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Meroplankton Monitoring Data from a Fixed Platform
in the Chesapeake Bay Mouth, 1982 - 1983

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Ray S. Birdsong, David W. Byrd, James F. Matta,
and Bert W. Parolari, Jr.

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Introduction

Long-term monitoring studies of non-commercial marine organisms are rare, especially studies of zooplankton populations. Where such data bases exist they are frequently the source of unique and valuable information. The importance of long-term data bases is the continuity of data over time hence their maximum value is only realized after a number of iterations of the ecological cycle under study. This report constitutes a preliminary look at the first two years of data from what we hope will become a continuing study of meroplankters in the Chesapeake Bay mouth.

Among the objectives of this research were to compare the technique of monitoring zooplankton from a fixed platform, (the fishing pier on the South Island of the Chesapeake Bay Bridge-Tunnel) with towed collections. The fixed platform sampling approach was selected for testing because it is both less expensive and, not being weather dependent, more reliable than boat towed collections. These are both important considerations in the establishment of a long-term program.

At present the data from the companion towed stations are unavailable to us, consequently the level of success of this approach cannot be fully evaluated here. The data, however, constitute a unique data set in that they comprise the largest discrete depth meroplankton study conducted in the bay mouth region and consequently merit discussion in

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themselves.

An additional report comparing the 2 collection techniques will be forthcoming when all data are available.

Sampling Regime and Methodolgy

Sampling was conducted semimonthly from January 1982 through December 1983 from the end of the fishing pier which extends from the South Island of the Chesapeake Bay Bridge-Tunnel contiguous to the Thimble Shoal Channel.

Samples were taken at the following discrete depths:

- (1) surface
- (2) one meter below the surface
- (3) one meter above the bottom
- (4) bottom

Each series of samples comprised three or four serial replicates each of fifteen minutes duration at each depth. The volume of water filtered varied widely between sampling dates and depths and occasionally between replicates.

Two types of net frames were employed, both fitted with 353 micron mesh conical nets with 0.5 m diameter openings. Neuston and bottom samples were taken with the net fitted to a rectangular frame 21.5 cm x 55.5 cm yielding a mouth area of 1193.25 sq. cm. When fished at the surface as a neuston net, the rectangular frame was fitted with side floats which held the upper portion of the frame above the surface. When

fished in this mode, the effective fishing area of the mouth was approximately 895 sq. cm.

Below the surface and above the bottom samples were taken with the nets fitted to a 1/2 m mouth diameter circular bongo frame which yielded a mouth area of 1963.5 cm . Since this yielded two simultaneous replicates, the gear was fished for two fifteen minute sets at each depth during a series to produce two serial sets of two simultaneous replicates. All four replicates were treated the same.

All nets were equipped with torpedo type flow meters with "low flow" rotors (General Oceanics model #2030). Temperature and salinity were taken with an inductive salinometer at the surface and bottom at the start and end of each sampling-series (Tables 1 and 2). During the first five months of the study, surface and bottom current speed and direction were monitored with a Bendix model Q-9 current meter. Current measurements were discontinued in May of 1982.

Passive sampling inherently samples a smaller volume of water than towed samples of the same duration, consequently, in this study, sampling was conducted on or near the new and full moons when tidal currents were presumed to be at their maximum. For the first nine months of the study, January 1982 to September 1982, sampling was conducted on both the ebb and flood tides near the presumed time of maximum flow. This sampling protocol presented many difficulties, as outlined below, and was abandoned for a single series of samples

on each sampling date taken without regard to tidal stage. The original protocol presented the following problems:

- (1) Current speed and sometimes direction near the surface were partially, but importantly dependent upon wind speed and direction and fresh-water outflow of the bay drainage systems.
- (2) Time of tide change and maximum ebb and flood were impossible to anticipate within the limits required by the protocol.
- (3) Time of maximum velocity of near-surface and near-bottom waters were usually out of phase, sometimes by several hours. Direction of flow differed in surface and bottom waters during a portion of each tidal cycle and on occasion throughout an entire tide phase.

Samples were concentrated into one quart containers and preserved in the field in 10% formalin in seawater. During the sorting process in the laboratory, samples were split as required following the "CVS" method of Alden, et al (1982). Splits were accomplished with a Folsom plankton splitter and subsamples were randomly selected for sorting. All meroplankton in each subsample sorted were enumerated and identified to the lowest taxonomic level possible under the budgetary constraints of the project.

After sorting, subsamples were recombined and all samples were archived in the Department of Biological Sciences, Old Dominion University, Norfolk, Virginia.

Results and Discussion

The results presented here are preliminary and involve no statistical scrutiny. Variation between replicates is, however, obviously high.

Tables 3 and 4 show the frequency and density of meroplankters collected in 1982 and 1983. In these tables the frequency represents the number of replicates in which an organism appeared, e.g., if an organism appeared in a single sampling series in all three replicates at all four depths, it has been counted as twelve occurrences in the yearly total. Also, the density represents the cumulative density at all depths and all replicates in which the organism appeared. The additional 104 samples taken in 1982 result from both ebb and flood collections for a portion of that year. Where larval stages are readily identifiable, species are divided on the list into these stages, eg. the blue crab, Callinectes sapidus, is listed both as "C. sapidus zoea" and as "C. sapidus megalopa".

The meroplankton collections were dominated by four general groups: 1) fish eggs, especially those of the bay anchovy, Anchoa mitchilli; 2) barnacle nauplii; 3) crab zoea of a variety of species; and 4) polychaete annelid larvae.

Although fish eggs were abundant in the collections, few fish larvae were taken. This scarcity was also noted among the more advanced stages of crab larvae. While advanced stages are expected to be in lower abundance than younger

stages, we suspect net avoidance was responsible for some of the difference seen in this study.

The high density of barnacle larvae was almost certainly the result of the location of the collection site. A large barnacle population exists on the rip rap forming the tunnel island from which the collecting pier extends.

Striking differences in density were observed in many species between 1982 and 1983. Of the twenty species or groups showing the highest densities in 1982, 17 were less abundant in 1983. Seven of these species or groups showed a reduction in density of an order of magnitude or greater. The reduction in abundance in 1983 compared to 1982 extends through most of the species or groups collected.

As can be seen in Figures 2 - 35 the time of first occurrence and the time of peak abundance was later in 1983 than in 1982 for most species. The bay mouth was slightly warmer and less saline in 1983 than in 1982, however, we have no evidence linking this with the general phenomenon of the retarded spawning season.

Discrete depth zooplankton samples below the neuston layer are rare from shallow inshore waters. The samples reported on here appear to be unique in their extent over time in the lower Chesapeake Bay. Tables 5 and 6 show the frequency and density at depth for the most abundant meroplankters in 1982 and 1983, respectively.

A large body of literature exists on the vertical distribution and migration of zooplankters. Since all of our

collections were made during the day, we produced no information on diurnal vertical movement in the water column; however, it is apparent from Tables 4 and 5 that many species show uneven distributions at least during the day.

Near surface waters were dominated by fish eggs and crab zoea. Especially abundant in the surface layer were the eggs of the bay anchovy, Anchoa mitchilli and the zoea stages of the blue crab, Callinectes sapidus, and the rock crab, Cancer irroratus.

Near bottom water were dominated by polychaete annelid larvae, bivalve mollusk larvae and the zoea stages of several crabs, Pinnixia, Pinnotheres, Upogebia and Libinia.

A number of meroplankters appeared to be scattered throughout the water column. These forms include Anchoa mitchilli larvae, the zoea of the sand shrimp, Crangon septempinosa, the mud crab, Neopanope texana sayi, and fiddler crabs, Uca spp. Also prominent were the megalopa stages of the blue crab, Callinectes sapidus, and the mud crab, Hexapanopeus angustifrons, as were barnacle nauplii, gastropod larvae, and spionid polychaete larvae.

Tables and Figures

Table 1. Temperature and salinity data accompanying the 1982 meroplankton samples at South Island, Chesapeake Bay Bridge-Tunnel. "Begin" = beginning of a sample series and "End" = end of a sample series; "F" = flood tide, "E" = ebb tide.

Date		Surface				Bottom			
		Temperature (C)		Salinity (o/oo)		Temperature (C)		Salinity (o/oo)	
		Begin	End	Begin	End	Begin	End	Begin	End
		-----	-----	-----	-----	-----	-----	-----	-----
01/27/82	F	0.3	0.4	20.7	22.5	0.4	0.5	21.8	25.2
	E	0.4	0.4	23.3	21.1	0.5	0.5	25.0	21.5
02/08/82	F	---	---	----	----	---	---	----	----
	E	2.6	3.1	18.9	19.6	2.5	2.5	21.3	21.6
02/24/82	F	4.0	---	23.7	24.0	3.3	---	31.6	30.8
	E	4.7	5.0	22.8	22.5	3.2	3.8	31.8	25.3
03/09/82	F	4.1	4.1	21.2	22.1	4.0	2.8	21.8	23.0
	E	4.6	4.8	22.5	20.5	4.0	4.7	23.0	20.9
03/25/82	F	7.7	7.8	19.8	20.1	6.3	6.2	26.4	27.7
	E	8.9	8.9	19.1	19.1	6.5	7.2	27.2	22.1
04/08/82	F	7.5	7.6	22.1	21.7	7.3	7.6	18.5	21.9
	E	7.6	8.2	22.3	21.5	7.4	7.8	23.9	22.7
04/22/82	F	11.1	11.0	22.2	22.4	10.6	10.5	23.9	23.0
	E	11.7	11.8	21.2	21.1	10.0	11.3	25.7	21.8
05/06/84	F	15.3	----	19.6	----	12.4	----	27.3	----
	E	15.8	16.5	20.3	19.9	12.2	16.5	27.5	21.1

Table 1. Cont'd.

Date		Surface				Bottom			
		Temperature (C)		Salinity (o/oo)		Temperature (C)		Salinity (o/oo)	
		Begin	End	Begin	End	Begin	End	Begin	End
05/25/82	F	20.0	19.8	21.1	22.0	19.5	18.8	22.9	23.9
	E	20.4	20.5	22.0	22.0	19.5	19.8	23.1	21.3
06/08/82	F	22.0	21.6	28.9	29.3	19.6	19.7	30.4	30.4
	E	22.2	22.2	22.1	20.7	20.4	20.4	29.2	26.4
06/23/82	F	22.7	22.8	20.1	20.3	20.8	21.5	24.8	24.1
	E	22.7	23.4	22.4	20.2	22.3	23.5	22.5	22.0
07/07/82	F	23.5	23.7	21.4	21.4	20.1	20.5	27.1	26.4
	E	24.4	24.2	21.6	21.2	20.7	21.7	25.7	24.2
07/20/82	F	26.5	26.5	28.8	21.5	25.1	24.6	22.2	22.7
	E	24.8	24.2	22.8	23.4	19.9	20.2	27.2	26.9
08/04/82	F	26.8	27.9	20.7	20.4	17.8	20.0	29.0	27.7
	E	25.8	25.5	20.1	21.0	16.5	17.2	29.4	28.7
08/18/82	F	24.8	24.6	22.1	22.2	24.2	24.0	22.4	22.1
	E	23.7	23.7	22.4	23.1	22.4	21.9	24.7	25.7
09/02/82	F	23.2	23.3	24.3	23.8	22.9	23.1	24.6	24.4
	E	22.8	22.7	23.2	24.3	21.8	21.8	27.8	27.6

Table 1. Cont'd.

Date	Surface				Bottom				
	Temperature (oC)		Salinity (o/oo)		Temperature (oC)		Salinity (o/oo)		
	Begin	End	Begin	End	Begin	End	Begin	End	
	-----	-----	-----	-----	-----	-----	-----	-----	
09/16/82	F	24.2	24.2	23.8	23.2	23.0	24.0	25.3	23.3
	E	23.5	24.0	24.2	24.9	23.4	23.3	24.8	25.9
09/16/82	F	24.2	24.2	23.8	23.2	23.0	24.0	25.3	23.3
	E	23.5	24.0	24.2	24.9	23.4	23.3	24.8	25.9
09/29/82	F	22.0	22.0	22.3	22.0	21.7	21.6	22.6	26.4
	E	21.5	21.8	22.0	22.8	21.6	21.5	26.9	26.7
10/13/82	F	MISSING DATA				MISSING DATA			
	E	MISSING DATA				MISSING DATA			
10/27/82		14.2	14.2	24.0	22.6	14.2	14.1	29.7	29.5
11/16/82		13.1	12.3	26.5	24.6	13.0	12.4	27.3	25.4
11/30/82		11.9	11.7	25.9	25.3	11.8	11.6	26.2	25.2
12/14/82		8.1	7.4	21.1	21.5	8.2	8.6	21.8	26.2
12/29/82		9.0	8.8	22.1	23.4	8.8	8.7	22.5	23.6

Table 2. Temperature and salinity data accompanying the 1983 mero-plankton samples at South Island, Chesapeake Bay Bridge-Tunnel. "Begin" = beginning of a sample series and "End" = end of a sample series.

Date	Surface				Bottom			
	Temperature (C)		Salinity (o/oo)		Temperature (C)		Salinity (o/oo)	
	Begin	End	Begin	End	Begin	End	Begin	End
01/13/83	6.2	6.0	22.6	22.1	6.5	6.1	23.2	22.4
01/27/83	4.0	3.9	21.3	21.9	4.1	4.0	22.3	21.4
02/15/83	4.2	4.6	20.7	20.6	3.6	3.5	23.5	21.3
03/02/83	5.9	5.7	20.9	19.7	5.8	5.7	21.3	19.9
03/15/83	8.2	8.6	18.9	18.5	6.4	7.6	27.2	20.6
03/29/83	8.3	8.6	18.8	19.8	8.0	7.7	20.3	21.2
04/13/83	11.1	11.1	17.9	19.1	10.3	10.4	20.4	19.5
04/28/83	13.8	13.8	15.8	16.0	11.3	11.6	21.6	20.7
05/12/83	15.6	15.3	21.3	21.8	13.0	13.5	29.7	29.7
05/26/83	18.7	18.6	20.7	19.5	17.1	15.2	24.5	27.1
06/09/83	20.0	20.6	21.2	20.6	16.2	18.6	27.5	21.9
06/28/83	24.9	25.7	19.5	19.2	20.2	21.1	27.1	27.1
07/12/83	24.7	26.0	18.2	16.5	22.3	24.4	23.0	17.8
07/26/83	25.2	27.1	22.2	20.3	21.4	24.1	26.9	24.1
08/09/83	27.5	27.3	25.1	22.3	24.0	24.8	24.5	24.1
08/24/83	24.5	25.0	25.6	26.0	23.9	24.0	25.8	25.0
09/09/83	26.9	26.7	24.3	24.3	25.9	26.4	24.2	24.0
09/22/83	23.3	23.2	25.7	24.1	23.2	23.5	26.5	24.4
10/07/83	21.1	20.8	24.5	24.8	20.7	20.9	25.0	23.8
10/27/83	24.3	15.7	24.3	22.5	17.1	16.5	23.3	22.0

Table 2. Cont'd.

Date	Surface				Bottom			
	Temperature (C)		Salinity (o/oo)		Temperature (C)		Salinity (o/oo)	
	Begin	End	Begin	End	Begin	End	Begin	End
11/15/83	13.1	13.1	27.6	28.5	13.2	13.4	27.0	29.4
11/22/83	12.2	12.3	25.8	25.1	12.3	12.0	25.5	25.5
12/10/83	9.7	9.3	22.8	21.4	11.4	11.4	23.4	28.6

Table 3. Frequency of occurrence and density of meroplankton taken at South Island, Chesapeake Bay Bridge-Tunnel in 1982. Total samples = 379. Species density is the average of all samples in which the species appeared. Frequency is the number of tows in which an organism appeared.

Species	Frequency	Density (#/100 cu. m.)
<u>Ammodytes americanus</u> larvae	15	7.975
<u>Menidia menidia</u> larvae	7	30.688
<u>Scophthalmus aquosus</u> larvae	4	43.846
<u>Scophthalmus aquosus</u> eggs	43	131.559
<u>Hypsoblennius hentzi</u> larvae	29	41.536
<u>Anchoa mitchilli</u> larvae	91	593.500
<u>Anchoa mitchilli</u> eggs	126	35,530.500
<u>Chaetodipterus faber</u> larvae	1	1.531
<u>Gobiesox strumosus</u> larvae	2	3.407
<u>Gobiosoma boscii</u> larvae	51	53.574
<u>Tautoga onitis</u> larvae	1	5.923
<u>Lophius americanus</u> larvae	1	10.554
<u>Bairdiella chrysoura</u> eggs	15	221.259
<u>Cynoscion regalis</u> larvae	8	26.459
<u>Menticirrhus saxatilis</u> larvae	1	21.297
<u>Pogonias cromis</u> eggs	5	22.266
<u>Trinectes maculatus</u> larvae	12	16.948
<u>Trinectes maculatus</u> eggs	80	843.679
<u>Hippocampus</u> sp.	1	3.822
<u>Syngnathus fuscus</u>	5	5.768
<u>Sphoeroides maculatus</u>	1	6.019
Fish egg, unidentified	87	400.886
Fish larvae, unidentified	9	16.354
<u>Ophiurae</u> sp. larvae	2	56.466
<u>Lucifer faxoni</u> larvae	51	52.943
<u>Penaeus</u> sp. zoea	2	9.271
Palaemonidae, unidentified zoea	38	108.719
<u>Alpheus</u> sp. zoea	22	41.762
<u>Ogyrides</u> sp. zoea	15	59.851
<u>Hippolyte</u> sp. zoea	1	1.359
<u>Crangon septemspinosa</u> zoea	160	637.402
<u>Callinassa</u> sp. zoea	79	268.710
<u>Upogebia affinis</u> zoea	140	1,696.430
<u>Naushonia crangonoides</u> zoea	3	19.334
Shrimps, unidentified zoea	5	61.911
<u>Euceramus</u> sp. zoea	39	228.395
<u>Polyonyx gibbesi</u> zoea	85	101.381
Porcellanidae, unidentified zoea	2	25.312
<u>Pagurus</u> sp. zoea	92	250.634
<u>Emerita talpoida</u> zoea	43	79.195
<u>Lepidopa websteri</u> zoea	2	16.230

Table 3. Cont'd.

Species	Frequency	Density (#/100 cu. m.)
<u>Callinectes</u> <u>sapidus</u> zoea	145	4,698.590
<u>Callinectes</u> <u>sapidus</u> megalopa	34	184.481
<u>Ovalipes</u> <u>ocellatus</u> zoea	73	569.231
<u>Portunus</u> <u>gibbesii</u> zoea	7	534.092
<u>Portunus</u> <u>spinimanus</u> zoea	16	201.819
<u>Portunus</u> sp. zoea	25	1,279.160
<u>Cancer</u> <u>irroratus</u> zoea	32	6,152.010
<u>Eurypanopeus</u> <u>depressus</u> zoea	7	32.697
<u>Hexapanopeus</u> <u>angustifrons</u> zoea	85	658.077
<u>Hexapanopeus</u> <u>angustifrons</u> megalopa	14	74.212
<u>Neopanope</u> <u>texana</u> <u>sayi</u> zoea	142	1,417.530
<u>Neopanope</u> sp. megalopa	1	36.158
Xanthidae unidentified zoea	26	316.377
<u>Pinnixa</u> <u>chaetoptera</u> larvae	100	927.076
<u>Pinnixa</u> <u>chaetoptera</u> megalopa	1	43.390
<u>Pinnixa</u> <u>cylindrica</u> zoea	42	466.459
<u>Pinnixa</u> <u>sayana</u> zoea	114	419.294
<u>Pinnixa</u> sp. zoea	9	64.106
<u>Pinnotheres</u> <u>maculatus</u> zoea	54	126.545
<u>Pinnotheres</u> <u>ostreum</u> zoea	123	1,122.150
<u>Pinnotheres</u> <u>ostreum</u> megalopa	22	135.826
<u>Pinnotheres</u> <u>ostreum</u> crab stage	14	29.716
<u>Uca</u> spp. zoea	115	889.014
<u>Libinia</u> sp. zoea	51	301.170
<u>Libinia</u> sp. megalopa	5	673.533
Zoea, unidentified	9	96.525
Barnacle nauplii	279	8,699.750
Barnacle cyprid	11	70.432
<u>Squilla</u> <u>empusa</u> zoea	61	63.835
Ampharetidae, unidentified	3	8.094
<u>Asabellides</u> <u>oculata</u>	51	103.213
<u>Mediomastus</u> <u>ambiseta</u>	5	20.410
Chrysopetalidae, unidentified	18	88.979
<u>Paleanotus</u> <u>heteroseta</u>	2	29.329
Goniadidae, unidentified	1	30.613
Hesionidae, unidentified	12	949.629
Nephytidae, unidentified	4	54.909
Nereidae, unidentified	110	837.775
<u>Nereis</u> <u>succinea</u>	2	3.624
<u>Pebtinaria</u> <u>gouldi</u>)	2	69.262
Opheliidae, unidentified	6	56.942
Phyllodocidae, unidentified	17	180.796
<u>Paranaitis</u> <u>speciosa</u>	12	23.429
Polynoidae, unidentified	30	194.839
<u>Polydora</u> sp.	64	922.717
<u>Paraprionospio</u> <u>pinnata</u>	2	18.703

Table 3. Cont'd.

