NOAA Technical Report NMFS Circular 438

Marine Flora and Fauna of The Northeastern United States. Scleractinia

Stephen D. Cairns

July 1981
NOAA TECHNICAL REPORTS
National Marine Fisheries Service, Circulars

The major responsibilities of the National Marine Fisheries Service (NMFS) are to monitor and assess the abundance and geographic distribution of fishery resources, to understand and predict fluctuations in the quantity and distribution of these resources, and to establish levels for optimum use of the resources. NMFS is also charged with the development and implementation of policies for managing national fishing grounds, development and enforcement of domestic fisheries regulations, surveillance of foreign fishing off United States coastal waters, and the development and enforcement of international fishery agreements and policies. NMFS also assists the fishing industry through marketing service and economic analysis programs, and mortgage insurance and vessel construction subsidies. It collects, analyzes, and publishes statistics on various phases of the industry.

The NOAA Technical Reports Circular series continues a series that has been in existence since 1941. The Circulars are technical publications of general interest intended to aid conservation and management. Publications that review in considerable detail and as a high technical level certain broad areas of research appear in this series. Technical papers originating in economics studies and from management investigations appear in the Circular series.

NOAA Technical Report NMFS Circulars are available free in limited numbers to governmental agencies, both Federal and State. They are also available in exchange for other scientific and technical publications in the marine sciences. Individual copies may be obtained (unless otherwise noted) from DE22, User Services Branch, Environmental Science Information Center, NOAA, Rockville, MD 20852. Recent Circulars are:


427.7 Anomalies of monthly mean sea level along the west coasts of North and South America. By Dale E. Bretschneider and Douglas R. McLain. July 1979, p. 51-64, 6 figs.


427.13 Data on cold weather conditions along the Atlantic and Gulf coasts during the fall and winter of 1976-77. By J. Lockwood chamberlin and Reed S. Armstrong. July 1979, p. 167-174, 1 fig., 1 table.


NOAA Technical Report NMFS Circular 438

Marine Flora and Fauna of the Northeastern United States. Scleractinia

Stephen D. Cairns

July 1981

U.S. DEPARTMENT OF COMMERCE
Malcolm Baldrige, Secretary
National Oceanic and Atmospheric Administration

National Marine Fisheries Service
Terry L. Leitzell, Assistant Administrator for Fisheries
FOREWORD

This NMFS Circular is part of the subseries "Marine Flora and Fauna of the Northeastern United States," which consists of original, illustrated, modern manuals on the identification, classification, and general biology of the estuarine and coastal marine plants and animals of the Northeastern 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.

Geographic coverage of the "Marine Flora and Fauna of the Northeastern 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 Virginia, but may vary somewhat with each major taxon and the interests of collaborators. Whenever possible representative specimens dealt with in the manuals are deposited in the reference collections of major museums of the region.

The "Marine Flora and Fauna of the Northeastern 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 major taxon, treated in a separate manual, includes an introduction, illustrated glossary, uniform originally illustrated keys, 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.

These manuals are intended for use by biology students, biologists, biological oceanographers, informed laymen, and others wishing to identify coastal organisms for this region. Often they can 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 in 1964, and produced under the auspices of the Systematics Ecology Program, Marine Biological Laboratory, Woods Hole, Mass. After a sufficient number of manuals of related taxonomic groups have been published, the manuals will be revised, grouped, and issued as special volumes, which will consist of compilations for phyla or groups of phyla.
Marine Flora and Fauna of the Northeastern 
United States. Scleractinia

STEPHEN D. CAIRNS

ABSTRACT

This manual discusses the 14 species of scleractinian corals known from the northeastern United States coast from Virginia to Nova Scotia. Following a brief introduction to the general biology and morphology of Scleractinia, an illustrated dichotomous key and two tabular keys are given for these species. An annotated systematic list includes complete geographic and bathymetric ranges, references to pertinent literature, and, for some species, ecological and taxonomic notes. Zoogeographic affinities of the fauna are briefly discussed. A selected bibliography is provided.

INTRODUCTION

Fourteen species of stony corals (order Scleractinia) are known from off the northeastern coast from Chesapeake Bay to southern Nova Scotia of which only one, Astrangia astreiformis, occurs at depths shallow enough to be collected routinely by snorkeling or scuba diving. The remaining species are usually collected by benthic trawls or dredges and occur as deep as 3,200 m off the northeast coast. Much research has been done on the easily accessible A. astreiformis, but little more than physical descriptions and distributions are known for the deeper water species. All 14 species are included in this report.

Of these 14 species, 13 are ahermatypic; i.e., they do not possess symbiotic zooxanthellae (a unicellular dinoflagellate) in their endodermal tissue. Individual colonies of A. astreiformis may or may not have zooxanthellae, depending perhaps on water temperature or light intensity; more frequently this species lacks the symbionts. The term ahermatypic is thus a physiological condition determined by ecological factors and therefore is not a character of great value in classification.

Ahermatypic corals have been equated with deepwater corals, solitary corals, or nonreef building corals. This is an oversimplification; in fact, many species occur in shallow water, and some large, colonial deepwater (500-800 m) ahermatypes (e.g., Lophelia prolifera, Enallopsammia profunda) form the framework for reeflike structures. It is true, however, that all deepwater corals are ahermatypic because below the euphotic zone the zooxanthellae, being plants, cannot photosynthesize. Not restricted by the generally higher (often tropical) temperature and light requirements that zooxanthellae impose on hermatypic corals, the ahermatypic inhabit a more extensive geographic range. They are found in all oceans from the Norwegian Sea (lat.70°30’N) to the Ross Sea, Antarctica (lat.78°29’S), from 0-6,328 m depth (Keller 1976), and in temperatures of -1.1°C to over 29°C.

