View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by College of William & Mary: W&M Publish

W&M ScholarWorks

VIMS Articles

1979

Some Aspects Of The Biology Of Deep-Sea Lobsters Of The Family Polychelidae (Crustacea, Decapoda) From The Western North-Atlantic

Elizabeth L. Wenner
Virginia Institute of Marine Science

Follow this and additional works at: https://scholarworks.wm.edu/vimsarticles

 Part of the Aquaculture and Fisheries Commons

Recommended Citation

Wenner, Elizabeth L., "Some Aspects Of The Biology Of Deep-Sea Lobsters Of The Family Polychelidae (Crustacea, Decapoda) From The Western North-Atlantic" (1979). *VIMS Articles*. 632.
https://scholarworks.wm.edu/vimsarticles/632

This Article is brought to you for free and open access by W&M ScholarWorks. It has been accepted for inclusion in VIMS Articles by an authorized administrator of W&M ScholarWorks. For more information, please contact scholarworks@wm.edu.

SOME ASPECTS OF THE BIOLOGY OF DEEP-SEA LOBSTERS OF THE FAMILY POLYCHELIDAE (CRUSTACEA, DECAPODA) FROM THE WESTERN NORTH ATLANTIC [1,2]

ELIZABETH LEWIS WENNER[3]

ABSTRACT

Stereomastis nana was the most abundant species of Polychelidae collected by otter trawl on the continental slope of the Middle Atlantic Bight, off the eastern United States. Total catches were almost four times greater than those of its congener, *S. sculpta*. Other polychelid species, *Polycheles validus* and *P. granulatus*, were caught infrequently. *Stereomastis nana* was abundant at depths of 1,400-2,599 m, and *S. sculpta* occurred at 486-2,257 m. *Stereomastis nana* and *S. sculpta* appear to spawn year round, and both may be deep-sea scavengers.

The Polychelidae are the only extant members of the superfamily Eryonoidea, a group represented in fossil records from the mid-Triassic period (Glaessner 1969; Firth and Pequegnat[4]). The family is currently placed by Glaessner (1969) within the infraorder Macrura, along with the spiny lobsters (Palinuridae) and the shovel-nosed lobsters (Scyllaridae). Although the Polychelidae are not of commercial importance, interest in these lobsters dates back when Bate (1888) discussed uniqueness of the family because its members lack eyes and are related to forms thought to be extinct since the Mesozoic. In addition, some species live at extreme depths. Since that time, Andrews (1911) indicated the occurrence of external spermatophores and discussed sperm transfer among male and female polychelids; Santucci (1933) and Bernard (1953) suggested that *Polycheles typhlops* performs reproductive migrations up slope; and Firth and Pequegnat (see footnote 4) investigated taxonomic relationships of the entire family Polychelidae as well as certain aspects of its biology.

Otter trawl collections of Polychelidae have been made by the Virginia Institute of Marine Science on the continental slope near Norfolk Canyon, off the eastern United States from 1973 to 1976, which confirmed their importance as benthic slope crustaceans. In this paper, I give new biological information on this interesting group of decapods that has come to light as a result of these collections. Species from the western North Atlantic which are discussed include *Polycheles validus*, *P. granulatus*, *Stereomastis nana*, and *S. sculpta sculpta* (distinguished from the Pacific form, *S. sculpta pacifia*, by Firth and Pequegnat (see footnote 4), but referred to in this paper, for simplicity, as *S. sculpta*).

METHODS AND MATERIALS

Polychelidae were collected during eight seasonal cruises from June 1973 to January 1976 in the Middle Atlantic Bight (lat. 33°33'-38°52' N). Tows were made either with a 13.7 m or 9.1 m (headrope) semiballon four-seam otter trawl for 0.5 h at depths shallower than 2,000 m and 1 h in water deeper than 2,000 m (see Musick et al.[5] for detailed gear description). A precision depth recorder determined mean depth of trawl every 3 min after the trawl hit bottom for 0.5-h tows and every 6 min for 1-h tows. Bathythermographs or reversing thermometers recorded bottom temperatures. Analyses of relative abundance did not include samples from tows in which the net tore, failed to reach bottom, or became twisted during a

[1]Based on part of a dissertation to be presented to the School of Marine Science, College of William and Mary, Williamsburg, Va.

[2]Contribution No. 881, Virginia Institute of Marine Science, Gloucester Point, Va.

[3]Virginia Institute of Marine Science, Gloucester Point, Va.; present address: South Carolina Wildlife and Marine Resources Department, P.O. Box 12559, Charleston, SC 29412.

[4]Firth, R.W., Jr., and W.E. Pequegnat. 1971. Deep-sea lobsters of the families Polychelidae and Nephropidae (Crustacea, Decapoda) in the Gulf of Mexico and Caribbean Sea. Texas A&M Res. Found. Ref. 71-11T, College Station, 106 p.

[5]Musick, J. A., C. A. Wenner, and G. R. Sedberry. 1975. Archibenthic and abyssobenthic fishes. *In* May 1974 baseline investigation of Deepwater Dumpsite 106, p. 229-269. NOAA Dumpsite Eval. Rep. 75-1, 388 p.

Manuscript accepted December 1978.
FISHERY BULLETIN: VOL. 77, NO. 2, 1979.

tow, but these samples were used in length-frequency distributions and reproduction analyses.

All specimens were identified by me from Firth and Pequegnat's (see footnote 4) key to the Polychelidae. Short carapace length (SCL), i.e., the distance from the median posterior margin of the carapace to the orbit, was measured to the nearest millimeter.

Sex and gonad condition were recorded for all polychelids, and gonads representative of stages of development were obtained for histological examination and placed in Davidson's fixative (Humason 1972). Validity of female gonad stages was determined by gross ovarian morphology, ovarian histology, and oocyte diameter. The longest horizontal diameter of 15 oocytes randomly chosen from excised ovaries of each lobster was measured with an ocular micrometer.