Species	Frequency	Density (#/100 cu. m.)
<u>Spiophanes bombyx</u>	2	10.136
Spionidae, unidentified	238	3,085.240
Syllidae, unidentified	7	80.544
<u>Autolytus sp.</u>	14	2,335.810
Polychaeta, unidentified	124	602.387
Echinoderm larva, unidentified	2	20.700
Nudibranchia, unidentified	6	25.755
Oligochaeta	3	29.836
Phoronidae, unidentified	65	318.994
Tunicate larvae, unidentified	3	66.538
Nematoda, unidentified	8	46.962
Solenidae, unidentified	30	101.343
Bivalves, unidentified	183	809.434
<u>Ilyanassa sp.</u>	4	215.075
Gastropoda, unidentified	184	1,320.150
<u>Loligo sp. larvae</u>	3	49.587

Table 4. Frequency of occurrence and density of meroplankton taken at South Island, Chesapeake Bay Bridge-Tunnel in 1983. Total samples = 275. Species density is the average of all samples in which the species appeared. Frequency is the number of tows in which the organism appeared.

Species	Frequency	Density (#/100 cu. m.)
<u>Ammodytes americanus</u>	1	53.084
<u>Menidia menidia</u> larvae	2	5.985
<u>Scophthalmus aquosus</u> larvae	1	2.993
<u>Scophthalmus aquosus</u> eggs	7	24.915
<u>Hypsoblennius hentzi</u> larvae	38	281.535
<u>Anchoa mitchilli</u> larvae	41	280.937
<u>Anchoa mitchilli</u> eggs	84	4653.300
<u>Gobiesox strumosus</u> larvae	3	4.514
<u>Gobiosoma bosci</u> larvae	19	69.779
<u>Tautoga onitis</u> larvae	1	12.260
<u>Bairdiella chrysoura</u> eggs	19	187.905
<u>Cynoscion regalis</u> larvae	3	24.421
<u>Trinectes maculatus</u> larvae	5	7.745
<u>Trinectes maculatus</u> eggs	61	723.413
<u>Hippocampus</u> sp.	1	6.280
Fish eggs, unidentified	46	2007.910
Fish larvae, unidentified	6	5.920
<u>Ophiuræ</u> sp.	2	245.206
<u>Lucifer</u> sp. zoea	41	314.181
<u>Penaeus</u> sp.	1	1.149
Paleomonidae, unidentified zoea	64	107.451
<u>Alpheus</u> sp. zoea	18	325.469
<u>Ogyrides</u> sp. zoea	1	4.544
<u>Hippolyte</u> sp. zoea	1	28.677
<u>Crangon septemspinosus</u>	172	3252.590
<u>Callinassa</u> sp. zoea	41	342.792
<u>Upogebia affinis</u> zoea	80	538.482
<u>Naushonia crangonoides</u> zoea	3	6.845
Shrimps, unidentified	6	2.936
<u>Euceramus</u> sp. zoea	63	103.697
<u>Polyonyx gibbesii</u> zoea	10	43.974
<u>Pagurus</u> sp. zoea	75	236.338
<u>Emerita talpoida</u> zoea	20	74.708
<u>Callinectes sapidus</u> zoea	104	4388.360
<u>Callinectes sapidus</u> megalopa	19	238.359
<u>Ovalipes ocellatus</u> zoea	20	70.104
<u>Portunus</u> sp. zoea	2	109.018
<u>Cancer irroratus</u> zoea	38	472.196
<u>Hexapanopeus angustifrons</u> zoea	74	429.745
<u>Hexapanopeus angustifrons</u> megalopa	3	16.380
<u>Neopanope texana sayi</u> zoea	96	376.065

Table 4. Cont'd.

Species	Frequency	Density (#/100 cu. m.)
<u>Neopanope sp.</u> zoea	4	34.171
Xanthidae, unidentified zoea	7	268.590
<u>Pinnixa chaetoptera</u> zoea	63	386.653
<u>Pinnixa cylindrica</u> zoea	26	185.926
<u>Pinnixa sayana</u> zoea	77	245.491
<u>Pinnotheres maculatus</u> zoea	36	78.668
<u>Pinnotheres ostreum</u> zoea	64	378.964
<u>Pinnotheres ostreum</u> megalopa	5	104.052
<u>Pinnotheres ostreum</u> crab stage	20	53.166
<u>Uca spp.</u> zoea	74	1428.300
<u>Libinia sp.</u> zoea	8	30.390
Zoea, unidentified	6	292.700
<u>Squilla empusa</u> zoea	40	144.591
Barnacle nauplius	244	17842.900
Barnacle cypris	48	357.393
Ampharetidae, unidentified	24	259.238
<u>Asabellides oculata</u>	1	57.355
<u>Mediomastus ambiseta</u>	30	287.728
Goniadidae, unidentified	2	6.446
Nephytidae, unidentified	2	105.936
Nereidae, unidentified	45	178.302
<u>Pectinaria gouldii</u>	3	55.456
Phyllodocidae, unidentified	3	96.735
<u>Paranaitis speciosa</u>	2	4.526
Polynoidae, unidentified	13	82.667
<u>Polydora sp.</u>	8	71.703
Spionidae, unidentified	170	587.093
Syllidae, unidentified	35	305.647
<u>Autolytus sp.</u>	3	11.121
Polychaeta, unidentified	37	201.635
Nudibranchs, unidentified	5	44.800
Oligochaeta, unidentified	2	11.905
Phoronidae, unidentified	12	25.915
Solenidae, unidentified	4	17.979
Bivalves, unidentified	108	377.521
Gastropoda, unidentified	105	557.816
<u>Loligo sp.</u>	1	12.561

Table 5. Frequency and average density (number/100 cu. m.) by depth for the most abundant meroplankters in 1982.

Species	Neuston		Surface-1m		Bottom+1m		Benthic	
	Freq.	Density	Freq.	Density	Freq.	Density	Freq.	Density
<u>Anchoa mitchilli</u> eggs	22	168,067	45	11,507	39	4,757	20	3,800
<u>Anchoa mitchilli</u> larvae	11	1,161	27	493	38	469	15	674
<u>Gobiosoma boscii</u> larvae	2	8	12	33	25	46	12	98
<u>Bairdiella chrysoura</u> eggs	1	2,472	9	23	4	97	1	250
<u>Trinectes maculatus</u> eggs	16	3,201	38	323	19	120	7	243
fish eggs, unidentified	21	377	21	61	39	43	6	104
<u>Crangon septemspinosus</u> zoea	23	212	35	95	55	353	48	1,561
<u>Upogebia affinis</u> zoea	19	1,894	41	821	53	2,051	27	2,192
<u>Callinectes sapidus</u> zoea	21	19,949	52	2,398	49	2,287	23	1,115
<u>Callinectes sapidus</u> megalopa	3	6	10	128	17	256	4	157
<u>Fortunus</u> sp. zoea	4	5,715	12	666	2	15	7	156
<u>Cancer irroratus</u> zoea	9	21,400	12	197	11	172	0	0
<u>Hexapanopeus angustifrons</u> zoea	18	1,243	33	707	20	296	14	306
<u>Hexapanopeus angustifrons</u> megalopa	1	7	1	7	9	82	3	95
<u>Neopanope texana</u> sayi zoea	24	2,867	33	588	56	1,305	29	1,379
<u>Pinixa chaetoperana</u> zoea	9	138	25	81	52	1,569	14	560
<u>Pinixa cylindrica</u> zoea	8	1,880	7	31	23	159	4	171
<u>Pinixa sayana</u> zoea	12	1,227	34	158	43	367	25	478
<u>Pinnotheres ostreum</u> zoea	15	649	38	140	45	2,374	25	646
<u>Uca</u> spp. zoea	17	2,210	35	464	47	933	16	287
<u>Libinia</u> spp. zoea	4	10	7	11	23	391	17	368
barnacle nauplii, unidentified	50	1,901	93	4,270	50	1,901	93	4,270
bivalve larvae, unidentified	24	95	52	462	24	95	52	462
gastropod larvae, unidentified	24	1,884	50	1,032	24	1,884	50	1,032
spionid polychaete larvae	30	219	89	1,327	30	219	89	1,327
nereid polychaete larvae	5	308	27	143	5	308	27	143
<u>Polydora</u> sp. larvae	8	65	36	220	8	65	36	220
<u>Autolytus</u> sp. larvae	1	7	1	196	1	7	1	196

Table 6. Frequency and average density (number/100 cu. m.) by depth for the most abundant meroplankters in 1983.

Species	Neuston		Surface-1m		Bottom+1m		Benthic	
	Freq.	Density	Freq.	Density	Freq.	Density	Freq.	Density
<u>Anchoa mitchilli</u> eggs	21	7,478	234	3,988	21	1,407	19	5,923
<u>Anchoa mitchilli</u> larvae	8	66	10	72	12	232	11	681
<u>Gobiosoma bosci</u> larvae	0	0	3	5	8	52	8	112
<u>Bairdiella chrysaora</u> eggs	2	785	10	148	6	55	1	29
<u>Trinectes maculatus</u> eggs	15	2,572	20	100	13	68	13	205
fish eggs, unidentified	7	12,587	13	227	4	7	0	0
<u>Crangon septemspinosus</u> zoea	41	7,852	46	1,768	44	1,507	41	2,191
<u>Upegebia affinis</u> zoea	13	130	26	322	22	438	19	1,232
<u>Callinectes sapidus</u> zoea	28	7,595	27	2,016	25	2,940	24	4,823
<u>Callinectes sapidus</u> megalopa	2	295	1	14	9	156	7	361
<u>Portunus</u> sp. zoea	1	48	0	0	0	0	1	170
<u>Cancer irroratus</u> zoea	8	932	11	18	10	232	9	884
<u>Hexapanopeus angustifrons</u> zoea	11	553	24	407	21	364	18	462
<u>Hexapanopeus angustifrons</u> megalopa	0	0	1	6	2	22	0	0
<u>Neopanope texana sayi</u> zoea	18	104	29	149	25	373	24	857
<u>Pinixa chaetoperana</u> zoea	5	90	14	40	6	45	0	0
<u>Pinixa cylindrica</u> zoea	6	702	14	25	24	401	20	686
<u>Pinixa sayana</u> zoea	5	56	24	31	25	215	23	543
<u>Pinnotheres ostreum</u> zoea	7	109	16	110	21	403	20	663
<u>Uca</u> spp. zoea	13	1,082	23	374	20	1,735	18	2,685
<u>Libinia</u> spp. zoea	0	0	5	5	2	23	1	171
barnacle nauplii, unidentified	60	40,046	68	6,686	59	8,818	57	17,123
bivalve larvae, unidentified	10	975	19	55	44	293	35	489
gastropod larvae, unidentified	14	125	34	225	41	1,052	16	378
spionid polychaete larvae	23	1,709	42	121	58	591	47	449
neriid polychaete larvae	3	37	7	15	20	90	15	400
<u>Polydora</u> sp. larvae	8	72	0	0	0	0	0	0
<u>Autolytus</u> sp. larvae	1	30	0	0	2	2	0	0

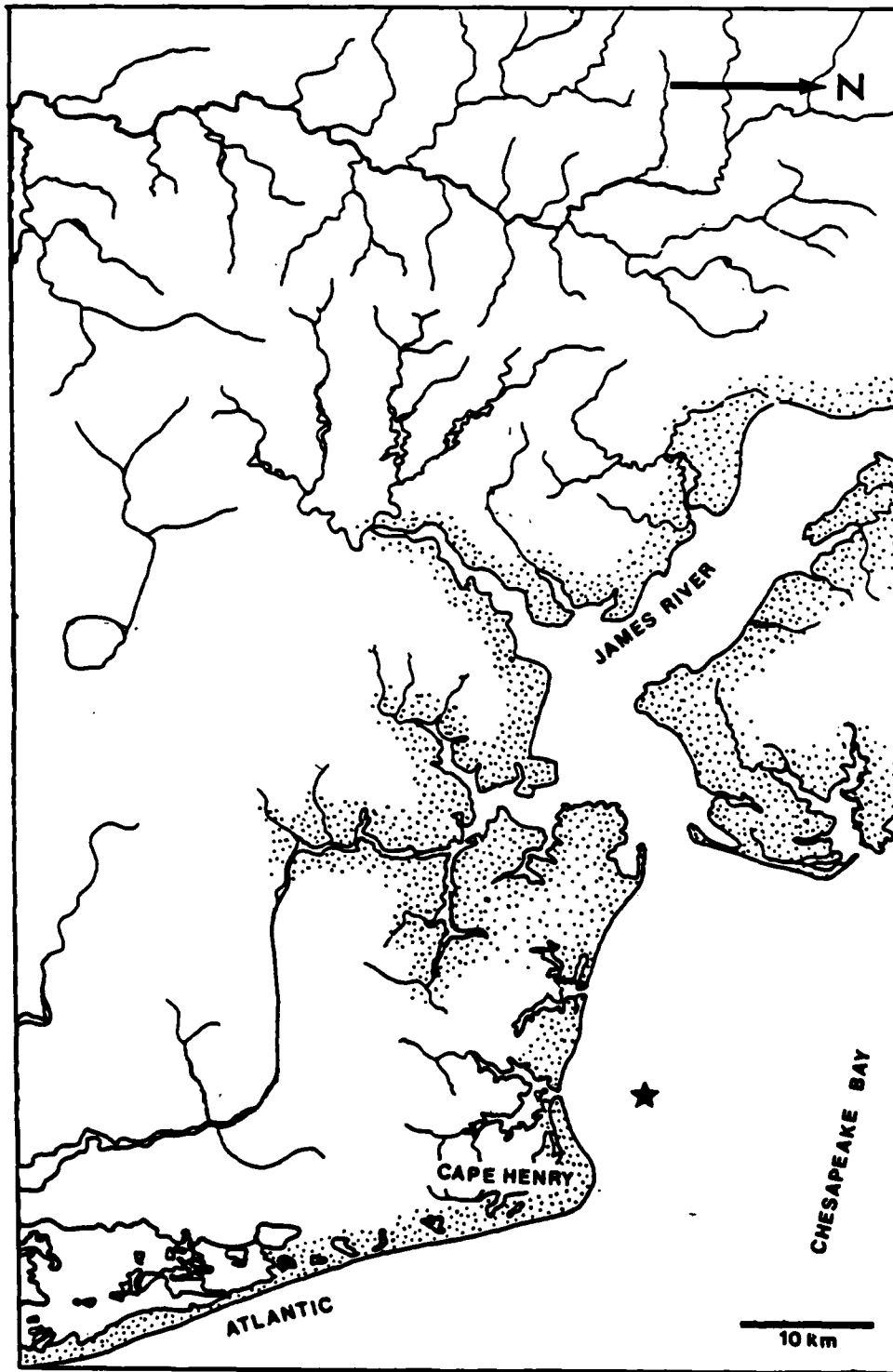


Figure 1. Location of collection site (star) on the South Island of the Chesapeake Bay Bridge-Tunnel.

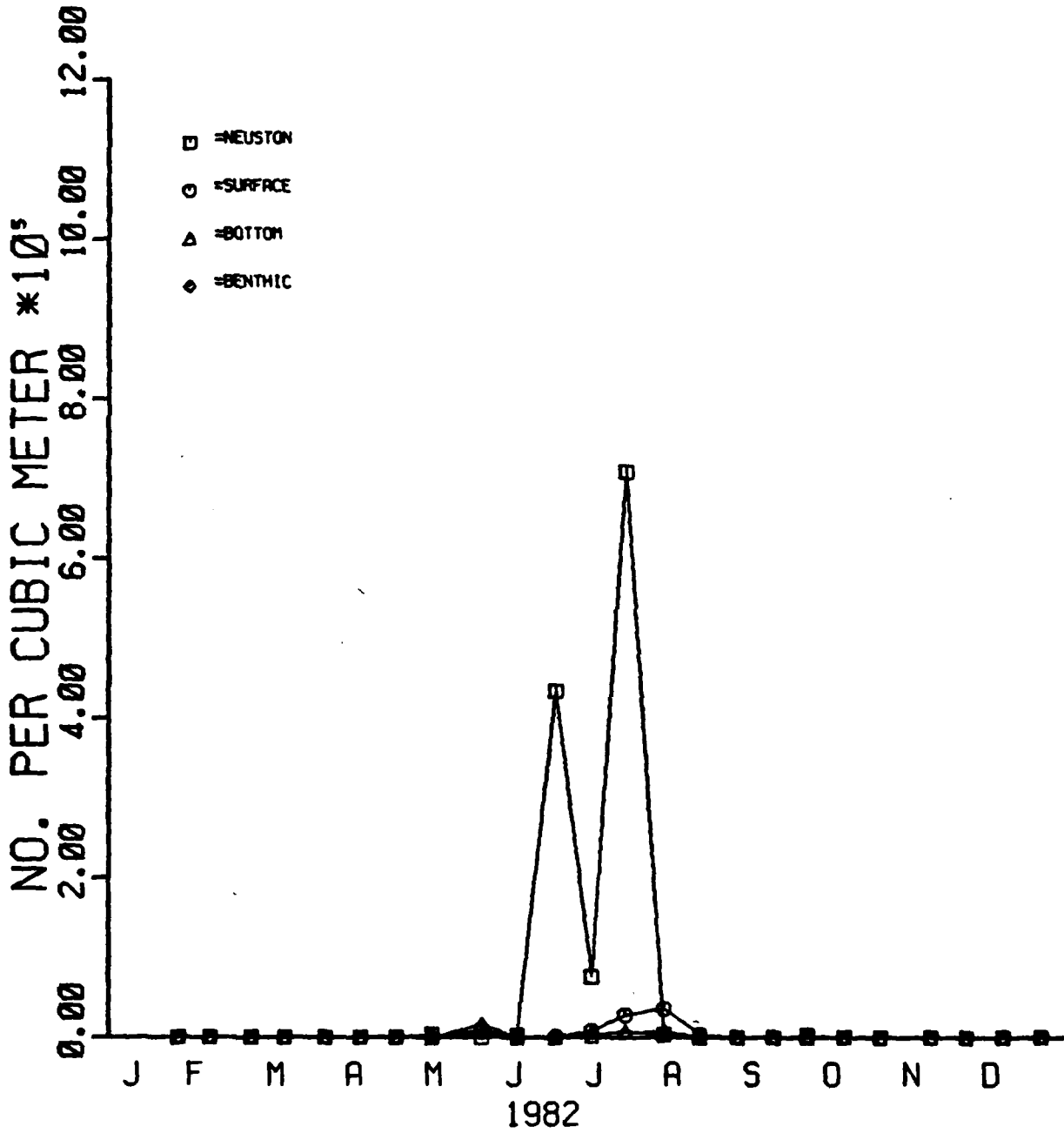


Figure 2. Density of Anchoa mitchilli eggs by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

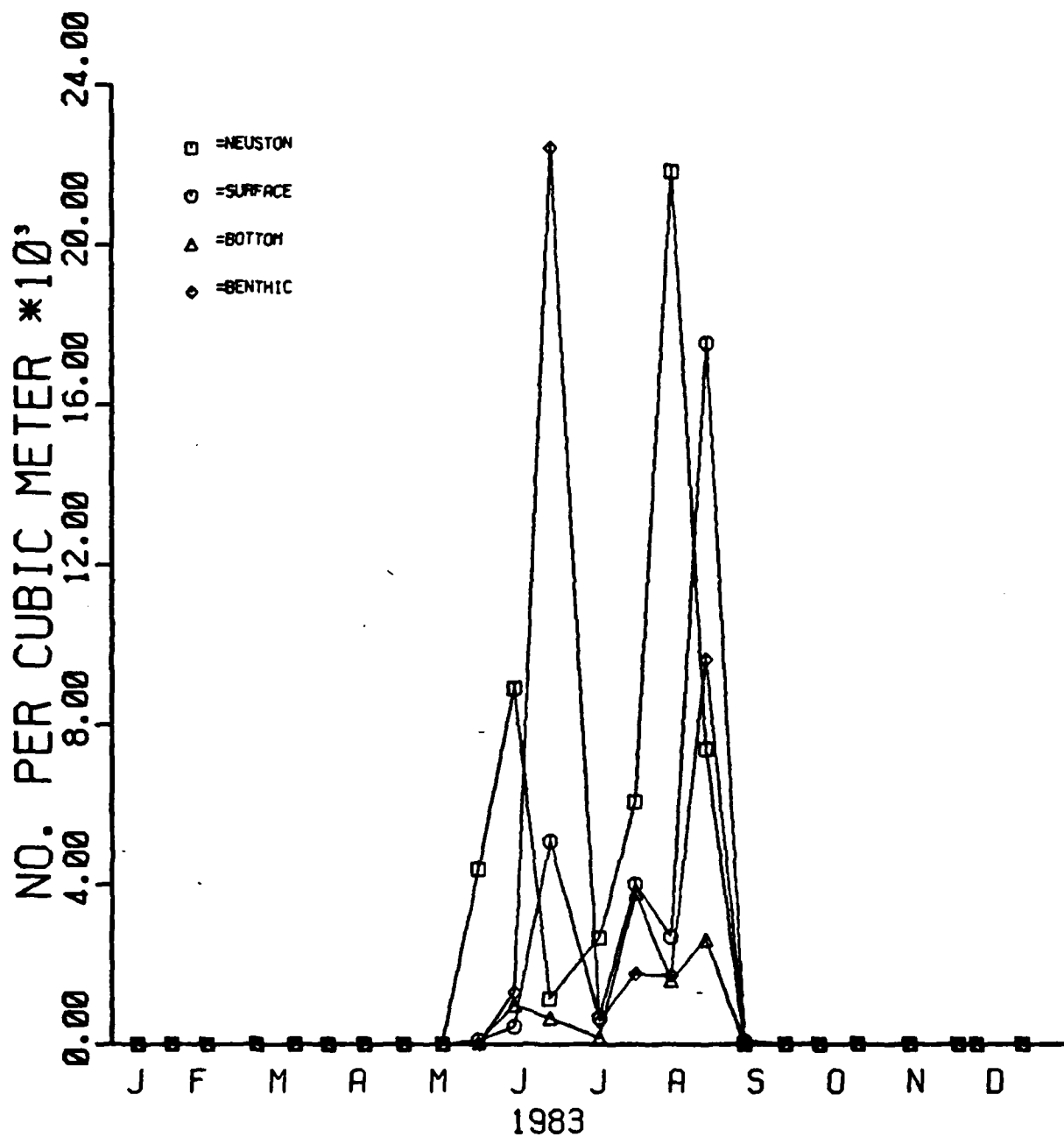


Figure 3. Density of Anchoa mitchilli eggs by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

