *Mnemiopsis leidyi* (Verrill, 1898a; Crowell, 1976). There are up to 40 tentacles; physa and nemathybomes are absent, and a thick cuticle covers the scapus.

Nematostella vectensis Stephenson, 1935, p. 44 (=*Nematostella pellucida* Crowell, 1946, p. 58 (see also Hand, 1967, p. 411; Williams, 1976, p. 51, p. 257; Williams, 1979, p. 69)

This very small brackish-water, estuarine and salt marsh species (Williams, 1975b; Williams, 1976) is found in northern Europe and as far south as Cape Cod on the Atlantic coast of North America. It is colorless except for numerous white bands around the 16 tentacles. Nematosomes in the coelenteron are unique to this genus. Nemathybomes are absent. Asexual reproduction is by transverse fission.

Drillactis pallida (Verrill, 1879, p. 198), = *Edwardsia pallida*, not *E. pallida* Carlgren, 1921; see Williams, 1981, p. 351 (see also Verrill, 1922, p. 133, *Drillactis*)

This low intertidal sand-burrowing species is known only from Verrill's (1879) incompletely described specimens taken at Provincetown, Massachusetts. It has a long, slender, smooth column, 24 tentacles, with the inner ones shorter than the outer, and mesenteries divisible into macrocnemes and microcnemes. The aboral end is tapered, there are two siphonoglyphs, and nemathybomes are absent. A specimen recently collected in South Carolina appears to be this species. The anemone described by Field (1949) as *Halcampoides* sp. may also be this species, although her specimens had only 12–16 tentacles.

Family Haloclavidae

Haloclava producta Stimpson, 1856, p. 110 (see also Verrill, 1864–1866, p. 30; Carlgren, 1921, p. 107, = *Halcampa albida* Verrill, 1864–1866, p. 29; Widersten, 1976, p. 863)

This elongate sand-burrowing anemone has 20 tentacles, broadest at their tips, and 20 prominent rows of raised adhesive verrucae on the distal two thirds of the column. It is found from the low intertidal to shallow subtidal (15 m). It has no marginal sphincter, a single siphonoglyph, and is reported to be nocturnally active.

Mesacmaea laevis and *M. chloropsis* (Verrill, 1864–1866, p. 27 [*Ilyanthus*]).

These are incompletely described species, possibly rare, and are not included in Carlgren's (1949, p. 31) discussion of the genus. *Mesacmaea chloropsis* was collected from South Carolina, *M. laevis* from Eastport, Maine. Both species have elongate columns, tapering toward the narrow base, which may have a terminal pore and have up to 36 tentacles of moderate length. The margin is crenulated with rounded projections. *Mesacmaea laevis* reaches 2.5 cm in length preserved; *M. chloropsis* reaches 8 cm when expanded. These species are not included in the key because of their uncertain status.

Peachia parasitica (Agassiz, 1859, p. 23, *Bicidium*) (see also Verrill, 1922, p. 124 (Siphonactinia); = *Bicidiopsis artica*, Verrill, 1922, p. 127; = *B. tubicola*, Verrill, 1922, p. 126; Widersten; 1976; p. 863)

This species occurs from Cape Cod to northern Maine and probably farther north. It is a burrowing anemone with eight to 18 (usually 12) tentacles and 10–20 (often 12) ridges on the column, only twice as long as wide when preserved. It is found in gravel from the low intertidal to 91 m depth in silt clay. The prominent raised conchula on the oral disc is a good means of identification. Juveniles and small adults are parasitic on the scyphyzoan medusa *Cyanea artica*.

Family Halcampidae

Halcampa duodecimcirrata (Sars, 1851, p. 142, *Edwardsia*). (Verrill, 1869, p. 162, *Edwardsia farinacea*, see also Carlgren, 1921, p. 119; Verrill, 1922, p. 122; Widersten, 1976, p. 862)

This elongate burrowing anemone has 12 conical banded tentacles with no obvious column ridges, but with a periderm. It has been found in mud from 10 to150 m depth, from Cape Cod north to at least the Bay of Fundy. A specimen collected recently from 600 m was identified by the author. Prominent tenaculi on the column are often red even on preserved specimens.

Family Actiniidae

Pseudactinia melanaster (Verrill, 1901, p. 5l; Verrill, 1907, p. 257) (=*Anemonia elegans* Verrill, 1901, p. 50; Verrill, 1907, p. 261; = *A. sargassensis* Hargitt, 1908, p. 117; = *A. antilliensis* Pax, 1924, p. 99 (see also Field, 1949, p. 8; den Hartog, 1985, p. 175)

This small anemone is found throughout the Caribbean and north to North Carolina, intertidally and on floating *Sargassum* plants, and is often cryptically colored. The 30–200 relatively long tentacles are not retractile. The column is smooth and has light colored acrorhagi on the parapet. There are no siphonoglyphs or directive mesenteries, and asexual reproduction occurs by longitudinal fission.

Bunodosoma cavernata (Bosc, 1802, p. 22, *Actinia*) (see also McMurrich, 1887 (*Phymactis*), p. 61; Verrill, 1899a (*Bunodosoma*), p. 45; Carlgren and Hedgepeth, 1952, p. 149)

This is a stout, low intertidal to shallow subtidal Caribbean anemone, found north to North Carolina, with close-packed nonadhesive vesicles covering the column and acrorhagi at the parapet. There are up to 96 tentacles of moderate length and two siphonoglyphs. It may be confused with *B. granuliferum* (Lesueur, 1817) farther south (but see McCommas and Lester, 1980).

Bolocera tuediae (Johnston, 1832, p. 163, *Actinia*) (see also Carlgren, 1921 p. 141; Stephenson, 1918, p. 112, 116; Carlgren, 1891, p. 241; = *B. occidua* McMurrich, 1893, p. 154; = *B. longicornis*, Stephenson, 1935, p. 130; Widersten, 1976, p. 863; Manuel, 1981, p. 104)

This widely distributed species is found from North Carolina to the arctic and northern Europe, from 20–1,000 m depth, rarely to 2,000 m. It is also found in the southwest Atlantic (subspecies *occidua*, Riemann-Zürneck, 1980, 60–545 m depth). The column is completely smooth, hidden by the tentacles when expanded. Column and tentacle color is uniform orange, cream, or pink, sometimes with inner tentacles a darker color. Tentacles often drop off during collection and on preserved specimens.

Epiactis fecunda (Verrill, 1899b, p. 378, *Epigonactis*). (Verrill, 1922, p. 11; = *E. regularis*, Verrill, 1899b, p. 380)

This is a small stout deepwater anemone (25–360 m) from the northwest Atlantic, collected from Massachusetts to Newfoundland, with obvious external pits in the column in which embryos, larvae, and juveniles are brooded. The tentacles are stout and number at least 90, and the column has prominent tubercles on the upper half. This species may be synonymous with *Epiactis marsupialis* Carlgren, 1901 (p. 482), from the Pacific arctic region.