Fecundity was estimated from total external egg number. I stripped eggs from the pleopods, placed them in a graduated tube, and adjusted the volume to 10 ml with water. After mixing, I took three 0.5 ml aliquots and counted eggs from the aliquots on a gridded Petri dish. I then noted the degree of embryological development of eggs, similar to descriptions by Meredith (1952) and Allen (1966), and measured the longest horizontal diameter of 15 randomly chosen eggs.

I also removed stomachs from preserved lobsters and sorted and identified their contents where possible. The importance of food taxa was then determined from their numerical abundance.

RESULTS

Stereomastis nana (Smith)

Stereomastis nana is found in the three major oceans but not in the Mediterranean and Caribbean Seas or the Gulf of Mexico (Firth and Pequegnat see footnote 4). Its bathymetric distribution within the western North Atlantic off the east coast of the United States was reported to be 1,289-3,506 m (Smith 1884, 1887); off Greenland and Iceland, specimens have been taken from 1,271 to 2,271 m (Hansen 1908).

Abundance data based on our 13.7 m otter trawl catches show that *S. nana* constitutes 20% by number of the total benthic decapod fauna at depths below 1,200 m. Its importance within the benthic decapod community diminishes to 0.3% at depths between 400 and 1,199 m. Trawls within the Middle Atlantic Bight collected 459 *S. nana* from depths of approximately 613-2,642 m and temperatures of 2.4°-5.0° C. Analysis of variance showed a significant difference (Table 1) between abundance of *S. nana* for depth intervals shown in Figure 1. Scheffé's multiple mean comparison test (Snedecor and Cochran 1967) showed the mean catch rate, expressed as $\log_{10}(x + 1)/0.5$ h tow, to be significantly higher at depths of 1,400-2,599 m. There was no discernible change in depth distribution of this species with season.

There was also no apparent segregation of sex with depth since both male and female *S. nana* occurred throughout the depth range. Chi-square analysis using Yates correction (Woolf 1968) showed females and ovigerous females to be significantly more numerous than males at arbitrarily chosen depth strata of 1,200-1,999 and 2,000-2,800 m (Tables 2, 3). There was no significant relationship between average size of *S. nana* and depth of capture ($F = 0.056$, df = 1,460).

Males (mean = 22 mm SCL), females (mean = 25 mm SCL), and ovigerous females (mean = 28 mm SCL) differed significantly from each other in size by analysis of variance (Table 4) and Scheffé's multiple mean comparison test. Sex ratios varied significantly with size, with females predominating at lengths >26 mm SCL and males at lengths <22 mm SCL (Table 5).

Among the Polychelidae, sperm transfer is accomplished by attachment of spermatophores to the surface of the posterior sterna of the females (Andrews 1911). Most ovigerous and nonovigerous females >23 mm had externally attached spermatophores (Figure 2). All ovigerous females except five damaged individuals had spermato-

TABLE 1.—One-way analysis of variance on abundance, expressed as $\log_{10}(x + 1)$ per 0.5 h tow, of *Stereomastis nana* and *S. sculpta* by depth interval (see Figure 1 for description of depth intervals).

Source of variation	df	SS[1]	MS[2]	*F*
S. nana:				
Among groups (depth interval)	10	13.3	1.3	16.23**
Within groups	126	10.4	0.1	
Total	136	23.7		
S. sculpta:				
Among groups (depth interval)	9	1.5	0.17	2.88
Within groups	129	7.6	0.06	
Total	138	9.1		

[1]SS = sum of squares.
[2]MS = mean squares.
**$P < 0.01$.

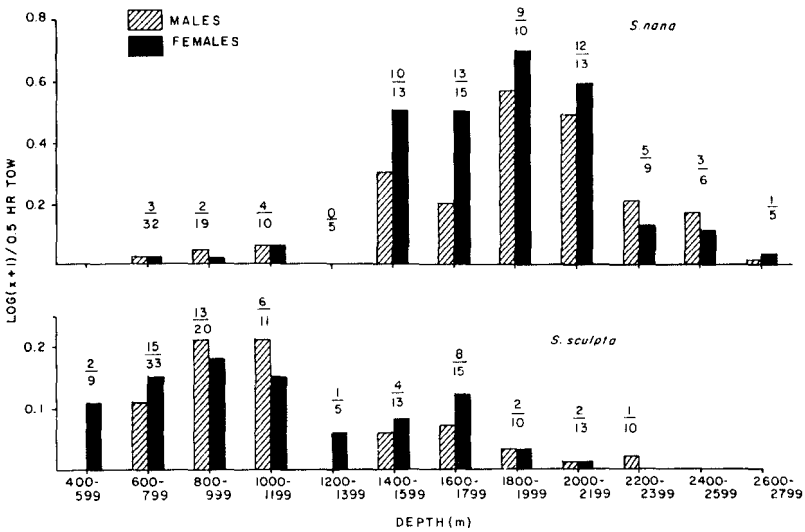

FIGURE 1.—Abundance of *Stereomastis nana* and *S. scuplta* by depth, expressed as log $(x + 1)$ per 0.5 h tow, where x is number of individuals. Ratios over bars indicate number of stations where *Stereomastis* spp. were captured to total number of stations within depth intervals.

TABLE 2.—Summaries for three depth strata of morphological and reproductive data on *Stereomastis nana* and *S. sculpta* from the continental slope. $\bar{x}$ = arithmetic mean; SCL = short carapace length in millimeters; 95% confidence limits (CL) follow the means. Percent ovigerous females is based on total female samples only.