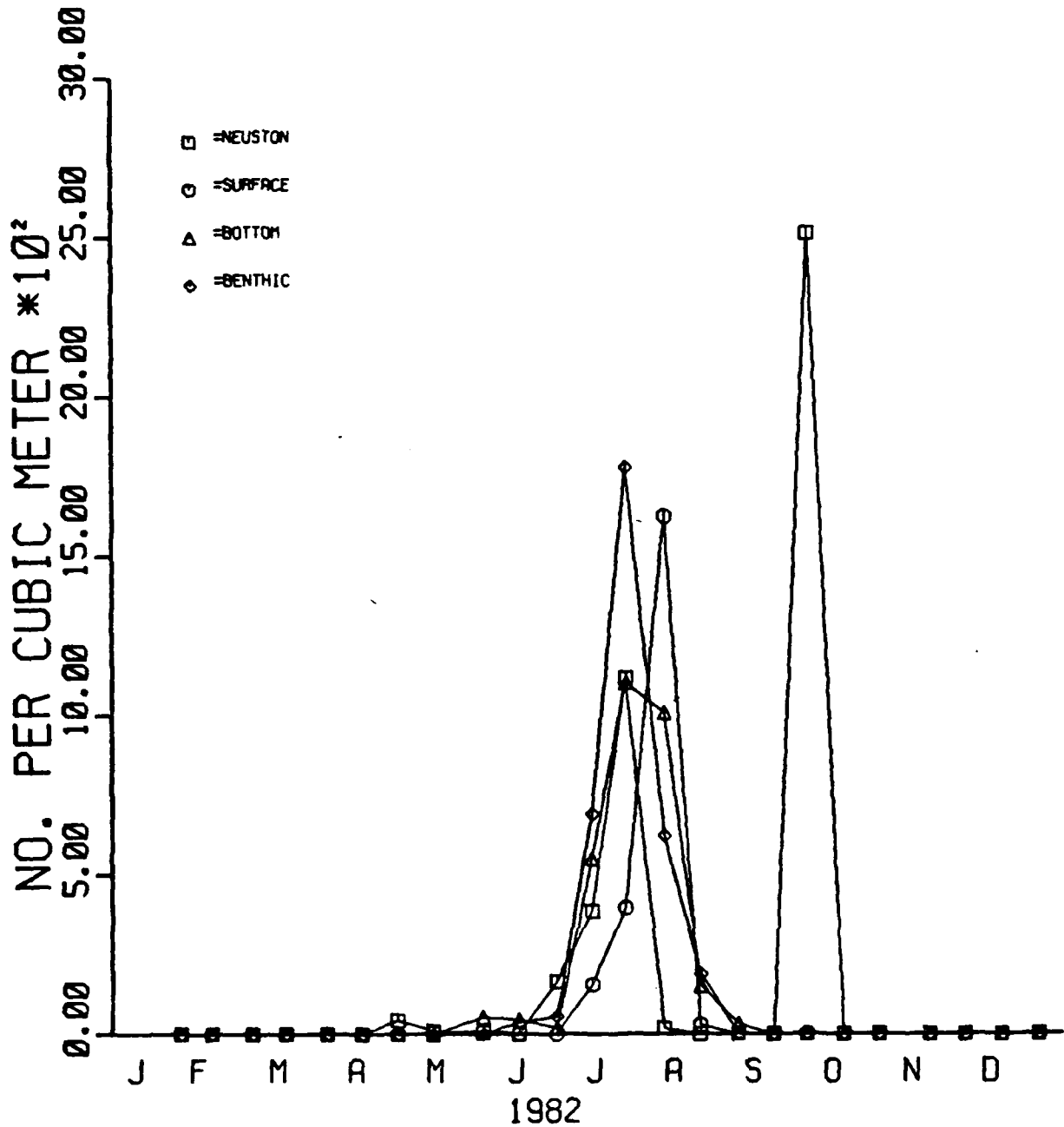


Figure 4. Density of *Anchoa mitchilli* larvae by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

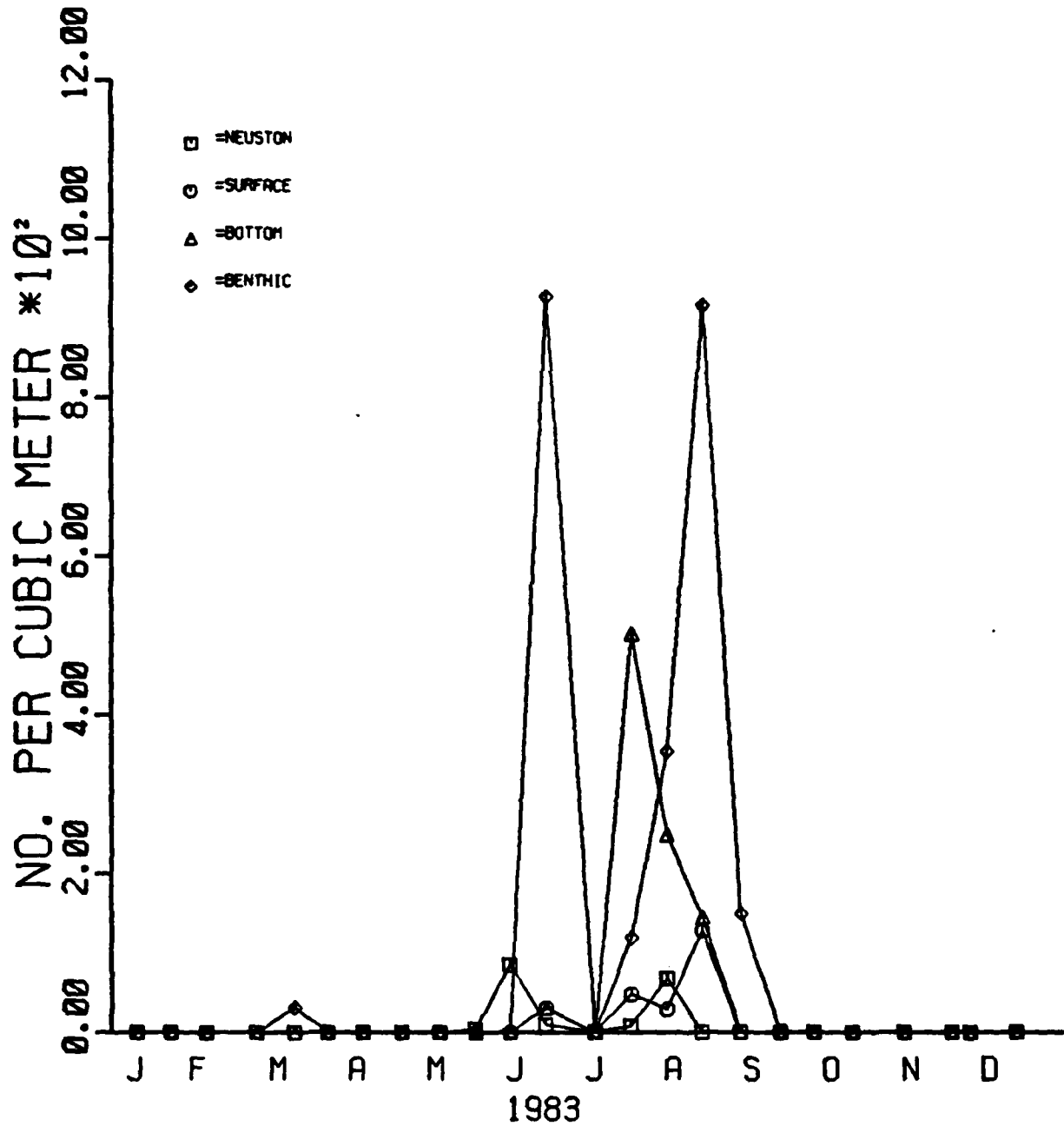


Figure 5. Density of Anchoa mitchilli larvae by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

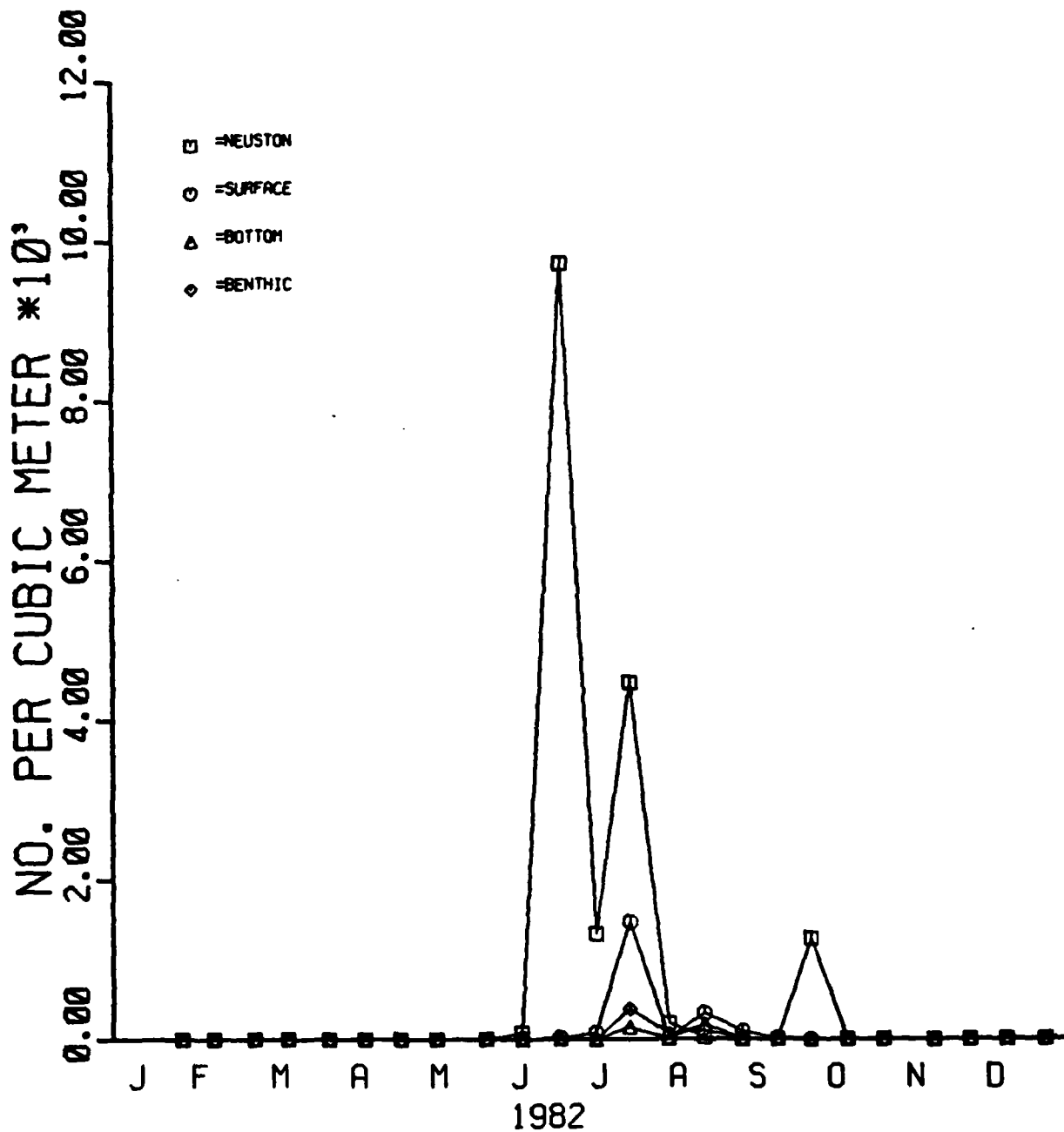


Figure 6. Density of *Trinectes maculatus* eggs by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

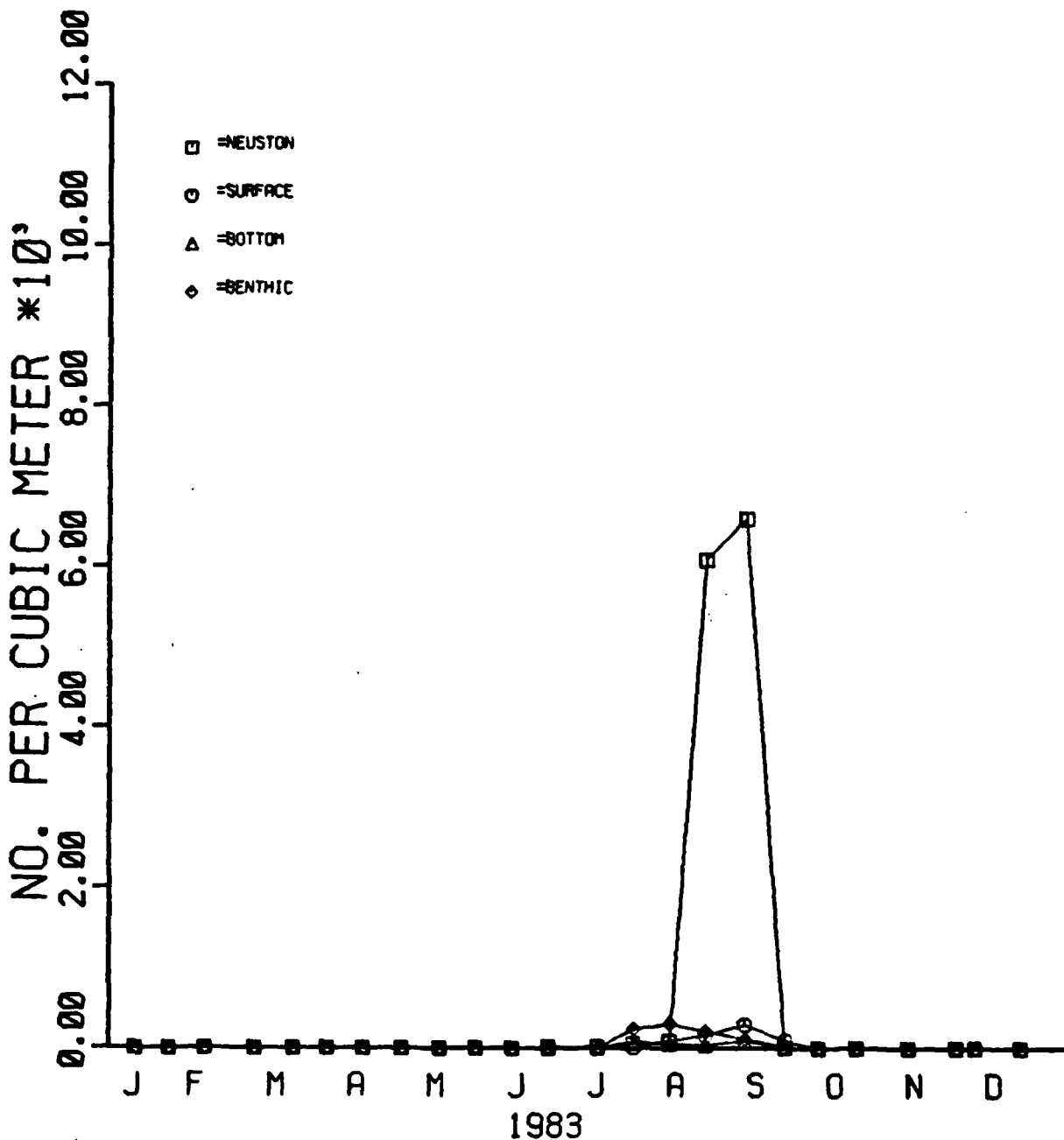


Figure 7. Density of *Trinectes maculatus* eggs by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

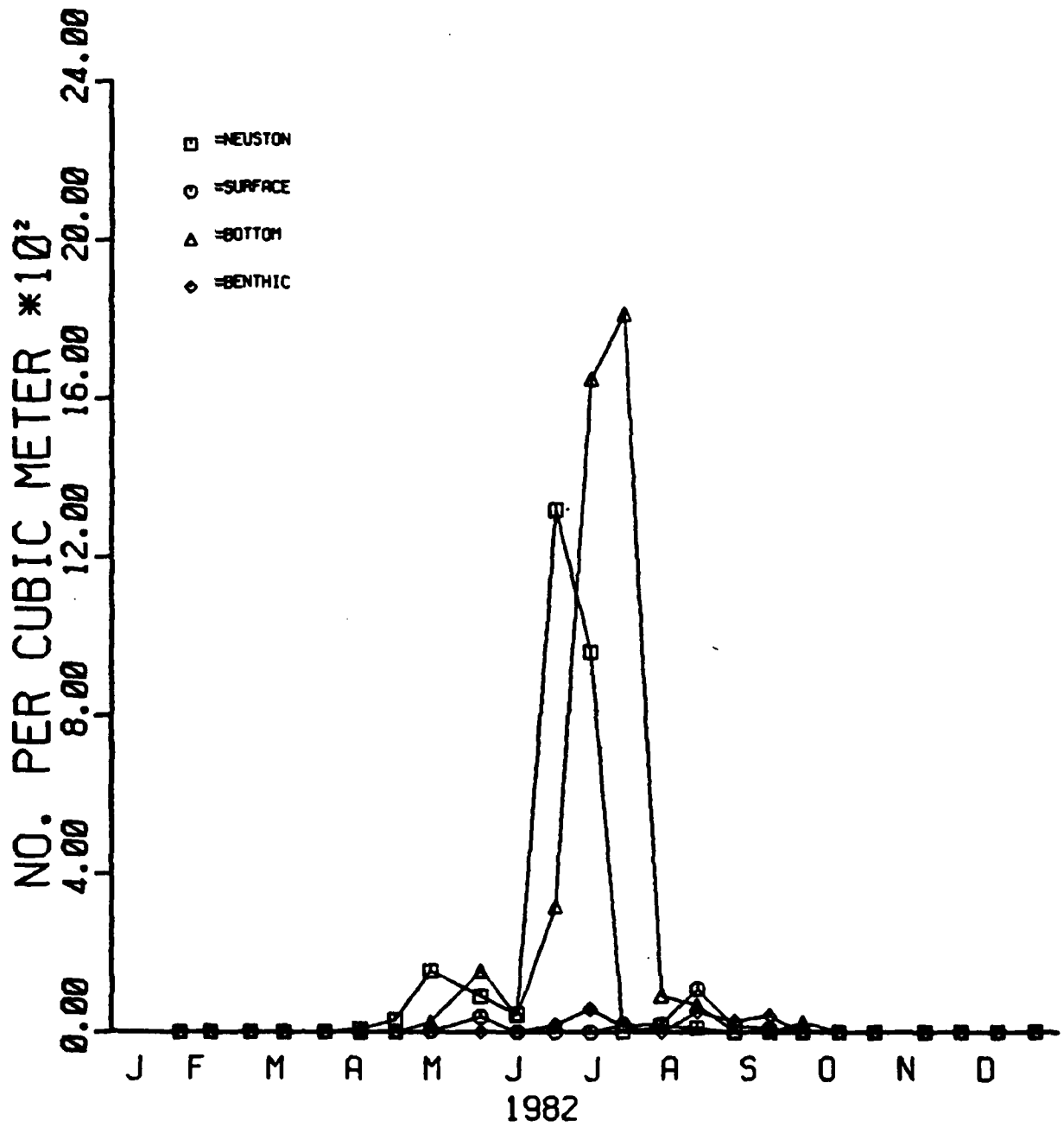


Figure 8. Density of unidentified fish eggs by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

