

*JAMES A. BLAKE*

*Revision of the  
Genus *Polydora* from  
The East Coast of  
North America  
(*Polychaeta: Spionidae*)*

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## ABSTRACT

Blake, James A. Revision of the Genus *Polydora* from the East Coast of North American (Polychaeta: Spionidae). *Smithsonian Contributions to Zoology*, number 75, 32 pages, 1971.—Twelve species of *Polydora* from the east coast of North America are described on the basis of recent collections as well as material deposited in various museums. The study includes 11 previously described species, one new species, 10 synonyms, and one *nomen nudum*. Diagnosis of the genus *Polydora*, with a key to the species covered, are included.

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The family Spionidae is among the largest, in number of species, of the Polychaeta. They are typically marine bottom-deposit feeders and occur mostly in coastal waters. The family is rare in the deep sea.

The spionids have a pair of long peristomial palps which are used in feeding. Each palp has a ciliated groove along which particles move toward the mouth; some of these particles are used to build tubes while others are utilized as food. The sorting mechanism, however, is not as well developed as in some other polychaete families.

The Spionidae has been divided into several subfamilies (Söderström, 1920; Orrhage, 1964). The subfamily Spioninae contains the genera *Pygospio*, *Spio*, *Paraspio*, *Polydora*, *Boccardia*, and *Pseudopolydora*. The three latter genera comprise the polydorid complex in which the fifth setigerous segment is modified and includes specialized setae or spines. The structure of the spines form useful taxonomic characters. Major systematic treatments of the polydorids include works by Carazzi (1893), Mesnil (1896), Söderström (1920), Fauvel (1927), Hartman (1941), Woodwick (1964), and Day (1967).

Our knowledge of species of *Polydora* from the east coast of North America comes largely from the studies of Verrill (1880, 1881, 1885a, b), Webster (1879a, b), Andrews 1891a, b), Moore (1907), and

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Hartman (1942, 1943, 1944, 1945, 1965). These five authors described eleven species of *Polydora*. Four additional species, previously known from other geographic areas, were reported. Special mention should be made of the paper by Bosc (1802), in which the description of the type species of the genus, *P. cornuta* Bosc from Charleston, South Carolina, was given. Unfortunately, the description of that species was superficial and specific determination is today impossible. Thus, the type-species of *Polydora* is indeterminable.

Considerable confusion exists with regard to the four species of *Polydora* erected by Verrill. Only for *P. concharum* Verrill (1880) are adequate descriptions and figures given (Verrill, 1885a; Hartman, 1942, 1944) and type-material available. *Polydora gracilis* Verrill (1880) and *P. tubifex* Verrill (1885b) were described but never figured, while *P. littorea* Verrill (1881) is a nomen nudum. Hartman (1944) belatedly published a number of Verrill's unpublished plates, which contained some figures of *Polydora*, including *P. concharum* and *P. littorea*.

Webster (1879a, b) described *P. hamata*, *P. caeca*, and *P. ligni*. *Polydora caeca*, however, was declared a junior homonym by Hartman (1943) and renamed *P. websteri*. *Polydora hamata* was referred to *Boccardia* by Blake (1966). *Polydora aggregata* was named and the larvae described by Blake (1969b).

The other species described from eastern North

America include *Polydora commensalis* Andrews (1891a), *P. colonia* Moore (1907), and *P. tetra-branchia* Hartman (1945). Four species from other regions have also been reported to occur in eastern North America, including *P. ciliata* (Johnston) and *P. quadrilobata* Jacobi, reported by Procter (1933); *P. socialis* (Schmarda), reported by Hartman (1945); and *P. caulleryi* Mesnil, reported by Hartman (1965).

Despite these numerous references and others, only Hartman (1945) provides useful keys and descriptions to a number of species. Unfortunately, that study is limited to North Carolina and excludes several species found in adjacent areas. The present study is an attempt to reevaluate older records and to provide new information on species of *Polydora* for the entire eastern seaboard. New collections come from Newfoundland to South Carolina. Most were collected by the writer, while others were collected by various individuals, acknowledged in the text. The bulk of these collections have been deposited in the United States National Museum.

Field collections of adult *Polydora* were made intertidally and subtidally from shells and sediment. As a result of the author's location in Maine, extensive collections were made in that area. Subtidal samples were obtained with either a biological dredge or a 0.05 m<sup>2</sup> Ponar Grab. Sediment was washed with sea water through fine-mesh screens. The tubes were removed and placed in jars in running seawater.

In the laboratory, the tubes were carefully dissected and the worms removed. *Polydora* from shells were removed after cracking the shells with a hammer or pliers.

Adults were relaxed in 0.15% propylene phenoxylol prior to fixation in 10% formalin or Bouin's fluid. After several days in the fixative, the worms were removed and stored in 70% ethyl alcohol.

Older collections of *Polydora*, deposited in the Allan Hancock Foundation, University of Southern California (AHF), Academy of Natural Sciences of Philadelphia (ANSP), United States National Museum (USNM), and the Yale Peabody Museum of Natural History (YPMNH) were also examined.

The following people assisted by arranging for the loan of specimens from their respective Museum: Marian H. Pettibone (USNM), Willard Hartman (YPMNH), and Olga Hartman (AHF).

The following people were of assistance during visits to their Museums by helping locate specimens and providing working space: Olga Hartman and Kristian Fauchald, of the Allan Hancock Foundation, during my visit in September 1968; R. Tucker Abbott, of the Academy of Natural Sciences in Philadelphia, during my visit in October 1968. On numerous occasions, Keith H. Woodwick of Fresno State College, Fresno, California, provided working space, offered advice and allowed me to examine his extensive collections of *Polydora* from California.

Additional collections were received from David Grant and Katherine D. Hobson of the Systematics-Ecology Program, Woods Hole, Massachusetts (SEP); Anders Eliason of the Naturhistoriska Museet, Göteborg, Sweden (NMGS); François Rullier of the Université Catholique d'Angers, France; Lucien Laubier, Laboratoire Arago, Banyuls-Sur-Mer, France; P. Korringa, Rijksinstituut voor Visserij-Onder, Bergen-Op-Zoom, The Netherlands; John W. Evans, Memorial University of Newfoundland, St. John's, Newfoundland; John D. Davis, Smith College, Northampton, Massachusetts; and Sarah A. Haigler, Virginia Institute of Marine Science, Gloucester Point, Virginia.

Specimens of *Polydora concharum* collected by the writer in August 1968 aboard the R/V *Hero* off West Greenland are also included. Complete results of the *Hero* cruise will be published later.

Assistance rendered by Mrs. Crystal M. Blake, Barbara Hilton, Thomas L. Richards, Michael A. Mazurkiewicz, David Dean and George S. Noyes is gratefully acknowledged.

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### Genus *Polydora* Bosc, 1802

TYPE-SPECIES.—*Polydora cornuta* Bosc, 1802.

DIAGNOSIS.—Prostomium rounded or bifid anteriorly, extending back as a caruncle. Eyes present or absent. First setigerous segment with or without notosetae. Setiger 5 greatly enlarged, with special-

ized spines and companion setae arranged in a single curved row. Posterior notosetae may include specialized spines or hooks as well as capillaries. Hooded hooks usually begin on setiger 7. Branchiae begin on segments posterior to setiger 5 and are not fused to the notopodial lobes. Pygidium enlarged, saucer-like or divided into lobes.

The following species of *Polydora* are covered in this report (synonyms in parentheses; those marked with an asterisk are new synonyms) :

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|--|--|
| <ol style="list-style-type: none"> <li>1. <i>P. ligni</i> Webster, 1879b<br/>(<i>*P. littorea</i> Verrill, 1881. Nomen nudum)<br/>(<i>P. amaricola</i> Hartman, 1936)</li> <li>2. <i>P. websteri</i> Hartman, 1943<br/>(<i>P. caeca</i>.—Webster, 1879a.—Not Oersted, 1843)</li> <li>3. <i>P. aggregata</i> Blake, 1969b</li> <li>4. <i>P. tetrabanchia</i> Hartman, 1945</li> </ol> | <ol style="list-style-type: none"> <li>5. <i>P. caulleryi</i> Mesnil, 1897<br/>(<i>P. carazzi</i> McIntosh, 1909)<br/>(<i>P. brachycephala</i> Hartman, 1936)</li> <li>6. <i>P. quadrilobata</i> Jacobi, 1883<br/>(<i>*P. tubifex</i>, Verrill, 1885b)<br/>(<i>P. littorea</i>.—Hartman, 1944)</li> <li>7. <i>P. colonia</i> Moore, 1907<br/>(<i>*P. ancistrata</i> Jones, 1962)<br/>(<i>P. hoplura inhaca</i> Day, 1957)</li> <li>8. <i>P. commensalis</i> Andrews, 1891a<br/>(<i>P. ciliata brevipalpa</i> Zaks, 1935)</li> <li>9. <i>P. concharum</i> Verrill, 1880</li> <li>10. <i>P. socialis</i> (Schmarda, 1861)<br/>(<i>Leucodore socialis</i> Schmarda, 1861)<br/>(<i>P. socialis plena</i> Berkeley and Berkeley, 1936)<br/>(?<i>P. gracilis</i> Verrill, 1880)</li> <li>11. <i>P. anoculata</i> Moore, 1907</li> <li>12. <i>P. hartmanae</i> new species<br/>(<i>P. anoculata</i>.—Hartman, 1945.—Not Moore, 1907)</li> </ol> |
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**Key to the Species of *Polydora* from the East Coast of North America**

(Figure numbers in parentheses)

- |   |                                |
|---|--------------------------------|
| 1. Hooded hooks begin on setiger 7. ....  | 2                              |
| Hooded hooks begin on setigers 10–17. Palps very short (11a). Modified spines of setiger 5 with long lateral sheaths (11b, c). ....                                       | <i>P. commensalis</i> (p. 17)  |
| 2. Hooded hooks with a constriction on the shaft (2d,e). ....   | 3                              |
| Hooded hooks without a constriction on the shaft (8f). ....   | 6                              |
| 3. Nuchal tentacle present (1a). ....   | <i>P. ligni</i> (p. 5)         |
| Nuchal tentacle absent. ....  | 4                              |
| 4. Modified spines of setiger 5 bifid, with subterminal collars (10d–f). Posterior notopodial hooks present (10h–k). ....   | <i>P. colonia</i> (p. 15)      |
| Modified spines of setiger 5 falcate, with lateral accessory structures. Posterior notopodial hooks absent. ....  | 5                              |
| 5. Modified spines of setiger 5 with lateral sheaths or flanges (3b–g). Bores in calcareous structures. ....  | <i>P. websteri</i> (p. 6)      |
| Modified spines of setiger 5 with weakly developed lateral shelves or knobs (4b–e). Forms mat of tubes on rocky shores. ....  | <i>P. aggregata</i> (p. 8)     |
| 6. Posterior notopodial spines present, awl-shaped (8g; 9j). ....   | 7                              |
| Posterior notopodial spines absent. ....  | 8                              |
| 7. Modified spines of setiger 5 large, falcate, with pectinate or bushy tops (8c, d). ....  | <i>P. caulleryi</i> (p. 11)    |
| Modified spines of setiger 5 bifid, or with bushy tufts between the teeth (9e, g). ....   | <i>P. quadrilobata</i> (p. 13) |
| 8. Modified spines of setiger 5 bifid, or with well developed lateral teeth or sheaths. ....  | 9                              |
| Modified spines of setiger 5 simple, falcate or with a weakly-developed accessory shelf. ....   | 11                             |
| 9. Branchiae begin on setiger 7. Modified spines of setiger 5 bifid, with two large teeth (7b, c). ....   | <i>P. tetrabanchia</i> (p. 10) |
| Branchiae begin on setigers 9–12. Modified spines on setiger 5 falcate, with lateral sheath or tooth. ....  | 10                             |
| 10. Modified spines of setiger 5 falcate, with lateral sheath or tooth and fine hairs in concavity (16b–h). Branchiae begin on setigers 11–12. ....                       | <i>P. hartmanae</i> (p. 25)    |
| Modified spines of setiger 5 falcate, with lateral sheath or tooth not covered with fine hairs (15b–i). Branchiae begin on setigers 9–10. ....                            | <i>P. anoculata</i> (p. 25)    |
| 11. Modified spines of setiger 5 falcate, with weakly-developed lateral shelf (12b–d). Pygidium with four unequal lobes (12j). Caruncle extending no further than setiger |                                |

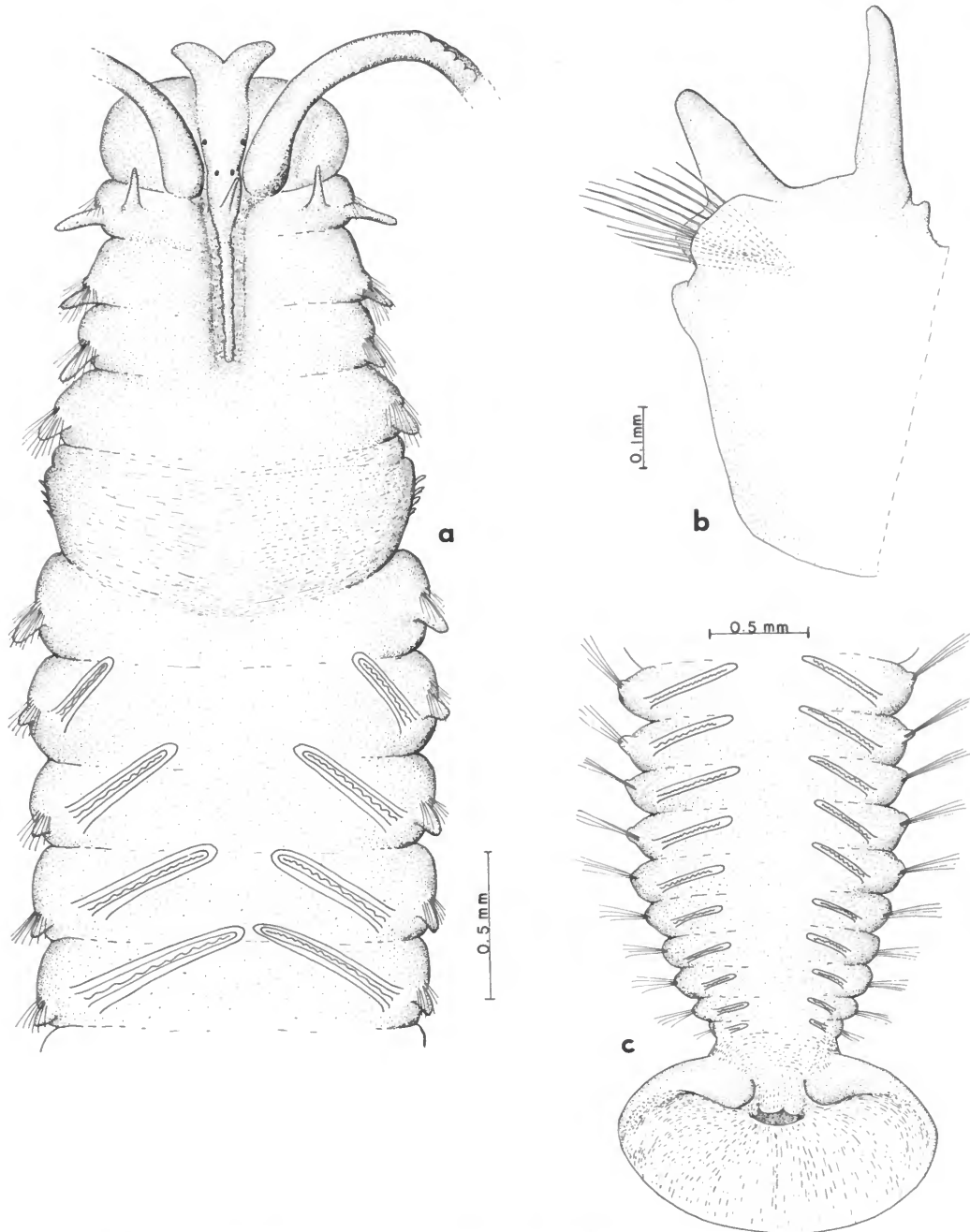


FIGURE 1.—*Polydora ligni*: a, Anterior end, dorsal view; b, setiger 1, anterior view; c, posterior end, dorsal view.