Urticina crassicornis (Johnston, 1847 p. 226, *Actinia crassicornis*) (see also Carlgren, 1921, p. 168 (*Urticina*), Stephenson, 1935, p. 139; Hand, 1955, p. 72 (*Tealia*); = *Rhodactinia davisii* Agassiz, 1847, p. 677; Verrill, 1883, p. 18; = *Urticina eques* (Gosse, 1860, p. 351, *Bolocera*; see Manuel, 1981, p. 109)

This large circumarctic-boreal anemone is found on mid-intertidal rock and on hard substrata to >300 m depth, from just below Cape Cod to the Arctic. The small scattered verrucae are not adhesive. It broods juveniles to the 12–24 tentacle stage. The morphology and nematocyst distributions are equivalent to *U. crassicornis* on the west coast of North America (Hand, 1955). This species is probably also equivalent to *Urticina eques* (=*Tealia felina* var. *lofotensis* Stephenson, 1935) in northern Europe. Manuel (1981) determined the genus name *Urticina* Ehrenberg, 1834, to have priority over the more commonly used *Tealia* Gosse, 1858.

Aulactinia stella (Verrill, 1864–1866, p. 16, *Bunodes*) (see also Verrill, 1899a, p. 43 (*Bunodactis*); Verrill, 1922 p. 429 (*Tealiopsis*); Carlgren, 1921, p. 148; Carlgren, 1942, p. 74 (*Cribrina*)

This small intertidal and shallow subtidal anemone broods its juveniles internally and occurs from Maine to Greenland on rocky shores. Dunn, et. al. (1980) referred this species, certain other *Bunodactis* species, and a newly described west coast (Pacific) species (*Aulactinia incubans*) to the genus *Aulactinia*.

Aulactinia capitata Verrill, 1864–1866, p. 20 (see also Dunn et al., 1980, p. 2078)

This southern east coast (Atlantic) and Gulf of Mexico species occurs from low intertidal to shallow subtidal habitats, buried to the tentacles in sand. This species is usually somewhat elongate with a very narrow lower column and wide upper column when preserved. The upper half to third of the column has prominent vertical rows of tightly packed adhesive verrucae. The lower half to two thirds lacks verrucae and forms deep horizontal fissures in preserved specimens. The first verrucae below the tentacles are trilobed.

Family Actinostolidae

Sicyonis obesa (Verrill in Carlgren, 1934, p. 7, *Actinernus obesus*) (see also Carlgren, 1949, p. 81)

Known only from specimens collected off Chesapeake Bay and Martha's Vineyard, this is a large very deepwater (>1,200 m) species. One specimen studied by Verrill was placed in the USNM as the type, but Carlgren (1934) gives the first full description of the species, listing Verrill as the author and noting that *Actinernus obesa* seems to have been a "museum name" and was never published. Possibly the largest anemone found along this coast (to >12 cm basal diameter, preserved); the thick body wall, short thick tentacles, and smooth vertically flattened column are distinctive.

Paranthus rapiformis (Lesueur, 1817, p. 171, *Actinia*) (see also: Verrill, 1899b, p. 213 (*Ammophilactis*); Carlgren, 1934, p. 17; Widersten, 1976, p. 868)

This is a small to moderate-size intertidal to shallow subtidal sand-dwelling anemone from the southern east coast and the Gulf of Mexico. Specimens often swell to spherical or goblet-shaped forms with the base much smaller than column diameter and remain that way when preserved. Newly collected and inflated preserved specimens resemble peeled onions.

Actinoscyphia saginata (Verrill, 1882, p. 225, *Actinernus saginatus*) (see also Stephenson, 1918, p. 128; Stephenson, 1920, p. 541 (*Actinoscyphia*); Carlgren, 1934, p. 8).

An arctic-boreal, deepwater (≥700 m) North Atlantic species found from the arctic to N. Carolina, this species has threadlike tentacles and a vertically flattened smooth column, usually with a small base. The base may enfold worm tubes or sponge (*Hyalonema* sp.) spicule bundles. Ecological observations and photographs of a similar species (*A. aurelia*) are given by Aldred et al. (1979).

Liponema multicornis (Verrill, 1879, p. 198, *Bolocera*) (see also Verrill, 1922, p. 117 (*Eubolocera*); Carlgren, 1921, p. 143 (*Bolocera*); Carlgren, 1928, p. 148 [*Liponema*]).

This flattened deepwater (>80 m) North Atlantic anemone is found as far south as Cape Cod, has a convex oral disc and is completely covered with several hundred short papilliform tentacles. The base is much smaller than the oral disc and is hidden by it in life.

Actinostola callosa (Verrill, 1882, p. 224, 315, *Urticina*) (see also Carlgren, 1891, p. 227 (*Actinostola*); = *Catadiomene atrostoma* Stephenson, 1918, p. 118; Riemann-Zürneck, 1971, p. 169; Widersten, 1976, p. 865)

This large deepwater (>90 m) circumarctic-boreal species is found in large numbers as far south as Cape Cod. It is taller than wide, with a very thick tubercled column and short, thick, striated tentacles beginning at the margin, increasing in length toward the mouth. The concave base is as wide or wider than the upper column, sometimes enfolding a mud bolus. The column tubercles are thick and flattened, most prominent on the upper third of the column.

Stomphia coccinea (Müller, 1776, p. 231, *Actinia*) (see also Carlgren, 1921, p. 234 (*Stomphia*); Carlgren, 1942, p. 75; Verrill, 1922, p. 1189; Siebert, 1973, p. 363–373; Widersten, 1976, p. 866)

This moderate size deepwater (5–400 m) circumarctic-boreal anemone has a smooth column, about as tall as wide or less so, with flaring base, sometimes with a mound formed in the center of the base. It sometimes occurs with *Urticina crassicornis*, which it resembles, except for the broader base, flatter body, and totally smooth column. It is able to detach easily and swims in response to attack by predatory seastars.

Antholoba perdix (Verrill, 1882, p. 223, *Urticina*) (see also Verrill, 1883, p. 49; Verrill 1899b, p. 210 (*Paractis*, *Archactis*); Widersten, 1976, p. 869)

This flattened deepwater (>100 m) anemone has several hundred small tentacles covering most of the oral disc, increasing in size toward the mouth. This anemone is able to capture large (30 cm) swimming fish in aquaria. The body is flattened vertically. The column is smooth when alive, and is deeply wrinkled vertically and horizontally when preserved. The fosse is not distinct and tentacles begin at the margin. This species is often found on shells from Cape Cod south into the Caribbean sea.

