A Study of Sieve (Screen Mesh-Opening) Size Effects on Benthic Fauna Collected from Anclote Anchorage.

Selvakumaran Mahadevan

and

Geoffrey W. Patton

A TECHNICAL REPORT

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ABSTRACT

Benthic fauna samples were collected at four sites in Anclote Sound Florida). The purpose of the study was to evaluate sieve size (1.0 mm and 0.5 mm) induced effects on the description of community structure. Community parameters evaluated were: species composition, faunal density, species richness, species diversity, evenness and faunal similarity. Pronounced changes were evident in all the community parameters when the smaller sieve size was utilized. The 0.5 mm sieve size provided a more realistic and comprehensive picture of the benthic communities at the study site. Results of the present study were applied to evaluate a previous environmental impact study conducted at the site with a 1.0 mm sieve. The previous study was found to be inadequate in terms of the sieve size used.

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LIST OF PARTICIPANTS

Selvakumaran Mahadevan, Ph.D. Staff Scientist	Project Manager
Geoffrey W. Patton, B.S. Staff Biologist	Research Assistant
Mark Gallo, A,A. Student Intern	Technician

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I. INTRODUCTION

The importance of screen size in washing benthic faunal samples is well recognized (Reish, 1959; Word et al., 1976; Swartz, 1978). The screen size used in a study can determine the characteristics of a benthic community an investigator describes. Essentially, two investigators can sample the same community with different sieves and come up with entirely different characterizations. Also determination of an adequate sieve size is:

- site specific
- substrate specific
- season specific (if juveniles are included)
- sometimes resource limited (a larger sieve size washed sample generally takes less labor and cost to process)
- study specific (depending on the questions asked in the study)

Hence, standardization of sieve size is neither necessary nor warranted. Depending upon the type of questions asked in a study, it is imperative to determine the adequate sieve size (to use) prior to initiating any large scale sampling exercises. On a global basis, the most commonly used sieve sizes by benthic ecologists are 0.5 mm and 1.0 mm mesh openings. With the advent of NEPA (National Environmental Policy Act) in 1969, considerable emphasis has been placed on the study on benthos in environmental impact assessment studies. Spin-offs from this emphasis are efforts by Agencies to standardize sieve sizes used in such studies (Swartz - EPA, 1978 - 1.0 mm; Florida Department of Environmental Regulation, Chapter 17-3 Rules, 1978 - 0.5 mm).

The present study was instituted to study the adequacy of a sieve

size (1.0 mm) used in an environmental impact assessment study conducted at Anclote Anchorage (Florida) by Thorhaug et al. (1977). Thorhaug's study attempted to assess the effects on the benthos caused by a Power Plant as part of a requirement for a 316a Demonstration (Section 316 a, Public Law 92-500, Federal Water Pollution Control Act Amendments of 1972). Specific objectives of the present study were to:

- Evaluate the adequacy of the 1.0 mm sieve size in describing the benthic macrofaunal community structure at the study site
- Assess the limitations imposed by the use of the 1.0 mm mesh size sieve in the results of the 316a study
- Evaluate the validity of the impact assessment conclusions in light of the sieve size used in the 316a study

A description of the study area is provided by Thorhaug et al. (1977). Major habitats identified in their study were:

- Inshore sandy areas
- Inshore grass beds (Halodule and mixed grasses)
- Mid-bay grass beds (Thalassia, Syringodium and mixed grasses)
- Off-shore sandy areas

For purposes of this study, the following four sites were sampled: an inshore sandy area, a Thalassia-dominated (also some Halodule) area, a Syringodium -dominated area and an offshore sandy area devoid of grasses.

II. MATERIALS AND METHODS

A. Stations: Four stations were sampled at the study site (location of stations are shown in Figure 1). The stations were located such that all major types of benthic habitats in the area would be represented.

B. Sampling Period/Methods: Sampling was conducted on December 12, 1978. Five replicates utilizing a core sampler (Zimmerman et al. 1971) were collected at each station and washed through a 0.5 mm sieve in the field. Except for the use of a rose bengal solution (to facilitate easy and accurate sorting), all field and preservation methods were identical to those utilized by Thorhaug et al. (1977).

C. Laboratory Processing/Analysis: In the laboratory each replicate sample was split into two fractions by washing through a 1.0 mm sieve. Material retained on the 1.0 mm sieve was preserved, and the remaining material was re-washed through a 0.5 mm sieve and also preserved in 70% isoproponol. The 0.5 mm fraction was sorted by use of a binocular microscope. The 1.0 mm fraction was decanted into two portions: (1) a fraction consisting of lighter and smaller animals, which was sorted by use of a microscope (2) a fraction consisting of heavier and larger animals (primarily mollusks), which was hand-sorted from a shallow,white-background pan. Species were identified to the lowest practical taxonomic level consistent with the earlier study (Thorhaug et al. 1977).

