

Studies on the small invertebrate plankton of the Sargasso Sea

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ABSTRACT: During the German Eel Expedition in Spring 1979, the horizontal and vertical distribution of the invertebrate plankton was studied in the epipelagic zone of the western central Sargasso Sea, based on 55 μm and 100 μm mesh net samples. In the isothermal waters north of the thermal front, plankton biomass was on average 2–3 times higher than in the warmer stratified waters south of the front. With regard to the fraction of small invertebrates (nauplii and microcopepods) the differences in numerical abundance between the two areas were similar to those reported in the literature for other size ranges of organisms. No divergency was obvious in the plankton composition in terms of major taxonomic groups and size classes. In both parts of the area, organisms smaller than 400 μm , which form a fraction not quantitatively sampled by the conventional 200 μm or 300 μm mesh nets, accounted for 71–92 % of the total number of organisms in the 55 μm net samples and for more than 50 % in the 100 μm net samples. Average concentrations of the potential food supply for early larval fish stages in the upper 100 m appear to be comparable with values reported in the literature for areas well known for larval fish development, such as the California Current.

INTRODUCTION

The subtropical convergence or thermal front (Backus et al., 1969) is a characteristic feature of the Sargasso Sea, separating the central part into cooler, more productive northern parts and warmer, less productive southern parts. In the northern part, a thermal stratification of the euphotic zone is restricted to the summer period, when surface temperatures increase to more than 18 °C. In the southern part, the upper waters are vertically stratified all year round and generally remain at higher temperatures.

Corresponding to these differences in the temperature structure, several authors have observed north to south differences in the biota of the Sargasso Sea. Ryther & Menzel (1960, 1961) reported that the net primary production in winter or springtime was significantly lower in the southern stratified waters than in the adjacent northern area. Differences between the North and South have also been investigated regarding the species abundance and composition of phytoplankton (Hulburt, 1964), epipelagic copepods (Colton et al., 1975) and mesopelagic fishes (Backus et al., 1969), as well as the abundance of planktonic Foraminifera and Radiolaria (Cifelli & Sachs, 1966).

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In general, a decrease in abundance and/or biomass from north to south has been reported for all these organisms, explained by the corresponding reduction in primary production (Backus et al., 1969) and by the differences in environmental conditions in the subsurface layers inhabited by migrating animals during the day (Colton et al., 1975).

During the Sargasso Sea Eel Expedition in Spring 1979 (Tesch, 1982), a plankton sampling program was carried out aboard R. V. "Friedrich Heincke". Special attention was paid to the small invertebrate component (nauplii and microcopepods) of the plankton community, which is a potential food source for larval fish. This paper presents results of studies on the horizontal and vertical distribution of the 0.1 mm mesh net plankton biomass on two north-south transects and provides information on the abundance and composition of the invertebrate plankton component from 0.1 mm and 0.05 mm mesh net samples at selected stations both north and south of the thermal front.

METHODS

Zooplankton samples were collected aboard the R. V. "Friedrich Heincke" between March 18 and March 28, 1979 at 36 stations located along four north-south transects between 31°30'N to 26°30'N and 51°W to 61°W. The distance between the transects was about 80 nautical miles (nm). Along each transect, 7 to 11 stations were located, each 30 nm apart (Fig. 1). The geographic position of each station is given by Tesch (1982).

Vertical temperature profiles from 0–300 m were taken with an expandable bathythermograph (XBT) immediately after the plankton tows at each station. In addition, surface water temperature was measured continuously at a depth of 5 m.

Two different types of plankton samplers were used. At each station, vertical hauls, integrating the upper 100 m, were taken with an Apstein-net, which had an opening reduction cone with 0.02 m² aperture and a mesh size of 55 µm. Since the analysis of these samples turned out to be extremely time consuming, only the northernmost and southernmost station of each transect has been included in the present study. A multiple opening-closing net (Weikert & John, 1981) with 100 µm mesh size was used to sample five consecutive depth strata between 0–200 m (0–25 m, 25–50 m, and 50 m steps in the 50–200 m range) separately during one vertical tow. At each of the stations 555, 553, 564 and 565a, one additional tow was made from 500 m to the surface in 100 m steps. The sampler has an aperture of 0.25 m²; net changes were actuated from a deck unit according to the readings of a depth recorder. Due to heavy weather conditions at the beginning of the survey, 100 µm mesh net samples can be considered quantitatively only along the two western transects, III and IV, and at Station 539 (Fig. 1, 2). The analysis, therefore, has been restricted to these stations.

The samples were preserved in a 4 % formaldehyde-seawater solution buffered with hexamethylenetetramine. For sorting and further storage, they were transferred into a formalin-free preservative fluid containing 5 % propylene glycol, 0.5 % propylene phenoxetol and 94.5 % filtered seawater (Steedman, 1976).

