# Faunal variation on pelagic Sargassum

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# Faunal variation on pelagic *Sargassum*\* \*\*

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## Abstract

Pelagic *Sargassum* was collected in late summer, late winter, and early and late spring from inshore waters, the Gulf Stream and the Sargasso Sea of the Western North Atlantic Ocean. The noncolonial macrofauna was picked from the weed samples. The 34 samples contained 67 species and 11,234 individuals. The Shannon-Wiener index of diversity had a mean value of $2.419 \pm 0.177$ ($t_{.05} s_{\bar{x}}$) and a statistical range between 1.401 and 3.437 ($t_{.05} s$). Mean diversity values were not significantly different among the various sampling series, and diversity did not vary with raft volume. High diversity values were related to an equitable distribution of species resulting from a stable environment and an area low in productivity. Species composition of the *Sargassum* organisms varied seasonally and geographically. Animals were more abundant in the spring than in the fall samples. Samples collected on a transect in the Gulf Stream and Sargasso Sea maintained a similar faunal composition.

## Introduction

The brown alga *Sargassum*, or gulf-weed, belongs to the order Fucales, which contains many species with vesicles or bladders for buoyancy. The presence of pelagic *Sargassum* with its attendant fauna is well known in the Sargasso Sea of the Atlantic Ocean, but the genus also occurs around Japan (IDA et al., 1967) and in the Red Sea (MARKKAVEEVA, 1965) with an associated fauna.

WINGE (1923) and DEACON (1942) have reviewed the early literature on *Sargassum*. KRÜMMEL (1891) attempted to fix the boundaries of the Sargasso Sea by studying the distribution of *Sargassum*. From records kept by German sea captains, he computed the number of times the weed was sighted in 1° squares and then, incorrectly, combined his results to give 10, 5, and 0.3% probability contours for 5° squares. WINGE (1923) collected *Sargassum* by plankton net and charted approximate boundaries of occurrence of the weed. PARR (1939) sampled extensive areas of the Sargasso Sea and the Gulf of Mexico and found that the sterile eupelagic species *Sargassum natans* and *S. fluitans* made up over

99% of the total pelagic vegetation in the Sargasso Sea, and that the 2 morphological types *natans* I and *fluitans* III composed between 88 and 99% of this total. Other forms of *S. natans* and *S. fluitans* were correspondingly rare, and species torn from littoral bottoms were insignificant. From a variety of evidence, PARR proved that attached coastal species, although occasionally encountered in the Gulf Stream, make no significant contribution to the flora of the Sargasso Sea proper.

PARR's (1939) work on vertical distribution of *Sargassum* demonstrated that only insignificant amounts of the weed are found below the surface. These results, buttressed by WOODCOCK's (1950) study of the extreme buoyancy of *Sargassum*, prove further that the weed is in its natural habitat on the high seas, and is not a coastal castaway with a short pelagic life.

Life associated with *Sargassum* divides into a myriad of forms including micro-, meio-, and macrofaunal components. CONOVER and SIEBURTH (1964) and SIEBURTH and CONOVER (1965) worked on the bacteriocidal effects of *Sargassum* tannins on vibrios and pseudomonads isolated from the alga. With few exceptions, the meiofauna is unstudied. THULIN (1942) found a tardigrade, *Styraconyx sargassi*, and YEATMAN (1962) investigated the copepods of gulf-weed, and hypothesized that the alga was the agent responsible for transplanting several American species to Europe. I filtered material from water in which the weed was agitated and found copepods, nematodes, amphipods, isopods, mites, and tardigrades.

Both sessile and motile forms compose the macrofauna. Many of the sessile species are colonial and, in the case of hydroids, often specific for different morphological types of *Sargassum* (WINGE, 1923; BURKENROAD, in PARR, 1939; WEIS, 1968). HENTSCHEL (1922) found changes in presence or absence of sessile species on different samples and attempted to quantify these species by the number of colonies or the number of vertical branches of hydroid on 10 cm long *Sargassum* leaves. HENTSCHEL analyzed the guts of the important sessile forms (*Membranipora*, *Spirorbis*, *Lepas*, and *Diplosoma*) and discovered that these species subsisted largely on nannoplankton. Surprisingly, many of the

guts contained nematocysts from *Physalia* and unidentified coelenterates. He attributed absence of food contents in hydroids to regurgitation caused by their preservation in formalin. After looking at the gut contents of the nudibranch *Scyllaea pelagica* and the grapsid crab *Planes minutus*, he concluded that the sessile organisms were not an important component of their food. Hentschel (1922) also discussed reproduction of the attached forms and described differences between the fauna of coastal and pelagic species.

Although Thomson (1878) and Murray and Hjort (1912) mention weed animals they encountered during their cruises, Timmermann (1932), a student of Hentschel, has done the only extensive work concerning motile forms. Unfortunately, he attempted to cover the whole Sargasso Sea with 55 samples, many of which were small and sporadically distributed. Timmermann stated that the free-living animals were saved in only some of the samples, but that the remainder sufficed, in general, to recognize the characteristic features of the geographical distribution. His species list appears to be low in numbers of individuals and numbers of species. I believe that his samples are unrepresentative, and I cannot accept his discussion of distribution and his observation of a decrease in fauna during the winter.

Prat (1935) discussed some of the animals and algae he found on *Sargassum*, but gave no quantitative or station data. Adams (1960) described the postlarval development of the *Sargassum* fish *Histrio histrio*. Her paper ends with a discussion of the *Sargassum* complex from the literature and a rather large, although sourceless, list of species found on *Sargassum*. Weis (1968) dipped 4 samples of gulf-weed from the Gulf Stream and identified the animals to genus. She found large numbers of the shallow water snails *Bittium* and *Rissoa* on the weed, but unfortunately chose to explain their presence by suggesting a benthonic origin for the *Sargassum*. Winds at times pile up great masses of weed on beaches of the Atlantic and Gulf coasts. A change in wind direction will carry the weed back out to sea along with any newly recruited species, even intertidal forms.

Available literature does not give more than a vague idea of the numerical distribution of organisms in the pelagic *Sargassum* community. My approach was to take a detailed look at that part of the *Sargassum* macrofauna which could be readily counted. Variations in time and space could then be charted with some confidence and indices of community ecology applied.

### Materials and methods

*Sargassum* samples were dip-netted in the Atlantic Ocean at a number of stations. I took 18 late summer samples between 1 and 5 October, 1968 in 3 areas surrounding Cape Hatteras, North Carolina, USA. Four of the samples came from north of the Cape (I), 5 adjacent

to the Cape (II), and the remaining 9 to the south (III). All further samples were taken south of Hatteras. On a late winter cruise in March (RR), I managed to obtain only 1 small sprig of *Sargassum* in a plankton tow (33°27′ N, 76°56′ W, temperature 22.3 °C, volume 1.3 ml). Scientists in an airplane, looking for fish shoals, did not detect *Sargassum* north of Charleston, South Carolina. Nine early spring samples from 29 April of