Scleractinia are monocious or dioecious; in either case their motile larval form is a planula capable of remaining planktonic for weeks. In addition to sexual reproduction, some species propagate by asexual budding and others have remarkable powers of regeneration. For instance, the corallum of Dasmosmilia lymani usually splits longitudinally into several fragments, each wedge-shaped piece subsequently producing 1-30 small buds growing directly from the mesenterial tissue. It is rare to find a specimen of D. lymani that grew directly from a planula, i.e., not attached to an inside fragment of a parent specimen.

All planulae need a hard substrate on which to settle. Following settlement and subsequent growth, corals may either remain attached to the substrate or become free, lying unattached on the substrate. The attached corallum usually reinforces its base of attachment by various means, whereas the subsequently unattached corallum becomes free by lacking reinforcement of an originally weak attachment or by completely overgrowing the substrate, as in the case of a sand particle. Some unattached species (e.g., Caryophyllia ambrosia) become top-heavy, fall to one side, but subsequently reorient themselves toward an upright position, producing a horn-shaped corallum.

The scleractinian fauna of the northeastern coast of the United States is relatively low in diversity when compared to other areas in the western Atlantic, even when the reef corals (hermatypes) are excluded from consideration. For example, there are approximately 160 species of Scleractinia in the Caribbean; 76 deepwater (over 200 m) ahermatypes (Cairns 1979), about 30 exclusively shallow-water ahermatypes, and about 54 hermatypic species. In the region between north Florida and Cape Hatteras there are about 40 species known: 28 deepwater ahermatypes (Cairns 1979), about 8-10 exclusively shallow-water ahermatypes, and several hardy hermatypic species, i.e., Solenostrea, Siderastrea, Oculina. In the western Atlantic north of the North Carolina-Virginia border there are 17 species known, 16 deepwater ahermatypes and one exclusively shallow-water species, A. astreiformis. Fourteen of these 17 species are treated in this work, the other three: Vaughanella margaritata (Jourdan, 1895); Fungiocyathus durus Keller, 1976; and P. marenzelleri (Vaughan, 1906) are known from localities north of Maine. Other species occurring south of the area of consideration for this manual that may subsequently be found there include: Dendrophyllia gudiana (Duncan, 1873); Proclastomella conferta Cairns, 1978; Concentrotheca laevigata (Pourtales, 1871); and Polymyces fragilis (Pourtales, 1868).

The 14 species of Scleractinia known off the northeastern coast of the United States are, in general, widely distributed species. Six are cosmopolitan and seven are amphip-
Atlantic. Of the latter, five are primarily cold temperate, one (*A. astreiformis*) is found both in temperate and tropical waters, and one (*Deitocystus italicus*) is primarily a tropical species with northern limits in the cold temperate region. Only one species, *Enalopsammia profunda*, is endemic to the western Atlantic and is most common in the warm temperate region.

**MORPHOLOGY**

The calcareous skeleton of a scleractinian coral, the *corallum*, may be composed of numerous individual units producing a *colonial* corallum or it may be a *solitary* coral with only one unit produced by one polyp. The shape of the corallum of solitary corals is important at the generic and specific levels and is commonly described in geometric terms (e.g., conical, trochoid, cylindrical); shapes of colonial corals are described by branching pattern.

Corals may be either attached to the substrate or unattached (free), this difference usually being consistent at the species level. If attached, the base of the coral is firmly cemented to a hard surface. A solitary attached coral usually has a stemlike *pedicel* directly above the base (Fig. 1), which supports the *calice*, the round to elliptical oral surface of the corallum. The solitary attached coral often reinforces its attachment by thickening its pedicel, expanding its base, and, in some species, producing anchoring rootlets or adding successive rings of compartmentalized, concentric chambers around the base and pedicel. A solitary unattached coral usually has a flat or bowl-shaped base and lacks the pedicel. The sides or walls of solitary corals and coralites of colonies are termed the *theca*. This *theca* may be granular or porcellaneous in texture and often bears longitudinal ridges called costae corresponding to the larger septa. Skeletal deposits formed between individual coralites of a colony are called *coenosteum*.

The calice of most species is regularly and hexamerally subdivided by radial partitions, called *septa*. The six largest septa, divide the calice into six equal areas or *systems* (Fig. 2), and comprise the first cycle of septa. The second cycle also consists of six septa which are generally smaller and occur halfway between the first cycle septa. The 12 third cycle septa are formed in each space created by the previous 12 septa. Calices with 6-7 cycles of septa (192-384 septa) are known. Septa with the upper edges extending above the *theca* are termed *exsert* septa. Sometimes one or several adjacent septa of a calice are extremely exsert and bent over the calice, forming a hoodlike structure called a *rostrum* (e.g., see figure of *Enalopsammia rostrata*). Small accessory lobes are sometimes present on the inner edges of the septa of certain cycles. These are called *pali* (singular: palus), or *paliform lobes*, and are often used as a generic level character. Directly in the center of the calice there is often a structure called a *columella*, which may appear as a lamella (lamellae), a spongy mass (trabecular), a single rod (styliform), a field of simple or twisted rods (papillose, fascicular), or simply a fusion of the inner edges of the larger septa (rudimentary). The type of columella is often used to distinguish genera and subgenera.

