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MACROINVERTEBRATE INFAUNA OF A SALT MARSH TIDAL CREEK

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Abstract: Tidal creeks are the main avenues for exchange of materials between salt marshes and river mouth estuaries. The spatial and temporal distributions of benthic macroinvertebrate infauna of a tidal creek near St. Marks Lighthouse in northern Florida were investigated. One hundred and eleven species were found during the course of study. The numbers of species and individuals declined from the creek mouth to its origin. The results were compared to published macrobenthic invertebrate data from a nearby estuary and nearby salt marshes to determine the faunal relationships of these areas to the creek. More estuarine species than marsh species were found at the creek mouth but at the creek headwaters fewer estuarine than marsh species were found. However, numerous creek species had not been recorded from local salt marsh or estuarine locations. The evidence indicates this tidal creek to be an ecotone between the salt marsh and the adjoining estuarine habitat.

Tidal creeks are integral parts of a salt marsh system and connect it to an adjoining estuary. Various materials are known to be transported in these creeks during tidal cycling (de la Cruz, 1973; Settemyere and Gardner, 1975; Pickral and Odum, 1976; and Hackney and de la Cruz, 1979). Tidal creeks also act as pathways for fish and invertebrates to travel between marsh and estuary (Subrahmanyam and Drake, 1975; Hackney and Burbanck, 1976; Hackney, Burbanck and Hackney, 1976; Subrahmanyam, Kruczyński and Drake, 1976; Homer, 1977; Hackney and de la Cruz, 1978; Subrahmanyam and Coultas, 1980; and Weinstein, Weiss and Walters, 1980).

Salt marsh invertebrate fauna is composed of both estuarine and resident species (Teal, 1962; Subrahmanyam *et al.*, 1976). Since tidal creeks connect salt marshes to estuaries, it is reasonable to assume that the creek fauna is similar to the fauna of these habitats. What is not known, however, is the relative importance of the salt marsh and estuarine faunal components to a tidal creek as it is traversed from its origins in the marsh to its mouth in the estuary. The present study seeks to determine the spatial and temporal patterns of macrobenthic in-

vertebrate infauna at four study sites located along the length of a tidal creek.

MATERIALS AND METHODS

Study Area

A tidal creek 1½ km north of St. Marks Lighthouse (30°5'N, 84°11'E) was chosen as the study site (Figure 1). Four infaunal sampling stations were established along the length of the creek. The first of these stations was at the creek's mouth and the last at the origin, with the remaining two stations at approximately 100 m intervals. *Spartina alterniflora* bordered the creek, and *Juncus roemerianus* was the dominant halophyte of the adjacent marsh; this vegetational pattern is typical of northern Florida marshes (Eleuterius, 1976). Water depth during an average high tide was about 100 cm at stations 1 (at the mouth) and 4 (at the origin), 75 cm at station 2 and 50 cm at station 3. During low tide, water depth was 5-10 cm at stations 1 and 4, and less than 5 cm at station 2. Station 3 was completely drained during most low tides.

Sampling Procedure

The study was conducted from

Figure 1. The location of the four stations in a tidal creek in the St. Marks Lighthouse marsh.

January to December, 1977. Initial samples taken during the first two months were used to determine optimum time of sampling, sample size, number of samples, quadrat size and depth of sampling. Thereafter, monthly, triplicate, 15 cm deep cores were taken randomly during low tide using a 20 cm long, 6.9 cm i.d. plexiglass tube, from a gridded site at each station. Samples were sieved in the field using a 0.5 mm mesh (8" U.S. standard) sieve. The 0.5 mm mesh size was chosen so that juveniles of some macrofaunal groups could be retained. Meiofauna captured using this sieve is not discussed in this report. Organisms retained on the screen were fixed in the field using buffered 10% formalin-seawater with rose bengal as a vital dye. In the laboratory, the species were classified and then stored in 40% isopropyl alcohol. Identifications of macrofauna were done to the species level where possible with the exception of the oligochaetes which were treated

as a single taxon.

Calculations and Statistics

Distributional statistics, including number of species, number of individuals/m², rank by number and percent of total were evaluated for each station. Density/m² was computed by multiplying the average number of animals collected in the three replicate cores by 89. Biological importance (Sanders, 1960) was calculated for each station.