Family Hormathiidae

Hormathia nodosa (Fabricius, 1780, p. 350, *Actinia*) (see also Carlgren, 1928, p. 294 (*Hormathia*); Carlgren, 1933, p. 26; Carlgren, 1942, p. 46; = *Actinauge rugosa* Verrill, 1922, p. 95; = *A. borealis* p. 98; = *Chondractinia tuberculosa*, p. 102; Widersten, 1976, p. 871).

A common aggregating deepwater (>60 m) anemone found from the Canadian Arctic and Greenland to Cape Cod, this species has a thick column with a wide range of variation in texture, from a few longitudinal rows of raised tubercles near the margin to rows of large hooked tubercles (var. *tuberculosa*) on the entire column. A periderm forms on the scapus whereas the scapulus is smooth. The base is as wide or wider than the column. This species may form hybrids with *Hormathia digitata* where they overlap, according to Carlgren (1942). This anemone sometimes attaches to shells, crab carapaces, gorgonians, and other hard objects.

Actinauge longicornis (Verrill, 1882, p. 222, *Urticina*) (see also Verrill, 1882, p. 53 (*Actinauge*); Carlgren, 1942, p. 36; Riemann-Zürneck; 1973).

This is a very common large deepwater (>200 m) anemone found from Cape Cod to the Caribbean, taller than wide, whose expanded oral disc is not bilobed. Living specimens have a distinct dark-colored scapulus (brown, purple) against a bright white column and tentacles. The thick column wall has very small low tubercles, or the entire column is almost completely smooth (some wrinkles when preserved) and lacks a periderm. This species has fewer mesenteries than does *A.verrilli*, with 16 or more perfect and six sterile in the upper column, and six pairs near the base. It is found south of Cape Cod to the south Atlantic (Riemann-Zürneck, 1973).

Actinauge verrilli (McMurrich, 1893, p. 184) (see also Verrill, 1922, p. 94; Carlgren, 1933, p. 28; = *Urticina nodosa* Verrill, 1873a, p. 440; Widersten, 1976, p. 872; Dunn, 1983, p. 48)

This large and common deepwater (>120 m) anemone is found from the arctic south to Delaware. It is taller than wide, and its expanded oral disc forms two large lobes resembling the leaves of a Venus flytrap plant. The tentacles and oral disc retract fully on preservation. The column wall is thick and sculptured into large square tubercles, larger in the upper half, whose form and number vary widely. A periderm is usually evident on the scapus. This species has more mesenteries than does *A. longicornis*, with 40 perfect and one sterile in the upper column, and six pairs near the base. This species also has been found in the south Atlantic (McMurrich, 1893; Dunn, 1983).

Phelliactis americana (Widersten, 1976, p. 872)

Only a few specimens of this deepwater (to 1,000 m) species have been collected, on gravel, south of Nova Scotia and east of Cape Cod. The thick column has a distinct ridged scapulus and tubercled scapus and is asymmetrical, one side being somewhat larger than the other. Tubercles are low hemispheres in up to 48 regular vertical rows, and there may be traces of periderm. Acontia are abundant and the tentacles are short and numerous (to 190). This species resembles *Hormathia nodosa* but has more tentacles, a more prominent scapus, and tubercles in very regular vertical rows.

Paracalliactis involvens (McMurrich, 1893, p. 182, *Adamsia*) (see also Carlgren, 1947, p. 15; = *Urticina consors* Verrill, 1882, p. 225)

A deepwater species (>200 m) found from Cape Cod south to at least Virginia. This anemone forms a carcinoecium housing a hermit crab (*Sympagurus pictus*). The column is smooth and there are numerous small tentacles. The base secretes a cuticle and completely replaces the original shell that it once covered.

Allantactis parasitica Danielssen, 1890, p. 20 (see also Carlgren, 1933, p. 30; Carlgren, 1942, p. 34; = *Calliactis kröyeri* Danielssen, 1890, p. 36)

This deepwater circumartic-boreal anemone (6–1,448 m) lives on shells (e.g. *Sipho, Neptunea*) inhabited by hermit crabs (*Pagurus bernhardus*). The anemone does not replace the shell by forming a cuticle. The column is smooth and often extremely flattened vertically when preserved, although Carlgren (1942) illustrated one specimen, probably preserved, about three times as long as wide. This species is more northerly in distribution than *Paracalliactis involvens*, which is similar, and it possesses a column that is not divided into scapus and scapulus.

Calliactis tricolor (Lesueur, 1817, p. 171, *Actinia*) (=*Actinia bicolor*, Lesueur, 1817, p. 171; = *Cereus sol* Verrill, 1864–1866, p. 24; = *Adamsia egletes* Duchassaing and Michelotti, 1866, p. 134) (see also McMurrich, 1898, p. 234 (*Adamsia*); Haddon, 1898, p. 457 (*Calliactis*); Duerden, 1902, p. 359; Field, 1949, p. 12; Carlgren and Hedgepeth, 1952, p. 160)

This shallow-water (<30 m) anemone, about as tall as wide when preserved, lives on gastropod shells (*Polinices, Fasciolaria, Rehderia, Busycon*) alone or inhabited by hermit crabs (*Pagurus policaris, P. impressus, Clibinarius vittatus, Petrochirus bahamensis*) or on crab carapaces (*Pericera cornuta, Hepatus epheliticus*) (Cutress et al. [1970]; McLean and Mariscal [1973]; Brooks and Mariscal [1986]). It is found in the Caribbean, the Gulf of Mexico, and north along the east coast to North Carolina.

Adamsia sociabilis Verrill, 1882, p. 225 (see also Verrill, 1883, p. 45)

A small deepwater (>150 m) species found from New Jersey north to at least Nova Scotia, this anemone forms a conical carcinoecium covering only the abdomen of a hermit crab (*Catapagurus sparreri*), and is found on mollusk shells (*Cadulus, Dentalium, Cavolina*) when juvenile. The anemone is carried on the crab with the mouth and tentacles pointing downward, sweeping the substrate. Tentacles form two distinct circles around the protruding mouth.

Chondrophellia coronata (Verrill, 1883, p. 53, *Actinauge nodosa*) (see also Carlgren, 1925, p. 6, *Chondrophellia*; Carlgren, 1928, p. 215; Carlgren, 1942, p. 32, p. 77; = *Actinauge fastigiata*, McMurrich, 1893, p. 187; = *Hormathia elongata* Gravier (1918, p. 14).

This distinctive and rarely collected deepwater (>600 m) North Atlantic anemone is found as far south as Virginia. It is about two to three times as long as wide when preserved and has a "crown" comprising two rows of 12 tubercles each at the margin, completely hiding the retracted scapulus and tentacles when contracted. A dark brown periderm covers the lower half of the column. The base can be broad, concave, and folded around a mud bolus.

