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Charles G. Messing
Nova Southeastern University Oceanographic Center, messingc@nova.edu

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ANALYSIS OF BENTHIC MACROINVERTEBRATE ASSEMBLAGES BIRCH LANDINGS, FORT LAUDERDALE, FL

by

Charles G. Messing, Ph.D.

SUMMARY
Quantitative analysis of benthic macroinvertebrate assemblages in the Intracoastal Waterway in an area of proposed dredge and fill adjacent to existing sea wall at Birch Landings, Fort Lauderdale, FL (Broward County) reveals a community dominated by a small number of annelid worm species typical of stressed, high organic content, moderately reduced salinity, estuarine and canal habitats found along much of coastal south Florida. It is concluded that the proposed construction will impact no unique assemblage of organisms nor affect significantly the population resources of any macroinvertebrate species.

INTRODUCTION

This study provides a quantitative analysis of faunal composition and diversity of benthic macroinvertebrate assemblages at a proposed dredge and fill/construction site in the Intracoastal Waterway (ICW) at Birch Landings, Fort Lauderdale, FL (Broward County). Samples were collected on 5 December 1989. Macroinvertebrates were collected quantitatively using a core tube; an additional qualitative sample was also taken. Organisms were separated from the sediment, identified and counted. Shannon-Wiener diversity indices and numerical percentage composition of major taxonomic groups and dominant taxa were compiled for each sample. Physical water quality parameters were measured in the field at each station. A total of 1135 organisms were collected in the quantitative samples. Species-level taxa were distinguished for 1006 individuals (Nematoda and Nemertina were not sorted to species) representing 60 species. A small number of annelid worm species dominate all samples. Results are compared with a recent broad-based survey of benthic macroinvertebrate communities in the Broward County ICW (Rudolph, in press) and with the primary scientific literature.

The benthic macroinvertebrate fauna at the study site is typical of stressed estuarine and canal habitats found along much of coastal south Florida that are characterized by moderately reduced salinities and fine sediments containing high organic content.

STUDY SITE AND HABITAT CHARACTERIZATION

The study site (Figure 1) is adjacent to existing sea wall at Birch Landings along the eastern margin of the ICW in Fort Lauderdale (Broward County) about 100 m south of the Sunrise Blvd. bridge. The site is influenced tidally and by freshwater drainage probably chiefly from Middle River. Quantitative core stations were occupied about 2 m from the sea wall in 2 m depth at the northern end of the proposed construction site and about 6 m from the sea wall in 3 m depth at the southern end of the site (Figure 1). Physical data for both stations are given in Table 1. Water quality parameters are virtually identical at both stations. Substrate characteristics differ, however. Station 1 exhibits numerous shells and shell hash derived from oysters growing on the adjacent sea wall. Shells and shell fragments decrease in abundance away from the sea wall and contribute much less to station 2 sediment which exhibits a higher proportion of fine inorganic particles. Abundant finely divided plant detritus (probably mangrove peat) at both stations is easily stirred into suspension. No rooted vascular plants were observed at the site.

METHODS

Two quantitative samples (A and B) were taken at the two stations (1 and 2) at the study site using a core tube of 1600 ml capacity. The extremely fluid consistency of the substrate prevented vertical extraction; samples were scooped horizontally from the bottom. The initial sample at each station (1A, 1B) did not fill the entire volume of the core tube. The second samples (2A, 2B) did; each represents approximately 250 cm^2 of sediment surface area. Samples were placed in plastic bags and fixed in 5% buffered seawater formaldehyde solution with Rose Bengal stain added to facilitate sorting. One qualitative sample, a cluster of dead, sediment- and algae-covered oyster shells, was collected at station 1. Fixed samples were sieved through a #35 U.S. standard sieve (0.5 mm mesh) and the retained material was transferred to 70% ethanol. Organisms were individually separated from the sediment, identified to lowest possible taxon and counted.

Dissolved oxygen and temperature were recorded with a Nester Instruments 8500 portable dissolved oxygen monitor. Salinity was recorded with a Yellow Springs Instruments (YSI) model 33 Salinity-Conductivity-Temperature meter.

Shannon-Wiener diversity indices (H') are calculated for each sample and station using the following formula:

$$H' = -\sum_{i=1}^{s} P_i \log_2 P_i \qquad (1)$$

where s is the total number of species (=richness) and Pi is the proportion of the sample belonging to the ith species. Maximum diversity (H'_{max}) is the $\log_2$ of s (Pearson & Rosenberg, 1978). Evenness (J) is a measure of how equally the total number of individuals are distributed among the species. J reaches a maximum when all species are represented by an equal number of specimens (Pielou, 1975; Levinton, 1982). Evenness is calculated from the formula:

$$J = \frac{H'}{H'max} \qquad (2)$$

In addition, each station is characterized by the numerical percentage composition of dominant organisms and major taxonomic groups. The latter include Nematoda, Polychaeta, Oligochaeta and Crustacea.