Table 1. *Positions and surface temperatures where Sargassum samples were collected, together with respective raft volumes*

| Sample | Latitude (N) | Longitude (W) | Temperature (°C) | Raft volume (ml) |
|---|---|---|---|---|
| I 4 | 36°55′ | 74°44′ | 21.9 | 15 |
| I 5 | 36°38′ | 74°42′ | 22.6 | 255 |
| I 5a | 36°38′ | 74°42′ | 22.6 | 151 |
| I 6 | 36°37′ | 74°44′ | 22.3 | 325 |
| II 7 | 35°24′ | 75°23′ | 23.6 | 82 |
| II 7a | 35°24′ | 75°23′ | 23.6 | 74 |
| II 7b | 35°24′ | 75°23′ | 23.6 | 242 |
| II 7c | 35°24′ | 75°23′ | 23.6 | 202 |
| II 8 | 35°18′ | 75°03′ | 25.0 | 322 |
| III 1 | 34°35′ | 76°14′ | 27.4 | 708 |
| III 1a | 34°35′ | 76°14′ | 27.4 | 25 |
| III 9 | 34°18′ | 75°37′ | 27.7 | 339 |
| III 9a | 34°18′ | 75°37′ | 27.7 | 387 |
| III 10 | 34°14′ | 75°51′ | 26.6 | 562 |
| III 10a | 34°14′ | 75°51′ | 26.6 | 817 |
| III 10b | 34°14′ | 75°51′ | 26.6 | 1,327 |
| III 10c | 34°14′ | 75°51′ | 26.6 | 424 |
| III 11 | 34°16′ | 76°17′ | 27.5 | 388 |
| S 1 | 34°16′ | 75°48′ | 23.0 | 157 |
| S 2 | 34°16′ | 75°48′ | 23.0 | 64 |
| S 3 | 34°16′ | 75°48′ | 23.0 | 71 |
| S 4 | 34°16′ | 75°48′ | 23.0 | 40 |
| S 5 | 34°16′ | 75°48′ | 23.0 | 38 |
| S 6 | 34°16′ | 75°48′ | 23.0 | 30 |
| S 7 | 34°16′ | 75°48′ | 23.0 | 33 |
| S 8 | 34°16′ | 75°48′ | 23.0 | 20 |
| S 9 | 34°16′ | 75°48′ | 23.0 | 13 |
| D 1 | 34°21′ | 75°36′ | 26.2 | 102 |
| D 1a | 34°21′ | 75°36′ | 26.2 | 127 |
| D 2 | 33°56′ | 74°27′ | 21.6 | 92 |
| D 3 | 33°32′ | 72°37′ | 21.8 | 124 |
| D 4 | 33°26′ | 71°56′ | 22.1 | 134 |
| D 5 | 33°15′ | 71°01′ | 22.2 | 269 |

the previous year (S) came from a limited area within the Gulf Stream. Late spring samples from 25 and 26 May, 1969 (D) were collected along a transect from the Gulf Stream into the Sargasso Sea. All samples were collected within a temperature range of 22 °C to 28 °C. Fig. 1 is a chart of the stations, and Table 1 lists the position, temperature, and raft volume for each sample. Samples were preserved in 10 % buffered formalin and later picked for countable animals. All motile forms of approximately 1 mm and larger were selected as were the noncolonial sessile forms. The calcareous polychaete *Spirorbis* was not considered. Raft volumes were quantified by water displacement.

The organisms were identified to species when possible. Identification of portunid crabs in the late summer samples presented a problem because both megalopa and juveniles were present. The larval forms were designated by letter (Portunid A, B, etc.), but the juveniles were only partially separated, resulting in the lumped category of *Portunus* spp. Many of the juveniles had autotomized their chelae, a structure needed for identification. In addition, there was undoubtedly overlap between megalopa and juvenile forms. Statistical treatment of the portunids varied, and will be explained in each case.

Diversity was calculated from Shannon's equation (1948) with the aid of tables provided by Lloyd et al.

$$\varepsilon = s'/s$$

where $s'$ = number of species conforming to MacArthur's model which would give the observed value for species diversity,

$s$ = the number of species present in the sample.

When larval and juvenile portunids occurred in the same sample, individual categories of megalopa and juveniles were arbitrarily paired until the smaller category of the two was exhausted. For example, if 4 Portunid B megalopa, 4 *Portunus sayi* and 5 *P. anceps* occurred together, they would be treated as one species
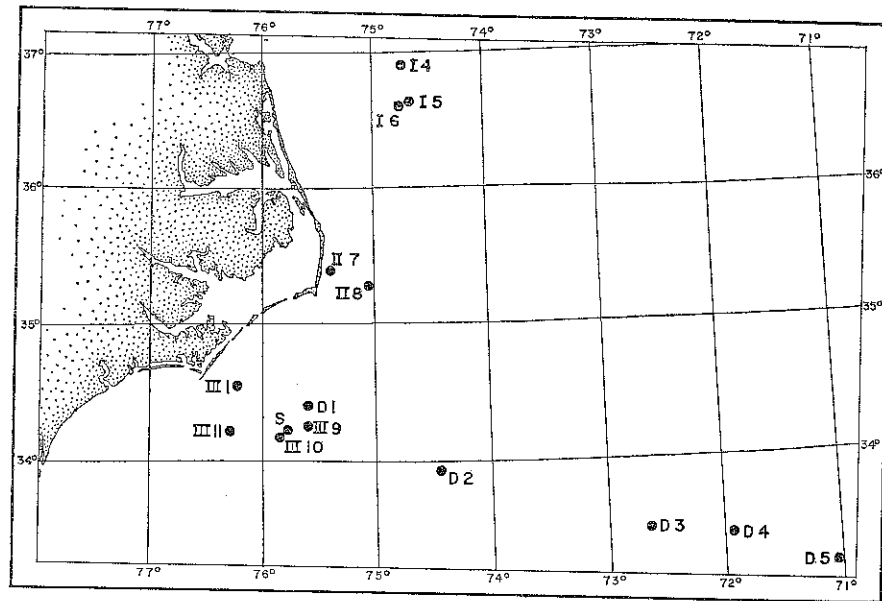


Fig. 1. Location of stations where *Sargassum* was collected

(1968). The diversity index (H′) is based upon the proportion of the number of individuals of each species to the total number of individuals in the sample:

$$H' = -\Sigma p_i \log_2 p_i$$

where $p_i = n_i/N$,

$n_i$ = number of individuals in the ith species,

$N$ = total individuals in the sample.

This index is sensitive to both numbers of species and their distribution.

Equitability ($\varepsilon$) (Lloyd and Ghelardi, 1964) specifically isolates the evenness of species diversity by comparing the number of species in a given sample to the number predicted by a hypothetical standard of species distribution, in this case MacArthur's (1957) model based on nonoverlapping niches:

of 8 organisms and a second species of 5 organisms to establish the number of species, diversity, and equitability of the sample.

In an attempt to define qualitative differences between various sets of samples, I calculated Sanders' (1960) dominance-affinity index for all possible sample pairs. It was obtained by computing the percentage of the total sample represented by each species present in both samples, and then summing the smaller percentage for each species. High values of the index indicated faunal homogeneity or affinity between the samples being compared. Portunids were treated in their separate categories.

In order to examine the numerical dominance of species in a series of samples, I used the biological index described by Sanders (1960). The species were ranked 1 to 7 in each sample and assigned values in

reverse order of abundance so that a rank of 1 was given 7 points, a rank of 2, 6 points, etc. The bioindex value for each species was determined by adding the number of points it scored in all of the samples considered. For example, if a species occurred in 6 samples and ranked first in 4 and second in 2, its index value would be 40. This index prevents the obvious bias inherent in ranking species solely by total number of individuals, namely that a species occurring with a low frequency but in large numbers will be ranked above other species present in moderate numbers at most stations. The portunids were treated as a group in this analysis.

### Results

Numbers of species and individuals and values for diversity and equitability are listed in Table 2. The values for diversity do not appear to contradict a normal distribution, and normality was assumed for statistical treatment of the data. The mean values 2.592, 2.571, 2.228, 2.432, and 2.447 for areas I, II, and III, and series S and D, respectively, gave a nonsignificant F-test after analysis of variance (F = 0.5413; 4,28 df).