5. Larval pigment retained only in juveniles. Posterior capillary notosetae of three sizes. .... *P. concharum* (p. 20)  
 Modified spines of setiger 5 falcate, with subterminal boss (14b). Pygidium with 1-3 lobes (13c, d). Caruncle extending to setigers 4-9. Larval pigment retained on most adults. Posterior capillary notosetae of one size. .... *P. socialis* (p. 20)

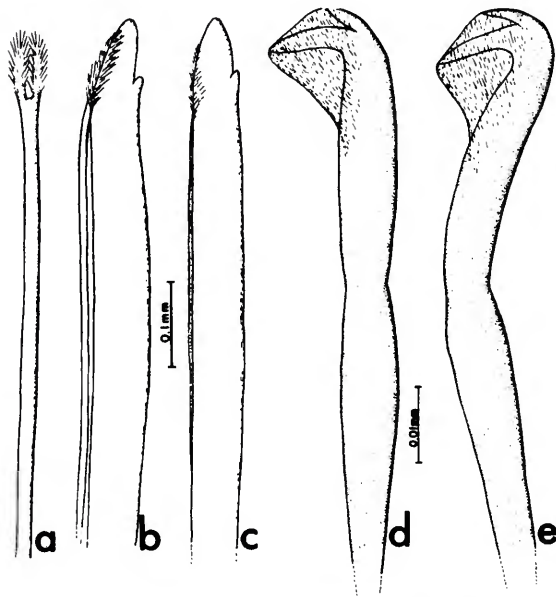


FIGURE 2.—*Polydora ligni*: a, Companion seta of setiger 5; b, c, heavy spines and companion setae of setiger 5; d, e, hooded hooks.

### *Polydora ligni* Webster

#### FIGURES 1-2

- Polydora ciliatum* Agassiz, 1867, pp. 323-330, pls. 9-10.—Verrill, 1873, pp. 51, 309, 345, 364, 453, 603, pl. 14, fig. 78. Not Johnston, 1838.  
*Polydora littorea* Verrill, 1881, p. 301 (nomen nudum).—Hartman, 1944, pp. 336, 340, pl. 18: fig. 10, not pl. 18: fig. 9.  
*Polydora ligni* Webster, 1879b, p. 119, pl. 5: figs. 45-47.—Webster and Benedict, 1884, p. 729.—Söderström, 1920, pp. 265-267, figs. 170-174.—Cowles, 1930, p. 341.—Berkeley and Berkeley, 1936, pp. 471-472; 1952, p. 19, figs. 31-33; 1954, p. 464.—Friedrich, 1937, pp. 345-347, figs. 5-6; 1938, p. 133.—Rioja, 1943, pp. 232-244; 1947, p. 207.—Mortenson and Galtsoff, 1944, pp. 164-165.—Graham and Gay, 1945, p. 379.—Hartman, 1941, pp. 309-310, figs. 47-49; 1945, p. 32; 1951, p. 82; 1954, p. 10; 1961, p. 29; 1969, pp. 137-138, figs. 1-6.—Hartman and Reish, 1950, p. 28.—Smidt, 1951, pp. 63-65.—Hannerz, 1956, pp. 106-111, figs. 37-38.—Jones, 1961, p. 266.—Eliason, 1962, p. 52.—Reish, 1963a, pp. 25, 30; 1963b, pp. 265-270; 1964a, pp. 202-207; 1964b, pp. 86-92.—Wells

and Gray, 1964, p. 73.—Galtsoff, 1964, p. 421-425.—Cory, 1967, pp. 71-89.—Berkeley, 1968, p. 560.—Blake, 1969b, pp. 4-10, figs. 1-4.

*Polydora amaricola* Hartman, 1936, p. 49, figs. 6-10.

**MATERIAL EXAMINED.**—Maine (Cobscook Bay; Lamoine Beach; Penobscot River; Damariscotta River; Sheepscot River), Massachusetts (Woods Hole; West Falmouth; Hadley Harbor), Connecticut (Noank), New Jersey (Raritan Bay, coll. D. Dean), North Carolina (Beaufort).

**DESCRIPTION.**—Largest specimens measure 32 mm in length and have up to 80 segments. The prostomium is bifurcated and flares laterally. There are four eyes, arranged as a trapezoid. A nuchal tentacle is present on the caruncle at about the level of setiger 1. The caruncle continues posteriorly as a narrow ridge through setiger 3. A ciliated groove lies on either side of the caruncle (Figure 1a).

Setiger 1 has well-formed parapodial lobes but contains only capillary neurosetae (Figure 1b). Setigers 2-4 and 6 contain fascicles of finely winged capillary setae. After setiger 6 the number of notosetae gradually diminishes, until in posterior segments only a tuft of long capillary setae remains. Bidentate hooded hooks begin on setiger 7 (Figure 2d, e). There are up to 15 hooks per neuropodium and no accompanying capillary setae. Hooks of the same neuropodium may have the main fang either at a right angle to the shaft or bent to about 70°. A constriction and curve are prominent on the shaft. A striated hood covers the teeth.

Setiger 5 is modified to include a row of heavy spines with closely adhering companion setae (Figure 2a-c). The former have a small accessory tooth which may be considerably worn. The latter have a delicate feathery end; when depressed, the tip is seen to be forked.

Branchiae are long and thin, beginning on setiger 7 and continuing to near the end of the body.

The pygidium is a large, flaring cup with a dorsal gap (Figure 1c).

Color in life is light tan with red blood vessels. Except for lateral black pigment spots often present in juveniles, the body is unpigmented.

**REMARKS.**—*Polydora littorea* Verrill is herein considered synonymous with *P. ligni*. The species was named by Verrill (1881) but was never described. Verrill erected the name *littorea* to replace the *P. ciliatum* of Agassiz (1867), which he considered to be distinct from the European *P. ciliata*. The figures of the adults and larvae of Agassiz's *P. ciliatum* appear to be *P. ligni*. Plate 18, Figure 10, was cited by Verrill but not published until Hartman (1944) issued Verrill's plates. A nuchal tentacle is not evident and Figure 10 is indeterminable in other respects. Figure 9, however, cited by Hartman as *P. littorea*, is not the same species. It resembles *P. quadrilobata* Jacobi both in general shape and structure of the pygidium.

The species in North America most closely related to *P. ligni* is *P. nuchalis* Woodwick from California (Woodwick, 1953), both species having a nuchal tentacle. *Polydora nuchalis* differs in that no accessory structure is present on the modified spines of setiger 5. Further, the companion setae are of different structure.

**ECOLOGY.**—*Polydora ligni* is a common inhabitant of estuaries in North America. It constructs fragile tubes of silt on tidal flats or attached to shells, rocks and wood. The species does not bore into calcareous structures. Galtsoff (1964) reported that on several occasions in Delaware Bay the reproduction of *P. ligni* was so rapid that nearly every live oyster of the affected area was killed by a deposit of mud several inches thick. Mud particles suspended in the water are caught on the worm's palps and carried toward the head by ciliary action. The silt is then formed into a tube in the manner described for other species by Hempel (1957b) and Dorsett (1961).

**DISTRIBUTION.**—East and west coasts of North America, Gulf of Mexico and northern Europe.

### *Polydora websteri* Hartman

#### FIGURE 3

*Polydora ciliata*.—Procter, 1933, p. 142.—Kavanaugh, 1941, pp. 32-34.—Lunz, 1940, p. 310; 1941, pp. 273-283.—Abbott, 1946, pp. 15-18, pl. 3.—Medcof, 1946, pp. 498-515.—Plaine, 1952, pp. 121-123, fig. 1.—Turner and Hanks, 1959, pp. 109-111.—Landers, 1967, pp. 63-66, figs. 1-2. Not Johnston, 1838.

*Polydora caeca*.—Webster, 1879a, pp. 252-253, pl. 9: figs. 119-122.—Andrews, 1891a, p. 291. Not Oersted, 1843.

*Polydora websteri*.—Hartman, 1943, pp. 70-72, fig. 1; 1945,

p. 33; 1951, pp. 81-82; 1954, p. 415; 1961, pp. 99-100, pls. 16-17; 1966b, p. 223; 1969, pp. 151-152, 4 figs.—Loosanoff and Engle, 1943, pp. 69-78.—Grice, 1951, pp. 1-10.—Mackin and Cauthron, 1952, pp. 14-24.—Menzel, 1955, p. 112.—Hopkins, 1958, pp. 268-277, figs. 1-6.—Owen, 1957, pp. 35-46.—Rioja, 1960, p. 304.—MacKenzie and Shearer, 1961, pp. 105-111.—Wells and Gray, 1964, p. 73.—Galtsoff, 1964, pp. 421-425.—Forbes, 1966, pp. 280-281.—Davis, 1967, pp. 67-72, figs. 2-3.—Evans, 1969, pp. 775-782.—Blake, 1969a, pp. 814-815, fig. 2; 1969b, pp. 10-16, figs. 5-11.—Haigler, 1969, pp. 821-828, figs. 1-3.

**MATERIAL EXAMINED.**—Maine (Lamoine Beach; Damariscotta River; Boothbay Harbor region, Ocean Point), Newfoundland (St. Mary's Bay, 10-20 meters, coll. J. W. Evans), Quebec (Gaspé Peninsula, coll. J. D. Davis), Connecticut (Milford, Type AHF 1569; Noank), Virginia (Gloucester Point, coll. J. L. Simon), North Carolina (Beaufort), South Carolina (Charleston, coll. M. Chamberlain), California (Morro Bay, coll. K. H. Woodwick).

**DESCRIPTION.**—*Polydora websteri* is a small slender species, measuring up to 20 mm in length and having about 100 segments. In life it is light tan with red branchiae, palps and blood vessels. Body pigmentation is variable, absent in some specimens while others have dense anterior and posterior black pigment.

A prostomial anterior incision may be distinct, weak or absent (Figure 3a). Specimens from New England and eastern Canada tend to have a weakly incised or rounded prostomium, while in specimens from the middle Atlantic and southern states, it tends to be more strongly incised. Postlarval forms from Maine have a rounded prostomium. The caruncle terminates bluntly on setiger 2. Eyes are present or absent; if present, there are four, disposed as in Figure 3a.

Setiger 1 has only capillary neurosetae and elevated notopodial lobes. Setigers 2-4 have blunt notopodial lobes with fascicles of winged capillary setae. The neuropodial lobes are greatly reduced and contain winged capillary setae. Setiger 6, and those immediately following, contain dorsal fascicles of winged capillary setae. The number of setae per notopodium gradually diminishes in the middle segments. In far posterior segments, only three or four winged capillary setae are found in each notopodium. On setiger 7, bidentate hooded hooks replace the neuropodial winged capillary setae. The hooks number about six in a series and have the

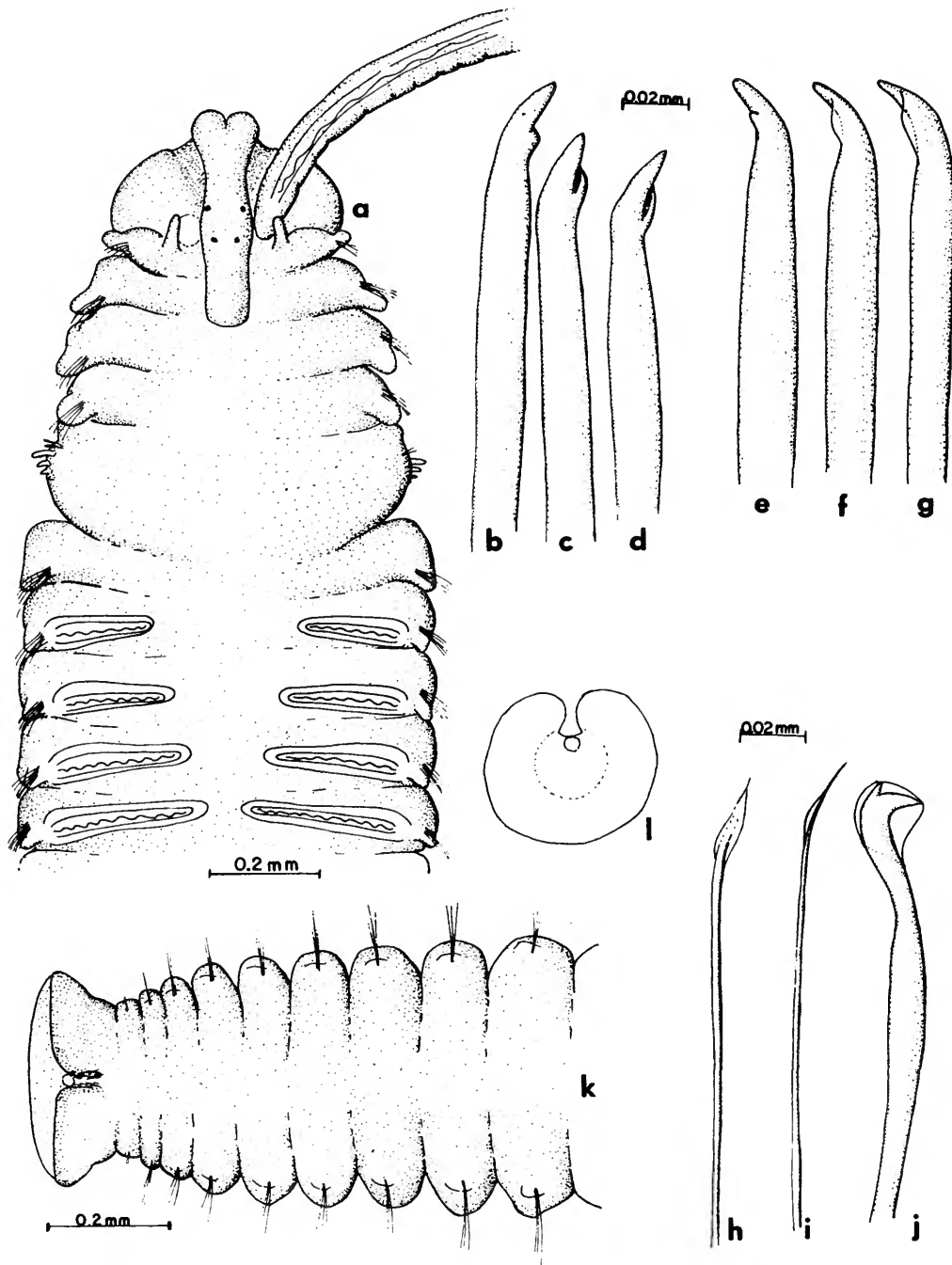


FIGURE 3.—*Polydora websteri*: a, Anterior end, dorsal view; b-g, heavy modified spines of setiger 5 showing different views and degrees of wear; h, pennoned companion seta of setiger 5; i, superior dorsal winged seta of setiger 5; j, hooded hook; k, posterior end, dorsal view; l, pygidium, posterior view.

main fang at a right angle to the shaft. Each hook has a constriction on the shaft (Figure 3j).