Differences in faunal diversity and affinity were used to support observations of distributional trends. Shannon-Weaver's H' with Basharin's (1969) correction for sample size was used as the index of diversity. Morisita's Index of Affinity ($C\lambda$) (Morisita, 1959) was calculated to determine the similarity of species composition between stations. Analysis of variance (ANOVA) and Duncan's New Multiple Range Test (DNMRT) (Steele and Torrie, 1960) were used to test the significant differences of H' among stations, and to evaluate spatial and temporal changes in the numerical abundance and numbers of species found at the four stations.

RESULTS

A total of 111 species with 7,579 individuals was recorded during this study. These were distributed among the stations as follows: station 1, 78 species (2,602 individuals); station 2, 66 species (1,924 individuals); station 3, 54 species (1,362 individuals); and station 4, 44 species (1,691 individuals) (Table 1).

The densities of organisms at all stations varied both spatially and temporally with a high of 43,343/m² at station 1 in March and a low of 979/m² at station 3 in August. The greatest number of individuals was usually taken at station 1, and a more or less step-wise decline in densities was observed

through the remaining stations. Seasonal fluctuation patterns in density tended to be similar at all four stations. Densities peaked at stations 1, 2 and 3 in March, followed by a drop at all stations during July and August, then rose for the most part during September, and generally decreased again during November and December (Figure 2). The density increases, although similar at all stations, were largely due to different species at each station. A large elevation during spring at station 1 was mostly due to an increase in populations of the amphipod *Ampelisca abdita* and the tanaidacean *Hargaria rapax*. The fall peak at station 1, however, was predominantly due to high abundance of the polychaete *Laeonereis culveri* along with *H. rapax*. Peaks at stations 2 and 3 were greatly due to an increase of the gastropod *Hydrobia* sp., while *H. rapax* and the polychaete *Fabricia* sp. were largely responsible for the spring peak at station 4. These differences in monthly densities among stations were found to be significant from stations 3 and 4, and station 3 was significantly different from station 4 (DNMRT, $p < 0.05$).

Seasonal trends in number of species at each station closely paralleled those of density. The station 3 sample in August with three species had the lowest number of species of any sample. This corresponded to the lowest density which also occurred at station 3 in August. The highest number of species, however, was concurrent with the third highest density value. Station 1, with 40 species and station 2, with 47 species showed their greatest numbers of species in June while station 3, with 25 species, peaked in March and station 4, had a high of 19 species in March and then again in May. All of the stations showed their lowest numbers of species during July and August with a second

low in November (Figure 2). Differences in species numbers among stations were found to be significant (ANOVA, $p < 0.05$). Station 1 was found to be significantly different in numbers of species from stations 2, 3 and 4; station 2 was significantly different from stations 3 and 4; but station 3 was not significantly different from station 4 (DNMRT, $p < 0.05$).

A gradient was detected when we considered the number of species, enumerated from the most numerous to the least numerous, needed to account for 90% of the density at each station. At station 1, the most estuarine of the stations, 21 species were needed to make up 90% of the total density while 13 species were required at stations 2 and 3 and only 5 species at station 4 (Table 1). *Hargaria rapax*, *Laeonereis culveri* and the gastropod hydrobid sp. 1 were the only species found to be in common from the top 90% of the species at all stations. Other species were found to be important at one, two or three stations but not at the others. *Ampelisca abdita* was the most abundant species at station 1 but occurred in low numbers at stations 2, 3, and not at all at station 4. The polychaete *Streblospio benedicti* was found to be equally important at stations 1, 2 and 3. The isopod *Xenanthura brevitelson* and the polychaetes *Aricidea* sp., *Amphicteis gunneri* and *Sphaerosyllis longicirrata* were important only at stations 1 and 2. The amphipod *Grandidierella bonnieroides*, the isopod *Edotea montosa* and the polychaete *Haploscoloplos foliosus* were important at stations 1 and 3 but not at 2 or 4. The cumacean *Almyracuma* sp. and the gastropod *Parastarte triquetra* were important at stations 2 and 3 but not at 1 or 4. The polychaete *Fabricia* sp. was very abundant at station 4 but found only rarely at the other stations.

There were wide seasonal and

Table 1. Distributional statistics of all species found at the four St. Marks tidal creek stations including the total number of species, rank by number and rank by percentage at each site.