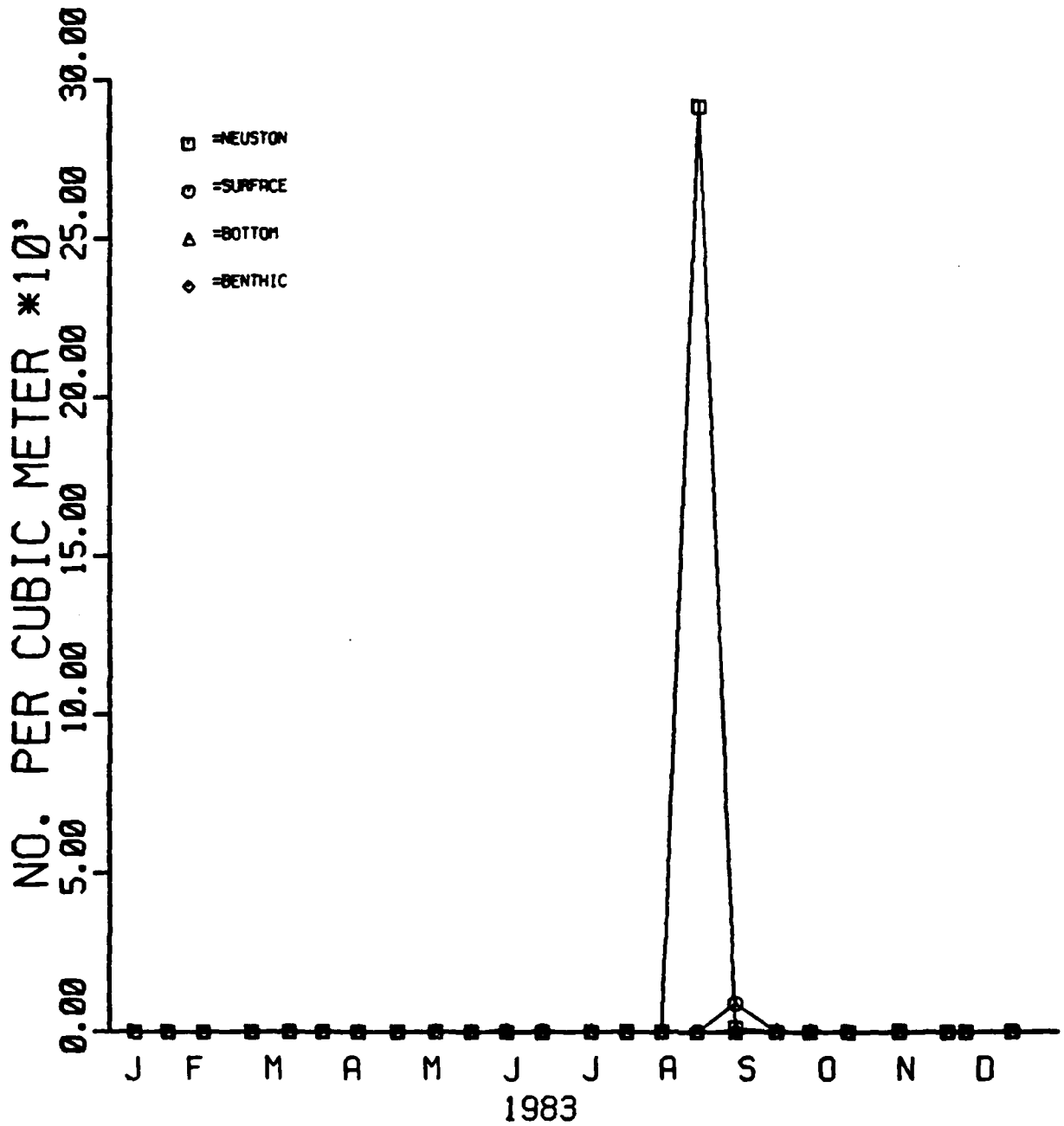


Figure 9. Density of unidentified fish eggs by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

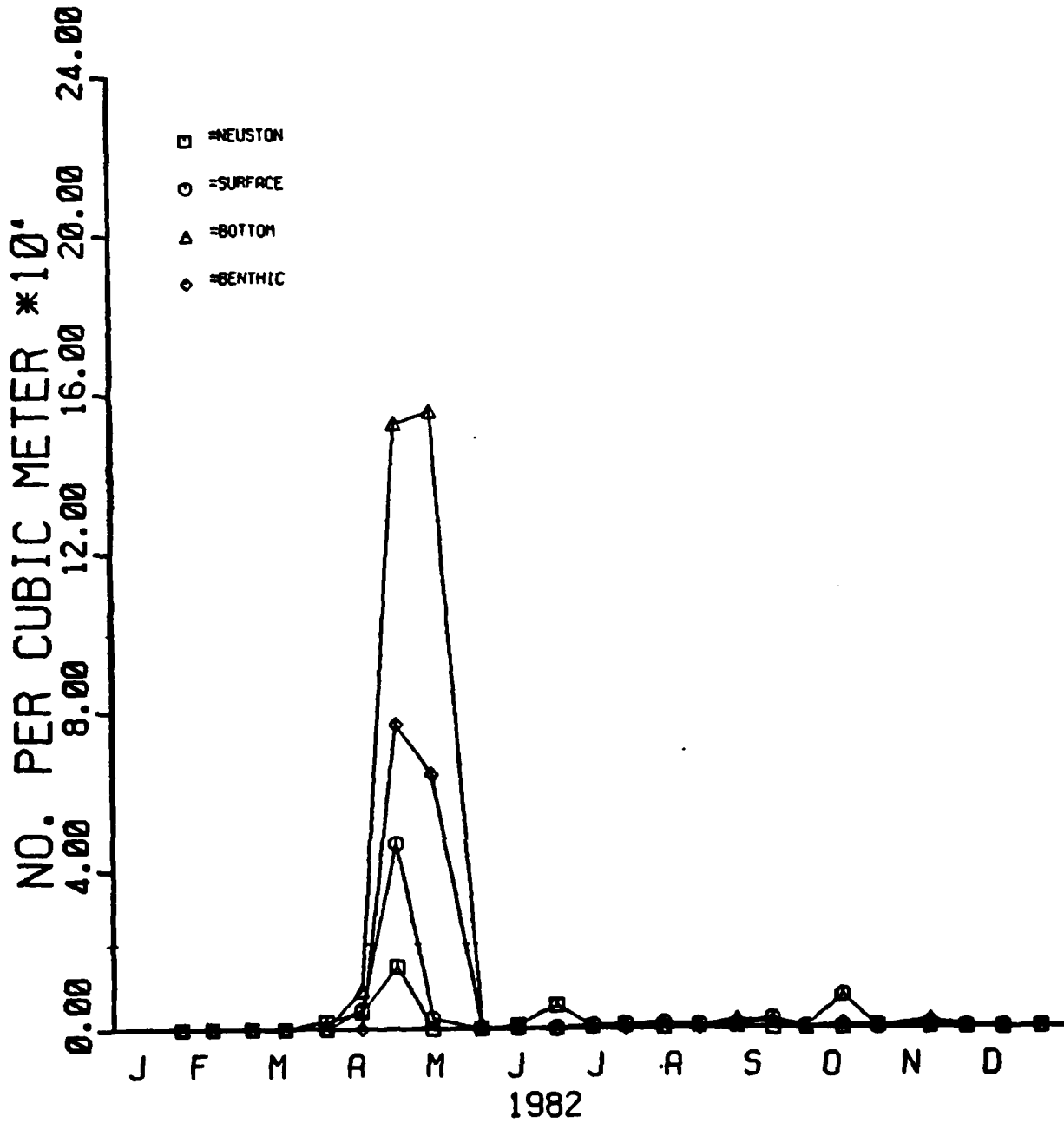


Figure 10. Density of barnacle nauplii by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

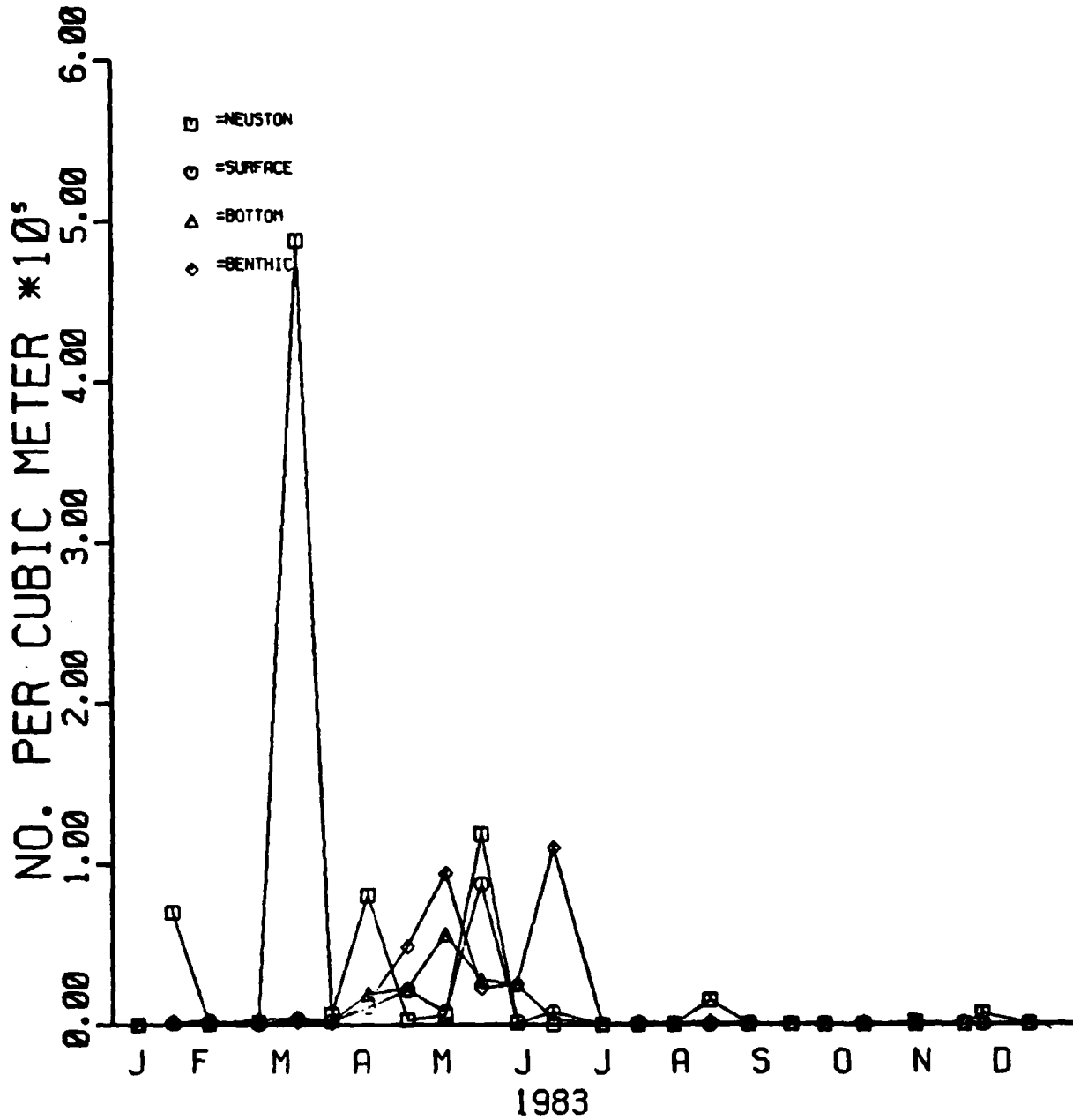


Figure 11. Density of barnacle nauplii by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

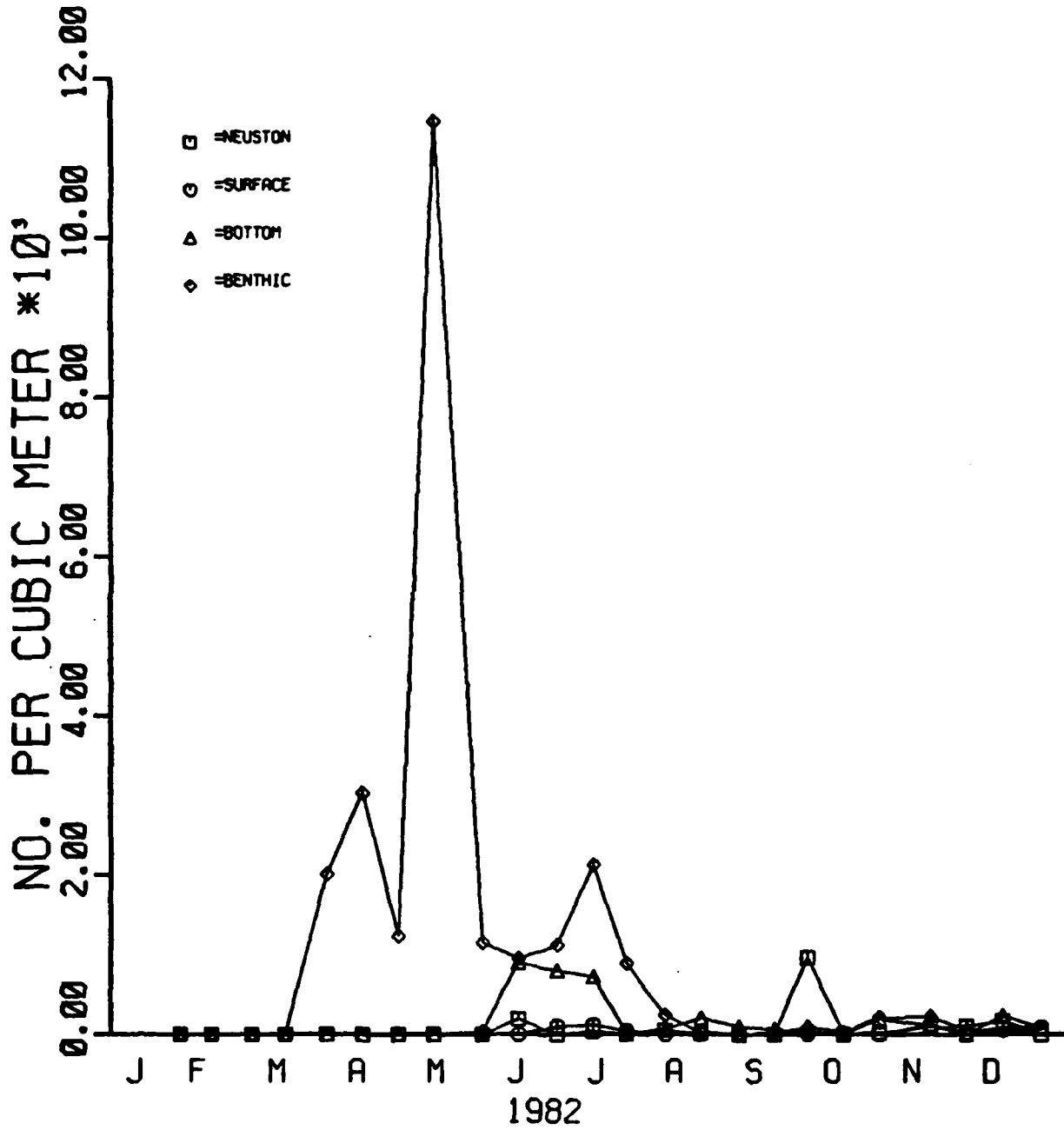


Figure 12. Density of Crangon septemspinosus zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

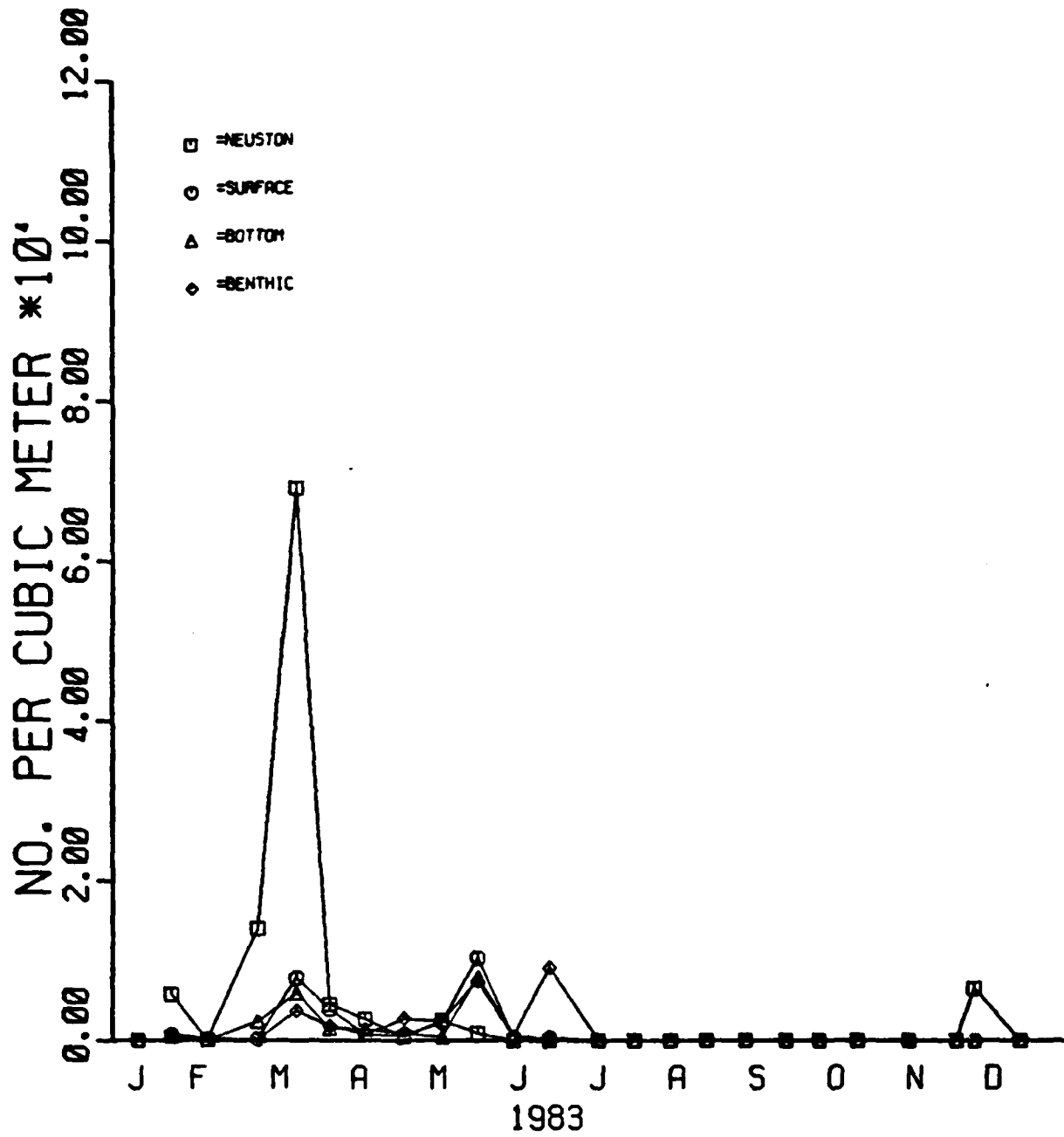


Figure 13. Density of *Crangon septemspinosus* zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