	400-1,199 m		1,200-1,999 m		2,000-2,800 m	
Item	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*
No. successful tows	9	36	32	15	21	3
Temperature (° C)	4.5	4.8	3.7	3.8	3.1	2.9
No. individuals	14	107	239	20	209	3
N (Percent) males	5(35.7)	48(45.1)	73(30.5)	12(60.0)	79(37.8)	1(33.3)
N (Percent) females	9(64.3)	59(54.9)	166(69.5)	8(40.0)	130(62.2)	2(66.7)
N (Percent) ovigerous females	3(33.3)	8(14.0)	92(55.4)	0	36(27.7)	0
$\bar{x}$ (CL) SCL all individuals	24(18;29)	34(31;37)	26(26;27)	30(24;35)	24(23;25)	35(0;78)
Size range	18-34	16-69	17-37	19-72	16-38	19-54
$\bar{x}$ (CL) SCL males	21(15;27)	33(31;36)	22(22;23)	27(24;31)	22(22;23)	20(ND[1])
Size range	18-26	16-52	17-28	19-37	18-26	ND
$\bar{x}$ (CL) SCL females	27(20;33)	35(32;38)	27(26;28)	33(20;47)	25(24;25)	42(0;192)
Size range	19-34	18-55	18-37	22-72	16-38	30-54
$\bar{x}$ (CL) SCL ovigerous females	29(16;41)	52(48;56)	29(28;29)	ND	29(28;30)	ND
Size range	25-34	45-58	25-35	ND	24-38	ND

[1]ND = no data.

TABLE 3.—Chi-square test for goodness of fit, using Yates correction for continuity of male: female ratios of *Stereomastis nana* and *S. sculpta* by depth interval.

		Frequency		χ^2	
Depth interval (m)	Sex	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*
400-1,199	M	5	48	0.64	0.93
	F	9	59		
1,200-1,999	M	73	12	36.18**	0.45
	F	166	8		
2,000-2,800	M	79	1	11.96**	ND[1]
	F	130	2		

**$P < 0.01$.
[1]ND = no data.

phores from these individuals were dislodged during capture. Thirty-seven male *S. nana* >19 mm were also found with a hardened secretion of spermatophores projecting out of the gonopore at the base of the fifth pereopod (Figure 2). Ovigerous females, nonovigerous females, and males with external spermatophores occurred at all depths, with maximum numbers at 1,400-2,199 m. No males or females with external spermatophores, and only one ovigerous female occurred deeper than 2,400 m.

By examination of ovaries, I defined six stages of ovarian development in *Stereomastis* spp. (Figure

TABLE 4.—One-way analysis of variance on short carapace length of *Stereomastis nana* and *S. sculpta* by sex (male, female, and ovigerous female).

Source of variation	df	SS[1]	MS[2]	*F*
S. nana:				
Among groups (sexes)	2	3,010	1,505.2	74.25**
Within groups	459	9,304	20.3	
Total	461	12,314		
S. sculpta:				
Among groups (sexes)	2	3,592	1,796.2	16.90**
Within groups	122	12,964	106.3	
Total	124	16,556		

[1]SS = sum of squares.
[2]MS = mean squares.
**$P < 0.01$.

TABLE 5.—Percent of male *Stereomastis nana* by size interval. Size groupings result from chi-square analysis of male and female frequencies by 2 mm size intervals.

SCL (mm)	Males	Females	Males (%)	χ^2
16-21.9	69	23	75	22.01**
22-25.9	72	67	52	0.11
26-39.9	14	210	6	171.50**
Total	155	300	34	45.57**

**$P < 0.01$.

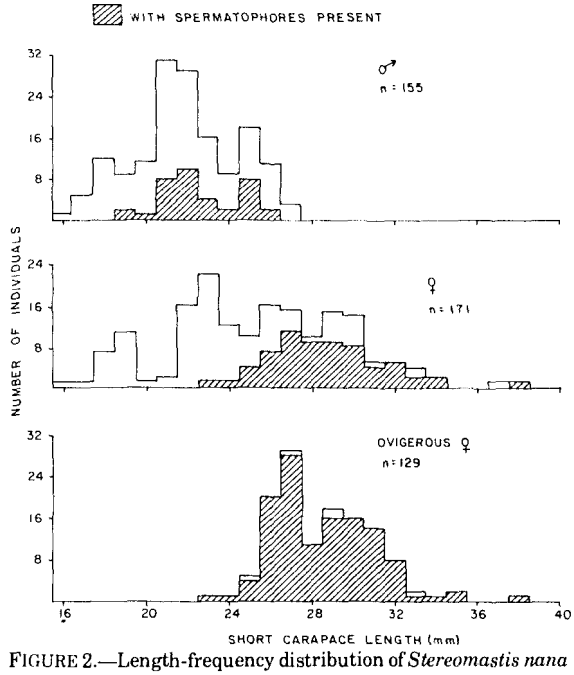

FIGURE 2.—Length-frequency distribution of *Stereomastis nana* pooled for all months of collection.

3). Immature ovaries were threadlike and difficult to remove from the specimens because of their adherence to the dorsal portion of the digestive gland. In cross section, the oocytes appeared very small (0.05-0.2 mm, mean = 0.1 mm) with the nucleus composing most of the oocyte. Resting ovaries had oocytes (0.1-0.3 mm, mean = 0.2 mm) with a large nucleus and no yolk granules (Figure 4A). The intermediate ovary had fewer densely packed oocytes (0.1-0.4 mm, mean = 0.3 mm). A distinct basophilic nucleus with condensed chromosomes was visible in cross section. Yolk granules partially filled the cytoplasm. The germinative zone was well developed and filled with developing, basophilic oocytes (Figure 4B). In the ripening ovary, the oocytes were irregularly shaped (0.3-0.8 mm, mean = 0.5 mm), with the cytoplasm partially filled with yolk granules. There was a visible nucleus. The germinative area within the ovary was larger than in ripe individuals. In gravid individuals, the ovary occupied much of the thoracic cavity, with anterior and posterior horns extending laterally. The oocytes (0.5-0.9 mm in diameter, mean = 0.7 mm) were tightly packed and irregularly shaped, yet they were easily dislodged from the ovary with slight probing. Histological sectioning revealed oocytes to be filled with yolk granules. The nucleus was generally not visible and the central germinative zone of the ovary was compressed (Figure 4C). Individuals with ovaries judged to be spent were usually ovigerous females. The ovaries contained a few atresic (0.3-0.4 mm) oocytes, but much of the ovary was filled with resting stage basophilic oocytes (0.1-0.2 mm (Figure 4D)).