Table 2. *Number of species and individuals, diversity and equitability of Sargassum samples*

| Sample | Species | Individuals | H′ | ε |
|--------|---------|-------------|------|------|
| I 4 | 7 | 60 | 2.0600 | 0.75 |
| I 5 | 10 | 200 | 2.4565 | 0.83 |
| I 5a | 14 | 80 | 3.0517 | 0.84 |
| I 6 | 8 | 82 | 2.8004 | 0.82 |
| II 7 | 11 | 35 | 3.0927 | 1.10 |
| II 7a | 13 | 106 | 2.6315 | 0.66 |
| II 7b | 15 | 141 | 2.5409 | 0.53 |
| II 7c | 10 | 137 | 2.0110 | 0.53 |
| II 8 | 18 | 395 | 2.5775 | 0.46 |
| III 1 | 13 | 480 | 1.8588 | 0.36 |
| III 1a | 5 | 17 | 1.9903 | 1.05 |
| III 9 | 10 | 285 | 1.6803 | 0.41 |
| III 9a | 8 | 98 | 2.4783 | 0.95 |
| III 10 | 10 | 179 | 2.3723 | 0.70 |
| III 10a | 12 | 804 | 1.8964 | 0.40 |
| III 10b | 14 | 730 | 2.4941 | 0.55 |
| III 10c | 12 | 179 | 2.5322 | 0.66 |
| III 11 | 18 | 546 | 2.7469 | 0.52 |
| S 1 | 19 | 599 | 2.9178 | 0.56 |
| S 2 | 19 | 266 | 3.3529 | 0.77 |
| S 3 | 16 | 131 | 2.6495 | 0.54 |
| S 4 | 16 | 187 | 3.1783 | 0.80 |
| S 5 | 9 | 47 | 2.7553 | 1.04 |
| S 6 | 6 | 301 | 1.0270 | 0.41 |
| S 7 | 9 | 266 | 1.9866 | 0.58 |
| S 8 | 10 | 80 | 2.1123 | 0.58 |
| S 9 | 6 | 37 | 1.9064 | 0.82 |
| D 1 | 15 | 364 | 2.4978 | 0.52 |
| D 1a | 18 | 513 | 2.9069 | 0.58 |
| D 2 | 15 | 505 | 2.2531 | 0.43 |
| D 3 | 12 | 562 | 1.8550 | 0.39 |
| D 4 | 16 | 976 | 2.8374 | 0.62 |
| D 5 | 15 | 1,709 | 2.3299 | 0.45 |

The regression of diversity on raft volume (Fig. 2) showed that, in addition to not changing with season or geographical area, the diversity index did not vary with sample volume. The mean for 33 samples was $2.419 \pm 0.177$ ($t_{.05}\, s_{\bar{x}}$) and the confidence interval on the individual data points ranged from 1.401 to 3.437 ($t_{.05}\, s$). Variation in calculated diversity values was
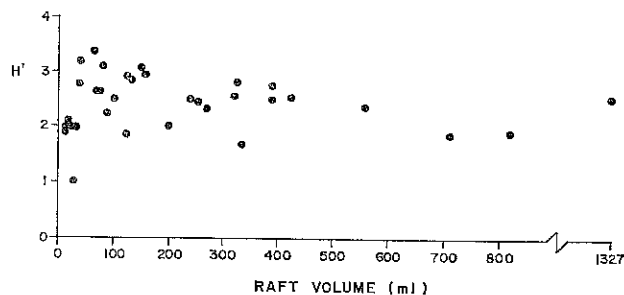


Fig. 2. Relationship of diversity (H′) to raft volume for all *Sargassum* samples
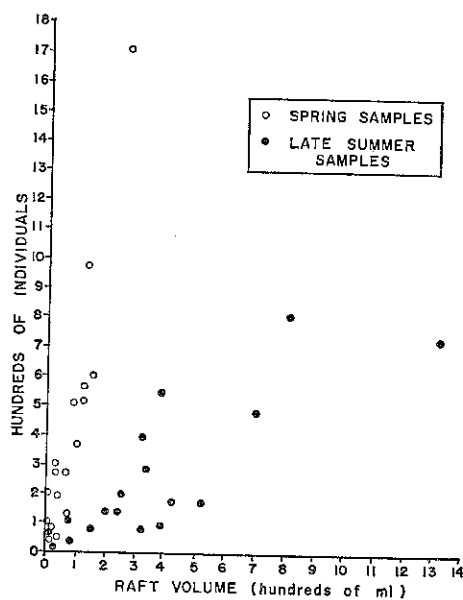


Fig. 3. Relationship of number of individuals to raft volume for *Sargassum* samples collected during spring and late summer

such that several samples in any one area are needed before a reliable estimate may be made.

Diversity is a function of the number of species, the number of individuals, and the distribution of the individuals among species, i.e. equitability. Numbers of species per sample did not change drastically during the year. Indeed, variation was as great within the fall samples as it was throughout the year. In general, within a given set of samples, larger rafts tended to hold more species.