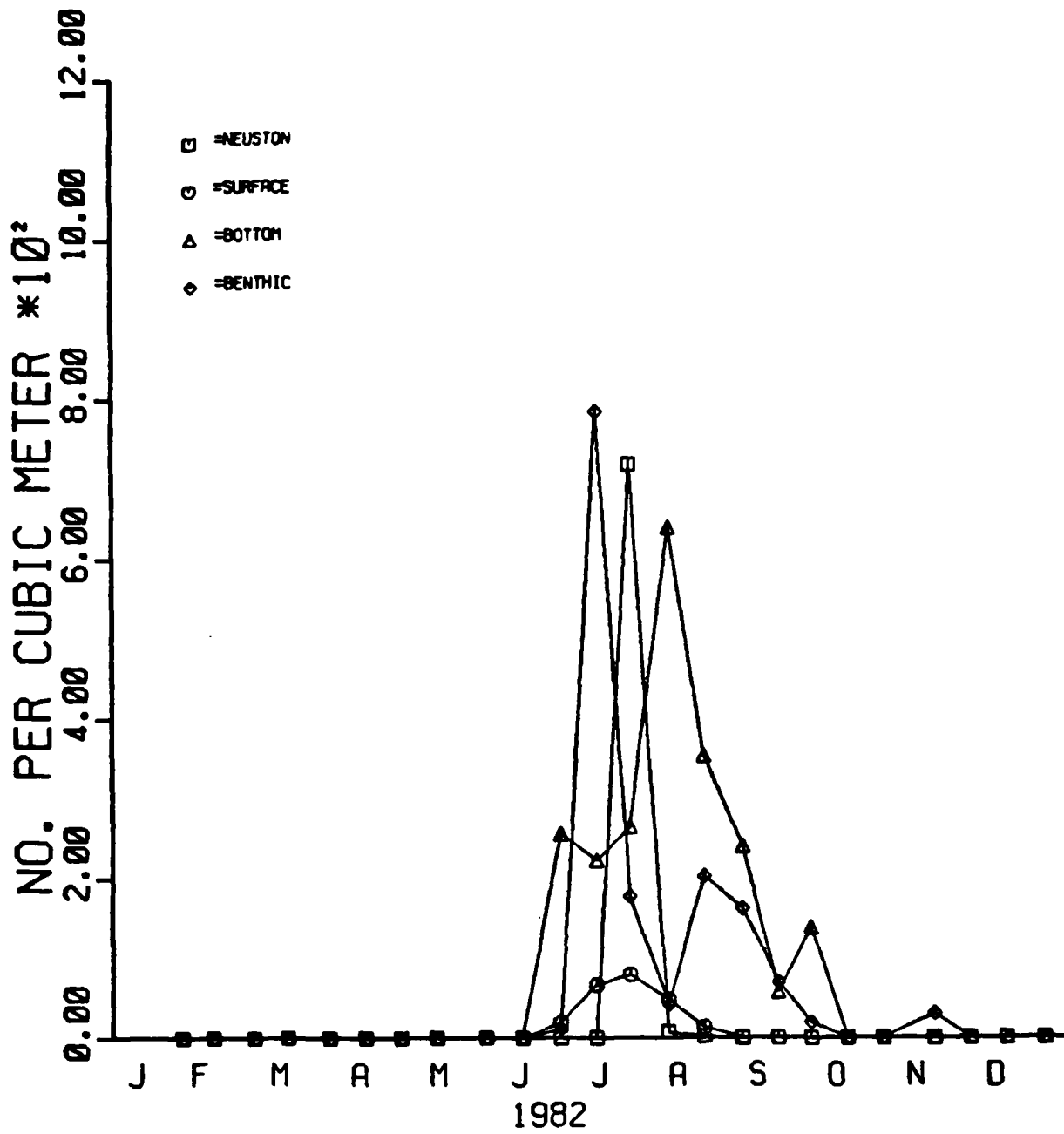


Figure 14. Density of *Callianassa* sp. zoea by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

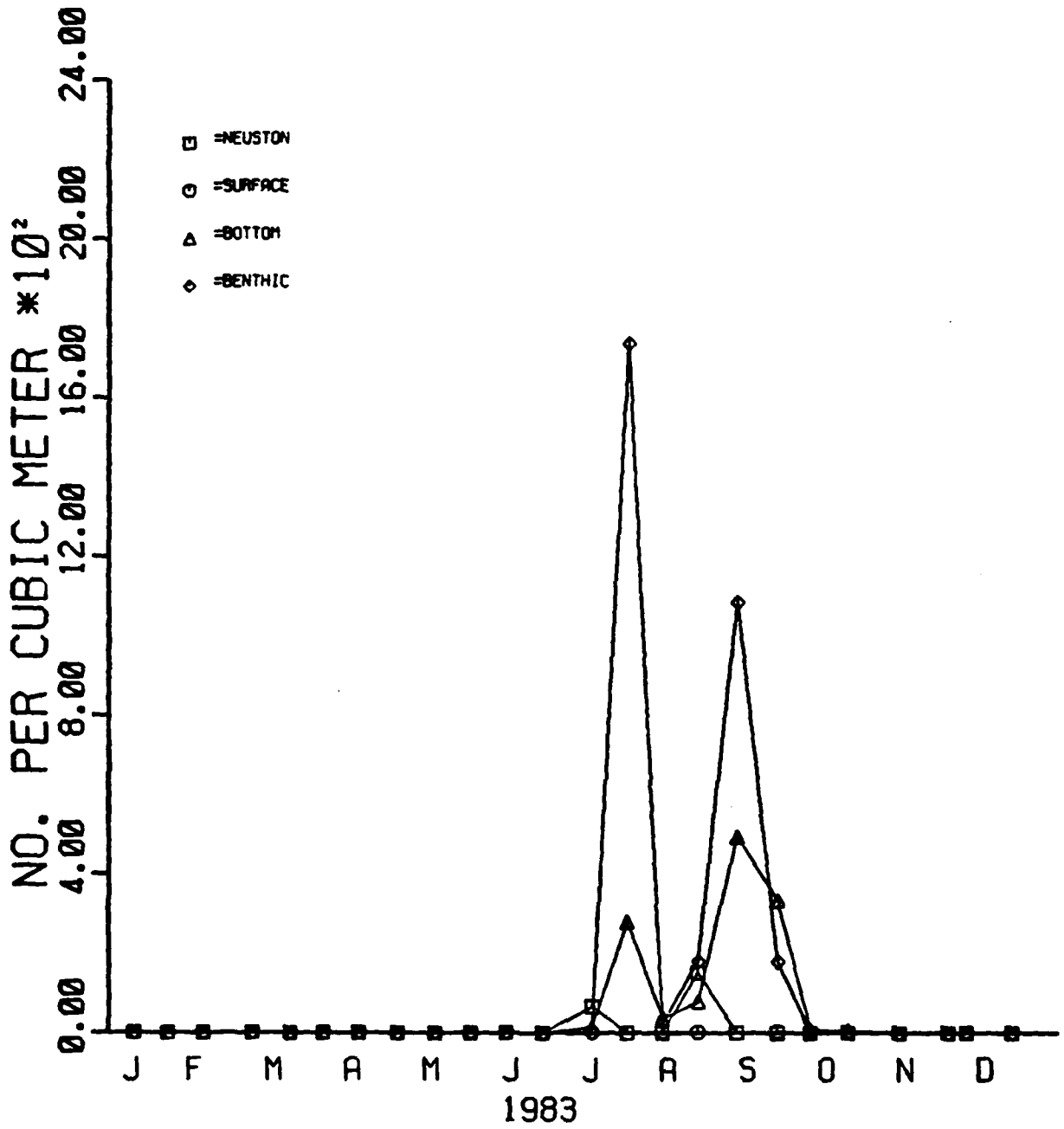


Figure 15. Density of Callianassa sp. zoea by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

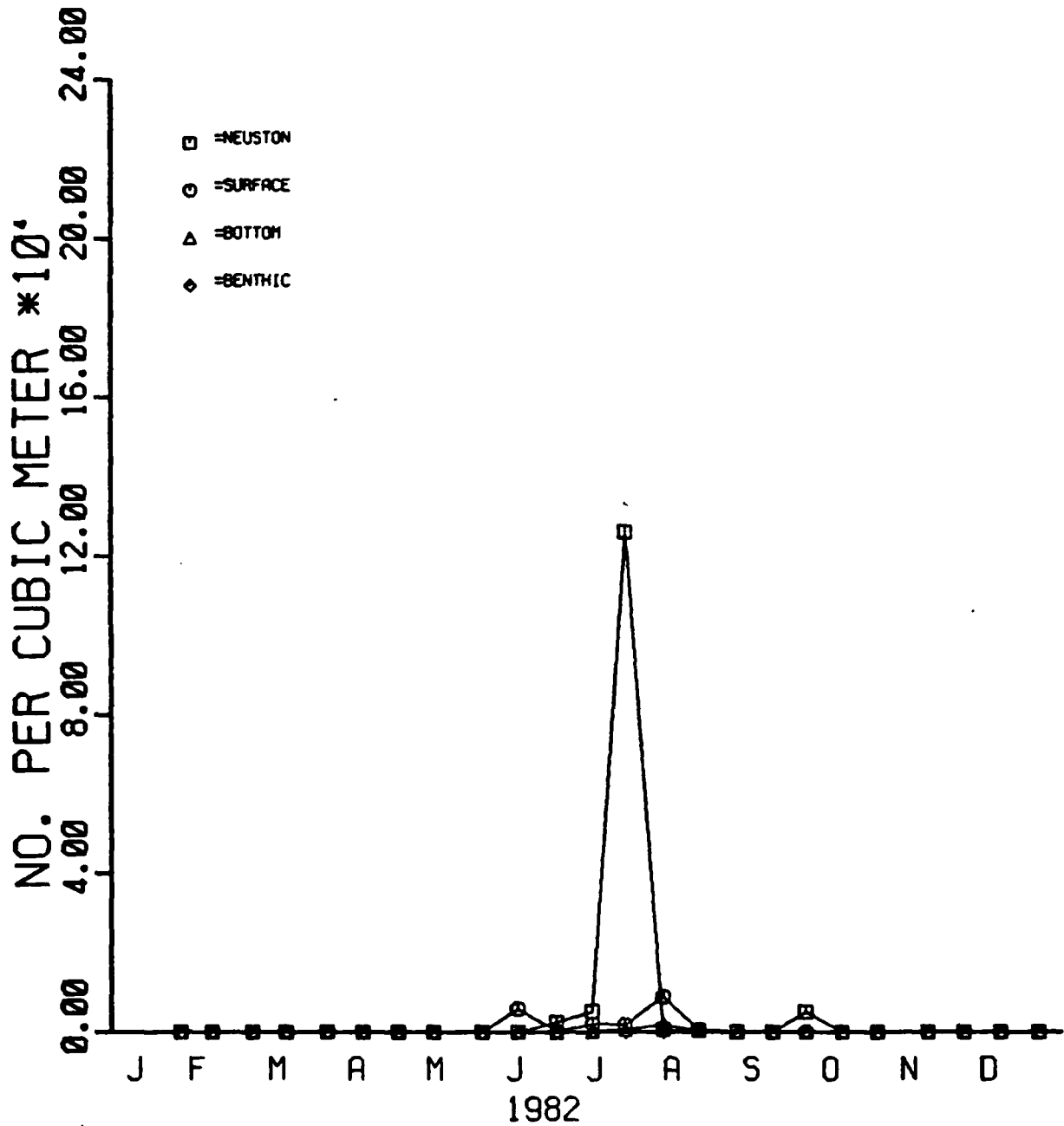


Figure 16. Density of *Callinectes sapidus* zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

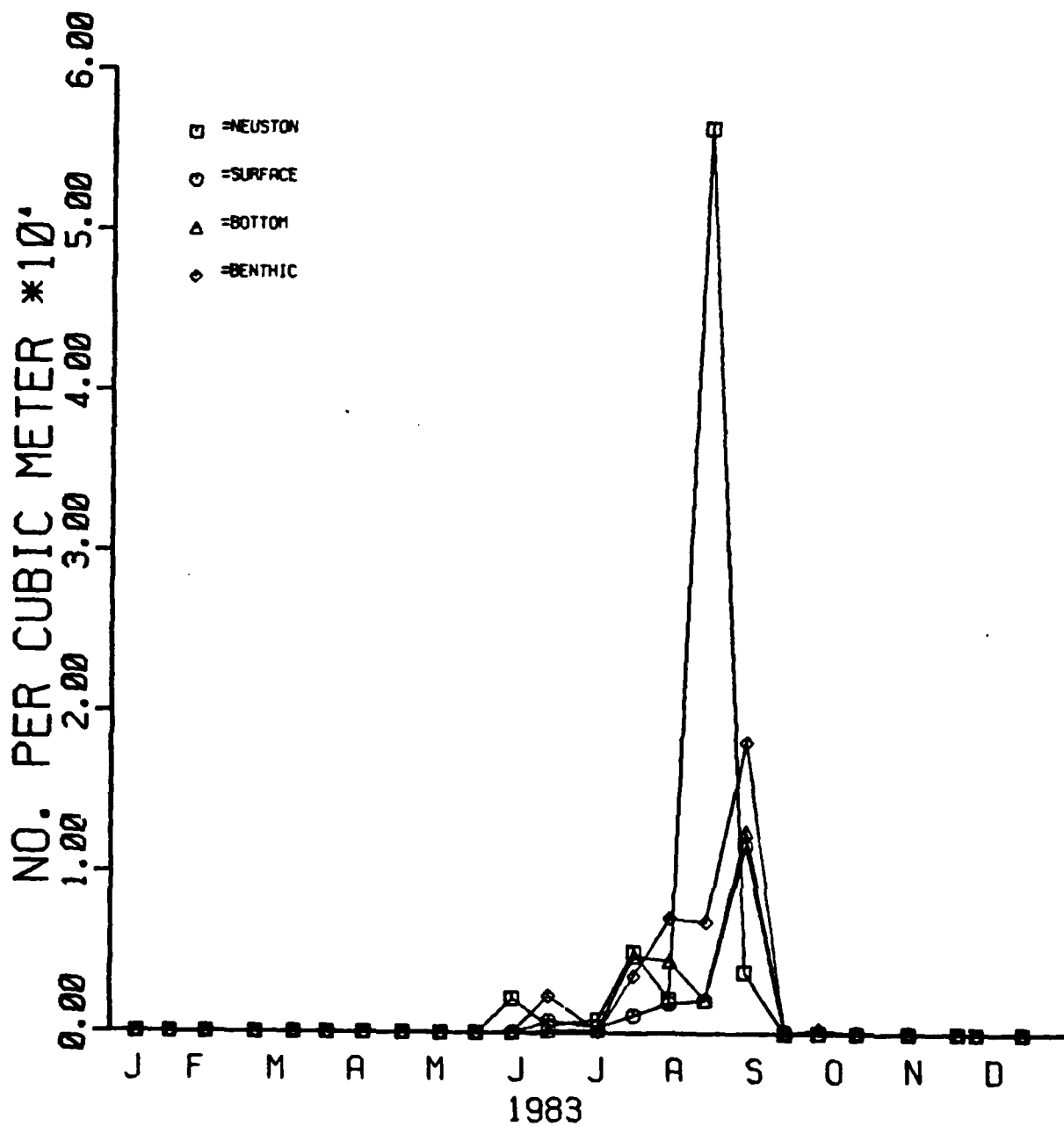


Figure 17. Density of *Callinectes sapidus* zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

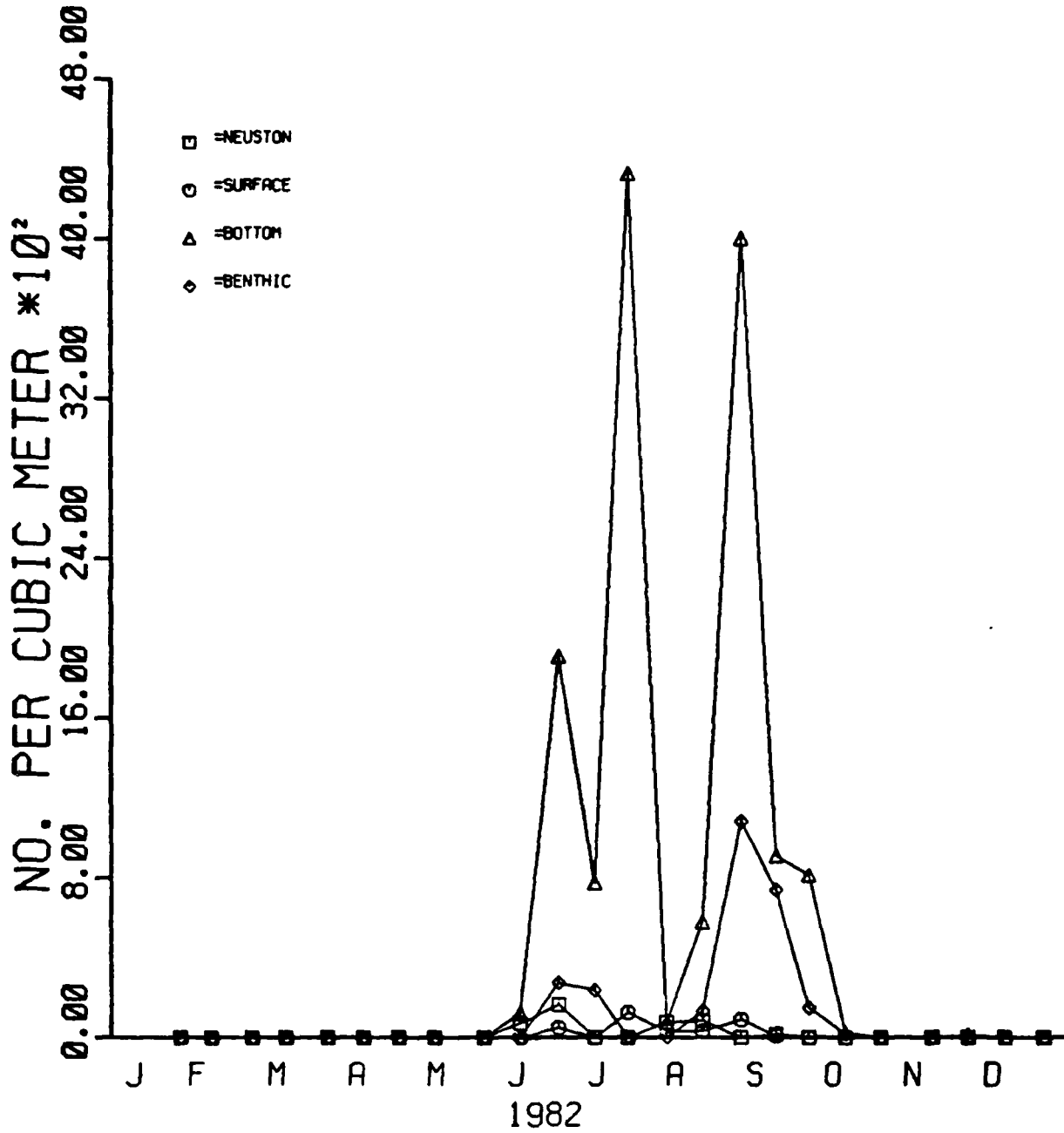


Figure 18. Density of *Pinnixa chaetoptera* zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

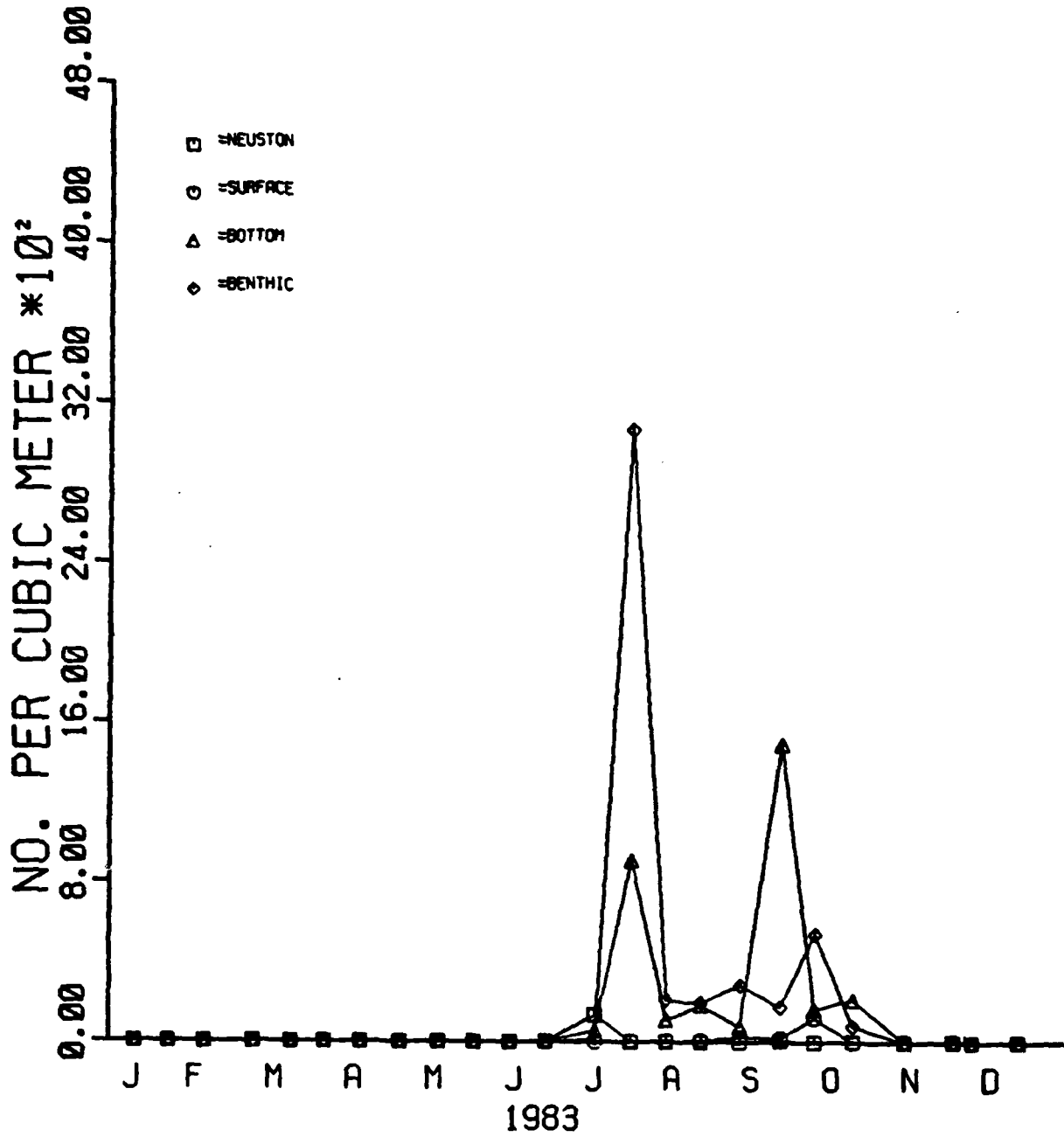


Figure 19. Density of Pinnixa chaetoptera zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