Most nonovigerous females <26 mm had immature and resting ovaries (Figure 5). Individuals with ripening and gravid ovaries first appeared at 21 mm, and the percentage of females in these stages increased with increasing size. Approximately 58% of the 65 nonovigerous females with external spermatophores were ripe. The remaining individuals had immature (6%), resting (9%), intermediate (11%), ripening (8%), or spent (8%) ovaries. A large percentage of ovigerous *S. nana* 21 mm or larger were spent, but there were some ovigerous individuals with ovaries in each stage of development (Figure 5). In most cases, ovigerous females with ripening or gravid ovaries had advanced eggs (eyes and a discernible abdomen), corresponding to C or C+ stage designated by Meredith (1952). Spent individuals had eggs that were newly deposited (stages A-A+) or gastrulated (stage B+).

Ovigerous and other female *S. nana* with external spermatophores attached were found during

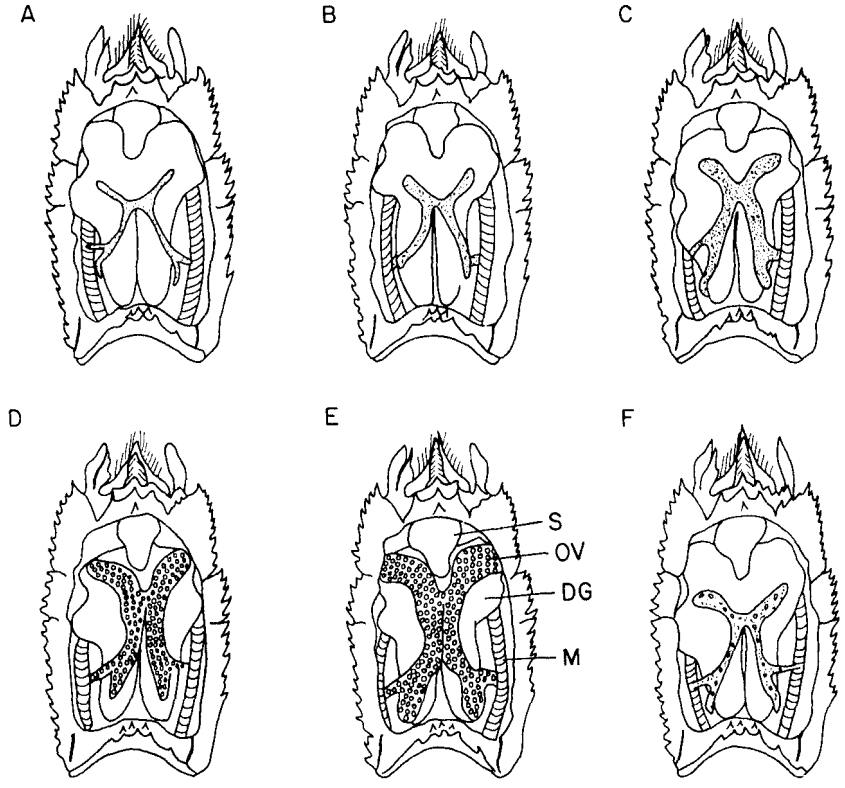

FIGURE 3.—Cephalothoracic position and relative size of the ovary of Polychelidae during ovarian development stages (dorsal view): A. Immature; B. Resting; C. Intermediate; D. Ripening; E. Gravid; and F. Spent. OV = ovary; DG = digestive gland; M = muscle; and S = stomach.

every month of collection (Table 6). Individuals with advanced eyed (stages C-C+) eggs and egg remnants (stage D), indicative of imminent or recent hatching, were also collected each month. Similarly, there were gravid and ripening females and spent ovigerous females present throughout the year (Figure 6), but there was no indication that seasonal peaks in oviposition occurred.

The estimated number of eggs on the pleopods ranged from 1,015 to 7,580 (mean = 3,392, n = 10) with a mean diameter of 0.7 mm. There was no apparent relation between body size and fecundity for 10 individuals examined.

I examined 127 males (17-36 mm SCL) for presence of external (protruding from gonopores) and internal (present in vas deferens) spermatophores.

TABLE 6.—Summary of data on reproductively mature individuals and advanced egg development in *Stereomastis nana* and *S. sculpta* by month of collection.

Item	September		November		January		April		May-June		July	
	S. nana	*S. sculpta*	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*	*S. nana*	*S. sculpta*
Males:												
Sample size	10	15	58	16	19	8	23	5	13	13	34	2
Percent total catch	20	45	35	53	26	50	39	28	36	59	42	33
Percent with spermatophores exuding	40	13	5	6	5	0	26	20	46	31	50	0
Nonovigerous females:												
Sample size	13	17	70	11	30	7	24	11	10	8	27	4
Percent with spermatophores attached	77	29	37	9	17	29	46	9	40	12	37	25
Ovigerous females:												
Sample size	26	1	37	3	24	1	12	2	13	1	19	0
Percent of total females	67	5	35	21	44	12	33	15	57	11	41	0