Species	Station 1			Station 2			Station 3			Station 4		
	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total
<i>Ampelisca abdita</i>	641	1	24.63	32	14	1.66	11	14	0.81	2	23	0.12
<i>Hargaria rapax</i> **	279	2	10.72	75	10	3.89	13	12	0.95	366	2	21.64
oligochaetes	242	3	9.30	218	3	11.30	147	3	10.79	765	1	45.24
<i>Aricidea</i> sp.	240	4	9.22	108	6	5.30	1	37	2.79			
<i>Laeonereis culveri</i> **	237	5	9.11	322	1	16.69	196	2	14.39	137	4	8.10
<i>Xenanthura brevitelson</i> *	129	6	4.96	144	4	7.47	3	22	0.22	4	19	0.24
<i>Gammarus mucronatus</i> **	87	7	3.34	18	17	0.93						
<i>Amphicteis gunneri</i> *	66	8	2.54	15	18	0.78	5	17	0.38			
<i>Granddlerella bonnieroides</i> **	64	9	2.46	22	16	1.14	16	11	1.17			
<i>Sphaerosyllis longicirrata</i>	55	10	2.11	41	12	2.13	2	27	0.15			
<i>Haploscoloplos follosus</i>	46	11	1.77	86	8	4.46	69	5	5.07	10	11	0.60
<i>Streblospio benedicti</i> *	42	12	1.61	36	13	1.87	36	6	2.64			
hydrobid #1	35	13	1.35	281	2	14.57	575	1	42.22	38	5	2.25
chironomid larvae	35	14	1.35	26	15	1.35	8	15	0.59	6	16	0.35
<i>Melinna maculata</i> *	35	15	1.35	8	23	0.41	1	38	0.07			
<i>Ampelisca verrilli</i> *	32	16	1.23	6	28	0.31	3	23	0.22			
<i>Bittium varium</i> *	24	17	0.92									
nemertine #1	23	18	0.88	13	21	0.67	24	9	0.67	1	27	0.06
<i>Cymadusa compta</i> *	20	19	0.77	4	31	0.21				1	28	0.06
<i>Edotea montosa</i> *	19	20	0.73	7	25	0.36	25	8	1.84	1	29	0.06
<i>Polydora ligni</i> *	19	21	0.73	14	20	0.73				1	30	0.06
<i>Retusa canaliculata</i> *	16	22	0.61	5	30	0.26	1	39	0.07			
<i>Almyracuma</i> sp.	14	23	0.54	87	7	4.51	93	4	6.83	4	20	0.23
<i>Parastarte triquetra</i>	14	24	0.54	79	9	4.10	30	7	2.20	10	12	0.59
<i>Mysella planulata</i>	13	25	0.50	2	35	0.10	2	28	0.15			
<i>Erichsonella attenuata</i>	12	26	0.46	8	24	0.41						
nemertine #2	10	27	0.38	7	26	0.36	5	18	0.37	2	24	0.12
<i>Amygdalum papyria</i> *	10	28	0.38	2	36	0.10	1	40	0.07	3	21	0.18
<i>Taphromysis bowmani</i> *	9	29	0.35	4	32	0.21						
nemertine #3	9	30	0.35	2	37	0.10	2	29	0.15			
<i>Fabricia</i> sp.*	8	31	0.31	1	44	0.05	2	30	0.15	206	3	12.18
<i>Cerithidea scalariformis</i> *	8	32	0.31	1	45	0.05	3	24	0.22			
<i>Cerapus estuaris</i>	7	33	0.27									
<i>Littorina irrorata</i> *	6	34	0.23	125	5	6.48	1	41	0.07	1	31	0.06
<i>Heteromastus filiformis</i> *	6	35	0.23	10	22	0.52	23	10	1.69			
<i>Lyonsia hyalina</i> *	6	36	0.23	1	46	0.05	1	42	0.07			
<i>Glycera americana</i>	6	37	0.23	1	47	0.05	1	43	0.07			
<i>Ampelisca vadorum</i> *	5	38	0.18	2	38	0.10						
<i>Cymodoce faxoni</i>	5	39	0.18	1	48	0.05						
<i>Cerapus</i> sp.*	5	40	0.18									
<i>Cyclaspis</i> sp.	5	41	0.18									
<i>Eteone heteropoda</i> **	3	42	0.12	6	29	0.31	5	19	0.37	2	25	0.12
<i>Macoma constricta</i>	3	43	0.12	1	49	0.05	4	20	0.29	1	32	0.06
turbellarian #2	3	44	0.12				3	25	0.22			
<i>Nereis succinea</i> **	3	45	0.12				2	31	0.15	1	33	0.06
slpunculd #2	3	46	0.12				2	44	0.15			
<i>Oxyurostylis smithi</i>	3	47	0.12									
<i>Amphipholes</i> sp.	3	48	0.12									
<i>Mitrella lunata</i> *	3	49	0.12									
<i>Tagelus plebius</i> *	2	50	0.08	15	19	0.74	2	32	0.15	2	26	0.12
hydrobid #2	2	51	0.08	1	50	0.65	8	16	0.59	8	13	0.48
mite	2	52	0.08	3	34	0.16				7	14	0.41
<i>Monoculodes edwardsi</i>	2	53	0.08	1	51	0.05						
<i>Anomalocardia cunemeris</i>	2	54	0.08	1	52	0.05						
<i>Capitella capitata</i> *	1	55	0.04	1	53	0.05	12	13	0.88	17	7	1.01