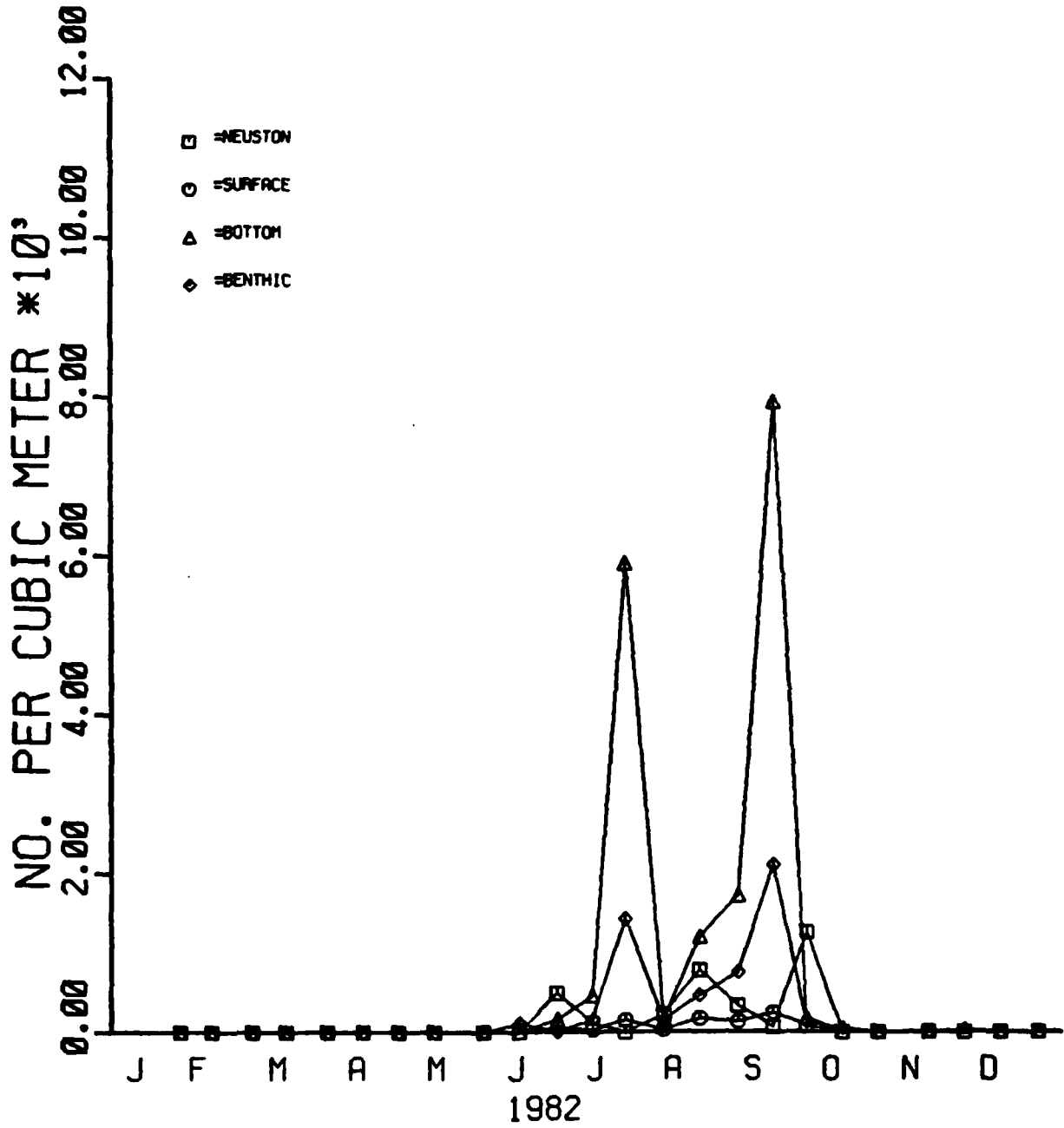


Figure 20. Density of Pinnotheres ostreum zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

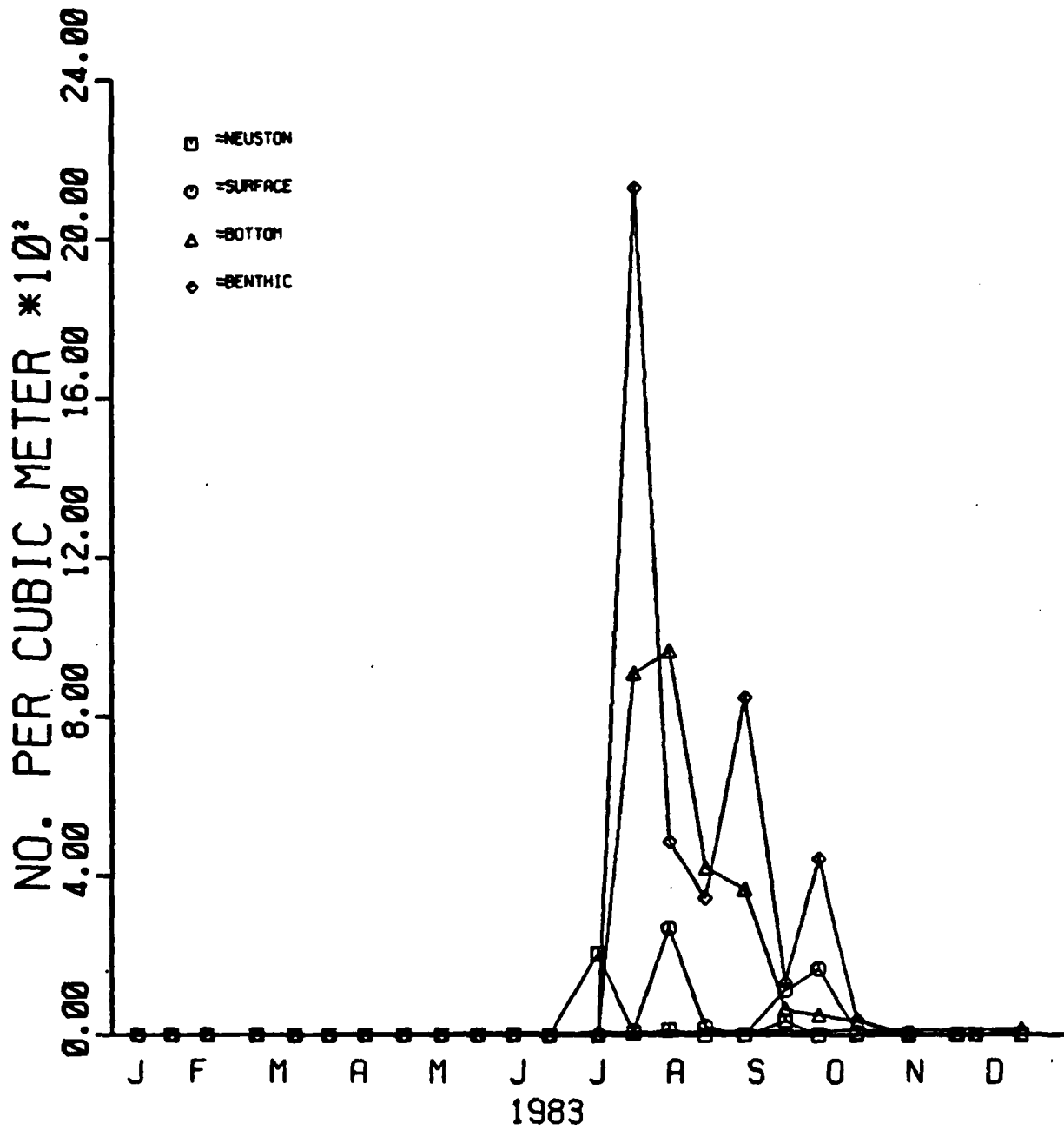


Figure 21. Density of *Pinnotheres ostreum* zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

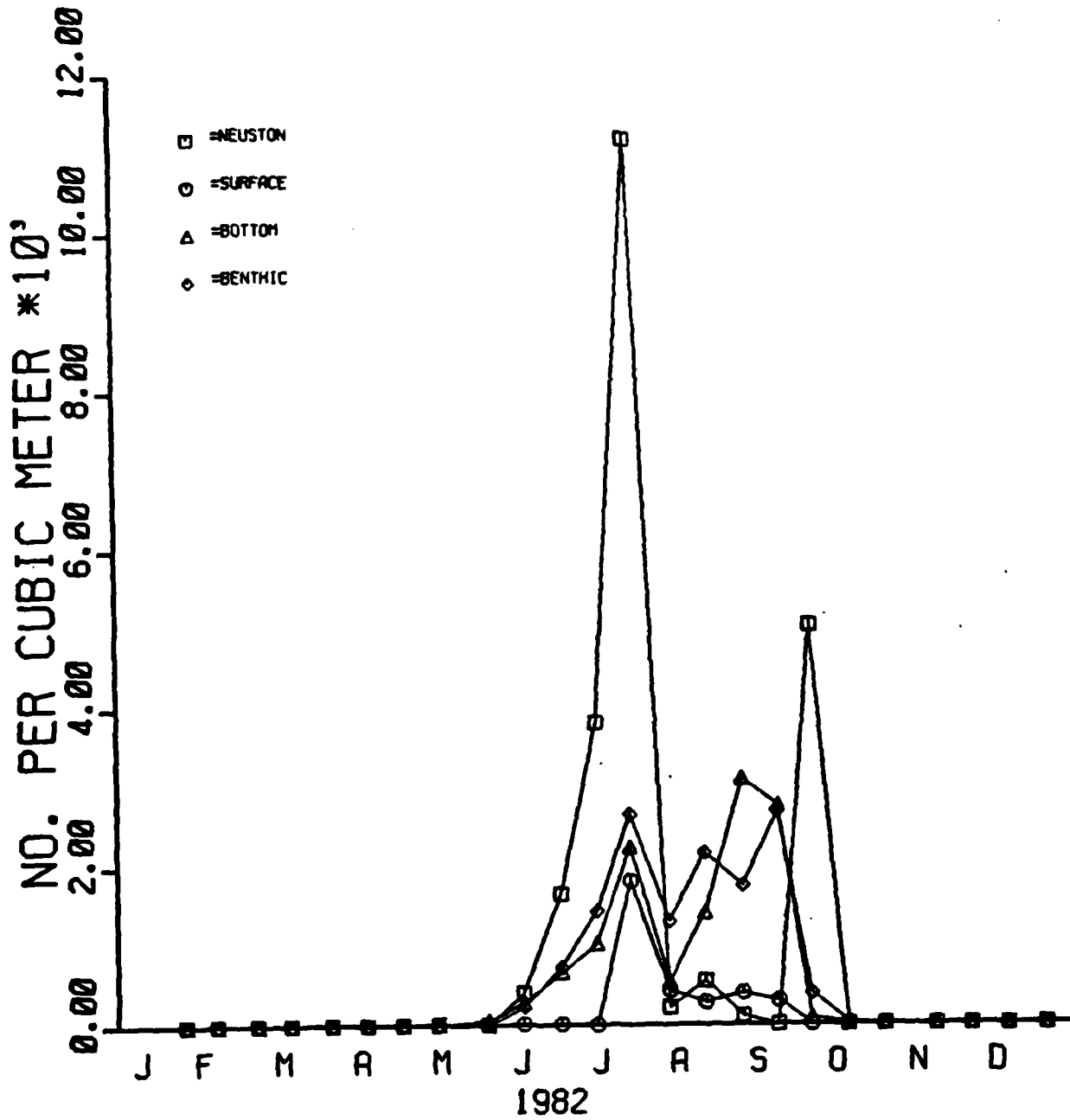


Figure 22. Density of *Neopanope texana sayi* zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

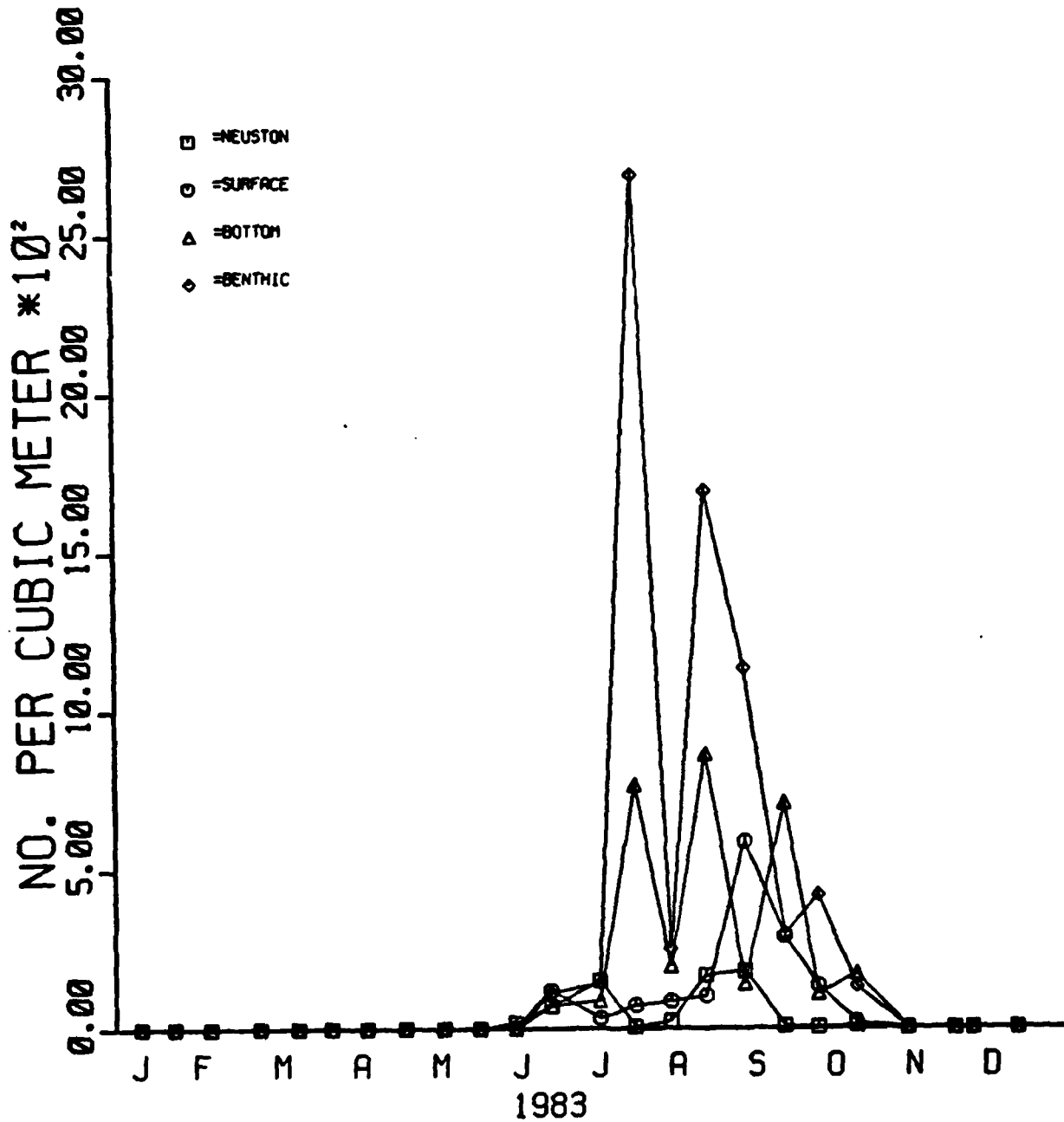


Figure 23. Density of *Neopanope texana sayi* zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

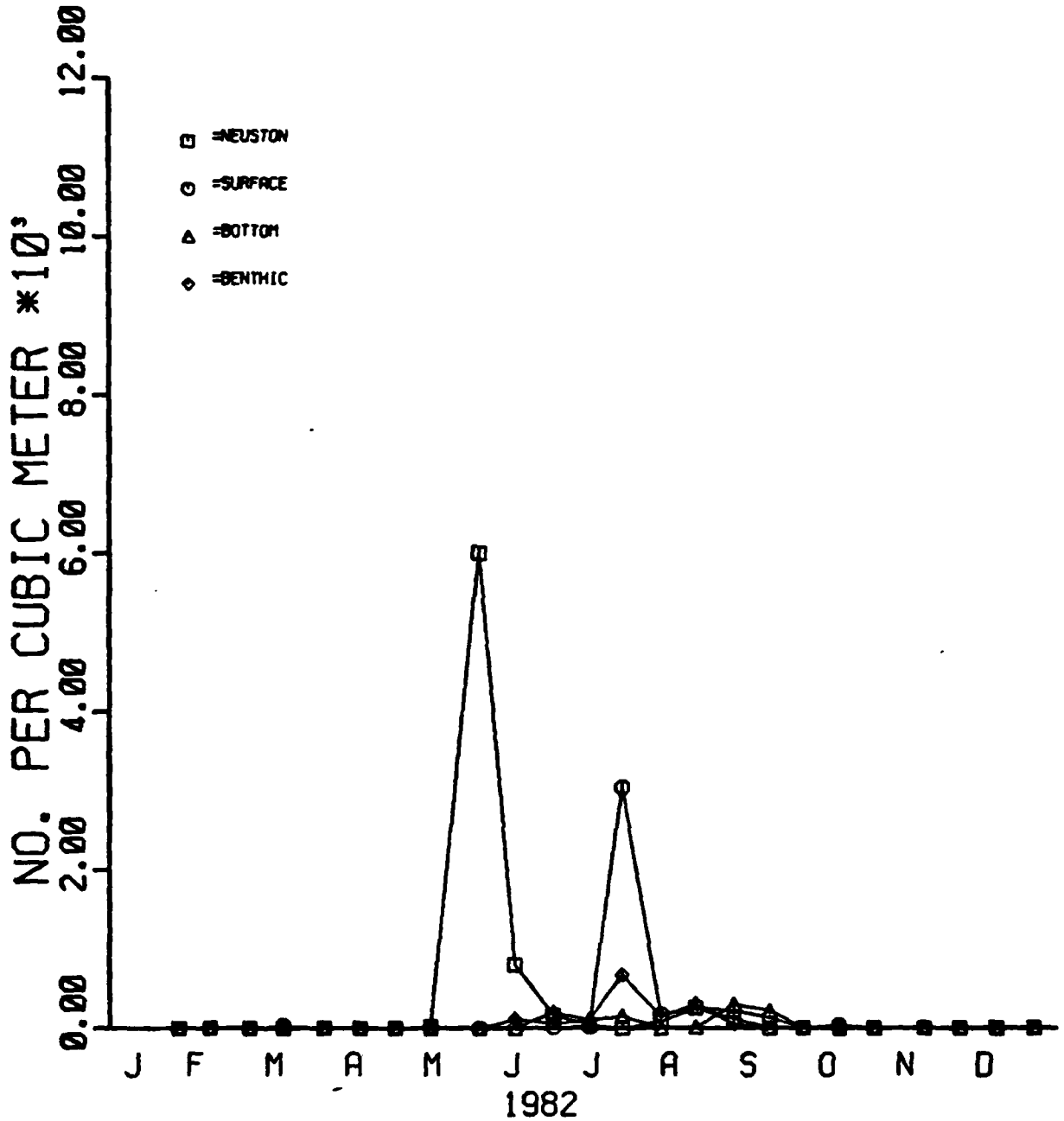


Figure 24. Density of Hexapanopeus angustifrons zoea by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