Setiger 5 is twice as large as either 4 or 6; the parapodia contain a row of heavy modified spines (Figure 3b-g) alternating with pennoned companion setae (Figure 3h). One or two superior dorsal, winged setae (Figure 3i) and a ventral fascicle of short winged setae are present. The modified spines are falcate and have a lateral flange or sheath. Figure 3b-g illustrates different views and degrees of wear of these spines.

Branchiae begin on setiger 7. They are small at first, reaching full size on setigers 11 and 12 and are absent from posterior segments.

The pygidium is cup-shaped with a distinct dorsal notch (Figure 3k, l).

REMARKS.—During the course of these studies, no specimens of *P. ciliata* have been identified from eastern North America. Hartman (1945) has already suggested that *P. ciliata* may not even occur in eastern North America. On this basis earlier records are herein referred to *P. websteri*. Both Blake (1969a) and Haigler (1969) reported that the hooded hooks of *P. websteri* begin on setiger 7 and not 8, as previously reported by Hartman (1945).

ECOLOGY.—The species is best known as a pest of commercial oysters, but is abundant in numerous intertidal and shallow water calcareous substrates, especially in eastern North America. In Maine the species has been found boring into shells of the scallop *Placopecten magellanicus* and the gastropods *Littorina littorea*, *Thais lapillus*, *Crepidula fornicata*, and *Lunatia heros*.

DISTRIBUTION.—East coast of North America from Quebec and Newfoundland to Florida, Gulf of Mexico, California, Oregon, and Hawaii.

### *Polydora aggregata* Blake

#### FIGURES 4-6

Blake, 1969b, pp. 16-21, figs. 12-15. (Description of larvae.)

MATERIAL EXAMINED.—Maine (Lamoine Beach State Park; Boothbay Harbor region, Ocean Point). The holotype (USNM 42246) and 10 paratypes (USNM 42247-8) have been deposited in the United States National Museum. Additional paratypes have been deposited in the Allan Hancock Foundation.

DESCRIPTION.—This is a small species measuring 6-8 mm in length and having 35-40 segments. The body has a characteristic reticulate, dark-brown pigment pattern of varying intensity on the peristomium and first six to eight segments (Figure 4a). The caruncle has two lateral clear areas which in life are seen to contain ciliary grooves. Posterior segments are generally not darkly pigmented, although the pygidium is often rimmed with black.

The prostomium is bifid, although in some preserved specimens the anterior end curves downward and appears rounded when seen from above. The caruncle ends abruptly on setiger 2. There are four eyes, the anterior pair cup-shaped and the posterior pair oval (Figure 4a).

Setiger 1 has only neurosetae, although a well developed notopodial lobe is present. Setigers 2-4 have blunt notopodial lobes with long and short, winged capillary setae. The neuropodial lobes are small, with those of setigers 2-4 becoming progressively shorter. Beginning on setiger 6, the notopodia contain fascicles of long and short, winged capillary setae. The number of setae per fascicle gradually diminishes in the middle region, and in posterior segments only a few long, thin, capillary setae are present. The winged capillary neurosetae are replaced by bidentate hooded hooks beginning on setiger 7 (Figure 4g). Each hook has a constriction on the shaft. Five or six hooks are present on most segments, although fewer are found in posterior segments.

Setiger 5 is about twice the size of preceding segments. The parapodia contain a curved row of heavy spines (Figure 4b-e) alternating with pennoned companion setae (Figure 4f). Tufts of winged setae are located above and below the heavy spines. The heavy spines are falcate, with a small lateral accessory structure appearing as a small elevation, cleft on one side and rounded on the other. This structure can be classed neither as a tooth nor flange. Deeper unworn setae have a long tapered mucron on their tips.

Branchiae begin on setiger 7 and are absent from posterior segments.

The pygidium is cup-shaped with a wide dorsal gap (Figure 4h).

REMARKS.—The name *Polydora aggregata* was prematurely introduced in a larval study (Blake, 1969b). The adult description is given here for the first time.

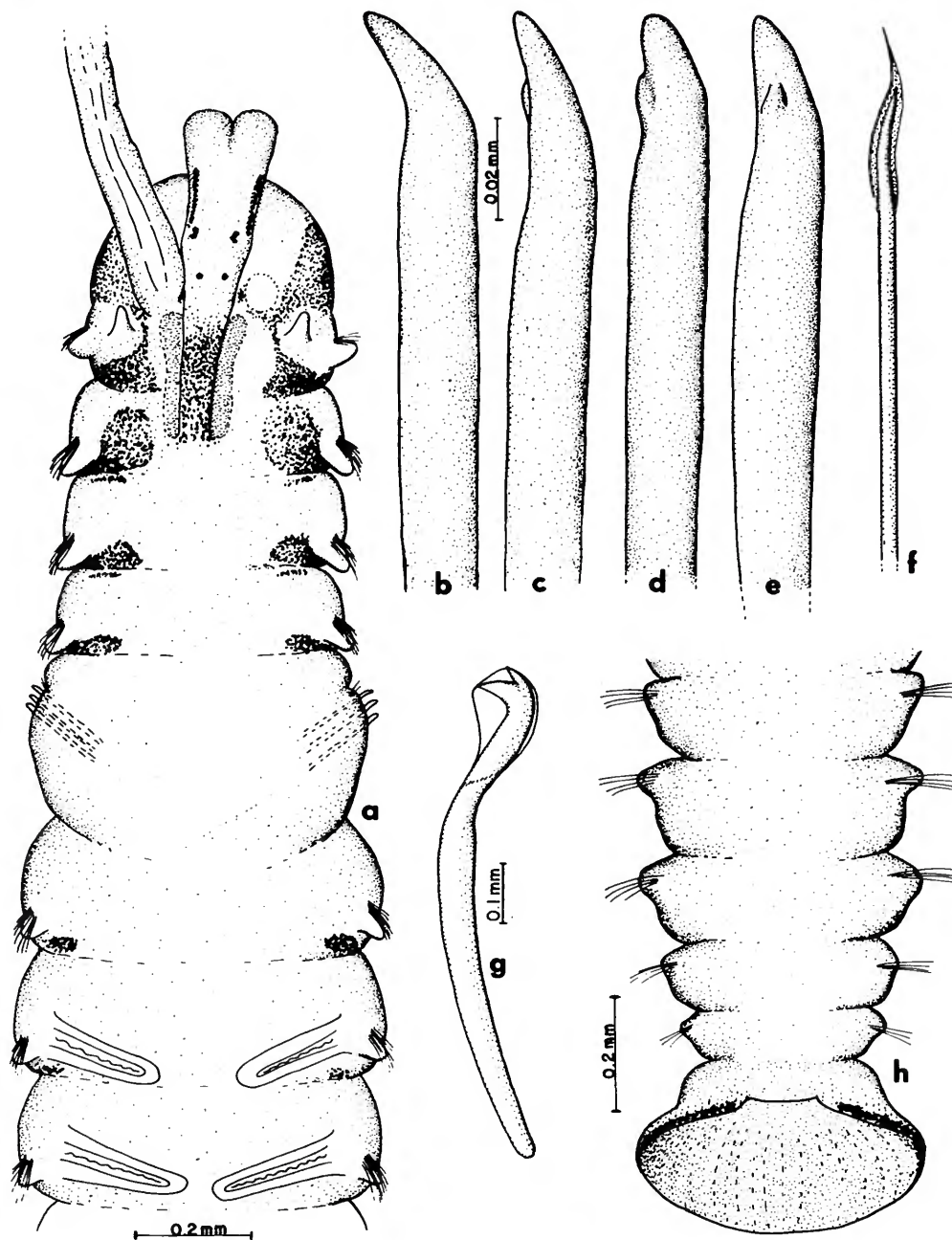


FIGURE 4.—*Polydora aggregata*: a, Anterior end, dorsal view; b-e, heavy modified spines of setiger 5 in different views; f, pennoned companion seta of setiger 5; g, hooded hook; h, posterior end, dorsal view.

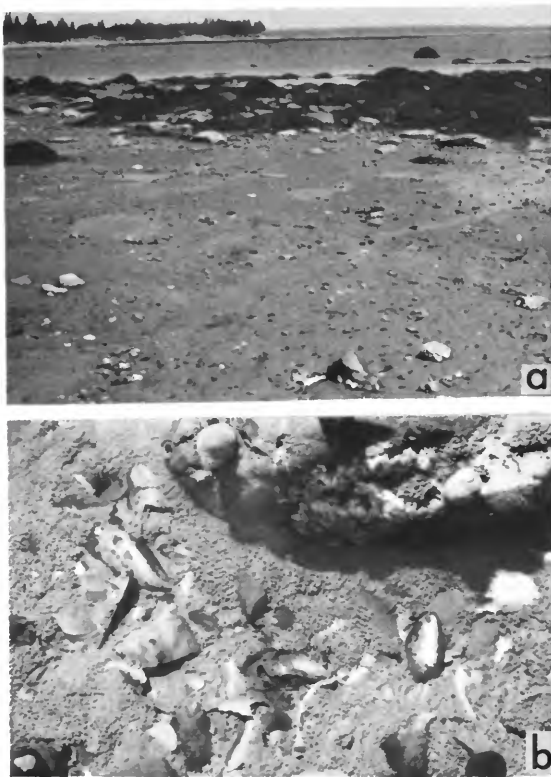


FIGURE 5.—Lamoine Beach, Maine: *a*, Foreground shows a solid mat of *P. aggregata* tubes; *b*, clustered tubes of *P. aggregata* between rocks and broken shells of *Mytilus edulis*. The snail is *Littorina littorea*.

*Polydora aggregata* is closely related to *P. limicola* (Annenkova, 1934). The two species are similar in habitat and morphology. They differ, however, in that *P. limicola* has a small, triangular tooth on the side of the modified spines of setiger 5, whereas *P. aggregata* has the structure described above.

**ECOLOGY.**—At Lamoine Beach, *P. aggregata* occurs in dense mats on and between rocks, exposed at low tide (Figure 5*a*). The mats are so thick in some areas they appear to stabilize the beach. At the lowest tide levels, the dense mats of tubes give way to tube clusters or clumps, which are attached to rocks, shells, or algae (Figures 5*b*; 6*a*, *b*). Occasionally, the orbinid *Naineris quadricuspida* (Fabricius), phyllodocids, chironomid larvae and nematodes are associates in the mats of tubes. At Ocean Point the species was found among holdfasts of *Chondrus crispus*.

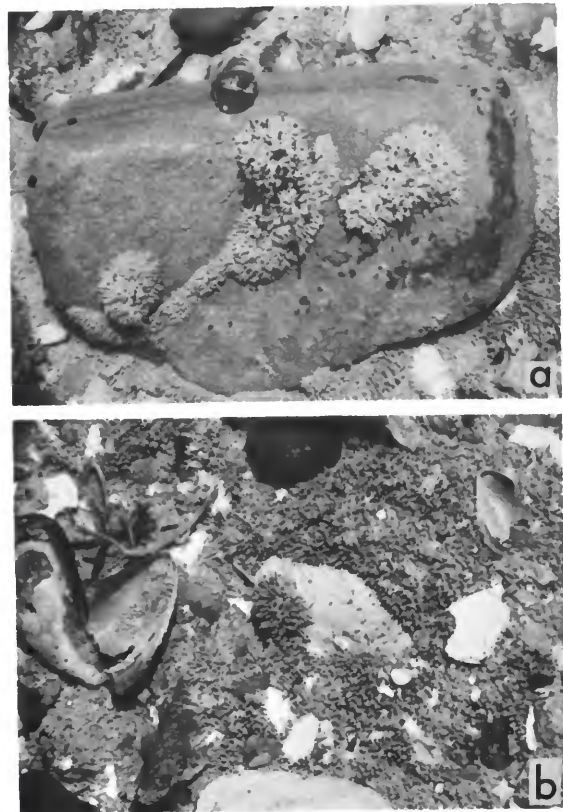


FIGURE 6.—Lamoine Beach, Maine: *a*, Rock with tube clusters of *P. aggregata*; *b*, tube clusters of *P. aggregata*.

**DISTRIBUTION.**—Maine, on semiexposed rocky shores.

#### *Polydora tetrabanchia* Hartman

FIGURE 7

Hartman, 1945, p. 34, pl. 1: figs. 7–10.

**MATERIAL EXAMINED.**—North Carolina (Beaufort, Types, AHF N1563).

**DESCRIPTION.**—This is a small species, measuring about 6 mm in length and having about 30 segments. The prostomium has a weak anterior incision. There are no eyes or nuchal tentacle. The caruncle extends to setiger 1.