D. Data Analysis: Data reduction and analysis consisted of the following elements at each station for each sieve size:

ANCLOTE SOUND

1. Inshore (Thalassia) grass bed
2. Mid-bay (Syringodium) grass bed
3. Off-shore sandy area
4. Inshore sandy area

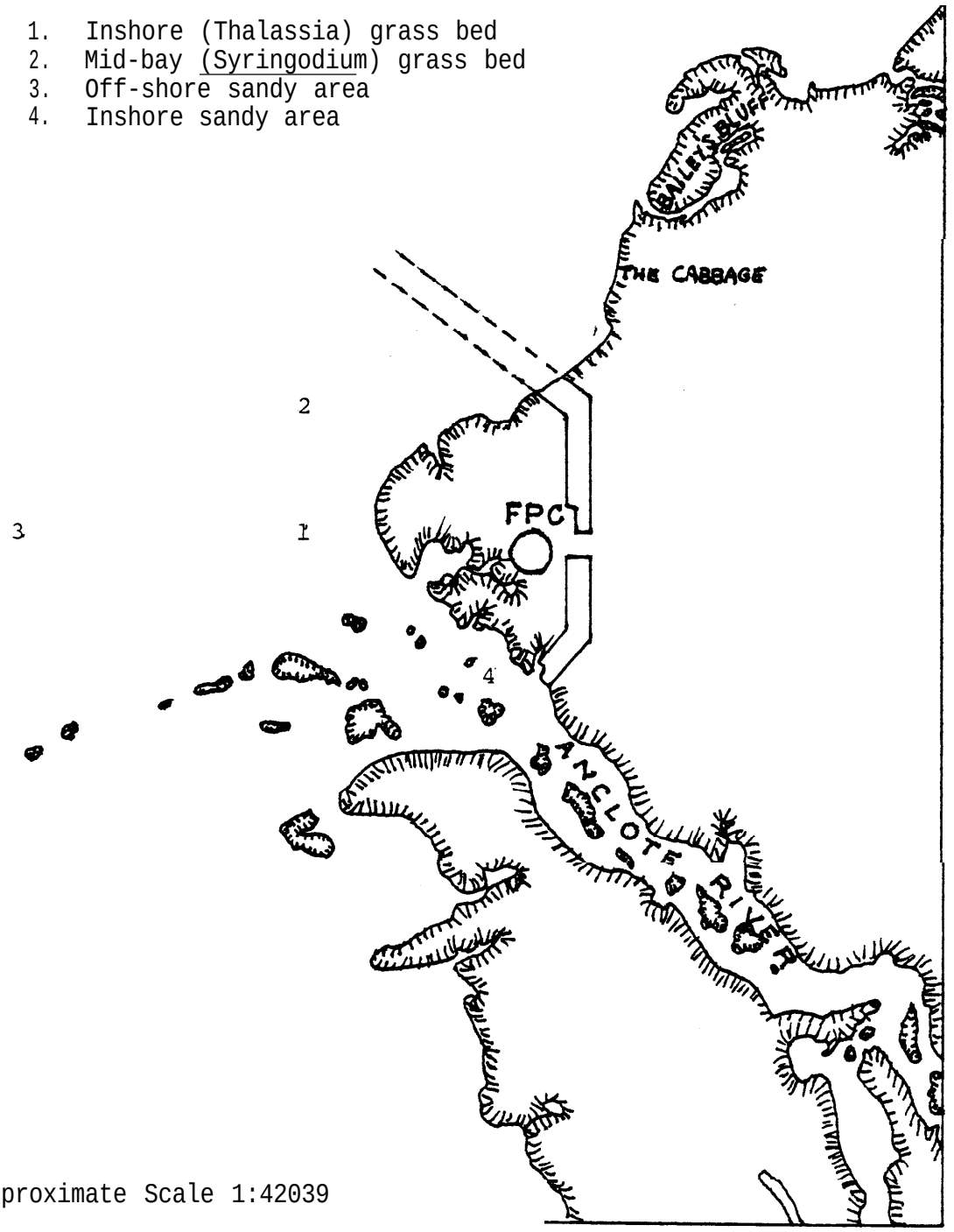

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Figure 1: Location of Stations.

- Species Composition (Species abundance lists).
- Dominant species (in terms of abundance).
- Proportion, abundance and species richness of major taxa.
- Faunal Density (number of organisms per square meter).
- Species Richness (number of species).
- Species Diversity (H', Shannon-Weaver Index; Shannon and Weaver, 1963).
- Evenness or Equitability (J', Pielou's Index; Pielou, 1966).
- Faunal Similarity between stations (C_λ, Morisita's Index; Morisita, 1959).

Primary emphasis of the data analysis was to evaluate the differences of the above elements between the two sieve sizes.

III. RESULTS

A. Species Composition: A total of 217 species were identified from 5,440 organisms collected at the four stations (Total: 20 samples). Of these, 150 species (from 1,303 organisms) were collected in the 1.0 mm sieve samples and 141 species (from 4,137 organisms) in the 0.5 mm sieve samples. Table 1 presents a composite species list (with actual abundances) for samples washed through a 1.0 mm sieve. Table 2 presents a composite list of species (and abundance) added by the use of a 0.5 mm sieve.

Dominant species (comprising over 10% of the total abundance at a station) at the different stations are presented in Table 3. Addition of 0.5 mm sieve fraction changed species dominance at all the stations.