| | I4 | I5 | I5a | I6 | II7 | II7a | II7b | II7c | II8 | III1 | III1a | III9 | III9a | III10 | III10a | III10b | III10c | III11 | S1 | S2 | S3 | S4 | S5 | S6 | S7 | S8 | S9 | D1 | D1a | D2 | D3 | D4 | D5 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **I4** | | 57.2 | 53.8 | 69.1 | 30.2 | 24.4 | 26.0 | 19.8 | 34.3 | 53.2 | 40.2 | 49.9 | 62.6 | 49.1 | 53.4 | 50.2 | 37.4 | 55.8 | 26.2 | 45.5 | 68.4 | 43.9 | 47.6 | 7.3 | 9.8 | 32.5 | 21.2 | 16.2 | 19.7 | 7.9 | 5.5 | 11.2 | 7.4 |
| **I5** | | | 58.0 | 77.9 | 14.7 | 18.1 | 22.6 | 29.2 | 23.9 | 31.3 | 21.5 | 17.5 | 48.5 | 41.1 | 33.3 | 44.4 | 43.2 | 28.5 | 37.9 | 62.3 | 68.0 | 50.1 | 54.4 | 16.0 | 21.1 | 48.8 | 32.4 | 39.8 | 45.0 | 28.0 | 25.4 | 34.9 | 32.7 |
| **I5a** | | | | 65.7 | 26.3 | 26.4 | 33.9 | 25.7 | 37.9 | 35.6 | 30.0 | 29.7 | 52.7 | 36.8 | 35.3 | 38.7 | 29.0 | 40.4 | 35.3 | 52.9 | 59.7 | 51.0 | 57.9 | 18.6 | 20.1 | 40.0 | 25.2 | 51.4 | 39.1 | 19.4 | 16.8 | 30.6 | 29.7 |
| **I6** | | | | | 22.0 | 27.4 | 30.5 | 27.0 | 34.3 | 35.1 | 30.5 | 31.9 | 59.2 | 37.9 | 36.5 | 52.0 | 35.9 | 39.9 | 33.5 | 51.3 | 72.5 | 49.5 | 53.9 | 12.9 | 20.0 | 45.9 | 27.2 | 35.1 | 34.3 | 21.5 | 18.7 | 25.8 | 24.8 |
| **II7** | | | | | | 38.9 | 42.8 | 33.1 | 31.6 | 37.8 | 40.2 | 30.7 | 33.7 | 35.4 | 34.8 | 35.8 | 31.1 | 35.6 | 8.5 | 18.7 | 26.5 | 21.6 | 27.8 | 4.3 | 3.0 | 7.5 | 0.0 | 9.3 | 10.0 | 7.3 | 6.1 | 4.4 | 3.7 |
| **II7a** | | | | | | | 52.2 | 39.1 | 28.7 | 24.0 | 25.7 | 25.0 | 27.4 | 22.8 | 22.9 | 24.0 | 26.7 | 24.1 | 9.2 | 17.3 | 19.5 | 16.6 | 23.8 | 1.9 | 3.0 | 5.6 | 7.6 | 12.6 | 7.2 | 3.5 | 5.5 | 5.8 | 7.7 |
| **II7b** | | | | | | | | 75.9 | 37.2 | 29.4 | 32.3 | 24.2 | 28.6 | 28.1 | 27.8 | 29.4 | 28.4 | 22.9 | 11.3 | 20.1 | 23.1 | 17.8 | 27.8 | 2.5 | 3.3 | 6.6 | 10.7 | 14.6 | 9.4 | 3.9 | 6.9 | 7.5 | 11.4 |
| **II7c** | | | | | | | | | 28.7 | 21.6 | 24.8 | 13.7 | 23.3 | 24.6 | 23.9 | 25.2 | 26.9 | 16.1 | 17.6 | 24.5 | 19.1 | 19.4 | 23.2 | 8.0 | 9.9 | 12.5 | 17.5 | 21.1 | 15.2 | 10.5 | 9.7 | 14.8 | 16.7 |
| **II8** | | | | | | | | | | 38.2 | 36.9 | 30.5 | 37.7 | 37.9 | 37.8 | 38.8 | 32.4 | 34.9 | 12.7 | 20.4 | 29.1 | 20.0 | 34.6 | 4.6 | 5.7 | 8.6 | 12.7 | 16.0 | 10.6 | 6.3 | 6.8 | 9.0 | 11.9 |
| **III1** | | | | | | | | | | | 43.9 | 80.6 | 52.0 | 59.6 | 88.7 | 58.6 | 45.7 | 63.6 | 15.5 | 27.1 | 36.6 | 23.4 | 46.9 | 8.1 | 6.8 | 12.5 | 12.1 | 16.6 | 16.4 | 11.7 | 11.9 | 11.5 | 12.9 |
| **III1a** | | | | | | | | | | | | 50.8 | 65.4 | 74.7 | 50.8 | 72.1 | 53.2 | 50.3 | 7.7 | 15.4 | 26.6 | 14.4 | 32.0 | 0.0 | 1.1 | 5.0 | 16.2 | 11.0 | 5.9 | 1.6 | 4.6 | 3.9 | 7.8 |
| **III9** | | | | | | | | | | | | | 54.0 | 56.5 | 81.6 | 56.4 | 35.9 | 71.8 | 9.4 | 15.7 | 28.5 | 16.2 | 33.6 | 1.8 | 2.9 | 6.6 | 4.9 | 13.0 | 8.0 | 3.3 | 6.3 | 5.7 | 6.1 |
| **III9a** | | | | | | | | | | | | | | 76.7 | 60.2 | 79.6 | 63.8 | 62.4 | 30.2 | 40.9 | 52.2 | 39.9 | 52.0 | 11.4 | 11.7 | 29.9 | 32.4 | 25.8 | 24.4 | 12.0 | 9.6 | 14.9 | 12.7 |
| **III10** | | | | | | | | | | | | | | | 66.0 | 93.9 | 71.0 | 66.5 | 17.3 | 29.5 | 39.5 | 26.0 | 50.3 | 9.9 | 9.0 | 13.7 | 22.9 | 18.2 | 18.2 | 13.5 | 11.9 | 14.3 | 13.8 |
| **III10a** | | | | | | | | | | | | | | | | 65.4 | 51.1 | 66.3 | 14.9 | 25.6 | 36.7 | 23.1 | 44.8 | 8.2 | 6.9 | 11.3 | 16.1 | 16.5 | 16.1 | 11.6 | 11.9 | 11.4 | 12.7 |
| **III10b** | | | | | | | | | | | | | | | | | 74.6 | 67.7 | 19.2 | 31.0 | 40.9 | 27.5 | 52.0 | 11.8 | 10.8 | 15.3 | 24.4 | 20.3 | 20.4 | 14.4 | 11.9 | 15.8 | 13.5 |
| **III10c** | | | | | | | | | | | | | | | | | | 45.1 | 17.8 | 28.9 | 28.1 | 25.4 | 38.2 | 10.5 | 9.2 | 14.2 | 22.4 | 19.1 | 19.0 | 13.9 | 12.5 | 13.7 | 12.7 |
| **III11** | | | | | | | | | | | | | | | | | | | 18.4 | 26.8 | 40.7 | 27.1 | 44.7 | 11.6 | 10.9 | 16.3 | 10.4 | 20.6 | 21.1 | 14.4 | 10.6 | 14.2 | 7.9 |
| **S1** | | | | | | | | | | | | | | | | | | | | 51.4 | 42.1 | 56.4 | 40.2 | 46.3 | 70.5 | 40.1 | 60.1 | 37.7 | 38.9 | 24.9 | 14.3 | 36.6 | 24.6 |
| **S2** | | | | | | | | | | | | | | | | | | | | | 61.9 | 73.5 | 57.0 | 20.3 | 22.9 | 56.2 | 32.5 | 48.0 | 53.0 | 34.5 | 16.4 | 47.7 | 40.1 |
| **S3** | | | | | | | | | | | | | | | | | | | | | | 60.8 | 61.3 | 21.0 | 27.3 | 47.4 | 26.6 | 35.5 | 36.5 | 24.9 | 18.2 | 28.6 | 19.8 |
| **S4** | | | | | | | | | | | | | | | | | | | | | | | 49.6 | 25.1 | 33.0 | 49.6 | 36.5 | 38.3 | 38.6 | 26.5 | 11.1 | 34.6 | 23.7 |
| **S5** | | | | | | | | | | | | | | | | | | | | | | | | 17.6 | 46.8 | 55.3 | 23.4 | 45.3 | 61.3 | 50.2 | 29.7 | 51.5 | 47.5 |
| **S6** | | | | | | | | | | | | | | | | | | | | | | | | | 67.0 | 16.6 | 63.0 | 17.8 | 16.0 | 15.0 | 9.5 | 21.2 | 9.2 |
| **S7** | | | | | | | | | | | | | | | | | | | | | | | | | | 24.2 | 67.5 | 22.5 | 23.1 | 19.9 | 12.7 | 27.1 | 15.9 |
| **S8** | | | | | | | | | | | | | | | | | | | | | | | | | | | 18.7 | 38.6 | 69.5 | 70.3 | 19.1 | 60.3 | 65.0 |
| **S9** | | | | | | | | | | | | | | | | | | | | | | | | | | | | 18.9 | 18.9 | 8.1 | 5.2 | 20.9 | 15.0 |
| **D1** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 54.0 | 34.9 | 19.7 | 45.0 | 41.3 |
| **D1a** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 76.1 | 36.0 | 82.2 | 70.4 |
| **D2** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 45.7 | 80.2 | 79.7 |
| **D3** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 42.1 | 34.1 |
| **D4** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | 78.8 |
| **D5** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

