

## TWO NEW GENERA OF DEEP-SEA POLYCHAETE WORMS OF THE FAMILY AMPHARETIDAE AND THE ROLE OF ONE SPECIES IN DEEP-SEA ECOSYSTEMS

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*Abstract.*—Two new ampharetid genera, *Decemunciger* and *Endecamera*, each with one new species, *D. apalea* and *E. palea*, are described from wood panels placed on the deep-sea floor by Turner (1973). The role of *Decemunciger* in deep-sea ecosystems is discussed.

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Recently, I examined a collection of ampharetid polychaetes removed from pieces of wood collected by R. D. Turner, using the submersible DSRV *Alvin*, from four experimental bottom stations in the North Atlantic, at depths ranging from 1830 to 3995 meters. The wood had been placed at these sites by Turner to study molluscan wood borers, and to “test the hypothesis that wood is an important source of nutrients and contributes to diversity in the deep sea” (Turner 1977:18).

Bivalve molluscs of the subfamily Xylophaginae (Family Pholadidae, Genera *Xyloredo* and *Xylophaga*) mechanically excavate burrows in wood (Turner 1973, 1977). The bivalves ingest wood particles, making wood by-products available within fecal pellets as food for detritus consumers. Adult and juvenile bivalves may be consumed by a variety of predators such as galatheid crabs. Turner (1977) suggests that young galatheid crabs may feed on recently settled *Xylophaga* larvae and, later, on larger invertebrates including adult borers. Stomach contents of older crabs contained sponge spicules, small pieces of wood, a nematode and polychaete setae (Turner 1977). Other groups in this deep-sea food chain include several families of polychaete worms, brittlestars, small sea urchins and predatory gastropods (Turner 1977).

Two new genera from the family Ampharetidae, each with one new species, have been found among the ampharetids associated with Turner's wood panels. The external anatomy of these ampharetids, *Decemunciger apalea* n. sp. and *Endecamera palea* n. sp., is described, followed by a discussion of the role of the former species in deep-sea ecosystems.

### Materials and Methods

Three experimental islands, each with 12 separate one foot cubes of spruce wood were placed by Turner (1977), for a period of five years, at the following locations:

1. Deep Ocean Station 1 (DOS-1), 39°46'N, 70°41'W, 110 miles south of Woods Hole, Mass., in 1830 m.
2. Deep Ocean Station 2 (DOS-2), 38°18.4'N, 69°35.6'W, 190 miles southeast of Woods Hole, Mass., in 3506 m.

3. Tongue of the Ocean, Bahama Islands (TOTO Tower 3), 24°53.2'N, 77°40.2'W, in 2066 m.

Each experimental island is encircled by wood panels, 24" × 5" × 1", which are removed and replaced each time the islands are visited. At the time of retrieval, panels are enclosed in mesh bags to prevent loss of crumbled wood and specimens. The mesh bags and their contents are then placed in retrieval boxes, carried on the DSRV *Alvin* basket. The contents of the bags may be preserved at the time the boxes are closed for return to the surface by puncturing plastic bags previously placed in the retrieval boxes, thus releasing gluteraldehyde. Alternatively, the contents in certain cases may be preserved immediately upon reaching the surface. Specimens were well preserved. The use of submersibles in studies of benthic communities is described by Grassle (1980a).

### Systematics

Ampharetid polychaetes generally are wide anteriorly, tapering gradually towards the posterior end (Fig. 1A). The prostomium is generally trilobed. Segments 1 and 2, which lie immediately behind the prostomium, are fused in most species, and ventrally form the lower lip. Segment 3, in some species, bears one lateral bundle of paleal setae on each side (Fig. 2A). The thorax begins at segment 4. The above segmental numbering system is that of Malmgren (1865–1866) and Fauvel (1927), who recognized two segments in front of the paleal.

#### *Decemunciger*, new genus

*Type-species*.—*Decemunciger apalea* n. sp. Gender, masculine.