The total plankton biomass in the 100 µm mesh net samples, not including molluscs and vertebrates, was determined by wet weight measurements. Each sample was concentrated on a preweighed 55 µm mesh filter, rinsed with 10 ml of 70 % alcohol to remove interstitial water and drained under a slight vacuum for 5 seconds. The filter was

placed in a closed plastic dish for weighing to avoid continuous evaporation during measurement (Beers, 1976). The weights, ranging from 50 mg to > 1000 mg per sample, were determined with a precision of ± 1 mg. Single large organisms, in most cases chaetognaths, large crustaceans or coelenterates, were weighed separately. Due to the removal of molluscs and vertebrates (larval fish and larvae of *Branchiostoma*), the actual biomass of the total zooplankton sampled is slightly underestimated; this is compensated for, to some extent, by a slight overestimation due to some contamination of samples with phytoplankton and detritus.

A more detailed evaluation of samples, providing information on the composition and abundance by major taxonomic groups and size categories, was restricted to northernmost and southernmost stations for comparison. The vertical distribution of the 100 μm mesh net plankton down to a depth of 500 m was investigated at the stations 565a (day) and 564 (night) in the northern area, and at Stations 555 (day) and 553 (night) in the southern area. Additional information for the upper 100 m depth zone, including smaller sized organisms, has been derived from the 55 μm mesh samples at the stations 523, 541 (day) and 539, 564 (night) in the north and 532, 555 (day) and 530, 553 (night) in the south.

Planktonic organisms were identified to major taxonomic groups and counted in four different size categories: < 200 μm , 200–400 μm , 400–1200 μm and > 1200 μm . Size classifications were made under a dissecting microscope with a magnification power of 25 and refer to total length or largest diameter of the specimens. Copepod length was measured excluding the furcal setae. The length of appendicularians recorded is the trunk length.

All abundance data presented in this paper refer to the metazoan fraction of the zooplankton only. Protozoans were not included in the counts, since they were usually entangled with phytoplankton, detritus or gelatinous material. Mucous material occurred in the samples down to 300 m in rather large amounts and made the sorting generally difficult. Copepod exoskeletons and dead copepods, which were distinguished from living material according to the criteria of Wheeler (1967) and Weikert (1977), were counted separately (100 μm mesh nets) or excluded and counted in selected samples only (55 μm mesh nets).

The numbers of organisms in the 55 μm mesh net samples, which could not be subdivided for counting, ranged between 1,800 and 33,000 per sample, representing the plankton content of 2.3 m³ of seawater. The filtered volume of the 100 μm mesh nets ranged from 6.5–25 m³, according to the depth strata taken. Samples were divided into two size fractions by filtration through 500 μm mesh gauze. The whole fraction was counted for larger sized organisms. In the smaller size fraction, the most abundant groups (copepods, nauplii and appendicularians) were estimated from subsamples. Only at greater depths, where plankton concentrations were low, were complete samples enumerated.

RESULTS

Hydrography

A general picture of the hydrographic situation in the Sargasso Sea in Spring 1979 is given by Wegner (1982), based on casts from a large number of stations over an extended

area taken aboard the F. R. V. "Anton Dohrn". According to his results, the horizontal surface temperature gradients did not indicate the presence of the very pronounced thermal front that was observed during some earlier studies (Katz, 1969; Voorhis, 1969).

The continuous recording of surface temperatures on board the R. V. "Friedrich Heincke" showed that the maximum horizontal temperature gradient was located at about 30°N along Transects I and II, and somewhat farther south, at about 27–29°N, along Transects III and IV, where the gradient was less pronounced (Fig. 1).

The vertical temperature distribution down to a depth of 300 m is shown in Figure 2 for all four transects. The most complete plankton data are available for Transects III and IV, where north of and at Stations 545 and 559, respectively, the water column was almost isothermal throughout the 0–200 m depth range, with temperature values of about 19°C, varying not more than $\pm 0.5^\circ\text{C}$. Southward, the surface temperatures increased to about 22°C within the sampled area, and a progressively increasing stratification in the upper 200 m depth range was indicated.