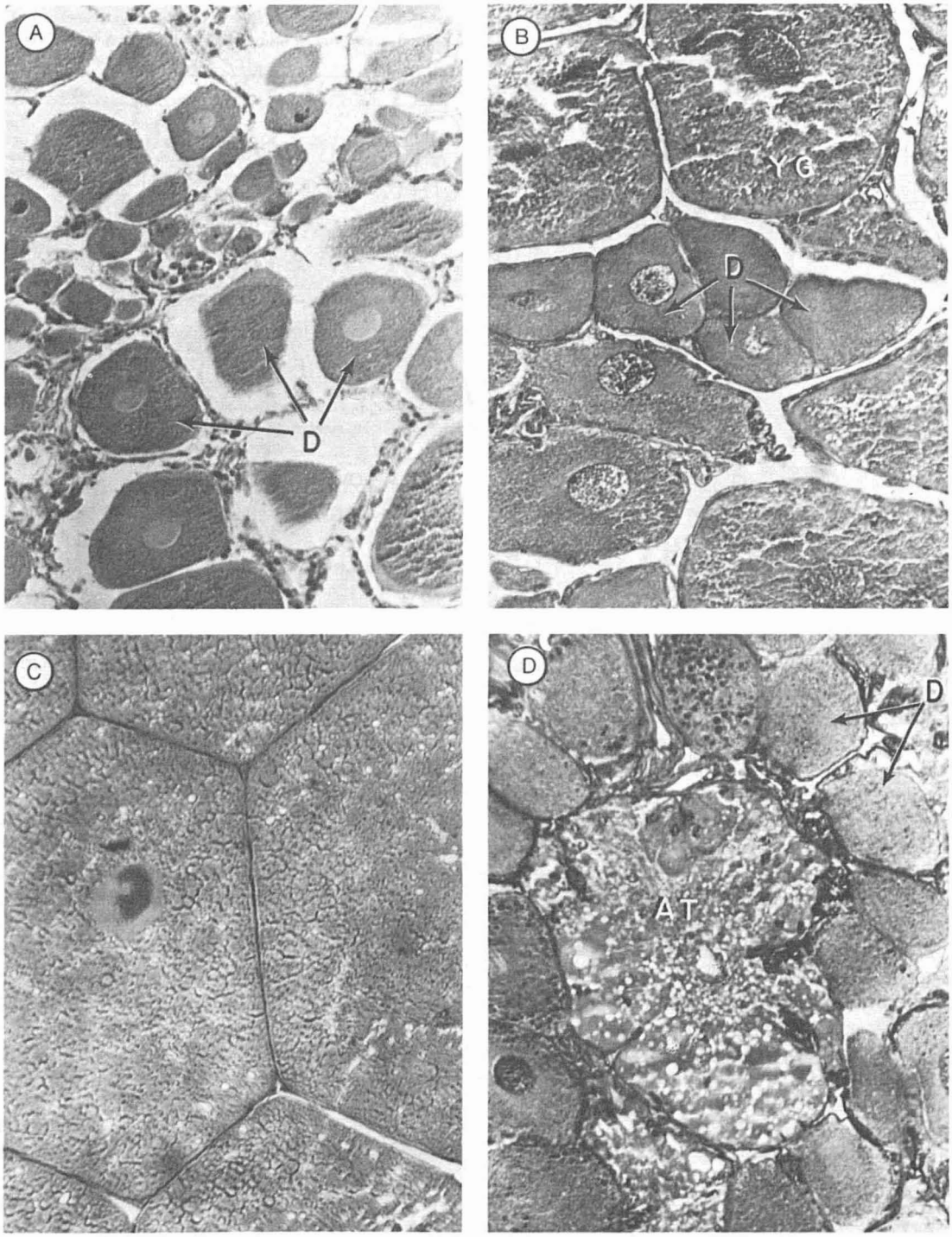

FIGURE 4.—Photomicrographs of four ovarian stages of *Stereomastis sculpta* and *S. nana*. Harris hematoxylin-eosin stain. A. Resting ovary from *S. nana* showing preponderance of developing (D) oocytes. × 165. B. Intermediate stage ovary from *S. nana*. Note presence of developing (D) oocytes among more advanced oocytes with yolk granules (YG) present. ×52. C. Gravid ovary from *S. sculpta* showing compacted yolk filled oocytes. × 52. D. Spent condition of *S. nana* showing atresic (AT) oocyte surrounded by developing (D) oocytes. × 52.

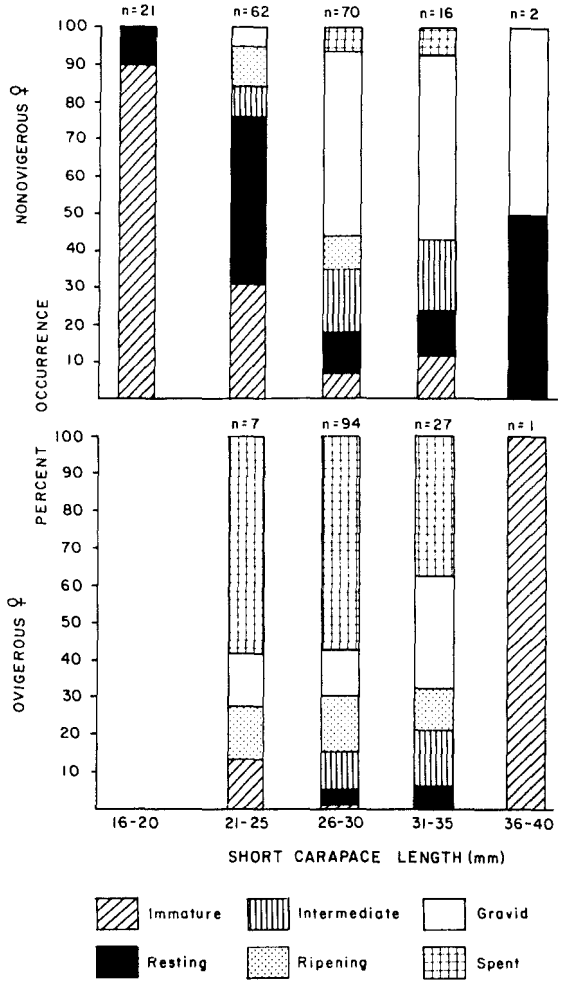

FIGURE 5.—Percent occurrence of ovigerous and nonovigerous *Stereomastis nana* in ovarian development stages for five length intervals.