Table 1. Composite species list of organisms retained in a 1.0 mm sieve.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
PLATYHELMINTHES				
Unid.sp.	0	2	0	0
NEMERTINEA				
Unid.sp.	1	3	17	4
NEMATODA				
Unid.sp.	0	4	22	1
BRYOZOA				
Unid.sp.	*	0	0	0
BRACHIOPODA				
Glottidia pyramidata	0	0	0	
ECHINODERMATA				
Ophiostigma isacanthum	0	1	0	
Unid.sp.	0	0	1	O
MOLLUSCA				
POLYPLACOPHORA				
Acanthopleura granulata	0	8	0	0
SCAPHOPODA				
Dentalium sp. 1	0	0	6	0
Dentalium sp. 2	0	0	1	0
GASTROPODA				
Anachis avara	1	0	0	0
Anachis semiplicata	1	0	0	0
Anachis sp.	0	0	9	0
Bullata ovuliformis	1	0	0	0
Caecum nitidum	4	6	0	0
Caecum pulchellum	1	0	0	0
Crepidula maculosa	0	2	0	0
Crepidula sp.	25	17	0	0
Diastoma varium	19	1	0	0
Haminoea succinea	0	0	0	3
Marginella aureocincta	3	2	0	0
Marginellidae sp.	1	1	0	0
Mitrella lunata	11	7	0	0
Natica pusilla	0	0	1	0
Retusa canaliculata	1	1	6	9
Rissoina catesbyana	2	0	0	0
Teinostoma biscayense	0	0	2	0

*Colonies not counted as individuals.

Table 1. Composite species list of organisms retained in a 1.0 mm sieve. Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Turbo castaneus	0	1	0	0
Turbonilla conradi	1	2	0	1
Turbonilla hemphilli	0	0	0	1
PELECYPODA				
Argopecten gibbus	1	0	0	0
Brachiodontes exustus	5	4	1	0
Chione cancellata	0	0	1	0
Chione sp. 2	0	1	0	0
Corbula sp.	0	0	10	0
Crenella sp. ?	2	0	0	0
Dosinia sp. ?	0	1	0	0
Gastrochaena hians	0	0	2	0
Laevicardium laevigatum	0	0	0	1
Lima pelucida	2	0	0	0
Lucina nassula	2	3	0	0
Parvilucina multilineata	0	1	0	0
Pteria colymbus	6	5	0	0
Tellina sp.	2	2	3	12
Tellina versicolor	0	0	0	2
Unid. sp. 6	0	0	3	0
Unid. sp. 7	0	0	2	0
Unid. sp. 8	0	0	1	0
Unid. sp. 9	0	0	0	2
Unid. sp. 10	0	0	20	13
ANNELIDA				
POLYCHAETA				
Aglasphamus verrilli	0	0	1	0
Apoprionospio pygmaea	0	0	0	1
Aricidea fragilis	15	30	2	0
Branchioasychis americana	0	2	0	0
Capitella capitata	3	1	0	0
Clymenella mucosa	0	0	0	1
Diopatra cuprea	0	1	0	0
Eteone heteropoda	1	0	0	0
Fabrica sp.	0	0	0	34
Glycera americana	2	2	0	8
Glycinde solitaria	3	6	0	3
Gyptis vittata	13	1	1	0
Harmothoe sp.	0	1	0	0
Lumbrineris sp.	0	0	19	4
Magelona pettibonae	0	1	0	0
Maldane sarsi	0	1	2	0
Mediomastus californiensis	0	0	2	1

Table 1. Composite species list of organisms retained in a 1.0 mm sieve, Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Megalomma pettibonae	2	0	0	0
Melinna maculata	0	1	1	0
Minuspio cirrifera	2	0	1	0
Nereis sp.	0	1	0	0
Notomastus latericeus	16	0	0	0
Notomastus hemipodus	0	0	3	0
Odontosyllis sp.	0	3	0	0
Onuphis sp.	0	0	0	10
Orbinidae sp. ?	3	0	0	0
Paranaitis sp.	0	0	1	0
Paraprionospio pinnata	0	3	5	0
Pectinaria gouldii	0	0	1	5
Pista cristata	0	0	1	0
Platyneries dumerilli	9	8	0	1
Podarke obscura	1	0	0	0
Polydora websteri	0	1	0	0
Prionospio heterobranchia	92	13	0	34
Pseudopolydora sp.	0	0	1	0
Sabellidae sp. 2?	1	1	0	2
Schistomeringos sp.	0	1	0	0
Scolelepsis texana	0	0	0	6
Scoloplos robustus	2	0	0	0
Scoloplos rubra	1	1	0	3
Spionidae sp. 2	0	0	2	0
Spirorbis spirillum	2	2	0	0
Sthenelais boa	0	0	23	0
Syllidae sp. ?	0	1	2	0
Syllis gracilis	12	6	1	0
Tharyx sp.	3	5	0	1
Travisia sp. 1 (juvs.)?	0	1	0	1
Unid.sp.	2	0	0	0
OLIGOCHAETA				
Unid.sp. 3	0	3	5	0
Unid.sp. 4	0	4	11	0
SIPUNCULOIDEA				
Unid.sp.	0	2	0	1
ARTHROPODA				
CRUSTACEA				
OSTRACODA				
Parasterope sp.	0		1	0
Sarsiella sp.	0		11	1
Unid.sp. 2	0		1	0
Unid.sp. 4	0		1	0