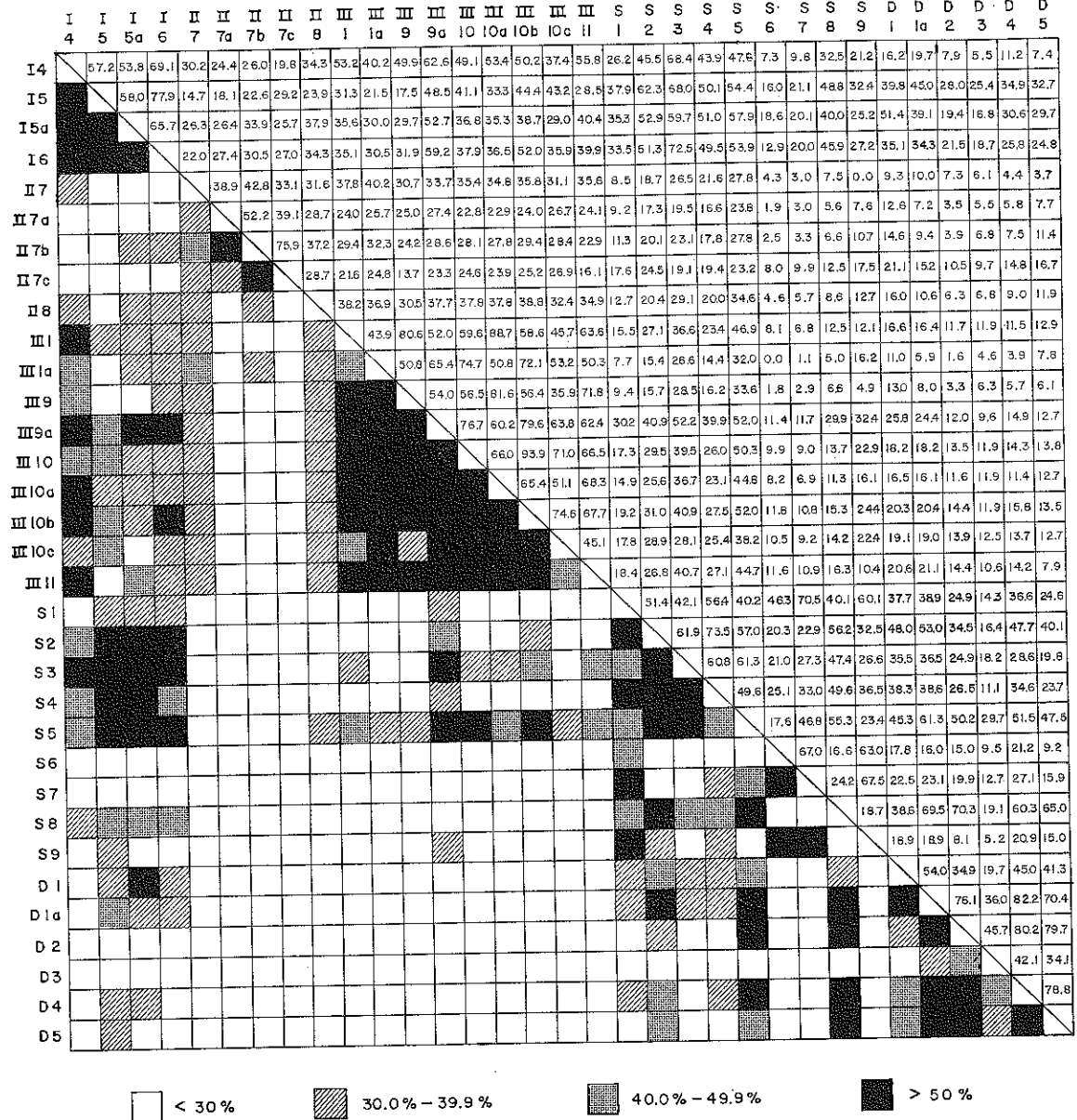☐ < 30 %    ▨ 30.0 % – 39.9 %    ▦ 40.0 % – 49.9 %    ■ > 50 %

Fig. 4. Trellis diagram of dominance affinity index for all sample pairs

The number of individual animals in each sample fluctuated markedly through the year (Fig. 3). Samples from late summer were combined; except for the larger samples from area III, the points for the 3 areas were similar where they shared similar raft volumes. The regression for the spring samples (series S and D) has a higher slope than the regression for the late summer samples, indicating a more abundant fauna on smaller raft volumes. With one exception (sample S1), the late spring samples had more organisms than early spring, but this is probably accounted for by the larger raft volumes of the D series and not by a change in faunal abundance.

Equitabilities were quite variable, ranging from 0.36 to 1.10. Twenty-two of the 33 values ranged between 0.50 and 1.00, with only 8 points below and 3 points above this range. These results indicate a high equitability.

The index of dominance affinity is shown on a trellis diagram (Fig. 4) arranged by groups of samples (I, II, III, S, and D). Such a diagram allows one to compare the affinities within an area and the affinities between areas. The mean affinity within areas I and III was 63.6 and 63.3, respectively. Such values indicate a homogeneous fauna (SANDERS, 1960). The mean affinity between samples in areas I and III dropped

Table 3. *Faunal frequency evaluation of area I*

| | 4 | 5 | 5a | 6 | Biological index value | Total | Frequency |
|---|---|---|---|---|---|---|---|
| *Gnesioceros sargassicola* | 25 | 84 | 20 | 38 | 28 | 167 | 4 |
| *Latreutes fucorum* | 20 | 17 | 17 | 14 | 21 | 68 | 4 |
| *Janira minuta* | | 27 | 8 | 10 | 14 | 45 | 3 |
| *Litiopa melanostoma* | 3 | 25 | 5 | 8 | 13 | 41 | 4 |
| Portunid B megalopa | | 2 | 4 | 2 | | | |
| Portunid D megalopa | | | 1 | | | | |
| Portunid E megalopa | | | 1 | | 9 | 20 | 4ᵃ |
| Portunid spp. juvenile | 1 | 3 | | 5 | | | |
| *Cronius ruber* | | | 1 | | | | |
| *Anoplodactylus petiolatus* | | 11 | 14 | 1 | 8 | 26 | 3 |
| *Platynereis dumerilii* | | 28 | 1 | 1 | 7 | 30 | 3 |
| *Leander tenuicornis* | 6 | 1 | 2 | 3 | 7 | 12 | 4 |
| Dromiid sp. megalopa | 4 | | | | 4 | 4 | 1 |
| *Stephanolepis hispidus* | 1 | | | | 2 | 1 | 1 |
| *Lucifer faxoni* | | | 3 | | 1 | 3 | 1 |
| *Hoploplana grubei* | | 2 | | | 0 | 2 | 1 |
| *Styliola subula* | | | 2 | | 0 | 2 | 1 |
| *Ampithoe longimana* | | | 1 | | 0 | 1 | 1 |

[a] Portunids are treated as a group.