**Figure 1.** Cutaway drawing of hypothetical solitary coral illustrating morphological features.

**Figure 2.** Diagram of relative sizes and position of septa in a calice containing three cycles (34 septa). Numbers refer to the cycle to which the septum belongs; only the upper right system is completely numbered.
KEYS TO THE SCLERACTINIA OF THE NORTHEASTERN COAST OF THE UNITED STATES

The identification and classification of Scleractinia depend entirely on characteristics of the corallum; therefore, it is generally necessary to remove the tissue from the corallum before using the keys. This is easily accomplished by soaking the coral in full-strength commercial bleach for several hours followed by thorough rinsing. The specimens should then be stored dry.

An illustrated, dichotomous key is presented first, followed by two tabular keys to the same species: one keying the colonial species and the other, the solitary ones. A blank space in the tabular key indicates that this character does not apply to this species.

DICHOTOMOUS KEY

1. Corallum solitary (see tabular key 1) ................................................................. 2
2. Corallum colonial (see tabular key 2) ................................................................. 10

2 (1) Corallum firmly attached to substrate ............................................................. 3
2 (1) Corallum unattached or attached to small fragment of parent specimen ......... 4

3 (2) Five or more cycles of septa (≥96 septa); septa and theca thick, robust; theca granular and costate; inner septal edges straight (Fig. 3) .................................................. Desmophyllum cristagalli

3 (2) Usually four cycles of septa (48 septa), occasionally 64 septa; septa and upper theca very delicate; theca smooth and porcelaneous; inner septal edges sinuous (Fig. 4A, B) ........................................... Lavonia cailliei

Figure 3.—Desmophyllum cristagalli: side view. Scale: 3 cm.

Figure 4.—Lavonia cailliei: A, side view of specimen with damaged upper septal edges; B, side view of specimen with intact septa, illustrating broad, encrusting attachment. Scales: 1 cm.
4 (2) Pali or paliform lobes present ................................................................. 5
4 (2) Pali or paliform lobes absent ................................................................. 7

5 (4) Coralium attached to fragment of parent corallum or has broken base; corallum fragile, easily fragmented; paliform lobes often multilobate and indistinguishable from the columella (Fig. 5A, B) .................... *Dasmosmilia lymani*

![Image of coralium](image1)

**Figure 5.** *Dasmosmilia lymani*: A, fragment of larger parent corallum with three small coralla asexually budding from parent; B, side view of intact corallum. Scale: 2 cm.

5 (4) Coralium free, base intact; corallum strong, not easily fragmented; paliform single-lobed and distinct from columella ................................................................. 6

6 (5) Pali (12–18) of uniform size occur on inner edges of third cycle septa; corallum a curved cone (horn-shaped); calicular diameter up to 40 mm (Fig. 6) ........................................... *Caryophyllia ambrosia ambrosia*

![Image of coralium](image2)

**Figure 6.** *Caryophyllia ambrosia ambrosia*: side view showing crown of pali and several central columellar ribbons. Scale: 2 cm.

6 (5) Pali of different sizes occur on first, second (sometimes missing), and third cycle septa; corallum conical but not curved; calicular diameter rarely over 15 mm (Fig. 7A, B) ........................................... *Detocyathus italicus*
Figure 7.—Deiocysthus trilicus: A, calicular view showing septal and palar arrangement and columella; larger pali before third cycle septa, smaller before first cycle septa; pali missing before second cycle; B, side view. Scales: 5 mm.

7 (4) Corallum discoidal; base flat (Fig. 8) .

...............................Fungicyathus fragilis

Figure 8.—Fungicyathus fragilis: Calicular view of slightly damaged specimen. Scale: 1 cm.

7 (4) Corallum conical, compressed-conical, or fragmented; base not flat ....................... 8
Rudimentary columnella formed by fusion of lower inner edges of larger septa; corallum usually intact

No columnella; corallum invariably fragmented
(Fig. 9)  
*Flabellum macandrewi*

Figure 9.—*Flabellum macandrewi*: side view. Scale: 1 cm.

Calice compressed or constricted in center (Fig. 10A, B)  
*Flabellum alabastrum*

Figure 10.—*Flabellum alabastrum*: A, calicular view showing constricted calice; B, side view. Scale: 2 cm.

Calice a regular ellipse (Fig. 11)  
*Flabellum angulare*

Figure 11.—*Flabellum angulare*: side view. Scale: 2 cm.
10 (I) Corallum encrusting, rarely producing short, stubby branches; inner edges of septa dentate; corallites directly adjacent (Fig. 12) ........................................... *Astrangia asteriformis*

Figure 12.—*Astrangia asteriformis*: an average-sized colony encrusting a rock. Scale: 2 cm.

10 (I) Corallum branching, arborescent; inner edges of septa smooth; corallites not directly adjacent .................................................. 11

11 (10) Colonies unipianar, with calices arranged on only one side; each calice bordered proximally by a rostrum (hood) (Fig. 13A, B) ................................................................. *Enallopsammia rostrata*

Figure 13.—*Enallopsammia rostrata*: A, a branch from part of a larger colony; note triangular swellings (rostra) beneath each calice. Scale: 2 cm. B, enlargement of rostrum of one calice. Scale: 3 mm.