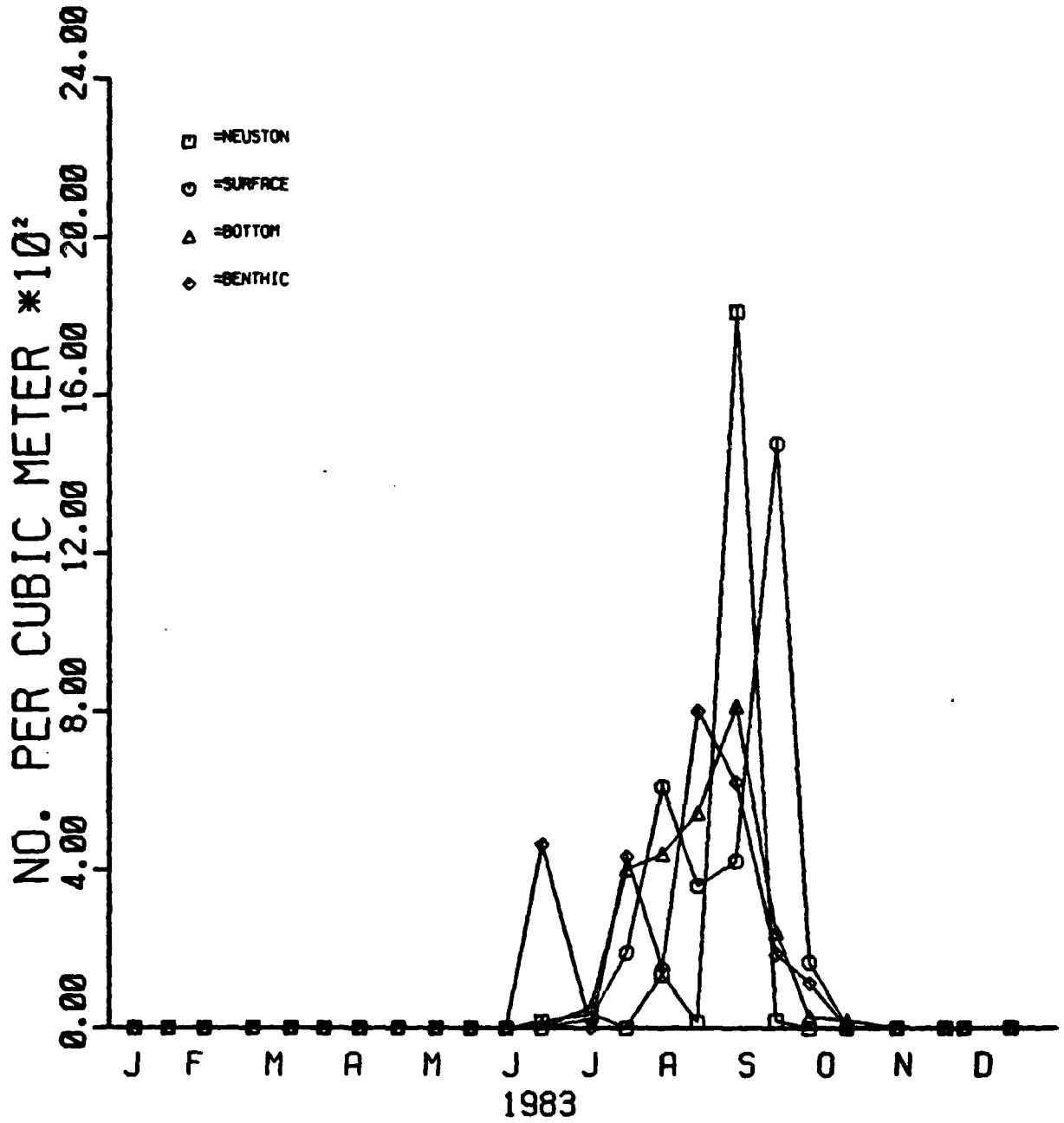


Figure 25. Density of *Hexapanopeus angustifrons* zoea by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

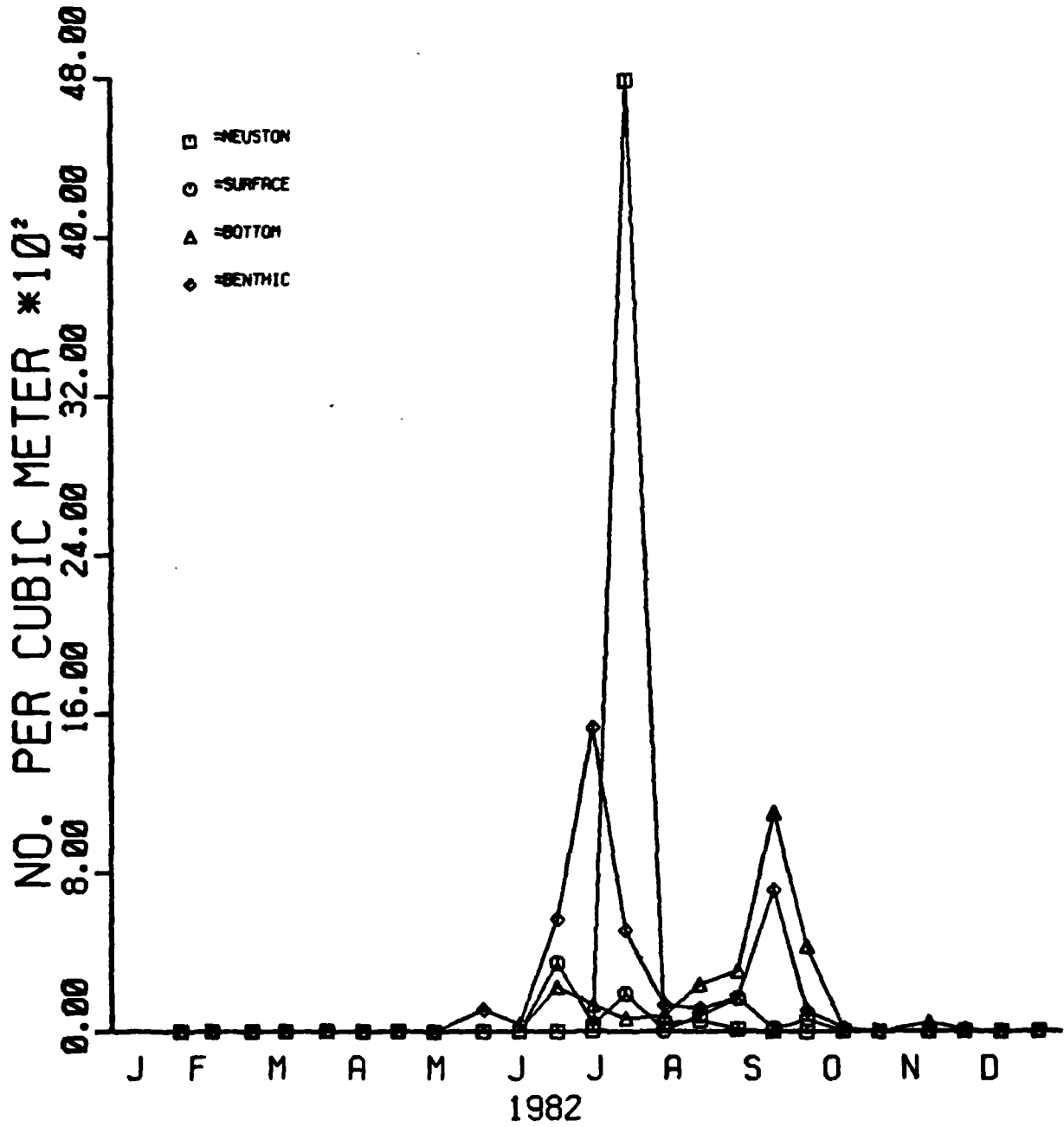


Figure 26. Density of *Pinnixa sayana* zoea by depth by semimonthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

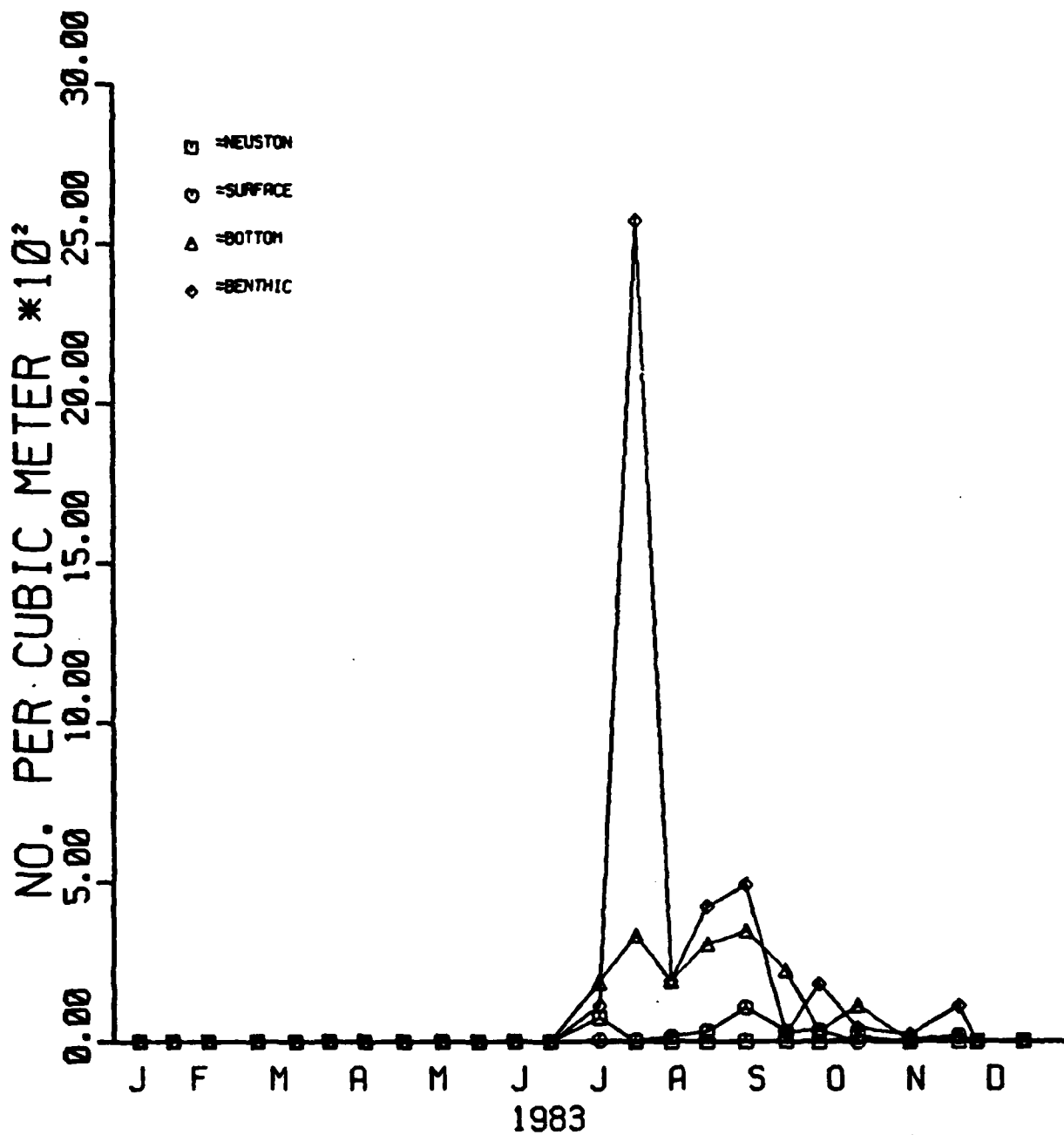


Figure 27. Density of *Pinnixa sayana* zoea by depth by semimonthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

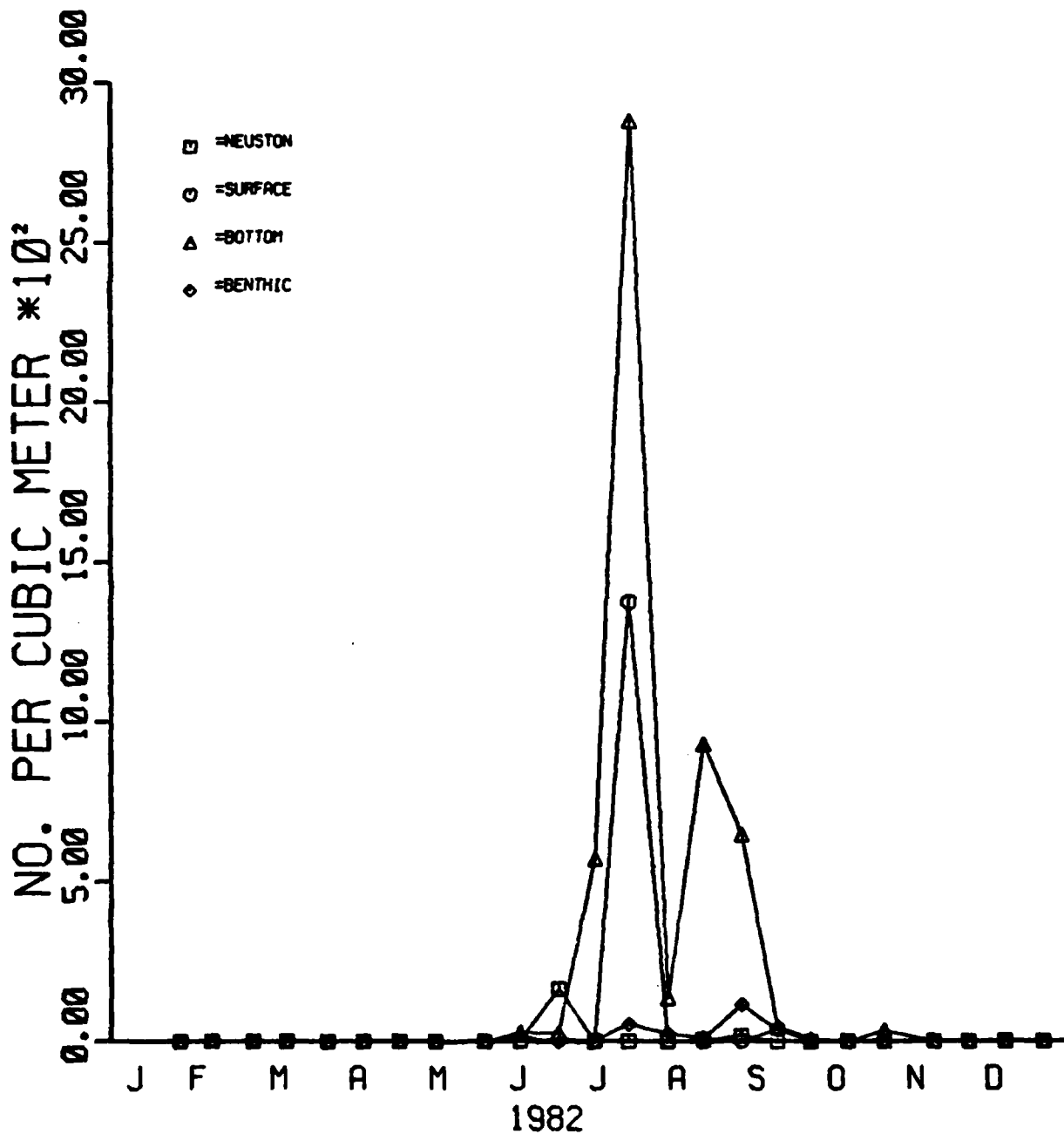


Figure 28. Density of *Ovalipes ocellatus* zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

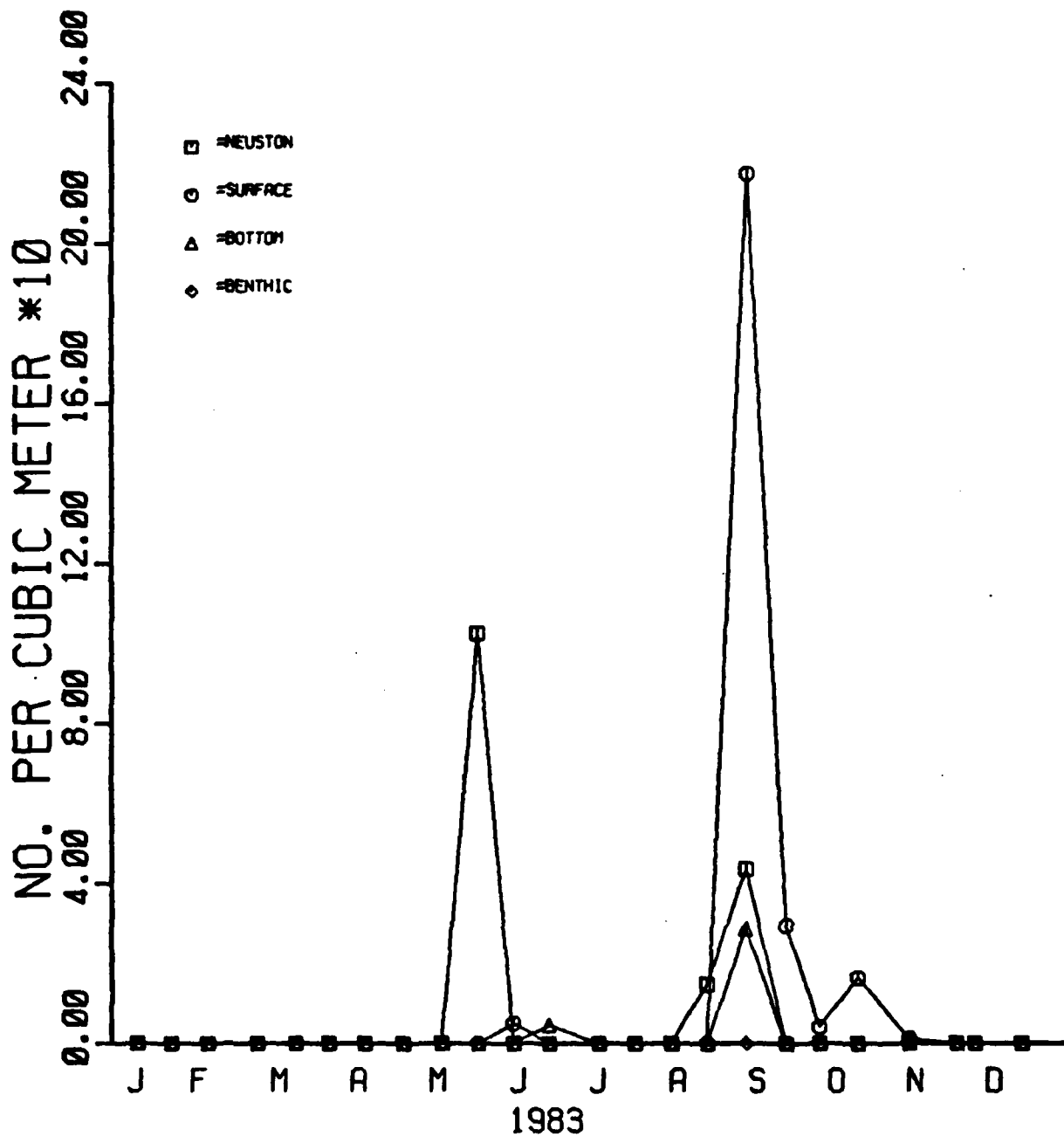


Figure 29. Density of Ovalipes ocellatus zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

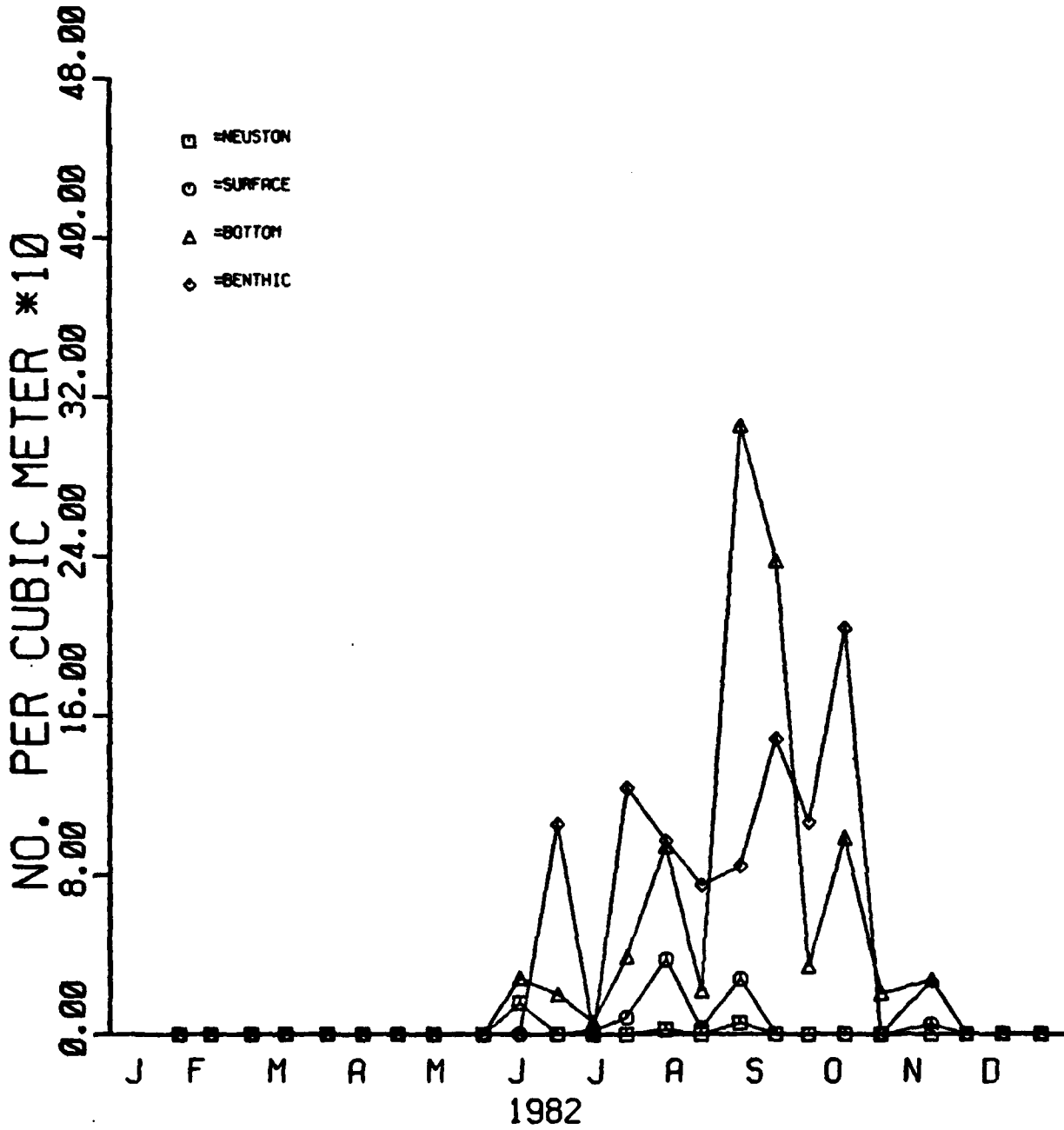


Figure 30. Density of Polyonyx gibbesii zoea by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