In the specimens examined, notosetae were not seen on setiger 1, although Hartman (1945) indicated they were present. Slender, fine, winged,

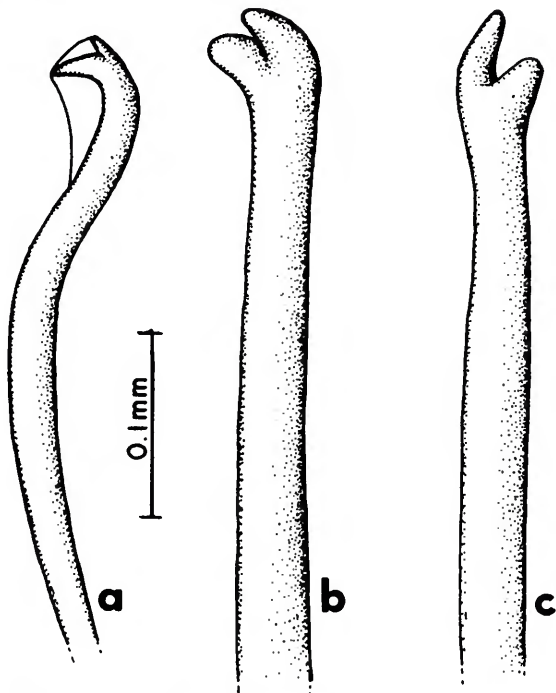


FIGURE 7.—*Polydora tetrabanchia*: a, Hooded hook; b, c, heavy modified spines of setiger 5.

capillary notosetae occur in setigers 2-4, 6, and succeeding segments. The neuropodia of setigers 1-4 and 6 contain winged capillary setae. Hooded hooks begin on setiger 7 with no more than three hooks per segment. They have the main fang bent at nearly a right angle to the recurved shaft (Figure 7a).

The modified spines of setiger 5 are distally bifid, with two large teeth (Figure 7b-c). There are usually two or three spines in each parapodium, accompanied by slender pennoned setae.

The pygidium is a simple, collar-like ring.

Branchiae begin on setiger 7 and usually number only four pair.

**DISTRIBUTION AND ECOLOGY.**—*Polydora tetrabanchia* bores in shell fragments and is known only from Beaufort, North Carolina.

#### *Polydora caulleryi* Mesnil

##### FIGURE 8

*Polydora caulleryi* Mesnil, 1897, pp. 88-89, pl. 3: figs. 12-14.—Southern, 1914, p. 104.—McIntosh, 1915, pp. 210-212, pl.

100: fig. 8, pl. 106: fig. 5.—Fauvel, 1927, pp. 54-55, fig. 19f-h.—Hartman, 1951, pp. 83-84; 1965, pp. 149-150, pl. 28: figs. b-d.—Pettibone, 1954, pp. 282-284, fig. 32f-g.—Hannerz, 1956, pp. 123-126, figs. 43-44.—Eliason, 1962, p. 53.—Blake, 1969b, p. 52, fig. 38.  
*Polydora carazzi* McIntosh, 1909, pp. 172-173, pl. 5: figs. 4-6.  
*Polydora brachycephala* Hartman, 1936, pp. 48-49, figs. 3-5; 1941, p. 307; 1944, p. 238; 1954, p. 10; 1961, p. 29; 1969, figs. 1-3.—Filice, 1958, p. 190.—Reish, 1959, pp. 38, 61, 67, 70, 75; 1964b, pp. 86-92.

**MATERIAL EXAMINED.**—Maine (Damariscotta River), Connecticut (Noank), Massachusetts (Cape Cod Bay, coll. SEP), California (Dillon Beach, coll. K. H. Woodwick), Sweden (Kattegatt, NMGS).

**DESCRIPTION.**—Largest specimens measure 50 mm in length, are 2.2 mm wide, and have over 150 segments. Rust colored pigmentation has been observed dorsally on the anterior segments of some specimens. The color in life is light tan with prominent red blood vessels. A female which had recently spawned was yellow.

The anterior end is prominently wedge-shaped (Figure 8a). The prostomium is deeply incised anteriorly with two rounded lobes. The caruncle extends back through setigers 3 or 4. Eyes are present or absent; if present, a small oval pair lies posterior to a more widely spaced cup-shaped pair. Palps are slender.

Setigers 1-4 have flattened, bladelike parapodial lobes, the notopodial lobes being somewhat auriculate (Figure 8b, h, i). The notosetae of setiger 1 are short, slender capillaries (Figure 8h) while those of setigers 2-4 are long, slender, winged capillaries (Figure 8i). Setiger 6 and succeeding segments contain notopodial fascicles of long, winged capillary setae. In far posterior segments, the capillary notosetae are replaced by a curved row of stout, sharply pointed spines (Figure 8g). Neurosetae of setigers 1-4 and 6 are long, slender capillaries. Bidentate hooded hooks begin on setiger 7, accompanied by a tuft of capillary setae. The hooks are recurved, with a main fang at nearly right angles to the shaft and have a smaller secondary tooth (Figure 8f). There are about 13 hooks on anterior setigers, the number gradually diminishing until in far posterior segments only about 5 can be found in a parapodium, accompanied by one or two capillary setae.

Setiger 5 is large, with a heavy musculature, overlapping setiger 6. The characteristic large, bushy-topped modified spines are arranged in an

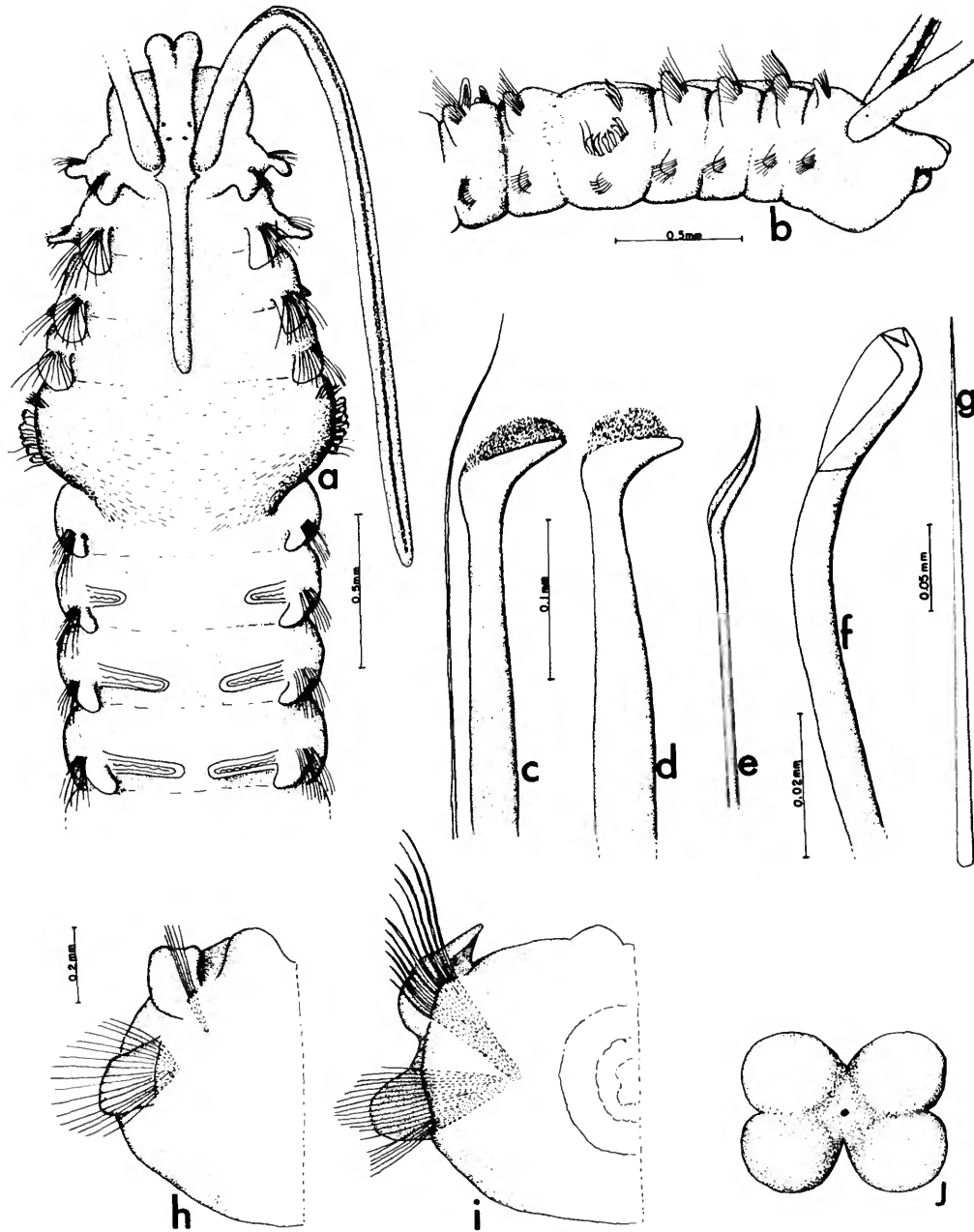


FIGURE 8.—*Polydora caulleryi*: a, Anterior end in dorsal view; b, anterior end, lateral view; c, heavy modified spine and companion capillary seta of setiger 5; d, heavy spine of setiger 5; e, dorsal seta of setiger 5; f, hooded hook; g, posterior notopodial spine; h, parapodium of setiger 1, anterior view; i, parapodium of setiger 3, anterior view; j, pygidium, posterior view.



anteriorly elevated semicircle, accompanied by a few very fine, capillary companion setae (Figure 8c, d). A vertical row of dorsal, winged setae is located anterior to and above the heavy spines (Figure 8e). The neurosetae consist of a tuft of curved capillary setae.

Branchiae begin on setiger 7, being small at first and reaching full size on setiger 11. They are absent from the last third of the body.

The pygidium consists of four equal lobes (Figure 8j).

REMARKS.—The synonymy of *Polydora caulleryi* and *P. brachycephala*, proposed by Pettibone (1954), is herein supported. California specimens possess posterior spines and agree in other respects with New England representatives. Specimens from the Kattegat (Sweden) did not differ from American material. Pelagic larvae obtained in New England waters agree well with those described by Hannerz (1956) from Sweden (Blake, 1969b).

DISTRIBUTION AND ECOLOGY.—*Polydora caulleryi* occurs in Europe, New England, Alaska and California. It ranges from low intertidal (Pettibone, 1954; personal observations) to continental shelf depths of 200 meters (Hartman, 1965).

### *Polydora quadrilobata* Jacobi

#### FIGURE 9

*Polydora quadrilobata* Jacobi, 1883, pp. 1-37, 2 pls.—Mesnil, 1897, pp. 87-88, pl. 3: figs. 9-11.—McIntosh, 1909, pp. 170-172, pl. 5: figs. 2-3; 1915, p. 236, pl. 98: figs. 13, 17, pl. 106: fig. 4.—Eliason, 1920, pp. 45-46; 1962, p. 52.—Fauvel, 1927, p. 52, figs. 18 l-n.—Annenkova, 1931, pp. 203-205; 1932, p. 139, figs. 6-9.—Procter, 1933, p. 142.—Friedrich, 1938, p. 133.—Berkeley and Berkeley, 1943, p. 130; 1954, p. 464.—Uschakov, 1955, p. 273, figs. 94a-d; 1965, p. 250, fig. 94a-d.—Rasmussen, 1956, p. 64.—Hannerz, 1956, pp. 122-123.—Hempel, 1957a, pp. 276-278; 1957b, pp. 100-135, fig. 5.—Hartman, 1961, p. 29; 1969, pp. 145-146, 4 figs.—Khlebovitch, 1961, p. 201.—Jones, 1961, p. 288.—Blake, 1969b, pp. 37-51, figs. 27-37.

*Polydora tubifex* Verrill, 1885b, pp. 438-439.—Sumner et al., 1913, p. 624.

*Polydora littorea*.—Hartman, 1944, pl. 18: fig. 9. Not Verrill, 1881.

MATERIAL EXAMINED.—Maine (Cobscook Bay; Lamoine Beach; Damariscotta River), Connecticut (Noank), Sweden and Denmark (NMGS).

DESCRIPTION.—Individuals measure up to 15 mm in length and have about 70 segments. The anterior

end has brown, reticulated pigmentation dispersed on the sides of the peristomium and on the anterior and posterior margins of setigers 1-7. The intensity of the pigmentation varies between individuals, but has been found in some degree on all specimens examined from New England. The color in life is light tan, with red blood prominent in the branchiae, palps, and blood vessels.

The prostomium is distinctly bifid on its anterior margin and continues posteriorly as an indistinct caruncle to about the middle of setiger 3 (Figure 9a). Four to six eyes are present in nearly a straight transverse line. The two outer pairs may be fused into a single mass. The palps are long and flexible, with a prominent ciliated groove.

Setiger 1 has capillary notosetae and neurosetae (Figure 9b). Setigers 2-4 and 6 have neuropodial fascicles of finely-winged, capillary setae. The notosetae of setigers 2-4 are winged capillaries (Figure 9c). Bidentate hooded hooks begin on setiger 7 (Figure 9i) and are accompanied by two or three fine capillary setae. There are usually no more than three or four hooks in any one parapodium. The notosetae of setiger 6 and succeeding setigers include fascicles of winged capillaries. The number of capillary notosetae diminishes in the middle segments, and they are completely replaced by heavier, sharply pointed spines in far posterior segments. These spines are disposed in a semicircular arrangement and give the posterior end a spinous appearance (Figure 9j-k).

Setiger 5 lacks parapodial lobes and has three types of setae (Figure 9d). The dorsal setae consist of a horizontally curved row of heavy, modified spines (Figure 9e, f) and a vertical curved row of shorter limbate setae (Figure 9g, h) located at the anterior end of the horizontal row, resulting in a J-shaped arrangement when the specimen is viewed from the sides. The heavy spines have a unique structure (Figure 9e, f). The distal end curves and is bifurcated at the tip, forming two nearly equal teeth between which is located a fine bushy tuft. When worn, the teeth and tufts may be reduced. A small fascicle of winged setae is located ventral to the modified spines.

Branchiae begin on segment 7. They are short and stubby, not reaching full size until setiger 12 or 13. They are absent from the posterior third of the body.