11 (10) Colonies bushy, with calices randomly arranged on branches; no calicular rostra ................................................................. 12
12 (1/1) Columella present; septa not exert; coenosteum finely porous, especially near calices; usually only 24 septa per calice (Fig. 14). \textit{Enallopsammia profunda}

\textbf{Figure 14.—}\textit{Enallopsammia profunda}: a branch from part of a larger colony. Scale: 5 cm.

12 (1/1) Columella absent; septa exert; coenosteum not porous; usually more than 24 (up to 60) septa per calice. \textbf{13}

13 (1/2) Calices in the process of intratentacular division common (various stages of splitting usually present); first three cycles of septa hexamerally arranged, septa of fourth and fifth cycles added irregularly; nonsplitting calices rarely exceed 5 mm in calicular diameter; coenosteal costae often extend up to 10 mm from calicular edge. \textit{(Fig. 15)} \textbf{Solenosmilia variabilis}

\textbf{Figure 15.—}\textit{Solenosmilia variabilis}: a distal branch of a larger colony. Scale: 3 cm.
Calices in process of intratentacular division rare (most calices, even terminal ones, appear discrete); septa not hexamerally arranged; calices up to 15 mm in calcicular diameter; coenostae costae rarely extend more than 5 mm from calcicular edge (Fig. 16) .............. *Lophelia prolifera*

**Figure 16.** *Lophelia prolifera*: a branch from part of a larger colony. Scale: 5 cm.

<table>
<thead>
<tr>
<th>Table 1.—Tabular key for solitary species.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Corallium attachment</strong></td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td><em>Fingecystus fragilis</em></td>
</tr>
<tr>
<td><em>Caryophyllia ambrosia</em></td>
</tr>
<tr>
<td><em>Darsonomia lymani</em></td>
</tr>
<tr>
<td><em>Dollocyathus italicus</em></td>
</tr>
<tr>
<td><em>Flabellum albamutum</em></td>
</tr>
<tr>
<td><em>Flabellum maculare</em></td>
</tr>
<tr>
<td><em>Flabellum angulare</em></td>
</tr>
<tr>
<td><em>Desmophyllum crassagalli</em></td>
</tr>
<tr>
<td><em>Jovania calidisi</em></td>
</tr>
</tbody>
</table>

1. Attachment of corallium: a—attached; f—unattached, flat base; c—unattached, conical base.
2. Thickness of septa: e—extensive; n—not extensive.
3. Texture of theca: p—porcelaneous; g—granular.
4. Presence of pali or poliiform lobes: O—absent; 1—one third cycle septa; 2—all but last cycle septa.
5. Axial budding: +—present; O—absent.
6. Fragility of corallium: r—robust, usually intact; f—fragile, easily broken; vf—very fragile, usually found in fragments.
7. Columnella: O—absent; t—rudimentary; f—fascicular (reeds, twisted ribbons, papillos; s—tubecular (spongy).
8. *Flabellum albamutum* and *F. angulare* differ in the shape of their corallia, which is not a coded character in this key.

**Table 2.—Tabular key for colonial species.**

<table>
<thead>
<tr>
<th><strong>Corallium shape</strong></th>
<th><strong>Inner septal edge</strong></th>
<th><strong>Calcicular orientation</strong></th>
<th><strong>Budding</strong></th>
<th><strong>Columnella</strong></th>
<th><strong>Septal texture</strong></th>
<th><strong>Septal arrangement</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Astrangia astriformis</em></td>
<td>e</td>
<td>d</td>
<td>O</td>
<td>e</td>
<td>p</td>
<td>n</td>
</tr>
<tr>
<td><em>Lophelia prolifera</em></td>
<td>a</td>
<td>s</td>
<td>2</td>
<td>O</td>
<td>is</td>
<td>O</td>
</tr>
<tr>
<td><em>Solenosmilia variabilis</em></td>
<td>a</td>
<td>s</td>
<td>2</td>
<td>O</td>
<td>id</td>
<td>O</td>
</tr>
<tr>
<td><em>Enallogromia profunda</em></td>
<td>a</td>
<td>s</td>
<td>2</td>
<td>O</td>
<td>e</td>
<td>s</td>
</tr>
<tr>
<td><em>Enallogromia rosea</em></td>
<td>a</td>
<td>s</td>
<td>1</td>
<td>i</td>
<td>r</td>
<td>e</td>
</tr>
</tbody>
</table>

1. Shape of corallium: a—arboreal; c—encrusting.
2. Inner edges of septa: d—dentate; s—smooth.
3. Orientation of calices on branch: 1—calices occur on only one side of branch; colony uniplanar; 2—calices occur on both sides of branch; colony buccal.
4. Calcicular rostrum: r—present; O—absent.
5. Budding: e—extratentacular; i—intratentacular, sympodial; d—intratentacular, dichotomous.
6. Columnella: s—spongy; p—papillose; O—absent.
7. Height of septa: e—extensive; n—not extensive.
8. Texture of coenostae near calices: p—porous; s—solid.
ANOTATED SYSTEMATIC LIST

This list follows the classification proposed by Wells (1956). Genera are arranged alphabetically within families. Geographic ranges include all published records and data from additional specimens examined at the National Museum of Natural History, Smithsonian; Yale Peabody Museum; and Museum of Comparative Zoology, Harvard. References to significant papers are cited in brackets at the end of each account.