Table 1. Continued.

Species	Station 1			Station 2			Station 3			Station 4		
	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total	# of Ind.	Rank by #	% of total
<i>Cyathura polita</i> **	1	56	0.04	1	54	0.05				26	6	1.54
<i>Uca speciosa</i> *	1	57	0.04							15	8	0.89
tubellarian #1	1	58	0.04	2	40	0.10	4	21	0.29	3	22	0.18
midge adult	1	59	0.04	1	55	0.05	2	33	0.15	1	34	0.06
Malanidae gen. sp.	1	60	0.04				2	34	0.15	1	35	0.06
<i>Geukensia demissa</i>	1	61	0.04	2	39	0.10						
brachyuran megalopa	1	62	0.04	1	56	0.05						
spider	1	63	0.04							1	36	0.06
hydroid colony	1	64	0.04	1	57	0.05						
<i>Cerithidea costata</i> *	1	65	0.04	1	58	0.05						
cirratulid gen. sp.	1	66	0.04	1	59	0.05						
sipunculid #1	1	67	0.04							1	37	0.06
<i>Ensis minor</i> *	1	68	0.04									
<i>Onobops</i> sp.	1	69	0.04									
venerid clam	1	70	0.04									
Sigalionidae gen. sp.	1	71	0.04									
<i>Bowmaniella dissimilis</i> *	1	72	0.04									
<i>Eurypanopeus depressus</i>	1	73	0.04									
<i>Mysidopsis</i> sp.	1	74	0.04									
Hesionidae gen. sp.	1	75	0.04									
<i>Bougainvillia</i> sp.	1	76	0.04									
tubellarian #3	1	77	0.04									
tubellarian #4	1	78	0.04									
<i>Heleobops</i> sp.				49	11	2.54	3	26	0.22			
<i>Cyrenoidea floridana</i> *										11	9	0.58
<i>Namalycastis abiuma</i>										11	10	0.58
midge larvae							2	35	0.15	7	15	0.37
kinorhynch				7	27	0.36	2	36	0.15			
<i>Polymesoda caroliniana</i> *							1	45	0.07	5	17	0.27
Talitridae gen. sp.										5	18	0.27
<i>Littrodinops palustres</i> *				3	35	0.16	1	46	0.07			
bivalve #1				4	33	0.21						
Lepismidae larvae				1	60	0.05				1	38	0.05
hydroid				2	41	0.10						
bivalve #2				2	42	0.10						
<i>Ceratonereis irritabilis</i>				1	61	0.05	1	47	0.07			
<i>Prionospio heterobranchia</i> *				2	43	0.10						
<i>Corophium louisianum</i> **							1	48	0.07			
<i>Melita</i> sp.**				1	66	0.05						
<i>Talorchestia</i> sp.										1	39	0.05
bibionidae larvae										1	40	0.05
bryozoan							1	49	0.07			
anthozoan							1	50	0.07			
<i>Hydractinia</i> sp.							1	51	0.07			
<i>Epitonium rupicolum</i> **										1	41	0.05
<i>Hydrobia</i> sp.										1	42	0.05
limpet							1	52	0.07			
<i>Macra fragilis</i> *										1	43	0.05
Amphinoidae gen. sp.				1	62	0.05						
<i>Arenicola cristata</i> *							1	53	0.07			
<i>Glycera dibranchiata</i>							1	54	0.07			
<i>Loandalia americana</i> *				1	63	0.05						
<i>Prinospio steenstropi</i>				1	69	0.05						
<i>Spio</i> sp.				1	65	0.05						
<i>Uca panacea</i>										1	44	0.50
Totals	2,602			1,924			1,362			1,691		

Table 1. Continued.