Amphianthus nitidus (Verrill, 1898b, p. 144, *Raphactis*) (see also Carlgren, 1934, p. 10, *Amphianthus*; Widersten, 1976, p. 873)

This small deepwater (128–605 m) anemone has an amplexicaulous base that surrounds gorgonian branches (*Paramuricea, Primnoa*) or, less commonly, hydroid stems or sponges. This species has been collected from Delaware north to at least Nova Scotia. Acontia are yellow and numerous. Inner tentacles are longer than outer, and the scapus is smooth or has up to eight low tubercles. The broad and distinctly ridged scapulus is visible when the anemone is contracted. This species closely resembles *A. mirabilis* but differs in size, column, and scapulus texture, and in the presence of acontia.

Amphianthus mirabilis (Verrill, 1879, p. 74, *Synanthus*) (see also Verrill, 1883, p. 48, Verrill. 1899b, p. 205; Carlgren, 1942, p. 7)

This is a small deepwater anemone (375–620 m) collected from the fishing banks off Nova Scotia and south to South Carolina. It has a smooth column and a broad amplexicaulous base wrapped completely around gorgonian branches (e.g. *Paragorgia arborea, Paramuricea grandis*) often with bases of several anemones fused. Acontia and cinclides are absent, contrary to Carlgren's (1949) diagnostic characters of the genus, and pedal laceration probably occurs.

Stephanauge nexilis (Verrill, 1883, p. 55, *Actinauge*) (see also Verrill, 1899b, p. 145 (*Stephanauge*), 1922, p. 99; Carlgren, 1942, p. 37; Widersten, 1976, p. 875)

A circumarctic deepwater (150–547 m) species found as far south as Cape Cod, this anemone's amplexicaulous base grasps the denuded axis of a pennatulid (e.g. *Balticina*). The upper scapus forms up to 26 flattened square tubercles, and the scapulus is distinctly ridged. Tentacles are numerous, to 200, but usually <100; acontia are few or possibly absent; there are few cinclides, and those are confined to the directive chambers. The base is elongated along one axis, causing lateral flattening of the scapus near the base. Some specimens may have more than six pairs of perfect mesenteries. See *S. acanellae* for comparison.

Stephanauge acanellae (Verrill, 1883, p. 46, *Sagartia*) (see also Carlgren, 1942, p. 49, *Stephanauge abyssicola* (Moseley); Verrill, 1898b, p. 145; Verrill, 1922, p. 101, *Raphactis*; Carlgren, 1928, p. 300)

This is a small deepwater (>487–2328 m) anemone with an amplexicaulous base grasping branches of the gorgonians *Acanella arbuscula* or *Mopsea* sp. It is a circumarctic species, found south to New Jersey and possibly to the Antilles (Verrill, 1883). The column is smooth and laterally flattened especially near the base, sometimes with one or more rings of low tubercles. Acontia are absent. It resembles *S. nexilis* but differs in column texture, color, depth, and substrate type. Morphological similarity and a nearly undistinguishable cnidom suggests that *S. nexilis* could be a subspecies or a sister species of *S. acanellae*.

Stephanauge spongicola (Verrill, 1883, p. 47, *Sagartia*) (see also McMurrich, 1898, p. 238; Widersten, 1976, p. 875)

This is another small deepwater (144–578 m) species found from Nova Scotia south to N. Carolina. It has a flat or amplexicaulous base, a smooth column sometimes with thin periderm, and 70–80 tentacles increasing in size from margin to inner oral disc. It occurs on a variety of substrata including hydroid stems, sponges, rocks, and worm tubes. Acontia are numerous, and cinclides are rare. The irregular number of siphonoglyphs (1–4) suggests asexual reproduction by longitudinal fission. It differs from *S. acanellae* and *S. nexilis* by having fewer tentacles and mesenteries and abundant acontia, and by having atrichous nematocysts in the tentacles and column.

Family Sagartiidae

Sagartiogeton verrilli Carlgren, 1942, p. 18 (=*Sagartia abyssicola* Verrill, 1882, p. 314; = *Sagartiogeton abyssicola* Carlgren, 1928, p. 260)

Sagartiogeton verrilli is a small deepwater (139–1,416 m) anemone found on worm tubes (*Hyalinoecia artifex*) or, more rarely, on rock. The base is flat or amplexicoulous, acontia are numerous, tentacles are red to maroon when alive; the actinopharynx is deep maroon when preserved. The column has a periderm that peels off in patches. The 96 tentacles increase in length from the margin to the inner oral disc. This species resembles *Stephanauge acanellae* and *S. nexilis* but has fewer tentacles, a larger number of perfect mesenteries, numerous acontia, and tenaculi on the scapus. It also resembles *S. spongicola* but has more mesenteries, more perfect mesenteries, tenaculi, and lacks atrichous nematocysts on the tentacles and column ectoderm. It differs from all three similar species by having microbasic amastigophore nematocysts in the tentacles, column, and acontia.

Actinothoe modesta (Verrill, 1866, p. 337, *Sagartia*) (see also Hargitt, 1914, p. 1240)

This elongate low intertidal to shallow subtidal burrowing anemone has an adherent base attached to cobbles, shell, or rock below sand. Two distinctive brown stripes occur on each tentacle when alive. It has been found only in Long Island Sound and southern Cape Cod to date. Acontia are extruded through the column and there is a mucous sheath on the column containing adherent sand grains when the anemone is first collected. This is the only burrowing acontiate anemone along the east coast of North America. The following three species are incompletely described and may be synonymous with *A. modesta* or with other North Atlantic *Actinothoe* species: *Actinothoe gracillima* (McMurrich, 1887, p. 61, *Sagartia*); *Actinothoe pustulata* (McMurrich, 1887, p. 60, *Sagartia*); *Actinothoe bradley* (Verrill, 1869, p. 484, *Sagartia*).

Family Metridiidae

Metridium senile (Linnaeus, 1767, p. 1088, *Actinia*) (see also Stephenson, 1935, p. 214; Carlgren, 1942, p. 59; Hand, 1956, p. 192; = *Metridium dianthus* Carlgren 1933, p. 22; = *Sargartia dianthus* Gosse, 1855, p. 274; = *Actinia marginata* Lesueur, 1817, p. 172; = *M. fimbriatum* Verrill, 1865, p. 150; Widersten, 1976, p. 850)

This very common and large shallow-water (mid-intertidal to 166 m) circumarctic-boreal anemone occurs south to New Jersey and is distinguished by a lobed crown of up to thousands of small tentacles in large specimens. The column is smooth and has a distinct collar, not present in small individuals. Asexual reproduction by pedal laceration produces clones of anemones all with the same color pattern (Parker, 1897; Hoffmann, 1976; Hoffman, 1986; Shick and Hoffmann, 1980); clones interact agonistically by inflating elongate catch-tentacles with specialized nematocysts (Purcell, 1977; Sebens, 1985). Acontia are numerous and are easily discharged through the column cinclidae. This anemone preys on small to relatively large zooplankton (Sebens and Koehl, 1984). Color is extremely variable. Common substrates include rock, shell, and wood.