The pygidium has four subequal lobes (Figure

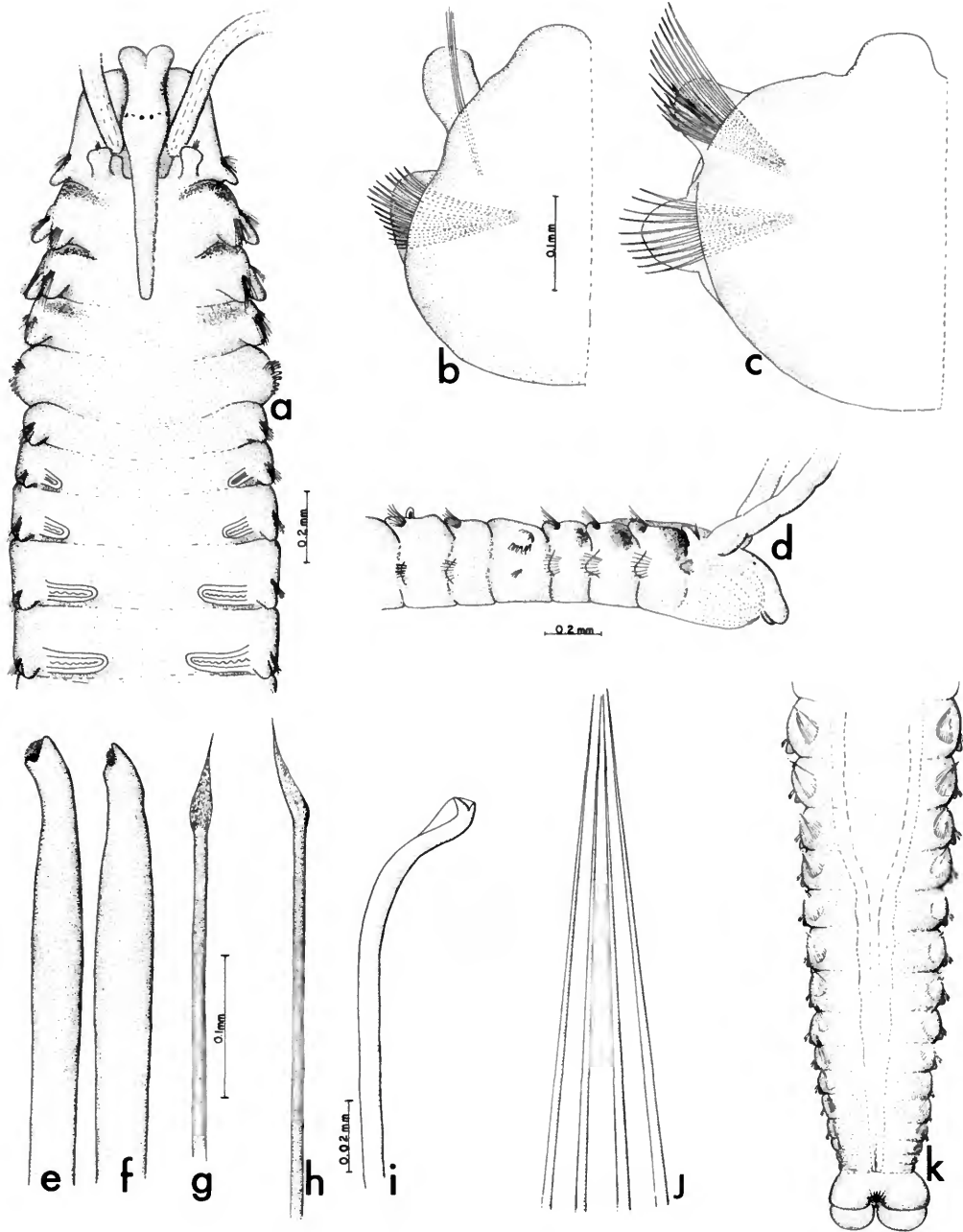


FIGURE 9.—*Polydora quadrilobata*: a, Anterior end, dorsal view; b, setiger 1, anterior view; c, setiger 3, anterior view; d, anterior end, lateral view; e, f, heavy spines of setiger 5; g, h, limbate setae of setiger 5; i, hooded hook; j, posterior notopodial spines; k, posterior end, dorsal view.

9*k*). When seen on living specimens under reflected light, they are white.

REMARKS.—Söderström (1920) considered *P. quadrilobata* to be a juvenile of *P. caulleryi*. This synonymy has not been supported by subsequent workers. There is no question, however, that the two species are closely related. A comparison between European and American specimens of *P. quadrilobata* revealed no morphological differences.

*Polydora tubifex* Verrill (1885b) is here referred to *P. quadrilobata*. The original description was incomplete and no setal details were given. The description as given by Verrill, would apply to several species. The eyes were said to be nearly in a straight line; the "caudal appendage" was small and consisted of four short lobes; and the anterior segments had "greenish-black" marks between segments. *Polydora quadrilobata* is the only species uncovered to date in New England to which this combination of characteristics agrees. J. Percy Moore (MS) described and figured *P. tubifex*. His description, however, differs markedly from that given by Verrill. Moore's specimen in the Academy of Natural Sciences of Philadelphia was examined. Consisting of a single specimen in two parts, it agreed with Moore's description but clearly belonged to *Polydora commensalis*.

ECOLOGY.—*Polydora quadrilobata* is a common species in New England. It is easily collected intertidally at Lamoine Beach and Cobscook Bay State Parks (Maine) where it occurs in sandy mud. At Noank, Connecticut, the species is abundant off the pier at the Marine Research Laboratory of the University of Connecticut, where it occurs in silty mud. The tubes stand erect in the substrate, are rusty colored, and are formed of fine silt. The species is usually associated with other spionids, maldanids, and sabellids. It was dredged in 10–12 meters in Clark Cove on the Damariscotta River, Maine, where it occurs in muddy substrate and is associated with *Polydora socialis* and a sabellid, *Laonome* sp.

DISTRIBUTION.—Europe, eastern Canada, New England, southern California, western Pacific.

### *Polydora colonia* Moore

#### FIGURE 10

*Polydora colonia* Moore, 1907, pp. 199–201, pl. 15: figs. 18–23.  
—Sumner, et al., 1913, p. 625.—Annenkova, 1938, p. 178.—

Hartman, 1945, pp. 32–33.—Ushakov, 1955, p. 273, fig. 94*g–j*; 1965, p. 252, fig. 94*g–j*.

*Polydora ancestrata* Jones, 1962, pp. 185–187, figs. 55–65.

*Polydora hoplura inhaca* Day, 1957, p. 99, fig. 6*k–l*; 1967, p. 468, fig. 18.2*n*.

MATERIAL EXAMINED.—Massachusetts (Holotype, ANSP 2324, Woods Hole; Hadley Harbor), North Carolina (Beaufort, AHF 1546), Jamaica (paratypes of *P. ancestrata*, in the collections of Keith H. Woodwick).

DESCRIPTION.—*Polydora colonia* is a small species, measuring up to 5 mm in length and having about 35 segments. The prostomium appears anteriorly rounded in preserved specimens (Figure 10*a*). In life it is seen to have a slight anterior bifurcation, which is turned under when preserved. The caruncle extends to setiger 2. The palps are short and reach posteriorly to setigers 8 or 9. Eyes and other body pigmentation are lacking (Figure 10*a*).

Setiger 1 contains only capillary neurosetae. The neurosetae of setigers 2–4 and 6 are short, winged capillaries. Hooded hooks begin on setiger 7. They are bidentate with a large fang and small secondary terminal tooth; the shaft has a constriction (Figure 10*g*). The notosetal fascicles of setigers 2–4, 6 and succeeding segments contain long capillary setae. The notosetae diminish in number in posterior segments and, in the last six or seven segments, are accompanied by one or two specialized hooks (Figure 10*l*). The more anterior hooks are slender (Figure 10*h, i*) and not as curved as those which follow (Figure 10*j, k*). The latter are recurved and falcate.

Setiger 5 is larger than the preceding and succeeding setigers. The modified spines are bifid, with two unequal teeth and a subterminal collar extending halfway around the spine (Figure 10*d–f*). Alternating with the three or four large spines are pennoned companion setae (Figure 10*c*). There is a small bundle of slender, winged, dorsal setae located above the modified spines (Figure 10*b*). A ventral tuft of three or four winged capillary setae is also present.

Branchiae begin on setiger 7, continuing through the middle segments; they are absent from the posterior one-half of the body. They are small and do not overlap dorsally (Figure 10*a*).

The pygidium consists of a flattened disk, the sides of which gradually merge into the last segment, leaving a wide dorsal gap (Figure 10*l*).

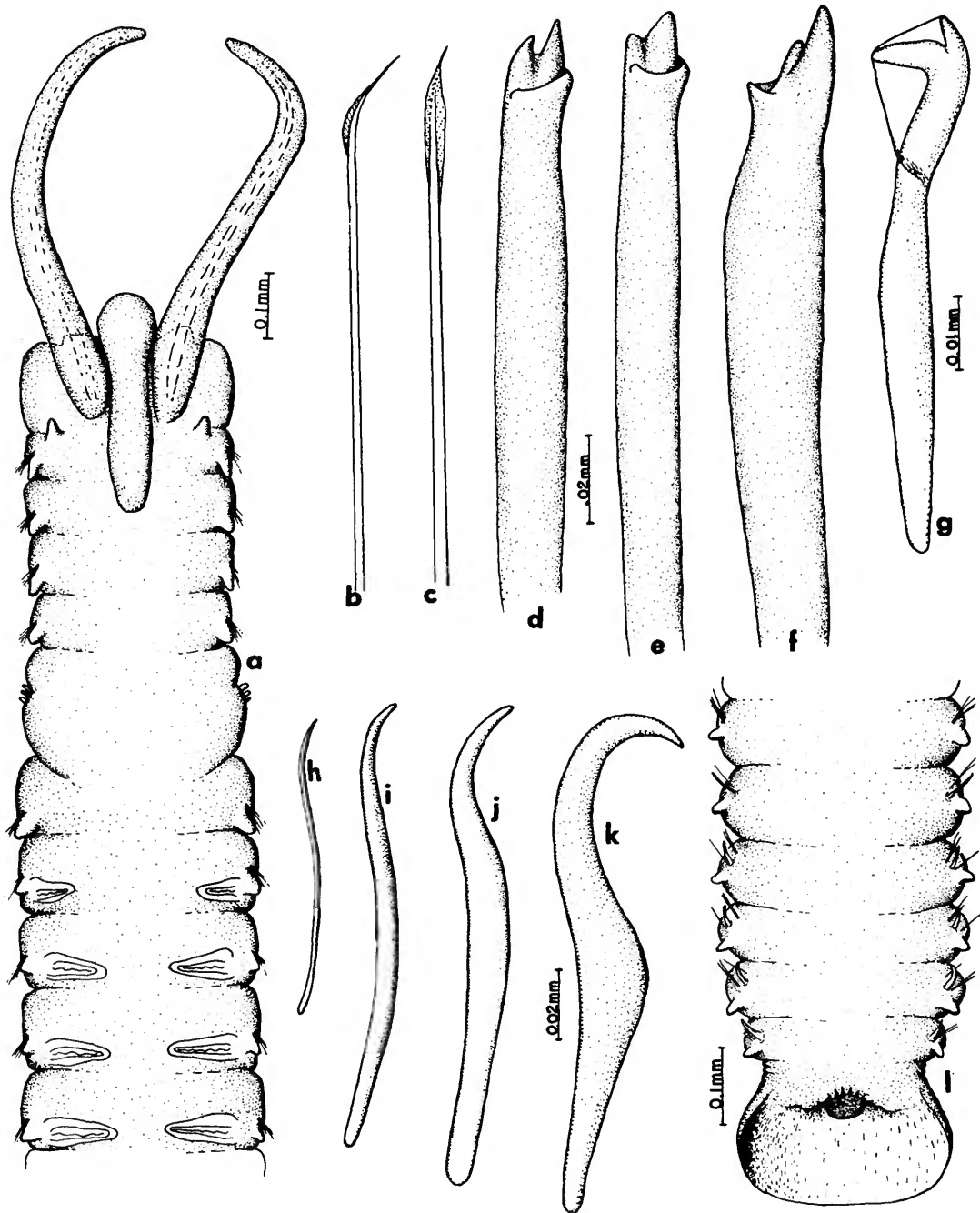


FIGURE 10.—*Polydora colonia*: a, Anterior end, dorsal view; b, superior dorsal seta of setiger 5; c, pennoned companion seta of setiger 5; d-f, heavy spines of setiger 5 in different views, g, hooded hook; h-k, posterior notopodial hooks representing a sequential change in structure on progressively more posterior segments; l, posterior end, dorsal view.

**REMARKS.**—*Polydora ancistrata* Jones is herein referred to *P. colonia* Moore. The differences between the two species, as discussed by Jones (1962), have not been substantiated by recent, well-preserved material collected from the type locality of *P. colonia* (Woods Hole, Massachusetts). *Polydora hoplura inhaca* Day (1957) also belongs in the synonymy, as suggested in a footnote by Day (1967).

The species most closely related to *P. colonia* is *P. spongicola* Berkeley (emend. Woodwick, 1963). The specimens of the latter from California and Mazatlán, Mexico (courtesy of Dr. Keith H. Woodwick) were examined by the writer. In *P. spongicola* the specialized spines of setiger 5 have a large terminal tooth surrounded by a flange, while in *P. colonia* there are two teeth surrounded by a collar.

**ECOLOGY.**—*Polydora colonia* inhabits tubes within sponges, forming compact, soft masses attached to pilings and rocks in areas of water movement.

**DISTRIBUTION.**—Massachusetts to North Carolina, Jamaica, South Africa, northwest Pacific.

### *Polydora commensalis* Andrews

#### FIGURE 11

*Polydora commensalis* Andrews, 1891a, pp. 25–35, 2 pls.—1891b, pp. 291–292, pl. 15: fig. 27.—Cowles, 1930, p. 344.—Berkeley and Berkeley, 1936, pp. 469–471; 1952, pp. 18–19, figs. 29–30.—Annenkova, 1938, p. 178, fig. 14.—Hartman, 1941, p. 308; 1945, p. 32; 1961, p. 29; 1969, pp. 133–134, 4 figs.—Rioja, 1943, p. 229.—Hartman and Reish, 1950, p. 28.—Uschakov, 1955, p. 272, fig. 93; 1965, p. 250, fig. 93.—Wells and Gray, 1964, p. 73.—Hatfield, 1965, pp. 356–368, figs. 1–5.—C. Berkeley, 1968, p. 560.—Blake, 1969a, pp. 815–816, fig. 3; 1969b, pp. 21–24, figs. 16–18.

*Polydora* sp. Berkeley, 1927, p. 420.

*Polydora ciliata brevipalpa* Zaks, 1933, p. 129.

**MATERIAL EXAMINED.**—Maine (Damariscotta River), Massachusetts (Cape Cod Bay, coll. SEP; North Falmouth, as *P. tubifex* coll. J. P. Moore, ANSP 1516), Connecticut (Noank), North Carolina (Beaufort).

**DESCRIPTION.**—Specimens measure up to 30 mm in length, are 2.5 mm in width, and have over 100 segments. The prostomium is rounded or weakly emarginate on its anterior margin; the entire head is usually contracted into the first setiger (Figure 11a). There is no caruncle. Four small eyes are arranged in a nearly straight line. The palps are unusually short and covered with numerous, fine

papillae, each with a sensory hair. The color in life is dark tan with a greenish cast on numerous segments. Red blood vessels are prominent.