*Diagnosis*.—Body short, of 13 thoracic setigerous segments, last 10 uncinigerous, and of 14 abdominal uncinigerous segments. Segments 1 and 2 fused ventrally forming lower lip. Segment 3 lacking paleae. Prostomium lacking glandular ridges. Smooth, ventrally grooved, oral tentacles. Four pairs of smooth branchiae on dorsal surface of segments 3–5. Branchial groups separated mid-dorsally by narrow space. Abdominal notopodia and notopodial and neuropodial cirri absent.

*Remarks*.—In comparison with other ampharetid genera with a similar distribution of uncinigerous thoracic segments, *Decemunciger* differs from *Melinnata* (Hartman, 1965), *Melinnopsides* (Day, 1964) and *Muggoides* (Hartman, 1965), among other characters, by having 4 rather than 3 pairs of branchiae; from *Melinnopsis* (McIntosh, 1885) by lacking a fleshy ridge across dorsal surface of segment 6; and from *Mexamage* (Fauchald, 1972) by having 4 pairs of branchiae inserted on 3 successive segments rather than 4.

*Etymology*.—Generic name derived from the Latin, refers to number of thoracic uncinigerous segments.

#### *Decemunciger apalea*, new species

Fig. 1A–C

*Material examined*.—(asb = asbestos-backed panel; D = DSRV *Alvin*).

*Description*.—Maximum size 6.3 mm long, 0.9 mm wide. Sexually mature individuals as small as 3.6 mm long, 0.54 mm wide. Holotype complete, 4.7 mm

Table of Material examined:

Panel	Submerged	Removed	Time submerged	No. of specimens	
				Adult	Juveniles
<i>DOS-1</i>					
N28	8-30-75(D597)	9-28-77(D794)	2 yrs	0	1
N34 (asb)	8-30-75(D597)	7-29-77(D773)	2 yrs	2	32
N35	8-30-75(D597)	9-18-78(D834)	3 yrs	2	4
N47	6-15-76(D658)	7-30-77(D774)	1 yr	0	3
N65	8-17-76(D685)	7-29-77(D773)	1 yr	0	13
N67	8-17-76(D685)	8- 1-77(D776)	1 yr	0	7
N72	7-29-77(D773)	9-18-78(D834)	1 yr	0	3
N91 (asb)	9-28-77(D794)	9-18-78(D834)	1 yr	1	1
<i>DOS-2</i>					
N31	9- 5-75(D601)	8- 3-77(D777)	2 yrs	16	10
	Holotype (USNM #71545) and 4 paratypes (USNM #71546)				
<i>TOTO TOWER 3</i>					
T56 (asb)	5-12-77(D755)	11-11-78(D851)	1 yr	0	1

long, 0.9 mm wide. Color in alcohol white to pale orange. Prostomium indistinctly trilobed, lacking glandular ridges. About 14 smooth oral tentacles, each with deep ventral groove. Segments 1 and 2 fused, ventral part forming lower lip. Segment 3 without paleae and not visually obvious. Four pairs of smooth branchiae, about  $\frac{1}{3}$  body length; 2 on segment 3, 1 on segment 4, and 1 on segment 5. Branchial groups separated mid-dorsally by narrow space. Notopodial lobes each bearing 7–11 winged capillary setae from segments 4–16. Each seta about 0.4 mm long, 7.5  $\mu\text{m}$  wide basally, and 10  $\mu\text{m}$  wide across the blade. Notopodia lobes (uncinigerous pinnules) bearing toothed uncini from segment 7 to end of abdomen. Ten thoracic and 14 uncinigerous abdominal segments. Thoracic uncini in single transverse rows, 22–35 per row. Each with about 10 teeth, more or less in 3 transverse rows, above a rounded basal prow (Fig. 1B). Abdominal uncini in single transverse rows, about 10–18 per row. Each with about 15 teeth in several transverse rows, above a rounded basal prow (Fig. 1C). Abdominal notopodia and notopodial, neuropodial, and anal cirri lacking. Pygidium rounded.