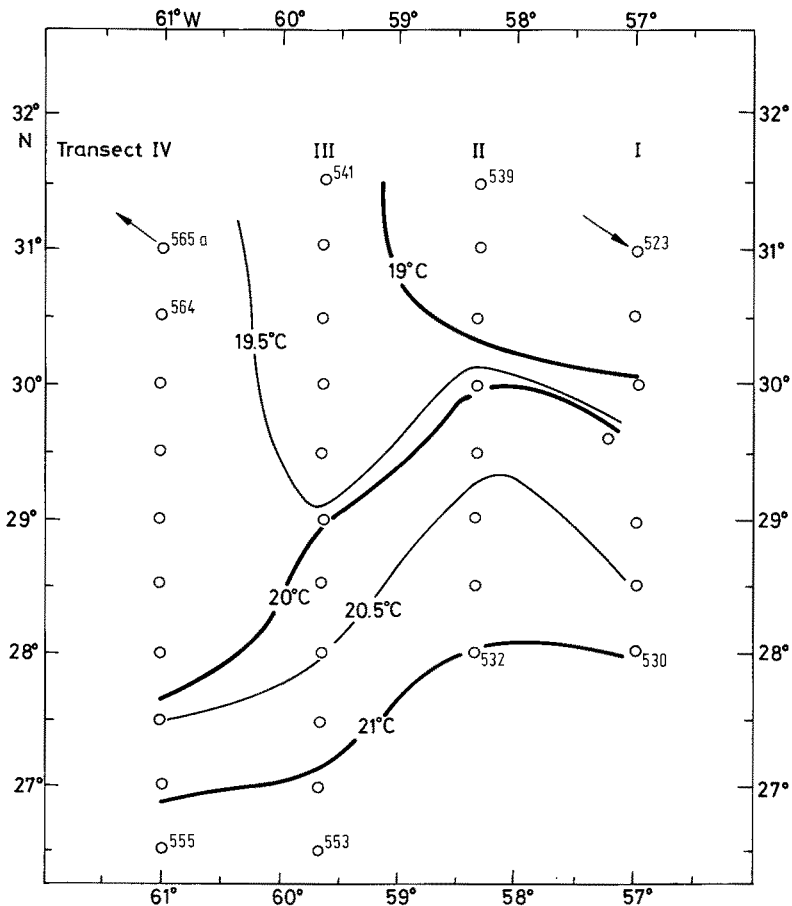


Fig. 1. Stationary grid of R. V. "Friedrich Heincke" and temperature distribution at 5 m depth in the central Sargasso Sea

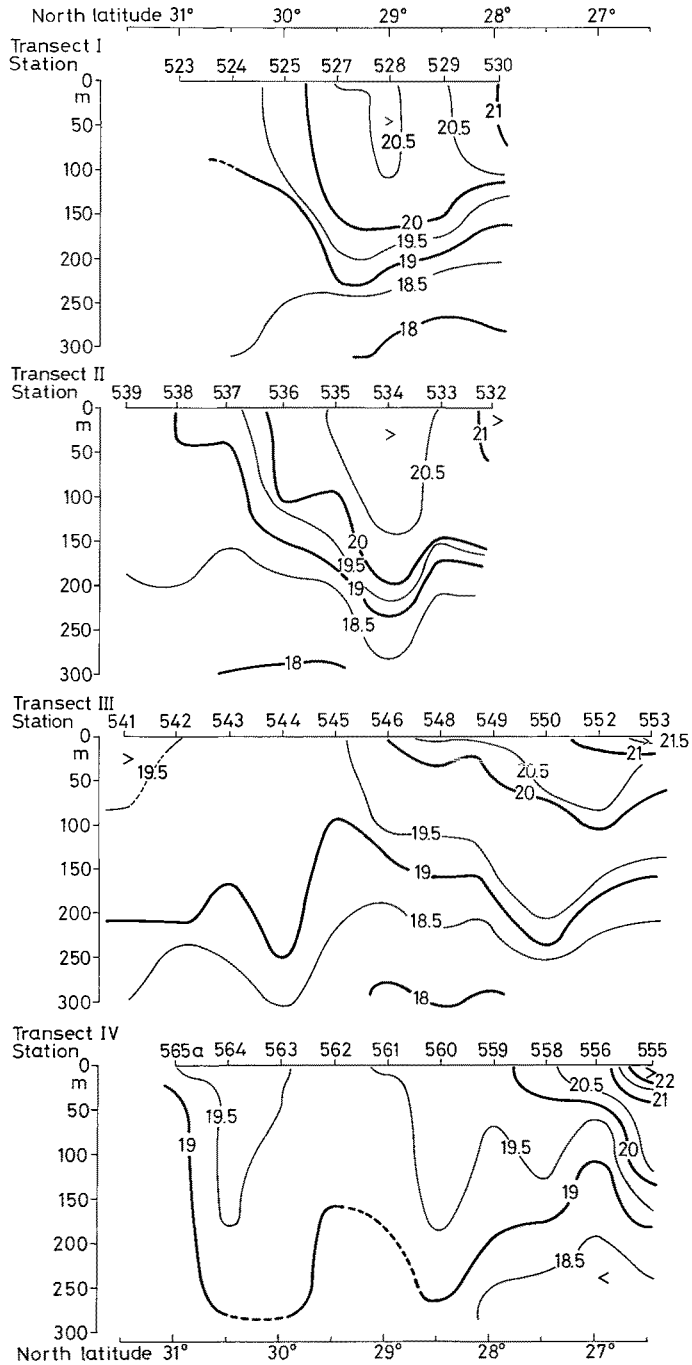


Fig. 2. Temperature distribution along four north-south transects in the central Sargasso Sea

Along Transects I and II, on which only the 55 μm mesh net samples of the northernmost and southernmost stations were evaluated, the same general picture of a vertically homogeneous water column in the north and a more stratified water to the south is apparent. The 20°C isotherm at the surface may be taken as the line separating the two types of temperature regimes.