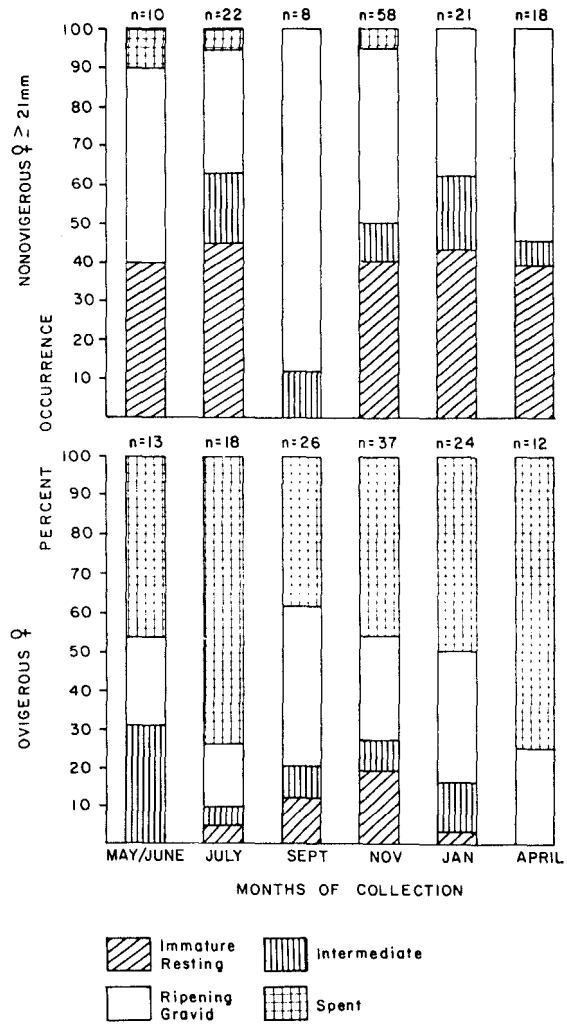

FIGURE 6.—Percent occurrence of ovigerous and nonovigerous *Stereomastis nana* in designated ovarian development stages by month of collection.

All individuals were sexually mature with spermatophores present within the vas deferens, and there were also some males at each season with spermatophores protruding from the gonopores (Table 6).

Analysis of stomachs from 438 *S. nana* showed 89% of them were empty. Among the remainder, 3% contained sediment with some Foraminifera, 2% contained either polychaete fragments or crustacean body parts, and 3% had unrecognizable paste. Single occurrences of fish scales (1%), shell fragments (1%), and one entire fish (Myctophidae?) (1%) were also noted.

Stereomastis sculpta (Smith)

Stereomastis sculpta has a wide geographic distribution, captures having been reported from the Atlantic and Indian Oceans, the Arabian, Mediterranean, and Caribbean Seas, and the Gulf of Mexico. It has been reported off the east coast of North America from lat. 35°49′-43°10′ N at depths of 460-1,568 m. It has not been reported from the Pacific Ocean, where it is replaced by the subspecies *S. sculpta pacifica* (Firth and Pequegnat see footnote 4). Roberts (1977) found *S. sculpta* to

be the most abundant polychelid collected by benthic skimmer in the Gulf of Mexico, and Firth and Pequegnat confirmed it as the most commonly caught polychelid both in that region and in the Caribbean Sea. Although Firth and Pequegnat stated that *S. sculpta* is one of the most commonly reported species in the Polychelidae and probably one of the most important polychelid species numerically on the continental slope, it was much less abundant than *S. nana* in my Middle Atlantic Bight collections (Figure 1). Abundance data based on 13.7 m otter trawl catches showed *S. sculpta* constituted 6.5% of the total benthic decapod catch. Its importance diminishes at lesser and greater depths within its bathymetric range of 486 (5.7° C) to 2,257 m (2.9° C). Analysis of variance showed no significant difference in abundance by depth intervals for 115 *S. sculpta* (Table 1).

The overall ♂:♀ ratio (1:1.1) and sex ratios for depths of capture did not differ significantly from 1:1 (Tables 2, 3). There was also no apparent relationship between average size of *S. sculpta* and depth of capture ($F = 2.321$, df = 2,122, $P = 0.05$).

Ovigerous females (mean = 54 mm) were significantly larger (Table 4) than males (mean = 32 mm) and other females (mean = 35 mm), based on analysis of variance and Scheffé's multiple mean comparison.

Spermatophores occurred only on females 45 mm and larger and were found protruding from the gonopores of males 32 mm and larger. Ovigerous females were 45 mm and larger, and all had attached spermatophores (Figure 7). Ovigerous females and most males and females with externally located spermatophores were found at the shoaler depths sampled; none were obtained below 1,199 m.

Ovarian development stages of *S. sculpta* were similar to those described for *S. nana*. Immature gonads were found in all nonovigerous females (n = 36) 36 mm and larger. Ripening and gravid individuals occurred only at sizes 38 mm and larger. Seven ovigerous females were spent, and one 54 mm individual was ripening.

Since ovigerous females were obtained each month, except July (Table 6), I conclude there was no clearly defined spawning season. Nonovigerous females with spermatophores attached occurred at all months. There was no relation between ovarian stage and month of capture.

Fecundity of four *S. sculpta* varied from 10,093 to 19,080 with a mean of 15,541. Eggs had a mean diameter of 0.6 mm.

All males were found to have spermatophores in the vas deferens. Males with external spermatophores were present during all months except January and July (Table 6).

Sixty-eight percent of 114 *S. sculpta* stomachs were empty. Stomachs of other individuals contained sediment with Foraminifera (13%), fish body parts (5%), polychaete parts (3%), crustacean parts (5%), and unidentifiable gurry (6%).

