EVE C. SOUTHWARD

Pogonophora of the Northwest Atlantic: Nova Scotia to Florida

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY NUMBER 88

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ABSTRACT

Southward, Eve C. Pogonophora of the Northwest Atlantic: Nova Scotia to Florida. *Smithsonian Contributions to Zoology*, number 88, 29 pages. 1971.—Benthic samples from 259 stations along the continental margin of North America have yielded eight genera and twenty-four species of Pogonophora. A key to the genera and species is provided. Three new species are described. After consideration of the geographical and depth distribution it is concluded that there are three main zoogeographical groups: Florida Current; northern shallow-water species; and widespread deep-water species.

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Introduction

Recent studies of the sea floor of the northwest Atlantic Ocean have included intensive sampling of the benthos by several groups of investigators working from Woods Hole Oceanographic Institution, the Woods Hole Laboratory of the Bureau of Commercial Fisheries, Duke University Marine Laboratory, and the University of Miami Institute of Marine Sciences. The samples have been sorted by the investigating teams and the Pogonophora from 259 of them sent to me for identification. The geographical region covered by the samples extends from Nova Scotia to Miami, and the depths at which pogonophores were found range from 40 to more than 5,000 meters (Figure 1). A small part of this material, including nine new species, has been described in a paper on the Pogonophora of the North Carolina region (Southward and Brattegard, 1968). Two species of the new genus *Crassibrachia* were described in a second paper (Southward, 1968), and Nielsen, in 1965, described four other species found near Miami. Examination of the rest of the samples has revealed a further three new species, which are described herein, and at least three others that are new but cannot be fully described or named without additional specimens. The distribution data provided by such extensive sampling programs permit some understanding of the factors that may control the distribution of these deep-sea animals.

I am most grateful to all those who have loaned specimens for this study of Pogonophora, namely: Dr. H. L. Sanders for samples collected by the *Atlantis, Atlantis II,* and *Chain*; Dr. R. L. Wigley for samples collected by the *Gosnold* and *Albatross;* Dr. G. T. Rowe, Dr. F. Grassle, Prof. J. H. Day, and Dr. E. B. Cutler for the *Eastward* samples; and Dr. F. M. Bayer and Mr. T. Brattegard for those from the *Silver Bay* and *Gerda.*

Type material of the new species and representative specimens of the other species are deposited in the National Museum of Natural History (USNM), Smithsonian Institution.

Dr. Eve C. Southward, Marine Biological Laboratory, Citadel Hill, Plymouth PL 1 2 PB, England.

Systematics

The 1,700 miles (2,800 km) of the continental margin of North America sampled by the programs has yielded twenty-four species of Pogonophora. This is a small number compared with the number of species of Polychaeta or Echinodermata likely to be found in the same area, but the phylum of Pogonophora is fairly compact, with small morphological differences between species and only slightly larger differences between genera; while big morphological differences correlated with different habits or habitats, such as are shown by polychaetes, for example, simply do not exist. All pogonophores are tubicolous, and nearly all live partly buried in soft sediments.

A key has been devised to help in the identification of nineteen named species, belonging to eight genera, which live in the area sampled; this key includes the three new species described herein. Five other species, which are known only from fragments, are included either in the key or in footnotes.

To make successful use of the key the investigator

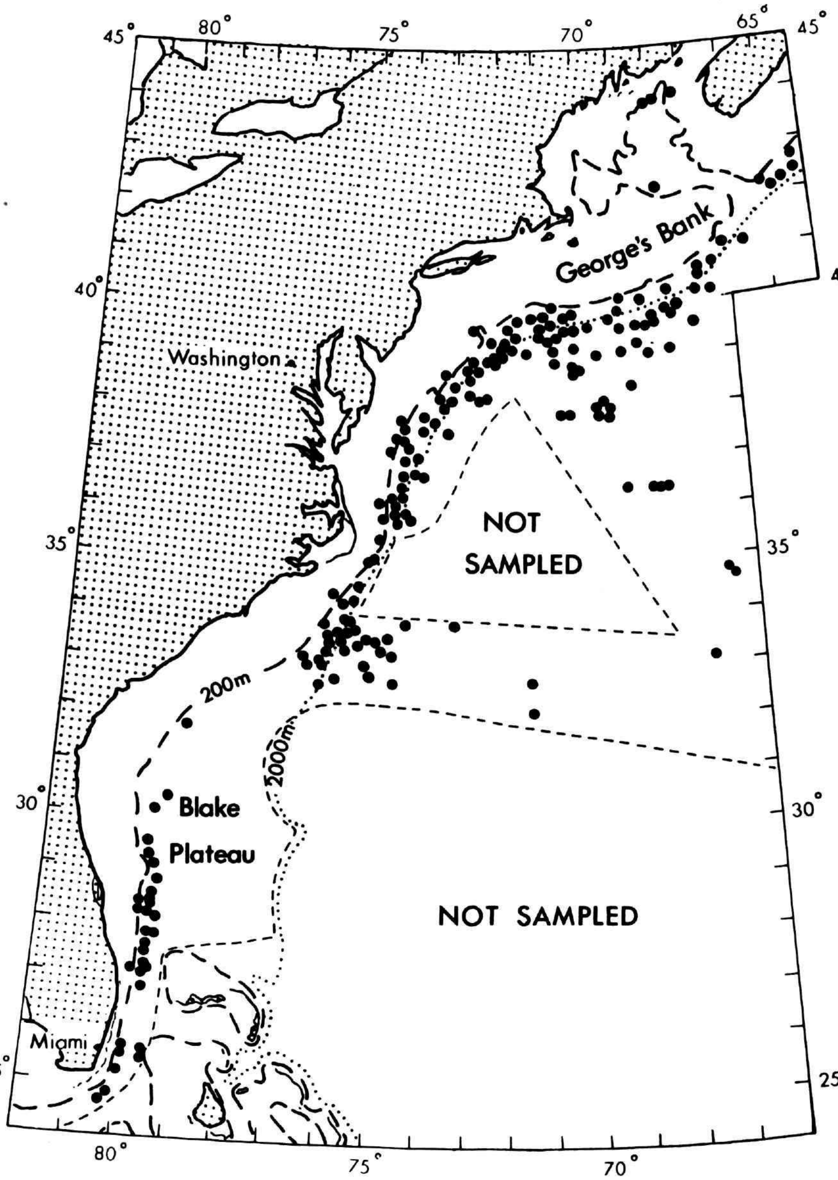

FIGURE 1.—Part of the northwest Atlantic showing the positions (●) at which samples of Pogonophora were collected. ––––, 200 m depth; ....., 2,000 m depth; - - - - -, approximate boundary of areas sampled.

must have the anterior end of an animal, together with several centimeters of its tube, and the animal should be sufficiently mature to contain recognizable oocytes or spermatophores in the trunk region of its body. The important characteristics to look for are the number of tentacles, the occurrence of white or opaque patches of epidermis on the forepart of the body, the presence or absence of rings on the tube, and whether the anterior part of the tube is simple or segmented. Care is necessary, as immature and juvenile specimens frequently differ from adults in having fewer tentacles as well as smaller size, and their tubes may have paler or narrower rings or none at all. In species with a segmented tube the segmentation often is not evident in young tubes, since it usually starts at a later stage in growth, about the time gamete development begins.

Key to Species of Pogonophora

1. One tentacle 10
   Two or more tentacles 2
2. Two to four tentacles 3
   More than four tentacles 6
3. Black tube, maximum diameter 0.28 mm ....***Crassibrachia sandersi*** Southward, 1968
   Brown or colorless tube 4
4. Segmented tube with brown rings 9
   Unsegmented tube 5
5. Two tentacles with dark spots; body also spotted; tube with grayish rings, maximum diameter 0.45 mm...............................***Nereilinum punctatum*** Nielsen, 1965
   Four tentacles, no spots; tube with white and brown rings, maximum diameter 0.55 mm. ***Oligobrachia floridana*** Nielsen, 1965
6. Seven to twelve tentacles, free from one another; segmented tube with brown rings...... 7
   Fifteen to twenty tentacles, stuck together to form hollow cylinder; tube unringed 8
7. Tube segments 4 to 7 mm long ....***Polybrachia eastwardae*** Southward and Brattegard, 1968
   Tube segments less than 1 mm long ....****Polybrachia lepida*** Southward and Brattegard, 1968
8. Grayish-white tube, maximum diameter 0.8 mm ....***Siphonobrachia ilyophora*** Nielsen, 1965
   Brown tube, maximum diameter 0.5 mm ....unnamed lamellisabellid
9. Anterior diameter of tube 0.25–0.27 mm. ***Diplobrachia similis*** Southward and Brattegard, 1968
   Anterior diameter of tube 0.14–0.16 mm ....***Diplobrachia floridiensis,*** new species
   Anterior diameter of tube 0.09–0.10 mm.............***Siboglinoides caribbeanus,*** new species
10. Two long white stripes on the forepart, behind the bridle; tube unsegmented, white ringed, maximum diameter 0.46 mm ......***Siboglinum candidum*** Southward and Brattegard, 1968
    Behind the bridle are small white or opaque patches or a complete annulus 11
11. Behind the bridle is a ventral Y-shaped raised area of swollen clear cells; tube white ringed, unsegmented, maximum diameter 0.41 mm ......***Siboglinum mergophorum*** Nielsen, 1965
    No such area behind the bridle 12
12. Anterior part of the tube segmented 13
    Tube unsegmented 15
13. Segments short and indistinct, 3 or 4 rings on each; middle of tube with reddish-brown rings close together, maximum diameter 0.16 mm. ***Siboglinum pholidotum*** Southward and Brattegard, 1968
    Segments have 5 to 9 rings 14
14. Forepart not more than 0.85 mm long; tube with narrow yellow rings, maximum diameter 0.14 mm ....***Siboglinum bayeri,*** new species
    Forepart at least 0.1 mm long; tube with wider rings, maximum diameter 0.17 mm. *****Siboglinum ekmani*** Jägersten, 1956
15. Stiff, smooth tube with close reddish-brown rings, maximum diameter 0.16 mm. ***Siboglinum pholidotum*** (see 13)
    Soft tube 16
16. Ring of opaque cells close behind bridle; tube with transparent colorless rings, maximum diameter 0.21 mm ....***Siboglinum fulgens*** Southward and Brattegard, 1968
    Opaque cells behind bridle patchily arranged 17

17. Bands of white cells along metameric region of trunk 18
No white cells on metameric region of trunk 19
18. White cells behind bridle in irregular lateral patches, joined dorsally and ventrally by white spots; tube with brown rings on middle part, white rings posteriorly, maximum diameter 0.5 mm ......**Siboglinum gosnoldae** Southward and Brattegard, 1968
White cells behind bridle in small lateral patches, touching on ventral side only; tube with long gray or pale brown rings, maximum diameter 0.29 mm. ****Siboglinum holmei** Southward, 1963
19. Forepart not more than 1.1 mm long; tube with narrow rings and wrinkled surface, maximum diameter 0.14 mm ....****Siboglinum angustum** Southward and Brattegard, 1968
Forepart 1.4 to 2.1 mm long; tube with narrow rings and wrinkled surface, maximum diameter 0.19 mm ....**Siboglinum longicollum** Southward and Brattegard, 1968

* A species attributed to *Diplobrachia* (Southward and Brattegard, 1968) is known from fragments, without tentacles. The segmented tube is 0.35 mm in diameter and resembles that of *Polybrachia lepida*.

** Three species of *Siboglinum*, known from fragments and all occurring on the lower continental slope or rise, could be confused with some species in this key: (1) like *S. holmei* but has smaller tube of 0.15–0.16 mm diameter, and no pinnules on tentacle; (2) has tube like *S. angustum* and forepart about the same length, but bridle is farther back; (3) has segmented tube, with 6 rings per segment, of a distinctive orange color, maximum diameter of 0.13 mm.

Siboglinum bayeri, new species

FIGURE 2

OCCURRENCE.—Twenty-two stations on continental slope between 25°40′ and 37°30′ N (Table 1). Depth range: 134–692 m.

MATERIAL EXAMINED.—About 120 animals and some empty tubes.

TYPE.—Holotype in National Museum of Natural History, USNM 43190.

DESCRIPTION.—This is a small pogonophore with a yellowish-brown tube, which is easily confused with *S. ekmani*. The forepart of the body is nine to ten times as long as wide, with a pointed cephalic lobe and a tentacle bearing two rows of pinnules.