Plankton biomass

The distribution of invertebrate plankton biomass, excluding molluscs and vertebrates, in the upper 200 m along Transects III and IV is depicted in Figure 3. The dots

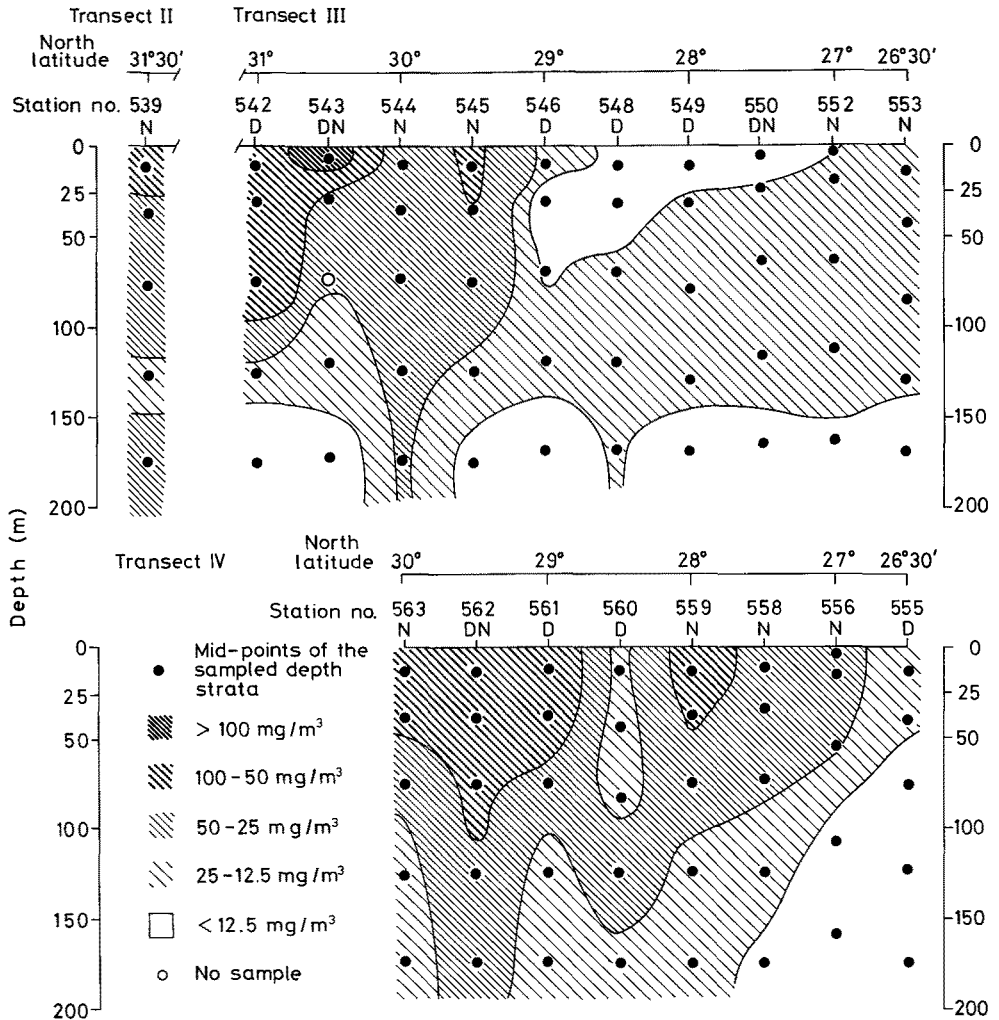


Fig. 3. The 100 μm mesh net plankton, excluding molluscs and vertebrates. Horizontal and vertical distribution of plankton biomass (wet weight in mg/m^3) along two north-south transects in the central Sargasso Sea. (D = day, N = night, DN = dusk)

Table 1. The 100 μm mesh net plankton, excluding molluscs and vertebrates. Average concentrations of biomass (wet weight in mg/m^3) for the upper 200 m at stations north and south of 20°C surface temperature in the Sargasso Sea. Values in brackets include the weight of single large organisms. (D = day, N = night, DN = dusk)