The reproductive cycle has been described for the west coast population whose individuals have some mature gametes throughout the year (Bucklin, 1982). Juveniles and small intertidal adults lack a lobed oral disc and have elongate tentacles of roughly equal size (Rawlinson, 1934; Carlgren, 1942). Although large adults are easily identified, small individuals could be confused with *Diadumene leucolena*, the only other epifaunal acontiate anemone with a partially overlapping range. *Diadumene* has prominent cinclides in vertical rows, and many differences in the cnidom (Table 3, also Hand, 1956; Westfall, 1965). Bucklin (1985) identified two ecophenotypes, *M. senile dianthus* and *M. senile pallidum* (Stephenson, 1935) from British shores (by electrophoresis). Genetic distance between British and North American east coast *Metridium* indicates a subspecies- to species-level of differentiation. See recent discussion in Fautin et al. (1989).

Family Aiptasiidae

Aiptasia pallida (Verrill, 1864–1866, p. 26, *Dysactis*) (see also Verrill, 1864–1866, p. 322, *Paranthea*; McMurrich, 1887, p. 59, *Aiptasia*; Andres, 1883, p. 391; = *Diadumene leucolena* in Field, 1949, p. 13, according to Hand, 1956, p. 229; den Hartog, 1985, p. 175)

A small mid-intertidal to shallow subtidal Caribbean anemone found as far north as North Carolina. The inner tentacles are long, slender, and of roughly equal length; those of the outer cycle are only about one fourth the length of the innermost ones. The most distinctive feature of this species is the two (rarely one or three) prominent horizontal rows of cinclides, without raised edges when preserved, girdling the midcolumn; the column is smooth otherwise. This feature distinguishes it from the co-occurring *A. eruptaurantia*.

This species can be distinguished from its Caribbean congener, *Aiptasia tagetes*, by the lack of distinct rows of cinclides in the latter. Both species harbor zooxanthellae (Clark and Jensen, 1982) giving the otherwise clear, white, or white speckled anemone a brown color. Common substrata include rock, algae, sponges, and mangrove roots. Pedal laceration is common, resulting in clones of a single sex. Adults produce large oocytes (250 μm) in spring and summer and spawn by October, although some populations spawn in April as well (in Florida, Jennison, 1983).

Aiptasia eruptaurantia (Field, 1949, p. 16, *Actinothoe*) (see also Carlgren, 1952, p. 376)

This moderate-size intertidal anemone is known only from North and South Carolina. It has distinctive red spots (surrounding cinclides) on the column and lines on the oral disc. Cinclides occur in one or more, commonly several, horizontal bands on the upper column and have distinct raised rims. Tentacles decrease in length away from the mouth; the outer ones are about two thirds as long as the innermost. This species can be distinguished from *A. pallida* by the arrangement of tentacles and cinclides, by the presence of microbasic amastigophore nematocysts in the tentacles and column of *A. eruptaurantia*, and by several other differences in the cnidom (Table 3).

Family Bathyphelliidae

Daontesia praelonga (Carlgren, 1928, p. 259, 302, *Sagartiogeton praelongus*) (see also Carlgren, 1942, p. 5)

A rarely encountered deepwater (>1,000 m) anemone known previously from Scandinavia and south of Iceland, this species was collected recently in 1,162 m depth off Delaware (by B. Hecker, K. Sebens ident.). The scapus has tightly packed elongate papillae (tenaculi) and is smooth to longitudinally ridged. This species differs from all others in this region by the presence of these numerous densely packed tenaculi on the scapus.

Family Aiptasiomorphidae

Haliplanella luciae (Verrill, 1898a, p. 493, *Sagartia*) (see also Stephenson, 1935, p. 197; Hargitt, 1914, p. 241; Hand, 1956, p. 210 (*Haliplanella*); = *Sagartia lineata* Verrill, 1869, p. 57; = *Haliplanella lineata* (Verrill) in Manuel, 1981, p. 134)

This small intertidal anemone has spread, possibly from Asia (Uchida, 1932; Williams, 1954, Williams, 1973) throughout the world. The smooth column is green to brown, frequently with vertical orange, yellow or white stripes. This anemone reproduces asexually by longitudinal fission (Davenport, 1900; Parker, 1902; Davis, 1909; Davis, 1919; Minasian, 1976; Shick and Lamb, 1977; Minasian and Mariscal, 1979) and occasionally forms elongate catch-tentacles, probably used in agonistic encounters (Williams, 1975a; Watson and Mariscal, 1983) resulting in spacing between individuals.

Family Diadumenidae

Diadumene leucolena (Verrill, 1864–1866, p. 366, *Sagartia*) (see also Carlgren, 1949, p. 109, *Diadumene*; Carlgren, 1952, p. 25; Hand, 1956, p. 223; Vassallo, 1969, p. 121; not *D. leucolena* Field, 1949, p. 13)

A small low intertidal to shallow subtidal anemone often with symbiotic algae (zooxanthellae), especially in the actinopharynx and oral disc. This species is found from South Carolina to northern Massachusetts (Salem Harbor; K. Sebens, unpubl.). Acontia are numerous, and the column usually has vertical rows of low vesicles along the top half. This anemone resembles small *Metridium senile* but can be distinguished by column structures and by several differences in the cnidom (Table 3).

Order ZOANTHARIA
Family Epizoanthidae

Epizoanthus incrustatus (Duben and Koren, 1847, p. 268, *Mamillifera incrustata*); (=*Zoanthus couchii* Gosse, 1860, p. 267; = *Z. rubricornis* Haddon and Shackleton, 1891, p. 652; = *Epizoanthus americanus* Verrill, 1864–1866, p. 34; see also Haddon and Shackleton, 1891, p. 636; Manuel, 1981, p. 73)

This moderately deepwater (>60 m) zoanthid (large colony with 15–20 polyps) forms a carcinoecium housing a hermit crab (e.g. *Eupagurus pubescens*). Small colonies (2–5 polyps) are found loose on worm tubes (*Hyalinoecia artifex*) or on small debris. Polyps are up to 1.5 cm tall by 0.6 cm wide preserved, with sand-encrusted columns and upper colony surfaces. Polyps cover only the upper (dorsal) colony surface.