Setigers 1–4 have well-developed noto- and neuropodial lobes with fascicles of long capillary setae (Figure 11a). Setigers 3 and 4 have some additional short capillary notosetae. Bidentate hooded hooks begin on setigers 12–17 (rarely 10–17). The hooks are accompanied by a few capillary neurosetae. The hooks have a main fang surmounted by a shorter secondary tooth (Figure 11d). The secondary tooth is reduced in hooks from far posterior setigers and, when viewed from certain angles, is difficult to see (Figure 11e). There are 5 or 6 hooks in anterior setigers, increasing to about 13 in middle setigers, and reduced to 4 or 5 posteriorly.

The setae of setiger 5 are modified to include a row of large curved spines and a small tuft of capillary neurosetae. The heavy spines have a characteristic long lateral flange or sheath (Figure 11b, c).

Branchiae are long and straplike, with membranous margins. They begin on setiger 6 and continue to the end of the body.

The posterior end of the animal is dorsoventrally flattened (Figure 11f). The anus is surrounded by a ring of small papillae, the number of which is variable, depending upon the age of the animal. In young juveniles 4 papillae may be present, increasing to 14 in the largest adults. An intermediate stage with 8 papillae is shown in Figure 11f.

**REMARKS.**—*Polydora commensalis* deviates widely from other species of the genus and should be removed from *Polydora*. However, the writer has knowledge of two undescribed species in California which appear to be closely related to *P. commensalis*. Until these new collections are studied in detail, the generic placement of *P. commensalis* had best be delayed.

The specimens, identified as *P. tubifex* Verrill and described by Moore (MS), were examined and found to be *P. commensalis* (ANSP 1516). *Polydora tubifex* Verrill (1885b) is here (p. 13) referred to *P. quadrilobata*.

**ECOLOGY.**—*Polydora commensalis* is known only from shells containing hermit crabs. In Maine, the mollusc shells include *Littorina littorea* and *Thais lapillus*, occupied by the hermit crab *Pagurus longicarpus*. Shells covered with the hydroid *Hydractinia echinata* appear to have a higher infestation of *P. commensalis*.

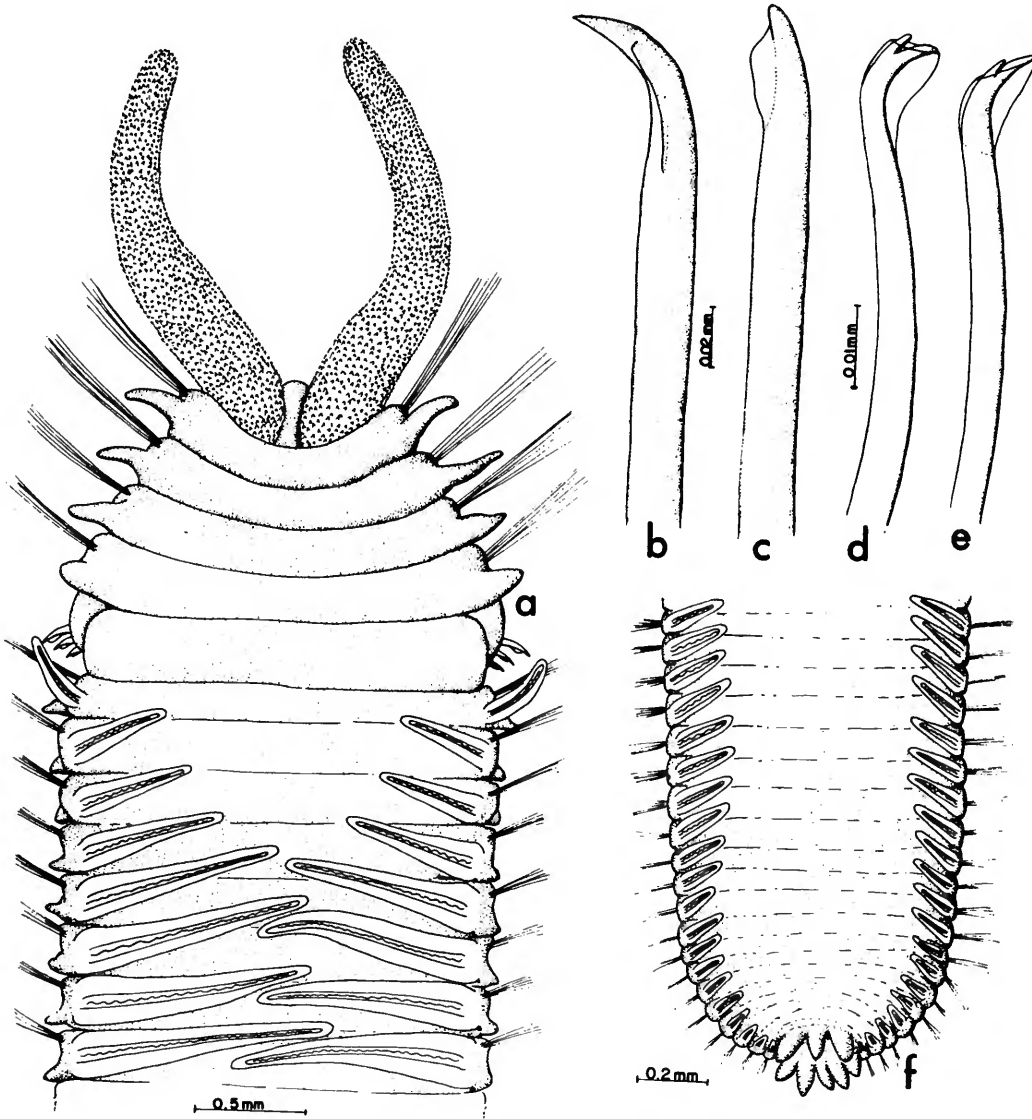


FIGURE 11.—*Polydora commensalis*: a, Anterior end, dorsal view; b, c, heavy spines of setiger 5; d, e, hooded hooks; f, posterior end, dorsal view.

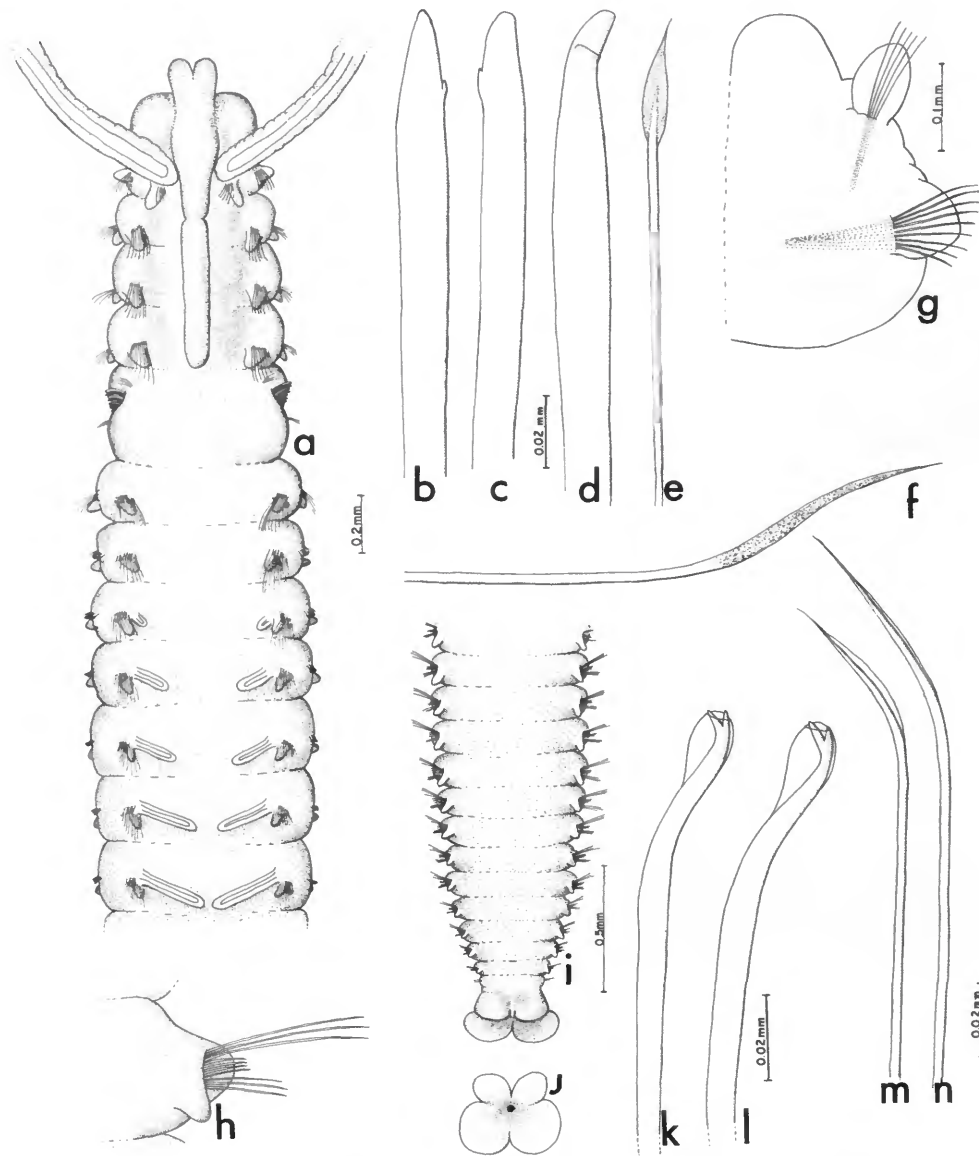


FIGURE 12.—*Polydora concharum*: a, Anterior end, dorsal view; b-d, heavy spines of setiger 5 in different views; e, pennoned companion seta of setiger 5; f, superior dorsal geniculate seta of setiger 5; g, setiger 1, anterior view; h, posterior setiger, dorsal view (not to scale); i, posterior end, dorsal view; j, pygidium, posterior view; k, l, hooded hooks; m, n, winged capillary notosetae.

DISTRIBUTION.—East and west coasts of North America; North Japan Sea.

*Polydora concharum* Verrill

FIGURE 12

*Polydora concharum* Verrill, 1880, pp. 174–176.—Webster and Benedict, 1884, p. 729; 1887, p. 737.—Sumner, et al., 1913, p. 624.—Procter, 1933, p. 142.—Hartman, 1942, pp. 64–66, figs. 121–123; 1944, pp. 336–340, pl. 19: fig. 10 (not fig. 8).—Evans, 1969, pp. 775–782.—Blake, 1969a, p. 816, fig. 4; 1969b, pp. 32–36, figs. 23–26.  
*Dipolydora concharum*.—Verrill, 1881, p. 320; 1885a, p. 688, pl. 43: fig. 186.

MATERIAL EXAMINED.—West Greenland (*Hero* Station 29F), Newfoundland (St. Mary's Bay, 10–20 meters, coll. J. W. Evans), Maine (Damariscotta River; Gulf of Maine, Types YPMNH 2687), Massachusetts (Cape Cod Bay, coll. SEP).

DESCRIPTION.—*Polydora concharum* is a long, slender species reaching lengths up to 140 mm and having over 300 segments. In life it is light tan with red branchiae and blood vessels. Juveniles have been found to retain larval pigment for a time after metamorphosis. In adults the body is largely colorless, although some specimens have been found with a line of dark pigment on the anterior borders of some segments, first appearing in setiger 6.

The prostomium is distinctly bifid on the anterior margin. The caruncle continues posteriorly as a low ridge to the anterior border of setiger 5 (Figure 12a). Eyes are either present or absent; when present, there are four in a trapezoidal arrangement. The palps are relatively short in comparison to the length of the animal and extend posteriorly for only 15 to 20 segments.

Setiger 1 has both noto- and neurosetae (Figure 12g). The former are fine capillaries, while the latter consists of winged capillaries. Setigers 2–4 have well developed postsetal lobes and large spreading fascicles of winged capillary noto- and neurosetae. Notosetae of setiger 2 are arranged in two successive rows, while those of setigers 3, 4, 6, and those immediately following have notosetae in three rows, those of each successive row being longer (Figure 12m, n). Notosetae from more posterior setigers lack wings; they are represented by three sizes of straight capillary setae (Figure 12h). The winged neurosetae of setigers 2–4 and 6 are arranged in two rows. Bidentate hooded hooks (Fig-

ure 12k, l) begin on setiger 7 and are accompanied by two or three capillary setae.

Setiger 5 is larger than preceeding and succeeding setigers. The setae are arranged in three bundles: a group of geniculate setae (Figure 12f) located anterior and dorsal to a semicircular row of large heavy spines (Figure 12b–d), alternating with smaller pennoned companion setae (Figure 12e); and a small tuft of ventral winged neurosetae. The heavy spines have a weakly-developed accessory shelf, horizontal to the main shaft. The structure was not observed by Verrill (1880) or Hartman (1942).

Branchiae begin on setigers 7–9. They are small anteriorly, reaching full size on setiger 11 or 12 and are absent from the posterior half of the body.

The pygidium is small and has four lobes, the dorsal pair being smaller than the ventral pair (Figure 12i, j).

ECOLOGY AND DISTRIBUTION.—Cape Cod, Massachusetts, to Newfoundland, in dredged shells and decayed wood; West Greenland.

*Polydora socialis* (Schmarda)

FIGURES 13, 14

*Leucodora socialis* Schmarda, 1861, p. 64, figs. a–c, pl. 26: fig. 209.  
*Polydora socialis*.—Mémil, 1896, pp. 193–194, pl. 12: figs. 30–32.—Ehlers, 1901, p. 165.—Hartman, 1941, pp. 310–311, pl. 48: figs. 41–42; 1945, pp. 33–35; 1948, p. 37; 1951, p. 83; 1953, pp. 43–44; 1961, p. 29; 1966a, p. 19, pl. 19: figs. 1–2; 1969, pp. 147–148, 2 figs.—Hartman and Reish, 1950, p. 28.—Rioja, 1943, p. 230.—Hartmann-Schröder, 1962, pp. 137–138, figs. 167–168; 1965, pp. 209–211, figs. 200–203.—Wells and Gray, 1964, p. 73.—Long, 1968, p. 348.—Blake, 1969a, pp. 816–817, fig. 5; 1969b, pp. 24–31, figs. 19–22.  
*Polydora socialis plena* Berkeley and Berkeley, 1936, pp. 468–469; 1952, p. 22.—Reish, 1968, p. 82.  
? *Polydora gracilis* Verrill, 1880, p. 174.