Suborder FUNGIINA
Superfamily FUNGICAE
Family FUNGIDAE

Fungiacathus fragilis Sars, 1872. Distribution probably worldwide. In western Atlantic, known from continental shelf south of Cape Cod, Mass. (412-460 m), 5.5°-6.1°C. Also known from eastern Atlantic, off Hawaii, and south of New Zealand (285-2,200 m). Because of its fragility it is usually damaged or in fragments when collected. It is distinguished from other closely related species by its possession of five cycles of septa and septa with sinuous upper edges. [Zibrowius 1980.]

Suborder FAVINIA
Superfamily FAVICAE
Family RHIZANGIDAE

Astrangia astreiformis Milne Edwards and Haimé, 1849 (= Astrangia danae Agassiz, 1850; not Astrangia danae Milne Edwards and Haimé, 1849). Star coral, Northern coral. Massachusetts to Texas from low tide to 35 m (−1°-22°C). This is the only scleractinian likely to be seen by snorkeling or with scuba off the northeastern coast of the United States. Also known from Puerto Rico and off tropical western Africa. Common on any hard substrate, i.e., stones, shells, pilings. May or may not have zooxanthellae. Often used as an experimental laboratory animal. Physiological studies include: Cummings (1976); Jacques et al. (1977); Szamter-Froelich and Pilson (1977); and Jacques (1978). Natural history accounts include: Agassiz (1850); Fewkes (1889); and Bachand (1978).

Milne Edwards and Haimé (1849) described both Astrangia astreiformis and A. danae in the same paper; A. danae has page priority but, because the type is lost, the description is poor, and the type-locality is unknown, it is considered a nomen dubium. The type of A. astreiformis is also lost, but because Milne Edwards and Haimé at least designated the type-locality of United States, it is chosen as the valid name for the common shallow-water Astrangia of the eastern and Gulf coasts. Louis Agassiz, in a paper read on 15 August 1849, independently described the same species and called it Astrangia danae, but because his account was not published until 1850, it is a junior synonym of A. astreiformis.

Suborder CARYOPHYLLIA
Superfamily CARYOPHYLLIAE
Family CARYOPHYLLIDAE

Caryophyllia ambrosia ambrosia Alcock, 1898. Continental slope off Georges Bank (1,487-2,286 m), 3.3°-4.2°C. Also known from eastern Atlantic and Indian Oceans (1,600-2,670 m). The other subspecies, C. ambrosia caribbeana Cairns, 1979, is found in more southern, shallower waters. It differs in having a broader, more open corallum and a rougher thecal texture. [Zibrowius 1980.]

Dasmosnillia taylori (Pourette, 1871). Common on outer edge of continental shelf from Alabama to south of Cape Cod, Mass. (48-366 m), 7°-21°C. Also known from off Venezuela, southeastern Brazil, and, in the eastern Atlantic, in area bordered by Portugal, the Azores, and Spanish Sahara (85-316 m). This species most frequently propagates by asexual budding from longitudinal fractures of the fragile corallum. Five to ten small buds originating from one wedge-shaped fragment are not uncommon. This is the most commonly collected coral from the study area and is not likely to be confused with any other species. [Cairns 1979.]

Dettocathus italicus (Michelotti, 1838). Common from Florida to southern Brazil, including Gulf of Mexico and Caribbean; Bermuda (403-2,634 m), 3°-7°C. One disjunct record on continental slope off New Jersey (Albatross station 2103), 4°C. Also known from eastern Atlantic and Azores (1,500-2,300 m). Some deepwater trawls result in hundreds of specimens. Distinguished from other species in this genus by its distinctive conical base and frequent absence of pali on the second cycle septa. Coralia of some specimens have a pink pigmentation. [Cairns 1979.]

Desmophyllum cristagalli Milne Edwards and Haimé, 1848. Cosmopolitan: widespread in Atlantic, Pacific, and Indian Oceans; Subantarctic; off Georges, Sable, and Grand Banks (off New England coast); Muir Seamount and seamounts between San Pablo and Kelvin Seamounts (off New England coast). Worldwide depth range: 35-2,450 m. This species has no columnar pali. Polyp light orange. Found in great numbers on undersides of ledges in Lydonia Canyon, off Massachusetts. [Cairns 1979.]

Lophelia prolifera (Pallas, 1766) (= L. pertusa (Linnaeus, 1758) nomen dubium). Common in western Atlantic from Nova Scotia to southeastern Brazil (95-1,000 m), 3°-12°C. Also known from eastern Atlantic, Indian, and Pacific Oceans (60-2,170 m). Abundant on Blake Plateau and in Straits of Florida as a major constituent of deepwater coral banks. Growth rate 6-8 mm/yr. Systematics [Cairns 1979]; ecology [Wilson 1979a, b].

Solenosmilia variabilis Duncan, 1873. Known from only two records off northeastern United States: Lydonia Canyon, off Cape Cod, Mass., and south of San Pablo Seamount. Also known from Muir Seamount; continental slopes from Georgia to southeastern Brazil (excluding Gulf of Mexico); eastern Atlantic; south of Greenland and Iceland; Indian Ocean; off southeastern Australia (280-2,165 m). Similar to L. prolifera but easily distinguished by its equal, intratentacular budding, which always produces some terminal calices that are in the process of splitting in two. Polyps light orange.