Epizoanthus paguriphilus Verrill, 1882, p. 137, 316 (see also Haddon and Shackleton, 1891, p. 641; = *E. abyssorum*, Manuel, 1981, p. 77; USNM specimens ident. by K. Sebens)

This deepwater (>500 m) zoanthid (colony <12 polyps) forms a carcinoecium housing a hermit crab (e.g. *Parapagurus pilosimanus*). Polyps are up to 2 cm tall by 1.2 cm wide preserved, with sand-encrusted columns and upper colony surfaces. There is a large polyp-free area on the central, upper (dorsal) surface. This and the larger polyp size distinguish it from *E. incrustatus*.

Order CERIANTHARIA
Family Cerianthidae

Cerianthus borealis Verrill, 1873b, p. 5 (see also Verrill, 1883, p. 534; Kingsley, 1904, p. 345; Shepard et al., 1986; Table 3; = cerianthid B, Carlgren, 1927, p. 444)

This large shallow to deep subtidal (0–500 m) cerianthid has 150–200 solid colored or distinctly banded marginal tentacles of unequal length and multiplanar arrangement. In large deepwater specimens, the tube protrudes 5–15 cm above the substrate but may be at or near the sediment surface in very shallow water. This species is found from Delaware north to the arctic. Spirocysts of the marginal tentacles are up to 56 μm in length, distinguishing this species from *Ceriantheopsis americanus*. Kingsley (1904) presented figures of the larva of this species (termed *Arachnactis* larva).

Ceriantheopsis americanus (Agassiz, 1859, p. 24, *Cerianthus*) (see also Verrill, 1864–1866, p. 32; McMurrich 1890, p. 131–150, *Ceriantheopsis*; Carlgren, 1912, p. 41; Field, 1949, p. 19)

A large low intertidal to shallow subtidal (0–70 m) species found south of Cape Cod to the Caribbean Sea, this anemone has up to 125 marginal unbanded tentacles of approximately equal length held in a multiplanar array. The tube opening does not protrude much above the substrate, if at all. Spirocysts of the marginal tentacles reach only 27 μm in length, half the size of those in *Cerianthis borealis*. Mariscal et al. (1977) provided information on cnidae and tube construction.

Cerianthid I (undescribed species, see Table 3 in Shepard et al., 1986; = cerianthid A)

This is a small very deepwater (1,600–1,900 m) cerianthid found in dense aggregations. Tentacles are held close to the sediment surface and the tube does not protrude above the substrate. Preserved specimens are <6 cm long. Marginal tentacles are uniformly dark red to black or purple in living specimens, numbering about 30. One specimen was collected in Baltimore Canyon (1,806 m) by B. Hecker. Shepard et al. (1986) reported the known range from Oceanographer to Veatch Canyons along the continental slope.

Cerianthid II (undescribed species)

This large very deepwater (1,500–3,000 m) species has marginal tentacles of equal length and multiplanar arrangement, dark, purple to almost black and unbanded. The tube extends only a few cm above the sediment. Photographs indicate there are about 60 marginal tentacles. This species has been photographed in Baltimore Canyon by B. Hecker.

Cerianthid III (undescribed species, see Table 3 in Shepard et al., 1986; = cerianthid C)

This deepwater species (200–400 m) is found in canyons on the continental slope (Lydonia and Oceanographer to Block Canyons). The tube protrudes up to 20 cm above the sediment surface. Marginal tentacles are white with purple marks in living specimens and are of unequal length, held in a uniplanar parabolic arrangement. No specimens have been collected, but it has been photographed in situ by Shepard et al. (1986). Photographs indicate there are approximately 80–100 marginal tentacles in large specimens.

Cerianthid IV (undescribed species, see Table 3 in Shepard et al., 1986; = cerianthid D)

A deepwater species known only from photographs taken in Hudson Canyon (200–300 m). The greenish-yellow marginal tentacles are held flush to the sediment surface, are of unequal length, and are arranged in a multiplanar array. No specimens have been collected, and its identification, even as a cerianthid, is thus only tentative.

Order CORALLIMORPHARIA
Family Corallimorphidae

Corynactis delawarei Widersten, 1976, p. 860

This small, deepwater (>200 m) corallimorpharian has been collected south of Cape Cod. Polyps are solitary or connected in rows of several individuals formed by longitudinal fission, with smooth unornamented columns. Tentacles bear acrospheres on their tips, and inner tentacles are longer than outer ones. Column and base are bright red to reddish brown or white in life. Acrospheres are distinct and white. Only one indistinct siphonoglyph is present. Found on rock, onuphid polychaete tubes, and on shell fragments (specimens in USNM).

Glossary

Definitions (modified and expanded from Carlgren, 1949; Manuel, 1981; for a more complete set of terms specific to cerianthids, see Arai, 1965).

Aboral: Part of polyp or structure remote from mouth, toward base.
Acontioid: Acontium-like organ of some Ceriantharia.

Acontium: Thread-like nematocyst-bearing organs attached to mesenteries, usually below mesenteric filament, in certain Actiniaria.

Acrorhagus (pl. acrorhagi): Verruca-like organ, with holotrichous nematocysts, in the parapet or fosse region of some anemones (Actiniidae), used for intra- and interspecific aggression. Also termed "marginal spherule."

Acrosphere: Spherical tentacle tip, clearly demarcated from stalk, often bearing dense nematocyst batteries.

Actinopharynx: Tubular "throat" of an anthozoan polyp, usually compressed laterally.

Actinostola rule: Principle that mesentery pairs of 3rd and later (youngest) cycles have one member of pair much smaller.

Basal disc: Flattened base of many solitary anthozoans (=pedal disc).

Budding: Asexual reproduction manifested by growth of new polyps from body wall, or growth of tissue between polyps (in colonial Anthozoa).

Capitulum: Delicate uppermost region of the column directly adjacent to tentacle bases in some Actiniaria.

Carcinoecium: Structure containing a hermit crab, formed by some colonies of Zoanthidea (also formed by the actinarians *Adamsia, Stylobates,* and *Paracalliactis*).

Catch-tentacle: Modified inner tentacle with numerous holotrichous nematocysts (in some acontiate Actiniaria); used in intra- and interspecific aggression (=fighting tentacle, sweeper tentacle).

Chamber: Area of coelenteron enclosed between adjacent mesenteries (includes endocoels, exocoels).

Ciliated tract: Lateral strand of trilobed mesenteric filament in most Actiniaria and Zoantharia.

Cinclis (pl. cinclides): Perforation or organized weak spot in column wall of some Actiniaria.

Circumscript muscle: Well-defined endodermal muscle, usually pronounced, borne on a single mesogleal lamella above the level of the body wall or mesentery.

Cnida (pl. cnidae): (nematocyst, spirocyst, ptychocyst). Microscopic capsule containing a long explosively evertible tube, sticky or penetrative, used for prey capture, defense, adhesion, burrow lining construction (cerianthids); characteristic of all Cnidaria.

Cnidoglandular tract: Central or only strand of the mesentric filament.