*Remarks.*—Mucus-lined tubes covered with particulate matter, about 3 times worm length. Female about 4 mm long and 0.5 mm wide with approximately 260 elliptical eggs in body cavity ranging from 25 to 150  $\mu\text{m}$  across widest diameter. No gonoducts visible.

*Etymology.*—Specific name, derived from the Latin, refers to lack of paleae.

#### *Endecamera*, new genus

*Type-species.*—*Endecamera palea* n. sp. Gender, feminine.

*Diagnosis.*—Body short, of 14 thoracic setigerous segments, last 11 uncinigerous and of 14 abdominal uncinigerous segments. Segments 1 and 2 fused, ventrally forming lower lip. Paleae present on segment 3. Prostomium lacking glandular ridges. Smooth, ventrally grooved, oral tentacles. Four pairs of smooth branchiae

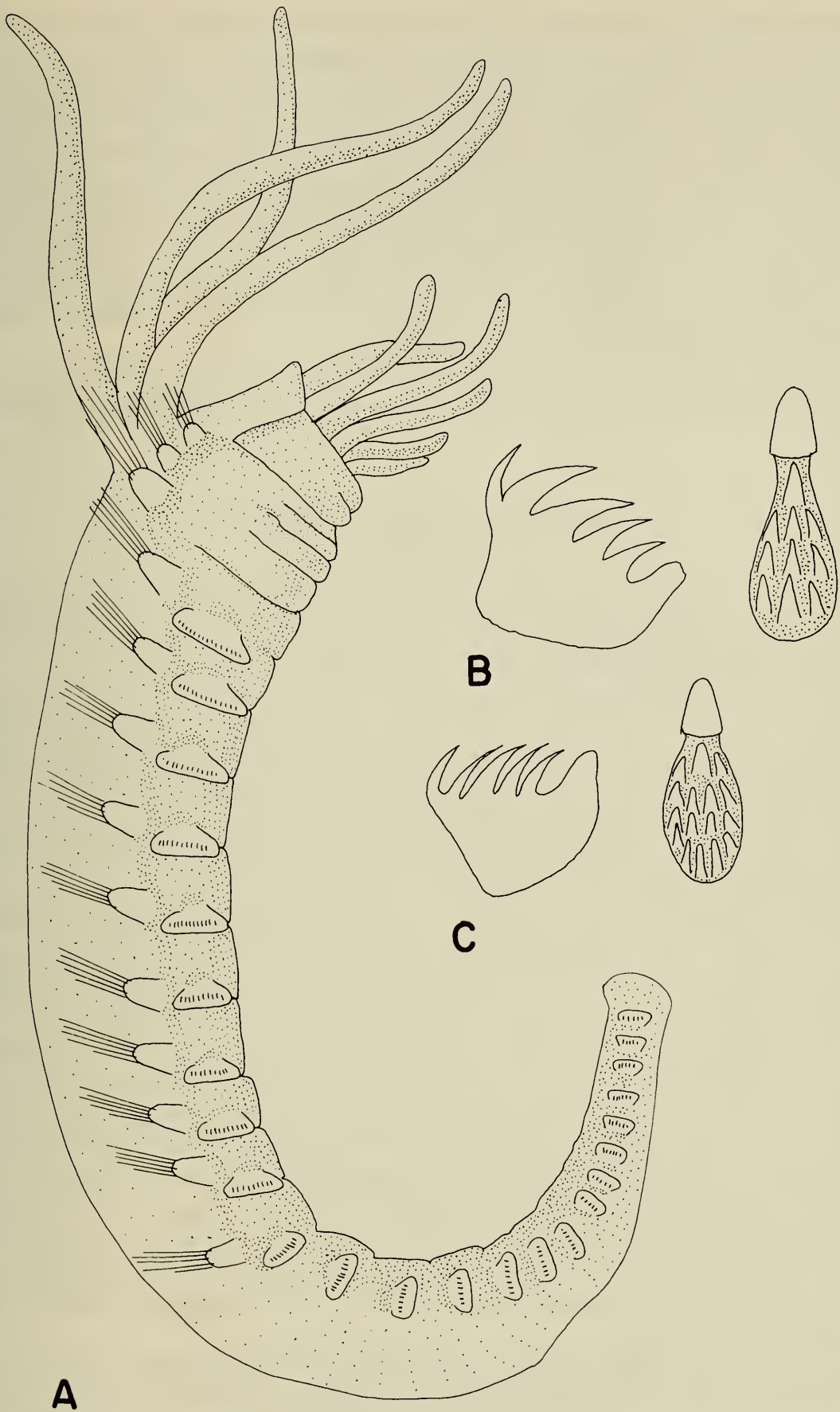


Fig. 1. *Decemunciger apalea*: A, Lateral view of entire worm, 5.2 mm long; B, Mid-thoracic uncini, lateral and frontal views, length = 16  $\mu\text{m}$ ; C, Mid-abdominal uncini, lateral and frontal views, length = 14  $\mu\text{m}$ .

on dorsal surface of segments 3–4. No mid-dorsal space between branchial groups. Abdominal notopodia and notopodial and neuropodial cirri absent.

*Remarks.*—In comparison with other ampharetid genera with a similar distribution of thoracic uncinigerous segments, *Endecamera* differs from *Ampharana* Hartman, 1967; *Amythasides* Eliason, 1955, and *Glyphanostomum* Levinsen, 1884, by having 4 rather than 3 pairs of branchiae; from *Amage* Malmgren, 1865–1866, *Grubianella* McIntosh, 1885, and *Phyllampharete* Hartman and Fauchald, 1971, by lack of abdominal notopodia; from *Pterampharete* Augener, 1918, and *Sabellides* Milne Edwards in Malmgren, 1865–1866, by having smooth rather than papillose oral tentacles, and from *Paramage* Caullery, 1944, by notosetae beginning on segment 4 rather than segment 6.

*Etymology.*—Generic name, derived from the Greek, and transcribed to the Latin with a feminine-singular ending, refers to number of thoracic uncinigerous segments.

*Endecamera palea*, new species