(text continues on page 11)

TABLE 1.—*Station list, classified under names of ships*

Station Number	Date D	M	Y	Latitude N. deg.	min.	Longitude W. deg.	min.	Depth m	Species and number of specimens
								Gosnold	
1039	05	05	63	44	10	67	45	178	*S. holmei*, 1
1171	11	08	63	44	51	66	46	141	*S. holmei*, 15
1179	11	08	63	44	06	67	00	157	*S. holmei*, 1
1248	02	09	63	42	40	64	10	611	*S. ekmani*, 3; *Siboglinum* species, t
1250	02	09	63	42	24	64	14	1628	*D. similis*, 1
1253	02	09	63	42	16	64	39	1800	*S. ekmani*, 1; *S. pholidotum*, 1
1255	02	09	63	42	08	64	53	1894	*D. similis*, 1; *S; pholidotum*, 1
1268	08	10	63	40	00	70	30	316	*S. holmei*, 37
1272	09	10	63	39	54	70	04	474	*S. ekmani*, 1; *S. holmei*, t
1326	14	10	63	39	21	72	06	952	*S. ekmani?*, 2
1327	14	10	63	39	19	72	04	1600	*S. angustum*, 3
1330	14	10	63	39	19	71	51	1604	*S. pholidotum?*, 1
1332	15	10	63	39	12	71	47	2330	*S. pholidotum?*, 1
1333	15	10	63	39	10	72	01	1785	*D. similis*, 1
1335	15	10	63	39	10	72	30	406	*S.* species, 1
1357	19	10	63	38	51	72	54	564	*S. ekmani*, 5; *S. holmei*, 1
1358	19	10	63	38	42	73	01	450	*S. ekmani*, 1; *S. holmei*, 1
1371	25	10	63	39	04	72	40	446	*S. ekmani*, 1; *S. holmei*, t
1561	28	05	64	25	39.7	80	02.7	261	*S. bayeri*, 1
1563	28	05	64	25	19.1	80	07	166	*S. bayeri*, t
1592	02	06	64	24	37.3	80	15.7	757	*S. candidum*, t

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date* D	M	Y	*Latitude N.* *deg.*	*min.*	*Longitude W.* *deg.*	*min.*	*Depth* *m*	*Species and number of specimens*
								Gosnold	
1595	02	06	64	24	54.8	80	03.5	500	*S. candidum*?, 1
1614	03	06	64	26	49.7	79	49.5	342	*S. candidum*, 1
1617	03	06	64	27	02	79	39.6	549	*S. candidum*?, 1
1618	04	06	64	27	02.3	79	50	321	*D. floridiensis*, 1
1619	04	06	64	27	09.8	79	52	258	*P. lepida*, 1; *O. floridana*?, t
1620	04	06	64	27	10	80	00	72	*S.* species, t
1622	04	06	64	27	19.9	79	50	303	*S. bayeri*, 14; *O. floridana*?, t
1623	04	06	64	27	30	79	50	286	*S. bayeri*, 3; *P. lepida*, t
1626	04	06	64	27	40	79	50.1	229	*S. bayeri*, t; *P. lepida*, 1
1628	04	06	64	27	49.8	79	41.4	529	*S. bayeri*, t
1633	04	06	64	28	10.4	79	48.9	301	*S. bayeri*, 9; *O. floridana*, t; *N. punctatum*, 1
1634	05	06	64	28	20.4	79	50.2	313	*S. bayeri*, 17; *N. punctatum*, 1; *O. floridana*, t; *Polybrachia* species, t
1635	05	06	64	28	30.8	79	52	348	*S. bayeri*, 14; *S. candidum*, 1
1636	05	06	64	28	30.5	80	00	134	*S. bayeri*, 3
1638	05	06	64	28	40.5	79	50.4	406	*S. bayeri*, 24; *S. candidum*, 4; *O. floridana*, t
1639	05	06	64	28	50.1	79	51.4	435	*S. bayeri*, 3
1654	06	06	64	30	29.9	79	27.2	752	*S. bayeri*, 1
1722	14	06	64	28	59.3	79	54.8	424	*S. bayeri*, 2; *S. candidum*, 6; *O. floridana*, t
1723	14	06	64	29	10.4	79	55.3	494	*S. bayeri*, 1
1724	14	06	64	29	10	80	05	202	*S. mergophorum*, 1
1726	14	06	64	29	32.8	80	00	494	*S. candidum*, 3; *N. punctatum*, 1; *D. floridiensis*, 1
1732	14	06	64	30	08.8	79	43.5	802	*O. floridana*, t
1763	17	06	64	31	49.8	79	14.5	259	*S. bayeri*, 1; *P. lepida*, t
1835	24	06	64	33	04.3	76	27.1	766	*S. angustum*, 2
1862	26	06	64	34	41.1	75	27.7	692	*S. bayeri*, 3; *O. floridana*, 1
1867	27	06	64	35	05.6	75	06.8	504	*S. bayeri*, 10; *S. ekmani*, t; *S. holmei*, 16; *S. longicollum*, 50; *S. gosnoldae*, 9; *O. floridana*, 6; *P. lepida*, 1; *Diplobrachia* III, 1
1868	27	06	64	35	12.7	74	59	470	*S. holmei*, 21; *S. bayeri*, 5; *O. floridana*, 2; *Diplobrachia* III, 1
1869	27	06	64	35	20.5	74	59.1	70	*S. longicollum*, 1; *P. lepida*, 1; *Siboglinum* species, t
1874	27	06	64	36	09.2	74	58	43	*S. longicollum*, t; *S. holmei*, t
1884	28	06	64	37	18.7	74	29.4	217	*S. holmei*, 1
1885	28	06	64	37	26.7	74	29.2	406	*S. holmei*, 5
2069	06	08	64	36	00	74	43.2	915	*S. ekmani*, 1; *S. longicollum*, 3; *S. gosnoldae*, t
2070	06	08	64	35	54.5	74	34.3	1745	*S. angustum*, 7
2071	07	08	64	35	59.7	74	14.5	2395	*S. ekmani*, t
2073	07	08	64	36	14.9	74	00	2610	*S. angustum*, 1
2075	07	08	64	36	15.5	74	24.1	1920	*S. ekmani*, t; *S. angustum*, t
2076	07	08	64	36	08.8	74	35.8	1560	*S. angustum*, t; lamellisabellid, t
2077	07	08	64	36	15	74	42.5	960	*S. ekmani*, 1
2078	07	08	64	36	21.7	74	43.5	365	*S. holmei*, 11
2079	07	08	64	36	30.1	74	36.4	1545	*S. pholidotum*, 3; *S. angustum*, 2; *S. fulgens*?, t; lamellisabellid, t
2082	08	08	64	36	35.2	74	40.6	400	*S. holmei*, 3
2084	08	08	64	36	44.7	74	29.6	1615	*S. angustum*, 2
2085	08	08	64	36	44	74	14.4	2145	*S. angustum*, 2; *S. pholidotum*, 1; *S. ekmani*, t
2086	08	08	64	36	50.2	74	00	2515	*S. ekmani*, 1; *D. similis*?, t
2087	08	08	64	37	04	74	01.5	2155	*S. angustum*, 3; *S. ekmani*, 1; *D. similis*, 1; *S. pholidotum*, t
2088	08	08	64	37	11	74	15.2	1600	*S. angustum*, 1

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date* D	M	Y	*Latitude N.* *deg.*	*min.*	*Longitude W.* *deg.*	*min.*	*Depth* *m*	*Species and number of specimens*
								Gosnold	
2089	08	08	64	37	11	74	26	1150	*S. angustum*, 2
2090	08	08	64	37	15.5	74	27.5	850	*S. longicollum*, 1; *S. ekmani*?, 1
2091	08	08	64	37	22.3	74	23.7	885	*S. longicollum*, 4; *S. ekmani*, 2; *S. angustum*, 2
2092	08	08	64	37	30	74	19.2	505	*S. holmei*, 2; *S. bayeri*, 1; *S. ekmani*, 1; *S. longicollum*, 1
2093	09	08	64	37	29.5	74	07.9	1100	*S. ekmani*, 2; *S. angustum*, 2
2094	09	08	64	37	35.9	73	59	1515	*S. angustum*, 5
2097	09	08	64	37	43.4	73	30.5	2275	*Siboglinum* species, t
2098	09	08	64	37	45	73	38.2	1955	*S. angustum*, 2; *D. similis*, 1; *S. pholidotum*, t
2099	09	08	64	37	47.9	73	47.5	1408	*S. angustum*, 8
2101	09	08	64	37	55.4	73	54	880	*S. angustum*, 1; *S. ekmani*, t
2107	12	08	64	38	12	73	37.2	870	*S. ekmani*, 7; *S. angustum*, 1; *Siboglinum* sp., t
2108	12	08	64	38	04.1	73	32.5	1660	*S. angustum*, 2
2109	13	08	64	38	13.3	73	17.5	1865	*S. angustum*, 1; *S. pholidotum*, 1; *D. similis*, 1
2111	13	08	64	38	19.8	73	06.5	2225	*S. angustum*, 1; *S. ekmani*, 1; *S. pholidotum*, 1; *D. similis*, 1
2112	13	08	64	38	24.7	73	19	1060	*S. angustum*, 1
2113	13	08	64	38	35.2	72	53.4	2060	*S. ekmani*, 1
2114	14	08	64	38	53.6	72	45.0	1010	*S. ekmani*, 1; *S. angustum*, t
2115	14	08	64	38	44.8	72	38.0	2155	*S. angustum*, 1
2116	14	08	64	38	18.2	72	42	2680	*D. similis*, t
2117	14	08	64	38	15.6	72	29	2910	*S. angustum*, 1; *C. sandersi*, t
2118	14	08	64	38	14.4	72	16	2975	*C. sandersi*, t
2120	15	08	64	38	51.2	72	15.6	2495	*S. pholidotum*, 2
2121	15	08	64	39	02.2	72	21.8	1328	*S. pholidotum*?, 1; *D. similis*, t
2122	15	08	64	39	10.5	72	22	635	*S. ekmani*, 2
2123	15	08	64	39	15	72	14	650	*S. ekmani*, 2
2124	15	08	64	39	05.4	72	08.2	1780	*S. angustum*, 3; *D. similis*, 1
2127	15	08	64	39	15	71	45.2	2055	*S. pholidotum*, 2; *S. ekmani*, 1; *D. similis*, t
2128	15	08	64	39	26.3	71	45.2	1605	*S. angustum*, 5
2129	16	08	64	39	44.6	71	44.7	678	*S. ekmani*, 6
2130	16	08	64	39	39.6	71	29.6	1407	*S. angustum*, 1; *Polybrachia*?, t
2131	16	08	64	39	50	71	25	740	*S. ekmani*, 1; *S. angustum*, 1; *D. similis*, t
2137	16	08	64	39	46	70	51.8	1605	*S. angustum*, 3
2138	17	08	64	39	55	70	51.9	500	*S. ekmani*, 10; *S. holmei*, 4
2139	17	08	64	39	55.8	70	25.6	440	*S. ekmani*, 1
2140	17	08	64	39	45.4	70	15.5	1965	*S. angustum*, 2; *S. pholidotum*, 1; *S. ekmani*, t
2142	17	08	64	39	31.3	70	31.3	2412	*D. similis*, 1
2143	17	08	64	39	15.1	70	29.4	2695	*D. similis*? 1; *S. pholidotum*? 1; *S. ekmani*, t
2144	17	08	64	38	59.2	70	29.3	2850	*C. sandersi*, t
2145	18	08	64	38	53	69	59	2925	*C. sandersi*, 1
2146	18	08	64	39	15.1	69	59.4	2646	*D. similis*, 2
2147	18	08	64	39	30.8	70	00	2435	*D. similis*, 1; *C. sandersi*, t
2148	18	08	64	39	46.7	70	04.5	1550	*D. similis*, t
2151	18	08	64	39	35	69	45.1	2270	*S. ekmani*, 2
2154	19	08	64	39	08.3	69	27.8	2840	*D. similis*, 1; *C. sandersi*, t
2155	19	08	64	39	05.0	68	59	3080	*D. similis*, t; *C. sandersi*, t; *Siboglinum* species, t
2158	19	08	64	39	42.9	69	06.3	1925	*S. pholidotum*, 1; *D. similis*?, 1
2161	20	08	64	39	56	68	50.8	1625	*S. ekmani*, 1
2163	20	08	64	39	40.6	68	30.8	2695	*S. ekmani*?, t
2164	20	08	64	39	24.3	68	20	3015	*D. similis*, 1; *C. sandersi*, t
2165	20	08	64	39	09.2	68	08.9	3310	*C. sandersi*, 1
2167	21	08	64	39	00	67	27	3975	*Siboglinum* species, t

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date D*	*M*	*Y*	*Latitude N. deg.*	*min.*	*Longitude W. deg.*	*min.*	*Depth m*	*Species and number of specimens*
								Gosnold	
2168	21	08	64	39	41	67	58.7	2950	*C. sandersi*, t
2169	21	08	64	39	50.2	67	40.7	2870	*D. similis*, 2; *Siboglinum* species, 1
2170	22	08	64	39	51	68	01.9	2655	*Siboglinum* species, 1
2174	22	08	64	40	02.1	68	21.4	1585	*D. similis*, 2
2177	22	08	64	40	01.5	68	55.8	505	*S. ekmani*, 1; *S. holmei*, t
2181	26	08	64	40	14.0	67	46.4	940	*S. ekmani*, 1
2185	26	08	64	40	17	67	28	1420	*D. similis*, 2
2186	26	08	64	40	05.9	67	29.6	2035	*S. pholidotum*, 3; *D. similis*, 1
2188	27	08	64	40	09.4	66	45.0	2715	*S. pholidotum*, 3
2189	27	08	64	40	18.2	67	00.3	2235	*S. pholidotum*, 18; *D. similis*, t
2191	27	08	64	40	42	66	44.9	690	*S. ekmani*, 1; *Siboglinum* species, 1
2192	27	08	64	40	44.7	66	35	1715	*D. similis*, 1
2193	27	08	64	40	52.3	66	33.5	610	*S. ekmani*, 3; *S. holmei*, 1
2194	28	08	64	40	46.1	66	25.0	2115	*S. pholidotum*, 6; *D. similis*, 1; *S. ekmani*, t
2195	28	08	64	40	56.4	66	25	1240	*S. ekmani*, 1; *S. angustum*, t
2200	17	09	64	41	10.3	66	13.2	941	*S. ekmani*, 2
2201	18	09	64	41	16.4	65	44.4	2451	*Siboglinum* species, 1
2212	20	09	64	42	12.3	65	08.9	1119	*S. ekmani*, 1
2497	04	08	66	37	05.6	74	39.8	398	*S. holmei*, t
2500	04	08	66	37	03.3	74	38.5	472	*S. holmei*, t
2572	04	08	66	37	25.6	74	29.9	410	*S. holmei*, t
2591	07	08	66	38	28.2	73	30.5	390	*S. holmei*, t
2598	11	08	66	39	39.3	72	28	190	*S. holmei*, t
								Albatross III	
80, 5	15	08	56	42	10	67	58	232	*S. holmei*, t
								Albatross IV	
64–13,11–8	13	11	64	44	00	65	15	110	*S. holmei*, 1
65–11,11	19	08	65	39	58	71	00	458	*S. holmei*, 1
65–11,11–10	19	08	65	39	58	71	00	458	*S. holmei*, 7
65–11,56	24	08	65	43	10	67	30	188	*S. holmei*, 1
								Eastward	
271 B	16	12	64	33	06.3	76	05.5	2000	*S. pholidotum*, a; *S. fulgens*, a; *S. angustum*, t; *D. similis*, a; *P. eastwardae*, a; *C. sandersi*, t
349	07	01	65	34	16.6	75	48.6	450	*S. mergophorum*, 1
351	07	01	65	34	13.6	75	45.6	620	*S. angustum*, 1
735	13	03	65	34	13.4	75	46.6	550	*S. candidum*, 1
738	13	03	65	34	17.5	75	49	445	*S. candidum*, t; *S. mergophorum*, 1
964	06	04	65	34	19.1	75	52	210	*S. mergophorum*, 2
982 B	08	04	65	33	29	76	01.3	1305	*S. angustum*, a
998 B	11	04	65	32	39.8	74	34.5	4480	*Siboglinum* species, t
1777	29	06	65	34	22.5	75	52	214	*S. mergophorum*, 1; *S. candidum*?, 1
1779	29	06	65	34	24	75	49	200	*S. mergophorum*, 2
2361	25	07	65	34	14.5	75	44.8	610	*S. ekmani*, 1; *S. angustum*, t
2980	30	09	65	34	23	75	54	160	*S. mergophorum*, 1
3417	29	11	65	34	14.8	75	46.7	650	*S. bayeri*, 5; *S. angustum*, 1; *P. lepida*, 13; *O. floridana*, 5; *Diplobranchia* sp., t; lamellisabellid, t
3443	30	11	65	34	28.8	75	51.4	190	*S. mergophorum*, 4; *Siboglinum* species, t
3445	30	11	65	34	22.2	75	52.5	198	*S. mergophorum*, 1