Cnidom: Complement of cnida categories in an anthozoan.

Cnidorhagus: Globular projection from a mesentery, with numerous nematocysts (Ceriantharia).

Coelenteron: Body cavity of anthozoans (=gastric cavity).

Collar: Strongly marked circular fold of body wall just below margin (=parapet).

Colony: Attached polyps produced by asexual budding from a common sexually produced ancestral polyp, retaining permanent organic connection between its constituent individuals.

Column: Cylindrical body of an anthozoan polyp (often refers only to external surface of body wall).

Complete mesentery: Equivalent to "perfect mesentery"; see definition.

Conchula: Raised ear- or shell-shaped extension of lip around siphonoglyph opening in *Peachia.*

Contractile: Capable of being shortened by muscular action (not equivalent to retractile).

Couple: Two equivalent mesenteries on opposite sides of the body across the directive axis.

Cuticle: Any hard outer covering of column or pedal disc in Actiniaria or Zoantharia, usually chitinous or sand-encrusted.

Cycle: Set of mesentery pairs of similar size and development time (in relation to those of other cycles) and more or less equally spaced in the radial plan. Also, a ring of tentacles of equal size arising from chambers between mesenteries of the equivalent cycle.

Decamerous: Arranged in multiples of ten, applying to number of tentacles or pairs of mesenteries in a cycle.

Diffuse muscle: A muscle composed of a number of separate mesogleal lamellae.

Directive axis: Axis of bilateral symmetry in an anthozoan polyp, passing through the siphonoglyph(s) and between pairs of directive mesenteries (long axis of mouth) in cross section.

Directive mesentery: One of a pair straddling the directive axis and connected to a siphonoglyph when present. In Hexacorallia, retractor muscles are on the exocoelic side, as opposed to all other mesentery pairs.

Distal: Part or region away from the base (=oral).

Dorsal: Side of body containing the siphonoglyph in cerianthids.

Ectoderm: Outer cell layer of the body wall (Cnidaria).

Ectomesogleal muscles: Muscles embedded primarily in the mesoglea on ectodermal side.

Endocoel: Space between a pair of mesenteries.

Endoderm: Inner cell layer of the body wall (Cnidaria). Covers both sides of mesenteries (=gastrodermis).

Endomesogleal muscles: Muscles embedded primarily in the mesoglea, on endodermal side.

Exocoel: Space between two adjacent pairs of mesenteries.

Fertile mesentery: Mesentery bearing gonads somewhere along its length.

Filament: = Mesenteric filament.

Fosse: Groove around the top of the column, enclosed by the parapet or collar in some Actiniaria.

Gastric cavity: Alternate term for Coelenteron.

Hexamerous: Arranged in multiples of six (pairs of mesenteries or tentacles), the fundamental arrangement in Actiniaria, Corallimorpharia, and Scleractinia.

Imperfect mesentery: One that does not attach to the actinopharnyx.

Inner cycle: Cycle of tentacles nearest mouth (primary).

Labial tentacles: Short tentacles arising from oral disc near mouth (Ceriantharia).

Lacuna: Cavity in mesoglea of zoanthids.

Lamella: Planar protrusion of mesoglea around which portions of muscles are organized.

Larviparity: Brooding of larvae in the parental coelenteron.

Limbus: Junction of column and basal disc (Thenarian Actiniaria).

Longitudinal fission: Asexual reproduction in Corallimorpharia and Actiniaria, by vertical (longitudinal) division of the polyp into two parts.

Macrocoele: Space between two large macrocnemes in which other smaller macrocnemes and microcnemes occur.

Macrocneme: Perfect mesenteries with well-developed musculature, filament, and gonads.

Margin: Junction of column wall and oral disc, sometimes applied to the parapet.

Marginal pseudospherules: Vesicles situated at the margin, resembling acrorhagi, often with an aperture, containing same cnidae as column (=pseudoacrorhagi).

Marginal spherules: Alternate term for acrorhagi.

Marginal tentacles: Tentacles of outer or marginal series in cerianthids. Tentacles arising from the margin in Corallimorpharians.

Marginal tooth: Small protuberance on the parapet in zoanthids.

Mesenteric arrangement: Mesenteries are arranged in pairs. **Directives** are situated in the directive axis and have their longitudinal muscles (retractors) turned towards the exocoel. **Ordinary pairs** have the retractor muscles turned towards the endocoel (facing each other). The directives are always **perfect**, other pairs may be perfect or imperfect. Usually the partners of the ordinary pairs are equally developed (equal), but sometimes they may differ in size (unequal). Usually the arrangement of the pairs is by multiples of six, **hexamerous**, sometimes of eight, **octamerous,** or of ten, **decamerous**. Irregularities in the arrangement are fairly common in connection with displacement or absence of the directive or dislocation of tentacles or after asexual reproduction. In elongate mud- or sand-dwelling forms, the perfect mesenteries are often strongly differentiated from the imperfect ones. Perfect mesenteries, or **macrocnemes**, have very strong retractors, gonads, and filaments. Imperfect mesenteries, or **microcnemes**, lack these organs. Intermediate mesenteries may occur. The arrangement of mesenteries in some families may be different from normal arrangement (e.g. Minyadidae, Endocoelantheae, Exocoelactiidae, and some Actinostolidae).

Mesenteric filament: Thickened structure attached along inner free edge of most mesenteries.

Mesenteric muscles: One side of each mesentery is occupied by a longitudinal muscle, the other by a **transverse** and a **parietobasilar muscle**; the latter usually run obliquely from the column to the pedal disc. In most Actiniaria, **basilar muscles** also run along both sides of the base of the mesentery, close to the pedal disc. The longitudinal muscles form more or less strong **retractors**. When the muscles are very strongly concentrated and only one mesogleal lamella (or a few main lamellae close to each other) issues from the main lamella of the mesentery, the muscle is termed **circumscript**. **Restricted retractors** show about the same degree of concentration, but a number of more scattered muscle lamellae arise from the mesentery. If the retractor is not strongly concentrated, it is termed **diffuse**. Sometimes, especially in elongate Athenaria, the longitudinal muscles are very weak except where they form the retractor. Close to the body wall, the longitudinal muscles increase in size and, together with the parietobasilar muscles, form a **parietal muscle**.

Mesenteric insertion: Attachment of mesentery to column wall or disc, usually externally visible as a line.

Mesenteric stoma (pl. stomata): Aperture in a mesentery connecting adjacent chambers of coelenteron (distal or oral end). Marginal stomata are just below margin and oral stomata occur near mouth.

Mesenteries: Internal walls, arranged radially and arising from the column wall and oral disc or base.

Mesoectodermal muscles: Muscles that are primarily ectodermal, with a small part embedded in the mesoglea.