Fig. 2A–C

*Material examined.*—St. Croix Station, 17°57.63'N, 64°48.6'W, in 3995 m DSRV *Alvin* dive 876, 20 Dec 1978, “wild” wood about 6 feet long. Eighteen specimens. Holotype (USNM 71547); 3 paratypes (USNM 71548).

*Description.*—Maximum size 5 mm long, 0.75 mm wide. Holotype complete, 3.3 mm × 0.5 mm. Color in alcohol white to pale orange. Trilobed prostomium with middle lobe about same width as lateral lobes; lacking glandular ridges. Smooth, ventrally grooved, oral tentacles. Segments 1 and 2 fused ventrally forming lower lip. Two lateral groups of paleae, about 11 in each group on segment 3. Each palea approximately 0.38 mm long, 5 μm wide basally, tapering gradually to a fine point. Four pairs smooth branchiae, about ¼ body length; 3 of each group in a straight line across dorsal surface of segments 3–4 with 4th inserted just anterior to most medial branchiae. No mid-dorsal gap between branchial groups. Notopodial lobes, each bearing 7–12 winged capillary setae from segment 4 to end of thorax. Setae about 0.43 mm long, 8 μm wide basally, and 10 μm wide across the blade. Notopodia of segment 4 minute while those of segments 5 and 6 larger than those of segment 4, but smaller than those of subsequent segments. Fourteen thoracic setigerous segments. Neuropodial lobes bearing toothed uncini from segment 7 to end of abdomen; 11 thoracic and 14 uncinigerous abdominal segments. Thoracic uncini in single transverse rows, about 23–27 per row. Each with 10 teeth, more or less in 2 transverse rows, above a rounded basal prow (Fig. 2B). Abdominal uncini in single transverse rows, about 10–18 per row. Each with about 13 teeth in several rows above a rounded basal prow (Fig. 2C). Abdominal notopodia and notopodial, neuropodial and anal cirri lacking. Pygidium rounded.

*Remarks.*—Mucus-lined tubes covered with particulate matter, about 3 times body length. Sexually mature females were broken or twisted making it impossible to count the number of eggs in the body cavity. No gonoducts visible.