Table 4. *Faunal frequency evaluation of area II*

| | 7 | 7a | 7b | 7c | 8 | Biological index value | Total | Frequency |
|---|---|---|---|---|---|---|---|---|
| *Stephanolepis hispidus* | 7 | 23 | 70 | 85 | 18 | 29 | 203 | 5 |
| *Latreutes fucorum* | 7 | 13 | 22 | 11 | 83 | 28 | 136 | 5 |
| *Litiopa melanostoma* | | 6 | 12 | 15 | 35 | 19 | 68 | 4 |
| Portunid D megalopa | | | 1 | | 2 | | | |
| *Portunus anceps* juvenile | 5 | 3 | 1 | | | | | |
| *Portunus sayi* juvenile | 2 | | 1 | | 1 | 14 | 36 | 4ᵃ |
| *Portunus* spp. juvenile | | 6 | 2 | 4 | | | | |
| *Cronius ruber* juvenile | 1 | | 3 | | 4 | | | |
| *Lucifer faxoni* | | 44 | 9 | | 2 | 11 | 55 | 3 |
| *Ampithoe longimana* | 5 | 1 | 3 | 6 | 10 | 9 | 25 | 5 |
| *Gnesioceros sargassicola* | | 2 | 1 | 6 | 13 | 8 | 22 | 4 |
| *Dromidia antillensis* megalopa | | | | | 181 | 7 | 181 | 1 |
| *Atylus minikoi* | | 1 | 9 | 5 | | 6 | 15 | 3 |
| *Leander tenuicornis* | 3 | 2 | 2 | | 9 | 5 | 16 | 4 |
| *Creseis virgula* | | | | | 23 | 4 | 23 | 1 |
| *Platynereis dumerilii* | 2 | | | 1 | 4 | 2 | 7 | 3 |
| *Janira minuta* | | | 2 | 4 | 1 | 1 | 7 | 3 |
| *Anadara ovalis* | 1 | 1 | | | | 1 | 2 | 2 |
| *Cuthona* sp. | 1 | | | | | 1 | 1 | 1 |
| *Brachyura* sp. A | 1 | | | | | 1 | 1 | 1 |
| *Anoplodactylus petiolatus* | | | 2 | 3 | 2 | 0 | 7 | 3 |
| *Doridella obscura* | | 2 | | | | 0 | 2 | 1 |
| *Hemiaegina minuta* | | | | 1 | | 0 | 1 | 1 |
| *Hyperia galba* | | | 1 | | | 0 | 1 | 1 |
| Gammarid sp. A | | | | | 1 | 0 | 1 | 1 |
| Gammarid sp. B | | | | | 1 | 0 | 1 | 1 |
| *Brachyura* sp. B | | 1 | | | | 0 | 1 | 1 |
| Tunicate sp. | | | | | 1 | 0 | 1 | 1 |
| *Selar crumenophthalmus* | | 1 | | | | 0 | 1 | 1 |

[a] Portunids are treated as a group.

Table 5. *Faunal frequency evaluation of area III*

| | 1 | 2 | 9 | 9a | 10 | 10a | 10b | 10c | 11 | Biological index value | Total | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Latreutes fucorum* | 309 | 4 | 180 | 24 | 49 | 476 | 187 | 23 | 212 | 58 | 1,464 | 9 |
| *Leander tenuicornis* | 46 | 7 | 63 | 17 | 47 | 118 | 172 | 24 | 125 | 51 | 619 | 9 |
| *Litiopa melanostoma* | 39 | 4 | 12 | 24 | 43 | 99 | 190 | 55 | 14 | 46 | 480 | 9 |
| *Platynereis dumerilii* | 44 | | 3 | 4 | 24 | 56 | 93 | 52 | 36 | 34 | 312 | 8 |
| Portunid A megalopa | | | | | | | | | 3 | | | |
| Portunid B megalopa | | | | | | 1 | | | | | | |
| Portunid C megalopa | | | | | | | | | 5 | | | |
| *Portunus anceps* juvenile | 2 | | | | | | | | 1 | 28 | 116 | 9ᵃ |
| *Portunus ordwayi* juvenile | | | | | | | | | 5 | | | |
| *Portunus sayi* juvenile | 10 | 1 | 3 | 1 | 1 | | 4 | 1 | 28 | | | |
| *Portunus* spp. juvenile | 5 | | 15 | 6 | 1 | 7 | 10 | 4 | | | | |
| *Cronius ruber* | 1 | | | | | 1 | | | | | | |
| *Gnesioceros sargassicola* | 18 | | 2 | 21 | 10 | 31 | 53 | 11 | 43 | 26 | 189 | 8 |
| *Stephanolepis hispidus* | 3 | 1 | | | 1 | 3 | 7 | 5 | 2 | 8 | 22 | 7 |
| *Probopyrus latreuticola* | | | 3 | | | 9 | 5 | 1 | 17 | 2 | 20 | 5 |
| *Dromidia antillensis* meg. | | | | | 2 | 5 | | | | 2 | 7 | 2 |
| *Hoploplana grubei* | | | 2 | | | 1 | 1 | | 1 | 2 | 5 | 4 |
| *Syugnathus pelagicus* | | | | | | | | | 14 | 1 | 14 | 1 |
| *Sagitta hispida* | | | | 1 | | | | | | 1 | 1 | 1 |
| *Leptochelia dubia* | | | 1 | | | | | 1 | | 0 | 2 | 2 |
| *Seriola dumerilii* | | | | | | 1 | | 1 | | 0 | 2 | 2 |
| *Anoplodactylus petiolatus* | 1 | | | | | | | | 2 | 0 | 2 | 1 |
| *Planes minutus* | | | | | | | 1 | | | 0 | 1 | 1 |
| *Anemonia sargassensis* | | | | | | 1 | | | | 0 | 1 | 1 |
| *Glaucus atlanticus* | | | | | | | | 1 | | 0 | 1 | 1 |
| *Spurilla neapolitana* | | | | | | | | | | 0 | 1 | 1 |
| *Lepas anatifera* | 1 | | | | | | | | | 0 | 1 | 1 |
| *Lepas fascicularis* | | | | | | 1 | | | 1 | 0 | 1 | 1 |
| *Squilla* sp. larva | | | | | | | | | | 0 | 1 | 1 |
| *Ampithoe longimana* | 1 | | | | | | | | 1 | 0 | 1 | 1 |
| Tunicate sp. | | | | | 1 | | | | | 0 | 1 | 1 |
| *Abededuf saxatilis* | | | | | | | 1 | | | 0 | 1 | 1 |
| *Abededuf taurus* | | | | | | | | 1 | | 0 | 1 | 1 |
| *Caranx dentex* | | | | | | | | | 1 | 0 | 1 | 1 |
| *Caranx bartholomaei* | | | | | | | | | 1 | 0 | 1 | 1 |
| *Hyperglyphe bythites* | | | | | | | | | | 0 | 1 | 1 |
| Centrolophid sp. | | | | 1 | | | | | | | 1 | 1 |

ᵃ Portunids are treated as a group.

to 41.2, but still denotes a strong relationship between these areas. The affinity within area II is 40.8, and the affinities between areas I and II and areas II and

Table 6. *Faunal frequency evaluation of RR-20*

| Species | Number of individuals |
|---|---|
| *Lepas pectinata* | 91 |
| *Anemonia sargassensis* | 45 |
| *Gnesioceros sargassicola* | 2 |

III drop to 26.7 and 29.2. These values demonstrate greater variability in the samples taken offshore from Cape Hatteras, and a faunal change compared with the bordering regions. The mean within the S series was 43.6, but this is somewhat misleading because the samples appeared to fall into 2 groups. Stations 1 to 5 have higher affinities for each other, comparatively higher raft volumes, and higher diversities than the remaining 4 samples. A number of taxa, including *Gnesioceros*, *Litiopa*, the Nudibranchia, *Leander*, and *Latreutes*, are more conspicuously represented in the first 5 samples. The mean within the D series was 54.68 and compares reasonably with the S series ($\bar{x} = 30.70$). Comparisons of the spring and fall samples show some interesting trends:

S:I  $\bar{x} = 39.5$     D:I  $\bar{x} = 25.9$
S:II  $\bar{x} = 14.3$     D:II  $\bar{x} = 9.5$
S:III  $\bar{x} = 21.8$     D:III  $\bar{x} = 13.0$