Table 1. Composite species list of organisms retained in a 1.0 mm sieve. Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Unid.sp. 5	1	0	0	0
Unid.sp. 6	0	0	1	0
MYSIDACEA				
Mysidopsis bigelowi	9	3	0	0
CUMACEA				
Cyclaspis sp.	0	0	11	1
Oxyurostylis smithi	0	0	34	6
ISOPODA				
Apanthura magnifica	0	0	0	1
Dynamenella sp.	0	1	0	0
Erichsonella filiformis	2	0	0	0
AMPHIPODA				
Ampelisca abdita	3	3	52	3
Ampelisca holmesi	0	0	41	3
Ampithoidae sp.	20	7	0	0
Aoridae sp. 1	2	0	0	2
Aoridae sp. 3 (nr. Microdeutopus)	0	13	9	0
Batea cathariensis	1	6	0	0
Batea sp. 1 (juvs,)	0	7	0	0
Corophium sp.	0	0	12	0
Cymadusa nr. compta	47	0	0	0
Cmadusa sp.	0	9	0	0
Elasmopus levis	3	0	0	0
Erichthonius nr. brasiliensis	0	7	0	0
Gitanopsis sp.?	2	1	0	0
Lembos websteri?	1	2	4	0
Listriella nr. barnardi	0	0	8	0
Lysianopsis alba	2	0	0	0
Melita nitida	14	4	0	0
Monoculodes edwardsi	0	0	1	0
Monoculodes nyei	0	0	6	3
Parametopella cypris	0	0	1	0
Photis pugnator	0	0	15	0
n. gen. n. sp. nr. Platyischnopus	0	0	1	6
Pontogenia sp.	2	0	0	0
Rudilemboides naglei	0	0	1	1
Stenothoe sp.	1	0	0	0
DECAPODA				
Alpheus normanii	1	7	0	0
Majidae sp.	0	1	0	0

Table 1. Composite species list of organisms retained in a 1.0 mm sieve, Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Megalopa (Unid. species)	0	0	1	0
Neopanope texana texana	1	0	0	0
Paguridae sp.	0	1	2	0
Pagurus annulipes	0	2	0	0
Pandora trilineata	0	0	0	8
Penaeid sp. 1	4	0	0	0
Penaeid sp. 2	20	11	0	0
Xanthidae sp.	5	0	1	0
CHORDATA				
CEPHALOCHORDATA				
Brachiostoma caribeaum	0	0	7	4
PISCES				
Lagodon rhomboides	0	1	0	0
Symphurus plagiusa	1	0	0	0
Total # Individuals	419	264	415	205
Total # Species	63	68	61	41

Table 2. Composite species list for organisms retained in a 0.5 mm sieve. (excluding the organisms retained in a 1.0 mm sieve).

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
PLATYHELMINTHES				
Euplana gracilis	0	0	0	1
Unid.sp.	0	2	1	0
NEMERTINEA				
Unid.sp.	0	1	12	10
NEMATODA				
Unid.sp.	4	72	98	4
BRYOZOA				
Unid.sp.	*	*	0	0
PHORONIDEA				
Unid.sp.	0	o	0	1
ECHINODERMATA				
Ophiophragmus sp.	1	o	0	0
CHAETOGNATHA				
Unid.sp.	0	o	0	1
MOLLUSCA				
POLYPLACOPHORA				
Unid.sp.	0	2	0	0
GASTROPODA				
Acteocina sp.	0	0	1	0
Busycon sp.?	0	0	1	0
Caecum imbricatum	0	0	2	0
Caecum nitidum	161	263	0	0
Caecum pulchellum	1,344	321	16	0
Crepidula sp.	42	18	0	0
Cylichna bidentata	0	0	1	0
Doridacea sp. 1	0	1	0	0
Doridacea sp. 2	0	1	0	0
Haminoea succinea	0	0	0	1
Mitrella lunata	14	0	0	0
Odostomia acutidens	0	0	0	2
Odostomia impressa	15	0	0	0
Odostomia sp.	0	0	2	1
Retusa canaliculata	0	10	1	73
Rictaxis punctostriatus	0	0	0	2

*Colonies not counted as individuals.

Table 2. Composite species list for organisms retained in a 0.5 mm sieve. Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Teinostoma biscayense	0	0	1	0
Turbonilla conradi	0	1	1	0
Turbonilla dalli	0	0	1	0
Unid.sp. 1 (juv.)	0	1	0	0
Unid.sp. 2	0	0	4	0
PELECYPODA				
Argopecten gibbus	0	1	0	0
Argopecten sp. (juvs.)?	4	0	0	0
Brachiodontes exustus	10	7	0	1
Chione sp. 1	0	1	0	0
Corbula sp.	0	0	12	1
Crenella sp.?	4	3	0	0
Ensis sp. (juv.)?	0	0	1	0
Mysella planulata	0	1	0	0
Parvilucina multilineata	0	0	4	0
Pteria colymbus	0	4	0	0
Semele sp.	0	0	6	0
Tellina sp.	12	11	5	17
Unid. sp. 1	2	0	0	0
Unid. sp. 2	0	1	0	0
Unid. sp. 3	0	0	1	0
Unid. sp. 4	0	0	1	0
Unid. sp. 5	0	0	1	0
Unid. sp. 10	0	0	0	18
ANNELIDA				
POLYCHAETA				
Ampharetidae sp.?	0	1	0	0
Apoprionospio pygmaea	0	0	1	0
Aricidea fragilis	1	2	1	2
Brania sp.	0	0	1	0
Capitella capitata	0	2	0	0
Eteone heteropoda	0	1	0	0
Exogone sp.	0	0	13	0
Fabrica sabella	3	0	0	19
Fabrica sp.	0	2	1	0
Glycera americana	0	0	0	2
Glycinde solitaria	0	0	1	0
Gyptis vittata	2	2	0	0
Mediomastus californiensis	0	0	3	4
Minuspio cirrifera	8	0	1	0
Nereidae sp. (juvs.)	1	1	0	1
Odontosyllis sp.	3	11	0	0
Parahesione sp.	0	0	1	0
Paraprionospio pinnata	0	0	3	5