*Etymology.*—Specific name, derived from the Latin, refers to presence of paleae on segment 3.

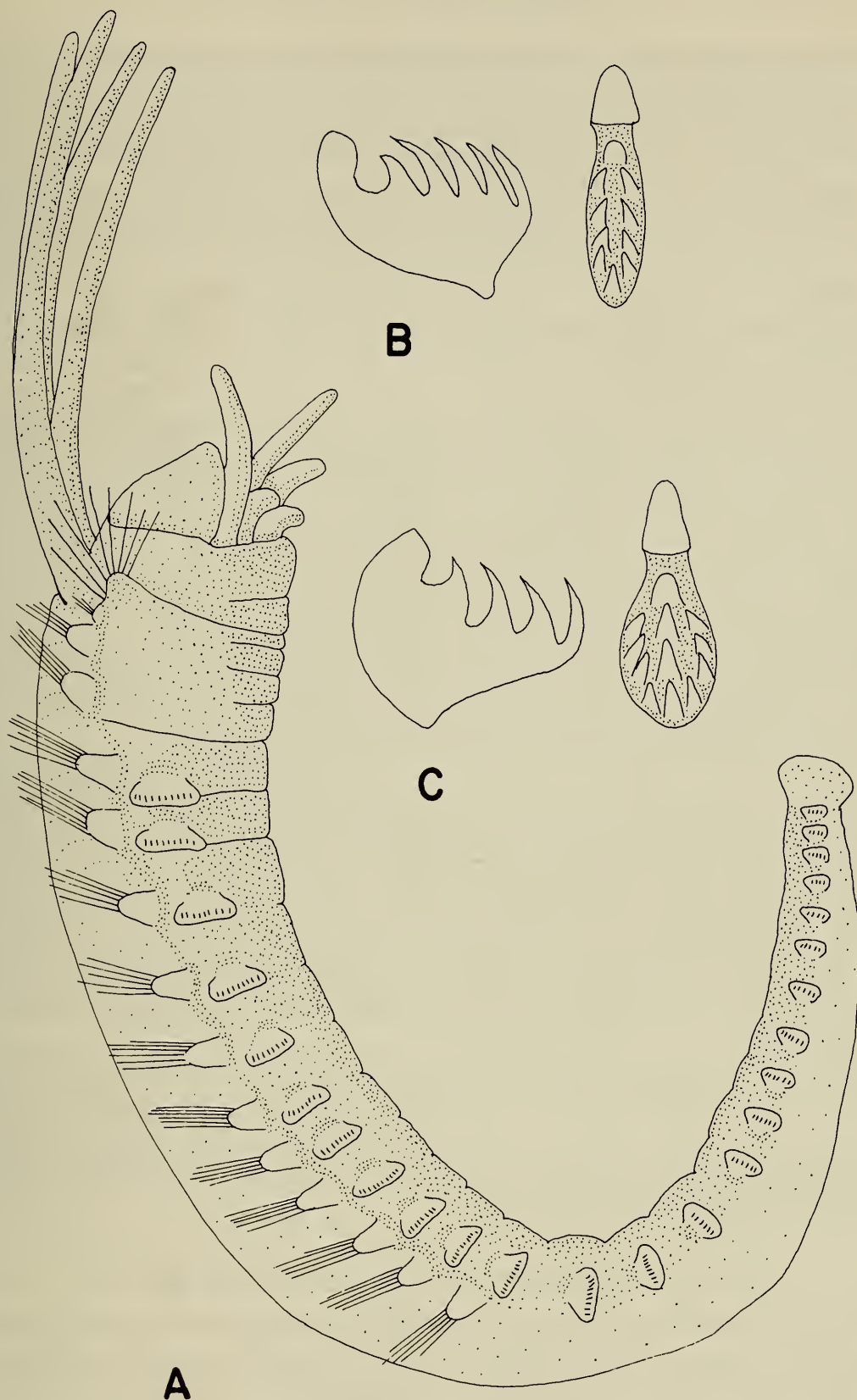


Fig. 2. *Endecamera palea*: A, Lateral view of entire worm, 4 mm long; B, Mid-thoracic uncini, lateral and frontal views, length = 14  $\mu\text{m}$ ; C, Mid-abdominal uncini, lateral and frontal views, length = 12  $\mu\text{m}$ .