Series S and area I had an amazingly high affinity considering the gulf in time and space that separated them. The early spring samples had higher affinities

Table 7. *Faunal frequency evaluation of series S*

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Biological index value | Total | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gnesioceros sargassicola | 113 | 82 | 57 | 55 | 7 | 22 | 23 | 23 | 6 | 52 | 388 | 9 |
| Anemonia sargassensis | 176 | 12 | 4 | 16 | | 247 | 234 | | 20 | 34 | 609 | 7 |
| Hemiaegina minuta | 44 | 40 | 3 | 18 | 9 | | 6 | 37 | | 32 | 157 | 7 |
| Latreutes fucorum | 20 | 21 | 31 | 22 | 12 | | 3 | 2 | | 28 | 111 | 7 |
| Janira minuta | 29 | 9 | 10 | 6 | 8 | 13 | 24 | 10 | | 28 | 109 | 8 |
| Lepas pectinata | 132 | 2 | 3 | 14 | 1 | 5 | 69 | 1 | 3 | 26 | 229 | 9 |
| Platynereis dumerilii | 22 | 20 | 8 | 9 | 5 | 13 | 5 | 3 | | 25 | 85 | 8 |
| Litiopa melanostoma | 20 | 15 | 3 | 1 | 3 | | | 1 | 6 | 15 | 49 | 7 |
| Cuthona sp. | 3 | 15 | | 29 | | | | | | 8 | 47 | 3 |
| Anoplodactylus petiolatus | 18 | 20 | | 4 | | | | | 1 | 7 | 43 | 4 |
| Hoploplana grubei | 2 | 8 | 3 | 4 | | | 1 | | 1 | 5 | 19 | 6 |
| Portunus sayi | 2 | 2 | | | | | 1 | | | 2 | 5 | 3 |
| Hyperia galba | | | 1 | | | 1 | | | | 2 | 2 | 2 |
| Portunid F megalopa | | | | | | | | 1 | | 2 | 1 | 1 |
| Leander tenuicornis | 4 | 3 | 1 | 4 | 1 | | | | | 1 | 13 | 5 |
| Tanystylum orbiculare | 6 | 5 | | | | | | | | 0 | 11 | 2 |
| Doto sp. | 2 | 5 | 2 | | | | | | | 0 | 9 | 3 |
| Lucifer faxoni | | 2 | 2 | 1 | 1 | | | | | 0 | 6 | 4 |
| Scyllaea pelagica | | 3 | | 3 | | | | | | 0 | 6 | 2 |
| Lepas anatifera | 2 | | | 1 | | | | | | 0 | 3 | 2 |
| Biancolina sp. | 1 | | 1 | | | | | | | 0 | 2 | 2 |
| Spurilla neapolitana | 2 | | | | | | | | | 0 | 2 | 1 |
| Doridella obscura | | | 1 | | | | | | | 0 | 1 | 1 |
| Lepas anserifera | | | | | | | 1 | | | 0 | 1 | 1 |
| Cronius ruber | | 1 | | | | | | | | 0 | 1 | 1 |
| Ovalipes guadulpensis | | | | 1 | | | | | | 0 | 1 | 1 |
| Dromiid sp. megalopa | | | | | | | | 1 | | 0 | 1 | 1 |
| Cladoceran sp. | | 1 | | | | | | | | 0 | 1 | 1 |
| Cavolina longirostris | 1 | | | | | | | | | 0 | 1 | 1 |
| Allorchestes sp. | | | 1 | | | | | | | 0 | 1 | 1 |

Table 8. *Faunal frequency evaluation of series D*

| | 1 | 1a | 2 | 3 | 4 | 5 | Biological index value | Total | Frequency |
|---|---|---|---|---|---|---|---|---|---|
| Janira minuta | 32 | 81 | 120 | 301 | 206 | 348 | 35 | 1,088 | 6 |
| Hemiaegina minuta | 40 | 177 | 234 | 4 | 339 | 827 | 33 | 1,621 | 6 |
| Sunamphitoe pelagica | 14 | 49 | 61 | 165 | 109 | 78 | 22 | 476 | 6 |
| Gnesioceros sargassicola | 48 | 74 | 32 | 5 | 71 | 39 | 20 | 269 | 6 |
| Anoplodactylus petiolatus | 175 | 42 | 1 | | 80 | 168 | 19 | 466 | 5 |
| Platynereis dumerilii | 6 | 34 | 31 | 36 | 36 | 44 | 14 | 187 | 6 |
| Litiopa melanostoma | 11 | 8 | 7 | 24 | 35 | 132 | 11 | 217 | 6 |
| Latreutes fucorum | 26 | 14 | 1 | 1 | 3 | 2 | 4 | 47 | 6 |
| Planes minutus | 1 | 3 | 2 | 16 | 6 | 6 | 3 | 34 | 6 |
| Hoploplana grubei | | 1 | 1 | | 14 | 40 | 2 | 56 | 4 |
| Anemonia sargassensis | | | | | 53 | | 2 | 53 | 1 |
| Cuthona sp. | 1 | | 7 | | 4 | 17 | 2 | 29 | 4 |
| Spurilla neapolitana | | | | 6 | | | 2 | 6 | 1 |
| Biancolina sp. | 5 | 14 | 4 | 1 | 1 | 4 | 1 | 29 | 6 |
| Acerotisa sp. | 1 | 2 | 1 | | 13 | | 0 | 17 | 4 |
| Leander tenuicornis | 2 | 5 | | 1 | | | 0 | 8 | 3 |
| Histrio histrio | | 1 | 2 | | 1 | 1 | 0 | 5 | 4 |
| Lepas pectinata | | | | | 5 | | 0 | 5 | 1 |
| Portunus sayi | 1 | 3 | | | | | 0 | 4 | 2 |
| Scyllaea pelagica | | | | 2 | | 2 | 0 | 4 | 2 |
| Probopyrus latreuticola | 1 | 2 | | | | | 0 | 3 | 2 |
| Polyclad sp. | | 2 | 1 | | | | 0 | 3 | 2 |
| Doto sp. | | 2 | | | 1 | | 0 | 3 | 2 |
| Endeis spinosa | | 1 | | | | | 0 | 1 | 1 |

for the late summer samples than did the late spring samples, possibly indicating faunal changes are greater during the summer months than during the winter. In every set of comparisons in which it was involved, area II had the lowest value.

The species responsible for these affinities are listed in Tables 3 to 8 by decreasing bioindex, abundance and frequency. The one sample from March (RR-20) has not been treated statistically because of its small size and uniqueness.

## Discussion

FAGER (1963) defined a community as a group of species which are often found together. Such a definition tacitly assumes the existence of communities, an assumption frequently made by marine biologists (FAGER, 1963; MARGALEF, 1967; JONES, 1969; MILLS, 1969). An opposite viewpoint holds that there are no communities, but rather randomly assembled collections of organisms whose ecological tolerance allows them to exist in a particular environment; each collection is an individual point on a continuum, and any grouping of them is, at best, artificial (FAGER, 1963). Since an individual *Sargassum* raft is discrete within the surrounding planktonic environment, and is populated by a sharply different fauna, it is best treated as a separate community.

Communities have often been named by dominant animals (biocenosis), substrate type (biotope), or by a combination of the two (JONES, 1969). Recently, ecologists have not felt the need for a specific name, which may be misleading, and have typified communities by groups of recurring organisms (FAGER, 1963; MARGALEF, 1967; JONES, 1969). However, I do not feel overly anachronistic in designating the weed complex as the *Sargassum* community. As well as being the substrate, the alga is the most obvious organism in the community.

