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MARINE POLYCHAETES OF AN EELGRASS (ZOSTERA MARINA) COMMUNITY IN BOGUE SOUND, NORTH CAROLINA

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Introduction

Zostera marina is a marine seed plant found on the coast from Greenland to Cape Fear, North Carolina. It is a cosmopolitan species found in temperate waters. The value of eelgrass has been recognized for many years. A primary source of phytoplankton in coastal waters, it ranks with Spartina alterniflora and in many cases surpasses it in productivity (Thayer, 1975). Its role is closely analogous to that played by Spartina, providing a stable habitat and a rich source of detritus and phytoplankton. Much work has been done on eelgrass invertebrate community structure. Few studies however have concentrated to any degree on the polychaete community of an eelgrass bed, notable exceptions being Commito (1975) and Marsh (1970). The goal of this study is to help fill this gap in the knowledge of eelgrass communities.

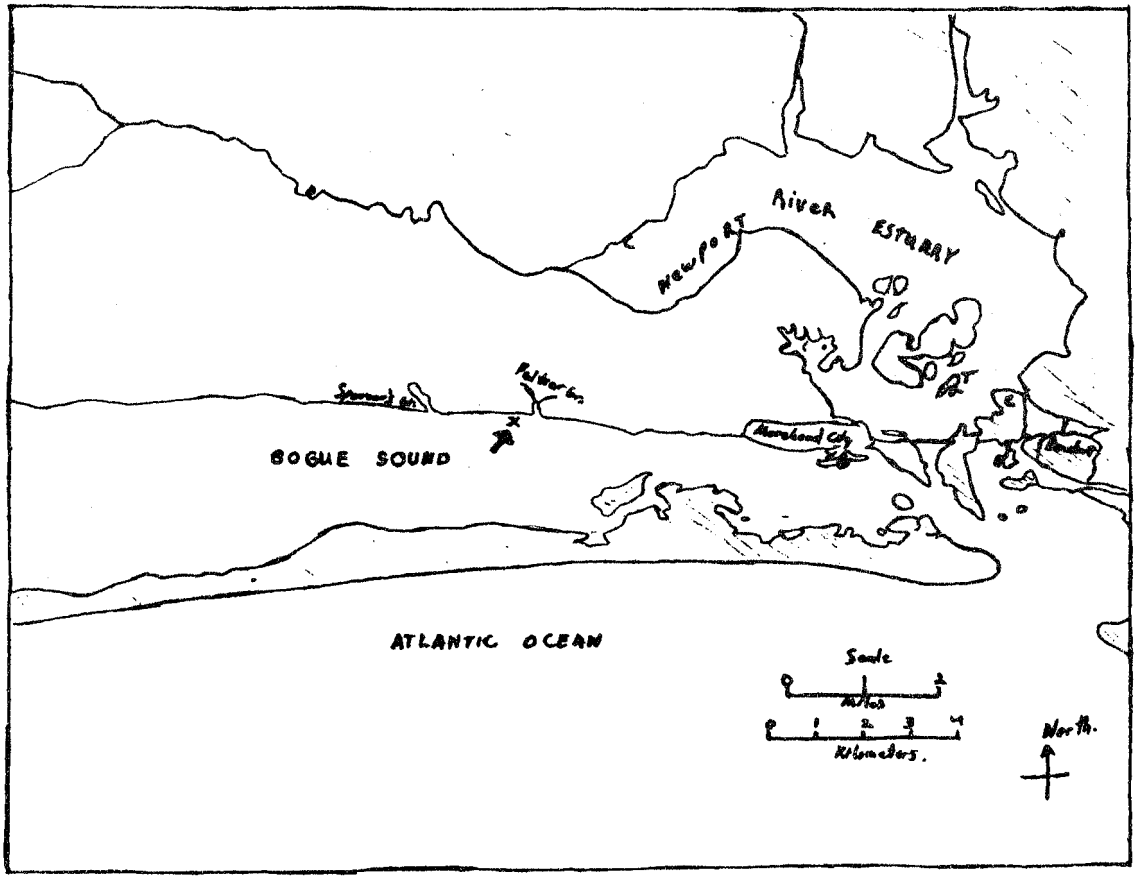
Study Area

The study area was near Beaufort, North Carolina, along the mainland shore of Bogue Banks. The extensive eelgrass beds in this area consist of a more or less unbroken chain of small patches scattered along most of the mainland shore from just below MLW to several hundred yards offshore. The plants use any areas where the water level falls sufficiently for a long enough period each day for them to receive proper sunlight. The sample area was chosen straight off Mansfield Park, located between Spooner's and Peltier Creeks. The selected bed was about 200 meters from shore in about forty centimeters of water at low tide. Figure 1 shows the location of the study area and the areas previously studied. The substrate was muddy sand with a firm consistancy. There was a slight slope gradient. The first eelgrass beds began about seventy-five meters from shore.

Figure One

Site location

(adapted from commito)



Materials and Methods

The sample area was chosen from a transect gradient drawn on a map of a five mile section of shore from Eighteenth Street to Spooner's Creek. Mansfield Park was the third alternative site selected by random drawing; the other areas were unsuitable for various reasons. Although the general location and approximate distance from shore were selected by random drawing the exact site was determined under bias because a more established stable community was desired.