Table 2. Composite species list for organisms retained in a 0.5 mm sieve. Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Phyllodoce arenae	0	0	0	1
Podarke obscura	0	2	0	0
Polydora socialis	16	0	0	0
Polydora sp. 1	0	0	2	0
Polydora sp. 2 (juvs.)	0	10	0	0
Prionospio heterobranchia	53	28	0	5
Pseudopolydora sp.	0	0	8	0
Sabellidae sp. 1 (juv.)	1	0	0	0
Sabellidae sp. 2	0	0	0	1
Scolelepis squamata	0	0	0	1
Scolelepis texana	0	0	0	1
Scoloplos robustus	1	0	0	0
Spiochaetopterus costarum oculatus	0	0	1	1
Spionidae sp. 1 (juv.)	0	0	1	0
Spionidae sp. 2	0	0	0	2
Spiophanes bombyx	0	0	0	2
Spirorbis spirillum	96	15	1	0
Sthenelais boa	0	0	7	0
Syllidae sp.	9	14	1	0
Syllis gracilis	12	6	0	0
Tharyx sp.	3	1	1	0
Travisia sp. 1 (juvs.)	0	2	0	0
Travisia sp. 2	0	0	0	1
OLIGOCHAETA				
Unid.sp. 1	0	0	1	0
Unid.sp. 2	7	0	0	0
Unid.sp. 3	0	21	4	0
Unid.sp. 4	0	0	4	0
ARTHROPODA				
PYCNOGONIDA				
Anaplodactylus pygmaeus	0	1	0	0
CRUSTACEA				
CHEPHALOCARIDA				
Lightiella floridana	3	35	0	0
OSTRACODA				
Haplocytherida setipunctata	2	89	307	4
Parasterope pollex	0	0	7	0
Sarsiella sp.	0	0	1	0
Unid.sp. 1	0	1	0	0
Unid.sp. 2	0	0	25	1
Unid.sp. 3	0	0	6	0

Table 2. Composite species list for organisms retained in a 0.5 mm sieve. Continued.

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Unid.sp. 4	0	0	3	0
Unid.sp. 7	1	1	1	10
COPEPODA				
Harpacticoida sp.	0	0	2	0
Unid.sp.	15	13	9	2
MYSIDACEA				
Mysidopsis bigelowi	0	0	0	1
CUMACEA				
Cumella sp.	0	0	1	0
Cyclaspis sp.	0	1	14	2
Oxyurostylis smithi	0	0	6	0
Unid. sp.	2	0	0	0
TANAIDACEA				
Unid.sp.	1	3	1	2
ISOPODA				
Cleantis sp.	0	0	0	1
Munna sp.	0	0	7	0
AMPHIPODA				
Ampelisca abdita	2	2	25	1
Ampelisca holmesi	0	0	16	1
Ampithoidae sp.	22	14	1	0
Aoridae sp. 1	0	0	0	2
Aoridae sp. 2 (juvs.)	81	0	0	1
Aoridae sp. 3 (nr. Microdeutopus)	0	10	0	0
Batea cathariensis (juvs.)	4	0	0	0
Batea sp. 1 (juvs.)	0	4	0	0
Unid.sp. nr. Batea	0	2	0	0
Caprellida sp.	3	0	1	0
Corophium sp.	1	3	10	0
Cymadusa nr. compta	0	3	0	0
Cymadusa sp.	35	0	0	0
Elasmopus levis	5	6	0	0
Erichthonius nr. brasiliensis	2	9	1	0
Gitanopsis sp.	14	12	0	0
Lembos websteri?	4	10	0	0
Listriella nr. barnardi	0	0	9	1
Lysianopsis alba	1	0	0	0
Melita appendiculata	1	0	0	0

Table 2. Composite species list for organisms retained in a 0.5 mm sieve. Continued,

Species	Number of Individuals			
	Sta. 1	Sta. 2	Sta. 3	Sta. 4
Melita nitida	14	10	1	0
Monoculodes edwardsi	0	0	1	0
Monoculodes nyei	0	0	1	0
Photis pugnator	0	0	39	0
n. gen. n. sp. nr. Platyischnopus sp.	0	0	0	1
Stenothoe sp.	4	1	0	0
Unid.sp. (juvs.)	81	0	0	0
DECAPODA				
Unid.Shrimp (juv.)	1	0	0	0
Total # Individuals	2,128	1,073	725	211
Total # Species	50	58	68	42

Table 3. Dominant Species, (over 10% of total density) patterns in relation to sieve sizes utilized. (Case 1: Organisms retained on a 1.0 mm sieve; Case 2: Organisms retained on a 0.5 mm sieve, including organisms above 1.0 mm).