Superfamily FLABELLIDAE
Family FLABELLIDAE

Flabellum alabasterum Moseley, 1873 (= Flabellum goodei Ver- rill, 1878. in part). Common on continental slope from Georgia to Davis Strait, including Gulf of Maine (357-1,977 m), 3.3°-7.0°C. Also known from eastern Atlantic from off Hebrides to Gulf of Guinea (1,200-2,000 m). Corallum sometimes reddish brown. [Zibrowius 1980.]
Flabellum macandrewi Gray, 1849 (= Flabellum goodel Verrill, 1878, in part). Fairly common on continental slope from Virginia to Nova Scotia (180-667 m), 4.5°-8.3°C. Also known in eastern Atlantic from Norway to Senegal (128-1,170 m), 5°-7°C. Very similar to previous species but differs in that 1) it is invariably found in fragments having, 3-24 septa, 2) lacks a columella, 3) has a more jagged calicular edge, and 4) has a shallower bathymetric range. [Zibrowius 1980.]

Flabellum angulare Moseley, 1876. Known from southern Nova Scotia south to the continental slope of South Carolina (2,265-3,186 m), 2.5°-5.0°C. Also known in the eastern Atlantic from off Scotland south to Morocco and the Azores (1,647-2,800 m). Very similar to F. alabaster but differing in that 1) the outline of the calice is always elliptical, not constricted, and 2) the corallum is always white, never reddish brown. [Zibrowius 1980.]

Javaea cauleei (Duchassaing and Michelotti, 1864) (= Desmosiphon eburneus Moseley, 1881; Desmosiphon nobile Verrill, 1885). Known from off Banqueau Bank, Nova Scotia, south to Oceanographer Canyon, off Cape Cod, Mass., and the continental slope of Georgia south to Burwood Bank, Argentina; eastern Atlantic; Indian and Pacific Oceans (400-2,165 m), 6°-16°C. Distinguished from Desmosiphon crepitata by a lesser number of septa and porcellaneous theca; however, probably indistinguishable in situ, i.e., from a subsurface. [Cairns 1979.]

Suborder DENDROPHYLLINA
Family DENDROPHYLLIDAE

Endallosomma profundum (Pourtales, 1867). Known from only three records off northeastern United States, all on continental slope off Georges Bank (1,211-1,748 m), 3.5°-3.7°C. Also known from continental slope from South Carolina south through Straits of Florida and Lesser Antilles (403-1,337 m), 3°-12°C. Abundant on Blake Plateau and in Straits of Florida where, along with Lophelia prolifera, it is a primary constituent of deepwater coral banks. [Cairns 1979.]

Endallosomma rostrata (Pourtales, 1878) = Endallosomma amphelooides (Alcock, 1902). Known from only three records off northeastern United States: continental slopes off San Pablo, New England, and Atlantis II Seamount (1,714-1,646 m). Also known from continental slope from Georgia to Brazil (5°-13°C); eastern Atlantic, western and central Pacific, Indian Oceans, and south of New Zealand (229-2,165 m). Requires hard substrate to support large corallum. Each calice bordered by a rostrum. [Cairns 1979.]

SELECTED BIBLIOGRAPHY


MOSELEY, H. N. 1873. Figs. 2-3. In W. Thomson, Notes from the "Challenger" VII. Nature (Lond.) 8:400-403, 6 figs.


WELLS, J. W.

WILSON, J. B.


ZIBROWIUS, H.
SYSTEMATIC INDEX

Astrangia
  astreiformis .................................................. 1, 2, 7, 9, 10
  danae ............................................................ 10
Caryophyllia
  ambrosia ambrosia ............................................... 1, 4, 9, 10
  ambrosia caribbeana ............................................ 10
Caryophyllidae .................................................. 10
Caryophyllina .................................................... 10
Concentrotheca
  laevigata .......................................................... 1
Dasmosmilia
  tymani ............................................................... 1, 4, 9, 10
Deltocyathus
  italicus ............................................................ 2, 4, 5, 9, 10
Dendrophyllia
  gaditana ........................................................... 1
Dendrophyllidae .................................................. 11
Dendrophyllina .................................................... 11
Desmophyllum
  cristagalli ........................................................ 3, 9, 10
  eburneum .......................................................... 11
  nobile ............................................................. 11
Entallopamnia
  ampheliodes ...................................................... 11
  profunda .......................................................... 1, 2, 8, 9, 11
  rostrata .......................................................... 2, 7, 9, 11
Faviina ............................................................. 10

Flabellidae .................................................................. 10
Flabellum
  alabastrum ........................................................... 6, 9, 10, 11
  angulare .............................................................. 6, 9, 11
  goodi ................................................................. 10, 11
  macandrewi .......................................................... 6, 9, 11
Fungiocyathus
  durus ................................................................. 1
  fragilis ............................................................... 5, 9, 10
  marenzelleri ........................................................ 1
Fungiidae .................................................................... 10
Fungiina ............................................................... 10
Javaria
  cailloti ................................................................. 3, 9, 11
Lophelia
  pertusa ................................................................. 10
  prolifera .............................................................. 1, 9, 10, 11
Polymyces
  fragilis ............................................................... 1
Pourtalesmilia
  conferta .............................................................. 1
Rhizangiidae .......................................................... 10
Solenosmilia
  variabilis ............................................................ 8, 9, 10
Vaughanella
  margaritata ........................................................ 1
ACKNOWLEDGMENTS

Preparation of the "Marine Flora and Fauna of the Northeastern United States" is being coordinated by the following Board:

Coordinating Editor:
Melbourne R. Carriker, College of Marine Studies,
University of Delaware, Lewes, DE 19958.