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date D*	*M*	*Y*	*Latitude N. deg.*	*min.*	*Longitude W. deg.*	*min.*	*Depth m*	*Species and number of specimens*
								Eastward	
4402 B	14	04	66	33	33	75	51.1	1960	*S. fulgens*, a; *Siboglinum* species, a
4406 B	14	04	66	33	40.5	75	52	2000	*S. ekmani*, a; *S. fulgens*, a
4665 B	12	05	66	32	40	76	16	2000	*S. pholidotum*, a; *S. fulgens*, a; *S. angustum*, t; *D. similis*, a; *P. eastwardae*, a; *C. sandersi*, t
4668 B	12	05	66	33	09.5	76	04.5	2100	*S. pholidotum*, a; *S. fulgens*, a; *P. eastwardae*, t
4672 B	12	05	66	33	50.5	75	46.3	2000	*S. pholidotum*, a; *S. angustum*, a
4929 B	27	06	66	33	26.5	75	20.1	3445	*S. angustum*, a; *C. sandersi*, t; *Siboglinum* species, t
5240	26	07	66	35	59.3	74	47	390	*S. longicollum*, 450; *S. holmei*, 360; *O. floridana*, 12; *P. lepida*, t
5251	26	07	66	36	00	74	35.5	1810	*S. angustum*, t
5268	27	07	66	36	00	74	13	2425	*S. ekmani*, 3
5467 B	15	08	66	32	10	71	18.2	5350	*S. angustum*, t; *D. similis*, t
5488 B	18	08	66	33	05	75	07	3940	*C. sandersi*, t
5491 B	19	08	66	33	30	74	51	3800	*C. sandersi*, a
5492 B	19	08	66	33	30.5	74	51.5	3750	*C. sandersi*, a
5494 B	20	08	66	33	33	75	04.5	3600	*C. sandersi*, a
5792 B	19	09	66	33	25	76	02.5	1500	*S. ekmani*, a; *S. pholidotum*, a; *S. fulgens*, a
5794 B	20	09	66	33	51.6	75	47	1560	*S. pholidotum*, a; *S. fulgens*, a; *P. eastwardae*, t
5796 B	20	09	66	34	18.2	75	37.6	1350	*S. ekmani*, a; *S. pholidotum*, a
5800 B	21	09	66	33	26.3	75	55.2	2600	*S. pholidotum*, a; *S. fulgens*, a; *D. similis*, a; *P. eastwardae*, a
5804 B	21	09	66	33	51	75	43	2610–2900	*S. pholidotum*, a
5807 B	22	09	66	34	00.6	75	39.2	2460	*Siboglinum* species, a
5811 B	23	09	66	33	40.6	75	54.0	2500	*Siboglinum* species, a; *S. fulgens*, t
5812 B	23	09	66	33	41	75	53	1500–1600	*S. fulgens*, a; *S. angustum*, t
6167 B	03	11	66	33	52.3	74	28.9	4050	*C. sandersi*, t
6169 B	03	11	66	33	23.8	74	46	4000	*C. sandersi*, a
6214 B	05	11	66	33	01.5	75	06.2	4000	*C. sandersi*, a
6224 B	06	11	66	33	37	74	45	4000	*Siboglinum* species, t; *C. sandersi*, a
6230 B	07	11	66	33	50.7	75	33.6	3000	*Siboglinum* species, t
6238 B	08	11	66	32	55	75	48.6	3000	*D. similis*, a; *C. sandersi*, t
6241 B	09	11	66	33	13	76	13.5	975	*Siboglinum* species, a
6244 B	09	11	66	33	24.5	76	32.5	500	*Siboglinum* species, a
6249 B	09	11	66	33	31.6	76	02.2	1000	*S. fulgens*, a
6255 B	10	11	66	33	52.5	76	06.0	510	*Siboglinum* species, t
6261 B	10	11	66	33	59.2	75	46	1125–1325	*S. ekmani*, a; *S. pholidotum*, a; *S. angustum*, a; *S. fulgens*, a; *D. similis*, t
6263 B	10	11	66	34	00.7	75	47.9	975	*S. angustum*, a
6269 B	11	11	66	34	16	75	44.8	500	*Siboglinum* species, t
								Atlantis	
Ber 1	13	04	60	32	16.5	64	42.5	1000	*Siboglinoides caribbeanus*, 1
Ber 8	05	09	61	32	21.3	64	33	1000	*S. caribbeanus*, 32
Sl 2	28	08	62	40	01.8	70	42	200	*Siboglinum holmei*, 9
Sl 3	28	08	62	39	58.4	70	40.3	300	*S. holmei*, 15
Sl 4	28	08	62	39	55.5	70	39.9	400	*S. holmei*, 12; *S. ekmani*, 3
D 1	23	05	62	39	54.5	70	35.0	466–508	*S. holmei*, 5; *S. ekmani*, 20
E 3	25	05	61	39	50.5	70	35	823	*S. ekmani*, 4; *S. angustum*, 1; *D. similis*, 1
F 1	24	05	61	39	47.0	70	45	1500	*S. ekmani*, 1; *S. angustum*, 13; *D. similis*, 3
G 3	23	05	62	39	41.4	70	38.3	2086	*S. ekmani*, t; *D. similis*, t
G 6	06	09	62	39	39.5	70	43	2151	*S. pholidotum*, 8; *S. ekmani*, t; *D. similis*, 1
G 7	06	09	62	39	41.2	70	40	2158	*S. ekmani*, 1

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date* D	M	Y	*Latitude N. deg.*	*min.*	*Longitude W. deg.*	*min.*	*Depth m*	*Species and number of specimens*
								Atlantis	
G 8	09	09	62	39	43.7	70	36	2021	*S. ekmani*, 1; *D. similis*, 1
G 9	09	09	62	39	44.7	70	38.3	2021	*S. ekmani*, 1; *D. similis*, 1
GH 1	27	09	61	39	25.5	70	35	2500	*D. similis*, 1
HH 3	21	05	61	38	47.0	70	08	2900	*Siboglinum* species, t; *C. sandersi*, 7
II 1	22	05	61	37	59	69	32	3742	*C. sandersi*, a
II 2	24	05	61	38	05	69	36	3752	*C. sandersi*, a
KK 1	10	08	61	36	23.5	68	04.5	4850	*C. sandersi*, t
OO 2	27	05	62	33	57	65	02.2	4667	*C. sandersi*, t
58	07	09	63	38	34.2	72	55	2000	*S. ekmani*, 6; *S. angustum*, 5; *S. pholidotum*, 1; *C. sandersi*, t
								Atlantis II	
61	20	08	64	39	43.2	70	37.8	2000	*D. similis*, t
62	21	08	64	39	26	70	33	2496	*D. similis*, 1
63	21	08	64	38	46.8	70	05.7	2891	*D. similis*, t; *C. sandersi*, t
64	21	08	64	38	46	70	06	2886	*C. sandersi*, 1
65	21	08	64	38	46.8	70	06.8	2891	*D. similis*, 2; *C. sandersi*, t
66	21	08	64	38	46.7	70	08.8	2802	*C. sandersi*, t
70	23	08	64	36	23	67	58.0	4680	*C. sandersi*, t
71	24	08	64	38	08	71	47.5	2946	*Siboglinum* species, 1; *C. sandersi*, 2
72	24	08	64	38	16	71	47	2864	*D. similis*, t; *C. sandersi*, t
73	25	08	64	39	46.5	70	43.3	1470–1330	*S. angustum*, 8; *S. ekmani*, 3; *D. similis*, 2
92	13	12	65	36	20	67	56	4692	*C. sandersi*, 1
95	17	12	65	38	33	68	32	3753	*Siboglinum* species, t; *C. sandersi*, 16
112	09	08	66	38	50.4	69	54.7	2900	*C. sandersi*, 3
118A	18	08	66	32	19.4	64	34.9	1153–1135	*D. similis*, t
126	24	08	66	39	37	66	47	3806	*D. similis*, t; *C. sandersi*, t
131	18	12	66	39	38.5	70	36.5	2178	*S. ekmani*, 1; *Siboglinum* species, 1
								Chain	
76	26	06	65	39	38.3	67	57.8	2862	*S. pholidotum*, t; *Siboglinum* species, a; *C. sandersi*, t
77	30	06	65	38	00.7	69	16	3806	*Siboglinum* species, t; *C. sandersi*, 1
78	30	06	65	38	00.8	69	18.7	3828	*C. sandersi*, 2
80	02	07	65	34	49.8	66	34	4970	*C. sandersi*, t
83	03	07	65	34	46.5	66	30	5000	*C. sandersi*, t
84	04	07	65	36	24.4	67	56	4749	*C. sandersi*, t
85	05	07	65	37	59.2	69	26.2	3834	*Siboglinum* species, 1; *C. sandersi*, 2
86	05	07	65	37	59	69	18.5	3848	*Siboglinum* species, t; *C. sandersi*, t
87	06	07	65	39	48.7	70	40.8	1102	*S. angustum*, 14; *S. ekmani*, 3; *D. similis*, t
88	06	07	65	39	54.1	70	37	478	*S. ekmani*, t
96	27	04	66	39	55.2	70	39.5	498	*S. ekmani*, 2; *S. holmei*, t
101	03	05	66	36	24.2	68	01.3	4700	*Siboglinum* species, t
103	04	06	66	39	43.6	70	37.4	2022	*S. ekmani*, 4; *D. similis*, 1
105b	05	06	66	39	56.6	71	03.6	530	*S. ekmani*, 3
								Silver Bay	
2725	01	02	61	28	23	79	56	172	*S. bayeri*, 2
								Gerda	
622	16	04	65	25	45	80	04	119	*S. mergophorum*, 1
629	30	06	65	25	57	79	18	366–307	*S. mergophorum*, 4; *D. floridiensis*, 2

TABLE 1.—*Station list, classified under names of ships*—Continued

Station Number	*Date* D	M	Y	*Latitude N.* deg.	min.	*Longitude W.* deg.	min.	*Depth* m	*Species and number of specimens*
								Gerda	
644	01	07	65	25	49	79	19	284–256	*S. mergophorum*, 7; *Siphonobrachia ilyophora*, 1
993	20	05	68	26	45	79	57	157	*S. mergophorum*, 3
994	20	05	68	26	51	79	57	159	*S. mergophorum*, 1
995	20	05	68	27	06	79	56	165	*S. mergophorum*, t; *Siph. ilyophora*, t
997	21	05	68	27	01	79	51	285–302	*S. bayeri*, 15; *S. mergophorum*, t; *O. floridana*, t; *N. punctatum*, t; *D. floridiensis*, t
998	21	05	68	27	10	79	43	366–375	*S. bayeri*, 1; *S. mergophorum*, t; *O. floridana*, t; *N. punctatum*, 1
999	21	05	68	27	18	79	39	531–551	*O. floridana*, t

t, empty tube or tubes

a, animal or animals present but not counted

B, pogonophores identified by T. Brattegard (see Southward and Brattegard, 1968)

Gear used for sampling is not specified for individual stations, but most of *Gosnold* samples were collected with a 0.5 sq. m Campbell grab; most *Eastward* samples were collected with a small benthic trawl; *Atlantis*, *Atlantis II*, and *Chain* samples were collected with either a Sanders anchor dredge or an epibenthic trawl.

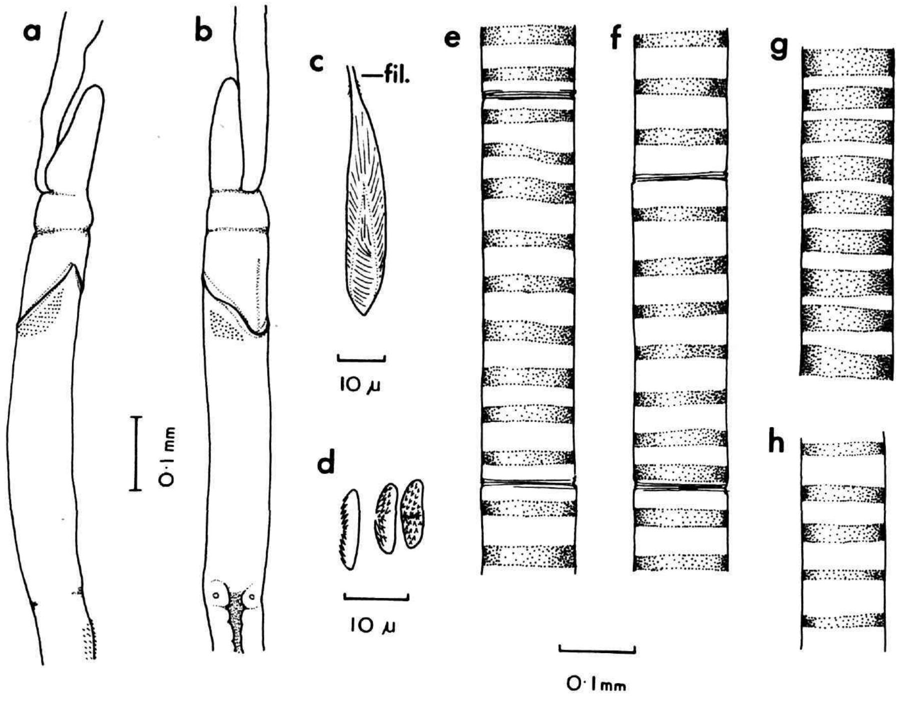

FIGURE 2.—*Siboglinum bayeri*, new species: *a*, anterior end, dorsolateral view; *b*, anterior end, ventrolateral view; *c*, spermatophore (fil. = filament); *d*, toothed platelets; *e*, part of tube with extra long segments; *f*, part of tube with usual length of segments; *g*, middle region of tube; *h*, posterior region of tube.