Nematodes are usually considered as meiofauna and were not distinguished at the species level. Significant numbers may have passed through the 0.5 mm mesh sieve so those collected may not adequately reflect their true abundance. They have not been included in calculations of diversity and evenness. The small number of nemertine worms were also not distinguished at the species level. They have been included in diversity and evenness calculations as a single species-level taxon.

RESULTS

Raw quantitative and qualitative sample data are presented in Table 2. Core samples reveal a benthic macroinvertebrate assemblage dominated by annelid worms. Of the 61 species-level taxa recognized, 30 (49%) are polychaetes and 9 (15%) are oligochaetes totalling 39 annelid species representing 64% of all taxa. Of the total of 1034 organisms collected in four core samples (excluding nematodes), annelids represent 88% (913 individuals). The next most diverse group, the Crustacea, account for a quarter of all species but less than 10% of all individuals.

The quantitative samples are dominated by a small number of species. The ten most abundant (16% of all species) account for 71% of all individuals collected (Table 3) and the fifteen most abundant taxa (25% of all species) represent 84% of the organisms present. Shannon-Wiener diversity indices and measures of richness and evenness for each core and station are given in Table 4.

Slight faunal differences appear between stations 1 and 2 although both exhibit about the same number of taxa (46 and 40, respectively) and all of the dominant taxa were collected at both stations. Taxa present in much greater numbers at station 1 or absent from station 2 include *Ehlersia cornuta*, *Tharyx dorsobranchialis*, *Tharyx* sp. A, *Capitella capitata*, *Fabriciola trilobata* and Tubificidae sp. Taxa present in much greater numbers at station 2 or absent from station 1 include *Sphaerosyllis* sp. A and *Limnodriloides* sp.

DISCUSSION

Of the ten most abundant taxa collected, nine have definitely been recorded elsewhere in Broward County during a survey of the ICW (Rudolph, in press). The remaining one, the syllid polychaete *Ehlersia cornuta*, was almost certainly collected but was distinguished only as *Ehlersia* sp. All dominant taxa occur elsewhere in south Florida as well (Milligan, personal communication; Messing, personal observation). Although samples collected during the Broward ICW survey were taken with a petite ponar grab sampler and are thus not strictly comparable with core samples taken during this study, some comparative comments can be made. Species richness values at the two Broward ICW survey stations closest to the study site (Hugh Taylor Birch State Park and Lake Mabel) span the same values as study site samples (provided oligochaetes are lumped together as in the Broward survey): 24-34 taxa. In addition, the molluscan fauna at the study site is depauperate relative to nearby Broward ICW survey stations.

Shallow-water marine habitats subject to fluctuating and sometimes extreme physical environmental factors are often characterized as stressed and exhibit recognizable, reduced-diversity faunal assemblages (Pearson & Rosenberg, 1978). The dominant taxa at the study site are typical of stressed inshore environments characterized by reduced (and likely fluctuating) salinity and organic enrichment (usually associated with pollution). *Capitella capitata*, cirratulids such as *Tharyx* spp., dorvilleids, spionids, fabriciine sabellids and tubificids are all characteristic of such stressed environments around the world. Most of these taxa are opportunists that rely on rapid reproductive and colonization rates and eurytopic physiologies in order to take advantage of habitats in which relatively few other organisms can survive (Pearson & Rosensberg, 1978; Fauchald & Jumars, 1979; Botton, 1979; McCann & Levin, 1989). Milligan (personal communication) recorded all dominant taxa in habitats similar to the study site along the west coast of Florida.

CONCLUSION

The benthic macroinvertebrate assemblage at the proposed dredge and fill site is dominated by a small number of species, chiefly annelid worms, all of which are found elsewhere in south Florida and, more specifically, elsewhere in the Broward County Intracoastal Waterway. The dominant species are typical of stressed communities subject to reduced salinity and organic enrichment. It is concluded that the proposed construction will impact no unique assemblage of organisms nor affect significantly the population resources of any macroinvertebrate species.

REFERENCES

Botton, M.L. 1979. Effects of sewage sludge on the benthic invertebrate community of the inshore New York Bight. Estuar. & Coastal Mar. Sci. 8:169-180.