Station No.	Case 1	Case 2 *
1.	Prionospio heterobranchia Cymadusa compta	Caecum pulchellum
2.	Aricidea fragilis	Caecum pulchellum Caecum nitidum
3.	Ampelisca abdita Ampelisca holmesi	Haplocytherida setipunctata Nematoda (unid. sp.)
4.	Fabricia sp. Prionospio heterobranchia	Retusa canaliculata

* Note: In the case of 0.5 mm, the most dominant species changes at all stations.

B. Major Taxa Patterns: The majority of the fauna at the study site consisted of Mollusca, Polychaeta and Amphipoda. Density and species richness of these major taxa at the four stations based on the different sieve sizes is presented in Table 4. Overall, Mollusks were strikingly abundant in the 0.5 mm fraction (primarily Caecum pulchellum and C. nitidum) particularly in the grassbed stations (1 and 2). Polychaetes and Amphipods were generally evenly distributed between the two sieve sizes. The contribution of the 0.5 mm sieve to both density and species richness of the three major taxa was substantial (see Table 5). Importantly, the differences between the sieve sizes varied between sites and between taxa. The differences were, however, more pronounced in the grassbed stations.

C. Faunal Density: Faunal density (total number of organisms/m^2) at the four stations for the two sieve sizes is presented in Table 6. Contribution of the 0.5 mm sieve was extremely high in the two grassbed stations, high in the offshore sand station and about even to the 1.0 mm fraction in the nearshore sand station (see also Table 7). Figure 2 graphically illustrates the extent of faunal density differences between the two sieve sizes. Depending on the bottom type, approximately 50 to 80% of the total macrofaunal abundance is lost by the 1.0 mm sieve.

D. Species Richness: Species richness (number of species per station) at the four stations for the two sieve sizes is presented in Table 6. The extent of additional species contributed by the 0.5 mm sieve is presented in Table 7. Approximately one-third more species are added by the 0.5 mm sieve at all stations.

E. Species Diversity and Evenness: Species diversity (H') and evenness

Table 4. Summary of Major Taxa density and species richness at four selected stations in Anclote Anchorage as deduced by (a) organisms retained in a 0.5 mm sieve but excluding organisms retained in a 1.0 mm sieve; (b) organisms retained in a 1.0 mm sieve; and (c) organisms retained in a 0.5 mm sieve.

Station/Sieve	MOLLUSCA		POLYCHAETA		AMPHIPODA	
	Density #/m^2	Species Richness # s/sta.	Density #/m^2	Species Richness # s/sta.	Density #/m^2	Species Richness # s/sta.
Sta. No. 1						
0.5 mm [a]	14,293	10	1,858	14	2,436	16
1.0 mm [b]	809	20	1,644	20	871	12
Both Sieves[c]	15,102	23	3,502	26	3,307	19
Sta. No. 2						
0.5 mm [a]	5,751	17	889	16	764	13
1.0 mm [b]	578	18	836	25	524	10
Both Sieves[c]	6,329	28	1,725	31	1,288	15
Sta. No. 3						
0.5 mm [a]	551	19	427	18	933	11
1.0 mm [b]	604	15	613	18	1,342	12
Both Sieves[c]	1,155	30	1,040	29	2,275	16
Sta. No. 4						
0.5 mm [a]	1,013	9	427	15	62	6
1.0 mm [b]	391	9	1,031	17	160	6
Both Sieves[c]	1,404	14	1,458	26	222	8

Table 5. Percentage increase of MAJOR TAXA density and species richness at selected Anclote stations due to the use of a 0.5 mm sieve instead of a 1.0 mm sieve,

Station #	MOLLUSCA		POLYCHAETA		AMPHIPODA	
	Density %	Species Richness %	Density %	Species Richness %	Density %	Species Richness %
1	1,767	15	113	30	280	58
2	995	56	106	24	146	50
3	91	100	70	61	70	33
4	259	56	41	53	39	33

Table 6. Summary of community characteristics at four selected stations in Anclote Anchorage as deduced by (a) organisms retained in a 0.5 mm sieve but excluding organisms above 1.0 mm; (b) organisms retained in a 1.0 mm sieve; and (c) all organisms retained in a 0.5 mm sieve.

Station/Sieve	Faunal Density (#/m^2)	Species Richness (#s/sta.)	Species Diversity H' (nats)	Evenness J'
Sta. No. 1				
0.5 mm [a]	18,916	50	1.72	0.44
1.0 mm [b]	3,724	63	3.20	0.77
Both sieves [c]	22,640	89	2.29	0.51
Sta. No. 2				
0.5 mm [a]	9,538	58	2.51	0.62
1.0 mm [b]	2,347	68	3.74	0.89
Both sieves [c]	11,885	99	3.07	0.67
Sta. No. 3				
0.5 mm [a]	6,444	68	2.55	0.60
1.0 mm [b]	3,689	61	3.38	0.82
Both sieves [c]	10,133	102	3.21	0.69
Sta. No. 4				
0.5 mm [a]	1,876	42	2.69	0.72
1.0 mm [b]	1,822	41	3.07	0.83
Both Sieves [c]	3,698	68	3.28	0.78

Table 7. Percentage change of some community characteristics at selected Anclote stations due to the use of a 0.5 mm sieve instead of a 1.0 mm sieve.