(Continued from page 4)

The pinnules are 110μ to 140μ long. At the level of the tentacle base is a transverse groove around the body, which is complete in some specimens but ventral only in others (Figure 2). It is followed by one or two additional transverse grooves and a short midventral furrow in front of the bridle. The thick yellow bridle keels are fused in a curve ventrally and just separate dorsally (Figures 2*a,b*). Behind the bridle are two triangular lateral patches of opaque whitish epidermis. The forepart and trunk are separated by only a slight groove. The anterior part of the trunk has about 28 papillae each side in the "metameric" region. There is no zone of enlarged papillae. The three girdles are single rows of toothed platelets; the first two rows are close together, while the third is 1.0 to 2.7 mm behind the second. The toothed platelets are narrow with two equal groups of teeth, and 10μ to 14μ long (Figure 2*d*). The postannular region bears small dorsal shields opposed by rows of 3 papillae. The spermatophores are narrow at the filament end but thicker at the other end (Figure 2*c*) and vary in length from 120μ to 155μ.

The tubes are light yellowish brown, with narrow rings, and the anterior ends are divided into segments. The first few segments are colorless, then 6 or 7 yellow rings appear on each segment (Figure 2*f*); a few specimens have longer segments with as many as 9 rings (Figure 2*e*). The middle part of the tube has wider rings and narrower interspaces (Figure 2*g*), but toward the posterior end the rings become narrower and very pale yellow (Figure 2*h*).

Measurements: Forepart 0.67–0.85 mm long by 0.075–0.09 mm diameter; preannular region 15–22 mm long. Tube anterior diameter 0.13–0.14 mm (rarely as much as 0.15 mm); posterior diameter 0.10–0.12 mm.

REMARKS.—In a previous paper (Southward and Brattegard, 1968) this species was not distinguished from *S. ekmani*, for the two species are very similar. Records in that paper of *S. ekmani* from *Gosnold* stations 1862, 1867, and 1868, and *Eastward* station 3417 are now transferred to *S. bayeri* (Table 1). The chief differences between *S. bayeri* and *S. ekmani* are the shape of the spermatophore and the size of the rings on the tube. The spermatophore of *S. ekmani* tapers at both ends (Figure 3*c*) in both American and European specimens (Ivanov, 1963; Webb, 1963), but the spermatophore of *S. bayeri* is a little shorter and much thicker (Figure 2*c*). The illustration of a spermatophore of *S. ekmani* in Southward and Brattegard, 1968, is not typical, and may be from *S. bayeri*. The tubes in the same figure are typical *S. ekmani* tubes. The tubes of the two species differ in the width and spacing of the rings, *S. bayeri* having narrow rings and broad interspaces, *S. ekmani* wider rings and narrower interspaces (Figure 3*a*).

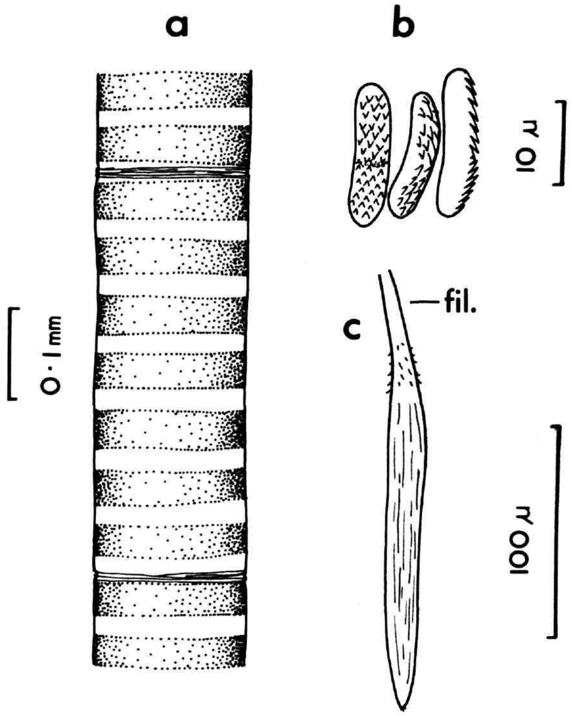

FIGURE 3.—*Siboglinum ekmani*: *a*, part of segmented region of tube; *b*, toothed platelets; *c*, spermatophore.

In both species the number of rings per segment is typically 6 or 7, but both can have more. When the tubes are compared side by side it can be seen that the *S. bayeri* tube is paler, less smooth, and a little narrower than the *S. ekmani* tube. The animals differ a little in other ways: the forepart of *S. ekmani* is more than 1.0 mm long, while that of *S. bayeri* is not more than 0.85 mm long; *S. ekmani* has darker yellow bridle keels and slightly longer toothed platelets than *S. bayeri*.

The habitats of the two species are almost completely separated. *Siboglinum bayeri* lives on the Florida-Hatteras continental slope at depths of 134–692 m, while *S. ekmani* lives in depths of 400–2,500 m on the main continental slope from North Carolina to Nova Scotia (see under Ecology and Distribution), and also occurs on the east side of the Atlantic. The two have been found together at only one station, at a depth of 504 m, off Cape Hatteras.

This species is named *Siboglinum bayeri* in honor of Dr. F. M. Bayer, who collected many of the specimens and who was the first to record Pogonophora off the coast of Florida (Bayer, 1962).

Siboglinum candidum Southward and Brattegard, 1968

FIGURES 4, 5

OCCURRENCE.—Eight stations on the continental slope between 30°13′ to 24°37′ N (Table 1). Depth range: 342–757 m.

MATERIAL EXAMINED.—About twenty animals and some empty tubes.

REVISED DESCRIPTION.—The first description of *S. candidum* was based on the anterior end of one young specimen. Now that some adults have been found the description must be altered.

The forepart of the body is about ten times as long as wide, with a small pointed cephalic lobe and a thin tentacle (Figure 4*a*). The pinnules on the tentacle, which are about 100μ long, are arranged in two alternating rows, so close together that they often seem to be one row. Behind the tentacle base a shallow groove encircles the body and from this a median ventral furrow runs back to the bridle (Figure 4*b*). Cutting across the ventral furrow is a deep oblique groove which runs back to meet the dorsal points of the bridle (Figures 4*b,c*), but in juvenile specimens this groove is not present (see Southward and Brattegard, 1968). In front of the bridle, on the ventral side, there are two small triangular patches of white epidermis, and behind the bridle are two long narrow ribbons of similar epidermis (Figures 4*a,b,c*). The bridle keels are colorless and, though on fairly high ridges, are not easy to see. They are separate both dorsally and ventrally. The white ribbons extend almost to the posterior end of the forepart, and here the forepart and trunk are separated by a constriction. In the male there is a single genital papilla on the ventral side just behind the constriction. The anterior part of the trunk has a deep ventral sulcus, containing a few very small papillae, between the two rows of 65 to 90 large lateral papillae (Figure 4*f*). The papillae look whitish (light stipple in Figure 4) and there are bands of denser white epidermis along the sides of the body, throughout the "metameric" region (heavy stipple in Figure 4). There follows a long region of the trunk with frequent patches of white cells and occasional round papillae tipped with adhesive plaques (Figure 4*g*). Behind this region is a short zone of enlarged papillae (6 to 12) and a dorsal patch of ciliated epidermis. The girdles, which lie about 10 mm behind the enlarged papillae, are accompanied by 3 ventral papillae and followed by the usual large ventral papilla (Figure 4*d*). There are two girdles, each consisting of two to four rows of toothed platelets. These platelets are colorless, up to 22μ long, slipper shaped, with a small anterior and large posterior group of teeth (Figure 4*h*). The postannular region bears small dorsal glandular shields of white cells opposite rows of 3 to 5 ventral papillae (Figure 4*i*). The spermatophores are narrow, slightly flattened, pointed at the filament end and a little thicker at the other end (Figure 5*e*). They vary in length in different individuals, from 240μ to 360μ, with a breadth of 20μ and thickness of 9μ to 12μ.

The tubes are whitish or grayish and transparent enough for one to see details of the animal through the wall. The anterior end is flattened and closed by extra internal layers of tube material (Figure 5*a*). The anterior few millimeters of the tube are limp and unringed, with a wrinkled surface, while the following 20 to 50 mm have narrow rings and wrinkled interspaces (Figure 5*b*). The rings then become wider and are separated by narrow interspaces (Figures 5*c,d*). This sequence of ring types is characteristic of adult tubes, but the tubes of young specimens have either wide rings or none at all.

Measurements: Forepart 2.8 to 3.7 mm long by 0.24 to 0.34 mm diameter; preannular region 50 to 60 mm long; tube diameter 0.36 to 0.46 mm. Juveniles are smaller with forepart 2.0 to 2.5 mm long and tubes about 0.2 mm in diameter. Two small

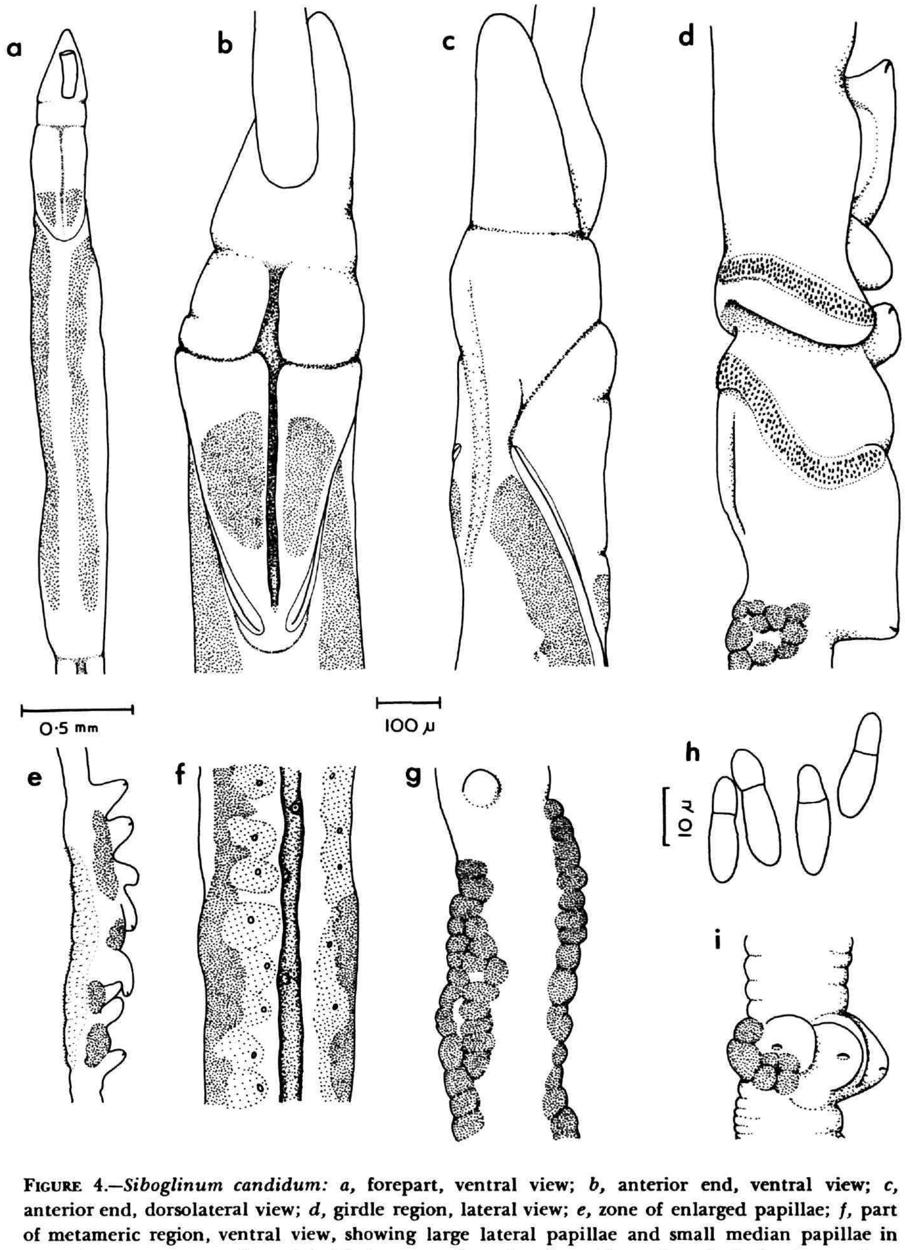

FIGURE 4.—*Siboglinum candidum: a*, forepart, ventral view; *b*, anterior end, ventral view; *c*, anterior end, dorsolateral view; *d*, girdle region, lateral view; *e*, zone of enlarged papillae; *f*, part of metameric region, ventral view, showing large lateral papillae and small median papillae in ventral groove; *g*, part of trunk behind metameric region; *h*, outlines of toothed platelets to show shape and size of groups of teeth; *i*, group of postannular papillae. Close stipple marks white areas; spaced stipple marks grayish-white areas.