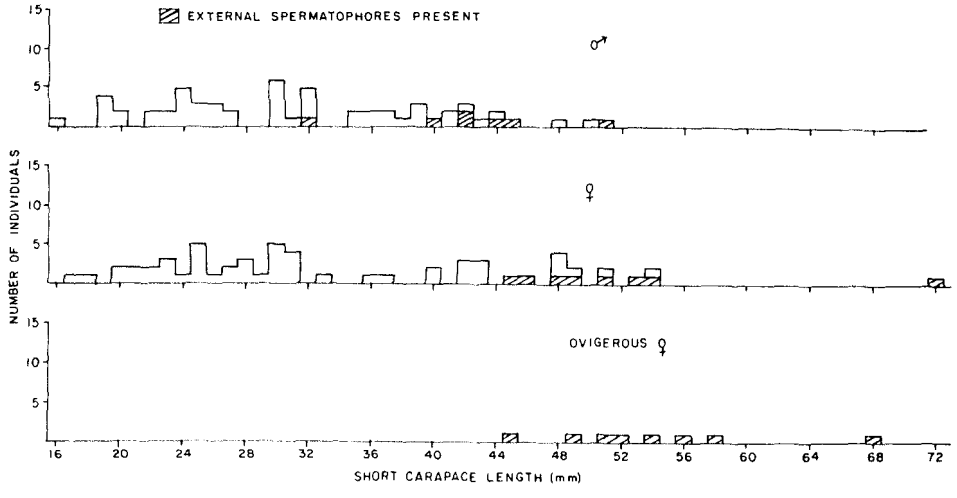

FIGURE 7.—Length-frequency distribution of *Stereomastis scultpa* represented in catches included in this study.

Other Polychelid Species

Polycheles validus (A. Milne-Edwards) is found in the eastern and western Atlantic, the Mediterranean and Caribbean Seas, and the Gulf of Mexico. Its distribution in the western North Atlantic extends northward to lat. 42° N at 2,211-2,393 m (Firth and Pequegnat see footnote 4). My Middle Atlantic Bight collections recovered 10 *P. validus* at depths between 1,698 and 2,337 m and temperatures of 3.8°-2.9° C. Males ranged from 21 to 48 mm with spermatophores present in gonopores of two individuals, 32 and 44 mm SCL. Two females were collected, 21 and 28 mm SCL, and both were immature. Small catches of *P. validus* are best attributed to its deep-living existence, having never been reported shallower than 1,280 m.

Polycheles granulatus (Faxon) has been reported from the Atlantic, Pacific, and Indian Oceans at depths of 347-2,505 m (Firth and Pequegnat see footnote 4). Captures of this species were reported at 349-799 m in the western North Atlantic by Squires.[6] I collected 11 individuals from the Middle Atlantic Bight at depths between 932 (4.4° C) and 2,068 m (3.4° C). Nine males, none with external spermatophores, were 16-22 mm SCL. Two immature females 18-28 mm were also captured. The presence of ovigerous female *P. granulatus* off the Nova Scotian Shelf at 350-440 m (Squires see footnote 6) and the fact that this species has not been reported from the Gulf of Mexico or the Carribbean Sea (Firth and Pequegnat see footnote 4) is evidence that reproducing populations of this species occur in the northerly reaches of the western Atlantic.

DISCUSSION

Although *Stereomastis nana* and *S. sculpta* were both represented in catches from the Middle Atlantic Bight, it is evident that relative abundance and bathymetric distribution of the two species are markedly different. *Stereomastis nana* was the most abundant species collected, total catches being almost four times greater than those of *S. sculpta*. Haedrich et al. (1975) collected only *S. nana* during trawling with a 4.9 m (16-ft) net on the continental slope south of New England. From further trawls in this location, they obtained 92 *S. nana* at 24 stations between 828 and 3,642 m, and only 2 *S. sculpta* at 2 stations between 1,328 and 1,938 m (Haedrich et al.[7]). Farther north, Squires (see footnote 6) collected 15 *S. sculpta* off the slope of the Grand Banks at depths of 420-810 m (4.1°-4.5° C). The lack of *S. nana* in his samples probably resulted from confinement of trawls to depths shallower than 800 m. *Stereomastis sculpta* is the most commonly caught polychelid in the Gulf of Mexico (Firth and Pequegnat see footnote 4). Roberts (1977) reported density estimates of 394 individuals/ha (565-918 m), 343 individuals/ha (1,061-1,829 m), and 88 individuals/ha (2,744-3,256 m) for the northeastern Gulf of Mexico. It appears, therefore, that *S. nana* is more abundant in the Middle Atlantic Bight while *S. sculpta* is more plentiful in southern latitudes.

Bathymetric distributions of the two species also differ, with *S. nana* found deeper on the continental slope than *S. sculpta*. Separate bathymetric distributions of these species as proposed by Barnard (1950) formed the basis for rejection of Smith's (1884) hypothesis that *S. nana* was a dwarf deep-sea form of *S. sculpta*.

Stereomastis nana and *S. sculpta* appear to spawn year round, producing large numbers of small eggs. There is no indication that increased numbers of ovigerous females occur at certain months, as suggested by Santucci (1933) and Squires (see footnote 6). Santucci (1933) found the greatest number of ovigerous female *Polycheles typhlops* were taken between April and July, while most *S. sculpta* were ovigerous in May, October, and November (Squires see footnote 6). Squires (see footnote 6) concluded from a study of 15 individuals that annual breeding occurs in *S. sculpta*. Collections of *S. nana* from my study indicate spawning occurs year round. Reproduction in *S. sculpta* appears also to be year round, but the small sample size limits interpretation of reproduction in this species.