Mesoendodermal muscles: Muscles that are primarily endodermal, with a small part embedded in mesoglea.

Mesoglea: Middle supporting layer of the body wall and other structures in Cnidaria, consisting of collagenous elastic connective tissue (alt. mesogloea).

Mesogleal muscles: Muscles wholly embedded in the mesoglea.

Metacnemes: Mesentery pairs arising after the first 12 mesenteries.

Microcneme: Small imperfect mesentery, lacking well-developed musculature, gonads, and filament; used only in opposition to macrocneme.

Multiplication chamber: Ventral chamber of cerianthids in which new mesentery couples arise.

Muscle process: Raised ridge of mesoglea bearing a layer of muscle fibers.

Nemathybome: Externally opening pocket in the mesoglea, containing a nematocyst battery, in certain Edwardsiidae. Often arranged in eight rows.

Nematocyst: Major category of cnidae usually possessing an armament of spines on the tube, arranged in three right-hand spirals. Types are given in introduction.

Nematosome: Ball of flagellated cells and nematocysts occurring free within the coelenteron of *Nematostella*.

Oral disc: Transverse plate of tissue beginning at distal end of column with mouth at its center and tentacles arising from its periphery or from the entire disc.

Papillae: Very small, nonadhesive protrusions of column, usually solid. Sometimes used to refer to very small vesicles.

Parapet: Infolded or upright distal rim of scapus, enclosing a circumferential groove (fosse) in Zoantharia and Actiniaria (= collar).

Parietal muscle: See mesenteric muscles.

Parietobasilar muscle: See mesenteric muscles.

Pedal disc: Basal disc.

Pedal laceration: Asexual reproduction in Actiniaria by fragmentation from the edge of the pedal disc.

Perfect mesentery: A mesentery reaching from the column wall and attaching to the actinopharynx.

Periderm: An external layer of secreted material of variable texture and appearance often incorporating sand, shell, and detritus.

Physa: Rounded aboral end of many Athenaria (Actiniaria).

Planula: Ciliated, sexually (sometimes asexually) produced larva of Anthozoans.

Polyp: Single anthozoan individual.

Primary mesentery or tentacle: One belonging to the first cycle to arise during development: in mesenteries, usually the most fully developed, in tentacles, usually the inner cycle.

Protocnemes: The first 12 mesenteries that arise as couples in Actiniaria.

Proximal: Pertaining to the attached or basal end, or the end of a polyp nearest the colony mass (=aboral).

Pseudocycle: One of several concentric rings of marginal tentacles in the Ceriantharia (not a true cycle because mesenteries are unpaired).

Ptychocyst: Category of cnidae produced by cerianthids, used in tube construction and distinct from spirocysts or nematocysts.

Radius: Area on the oral disc between adjacent mesenteric insertions.

Retractile: Capable of withdrawing oral disc, tentacles, and often distal part of column into the remainder of the column or into burrow.

Retractor muscle: See mesenteric muscles.

Ruga (pl. rugae): A tiny, usually microscopic, adhesive spot or papilla on the column (Actiniaria).

Scapular ridge: Longitudinal ridge on the distal part of the scapus, terminating in a marginal tooth on the parapet (Zoantharia).

Scapulus: Naked region of the column above the scapus, typically (but not only) present when the latter bears periderm (Actiniaria).

Scapus: Major and most extensive region of column; immediately above basal disc or physa. May bear periderm, verrucae, vesicles, tubercles (Actiniaria).

Septum (pl. septa): Vertical, radially oriented plate attached to the theca in the scleractinian coral skeleton. Also a widely used synonym for mesentery in Anthozoa, but should be used only for skeletal septa of corals.

Shaft: Proximal division of tube in heteronemic nematocyst.

Siphonoglyph: Ciliated groove at one or both corners of actinopharynx, often with thickened wall. Pumps water into the coelenteron from the exterior.

Sphincter muscle: Circular muscles situated near distal end of the column in many Actiniaria and Zoanthidea. The endodermal circular muscles of the column are often accumulated at or near the margin, froming a sphincter, is either endodermal or embedded in mesoglea (mesogleal sphincter). A third form, an endomesodermal or mesoendodermal sphincter is transitional. The endodermal sphincter is either elongate and broadly attached to the column (diffuse sphincter), or more concentrated (restricted). The most concentrated endodermal sphincter is termed "circumscribed" of which there are two kinds: "pinnate" with only one main lamella and "palmate" with few main lamellae. In the genus *Bolocera* and some allied genera, the base of each tentacle is provided with an endodermal sphincter. A weak endodermal sphincter may also be present to close the cinclides. An oral sphincter closes the mouth.

Spirocyst: Major category of cnidae possessing a tube devoid of spines (except in some large forms) that bears, when discharged, a left-hand spiral of glutinous substance, which is not penetrative. Spirocysts are unique to the Hexacorallia.

Stoma (pl. stomata): See mesenteric stoma.

Stomodaeum: = Mouth and/or actinopharynx, obsolete term.

Sucker: Adhesive spot on the column of anemones, histologically similar to a verruca but not protuberant. Often used for verruca.

Sulcus: = Siphonglyph, obsolete term.

Tentacle: Hollow appendage arising from oral disc, usually slender and more or less prehensile, used for prey capture.

Tenaculi: More or less solid papillae situated on column, tall and sometimes lobed; ectoderm is partly chitinized and with an usually strong, sometimes stratified cuticle, to which grains of sand or detritus may adhere.

Thread: Distal division of the tube in heteronemic nematocysts.

Transverse fission: Asexual reproduction by division of a polyp horizontally, across the column (*Fagesia*, *Gonactinia*, some cerianthids).

Tubercle: Solid mesogleal excrescence on the column, covered by ectoderm but nonampullaceous (Actiniaria).

Ventral: Arbitrary orientation of single siphonoglyph in Actiniaria.

Verruca (pl. verrucae): Hollow, wartlike, adhesive excrescence of the column in certain Actiniidae.

Vesicle: Ampullaceous, nonadhesive evagination of the column, simple or compound; with few or numerous nematocysts of various categories.

Viviparity: Production of fully formed juveniles after a period of brooding within coelenteron.

V-notch: A constant feature at junction of shaft and thread in undischarged p-mastigophore nematocysts, caused by final turn of spines on shaft. Often funnel-shaped.

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Systematic Index (not including obsolete synonyms)

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Publication of the "Marine Flora and Fauna of the Eastern United States" is most timely in view of the growing universal emphasis on work in the marine environment and the critical need for precise and complete identification of organisms related to this work. It is essential, if at all possible, that organisms be identified accurately to species. Accurate scientific names of plants and animals unlock the great quantities of biological information stored in libraries, obviate duplication of research already done, and often make possible prediction of attributes of organims that have been inadequately studied.

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