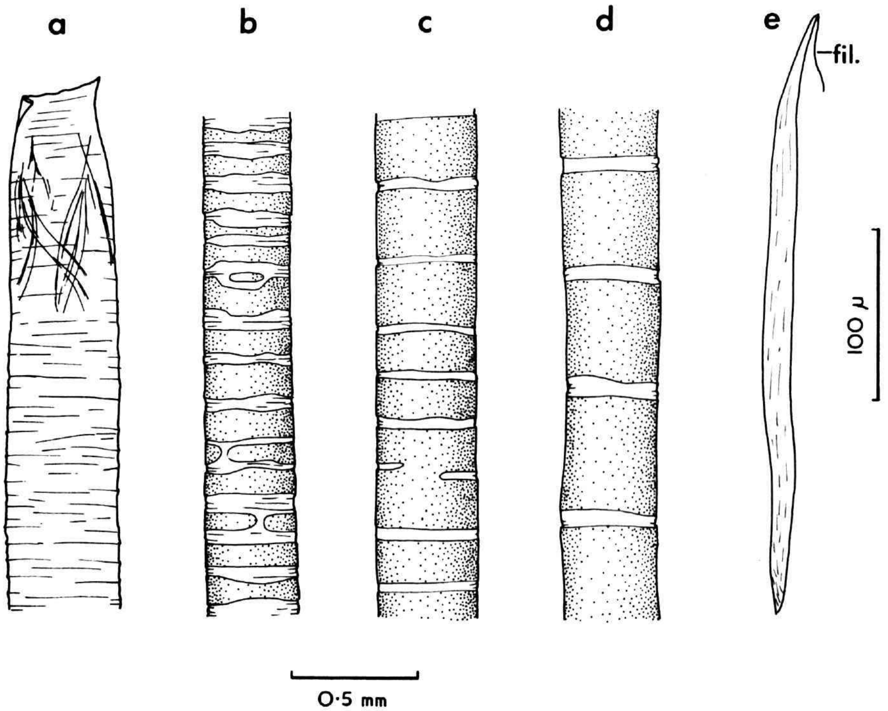

FIGURE 5.—*Siboglinum candidum: a,* anterior end of tube; *b,* anterior ringed part of tube, with short rings; *c,* middle ringed part of tube; *d,* posterior ringed part of tube; *e,* spermatophore (fil. = filament).

adults found off southern Florida have the white bands and typical spermatophores, but their forepart measurements are only 1.9 × 0.16 and 1.4 × 0.14 mm, and their tubes are only 0.2 mm in diameter.

REMARKS.—There are six other species of *Siboglinum* with white ribbons on the forepart and they form a compact group of at least subgeneric status (Table 2). Only two of them, *S. atlanticum* and *S. lacteum,* are found in the North Atlantic, both on the eastern side. *Siboglinum atlanticum* is about the same size as *S. candidum* and has a similar tube. In *S. atlanticum,* however, the anterior end of the tube is closed with a round cap of secretion, while in *S. candidum* the closure is flat (Figure 5*a*). The proportions of the forepart are much the same in the two species, but *S. atlanticum* has distinct brownish bridle keels and its postbridle white ribbons are closer together ventrally. The transverse groove in front of the bridle is deeper and longer in *S. candidum.* The paired papillae of the metameric region and the enlarged papillae are fewer in *S. candidum. Siboglinum atlanticum* has greenish-black pigment in many epidermal cells in the postmetameric part of the trunk, whereas *S. candidum* appears to be colorless. The spermatophores of *S. atlanticum* are longer than those of *S. candidum.* These differences are enough to distinguish *S. candidum* from *S. atlanticum.* The other Atlantic species, *S. lacteum,* is known from one animal only, a female. It has an unringed tube, is smaller than adult *S. atlanticum* or *S. candidum,* and has only two enlarged papillae.

Siboglinoides caribbeanus, new species

FIGURE 6

OCCURRENCE.—Two stations off Bermuda (Table 1) and three others not in Table 1, as follows:

TABLE 2.—*Characteristics of white-striped species of* Siboglinum

	S. atlanticum Southward and Southward 1958	*S. lacteum* Southward 1963 (in Ivanov 1963)	*S. taeniaphorum* Ivanov 1963	*S. subligatum* Ivanov 1963	*S. concinnum* Ivanov 1963	*S. arabicum* Ivanov 1963	*S. candidum* Southward and Brattegard 1968
Forepart length (mm)	2.8–4.0	2.4	3.1	1.8–2.9	2.1	1.6	2.8–3.7
Forepart diameter (mm)	0.26–0.4	0.25	0.36	0.16–0.27	0.2	0.2	0.24–0.34
Tentacle pinnules	+	+	+	0	+	+	+
Bridle-keel color	brown	brown	brown	0	0	0	0
Number of pairs of "metameric" papillae	150–170	75	60	75–105	70	65	65–90
Number of enlarged papillae	30–40	2	3	0	?	0	6–12
Toothed platelet length (μ)	14–18	15–18	11–13	14–16	?	12–13	15–22
Spermatophore length (μ)	500	?	?	300–350	?	?	240–360
Tube diameter (mm)	0.3–0.6	0.27	0.37	0.25–0.33	0.3	0.13	0.2–0.46
Tube color	gray	white	white	gray	yellowish	0	gray
Tube rings	+	0	+	+	+	0	+
Locality	Atlantic Ocean	Atlantic Ocean	Pacific Ocean	Indian Ocean	Indian Ocean	Arabian Sea	Atlantic Ocean

Oregon station 3552, 17°40′ N, 77°55′ W, 530 m depth, 16 May 1962; *Oregon* station 2202, 28°58′ N, 88°11′ W, 1140 m depth, 26 June 1958; *Explorer* station Ic, 16°40′ N, 82°51.6′ W, 366–690 m depth, 11 March 1960. Depth range: 366–1140 m.

MATERIAL EXAMINED.—About 40 specimens.

TYPE.—Holotype in National Museum of Natural History, USNM 43183.

DESCRIPTION.—This is a very small species with a brown-ringed and segmented tube. The forepart of the animal is about five times as long as wide, with a very small cephalic lobe (Figures 6*a,b*) and two tentacles with pinnules. A juvenile specimen has only one tentacle and could easily be mistaken for a species of *Siboglinum.* There is a small transverse groove behind the bases of the tentacles and in some cases a second one farther back (Figure 6*a*). A midventral furrow reaches from behind the tentacle to the point of the bridle. The bridle ridge is wide but the keels are narrow and colorless (Figure 6*a*). They are fused ventrally but just separate dorsally. Inside the forepart there are pyriform glands behind the bridle but none in front of it. The anterior part of the trunk bears two lateral ridges containing pyriform glands; after a short distance the ridges become subdivided into papillae, each containing one pyriform gland, and there are about 30 to 40 glands in all. From about the eighteenth gland each side there are small, colorless, nearly invisible plaques on the papillae (Figure 6*h*). The plaques are oval and about 12μ across. The wide dorsal ciliated band extends along the whole of this region and is then replaced by a band of granule-containing cells which continues almost to the girdle region. There are no enlarged papillae. There are two groups of girdles, separated by 0.5 to 1.5 mm of muscular trunk. The first group consists of two long bands of toothed platelets, one behind the other, spiraling around the body (Figure 6*j*); while the second consists of two shorter bands, lying on opposite sides of the body, usually one a little behind the other (Figure 6*j*). Thus, there seem to be four girdles, but they have probably developed from the usual pogonophoran plan of two girdles each divided into two parts. The girdle region has lengthened and the half girdles have grown apart. A similar situation is found in some species of *Siboglinum,* such as *S. ekmani* and *S. bayeri,* where the original anterior girdle has extended to give the appearance of two.

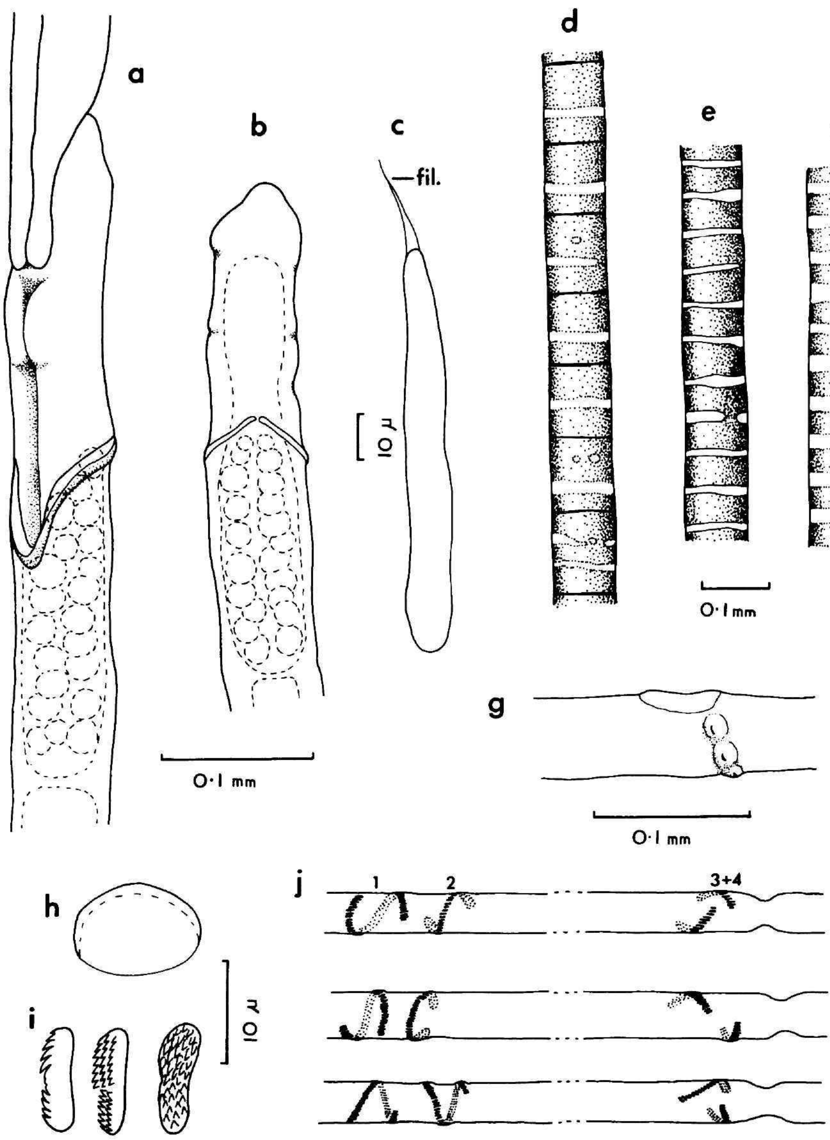

FIGURE 6.—*Siboglinoides caribbeanus*, new species: *a*, forepart of large specimen, lateroventral view; *b*, forepart of smaller specimen, dorsal view; *c*, spermatophore (fil. = filament); *d*, anterior segmented region of tube; *e*, middle of tube; *f*, posterior region of tube; *g*, postannular papillae; *h*, plaque from metameric region; *i*, toothed platelets; *j*, three diagrams showing various arrangements of the girdles found in different specimens.

The postannular region has small dorsal shields and ventral rows of 3 or 4 very small papillae (Figure 6*g*). The toothed platelets of the girdles have two groups of teeth, the anterior group equal in size or even larger than the posterior group. The spermatophores are roughly cigar shaped, slightly flattened at the filament end and about 100μ long (Figure 6*c*).

The tube has a stiff, smooth, transparent anterior end, which is segmented in adult tubes, and rings become visible about 2 mm behind the anterior tip. These rings are fairly wide and yellowish-brown in color, separated by narrow colorless interspaces (Figure 6*d*). The tube segments are short, with only 2 or 3 rings on each, and they may continue over quite a long part of the tube. The unsegmented posterior part of the tube is evenly ringed (Figure 6*e*), without any doubling, and posteriorly the rings become narrower and more widely spaced (Figure 6*f*).

Measurements: Forepart 0.33 to 0.46 mm long by 0.06 to 0.08 mm wide; preannular region up to 19 mm long; tube diameter 0.09 to 0.105 mm.

REMARKS.—This species was thought to belong to the genus *Diplobrachia* (*Diplobrachia* II, Southward, 1966), but it is now reassigned to *Siboglinoides* Ivanov, 1961, with which it shares a multiplicity of girdles as well as two tentacles.

Siboglinoides caribbeanus is distinguished from *S. dibrachia* Ivanov (1961, 1963) by its lack of pyriform glands in the region of the forepart in front of the bridle and by its possession of cuticular plaques on the metameric region of the trunk. It also has a narrower tube and the rings on the segmented part are less regular than those of *S. dibrachia*. Because of these differences it is necessary to revise the diagnosis of the genus slightly.

Genus *Siboglinoides*, revised diagnosis

Pogonophora of the family Siboglinidae with two tentacles. Flask-shaped glands may or may not be in front of the bridle. Metameric papillae are on the anterior part of the preannular region of the trunk, some of which may bear cuticular plaques. There are four or five girdles of toothed platelets in two groups. The postannular region possesses ventral papillae and dorsal shields. The spermatophores are cigar shaped. The tube is segmented, with 2 or 3 rings per segment.

Diplobrachia floridiensis, new species

FIGURE 7

OCCURRENCE.—Three stations on the continental slope off southern Florida (Table 1). Depth range: 300 to 500 m.

MATERIAL EXAMINED.—Three specimens, only one in good condition.

TYPE.—Holotype in the National Museum of Natural History, USNM 43188.

DESCRIPTION.—The forepart of the body is about eight times as long as wide, with a small cephalic lobe and three tentacles which emerge from a shallow depression (Figure 7*a*), and which each bear a double row of pinnules. The anterior part of the forepart is smooth, but there is a short midventral furrow in front of the bridle crossed by a short transverse groove. The thick yellow bridle keels are faintly cross-striated and touch one another on both sides of the body, without fusing (Figures 7*a,b*). The anterior part of the trunk bears about 12 papillae each side, the last 8 of which carry oval adhesive plaques about 15μ across, with striated front borders (Figures 7*a,i*). There is a zone of enlarged papillae, only 5 to 7 in number. The two girdles lie close together (Figure 7*g*). Their platelets are arranged in single rows and are rather narrow, with large posterior and small anterior groups of teeth. (Figure 7*j*). The platelets are 12μ to 15μ long. The postannular region has small dorsal glandular areas opposite single or paired large ventral papillae. The spermatophores are flat, rounded at the filament end and pointed at the other end, and are 170μ to 180μ long (Figure 7*k*).

The stiff orange-brown tube is 0.16 mm in diameter at the anterior end and only slightly narrower posteriorly. It is segmented at the anterior end, but there is no overlap between the segments and in some tubes they are not very distinct. The rings vary in size but are nearly always entire and smooth edged (Figures 7*c,d,e*); in the segmented part of the tube there are 2 or 3 rings on each segment.

Measurements: Forepart 0.95 mm long by 0.12 mm wide; preannular region 13 mm long; tube diameter 0.15 to 0.16 mm.