Station #	Faunal Density (# animals/m^2)	Species Richness (# s/sta.)	Species Diversity H'-nats	Evenness J'
1	+ 508%	+ 41%	- 28%	- 34%
2	+ 406%	+ 46%	- 18%	- 25%
3	+ 175%	+ 67%	- 5%	- 16%
4	+ 103%	+ 66%	+ 7%	- 6%

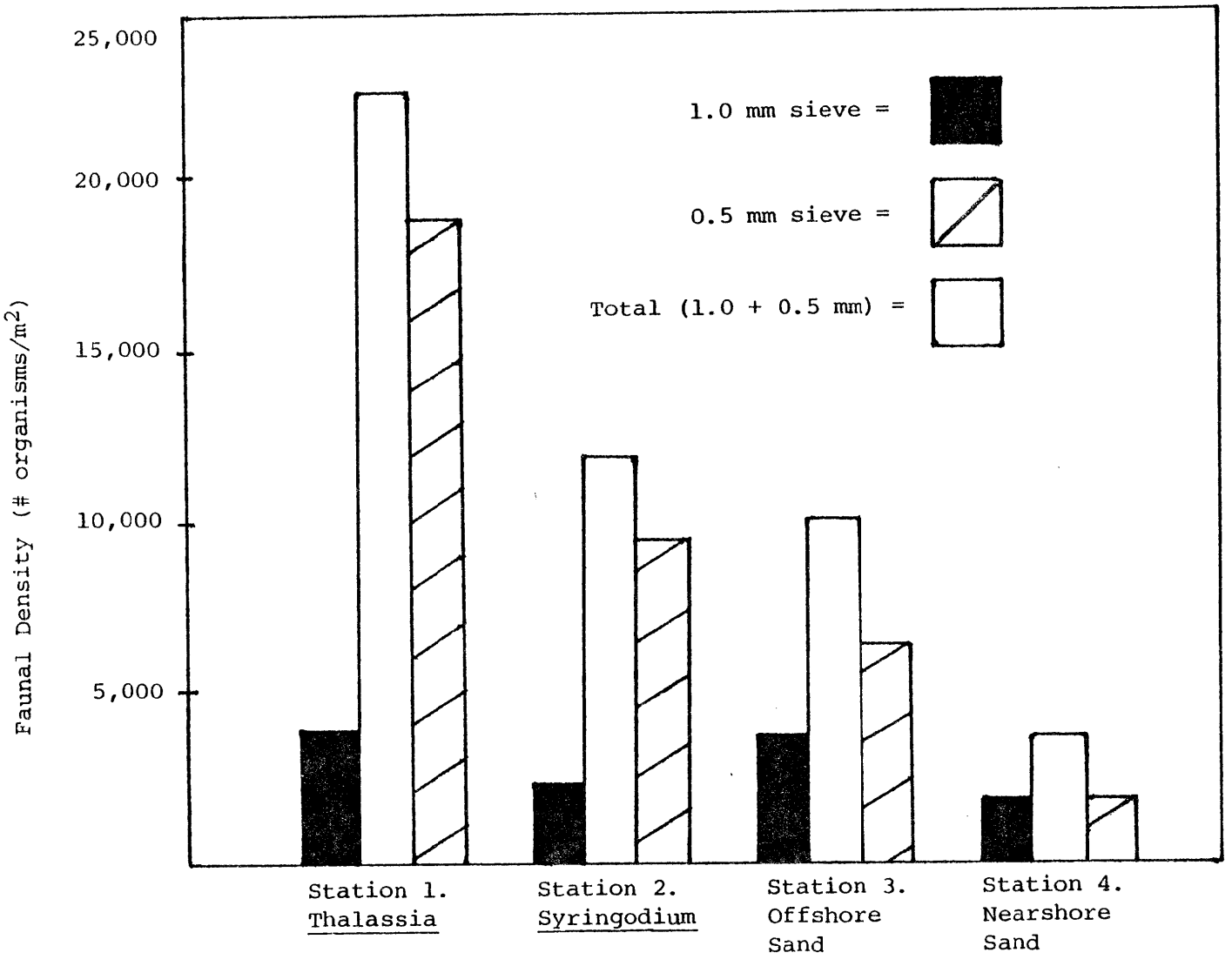

Figure 2. Density distribution between sieve sizes.

(J') at the four stations for the two sieve sizes are presented in Table 6. In general, a decrease in these parameters occurred due to the addition of the 0.5 mm fraction (probably related to the increase in dominance) Differences were more pronounced in the grass-bed stations (see also Table 7).

F. Faunal Similarity: To provide an evaluation of the difference in detecting faunal similarity between stations utilizing different sieve sizes, an analysis using Morisita's index was conducted for the 1.0 mm fraction and the total samples (1.0 + 0.5 mm sieves). Results in the form of matrices are presented in Tables 8 and 9. Patterns of similarity between the stations changed radically when the 0.5 mm fraction was added. As would be anticipated from habitat information, Stations 1 and 2 (grass beds) were highly similar to each other, while all other combinations were dissimilar, when both fractions are utilized in the analysis (Table 9). On the other hand, an analysis of the 1.0 mm sieve alone (Table 8), indicated that Stations 1 and 4 were moderately similar (a nearshore grassbed area and an offshore sandy area). This similarity could have been artificially introduced because of the larger sieve size. In general, addition of the 0.5 mm sieve size fraction appears to provide faunal similarity results that are more consonant with habitat information.