A small raft of algae afloat on the Atlantic Ocean is a rather extreme habitat. One would expect relatively fewer species on these biotic islands than in the deep-sea benthos beneath them (SANDERS, 1968). This situation is reflected in the diversity, which averaged 2.419 bits of information per individual. Although comparisons of diversities of different communities and different habitats are extremely risky, I will attempt two such comparisons to give the reader a basic frame of reference. GRASSLE (1967) found diversities ranging from 4.023 to 5.083 from grabs on the North Carolina shelf and slope sieved to include meiobenthos. Diversity values for SANDERS' (1960) study of Buzzards Bay, Massachusetts, as given by GRASSLE (1967), varied between 1.558 and 3.466. Although the *Sargassum* community has a tropical affinity and a benthic origin somewhere in the distant past, it has a lower diversity than a tropical benthic habitat.

Considering the uniqueness of the habitat and the number of species encountered, the weed community is remarkably diverse. High diversities were supported by the equitable distribution of the fauna. LLOYD and GHELARDI (1964) hypothesized that the equitability component of diversity is sensitive to the stability of the physical conditions. Indeed, physical conditions are stable: Temperatures range between 22° and 28 °C, Sargasso Sea salinities are high and constant, and dissolved oxygen at the ocean surface approaches saturation. Another factor promoting high diversity is the low productivity of the Sargasso Sea, which has been frequently labeled an oceanic desert. MARGALEF (1968) indicated an inverse relationship between productivity and diversity, reasoning that rich conditions, such as those in a plankton bloom, will favor those few species maximally adapted to utilize the situation.

Among the many theories explaining high diversity, stability is the most widely accepted (PIANKA, 1966). Time by itself does not automatically permit a community to diversify, but it is certainly part of the stability theory. In this light, it is interesting to note that MARKKAVEEVA (1965) found 10 species on *Sargassum vulgare* afloat in the Red Sea which also occur on pelagic *Sargassum* in the Atlantic. This finding indicated that the floating community is old, probably extending back to the time when the Tethys Sea existed.

The dominance affinity index within the individual series of samples was remarkably high when one considers that the weed floats on the water surface, the most variable part of the sea. There is no doubt that the weed forms the basis of a community and not a haphazard congregation of individuals. The change in fauna evident in area II may have resulted from a prolonged residence within the area. The gyre, adjacent to Cape Hatteras but inshore from the Gulf Stream (HARRISON et al., 1967), may have trapped the *Sargassum* where it could be modified by the local fauna. Affinities within the late spring samples show a similarity between the *Sargassum* community in the Gulf Stream and in the Sargasso Sea.

Dominance varied among the samples, and I would consider only the polyclad *Gnesioceros sargassicola*, the polychaete *Platynereis dumerilii*, the snail *Litiopa melanostoma* and the shrimp *Latreutes fucorum* as having maintained dominant positions in each series of samples. Many of the species showed seasonal peaks of abundance. The anemone *Anemonia sargassensis* was only abundant in the late winter and early spring collections. By late spring it had disappeared in all but 1 sample. Nudibranchs were most abundant in the spring. The *Lepas* barnacles also had peak abundance in late winter and early spring. *Lepas pectinata* was the only abundant species; it did not occur in association with *L. anserifera* as reported by PILSBRY (1907). Amphipods exhibited several types of seasonal distribution. *Hemiaegina minuta*, the only caprellid found, was

a dominant in both spring series. *Sunamphitoe pelagica* was a dominant in late spring, the only time it was collected, while *Biancolina* sp., a form which normally burrows into algae, had a maximum abundance in early spring although it was taken twice in late spring samples. *Ampithoe longimana* and *Atylus minikoi* were taken in late summer in the Hatteras area. The isopod *Janira minuta* was the dominant organism in late spring, but was also abundant in early spring and late summer in area I.

The pycnogonid *Anoplodactylus petiolatus* reached peak abundance in the late spring, but was present in every set of samples. TIMMERMANN (1932) found most of his *Anoplodactylus* in the central or eastern part of the Sargasso Sea. My observations show they can also be abundant in the western part of the sea and in the Gulf Stream. Although TIMMERMANN frequently encountered *Endeis spinosa*, I found only a single individual. HEDGPETH (1948) took *Tanystylum orbiculare* from gulf-weed cast ashore on the Gulf coast of Texas. I found only 11 individuals in 2 neighboring, early spring samples.

The portunids in the late summer samples were necessarily treated as a group, certainly elevating their position above that which an individual species could claim. Since most of the species were probably transients sharing similar niches, such treatment is not unjustified. Only *Portunus sayi* is commonly considered a resident of the community. The abundance of megalopa and juveniles (including dromiid megalopa) indicates that the weed might offer a protective advantage to the planktonic young. WILLIAMS (1965) lists the range of the portunid *Cronius ruber* as from South Carolina to Brazil. *Cronius* juveniles taken in the Virginian province probably represent a range extension for this species.

*Planes minutus*, a grapsid crab typically associated with *Sargassum*, was rare or absent except in late spring. The first 2 samples from the Gulf Stream contained 4 *P. minutus*, while the remaining 4 samples from the Sargasso Sea contained 30. Coincident with this was the disappearance of *P. sayi* from Sargasso Sea samples. Although both species occur in both localities, it is possible that *Planes* has a more pelagic distribution while *Portunus* remains closer to shore.

The shrimp *Leander tenuicornis* was dominant only in area III, although it was present in other series in low numbers.

Juvenile fishes were found chiefly in late summer in areas II and III. *Stephanolepis hispidus* was the dominant animal in area II. These juvenile filefishes lead a pelagic life, but associations with the weed remain transitory because the fishes leave for the bottom when between 50 and 100 mm in length (BERRY and VOGELE, 1961). Predation by these fishes in area II may have been partially responsible for the different faunal homogeneity. Seven of the 8 other species of juvenile fishes were found in area III, indicating a

tropical affinity. The pipefish *Syngnathus pelagicus* is a typical resident, but the other species were transients probably attracted to the weed for protection (GOODING and MAGNUSON, 1967). The *Sargassum* fish *Histrio histrio* was found only in late spring, although ADAMS (1960) took it year-round.

Regarding seasonal and local variation, this study has perhaps raised more questions than it has answered. I have no sure way of knowing if seasonal changes I observed were the result of real periodicity of the fauna or whether changes were due to variations within the great gyre of the Sargasso Sea. In other words, geographical variation within the gyre could be taken for seasonality because of sampling in one place at different times of the year. To rectify this situation and definitively establish spatial and temporal variation within the Western North Atlantic would require simultaneous sampling over many sections of the Sargasso Sea and the Gulf of Mexico, as well as repeated sampling over a several-year period at selected stations.

## Summary

1. Informational diversity for the noncolonial macrofauna picked from pelagic *Sargassum* had a mean value of $2.419 \pm 0.177$ ($t_{.05} s_{\bar{x}}$) and a statistical range between 1.401 and 3.437 ($t_{.05} s$).

2. Mean diversity values were not significantly different among the various sampling series and diversity did not vary with raft volume.

3. High diversity values were related to an equitable distribution of species resulting from a stable environment and an area low in productivity.

4. Species' composition of *Sargassum* organisms varied seasonally and geographically.

5. Animals were more abundant in the spring than in the fall samples.

6. Samples collected on a transect in the Gulf Stream and Sargasso Sea maintained a similar faunal composition.

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