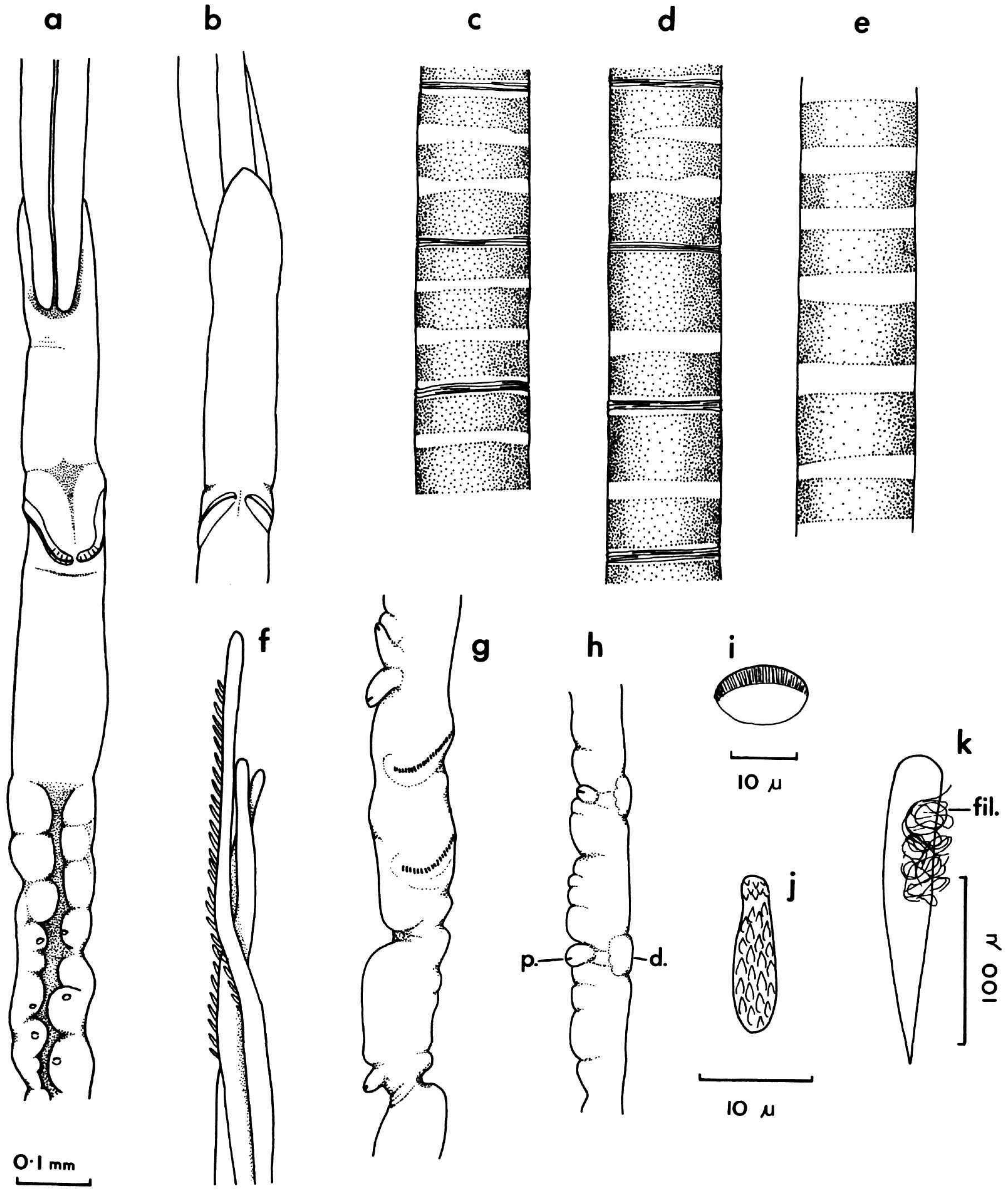

Figure 7.—*Diplobrachia floridiensis*, new species: *a*, forepart and anterior metameric region, ventral view; *b*, anterior end, dorsal view; *c*, *d*, anterior segmented regions of tubes, showing three-ringed and two-ringed segments; *e*, middle of tube; *f*, tips of tentacles, with pinnules; *g*, girdle region, lateral view; *h*, part of postannular region (d = dorsal glandular area; p = papilla); *i*, plaque from metameric region; *j*, toothed platelet; *k*, spermatophore (fil. = filament).

REMARKS.—The small number of tentacles, presence of metameric plaques, two girdles, and flat spermatophores, together with the segmented tube, are sufficient to show that this species belongs to the genus *Diplobrachia*. Five other species of *Diplobrachia* are already known, two of them occurring in the North Atlantic. These two, *D. similis* Southward and Brattegard, 1968, and *D. capillaris* Southward, 1959, have larger metameric plaques than *D. floridiensis*. *Diplobrachia capillaris* is about the same size as *D. floridiensis*, but its tube is more distinctly segmented, with slight overlaps between segments, and it has smaller spermatophores, about 120μ long. *Diplobrachia similis* is a larger species, with a tube diameter of 0.28 mm, and it has twice as many metameric papillae as *D. floridiensis*. The new species is characterized by its small size, long forepart, thick bridle keels, and small metameric plaques.

Distribution

CONDITIONS ON THE CONTINENTAL SLOPE AND RISE

A preliminary report on the results of the continental-margin program has been published by Emery (1965), in which the topography, lithology, and structure were considered. In the south the steep Florida-Hatteras slope descends to 700 or 800 m depth and is separated by the wide Blake Plateau from the lower continental slope. Off Cape Hatteras there is a continuous slope, starting between 80 and 130 m depth and continuing fairly smoothly to the start of the less steep continental rise at between 2,000 and 3,000 m (see Figure 12). In the northeast part of the area the slope is cut by numerous canyons which continue as channels down the continental rise to the abyssal plain.

The sediments of the continental slope are mainly silty clays or clayey silts, with silty sand in places on the upper slope. The continental rise is covered with silt, grading to red clay in depths over 4,000 m. There is also a narrow belt of silt along the Florida-Hatteras slope from 27° N to 30° N. Information about the deposits at *Gosnold* stations (see Table 1) is listed in the data reports of the continental-margin program (Hathaway, 1966, 1967); while the region just south of Cape Hatteras has been examined by Rowe and Menzies (1968) who give general information on deposits, temperature, and bottom currents. Data for some of the *Atlantis* and *Chain* stations have been published by Sanders, Hessler, and Hampson (1965).

The positions of the stations at which Pogonophora were found are given in Table 1, and their distribution is shown in Figure 1. Only parts of the continental rise and abyssal plain were sampled, and there is an unfortunate absence of samples from the lower continental slope near Cape Hatteras.

Surface currents along the east coast of North America flow northward from the Straits of Florida (Florida Current or Gulf Stream) and southward from Nova Scotia to meet at Cape Hatteras where the Gulf Stream curves eastward into the Atlantic. The bottom currents on the continental shelf generally follow the same trends as the surface currents, and along the Florida-Hatteras slope the water moves northward at all depths. Off the coast of North Carolina this northward flow of warmer water extends at times down to 500 m. At other times shifts in the position of the Gulf Stream allow colder deep water to cover this part of the slope. The colder water is part of the Western Boundary Undercurrent which moves in a southerly or southwesterly direction below about 1,000 m depth, along the slope from 38° N to at least 33° N, and probably much farther south. This undercurrent extends to depths of 5,000 m. There is some evidence of a northerly flow of Antarctic Bottom Water over the abyssal plain between the Bahamas and Bermuda. The bottom currents on the continental slope between Cape Cod and Nova Scotia are less well documented, but there is some indication of north-going currents at about 1,900 m depth. (Iselin, 1936; Swallow and Worthington, 1961; Howe, 1962; Volkman, 1963; Heezen et al., 1966; Rowe and Menzies, 1968).

The temperature of the bottom water in the greatest depths is 2.1° to 2.7° C, and along the continental slope the 3° isotherm lies between 2,500 and 2,800 m. The 4° isotherm lies at about 1,000 m and seems to mark the upper limit of stable temperature; above it seasonal and local variations occur. South of Cape Cod the annual variation is from 4.2° to 4.6°C at 800 m, 4.9° to 6.2°C at 500 m, and 7.3° to 12.4°C at 300 m. At the shallowest depth at which pogonophores occur in that area—about 200 m—the variation is from 10° to 15°C.

This water is part of a "wedge" of mixed Gulf Stream and coastal water which lies along the top of the continental slope from Cape Hatteras to Georges Bank and maintains a fairly constant temperature of 10° to 12°C at 100 to 200 m depth. South of Cape Hatteras the influence of the Florida Current may be felt down to about 500 m and there is much mixing and variation in the upper 500 m of water around Cape Hatteras. In the Florida Current the coldest water is found obliquely over the slope, but the level fluctuates greatly and between 100 and 400 m depth bottom-living species may be exposed to temperature variation between 8° to 18°C. Below 400 m there is a more constant temperature of 7° to 9°C. (Bigelow, 1927; Iselin, 1936; Anderson, Moore, and Gordy, 1961; Edwards, Livingston, and Hamer, 1962; Walford and Wicklund, 1968; Rowe and Menzies, 1968).

Ecology and Distribution of Individual Species

Family OLIGOBRACHIIDAE

Oligobrachia floridana (Figure 8). Found at fourteen stations (Table 1) and recorded by Nielsen (1965) off Miami. Depth range 200 to 600 m, but probably most characteristic of the 300 to 400 m zone. Deposit mud or silty clay. Temperature possibly 5° to 8°C. Northern limit 36° N, southern limit not determined. This is a Florida Current species, extending to just north of Cape Hatteras.

Nereilinum punctatum. Found at five stations (Table 1) and recorded by Nielsen (1965) off Miami. Depth range 200 to 494 m. Deposit clay, mud, or ooze. Northern limit 29°32.8′ N, southern limit not determined. This is an uncommon Florida Current species extending north only just beyond Cape Kennedy.

Family SIBOGLINIDAE

Siboglinoides caribbeanus. Found at two stations close to Bermuda (Table 1) and also in the Gulf of Mexico, Cayman Basin, and south of Jamaica (p. 15). Depth range 500 to 1,000 m.

Siboglinum mergophorum (Figure 8). Found at fifteen stations (Table 1) and recorded by Nielsen (1965) off Miami. Depth range 119 to 375 m, but apparently most common in the 150 to 250 m zone. Little data on deposit, can be muddy sand. Northern limit 34°28.8′ N, southern limit not determined. This is a Florida Current species, extending to near Cape Fear.

Siboglinum fulgens (Figure 11). Found at nine stations (Table 1). Depth range 1,000 to 2,600 m. Deposit fine silt and clay. Temperature 3° to 4°C. Northern limit 33°51.6′ N, southern limit not determined. This is a continental-slope species found in a very small area, but it may extend southward along the uninvestigated outer side of the Blake Plateau.

Siboglinum angustum (Figure 10). Found at fifty-one stations (Table 1). Depth range 600 to 2,610 m, but most common between 800 and 2,000 m. Deposit clay or mud, often containing Foraminifera. Temperature about 3° to 5°C. This is a continental-slope species of wide distribution, northern and southern limits not determined, but known from the Gulf of Mexico and Caribbean (Southward, 1966, *Siboglinum* X).

Siboglinum longicollum (Figure 9). Found at eight stations (Table 1). Depth range 70 to 915 m, one empty tube found at 43 m. Deposit clay or mud. Northern limit 37°30′ N, southern limit 35°05′ N. This species has been found in a restricted region of the upper continental slope, off Chesapeake Bay and Cape Hatteras.

Siboglinum holmei (Figure 9). Found at thirty-five stations (Table 1). Depth range 43 to 610 m, but most common between 200 and 500 m. Deposit usually silty sand or sandy mud, but can be anything from coarse sand to fine ooze. Temperature 4.5° to more than 12°C (in the Gulf of Maine in winter it may experience 2°C). Northern limit not determined, southern limit 34°41′ N. This is the only strictly northern species of the upper continental slope, with its southern limit near Cape Hatteras. It also occurs on the eastern side of the Atlantic (Southward, 1964).

Siboglinum pholidotum (Figure 10). Found at thirty-six stations (Table 1). Depth range 1,300 to 2,870 m, but usually between 1,800 and 2,200 m. Deposit clay or mud, often containing Foraminifera. Temperature about 2.5° to 4°C. Northern and southern limits not determined, but known from the Gulf of Mexico and Caribbean (Southward, 1966, *Siboglinum* G). This is a species typical of

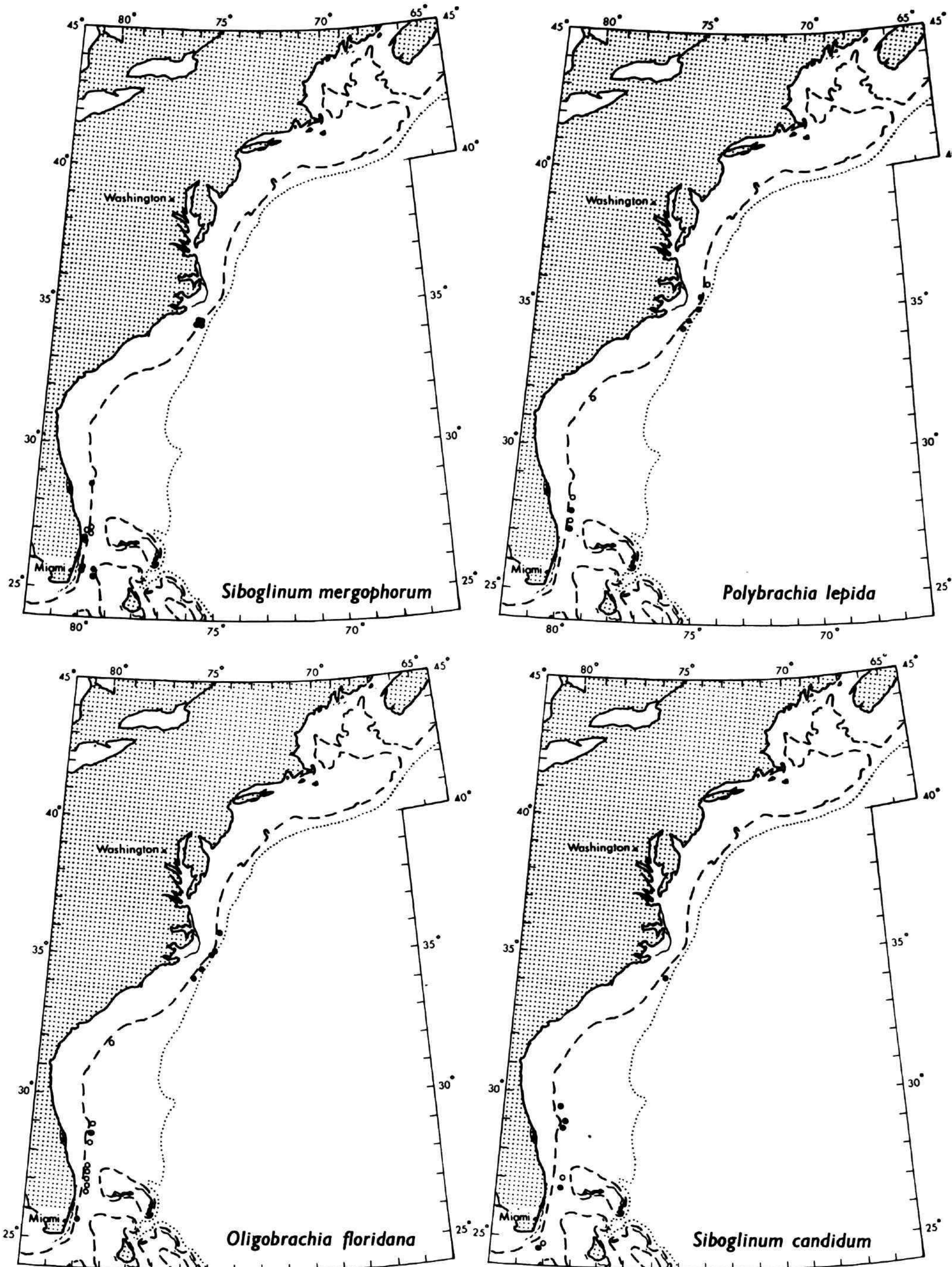

FIGURE 8.—Distribution of four "southern" pogonophores: ●, animals; o, empty tubes.