IV. DISCUSSION

Adequacy of sampling and laboratory analysis designs are paramount in making a reasonable assessment of adverse effects on benthic communities in relation to man-induced activities. Inadequate methods tend to provide inexplicable variations and often result in erroneous

Table 8. Faunal similarity (Morisita's Cλ) matrix for communities retained in a 1.0 mm sieve.

Station	2	3	4
1	0.484 **	0.027	0.503**
2		0.130	0.198
3			0.209

Table 9. Faunal similarity (Morisita's Cλ) matrix for communities retained in a 0.5 mm sieve (1.0 + 0.5 mm sieve),

Station	2	3	4
1	0.716 *	0.040	0.034
2		0.270	0.078
3			0.121

* = High Similarity; ** = Moderate Similarity. All other values: low similarity.

conclusions. The environmental assessment study conducted by Thorhaug et al. (l977) utilized a 1.0 mm sieve to separate macrofaunal benthos. Their reasoning was:

> "After sorting many samples to the 0.5 mm level, it was found that the organisms between 0.5 mm and 1.0 mm were overwhelmingly foraminifera, which were not to be analyzed in this program. Only an extremely occasional micro-mollusc was found, thus we sorted to 1.0 mm, not 0.5 mm." (page VI-15)

No data to support the above reasoning was presented in the report by Thorhaug et al. (op. cit.).

Although the present study is based on a single sampling period and is spatially limited to only four stations, we feel that the results strongly indicate the inadequacy of utilizing a 1.0 mm sieve at the study site. Our data incontrovertibly show that:

(1) Pronounced changes in species composition, density and species richness occur with addition of fauna retained on a 0.5 mm sieve.

(2) Most of the new species added by a 0.5 mm sieve are typically macrofaunal species (i.e., not meiofaunal).

(3) Micromolluscs (especially Caecum spp) were abundantly retained on the 0.5 mm sieve and invariably passed through the 1.0 mm sieve (contrary to Thorhaug et al., 1977. observations). For example, Station 1 retained 1547 individuals of Caecum spp on the 0.5 mm sieve and only 5 individuals on the 1.0 mm sieve.

(4) Abundance of some dominant species are under estimated by the 1.0 mm sieve.

(5) Influence of the 0.5 sieve in describing the benthic community structure beyond the 1.0 mm sieve description is variable and depends upon the habitat type i,e., variation of

community parameters between the two sieve sizes is not constant.

(6) Species belonging to several Phylogenetic groups are added by use of a 0.5 mm sieve.

(7) Species dominance changes with the addition of 0.5 mm sieve data.

(8) Species diversity and evenness changes with the addition of 0.5 mm sieve data.

(9) Comparison of faunal similarity between stations indicates that the use of a 1.0 mm sieve may provide erroneous associations.

The benthic environmental assessment study by Thorhaug et al. (1977) relied heavily on abundance, species richness and various community parameters. The present study clearly shows that all these factors are substantially affected by the use of a 1.0 mm sieve instead of a 0.5 mm sieve. The 0.5 mm sieve size samples provide a more realistic and comprehensive picture of the benthic communities at the study site. The 1.0 mm sieve imposes serious limitations in realistically evaluating the alteration of benthic communities caused by the thermal discharge at Anclote Sound. The faunal similarity analysis (see Results section) shows that comparison of stations using a 1.0 mm sieve could lead to erroneous associations. Because impact assessment analysis by Thorhaug et al. (1977) is primarily based on control vs. affected station comparisons, the validity of the assessment is questionable. It is quite probable that if a 0.5 mm sieve was utilized in the 316a study, a definitive impact assessment statement on the benthos could have been made (instead of attributing inexplicable variations to

natural phenomenon).

V. SUMMARY AND CONCLUSIONS

1. Four different habitats were sampled in Anclote Sound (Florida) to evaluate the effects of sieve size (0.5 and 1.0 mm sizes) in describing the benthic community structure.
2. A total of 217 different taxa were identified from 5,440 organisms collected in the study.
3. Pronounced changes in species composition, species richness, faunal density, species diversity, evenness and faunal similarity occur when a 0.5 mm sieve is utilized instead of a 1.0 mm sieve to separate the fauna.
4. Based on the data collected in this study, we conclude that:
   (a) a 1.0 mm sieve size (to separate benthic macrofauna) was inadequate to describe the community structure at the study site.
   (b) the Thorhaug et al. (1977) study did not satisfy the requirements of a 316a Demonstration for the benthic faunal component.

VI. RECOMMENDATIONS

Based on the present study, it is our opinion that the data collected by Thorhaug et al. (1977) on the benthic fauna (core samples) at Anclote Sound is inadequate to provide a valid impact assessment of thermal effects. Therefore, we suggest that the impact assessment be viewed with caution in any decision-making process relating to the evaluation of thermal effects on benthic fauna at the study site. Further, we recommend that future benthic studies in the area utilize a 0.5 mm sieve in separating macrofauna.

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