There is also no evidence to indicate that the reproductively mature females perform upslope migrations similar to those Santucci (1933) and Bernard (1953) suggested for *P. typhlops*. These investigators found that ovigerous females and other females with well-developed ovaries ascend to shallower depths where their eggs are released.

[6]Squires, H. J. 1965. Decapod crustaceans of Newfoundland, Labrador and the Canadian eastern Arctic. Fish Res. Board Can. Manuscr. Rep. Ser. 810, 212 p.

[7]R. L. Haedrich, G. T. Rowe, and P. T. Polloni, Biological Oceangraphers, Woods Hole Oceanographic Institution, Woods Hole, MA 02543, pers. commun. October 1977.

Firth and Pequegnat (see footnote 4) suggested a similar pattern for *P. crucifer* and *S. sculpta* but cautioned that other polychelid species may not perform migrations to shallow waters. There was no evidence to support this hypothesis among *S. nana* or *S. sculpta* since ovigerous and reproductively mature females occurred within depths of maximum abundance for the species. Lack of support for the hypothesis is also indicated by failure to find any correlation between size of individuals and their depth range. If such migrations occur, larger individuals, such as ovigerous and sexually mature females, would have been found at shallower depths.

Size at sexual maturity for *Stereomastis* spp. examined in my study agrees with Firth and Pequegnat's (see footnote 4) observations. However, they found *S. sculpta* as small as 18 mm with spermatophores protruding from the genital pores. In the present study, the smallest male in this condition was 32 mm.

Feeding habits among the Polychelidae are also not resolved. Firth and Pequegnat (see footnote 4) indicated the polychelids are detritus scavengers but Lagardère (1976) found *P. typhlops* exists by almost exclusive predation on mobile crustacean prey, such as mysids, euphausiids, and pelagic amphipods. He did note, however, presence of benthic polychaetes (Aphroditidae) in several stomachs. Stomach content analysis from the present study is most inconclusive since sediment, detritus, polychaetes, and fish body parts were found. Since polychelids have seldom been seen in bottom photographs and are thought to bury in sediment (Firth and Pequegnat see footnote 4), it appears that a scavenging mode of existence along the bottom is likely for *S. nana* and *S. sculpta*.

ACKNOWLEDGMENTS

I would like to thank J. Musick for providing ship time through National Science Foundation (NSF) Grants GS-37561 and GS-27725. Special thanks go to F. Perkins and P. Berry for providing histological sections. Information on catches of *Stereomastis* from the slope off New England were provided by R. Haedrich, G. Rowe, and P. Polloni (Woods Hole Oceanographic Institution) under NSF Grant OCE-74-22339.

This research was completed while the author was recipient of an NSF award (OCE-77-05698) for support of doctoral dissertation research in biological oceanography.

LITERATURE CITED

ALLEN, J. A.
1966. The dynamics and interrelationships of mixed populations of Caridea found off the north-east coast of England. In H. Barnes (editor), Some comtemporary studies in marine science, p. 45-66. Hafner Publ. Co., N.Y.

ANDREWS, E. A.
1911. Sperm transfer in certain decapods. Proc. U.S. Natl. Mus. 39:419-434.

BARNARD, K. H.
1950. Descriptive catalogue of South African decapod Crustacea. Ann. S. Afr. Mus. 38:1-837.

BATE, C. S.
1888. Report on the Crustacea Macrura collected by H.M.S. Challenger during the years 1873-76. Rep. Sci. Res. Voyage H.M.S. Challenger, 1873-76, Zool. 24, 942 p.

BERNARD, F.
1953. Decapoda Eryonidae (*Eryoneicus* et *Willemoesia*). Dana Rep. Carlsberg Found. 37, 93 p.

GLAESSNER, M. F.
1969 Decapoda. In R.C. Moore (editor), Treatise on invertebrate paleontology, Part R, Arthropoda 4, Vol. 2, p. 399-533. Geol. Soc. Am., Inc., and Univ. Kans.

HAEDRICH, R. L., G. T. ROWE, AND P. T. POLLONI.
1975. Zonation and faunal composition of epibenthic populations on the continental slope south of New England. J. Mar. Res. 33:191-212.

HANSEN, H. J.
1908. Crustacea Malacostraca. I. Dan. Ingolf-Exped. 3(2), 120 p.

HUMASON, G. L.
1972. Animal tissue techniques. 3d ed. W. H. Freeman and Co., San Franc., Calif., 641 p.

LAGARDÈRE, J. P.
1976. Recherches sur la distribution verticale et sur l'alimentation des crustacés décapodes de la pente continentale de l'Atlantique nord-oriental. Thèse, l'Université d'Aix-Marseille, France, 188 p.

MEREDITH, S. S.
1952. A study of *Crangon crangon* L. in the Liverpool Bay area. Proc. Trans. Liverp. Biol. Soc. 58:75-109.

ROBERTS, T. W.
1977. An analysis of deep-sea benthic communities in the northeast Gulf of Mexico. Ph.D. Thesis, Texas A&M Univ. College Station, 270 p.

SANTUCCI, R.
1933. Biologia del fondo a "Scampi" nel mare ligure. I. - *Polycheles typhlops*. Heller R. Comit. Talassograf. Ital. Mem. 199, 48 p.

SMITH, S. I.
1884. XV-Report on the decapod Crustacea of the Albatross dredgings off the east coast of the United States in 1883. U.S. Comm. Fish Fish. Rep. Comm. for 1882 10:345-426.
1887. XXI-Report on the decapod Crustacea of the Albatross dredgings off the east coast of the United States during the summer and autumn of 1884. U.S. Comm. Fish Fish. Rep. Comm. for 1885 13:605-705.

SNEDECOR, G. W., AND W. G. COCHRAN.
1967. Statistical methods. 6th ed. Iowa State Univ. Press., Ames, 593 p.

WOOLF, C. M.
1968. Principles of biometry. D. Van Nostrand Co., Inc., Princeton, N.J., 359 p.