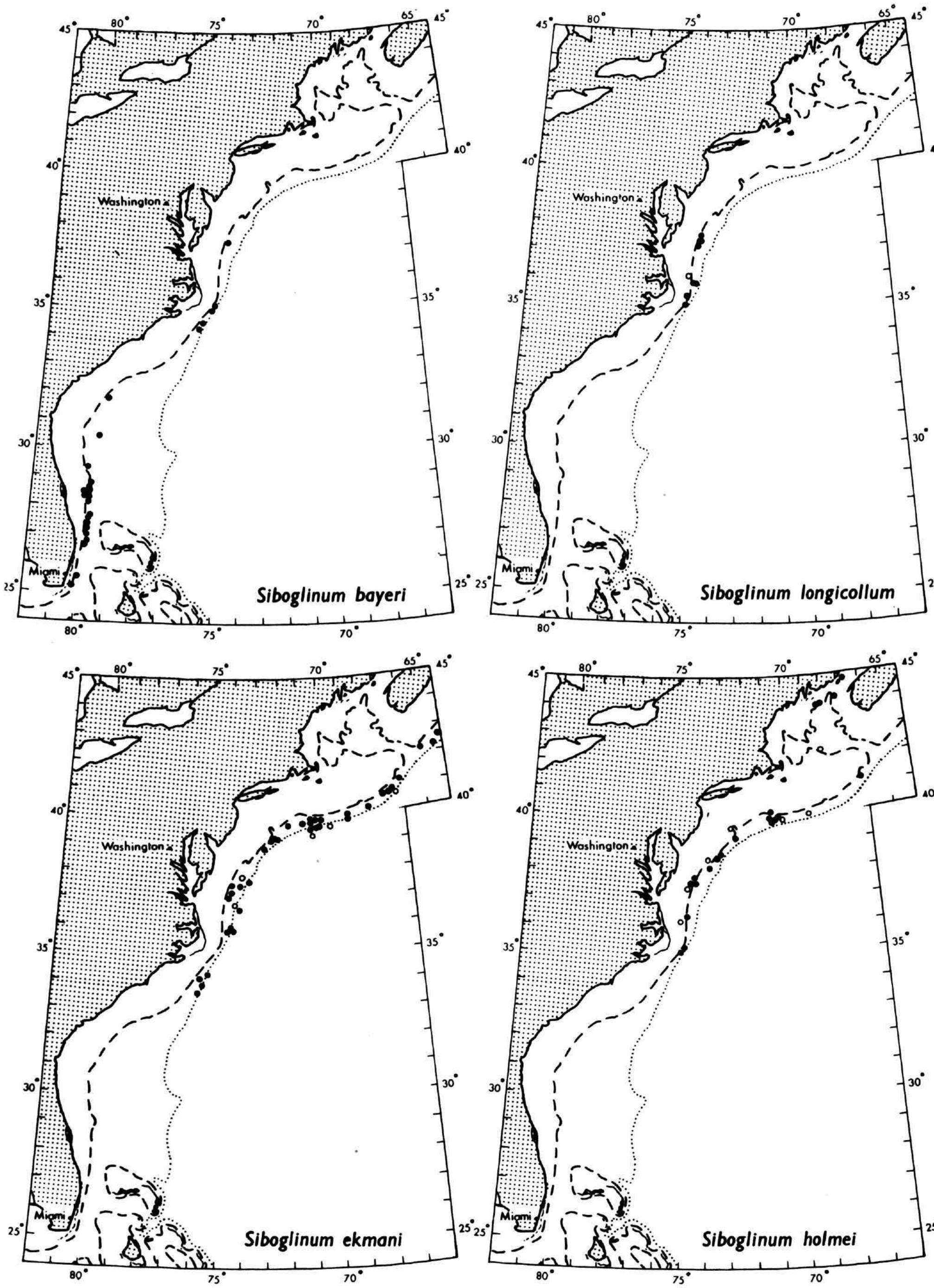

FIGURE 9.—Distribution of four pogonophores: *S. bayeri*, "southern"; *S. longicollum*, "intermediate"; *S. ekmani*, moderate depths; *S. holmei*, "northern"; •, animals; o, empty tubes.

the lower continental slope, found in a relatively narrow zone close to 2,000 m depth.

Siboglinum bayeri (Figure 9). Found at twenty-four stations (Table 1). Depth range 134 to 752 m. Deposit ooze, mud, or soft clay, sometimes mixed with sand. Northern limit 37°30′ N, southern limit not determined. This is a common Florida Current species, found in a wide range of depths on the Florida-Hatteras slope and extending north around Cape Hatteras, in about 500 m depth, to 37°30′ N.

Siboglinum ekmani (Figure 9). Found at sixty-three stations (Table 1). Depth range 400 to about 2,500 m, with some doubtful records from greater depths, but most common between 500 and 1,000 m. Deposit mud or clay, usually containing some sand or Foraminifera. Temperature 3.3° to 8°C. Northern and southern limits not determined. This is a common species on the continental slope between 500 and 1,000 m, but it is less common lower down the slope. It is widespread along the continental margin and may extend along the outer border of the Blake Plateau.

Siboglinum candidum (Figure 8). Found at fifteen stations (Table 1). Depth range 349 to 757 m. Deposit mud, clay, or ooze, often containing some coarser particles. Northern limit 34°17.5′ N, southern limit not determined. This is a Florida Current species, found in the deep part of the Florida Straits and in the 400 to 500 m depth zone of the Florida-Hatteras slope, extending north to just short of Cape Hatteras.

Family POLYBRACHIIDAE

Diplobrachia similis (Figure 10). Found at forty-seven stations (Table 1). Depth range 740 to 3,000 m, with empty tubes at 5,350 m; most common between 1,500 and 2,800 m. Deposit usually clay, frequently rich in Foraminifera. Temperature 2.2° to 4.7°C. Northern and southern limits not determined. This is a continental-slope species, extending downward onto the continental rise and widespread along the continental margin. Not yet found in the Gulf of Mexico or Caribbean. In the northern part of the area studied this species has its upper limit between 800 and 1,000 m, but off Carolina it is not found in depths much less than 2,000 m.

Diplobrachia floridiensis. Found at three stations (Table 1). Depth range 300 to 500 m. Northernmost record 28°32.8′ N, southern limit not determined. This is an uncommon species of the Florida-Hatteras slope (p. 17).

Polybrachia eastwardae (Figure 11). Found at four stations (Table 1). Depth range 1,560 to 2,000 m. Deposit fine silt and clay. Temperature 3° to 4°C. Northern limit somewhere between 33°33′ and 36°30′ N (no samples in intervening area), southern limit not determined. This species seems to be confined to the lower continental slope off North Carolina, but may be found to extend south along the outer slope of the Blake Plateau.

Polybrachia lepida (Figure 8). Found at ten stations (Table 1). Depth range 70 to 692 m, but usually between 200 and 300 m. Deposit mud or silty clay. Northern limit 35°59.6′ N, southern limit not determined, but not found at stations off southern Florida. This is a Florida Current species, extending northward to just beyond Cape Hatteras.

Crassibrachia sandersi (Figure 10). Found at forty-one stations (Table 1). Depth range 2,435 to 5,000 m. Temperature 2.2° to 3.2°C. Deposit mud or clay containing Foraminifera. Northern and southern limits not determined. This species is widespread on the continental rise and most common between 2,800 and 4,000 m. It is occasionally found on the abyssal plain.

Family LAMELLISABELLIDAE

Siphonobrachia ilyophora. Found at two stations (Table 1) and recorded off Miami by Nielsen (1965). Depth range 165 to 284 m. This is an uncommon species, found only on the upper part of the continental slope off Florida.

Zoogeography

After considering the distribution of each species separately they can be grouped into (1) deep-water species, (2) shallow-water northern species, (3) shallow-water southern species, with some of intermediate distribution (Table 3). The deep-water species are *Siboglinum angustum*, *S. pholidotum*, *Diplobrachia similis*, and *Crassibrachia sandersi*, which occupy successively deeper zones on the continental slope and rise, and all of which are presumably stenothermal. Although common on the upper and middle parts of the continental slope, *S. ekmani*

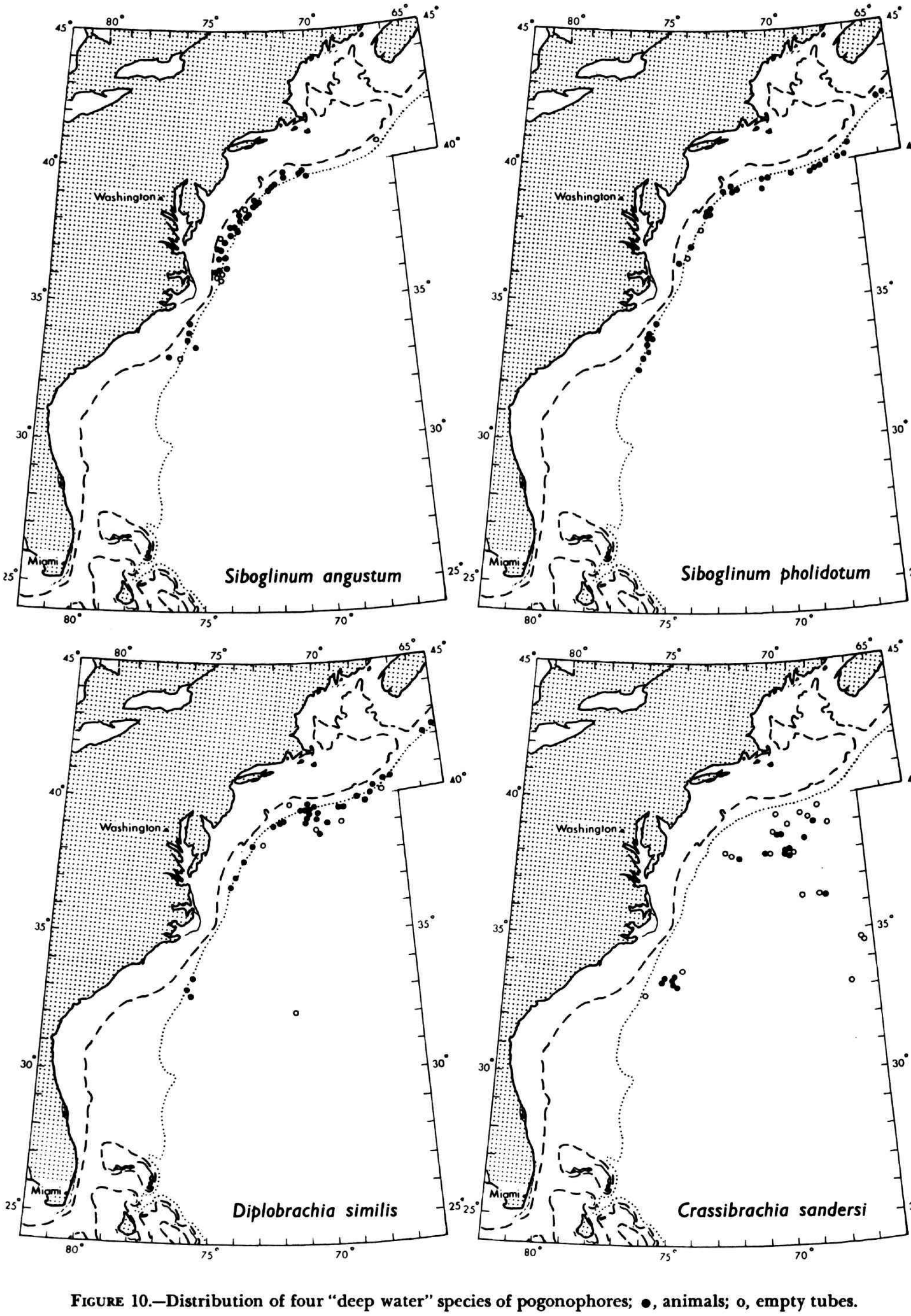

FIGURE 10.—Distribution of four "deep water" species of pogonophores; ●, animals; o, empty tubes.