Editorial Advisers:
Marie B. Abbott, 259 High Street, Coventry, CT 06238.
Arthur G. Humes, Boston University Marine Program,
Marine Biological Laboratory, Woods Hole, MA 02543.
Wesley N. Tiffney, Professor Emeritus, Boston University,
226 Edge Hill Road, Sharon, MA 02067.
Ruth D. Turner, Museum of Comparative Zoology,
Harvard University, Cambridge, MA 02138.

Roland L. Wigley, National Marine Fisheries Service,
Northeast Fisheries Center, NOAA, Woods Hole, MA
02543.
Robert T. Wilce, Department of Botany, University of
Massachusetts, Amherst, MA 02116.

The Board, which established the format for the "Marine Flora and Fauna of the Northeastern United States," invites systematists to collaborate in the preparation of manuals, reviews manuscripts, and advises the Scientific Editor of the National Marine Fisheries Service.

Thanks are expressed to Duane Hope, Department of Invertebrate Zoology, Smithsonian Institution, for permitting the author to work at the National Museum of Natural History during this study. Preparation of the illustrations by Charles G. Messing is also gratefully acknowledged.
COORDINATING EDITOR’S COMMENTS

Publication of the “Marine Flora and Fauna of the Northeastern United States” is most timely in view of the growing universal emphasis on environmental work and the urgent need for more precise and complete identification of coastal organisms than has been available. It is mandatory, where possible, that organisms be identified accurately to species. Accurate scientific names unlock the great quantities of biological information stored in libraries, obviate duplication of research already done, and often make possible prediction of attributes of organisms that have been inadequately studied.

Stephen Cairns started his research on Scleractinia at the Rosenstiel School of Marine and Atmospheric Science, University of Miami, where he studied the deepwater corals of the western Atlantic. He has continued his studies as a Research Associate at the Smithsonian Institution, with an emphasis on western Atlantic, Hawaiian, and Antarctic Scleractinia and Antarctic Stylasterina.

Preparation of this manual was supported in part by a grant from the Environmental Protection Agency to the Editorial Board of the “Marine Flora and Fauna of the Northeastern United States.” Work on the “Marine Flora and Fauna of the Northeastern United States” by the Coordinating Editor is supported by the College of Marine Studies, University of Delaware.

Manuals are available from the following:

User Service Branch, Library and Information Services, Division D822, Washington Science Center, Building #4, Rockville, MD 20852, at no charge as long as the supply lasts.
National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, either as paper copy or microfiche, for a charge.

Manuals are not copyrighted, and so may be photocopied from the NOAA Technical Report NMFS Circulars available in most major libraries.

The manuals so far published in the NOAA Technical Report NMFS Circular Series are listed below by author, title, circular number, and NTIS accession number.

<table>
<thead>
<tr>
<th>Circular</th>
<th>NTIS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>No.</td>
<td></td>
</tr>
</tbody>
</table>

Marine Flora and Fauna of the Northeastern United States:

COOK, DAVID G., and RALPH O. BRINKHURST. Annelida: Oligochaeta. 374 COM 73 50670
BORROR, ARTHUR C. Protozoa: Ciliophora 378 COM 73 50888
MOUL, EDWIN T. Higher Plants of the Marine Fringe. 384 COM 74 50019
McCLOSKEY, LAWRENCE R. Bryophyta. 386 COM 74 50014
MANNING, RAYMOND B. Crustacea: Stomatopoda. 387 COM 74 50487
WILLIAMS, AUSTON B. Crustacea: Decapoda. 389 COM 74 51194
POLLOCK, LELAND W. Tardigrada. 394 PB 257 987
LARSON, RONALD J. Ecdysozoa: Scyphozoa. 397 PB 261 839
CAVALIERE, A. R. Higher Fungi: Ascomycetes, Deuteromycetes, and Basidiomycetes. 398 PB 268 036
COULL, BRUCE C. Copepoda: Harpacticoida. 399 PB 268 714
CUTLER, EDWARD B. Sipuncula. 403 PB 273 062
PAWSON, DAVID L. Echinodermata: Holothuroidea. 405 PB 274 999
HO, JU-SHEY. Copepoda: Lernaeopodidae and Sphyriidae. 406 PB 280 040
HO, JU-SHEY. Copepoda: Cyclopoida Parasitic on Fishes. 409 PB 281 969
CRESSEY, ROGER F. Crustacea: Branchiura. 413 PB 222 923
BOVEE, EUGENE C., and THOMAS K. SAWYER. Protozoa: Sarcodina; Amoebae. 419 PB 285 538
WATLING, LES. Crustacea: Cumacea. 423 PB 296 460
ZULLO, VICTOR A. Arthropoda: Cirripedia. 425 PB 297 676
TODD, RUTH, and DORIS LOW. Protozoa: Sarcodina: Benthic Foraminifera
BUSH, LOUISE F. Turbellaria: Acoela and Nemertodermatida.
CAIRNS, STEPHEN D. Cnidaria: Scleractinia.

★ GPO—1961—798-545
NOAA TECHNICAL REPORTS
NMFS Circular and Special Scientific Report—Fisheries

Guidelines for Contributors

CONTENTS OF MANUSCRIPT

First page. Give the title (as concise as possible) of the paper and the author's name, and footnote the author's affiliation, mailing address, and ZIP code.