Fauchald, K. & Jumars, P. A. 1979. The diet of worms: a study of polychaete feeding guilds. Ann. Rev. Oceanogr. Mar. Biol. 17:193-284.

Levinton, J.S. 1982. Marine Ecology. Prentice-Hall, New York. 526 pp.

McCann, L.D. & Levin, L.A. 1989. Oligochaete influence on settlement, growth and reproduction in a surface-deposit-feeding polychaete. J. Exp. Mar. Biol. Ecol. 131:233-253.

Pearson, T.H. & Rosensberg, R. 1978. Macrobenthic succession in relation to organic enrichment and pollution of the marine environment. Ann. Rev. Oceanogr. Mar. Biol. 16:229-311.

Pielou, E.C. 1975. Ecological diversity. Wiley-Interscience, New York. 165 pp.

Rudolph, H. in press. Broward County BAS biological study results.

Table 1. Station data recorded for Birch Landing benthic community analysis. Data collected 5 December 1989.

	Station 1	Station 2
Distance from sea wall	2 m	6 m
Depth	2 m	3 m
Temperature	20.7°C	20.7°C
Salinity	28.8‰	28.8‰
Dissolved oxygen	7.9 ml l^{-1}	7.5 ml l^{-1}
Bottom characterization	Fine mangrove detritus, molluscan shell hash, algae-covered oyster shells.	Fine mangrove detritus, fine mud, few mollusk shells & shell fragments.

Table 2. Birch Landing benthic community analysis. Faunal composition. Two core samples (A & B) were taken at each station (1 & 2). A qualitative sample was washed from a cluster of dead, algae-covered oyster shells at station 1 (1-Algae).

	1A	1B	2A	2B	Total	1-Algae
Phylum NEMATODA	14	36	20	31	101	-
Phylum NEMERTINA	4	11	3	9	27	-
Phylum ANNELIDA						
Class POLYCHAETA						
Order PHYLLODOCIDA						
Family SYLLIDAE						
?*Eusyllis* sp.	-	-	-	-	-	1
Ehlersia cornuta	32	31	5	6	74	-
Exogone lourei	-	-	-	-	-	4
Exogone sp.	-	1	-	-	1	-
Odontosyllis enopla	-	-	-	-	-	3
Sphaerosyllis riseri	-	-	-	1	1	-
Sphaerosyllis sp. A	-	-	4	20	24	-
Sphaerosyllis spp.	-	4	-	-	4	-
Sphaerosyllis taylori	1	1	2	1	5	-
Streptosyllis pettiboneae	3	1	-	5	9	-
Typosyllis sp.	-	-	-	-	-	1
Family GLYCERIDAE						
Glycera abranchiata	-	4	-	-	4	-
Glycera sp. (juv.)	3	4	-	-	7	-
Order EUNICIDA						
Family ONUPHIDAE						
Diopatra cuprea	1	-	1	-	2	-
Family LUMBRINERIDAE						
Lumbrineris verrilli	5	2	-	-	7	-
Family DORVILLEIDAE						
Ophryotrocha sp. A	-	-	1	-	1	-
Ougia tenuidentis	-	-	1	-	1	-
Schistomeringos rudolphi	-	1	1	-	2	-
Order ORBINIIDA						
Family PARAONIDAE						
Aricidea philbinae	11	27	25	23	86	-
Aricidea taylori	8	23	7	11	49	-
Order SPIONIDA						
Family SPIONIDAE						
Prionospio cristata	-	1	-	-	1	-
Prionospio heterobranchia	20	13	2	2	37	-
Pseudopolydora sp.	-	1	-	-	1	-

Table 2. Continued

	1A	1B	2A	2B	Total	1-Algae
Family CIRRATULIDAE						
Caulleriella sp. D	2	3	2	1	8	-
Cirriformia sp. A	-	1	-	-	1	-
Tharyx dorsobranchialis	24	70	11	19	124	-
Tharyx sp. A	28	51	3	5	87	2
Tharyx sp. B	-	2	-	-	2	-
Order CAPITELLIDA						
Family CAPITELLIDAE						
Capitella capitata	12	35	5	4	56	-
Order TEREBELLIDA						
Family TEREBELLIDAE						
Polycirrus carolinensis	2	-	-	-	2	-
Family TRICHOBRANCHIDAE						
Terebellides stroemi	1	-	-	-	1	-
Order SABELLIDA						
Family SABELLIDAE						
Branchiomma nigromaculata	4	-	-	-	4	3
Chone cf. *americana*	1	-	-	-	1	-
Fabriciola trilobata	24	72	-	1	97	1
Family SERPULIDAE						
Salmacina sp.	-	-	-	-	-	2
Class OLIGOCHAETA						
Order TUBIFICIDA						
Family ENCHYTRAEIDAE						
Enchytraeidae sp.	-	-	1	-	1	-
Family TUBIFICIDAE						
Limnodriloides appendiculatus	-	2	9	7	18	-
Limnodriloides barnardi	-	2	-	-	2	-
Limnodriloides monothecus	5	13	6	-	24	-
Limnodriloides sp.	-	-	2	25	27	-
Smithsonidrilus marinus	-	3	-	-	3	-
Tectidrilus sp.	-	1	-	-	1	-
Thalassodrilides gurwitschi	-	-	3	15	18	-
Tubificoides brownae	2	10	4	12	28	-
Tubificidae sp.	23	43	18	8	92	-
Phylum MOLLUSCA						
Class GASTROPODA						
Family NERITIDAE						
Neritina virginea	1	1	-	-	2	-
Family CERITHIIDAE						
Bittium varium	-	-	-	-	-	2