Species	Station 1		Station 2		Station 3		Station 4	
	# of species	%	# of species	%	# of species	%	# of species	%
Stream only	34	52.3	20	38.5	16	40.0	17	45.9
Marsh type	5	7.7	7	13.5	6	15.0	5	13.5
Estuary type	18	27.7	17	32.7	11	27.5	9	24.3
Marsh & Estuary	8	12.3	8	15.4	7	17.5	6	16.2

* Denotes estuarine species (Livingston *et al.*, 1976).

* Denotes Marsh species (Subrahmanyam *et al.*, 1976).

Denotes number of individuals times 89 gives #/m².

spatial variations in H' values among the four stations throughout the sampling period (Figure 2). The highest H' value was 3.06 in June at station 1, and the lowest was 0.57 in August at station 3. The highest monthly H' of all four stations was 2.49 from June and the lowest was 1.48 in May. Differences in H' values were found to be significant (ANOVA, $p < 0.01$). Station 1 was significantly different from stations 3 and 4 but not from station 2; and stations 2, 3 and 4 were not significantly different from one another (DNMRT, $p < 0.05$).

Faunal similarity analyses showed that stations 2, 3 and 4 were not significantly different from one another and stations 1 and 4 showed the least affinity (Table 2). In general adjoining stations were more similar to one another than non-adjoining stations, and the degree of similarity decreased as the

distance between stations increased. Also, with the exception of the stations 2-3 comparison, the degree of similarity between stations tended to be the lowest in spring and highest during late summer or early fall.

DISCUSSION

There are few studies of salt marsh benthic invertebrate communities in the literature, however, the infaunal macroinvertebrates of the salt marsh at St. Marks are well known (Subrahmanyam *et al.*, 1976; and Subrahmanyam and Coultas, 1980). A 26% species similarity was found between the tidal creek and the St. Marks marsh, after discounting incompletely identified organisms. Also, a 33% species similarity was noted between the creek and some northeastern Gulf of Mexico tidal marshes (Heard,

Table 2. Morisita Index Station to Station Comparison.

Month Sampled	Station 1-2	Stations 1-3	Stations 1-4	Stations 2-3	Stations 2-4	Stations 3-4
M	0.0361	0.0093	0.0507	0.0561	0.0526	0.0363
A	0.0722	0.1080	0.0492	0.9161	0.2493	0.2607
M	0.0694	0.0697	0.0411	0.9773	0.9775	0.0581
J	0.3800	0.2584	0.1858	0.4130	0.1458	0.0196
J	0.5540	0.0268	0.0370	0.2280	0.5355	0.3534
A	0.6860	0.2338	0.1844	0.4773	0.4665	0.6019
S	0.7925	0.4970	0.1794	0.8731	0.8138	0.6750
O	0.9356	0.8637	0.1619	0.9590	0.1647	0.0602
N	0.1978	0.2613	0.0437	0.7559	0.1568	0.4030
D	0.1708	0.3846	0.2429	0.4390	0.1779	0.6252
Monthly Average	0.3894	0.2709	0.1176	0.6095	0.2830	0.3093

Figure 2. Seasonal fluctuations of observed species density (N) (multiply by 89 to get density/m²), solid line left hand scale; number of species (S), dashed line right hand scale; and Shannon-Weaver (H').

1982). The tidal creek species were also compared to those of Apalachicola Bay (Livingston, 1976), a well studied estuary approximately 50 km west of the St. Marks estuary. Forty five percent of the creek species were found to occur in Apalachicola Bay. The total species listed by Subrahmanyam *et al.* (1976) and Livingston (1976) accounted for 61% of creek species; a figure less than the total of the two studies which was due to an overlap of species occurrence between the St. Marks marsh and the Apalachicola Bay. A remainder of 39% of the creek species were found neither in the St. Marks marsh nor in the Apalachicola Bay.

Comparisons of the macroinvertebrates infauna of the four individual tidal creek stations with that of nearby Apalachicola bay (Livingston, 1976) and the St. Marks marsh areas (Subrahmanyam *et al.*, 1976) were made. The four most abundant species found during this study, listed one to four respectively, were hydrobid sp. 1, *Laonereis culveri*, *Hargaria rapax* and *Ampelisca abdita*. These species were also the most abundant species at stations 3, 2, 4 and 1 respectively, the first and third species being found only in the creek and the remaining two species at estuary, creek and marsh locations. Approximately one quarter of the species at each creek station were also observed by Livingston (1976) in Apalachicola Bay but not by Subrahmanyam *et al.* (1976) in the salt marsh adjoining the creek. The percentages of those species indigenous to the marsh environment varied, however, from 3% at station 1 to 11% at station 4 (Table 1). When only the important species at the tidal creek were considered 48%, 23%, 23% and 20% of these species, from stations one to four respectively, were also found exclusively among estuarine fauna (Livingston,