A four-sided frame with fine mesh sides was driven into the substrate so that no epifaunal organisms could escape. The average height of the eelgrass was estimated at twenty-five centimeters and the cross-sectional area of the sample was calculated as $0.67m^2$ due to the uneven terrain. The total epifaunal volume was $0.168m^3$. A deep wide hand net made from the same fine mesh, similar to a butterfly net, was swept through the area until no additional organisms could be captured. The contents of the net were placed in a jar of fresh sea water until it could be stored.

The eelgrass and substrate were dug up to thirty centimeters. The infaunal volume was recorded as $0.201m^3$ with a total epi- and infaunal volume of $0.369m^3$. Each shovelful was carefully sieved and the remaining material placed in a large bucket. The sieve consisted of a metal-framed basket lined with window screen. After the material was collected it was sieved a second time and placed in a bucket of sea water. The hand net was again swept through the area to collect materials that washed out previously. A final check was made by hand to collect any remaining grass and invertebrates that had managed to elude both net and shovel.

The material was divided and placed in half-gallon plastic bags with enough water to keep the plants wet. Each of the bags and the netted material in the jar was then refrigerated until transported to the lab. Once in the lab the bags were sorted one at a time by floatation over a three day period. The sorted material was preserved in a five percent formula and sea water solution to be identified later. The plants were separated into *Zostera* and *Hypnea* which included miscellaneous species. A wet volume was taken of the whole plants including roots and associated epiphytes. The detritus and shell fragments were also sorted and volumes taken. All measurements were wet volumes.

Finally a sediment analysis was made immediately outside the sample area. Since only a crude analysis was needed the samples were placed in a large graduated cylinder, shaken, and the water poured off at 30, 15, and 5 second intervals. Each time interval was repeated many times before advancing to the next time interval.

The relative volume and percent of each soil type was recorded.

Results

The soil consisted of 20.05% silt, 2.63% coarse silt, 3.68% fine sand, and 72.63% sand as shown in Table 1. A shell volume of 115 ml corresponding to 572 ml/m^3 and an infaunal volume percent of 0.000572%. The detritus was a far more significant element at 936 ml indicating 4657 ml/m^3 and 0.005% of the infaunal volume. The total volume of Zostera including roots and associated epiphytes was 1416 ml with a total percent volume of .00384%. If the density of the plants is taken to be about that of water the wet weight os Zostera can be calculated as 2113 g/m^2 and 3837 g/m^3. That of Hypnea would be 350.7 g/m^2 and 637 g/m^3 with a percent volume of 6.47×10^{-4}% as shown in Table 2.