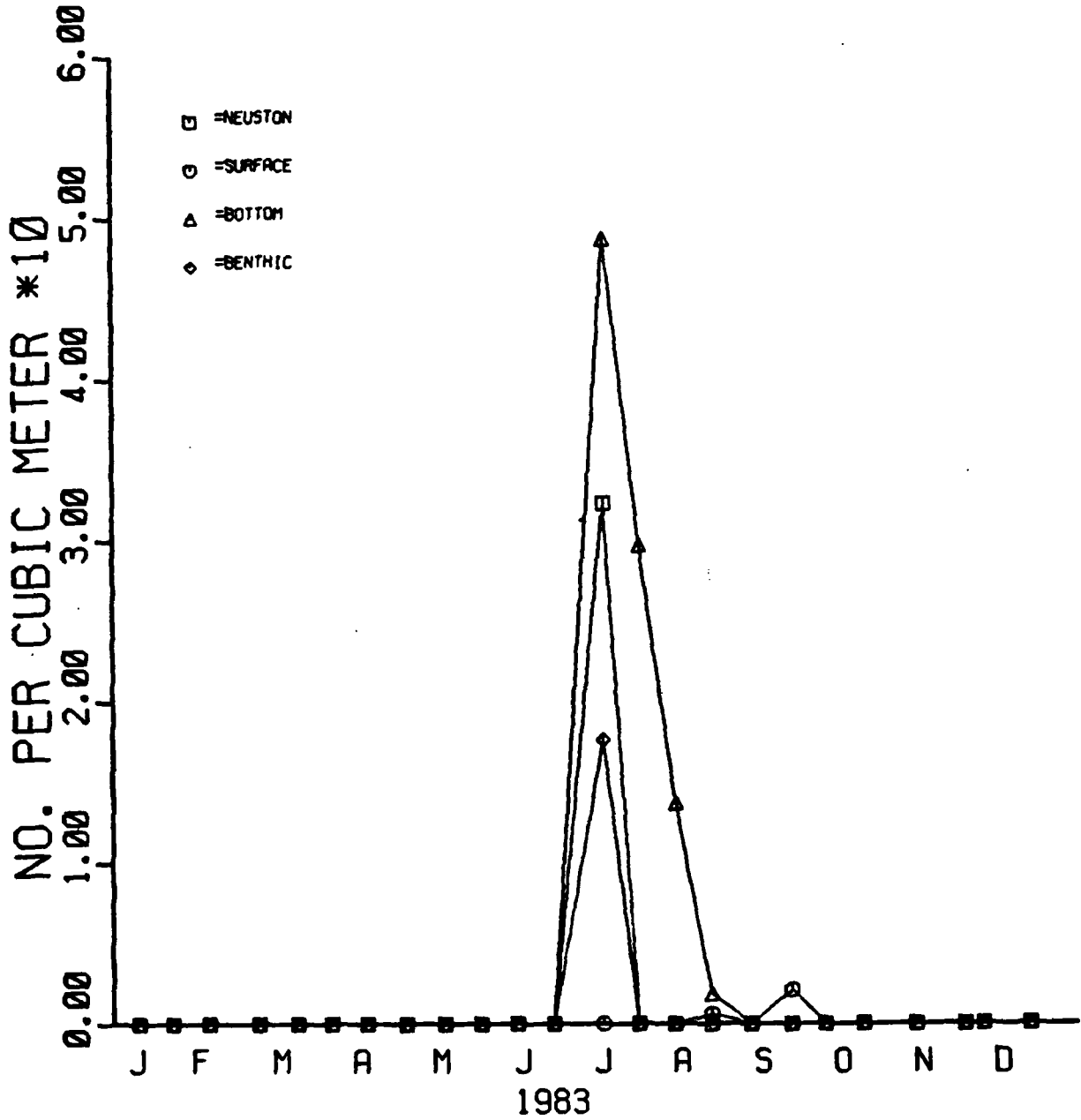


Figure 31. Density of Polyonyx gibbesii zoea by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

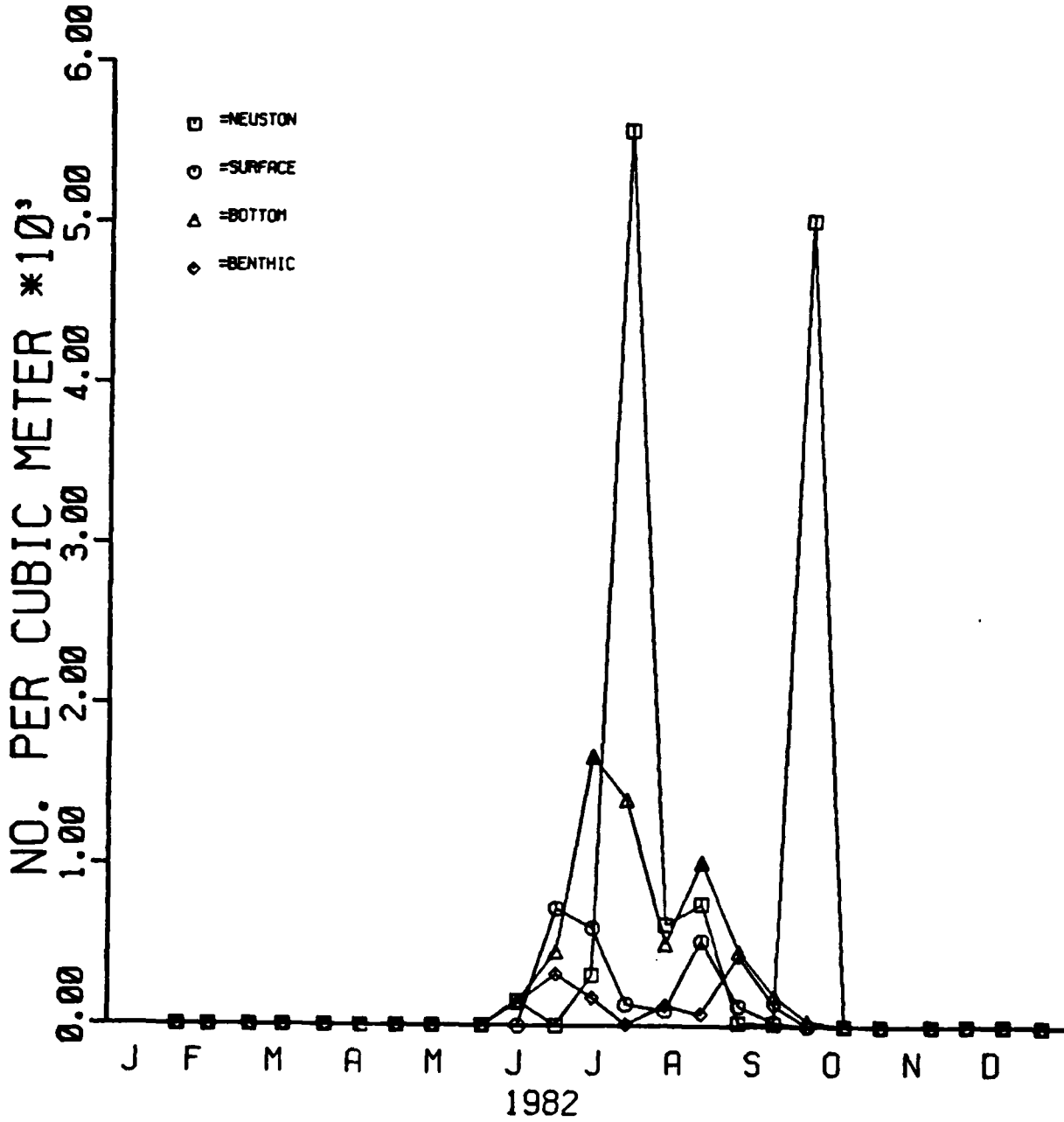


Figure 32. Density of Uca spp. zoea by depth by semimonthly by sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

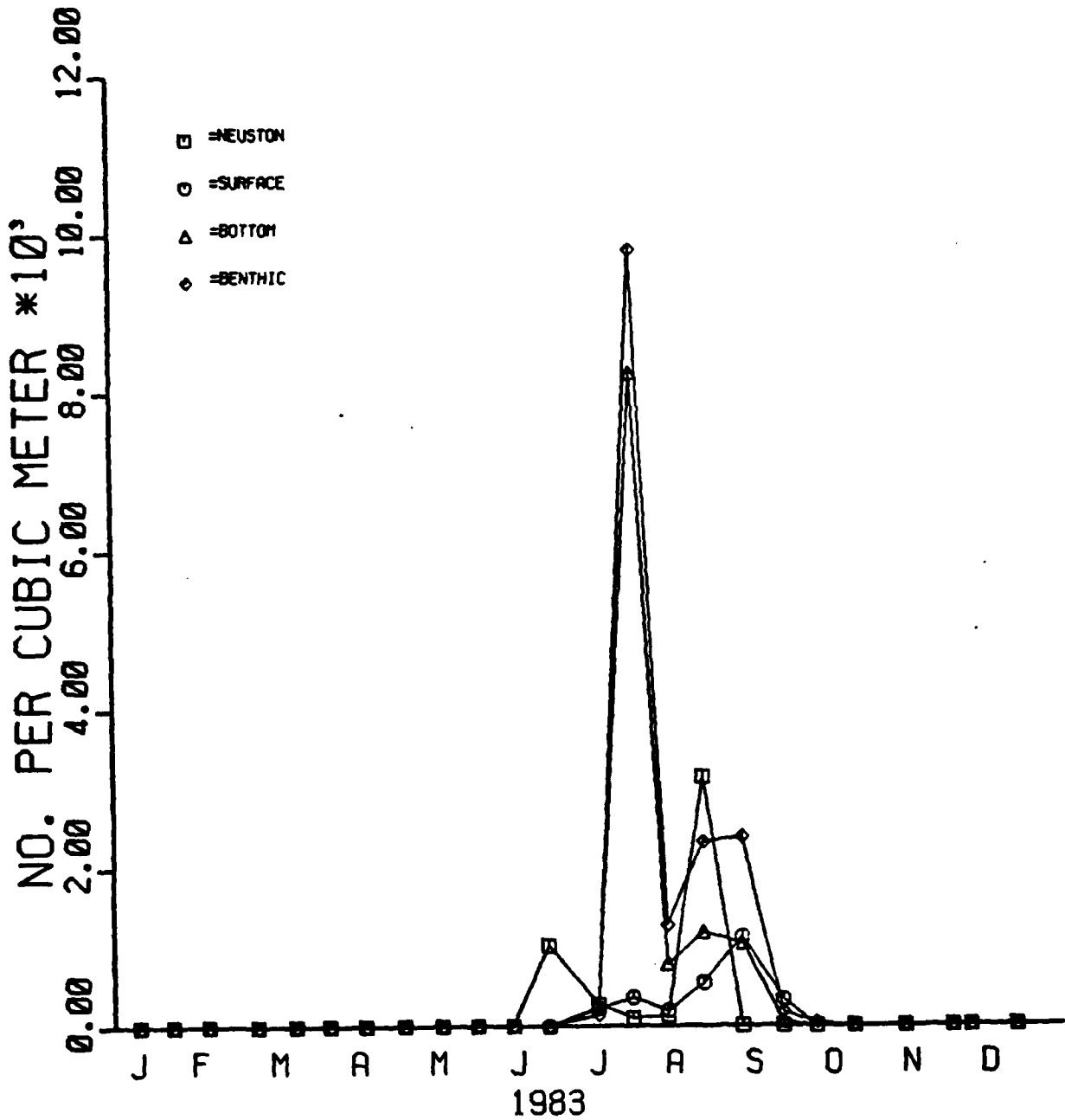


Figure 33. Density of *Uca* spp. zoea by depth by semimonthly by sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

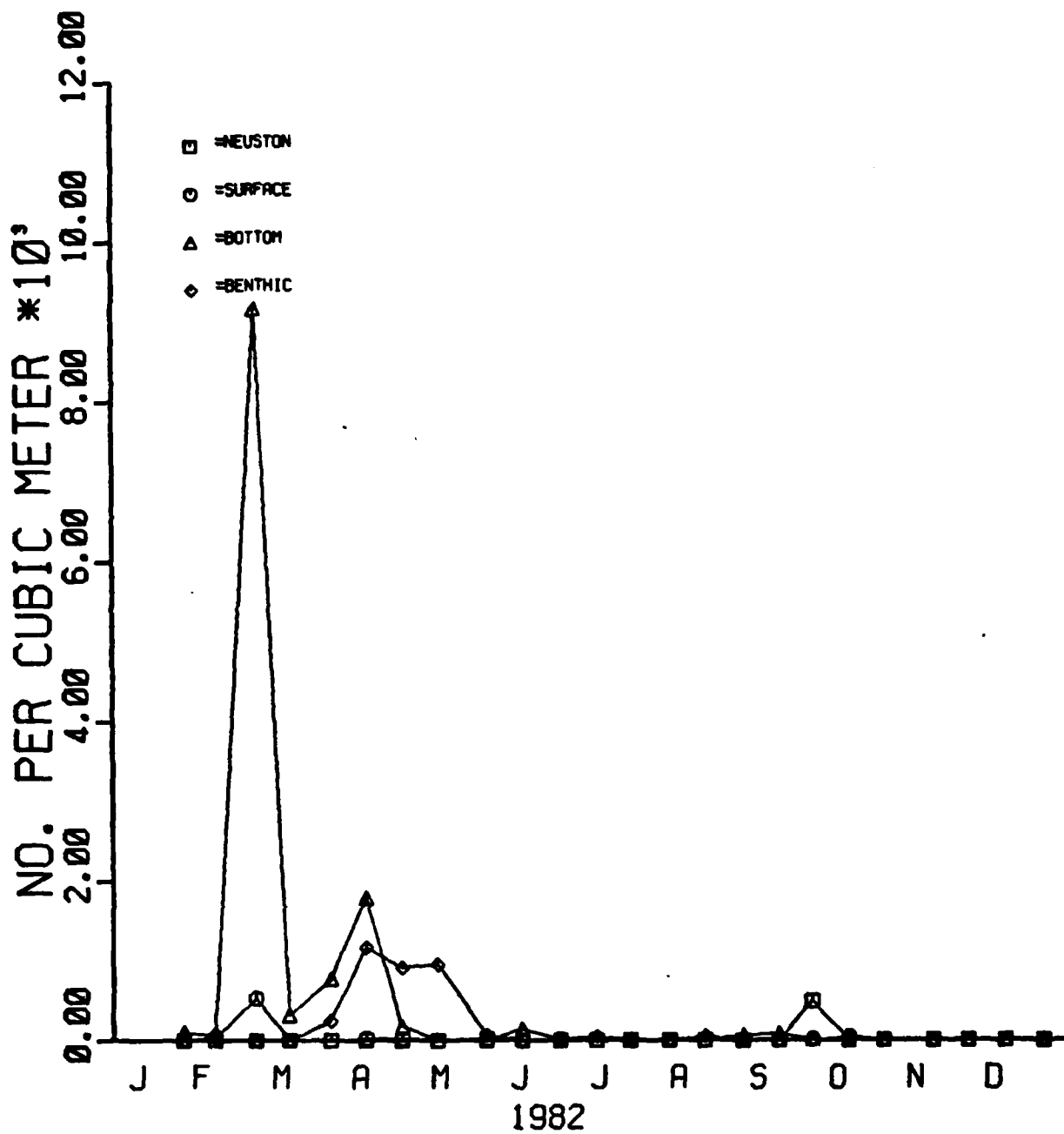


Figure 34. Density of nereid polychaete larvae by depth by semi-monthly sampling period for 1982 at the South Island of the Chesapeake Bay Bridge-Tunnel.

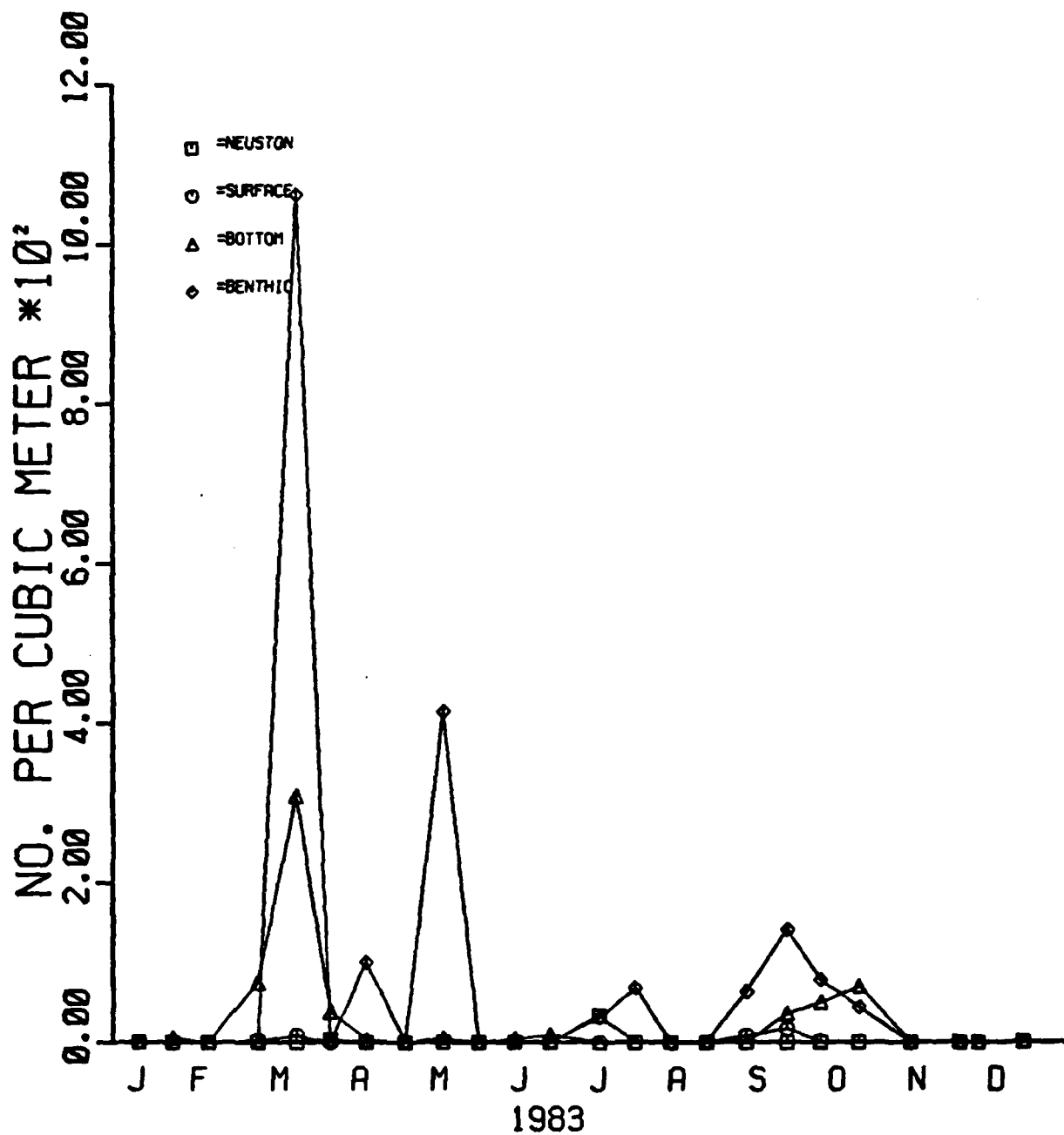
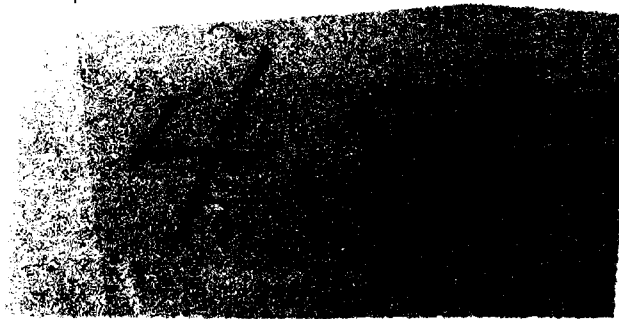


Figure 35. Density of nereid polychaete larvae by depth by semi-monthly sampling period for 1983 at the South Island of the Chesapeake Bay Bridge-Tunnel.

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