MATERIAL EXAMINED.—Maine (Damariscotta River), Massachusetts (Cape Cod Bay, coll. SEP), Connecticut (Mystic River), North Carolina (Beaufort), South Carolina (Charleston, coll. M. Chamberlain), California (Mugu Lagoon, AHF N1417; Cayucos), British Columbia (paratypes of *P. socialis plena*, USNM 32704), Chile (Lund University Chile Expedition 1947–48, deposited AHF).

DESCRIPTION.—Specimens of *Polydora socialis* from New England measure up to 55 mm in length and have over 400 segments. Individuals examined



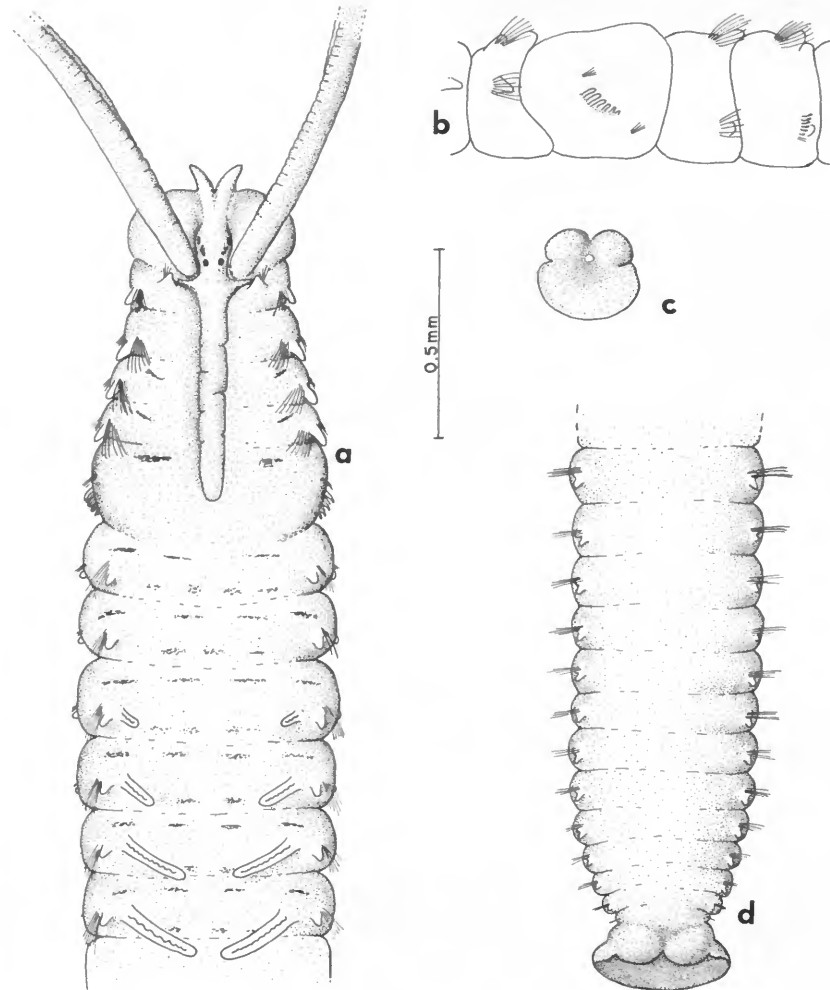


FIGURE 13.—*Polydora socialis*: a, Anterior end, dorsal view; b, diagram of setigers 4-7 in lateral view (not to scale); c, pygidium, posterior view; d, posterior end, dorsal view.

from North and South Carolina were not as large. Sexually mature females are orange. Larval pigmentation is retained on most adults (Figure 13a), including both dorsal and ventral bands.

The prostomium is deeply notched on its anterior margin. The caruncle extends to setigers 4-9. Eyes are present or absent; when present, they number four to six: a circular pair high up on the prostomial ridge, and more anterior second and third pairs, which may be fused laterally on the prostomial ridge (Figure 13a). The palps are long and prehensile in life; upon preservation, however, they

contract and extend posteriorly only to setigers 12-15.

Setiger 1 has capillary setae in both noto- and neuropodia (Figure 14a). Setigers 2-4, 6 and succeeding setigers have two types of posteriorly directed notosetae, an anterior row of short curved capillaries and a posterior row of long, stout capillaries. In far posterior setigers only a few laterally-directed capillary notosetae are present. The neuropodia of setigers 2-4 and 6 have posteriorly directed capillary setae. Bidentate hooded hooks begin on setiger 7. Two or three capillary setae ac-

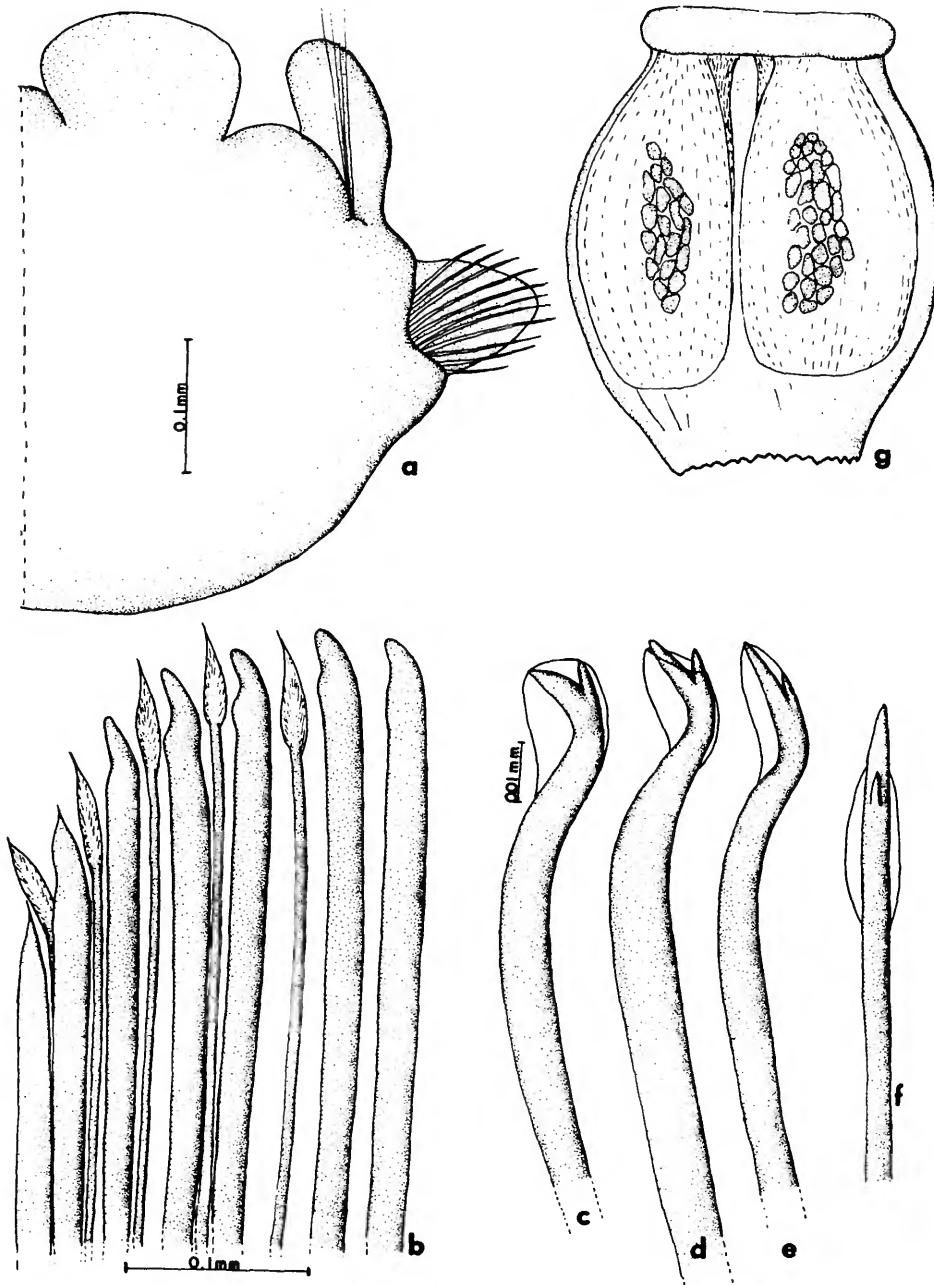


FIGURE 14.—*Polydora socialis*: *a*, Setiger 1, anterior view; *b*, fascicle of modified spines and pennoned setae from setiger 5; *c*, hooded hook from anterior setiger; *d*, hooded hook from median setiger; *e*, *f*, hooded hooks from posterior setigers; *g*, gizzard-like structure from an adult (not to scale).

company the hooks for several setigers, then disappear, and appear again in far posterior setigers. In anterior setigers, the hooks have a 45° angle between the main fang and the secondary tooth (Figure 14c). In posterior setigers, the main fang is longer and narrower, while the upper tooth is smaller and closely adhering to the shaft and diminishing the angle (Figure 14e).

Setiger 5 is large and well developed (Figure 13a, b). The setae include a small bundle of dorsal geniculate setae lying at the anterior end of a semicircular row of alternating heavy modified spines and smaller pennoned companion setae (Figure 14b). The heavy spines are falcate and have a subterminal protuberance. Ventral and posterior to the above is a small tuft of winged setae.

Branchiae begin on setiger 8 (rarely 7-9) and continue to near the posterior end.

The pygidium typically has a large ventral lobe and two small dorsal ones, with a dorsal gap (Figure 13c, d). In some specimens, however, the three lobes are continuous.

In *P. socialis* an unusual grinding apparatus has been observed between the esophagus and intestine. In young specimens, this "gizzard-like" structure is thin and transparent, consisting of four teeth, each with a central, inwardly directed cusp. In older specimens, the teeth are fragmented and lie as inclusions in four longitudinal muscles (Figure 14g). This structure is similar to one figured by Carazzi (1893) for *P. flava*.

**REMARKS.**—The type material of *P. socialis* (Schmarda) from Chile (Viña del Mar) was re-described by Mesnil (1896). Hartman (1941, 1948, 1961), Rioja (1943, 1947), and Hartman and Reish (1950) have extended the species range from Mexico to Oregon and Alaska. Hartman (1953, 1966a) has reported the species from the Falkland Islands. Records from eastern North America include Hartman (1945) and Wells and Gray (1964) from the Carolinas and Hartman (1951) from Florida. In each of these reports, the specimens lacked notosetae on setiger 1.

A new subspecies, *P. socialis plena*, was described by Berkeley and Berkeley (1936, 1952) from British Columbia. Reish (1968) reported *P. socialis plena* from Baja California. This subspecies differed in having notosetae on setiger 1. With the record of Reish, *P. socialis plena* overlapped the range of

*P. socialis* (sensu stricto), a fact which seemed unusual to this investigator.

Early in the present study it became apparent that all specimens of this species from the east coast of North America, from Maine to South Carolina, possessed notosetae on setiger 1, thus agreeing with the subspecies *plena*. Since the notosetae are small, it seemed possible that they had been overlooked in earlier east and west coast reports. During a visit to California, it was possible to examine specimens of *P. socialis* collected by Dr. Keith H. Woodwick from various California localities. All possessed notosetae on setiger 1. Collections in the Allan Hancock Foundation were also examined. The specimens which Hartman (1941) had reported from Mugu Lagoon, southern California, were found to have notosetae on setiger 1, as were specimens identified as *P. socialis* from the Lund University Chile Expedition (unpublished), now deposited in the Allan Hancock Foundation. Further, specimens of *P. socialis* from localities in Chile described by Hartmann-Schröder (1962, 1965) also possessed notosetae on setiger 1. The presence of notosetae on setiger 1 on all specimens from Chile to British Columbia, and from South Carolina to Maine eliminates the need for the subspecies *plena*.

The "gizzard-like" structure described above was found on all specimens examined and the structure of the modified spines of setiger 5 was found to be the same.

Specimens, described as *Polydora gracilis* Verrill by J. P. Moore (MS), were examined in the Philadelphia Academy of Natural Sciences. They agreed with *P. socialis*. Blake (1969a) placed *P. gracilis* in synonymy with *P. socialis* but this is at least questionable, since no type material of *P. gracilis* exists and the description is not adequate for specific determination.

**ECOLOGY.**—*Polydora socialis* constructs tubes in sediment and may form extensive beds (Hartman, 1941). In the Damariscotta River, Maine, *P. socialis* is found subtidally in sediment and to a lesser extent in shell. In the former, it forms tubes of silt with a firm mucoid lining, and is associated with *P. quadrilobata* and *Laonome* sp. In the latter it bores into shells of dead *Mercenaria* and living *Placopecten magellanicus* associated with *P. concharum* and *P. websteri*.