### Feeding of the Two Species

Ampharetid polychaetes live in mucus-lined tubes covered by particulate matter. The tube often extends some distance above the sediment surface. Jumars found that starved *Hobsonia* increased the length of their tubes more, over a period of several months, than those that were fed (Fauchald and Jumars 1979). They suggested that tube building may be a form of locomotion, allowing animals to enter new feeding areas. Fauchald and Jumars (1979) also suggested that horizontal or vertical tube orientation may depend on food availability; horizontal tube orientation would allow worms to cover a larger feeding area.

During feeding, worms emerge from the tube opening and evert their oral tentacles equal to about their body length over the sediment surface (Fauchald and Jumars 1979; personal observations on *Asabellides oculata* [Webster], *Hobsonia* [*Amphicteis*] *floridus* [Hartmen] and *Melinna cristata* [Sars]). Food adheres to mucus produced on the ventral side of the tentacles and is carried by cilia to the mouth. The tentacular apparatus of *Decemunciger apalea* and *Endecamera palea* appears similar to that of shallow water ampharetids and it is assumed that the method of feeding is also similar. Pieces of wood, detritus and bivalve larvae (*Xylophaga* sp.) were found in the gut cavity of *Decemunciger apalea*, while only detritus was noted in the digestive tract of *Endecamera palea*.

The digestive tract of both species like most ampharetids consists of buccal cavity, oesophagus, stomach, intestine, and rectum. The buccal cavity houses about 14 ventrally grooved and ciliated, smooth oral tentacles.

Food available to deep-sea organisms includes plankton, remnants of marine macrophytes such as *Sargassum*, remnants of land plants, particulate residues of deteriorating nekton and chemo-autotrophic bacteria found in hydrothermal vent areas (George and Higgins 1979, Rowe and Staresinic 1979). Rowe and Staresinic (1979), using sediment traps, found that about 4 g C/m<sup>2</sup>/yr, mainly in the form of fecal pellets, reached the deep-sea bottom. Marine macrophyte remains were next in importance. Pieces of the brown alga *Sargassum* accounted for an average of 0.4 g C/m<sup>2</sup>/yr while the contribution from other sources was relatively small.

*Decemunciger apalea* most likely feeds on fecal pellets produced by other animals on the "wood islands," on bivalve larvae (*Xylophaga* sp.) that settle near them, and on any type of detrital particle that reaches them from the surrounding water column. Fungi and bacteria on small pieces of ingested wood may represent an added source of nutrients.

### Life History/Recruitment/Growth Rate of *Decemunciger*

The rate of colonization in deep-sea sediments is about two orders of magnitude lower than in shallow water (Grassle 1977). In addition, larval recruitment and settlement, growth rates, and probably mortality rates, are generally lower in the deep sea (Grassle and Sanders 1973, Grassle 1977, Sanders 1979). Grassle (1980b) found fewer individuals and species in boxes of azoic sediment placed on the deep-sea floor, compared to samples taken from surrounding sediments. Because of these factors and others, deep-sea populations are commonly dominated by mature adults (Grassle 1977). Opportunistic wood boring, deep-sea bivalves (Subfamily Xylophagainae; Family Pholadidae) characterized by rapid growth,

Table 1.—Numbers of *Decemunciger apalea* (in parentheses) of various body lengths (in mm) for listed wood panels.