Table 3 shows the polychaetes obtained by rank, number, and number per unit area and volume. Platynereis dumerillii was the only species obtained in the hand net and is assumed to be the only epifaunal polychaete from the sample. It is the second ranked species with 22 specimens collected. Poecilochaetus johnsoni is the top ranked polychaete in the sample with 63 specimens recorded, making up 37.5% of the polychaete population. 62 of the specimens were anterior fragments averaging one centimeter in length; one specimen was found with 3 posterior segments intact. A total of 139 fragments ranging from one millimeter to three centimeters were collected; most of these were ripe with eggs. Apparently the eggs are released as the posterior segments of the worm deteriorates.

A total of 168 individuals was collected, representing more than 18 species counting the unidentified polychaetes. This is an overall total of 251 individuals per square meter and 455 per cubic meter. One epifaunal species, P. dumerillii, with 22 individuals making up 13.1% of the total population, was recorded. This indicates a count of 33 individuals per square meter and 109 per cubic meter. 17 infaunal species were recorded totaling 146 individuals and 86.9% of the population. An average value of 218 individuals per square meter and 726 per cubic meter is indicated.

Discussion

As pointed out by Marsh (1970) the relative density of plants makes the choice of a sample size difficult; often the sample is overwhelming large for certain groups of invertebrates or too small for others. Most of the studies performed on eelgrass communities are designed with a small sample size in order to deal with the large number of organisms such as amphipods and gastropods.

For this reason a large sample size was chosen, providing usable figures for the populations of less abundant invertebrates.

The sediment analysis corresponds with that of Parker (1975), sandy silt. A mixture of sand and silt offers the optimum substrate for plants, enough to provide nutrients and anchorage but not so much as to inhibit light penetration. Marsh's results also agree with the findings of this study. His station A was comparable to the present site in sediment and depth of water. Marsh obtained a sediment analysis of 25% silt and clay, less than 10% very fine sand, 45% fine sand, and 20% sand (Marsh, 1970).

The value of 2113 g/m^2 of Zostera agrees with Parker's values of 2500 wet g/m^2 in the sparser beds of Hadley Harbor in the Woods Hole region (Parker, 1975). The reason for the sparse beds in Bogue Sound are probably that this area is near the southern extent of its range and possibly there was an incomplete recovery from the major dieback of the 1930's. Further comparison of studies is impossible because most studies obtained data only for the above ground biomass with the exception of Parker and Nelson (1979). Comparison with these studies is difficult since only dry weight data is available.

The only other study for the Bogue Sound area is for the epifaunal community of Sugar Loaf Island near the opening into Beaufort Inlet. The island and the eelgrass bed is subject to a strong tidal current and pollution from the nearby channel, possibly resulting in a lower density of polychaetes. The most common neriad in Godfrey's study was P. dumerillii; however she obtained low counts during the summer months. A further comparison is unwarranted; Godfrey did not include data on the numbers of individuals per unit area (Godfrey, 1969).

Thayer in two studies of a developing eelgrass bed on Phillips Island gave data only for the total numbers of polychaetes obtained. The earlier study produced a total of 134 worms per square meter, a low count but reasonable for a newly established bed (Thayer and Adams, 1975). The second study found 302/m^2 indicating a major increase in population density of the bed (Thayer and LaCroix, 1976). These values are within an acceptable range of the values obtained in this study but indicate a somewhat lower population density.

Poecilochaetus johnsoni

This polychaete deserves special mention since it has never been recorded in the Beaufort area. Indeed there seems to be no positive identification of this species in the state of North Carolina. Two fragments identified as Poecilochaetus sp. were recorded by Day

(1973). He was unable to distinguish them as P. johnsoni or P. serpens because they were incomplete. A large number of specimens were obtained in this study, making a positive identification possible. According to Hartman (1939) P. serpens is distinguished by heavy spines replacing the dorsalmost notapodial setae. The specimens collected in this study lacked this quality and otherwise fit the description of P. johnsoni. The habitat described for this species is similar to that encountered in the area studied. It consisted of muddy sand that is firm enough for walking and is located proximal to the open sea but sheltered by a sand spit (Hartman, 1939). Bogue Sound could play a similar role in that it shelters the populations from the open ocean and yet provides a more constant salinity than areas of the Newport Estuary.