Area	Station No.	Transect IV		Station No.	Transect III	
		Sampling time	mg/m^3		Sampling time	mg/m^3
North of 20°C	563	N	31	539*	N	37 (70)
	562	DN	51	542	D	47**
	561	D	36 (39)	543	DN	36***
	560	D	24	544	N	31 (40)
	559	N	33 (35)	545	N	31 (33)
South of 20°C	558	N	23	546	D	12
	556	DN	17	548	D	13 (15)
	555	D	7.5 (9.0)	549	D	12 (13)
				550	DN	14 (15)
				552	N	19 (20)
			553	N	14	

* Station located on Transect II
 ** Large amounts of phytoplankton
 *** Sample of one depth stratum lost, value interpolated

mark the mid-points of the sampled depth strata; the weights of isolated large organisms have been excluded. The average values for plankton concentrations over the whole 0–200 m depth range varied in the range of 7.5 and 51 mg/m^3 (Table 1). At the stations north of the 20°C surface isotherm, where the vertical gradient between the surface and 200 m depth was less than 1°C, the plankton biomass in the 0–200 m depth layer averaged to a median value of 34.5 mg/m^3 , with a range of individual values of 24–51 mg/m^3 for this area. All the values from the stations south of this line, where the vertical temperature gradient increased to more than 1°C, fell into the range 7.5–23 mg/m^3 with a median of 14 mg/m^3 . They were thus consistently lower, differing on an average by a factor of 2.5 (Table 2).

Table 2. The 100 μm mesh net plankton, excluding molluscs and vertebrates. Median values for the average concentration of plankton biomass (wet weight in mg/m^3) for the 0–200 m depth layer north and south of the 20°C surface isotherm. Values in brackets include the weight of single large organisms

Samples	North		South		North:South ratio
	No. of samples	mg/m^3	No. of samples	mg/m^3	
All samples	10	34.5	9	14	2.5
Daytime samples	3	36 (39)	4	12 (12.5)	3.0 (3.1)
Nighttime samples	5	31 (35)	3	19 (20)	1.6 (1.8)
Dusk samples	2	43.5	2	15.5 (16)	2.8 (2.7)
Night:day ratio		0.86 (0.90)		1.6 (1.7)	

The plankton was collected at various times of day and night. In order to consider possible diurnal effects in the samples, the results were grouped into three categories. The daytime collections include all the samples taken after sunrise and until one hour before sunset. Nighttime collections encompass the time from one hour after sunset to one hour before sunrise. Dusk samples were taken during the two hour period around sunset (i.e. 17.00–19.00 hours). No samples were taken at dawn.

As shown in Table 2, for all time categories, the north-south differences in plankton concentrations were consistent in direction, but appear to be most pronounced during day. Since the proportion of day and night samples differed in both areas, the overall north:south ratio of 2.5:1, obtained by combining all samples irrespective of the sampling time, might be biased to some degree.

This comparison does not include results from the two northernmost and two southernmost stations, one sampled during the day, the other at night in each area. The biomass values, given in Table 3, include molluscs and vertebrates. Thus, they are not exactly comparable with the previous ones, though the difference seems to be minor. Based on this set of outermost stations on Transects III and IV, a more pronounced north:south ratio of about 4:1 was calculated for the average biomass density in the 0–200 m depth zone.

The vertical distribution of plankton biomass in the 0–500 m depth zone presented in Table 3 shows the maximum concentration to be in the upper 100 m. Below this depth, a more or less sharp decrease in biomass is apparent, which results in a difference of about one order of magnitude between the 0–100 m and 400–500 m layer.

The samples from a larger number of stations, at which sampling was restricted to the upper 200 m, revealed a wide range of variation in the vertical distribution of plankton biomass within this depth range (Fig. 3). On the average, two thirds of the total plankton biomass was concentrated in the upper 100 m. No pattern in time but in space is indicated from the observed differences. The vertical gradient in biomass appears to be less pronounced in the more stratified waters south of the 20°C surface isotherm as compared to the homogeneous waters north of this line.

Table 3. The 100 µm mesh net plankton, including molluscs and vertebrates. Vertical distribution in density by number (A = No./m³) and biomass (B = wet weight in mg/m³) north and south of the 20°C surface isotherm (D = day, N = night). Note that zooplankton abundance and biomass do not represent the same sample in the depth strata 0–100 m and 100–200 m

Station	North				South			
	565a D		564 N		555 D		553 N	
Depth (m)	A	B	A	B	A	B	A	B
0–100	2700	99	2800	94	400	14	900	28
100–200	620	19	520	30	290	5.0	600	12
200–300	140	5.6	740	25	7.7	2.0	57	5.5
300–400	21	4.9	49	3.3	17	1.4	21	1.3
400–500	12	9.4	40	3.7	0.72	1.1	7.6	1.7
Mean 0–500	700	27	860	32	145	4.7	320	9.7

The biomass values for invertebrate plankton presented in this study are within the range of wet weight data reported in the literature for the central Sargasso Sea (Bé et al., 1971). Compared to the smallest mesh sizes (150–200 μm) so far used for net samples in this area, the 100 μm net does not seem to add any important fraction to the total biomass. This will be different with respect to numbers as described below.