**DISTRIBUTION.**—East and west coasts of North America; Gulf of Mexico; Chile; Falkland Islands.

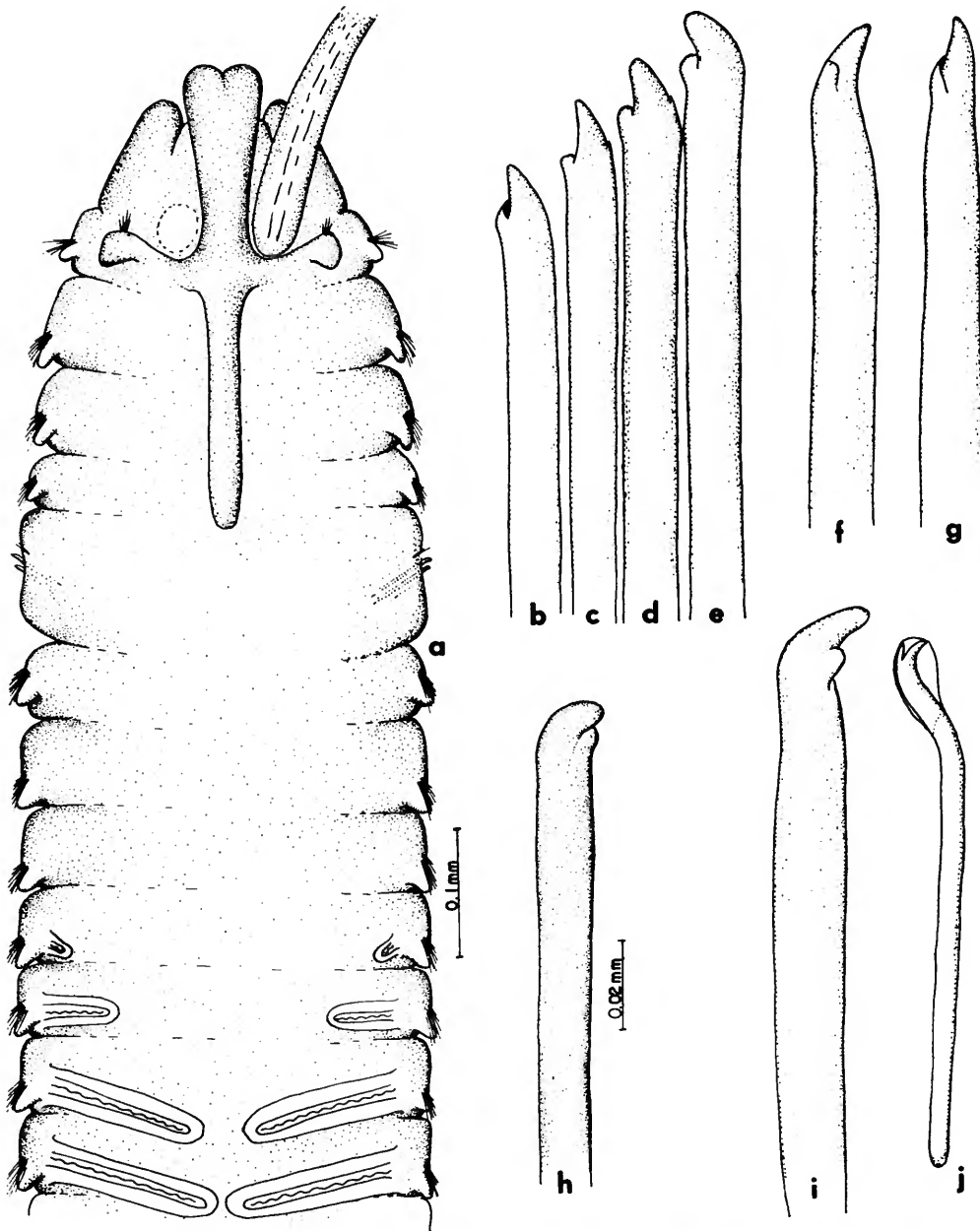


FIGURE 15.—*Polydora anoculata*: a, Anterior end, dorsal view; b–i, heavy modified spines of setiger 5 seen in different views and degrees of wear; j, hooded hook.

*Polydora anoculata* Moore

## FIGURE 15

*Polydora anoculata* Moore 1907, pp. 197-199, pl. 15:figs. 7-17, 23.—Sumner et al., 1913, p. 625.

**MATERIAL EXAMINED.**—Massachusetts (Cape Cod Bay, coll. SEP; Holotype, ANSP 2338).

**DESCRIPTION.**—*Polydora anoculata* is a thin, slender species measuring up to 20 mm in length and having about 100 segments. The prostomium is anteriorly bifurcated. Eyes are absent. The caruncle extends posteriorly to setiger 5 (Figure 15a).

Setiger 1 has both noto- and neurosetae. The former are thin, slender capillaries, while the latter have narrow wings. Setigers 2-4, 6 and succeeding setigers contain winged capillary notosetae. The slender capillary neurosetae of setigers 2-4, and 6 are almost completely replaced by hooded hooks on setiger 7. The hooks have a recurved shaft and no constriction (Figure 15f).

Setiger 5 contains three groups of setae: a bundle of pennoned dorsal setae anterior to a row of heavy spines alternating with pennoned companion setae, and a ventral tuft of delicate pennoned setae. The heavy spines have a lateral flange, which resembles a tooth when worn (Figure 15b-i). An additional small spur is occasionally seen on some spines.

Branchiae begin on setigers 9 or 10 (Figure 15a). They are small at first, attaining full size on setiger 11; they are absent from posterior setigers.

The pygidium is disklike, with a deep dorsal notch.

**REMARKS.**—*Polydora anoculata* resembles *P. giardi* Mesnil and *P. tridenticulata* Woodwick in branchial arrangement. It differs from the latter in the structure of the modified spines of setiger 5 (Woodwick, 1964). The differences between *P. giardi* and *P. anoculata*, however, have not been entirely resolved in the present study. Specimens labeled *P. giardi* were obtained from Europe, but they proved to be another species. It may be that the two species are conspecific. Additional material is needed for comparison.

**ECOLOGY.**—Moore (1907) reported *P. anoculata* associated with colonies of *Amaroecium pellucidum*, on piles among *Cynthia*, and in sponge together with *P. colonia*. In Cape Cod Bay it was found on a shell-gravel bottom.

**DISTRIBUTION.**—Known only from the Woods Hole region, Massachusetts.

*Polydora hartmanae*, new species

## FIGURE 16

*Polydora anoculata*.—Hartman 1945, p. 33. Not Moore 1907.

**MATERIAL EXAMINED.**—The specimens from Bogue Sound, near Beaufort, North Carolina, described by Hartman (1945) as *P. anoculata*, were reexamined. They proved to be an undescribed species. The holotype and one paratype are deposited in the Allan Hancock Foundation.

**DESCRIPTION.**—The types consist of two anterior ends and two posterior fragments, with the pygidium missing. One anterior end with 78 segments measured 10 mm in length.

The prostomium is distinctly bifid in its anterior margin, extending posteriorly as a low caruncle to setigers 4 or 5. Eyespots and nuchal tentacle are lacking. The peristomium is greatly enlarged on the lateral and anterior margins (Figure 16a).

Setiger 1 has fascicles of capillary setae in both the noto- and neuropodia. The neurosetae are finely unilimbate. Setigers 2-4 contain spreading fascicles of winged, capillary noto- and neurosetae. The notopodia of setiger 6 and succeeding setigers contain double fascicles of long and short, winged capillary setae, the number gradually diminishing posteriorly. No specialized posterior notosetae were observed. Bidentate hooded hooks begin on setiger 7, with 5 or 6 per neuropodium; they have a recurved shaft. The teeth are delicate and have a reduced angle between them. (Figure 16f).

Setiger 5 contains three groups of setae: a cluster of 4 or 5 large, geniculate setae (Figure 16k), located anterior and dorsal to a semicircular row of heavy spines (Figure 16b-h) alternating with pennoned companion setae (Figure 16i, j), and a small tuft of winged neurosetae below the large spines. The heavy spines are distally falcate, with a lateral flange, the latter being broken or worn on all except newly-formed spines. Tufts of fine hairs arise from the concavity separating the flange from the main fang and, to a lesser degree, on the exterior of the flange (Figure 16b-g).

Branchiae begin on setigers 11 and 12, being short and stubby anteriorly and reaching full size on about segment 16. They are absent from posterior segments.

The pygidial structure is unknown.

**REMARKS.**—*Polydora hartmanae* differs from

TABLE 1.—Some taxonomic characteristics of the species of *Polydora* from eastern North America

Species of	Branchiae:	Notosetae on first setiger	Modified posterior notopodial spines or hooks	Modified spines of 5th setiger	Eyes	Hooded hooks:	Pygidium	Other features
POLYDORA	a. begin on setiger b. on posterior segments					a. begin on setiger b. have constrict- ion on shaft		
aggregata	a. 7 b. absent on posterior half	absent	absent	falcate, with accessory knob	4	a. 7 b. present	disk-like	pigmented pattern in anterior region
anoculata	a. 9-10 b. absent on posterior half	present	absent	falcate, with accessory flange	0	a. 7 b. absent	disk-like	-
caulleryi	a. 7 b. absent on posterior third	present	awl-shaped spines	falcate, with bushy top	0-4	a. 7 b. absent	4 equal lobes	-
colonia	a. 7 b. absent on posterior half	absent	falcate recurved hooks	bifid tip, with sub- terminal collar	0	a. 7 b. present	disk-like	-
commensalis	a. 6 b. present	present	absent	falcate, with long accessory sheath	4	a. 10-17 b. absent	4-14 papillae	commensal in gastropod shells occupied by hermit crabs; palps short
concharum	a. 7-9 b. absent on posterior half	present	absent	falcate, with lateral sheath	0-4	a. 7 b. absent	4 lobes, dorsal pair smaller than ventral pair	comparatively long species; 3 sizes of posterior capillary notosetae
hartmanae	a. 11-12 b. absent	present	absent	falcate, with lateral flange and fine hairs	0	a. 7 b. absent	?	-
ligni	a. 7 b. present	absent	absent	falcate, with small accessory tooth	4	a. 7 b. present	disk-like	nuchal tentacle present
quadrilobata	a. 7 b. absent on posterior third	present	awl-shaped spines	bifid tip, with fine hairs be- tween teeth	4-6	a. 7 b. absent	4 subequal lobes	pigmented pattern in anterior body region
socialis	a. 8 (rarely 7-9) b. absent on last segments	present	absent	falcate, with sub- terminal boss	0-6	a. 7 b. absent	3 lobes or disk-like	gizzard-like struc- ture present; larval pigment re- tained on adults
tetrabranchia	a. 7 b. absent from setiger 11	absent	absent	bifid tip, with 2 large teeth	4	a. 7 b. absent	collar-like	very small species
websteri	a. 7 b. absent	absent	absent	falcate, with lateral flange or sheath	4	a. 7 b. present	disk-like	-

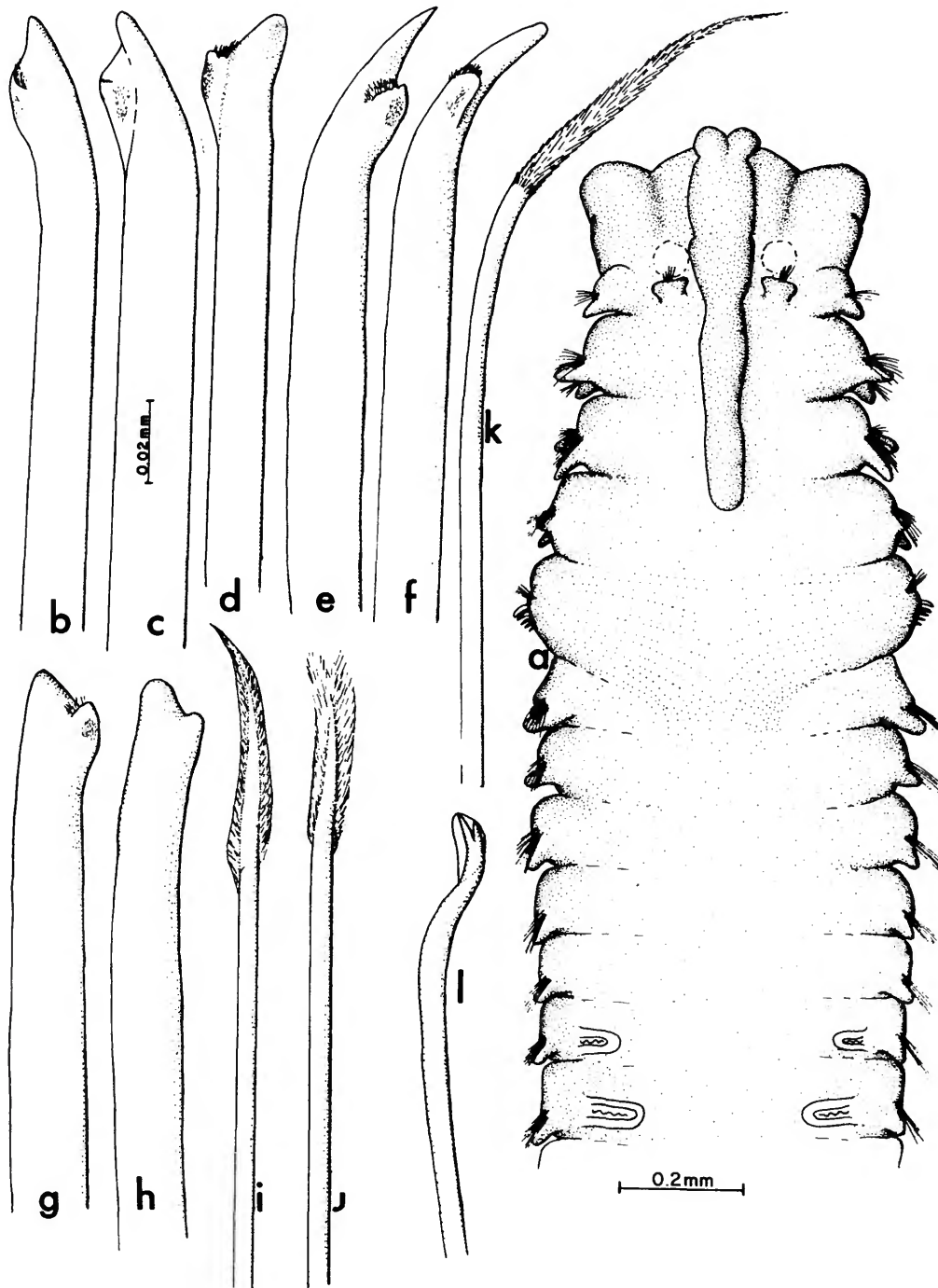


FIGURE 16.—*Polydora hartmanae* new species: a, Anterior end, dorsal view; b-h, heavy modified spines of setiger 5 seen in different views and degrees of wear; i-j, companion setae of setiger 5; k, dorsal geniculate seta of setiger 5; l, hooded hook.

other species in the structure of the modified spines of setiger 5.

**DISTRIBUTION AND ECOLOGY.**—The species is known only from North Carolina. It was reported by Hartman (1945, p. 33) as being “. . . dredged from a bottom of broken shell fragments.” It is not known whether the species actually bored into the shells or inhabited sediment.

### Summary

Twelve species of *Polydora* have been identified from collections obtained from various localities along the east coast of North America. A key to the species, descriptions and figures are included. The adults of *P. aggregata* are described for the first time. *Polydora hartmanae* is new to science. New synonymies include *P. littorea* Verrill, referred to *P. ligni* Webster, *P. tubifex* Verrill, referred to *P. quadrilobata* Jacobi, and *P. anastrata* Jones, referred to *P. colonia* Moore.

Four species to date have been reported only from eastern North America: *Polydora aggregata* from Maine, *P. hartmanae* and *P. tetrabanchia* from North Carolina and *P. anoculata* from Massachusetts. *Polydora concharum* ranges from New England to Newfoundland and West Greenland. Each of these species may be expected to have a wider range when additional collections become available. The other seven species of *Polydora* have a wider distribution.

Five species were found boring into shells or other calcareous structures: *P. commensalis*, *P. concharum*, *P. socialis*, *P. tetrabanchia* and *P. websteri*. Five species were found in sediment: *P. aggregata*, *P. caulleryi*, *P. ligni*, *P. quadrilobata* and *P. socialis*. The latter species is found in both sediment and shell. *Polydora colonia* is found in sponges, while *P. anoculata* occurs in association with tunicates and sponges.

Some taxonomic characteristics of the twelve species are summarized in Table 1.

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