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N31 DOS 2:	(1) 2.0; (4) 2.7; (3) 3.0; (2) 3.2; (5) 3.6; (1) 4.0; (7) 4.5; (1) 5.4; (1) 6.0; (1) 6.3.
N32 DOS 1:	(2) 0.4; (1) 0.6; (1) 0.65; (1) 0.85; (5) 1.0; (2) 1.2; (3) 1.4; (2) 1.75; (1) 1.8; (1) 1.9; (2) 2.0; (3) 2.3; (3) 2.5; (1) 2.8; (1) 3.0; (1) 3.5; (1) 5.0.
N34 and	
N65 DOS 1:	(1) 0.75; (1) 0.8; (2) 1.0; (2) 1.25; (3) 1.5; (1) 1.75; (1) 1.75; (1) 2.5; (1) 3.0.
N67 DOS 1:	(1) 1.2; (1) 1.3; (2) 1.5; (1) 1.75; (1) 2.5; (1) 2.65.
N72 DOS 1:	(1) 1.5; (1) 3.0; (1) 4.0; (1) 4.5; (1) 5.25.
N91 DOS 1:	(1) 1.0; (1) 4.5.

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early sexual maturity, and relatively large numbers of eggs, appear to be an exception to the generality above (Turner 1973, 1977). The larger number of eggs and the resultant large number of motile larvae allow at least a few individuals to reach geographically scattered pieces of wood (Turner 1973, Sanders 1979).

*Decemunciger* appears to have a life cycle similar to these bivalves. The large number of small eggs in the body cavity implies a high reproductive rate. The apparent onset of sexual maturity within a year's time, documented below, suggests early maturity and a rapid growth rate. Thus, also considering its ability to colonize a transient habitat, *Decemunciger* may be characterized as an opportunistic species. Evidence for this is as follows, the only unknown aspect being the method of larval dispersal.

*Decemunciger* with well developed egg or sperm in the body cavity ranged from about 3.6 to 6.3 mm in total body length. Worms less than 3.6 mm long were therefore assumed to be juveniles. Eggs probably pass singly through certain nephridia and nephridiopores into the anterior part of the tube where they are fertilized by sperm, released by males in the same fashion. *Hobsonia (Amphicteis) floridus* (Zottoli, 1974), *Hypaniola kowalewski* (Marinescu, 1964) and *Melinnexis artica* (Annekova, 1931), which have eggs roughly the same diameter as *Decemunciger*, retain developing larvae in the maternal tube until they are able to crawl on the bottom. It is hypothesized that these brooding and colonization patterns are the same for *Decemunciger*.

Sexually mature worms as well as juveniles were found on wood panels N72 and N91 which were submerged for one year. Thus, if one accepts the premise that wood panels are colonized solely by larvae, then sexual maturity is attained within a year (Table 1). The absence of sexually mature *Decemunciger* on wood panels N34, N65, and N67, which were also submerged for one year, suggests that larval worms settled on the wood late in the year and did not have sufficient time to reach sexual maturity. In addition, the presence of certain size classes of adults and juveniles on wood panels N31, N34, N72, and N91 suggests that this species reproduces only at certain times of the year. Rokop (1974) felt that deep-sea organisms generally reproduce throughout the year. Lightfoot, Tyler, and Gage (1979) suggest that cyclic seasonal breeding is more common in the deep-sea than previously supposed. Timing of reproduction most likely reflects seasonal abundance of food reaching the deep-sea floor (Lightfoot, Tyler, and Gage 1979).