Plankton abundance, composition and size distribution

100 μm mesh net plankton

This section summarizes preliminary results of a more detailed analysis of 100 μm mesh net plankton, based on the 500 m sampling profiles obtained on two northern and two southern stations (Tab. 3). The mean density for all planktonic organisms caught in the upper 500 m was about 760 individuals/ m^3 at the northernmost stations of the Transect III. This is double the number of organisms reported by Deevey (1971) and Deevey & Brooks (1971) for 203 μm mesh net plankton at station "S", located near Bermuda: the mean daytime value in springtime (March/April) over a three year period was about 350 organisms/ m^3 (range: 210–580 organisms/ m^3). The greater numbers obtained in the present study are accounted for mainly by the smaller mesh size used during sampling. More than 50 % of the total numbers of organisms caught were microcopepods and nauplii in the size group of less than 400 μm .

At the southern stations, the average density throughout the 500 m water column was about 220 organisms/ m^3 . Comparable data for this area are not available in the literature. The proportion of small organisms was about the same as it was north of the thermal front. Assuming that half the number of organisms would have been caught by 203 μm mesh nets, based on the above comparison, the plankton density encountered south of the thermal front appeared to be lower than the lowest density encountered by Deevey (1971) to the north, in the Bermuda area.

Table 3 includes information on the vertical distribution of the organisms according to their numerical abundance. The continuous decrease in the density of organisms from the surface downward corresponds to that in biomass given above. The decline in number is more pronounced, however. The depth layer 0–200 m contained on an average 92 % (80–97 %) of all organisms sampled within the 500 m water column, and between the 0–100 m and 400–500 m depth layer the difference was about two orders of magnitude as compared to a decline of one order of magnitude in biomass.

Besides a possible shift to larger organisms with increasing depth, not indicated by the rather wide size categories used in the present study, the less pronounced decline in "biomass" is at least in part due to an increasing percentage of dead or damaged specimens at greater depths, which were not included in the counts but in the weights, and which sometimes outnumbered the fraction of living animals by nearly one order of magnitude.

The living copepod fraction (including nauplii) in the 0–500 m layer averaged for 75 % and 87 % of the total numbers of living organisms at the northern and southern stations, respectively. Corresponding densities of copepod exoskeletons and carcasses averaged 360 and 100 per m^3 , respectively. This is about 40 % of all objects that might be counted as copepods, which is a far greater percentage than the 14.9 % reported by Deevey (1971) for the upper 500 m as an annual mean. One reason for the greater number

of copepod carcasses counted during the present study may certainly be the smaller mesh size used for sampling. On the other hand, it may also be interpreted as an indication of unfavourable hydrographic conditions (Weikert, 1977), which in this case could be due to the mixing of the water masses in the vicinity of the thermal front.

55 µm mesh net plankton

The abundance and composition of planktonic organisms at the four northern and four southern stations investigated using 55 µm mesh nets are provided by Table 4. The overall range of densities of organisms from the total of eight stations analysed was 1,400–14,000 specimens/m³. Systematic differences between day and night samples were not observed. The median concentration at the four northern stations was about three times higher than at the four southern stations.

The composition of the zooplankton according to major taxonomic groups seemed to be rather similar in both areas. Copepod nauplii accounted for 51–68% of the total numbers and copepodid stages I–VI for 28–42%. Molluscs (0.82–5.2%) and appendicularians (1.1–7.8%) alternated for the third and fourth ranks. All the other taxonomic groups listed in Table 4 accounted altogether for less than 2% of the total individual numbers. The group "larval forms" includes mainly unidentified trochophores and larval echinoderms and bryozoans, whereas larval stages of other organisms, such as salps and polychaetes, were included with their respective taxonomic groups. The group "molluscs" consisted mainly of pteropod larvae and juveniles. Lamellibranch larvae also occurred regularly, but in very small numbers.