Table 2. Continued.

	1A	1B	2A	2B	Total	1-Algae
Class BIVALVIA						
Order VENEROIDA						
Family LUCINIDAE						
Lucina pennsylvanica	-	3	2	-	5	-
Family VENERIDAE						
Veneridae sp.	-	-	2	-	2	-
Order MYTILOIDA						
Family MYTILIDAE						
Mytilidae sp.	-	-	-	-	-	1
Bivalvia sp. (unident. juv.)	-	-	1	-	1	-
Phylum CHELICERATA						
Class PYCNOGONIDA	-	-	-	-	-	1
Phylum CRUSTACEA						
Class COPEPODA						
Order HARPACTICOIDA						
Harpacticoida sp. A	-	3	1	4	8	-
Harpacticoida sp. B	-	4	-	8	12	-
Harpacticoida sp. C	-	-	1	-	1	-
Harpacticoida sp. D	-	-	1	-	1	-
Order CALANOIDA						
Calanoida sp. A	-	-	1	3	4	-
Class OSTRACODA						
Ostracoda sp. A	-	1	2	-	3	-
Ostracoda sp. B	-	1	1	2	4	-
Ostracoda sp. C	-	-	-	1	1	-
Class MALACOSTRACA						
Order AMPHIPODA						
Family COROPHIIDAE						
Corophiidae sp. A	-	3	-	-	3	-
Amphipoda indeterm.	-	-	-	-	-	5
Order TANAIDACEA						
Family KALLIAPSEUDIDAE						
Kalliapseudes sp.	8	18	7	6	39	-
Order ISOPODA						
Family CORALLANIDAE						
Corallanidae sp.	-	-	-	-	-	12*
Order MYSIDACEA						
Mysidacea indeterm.	-	-	-	1	1	-
Order DECAPODA						
Infraorder CARIDEA						
Caridea indeterm.	-	-	-	1	1	-

Table 2. Continued

	1A	1B	2A	2B	Total	1-Algae
Infraorder ANOMURA						
Family PORCELLANIDAE						
Petrolithes armatus	-	-	-	-	-	1
Paguroidea indeterm.	1	-	-	-	1	-
Infraorder BRACHYURA						
Family XANTHIDAE						
Xanthidae sp.			-	-		
Family						
			-	-		
Megalopa larva	-	1	1	-	2	-
Phylum ECHINODERMATA						
Class OPHIUROIDEA						
Ophiuroidea indeterm.	-	1	-	-	1	-

* A single mature female and 11 recently released juveniles.

Table 3. Ten most abundant taxa listed in decending order of abundance. All are polychaetes with the exception of Tubificidae sp. (Oligochaeta) and *Kalliapseudes* sp. (Tanaidacea). Percentage of total abundance excludes nematodes.

	Total numbers	% of total abundance
Tharyx dorsobranchialis	124	12.0
Fabriciola trilobata	97	9.4
Tubificidae sp.	92	8.9
Tharyx sp. A	87	8.4
Aricidea philbinae	86	8.3
Ehlersia cornuta	74	7.2
Capitella capitata	56	5.4
Aricidea taylori	49	4.7
Kalliapseudes sp.	39	3.8
Prionospio heterobranchia	37	3.6
TOTAL	741	71.7

Table 4. Species richness (s), Shannon-Wiener diversity indices (H') and evenness (J) calculated for each quantitative core sample and station.

	1A	1B	1A+1B	2A	2B	2A+2B	Total
Species richness (s)	26	39	46	33	27	40	61
H'	3.91	4.04	4.10	4.29	4.16	4.46	4.51
J	.832	.765	.742	.851	.875	.832	.760