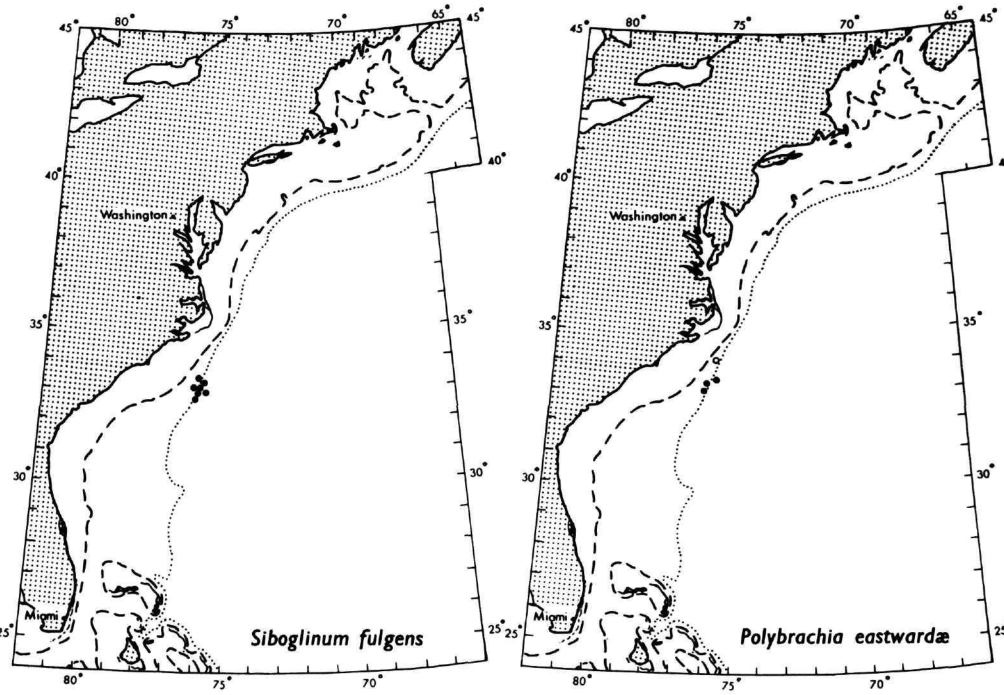

FIGURE 11.—Distribution of two "southern deep water" species of pogonophores; ●, animals; o, empty tubes.

TABLE 3.—*Zoogeographical groups*

NORTHERN SHALLOW WATER	SOUTHERN SHALLOW WATER	DEEP WATER
Siboglinum holmei	*Siboglinum bayeri*	*Siboglinum angustum*
	Siboglinum mergophorum	*Siboglinum pholidotum*
INTERMEDIATE SHALLOW WATER	*Siboglinum candidum*	*Diplobrachia similis*
Siboglinum longicollum	*Nereilinum punctatum*	*Crassibrachia sandersi*
(Sibloglinum gosnoldae?)	*Oligobrachia floridana*	
	Diplobrachia floridiensis	SOUTHERN DEEP WATER
	Polybrachia lepida	*Siboglinum fulgens*
	Siphonobrachia ilyophora	*Polybrachia eastwardae*
	WIDESPREAD AT INTERMEDIATE DEPTHS	
	Siboglinum ekmani	

must be regarded as less stenothermal than the above four species as it reaches up to the 400 to 500 m level, and thus overlaps the range of some of the shallow-water species. The only shallow-water species of northern distribution is *S. holmei*, which seems to be typical of the upper slope between Cape Hatteras and Georges Bank, in the region of mixed Gulf Stream and coastal water with a comparatively high but stable temperature of 10° to 12°C. The southern group of species inhabits the Florida-Hatteras slope, which is bathed by the cooler layers of the Florida Current. There are eight species in this group, *Siboglinum bayeri* having the widest distribution (Figures 8, 9). Some of them may well be found in the Gulf of Mexico, from where they could have spread with the north-going current through the Straits of Florida. Unfortunately, nothing is yet known of the pogonophores of the upper continental slope of the Gulf of Mexico.

Cape Hatteras Region

In an earlier paper (Southward and Brattegard, 1969) it was found that understanding of the distribution of Pogonophora off North Carolina was hampered by lack of information on their occurrence in deep water near Cape Hatteras. Furthermore, the southern shallow-water species *Siboglinum bayeri*, new species, was not recognized as such but was included with *S. ekmani*, giving the impression that *S. ekmani* occurred in shallower depths than it really does.

With the help of new information on the distribution of deep-water species from Virginia to Nova

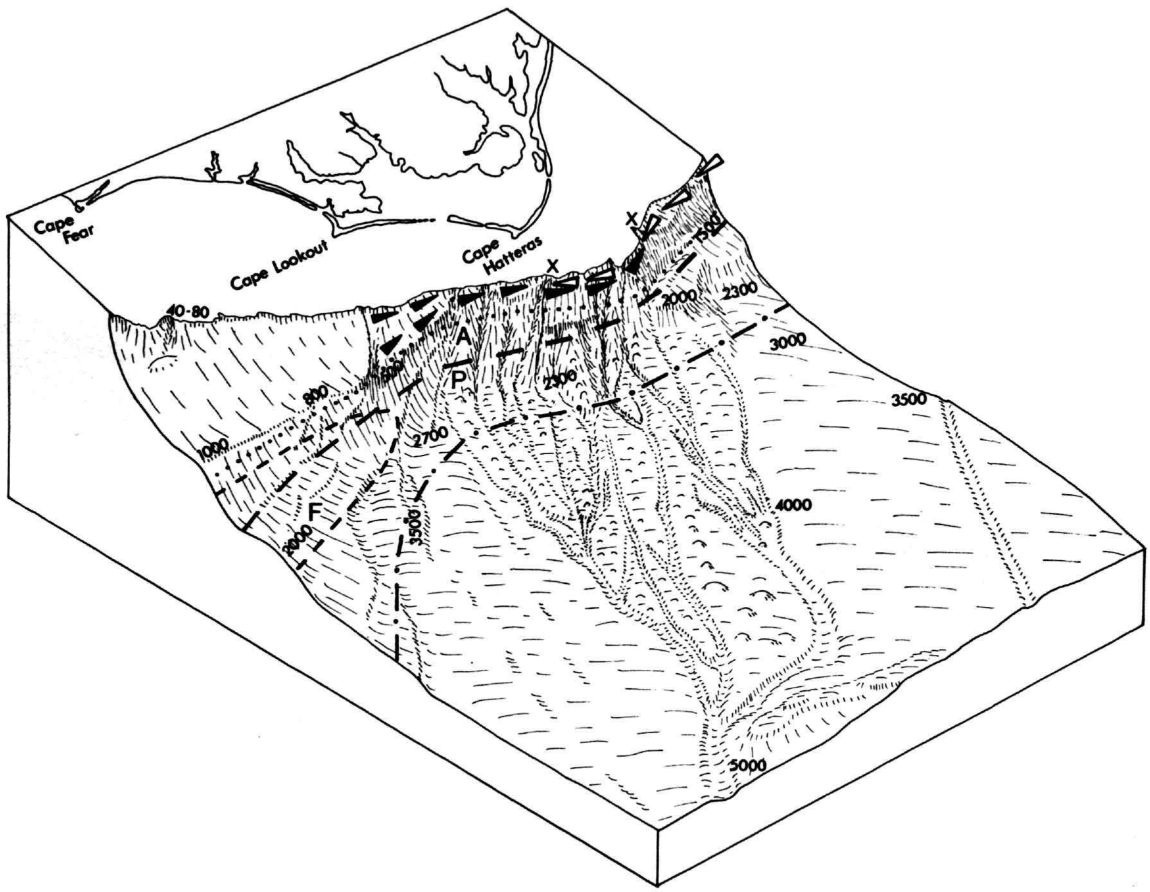

Figure 12.—Distribution of pogonophores on the continental slope and continental rise around Cape Hatteras. Physiographic diagram based on Newton and Pilkey (1969), Plate 2, with some depths added from Plate 1. Solid line is edge of continental shelf; ..... A, upper limit of *S. angustum;* ——— P, upper limit of *S. pholidotum;* —.—., upper limit of *C. sandersi* and lower limit of *S. pholidotum* (approximate). ---- F, northern limit of *Siboglinum fulgens* and *Polybrachia eastwardae*. Black arrows mark distribution of southern shallow-water species; white arrows mark distribution of *S. holmei;* X to X marks overlap. Numbers show depths in meters.

Scotia, recorded in this paper, one can arrive at a better idea of the distribution of the various species in the area close to Cape Hatteras (Figure 12). The upper limits of *S. ekmani* and *S. angustum* in the figure are based on actual samples, but those of *S. pholidotum* and *C. sandersi* have had to be estimated. *Siboglinum angustum* reaches the middle part of the slope, stopping between 1,000 and 800 m. *Siboglinum ekmani* is not included in Figure 12, to avoid having too many confusing lines, but its upper limit is between 600 and 500 m, which is a little deeper than its upper limit of about 400 m off New England. Some of the shallow-water species have their lower limits near 600 m and are found mixed with *S. ekmani* at a few stations in the 500 to 600 m depth zone. The so-called shallow-water populations of Pogonophora are those occurring between the edge of the continental shelf and 600 m. Figure 12 shows the penetration of the two main groups of shallow-water species around Cape Hatteras, with black arrows for the five Florida Current species (*S. bayeri, S. mergophorum, S. candidum, O. floridana,* and *P. lepida*). White arrows mark the distribution of the one northern species, *S. holmei*. One of the southern species, *S. bayeri*, has been found 150 km farther north than the rest of the group and off the edge of the map in Figure 12 (*Gosnold* station 2092). All five are common on the Florida-Hatteras slope to about 29° N, but between there and 34° N there is an area of coarse sediments in which Pogonophora do not seem to occur, though if any patches of finer sediments exist, pogonophores may be found in them. Pogonophora reappear in samples taken off Cape Lookout, where *S. mergophorum* lives right at the top of the continental slope (160 to 200 m) and the others occur at 400 to 600 m on the gently sloping northern tip of the Blake Plateau. From here they extend along the upper slope, in depths down to 500 m, to a little north of Cape Hatteras (36° N), and *S. bayeri*, as previously mentioned, turns up again at 37°30′ N and may occur in the intervening 150 km. From the north, *S. holmei* extends south as far as 35° N, just off Cape Hatteras, so the main area of overlap of northern and southern species is between 35° and 36° N (between Xs in Figure 12). The northward penetration of *S. bayeri* indicates some mixing of populations as far north as 37°30′ N. In the same region of the upper slope, between 35° and 37°30′ N, there is one common species, *S. longicollum* (see Figure 9), that does not occur outside this region, and two rarer species, *S. gosnoldae* and *Diplobrachia* species, may also be restricted to the same region. Gray, Downey, and Cerame-Vivas (1968) found an overlap of northern and southern echinoderm faunas in the same region of the edge of the continental shelf, so this is probably a common phenomenon.

At the northern end of the Blake escarpment a small area is (Figure 12F) inhabited by two species, *S. fulgens* and *P. eastwardae,* which are restricted to that area in depths of 1,000 to 2,600 m, although with them are found other common continental slope species.

Bottom Currents

Pogonophores have only a short dispersal period in their life history; the tube-living animal is almost entirely buried in the mud and is unlikely to move, though it might be carried downslope by slumping or turbidity currents. The early development of the embryo takes place inside the tube of the female, and the young animal probably emerges when it is a millimeter or two long and capable of secreting its own tube. At this stage it is light enough to be swept along by bottom currents, though it has no adaptations for swimming. One would therefore expect dispersal to be in the direction of the main bottom currents. In the Cape Hatteras region much attention has been paid to surface and bottom currents (Bumpus, 1955, 1965; Howe, 1962; Pratt, 1963; Barrett, 1965; Heezen, Hollister, and Ruddiman, 1966; Rowe and Menzies, 1968), and it is possible to compare these with the distribution of the pogonophore species.

The southern species are found in the lower layers of the Florida Current where it flows northward along the continental slope, and five of them reach the area off Cape Lookout (see Figure 12), where they occur in depths of 160 to 600 m. The current is known to extend down at times to 500 m or even deeper, covering the range of the southern pogonophores. Just off Cape Hatteras, where the Florida Current or Gulf Stream leaves the continental slope and turns out into the ocean, four of the five southern pogonophores stop. The fifth, *S. bayeri*, penetrates along the top of the continental slope for a further 150 km northward (Figure 9), where the prevailing currents seem to be in the wrong direction, but there are occasional reversals of flow, particularly in autumn and winter (Bumpus and Lauzier, 1965). The northern shallow-water pogonophore *S. holmei* (Figure 9) lives along the top of the continental slope from Georges Bank to Cape Hatteras, stopping where the north-going Florida Current begins to be strongly felt and presumably prevents further penetration southward. The region of overlap of northern and southern species between 35° N and 37°30′ N, where the endemic species *S. longicollum* occurs, is the region where variations of surface currents are most frequent, though below about 100 m depth north of Cape Hatteras there does not seem to be much current at all (Iselin, 1936). In greater depths, however, below about 800 to 1,000 m, the continental slope is swept by the Western Boundary Undercurrent, which flows southwest and south, following the continental margin (Swallow and Worthington, 1961). Off Cape Hatteras there is a zone of no motion at about 1,000 m, between this current and the Gulf Stream (Rowe and Menzies, 1968). Most of the deep-water pogonophore species live in the zone influenced by the Western Boundary Undercurrent, and only *S. ekmani* extends as shallow as the lowest level of influence of the Gulf Stream. The deep-water species most probably continue south along the lower slope and continental rise of the unsampled area beyond the Blake Plateau, and the two that are found in the Caribbean (*S. angustum* and *S. pholidotum*) could easily have traveled at some time with the flow of deep Atlantic water that is known to enter the Caribbean Basin at times through the Windward Passage and to form the bottom water of the Cayman Basin (Wüst and Gordon, 1964).

Thus, it does seem that the distribution of pogonophoran species is correlated with known bottom-water movements in the area, and this supports the idea that the young stages drift passively without any free swimming stage capable of reaching the upper-water layers. The restricted distribution of *Siboglinum fulgens* and *Polybrachia eastwardae* is not entirely explained by present knowledge of bottom currents, though the south-moving Western Boundary Undercurrent presumably prevents northward penetration along the continental slope, and whether they extend south along the Blake escarpment is unknown. Another species whose distribution raises a problem is *Siboglinoides caribbeanus*. This is the only pogonophore species so far found near Bermuda, where it occurs in 1,000 m depth, but it is otherwise found in the Caribbean Basin in 366 to 1,140 m, and no bottom current could carry it from there to Bermuda, or vice versa, since it is absent from greater depths in the Atlantic.

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