Table 4. The 55 µm mesh net plankton in the upper 100 m of the Sargasso Sea: abundance (No./m³) and composition of metazoan plankton

Organisms	Northern stations (N = 4)		Southern stations (N = 4)	
	Median	Range	Median	Range
Coelenterates	36	6.6 – 66	8.2	7.9 – 11
Medusae	16	3.5 – 39	1.1	0.74– 3.1
Siphonophores	13	3.1 – 41	7.7	6.6 – 7.9
Crustaceans	5400	2400 – 13000	1900	1300 – 4100
Copepodids I–VI	1750	850 – 5000	785	490 – 1200
Copepod nauplii	3600	1500 – 7900	1100	830 – 2900
Ostracods	13	8.4 – 26	8.2	5.7 – 12
Other crustaceans	8.6	0.88– 22	2.4	2.2 – 4.4
Molluscs	110	21 – 180	44	36 – 73
Tunicates	140	28 – 1200	50	29 – 98
Salps, doliolids	10	0.44– 87	0.22	0 – 0.44
Appendicularians	130	26 – 1100	50	28 – 98
Miscellaneous	38	6.2 – 140	9.3	7.5 – 14
Chaetognaths	26	3.5 – 110	4.4	2.2 – 5.7
Polychaetes	4.5	0.44– 13	0.66	0.44– 2.6
Larval forms	7.7	2.2 – 16	4.6	4.0 – 5.3
Total	5750	2400 – 14000	2000	1400 – 4300

Table 5. The 55 µm mesh net plankton in the upper 100 m of the Sargasso Sea: size distribution of major metazoan groups; median (and range) of numbers per m³ (approximations)

Size	< 200 µm	200-400 µm	400-1200 µm	> 1200 µm
Northern area (4 stations)				
Copepodids I-VI	125 (30- 390)	990 (510 -1900)	660 (250 -2600)	32 (7.9- 65)
Copepod nauplii	3400 (1400-7200)	185 (66 - 640)	1.6 (1.3- 46)	-
Molluscs	76 (11- 85)	28 (7.9 - 89)	3.1 (1.8- 60)	1.3 (0 - 22)
Appendicularians	-	2.8 (0 - 15)	69 (10 - 730)	56 (16 -370)
Chaetognaths	-	-	3.7 (0 - 15)	22 (3.5- 98)
Miscellaneous	+	15.5 (7.2 - 47)	36 (5.9- 55)	22 (7.6- 59)
Total	3600 (1500-7700)	1200 (640 -2600)	770 (260 -3500)	130 (35 -620)
Southern area (4 stations)				
Copepodids I-VI	42 (23- 93)	490 (290 - 860)	230 (170 - 240)	12 (7.5- 21)
Copepod nauplii	1000 (760-2800)	81 (53 - 110)	+	-
Molluscs	26 (19- 29)	16 (7.5 - 31)	3.7 (1.8- 11)	+
Appendicularians	-	4.2 (0.44- 16)	36.5 (17 - 52)	11.5 (5.3- 12)
Chaetognaths	-	-	+	4.4 (2.2- 5.3)
Miscellaneous	+	5.5 (2.8 - 11)	10.5 (7.2- 12)	8.2 (6.8- 11)
Total	1100 (820-2900)	590 (380 -1000)	280 (210 - 310)	38 (32 - 40)

+ = < 1 individual/m³

- = not sampled

The size distribution of planktonic organisms within the major taxonomic groups is provided by Table 5. Specimens smaller than 200 μm (microzooplankton) accounted for 52–68 % of the total number of all size groups. In this smallest size category, nearly all the organisms were copepod nauplii (93–96 %), microcopepods (2.1–5.8 %), or pteropod larvae (0.7–4.5 %). Tiny ostracods were occasionally noted.

Organisms 200–400 μm in size (small mesozooplankton) had a relative abundance of 19–31 %. In this size class, small copepodids were most abundant (73–87 %), copepod nauplii ranked next (7.0–25 %) and pteropods third (1.2–9.5 %). The remaining organisms (1.3–3.1 %) consisted mainly of appendicularians, ostracods, small hydromedusae, polychaetes and various larval forms.

The size group 400–1,200 μm , which accounted for 7.3–25 % of the total number of organisms, was again dominated by small copepods and copepodids (72–93 %). Appendicularians increased in relative importance (3.8–22 %), whereas molluscs were less abundant, and copepod nauplii were nearly lacking. The remaining organisms accounted for 2.0–5.8 %. These were mainly ostracods, but they also included chaetognaths or salps. Most bryozoan larvae were in this size class.

The larger organisms of more than 1,200 μm accounted for only 0.75–4.3 % of the total numbers. In contrast to the three smaller size classes mentioned above, the relative abundances of several taxonomic groups at the northern and southern stations seemed to be different. Appendicularians accounted for 40–62 % of the total numbers within this class at the northern stations, but only 14–38 % at the southern stations. Correspondingly, copepods showed a lower relative abundance in the northern area (11–28 %) than in the southern (23–55 %). Chaetognaths (5.8–19 %) and siphonophores (4.7–20 %) ranked third or fourth. The latter had a slightly higher relative abundance in the southern waters.