Contents. Contains the text headings and abbreviated figure legends and table headings. Dots should follow each entry and page numbers should be omitted.

Abstract. Not to exceed one double-spaced page. Footnotes and literature citations do not belong in the abstract.


Text footnotes. Type on a separate sheet from the text. For unpublished or some processed material, give author, year, title of manuscript, number of pages, and where it is filed—agency and its location.

Personal communications. Cite name in text and footnote. Cite in footnote: John J. Jones, Fishery Biologist, Scripps Institution of Oceanography, La Jolla, CA 92037, pers. commun. 21 May 1977.

Figures. Should be self-explanatory, not requiring reference to the text. All figures should be cited consecutively in the text and their placement, where first mentioned, indicated in the left-hand margin of the manuscript page. Photographs and line drawings should be of "professional" quality—clear and balanced, and can be reduced to 42 picas for page width or to 20 picas for a single-column width, but no more than 57 picas high. Photographs and line drawings should be printed on glossy paper—sharply focused, good contrast. Label each figure. DO NOT SEND original figures to the Scientific Editor; NMFS Scientific Publications Office will request these if they are needed.

Tables. Each table should start on a separate page and should be self-explanatory, not requiring reference to the text. Headings should be short but amply descriptive. Use only horizontal rules. Number table footnotes consecutively across the page from left to right in Arabic numerals; and to avoid confusion with powers, place them to the left of the numerals. If the original tables are typed in our format and are clean and legible, these tables will be reproduced as they are. In the text all tables should be cited consecutively and their placement, where first mentioned, indicated in the left-hand margin of the manuscript page.

Acknowledgments. Place at the end of text. Give credit only to those who gave exceptional contributions and not to those whose contributions are part of their normal duties.

Literature cited. In text as: Smith and Jones (1977) or (Smith and Jones 1977); if more than one author, list according to years (e.g., Smith 1936; Jones et al. 1975; Doe 1977). All papers referred to in the text should be listed alphabetically by the senior author's surname under the heading "Literature Cited"; only the author's surname and initials are required in the author line. The author is responsible for the accuracy of the literature citations. Abbreviations of names of periodicals and serials should conform to Biographical Abstracts List of Serials with Title Abbreviations. Format, see recent SSRF or Circular.

Abbreviations and symbols. Common ones, such as mm, m, ml, mg, °C (for Celsius), ‰, %, etc., should be used. Abbreviate units of measures only when used with numerals; periods are rarely used in these abbreviations. But periods are used in et al., vs., e.g., i.e., Wash. (WA is used only with ZIP code), etc. Abbreviations are acceptable in tables and figures where there is lack of space.

Measurements. Should be given in metric units. Other equivalent units may be given in parentheses.

FORM OF THE MANUSCRIPT

Original of the manuscript should be typed double-spaced on white bond paper. Triple space above headings. Send good duplicated copies of manuscript rather than carbon copies. The sequence of the material should be:

FIRST PAGE
CONTENTS
ABSTRACT
TEXT
LITERATURE CITED
TEXT FOOTNOTES
APPENDIX
TABLES (provide headings, including "Table" and Arabic numeral, e.g., Table 1—, Table 2—, etc.)
LIST OF FIGURE LEGENDS (entire legend, including "Figure" and Arabic numeral, e.g., Figure 1—, Figure 2—, etc.)
FIGURES

ADDITIONAL INFORMATION

Send ribbon copy and two duplicated copies of the manuscript to:

Dr. Carl J. Sindermann, Scientific Editor
Northeast Fisheries Center Sandy Hook Laboratory
National Marine Fisheries Service, NOAA
Highlands, NJ 07732

Copies. Fifty copies will be supplied to the senior author and 100 to his organization free of charge.
NOAA SCIENTIFIC AND TECHNICAL PUBLICATIONS

The National Oceanic and Atmospheric Administration was established as part of the Department of Commerce on October 3, 1970. The mission responsibilities of NOAA are to assess the socioeconomic impact of natural and technological changes in the environment and to monitor and predict the state of the solid Earth, the oceans and their living resources, the atmosphere, and the space environment of the Earth.

The major components of NOAA regularly produce various types of scientific and technical information in the following kinds of publications:

PROFESSIONAL PAPERS — Important, definitive research results, major techniques, and special investigations.

CONTRACT AND GRANT REPORTS — Reports prepared by contractors or grantees under NOAA sponsorship.

ATLAS — Presentation of analyzed data generally in the form of maps showing distribution of rainfall, chemical and physical conditions of oceans and atmosphere, distribution of fishes and marine mammals, stratospheric conditions, etc.

TECHNICAL SERVICE PUBLICATIONS — Reports containing data, observations, instructions, etc. A partial listing includes data serials; prediction and outlook periodicals; technical manuals, training papers, planning reports, and information serials; and miscellaneous technical publications.

TECHNICAL REPORTS — Journal quality with extensive details, mathematical developments, or data listings.

TECHNICAL MEMORANDUMS — Reports of preliminary, partial, or negative research or technology results, interim instructions, and the like.

Information on availability of NOAA publications can be obtained from:

ENVIRONMENTAL SCIENCE INFORMATION CENTER (DR22)
ENVIRONMENTAL DATA AND INFORMATION SERVICE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE
6009 Executive Boulevard
Rockville, MD 20852