1976). The marsh communities (Subrahmanyam *et al.* 1976), however, had a 5%, 15%, 8% and 0% species similarity to those of creek stations one to four respectively while those important creek species that were found in both the estuary and marsh accounted for 24%, 15%, 15% and 60% of species at these same stations. Therefore, 23%, 47%, 54%, and 20% of the important species at stations one to four respectively did not occur either in the marsh or the estuary.

These patterns of species numbers and species abundances indicate overall that the estuarine species have greater representation in the creek than the marsh species, but with an observable spatial gradient of importance. The greatest abundance of estuarine species was noticed at station 1 and it decreased towards station 4. For the marsh species, on the other hand, this pattern was reversed as more marsh type species occurred at station 4 and fewer at station 1. There was a large group of species that occurred in the tidal creek which was absent both in the marsh and in the estuary. This group of species also made up a great percentage of the faunal density of the creek especially at stations 2 and 3. These species are most likely the inhabitants of the intertidal mud flats located in front of the marsh. These mud flats were not investigated either by Livingston (1976) or by Subrahmanyam *et al.* (1976).

Seasonal changes in density or in the number of species were not found to be statistically significant at the St. Marks marsh (Subrahmanyam *et al.*, 1976). Fluctuating seasonal abundance patterns, on the other hand, are characteristics of dynamic estuarine communities (Orth, 1973; Subrahmanyam *et al.*, 1976; Livingston, 1976; Whitlatch, 1977). Tidal creeks, like

estuaries, have been shown to exhibit marked seasonal changes in species composition (Hackney and Burbank, 1976; Hackney *et al.*, 1976; and Hackney and de la Cruz, 1981). The tidal creek at St. Marks also has shown significant seasonal numerical density and species fluctuations (ANOVA, $p < 0.05$), with peaks both in spring and fall, which were similar at all tidal creek stations (Figure 2). These changes can be related to known patterns of breeding and recruitment which have been observed in areas similar to the St. Marks marsh and estuary (Nixon and Oviatt, 1973; Livingston, 1976; and Subrahmanyam and Coultas, 1980). Also, uniform mid-summer declines in density were most likely related to increased numbers of predatory fish using the tidal creeks during these months (Subrahmanyam and Drake, 1975; and Subrahmanyam and Coultas, 1980).

Morisita's Index of affinity showed neighboring stations to be more similar faunistically than ones further apart. This likeness was found to increase during the late summer months when *Hargaria rapax*, *Laeonereis culveri* and other important species, which were common to all four stations, had large increases in abundance.

The tidal creek was found to have a lower average Shannon Weaver H' value (1.9) than did the St. Marks marsh (2.5); diversity values were not available from estuarine studies for comparison. Salt marshes, areas generally regarded to have harsh physical environment (Brown, 1981), may have a more stable identifiable community structure (Boesch, 1972) than that of the tidal creek. The creek has shown lower average H' values at stations 3 and 4 than at stations 1 and 2. This break in H' may indicate an area of transition from a more stable marsh community to a more stable estuarine

community. The H' values at all four tidal creek stations showed significant seasonal variations as did H' values from the St. Marks and Wakulla marshes (Subrahmanyam *et al.*, 1976). All curves, although not strictly parallel, showed an early spring depression, spring gain, summer depression, late summer gain, and fall depression. Although similar curves were produced at each station, they were not necessarily spatially synchronous and their differences were found to be significant.

The creek which we studied was short, approximately 300 m, yet stations set at 100 m intervals proved to have different faunal composition. Gradients of species and numerical density and species diversity were shown to exist which increased towards the mouth of the creek during most of the study period. Based on these gradients, the faunal assemblage at the creek mouth was found to most resemble an estuarine community and that toward the creek origin was found to be more similar to that of the marsh community. This would warrant describing the tidal creek as an ecotone between the vegetated tidal marsh and the open water river mouth estuary. However, the large numbers of species which were not found in either the St. Mark's marsh (Subrahmanyam *et al.*, 1976) or in a nearby estuary (Livingston, 1976) would indicate a need for further investigation including the study of nearby intertidal areas such as mudflats and sandbars.

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