In general, the differences in abundance between the northern and southern stations are reflected in all size classes. With respect to major taxonomic groups, qualitative north-south differences are indicated in the largest size class only.

DISCUSSION

In the Sargasso Sea, the biomass of the plankton standing stock is generally considered to be low compared to adjacent areas in the Atlantic Ocean. Large scale comparisons of the invertebrate plankton fauna are based, in most cases, on pooled data from different parts of the Sargasso Sea. Bé et al. (1971) reviewed the earlier literature. The data they considered were obtained by sampling during various seasons, and no special attention was paid to the specific hydrographic situation at the time of sampling. Bé et al. noted, however, that in their own studies, the lowest values were always found in the "southwestern" part of the Sargasso Sea. According to their figures, this is an area between about 18 and 32°N, and between 45 and 55°W, a region, where permanent thermal stratification of the epipelagic zone can be expected.

More specific information required to relate the abundance of zooplankton in the Sargasso Sea to the thermal front is provided by Colton et al. (1975). Along a north-south transect sampled with a Hardy Plankton Recorder, the concentration of copepods north of the front averaged twice the value found at the stations south of the front. An equal or

larger ratio was obtained during the present study considering 100 μm and 55 μm mesh net plankton.

The abundance of zooplankton in the northern area of the Sargasso Sea shows a definite seasonal cycle with highest concentrations, in terms of both number and biomass, during spring (Deevey, 1971; Deevey & Brooks, 1971, 1977). This has been associated with the seasonal cycle of primary production which, in turn, can be related to the nutrient recycling in the upper waters during the winter mixing (Menzel & Ryther, 1960). No comparable information is yet available for the southern part of the central Sargasso Sea. The permanent thermal stratification implies, however, that the seasonal changes should be less pronounced in this part than in the north.

From the above discussion, the necessity to distinguish between the northern and southern part of the Sargasso Sea is apparent, even in large scale regional comparisons of plankton abundance. A general problem regarding the comparability of data lies in the fact that the location of the thermal front can vary throughout an extensive geographic region. Its position has been observed between 24 and 32°N (Colton et al., 1975). It meanders irregularly and the sharpness of the frontal separation between the two water bodies varies considerably (Wegner, pers. comm.).

Published data on the abundance of micro- and small mesozooplankton from the Sargasso Sea are scarce. Plankton collections using a mesh size of 200 μm or more fail to catch almost all the smallest copepods and the copepod nauplii (Deevey, 1971). Ortner et al. (1980) obtained small mesozooplankton from the upper 200 m in the northernmost Sargasso Sea with 67 μm mesh nets in August and November. It can be seen from their graphs of the vertical distribution that the concentration of nauplii and microcopepods (i.e. smaller than 500 μm) in the 0–100 m depth layer was generally similar to that plotted during the present study, based on 55 μm mesh net samples.

The smaller size fraction of metazoan plankton generally plays an important role as food for fish larvae (e.g. Arthur, 1977; Duka & Gordina, 1973). It was originally attempted in the present study to assess this small zooplankton fraction in the Sargasso Sea as potential food supply for eel larvae. The spawning area of the American and European eel (*Anguilla rostrata* and *A. anguilla*) is located in the southern part of the Sargasso Sea, and recent studies by Schoth & Tesch (1982) have demonstrated that the youngest larvae occur mainly in this area. However, not one single food organism has yet been found in the guts of the eel larvae. The information obtained on the concentration of small planktonic organisms may nevertheless be of interest because they represent a potential food supply for fish larvae of many species.

In the 0–100 m layer, median densities of nauplii, the most abundant group in the 55 μm mesh samples, were 3,600 and 1,100 individuals/ m^3 in the northern and southern areas, respectively. These concentrations are similar to those reported by Arthur (1977) from an important area of larval fish development in the Northeast Pacific. The mean concentration of nauplii in the upper 100 m of the California Current, based on sampling with 55 μm mesh nets, was 2,800 individuals/ m^3 .

The nets were towed from 100 m to the surface, so the information provided can be viewed only as average values. Differences in density on a smaller scale may be very pronounced (Timonin, 1976). Arthur (1977) claimed that the small scale distribution of planktonic organisms may be a more important factor than the average density. Peaks in the concentration of microzooplankton may coincide, for instance, with seasonal deep

chlorophyll maxima, as demonstrated in the temporarily stratified waters of the northernmost Sargasso Sea by Ortner et al. (1980). High chlorophyll concentrations at a depth of about 100 m during the summer stratification have also been reported for the area close to Bermuda (Menzel & Ryther, 1960), which may cause respective concentration peaks of microzooplankton in this area. Similar information on the small scale distribution of chlorophyll and/or microzooplankton is not yet available for that part of the southern Sargasso Sea that is thermally stratified without seasonal variation.

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