Conclusions

The polychaete populations of Bogue Sound were different than those of other eelgrass beds in species but similar in structure and total number of individuals. This suggests that there has merely been an exchange of species occupying the habitat while the niches available and total population supported by the eelgrass beds remain the same. Much more work needs to be done before an accurate model of a polychaete community in an eelgrass bed can be presented.

Acknowledgements

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Postscript

J. L. Taylor reported in Quar. Jour. Fla. Acad. Sci. 29:(1): 21 - 26 that specimens of P. johnsoni have been found in Florida and North Carolina. In most cases only a few fragments were found in each site but in Core Sound 189 specimens, both whole and fragmented, were discovered in a Zostera bed. This may be their preferred habitat.

--April 14, 1982

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TABLE 1

SOIL SAMPLE

Time	30 sec.	15 sec.	5 sec.	Remainder	Total
Type	Silt	Coarse silt	Fine sand	Sand	
Volume 1	25 ml	5 ml	5 ml	85 ml	120 ml
Volume 2	15 ml	0 ml	2 ml	53 ml	70 ml
Total	40 ml	5 ml	7 ml	138 ml	190 ml
Percent	20.05%	2.63%	3.68%	72.63%	98.99%

TABLE 2: VOLUME ANALYSIS

Component	Volume ml	Volume m^3	Weight g	Weight Area m^2	Weight Volume m^3	Percent Volume
Zostera marina & epiphytes	1416	$1.416 (10^{-3})$	1416	2113	3837	$3.84 (10^{-3})$
Hypnea & misc.	235	$2.55 (10^{-4})$	235	350.7	637	$6.37 (10^{-4})$
Detritus	936	$9.36 (10^{-4})$			4657	$4.66 (10^{-3})$
Polychaete tubes	73	$7.3 (10^{-4})$			363	$3.63 (10^{-4})$
Shells	115	$1.15 (10^{-4})$			572	$5.72 (10^{-4})$

Cross section of sample 0.67 m^2

Volume of sediment collected 0.201 m^3

Total volume of sample 0.369 m^3

All measurements taken wet

TABLE 3: POLYCHAETES

Species	Rank	Number	Percent	Cumulative percent	Number per area	Number per volume	Number per total volume
Poecilochaetus johnsoni	1	63 139 frag.	37.5	37.5	94 m^2	313 m^3	171 m^3
Platynereis dumerillii	2	22	13.10	50.6	33	109	60
Arabella iricolor	3	14	8.33	59.93	21	70	38
Drilioneris spp.	4	13 5 frag.	7.74	66.47	19	65	35
Amphitrite ornata	5	12	7.14	73.81	18	60	33
Orbinia	6	9	5.36	79.17	13	45	24
Diopatra cuprea	7	8 3 frag.	4.76	83.93	12	40	22
Capitellides	7	8	4.76	88.69	12	40	22
Sthenelois boa	8	7	4.17	92.86	10	35	19
Glycera americana	9	3	1.79	94.95	4	15	8
Polychaete A	10	2	1.19	96.84	3	10	5
Spirochaetopterus oculatus	11	1	0.60	96.44	1	5	3
Clymenella terquata	11	1	0.60	97.04	1	5	3
Pectinoria gouldii	11	1	0.60	97.64	1	5	3
Lepidesthenia veria	11	1	0.60	98.24	1	5	3

TABLE 3 (cont.)

Species	Rank	Number	Percent	Cumulative percent	Number per area	Number per volume	Number per total volume
Polychaete B	11	1	0.60	98.84	1	5	3
Polychaete C	11	1	0.60	99.44	1	5	3
Polychaete D	11	1	0.60	100.04	1	5	3
Total	18 species	168			251		455
Epifaunal	1	22	13.10		33	109	
Infaunal	17	146	86.90		218	726	