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### Literature Cited

- Augener, H. 1918. Polychaeta. *In*: W. Michaelsen (ed.), *Beiträge zur Kenntnis der Meersfauna Westafrikas* 2(2):67–625.
- Caullery, M. 1944. Polychètes sédentaires de L'Expedition du Siboga: Ariciidae, Spionidae, Chaetopteridae, Chloraemidae, Opheliidae, Oweniidae, Sabellariidae, Sternaspidae, Amphictendidae, Ampharetidae, Terebellidae.—*Siboga-Expédition Monographie* 24(2):1–204.
- Day, J. H. 1964. A review of the family Ampharetidae (Polychaeta).—*Annals of the South African Museum* 48:97–121.
- Eliason, A. 1955. Neue oder wenig bekannte schwedische Ampharetiden (Polychaeta).—*Göteborgs Kungelige Vetenskaps Handlingar* 6B(17):1–17.
- Fauchald, K. 1972. Benthic polychaetous annelids from deep water off western Mexico and adjacent areas in the eastern Pacific Ocean.—*Allan Hancock Monographs Marine Biology* 7:1–575.
- , and P. A. Jumars. 1979. The diet of worms: A study of polychaete feeding guilds.—*Oceanography Marine Biology Annual Review* 17:193–284.
- Fauvel, P. 1927. Polychètes sédentaires.—*Faune de France* 16:1–494.
- George, R. Y., and R. P. Higgins. 1979. Eutrophic hadal benthic community in the Puerto Rico trench. *In*: *The Deep-Sea Ecology and Exploitation*.—*AMBIO Special Report*, No. 6:51–58.
- Grassle, J. F. 1977. Slow recolonization of deep-sea sediment.—*Nature* 265:618–619.
- . 1980a. *In Situ Studies of Deep-Sea Communities*. *In*: *Advanced Concepts in Ocean Measurements For Marine Biology*. F. P. Diemer, F. J. Vernberg, and D. Z. Mirkes (eds.).—*The Belle Baruch Library in Marine Science*, No. 10:321–332.
- . 1980b. Rates of colonization in deep-sea benthic communities [Abstract].—*American Zoologist* 20(4):929.
- , and H. L. Sanders. 1973. Life histories and the role of disturbance.—*Deep-Sea Research* 20:643–659.
- Hartman, O. 1965. Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic areas.—*Allan Hancock Foundation Occasional Paper* 28:1–378.
- . 1967. Polychaetous annelids collected by the USNS ELTANIN and STATEN ISLAND cruises, chiefly from Antarctic seas.—*Allan Hancock Monographs in Marine Biology* 2:1–387.
- , and K. Fauchald. 1971. Deep-water benthic polychaetous annelids off New England to Bermuda and other North Atlantic areas. Part 2.—*Allan Hancock Monographs in Marine Biology* 6:1–327.
- Levinsen, G. M. R. 1884. Systematik-geografisk. oversigt over de nordiske Annulata, Gephyrea, Chaetognathi og Balanoglossi.—*Videnskabelige Meddeleser Dansk Naturhistorisk Forening* 1883:92–348.
- Lightfoot, R. F., P. A. Tyler, and J. D. Gage. 1979. Seasonal reproduction in deep-sea bivalves and brittlestars.—*Deep-Sea Research* 26(8A): 767–773.
- Malmgren, A. J. 1865–1866. Nordiska Hafs-Annulater.—*Öfversigt Svenska Vetenskaps Akademiens Förhandlingar* 22:181–192; 355–410.
- McIntosh, W. C. 1885. Report on the Annelida Polychaeta collected by the HMS Challenger during the years 1873–76.—*Challenger Reports* 12:1–554.
- Nyholm, K. 1950. Contributions to the life-history of the ampharetid, *Melinna cristata*.—*Zoologiska Bidrag fran Uppsala* 29:79–91.
- Okuda, S. 1947. On an ampharetid worm, *Schistocomus sovjeticus* Annekova, with some notes on its larval development.—*Journal of the Faculty of Science Hokkaido Imperial University* (6) 9:321–329.

- Rokop, F. J. 1974. Reproductive patterns in the deep-sea benthos.—*Science* 186:743–745.
- Rowe, G. T., and N. Staresinic. 1979. Sources of organic matter to deep-sea benthos. *In: The Deep Sea Ecology and Exploitation.*—AMBIO Special Report No. 6:19–24.
- Sanders, H. L. 1979. Evolutionary ecology and life-history patterns in the deep sea.—*Sarsia* 64:1–7.
- Turner, R. D. 1973. Wood-boring bivalves, opportunistic species in the deep sea.—*Science* 180:1377–1379.
- . 1977. Wood, molluscs, and deep-sea food chains.—*Bulletin of the American Malacological Union* 1977:13–19.
- Zottoli, R. A. 1974. Reproduction and larval development of the ampharetid polychaete *Amphicteis floridus*.—*Transactions American Microscopical Society* 93(1):78–89.

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