APPENDIX A

BIOLOGICAL ASSESSMENT OF PROPOSED OFFSHORE BORROW AREA AND REEF COMMUNITIES, DADE COUNTY BEACHES, FLORIDA

INTRODUCTION

Field surveys of sand bottom communities and reef organisms were made on 8 February and during the week of 20 May 1974, in order to assess the diversity and abundance of benthic organisms in the proposed project area. Many bottom organisms are of commercial value, while others are important in food webs that lead to production of important sport and commercial fishes as well as some invertebrates. In projects of this kind, large numbers of benthic organisms are unavoidably destroyed at both dredge and spoil sites. Therefore, qualitative and quantitative information on their regional distribution can be useful in the selection of operational sites that will cause a minimum amount of environmental damage. Furthermore, since many bottom dwellers are non-migratory, analysis of benthic communities may provide insight into prevailing chemical and physical conditions within the project area. In addition, such baseline data may also be used in biological monitoring studies during dredging operations, and as a measure of repopulation rates and characteristics following project completion.

INFAUNA SURVEY

On 8 February 1974, benthic samples from unconsolidated sediments were collected at five locations about 6,000 feet seaward of the Dade County shoreline in water between 35 and 65 feet deep. All collections were made by Pomar grab, which samples an area of 529cm^2. One Pomar grab sample was taken at each station.

All grab samples were washed on a No. 30 U. S. Standard sieve, and the residue was fixed in 10 percent sea water-formalin, and stained with rose bengal dye to facilitate recognition and sorting of infauna. Invertebrates from each sample were enumerated and identified to phylum or lower taxonomic category. Organisms were listed by group, and numerical data were used to calculate numbers of individuals/m^2, and rank (as percent), for each taxon in all samples (table 1-1).

In sandy sediments, population densities ranged from a low of 1,710 organisms per square meter at Station 1 to 14,003 organisms/m^2 at Station 4 (table A-1). The highest density encountered (26,225 organisms/m^2) was at Station 5 located outside the northerly limits of the borrow area. Average population density for the borrow area was 7,321 organisms/m^2. Sedentary polychaetes and nematodes were the

TABLE A-1

Density (expressed as no/m^2) of benthic macro-invertebrates collected 8 February 1974 from the proposed borrow area off the Dade County shoreline

Station No.	1		2		3		4		5	
Depth (feet)	35		65		60		45		43	
Substrate	medium to fine granules		medium to fine granules		medium to fine granules and shell		medium to fine granules, shell and some rock		sand, shell, and rock	
TAXA	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%	No/m^2	%
Aschelminthes										
Nematoda	817	47.8	3895	73.1	510	6.2	511	36.5	16397	62.5
Rhynchocoela			19	0.3			19	0.1	19	0.1
Sipunculida			19	0.3						
Bryozoa										
Unidentified colony			19	0.3	19	0.2	19	0.1		
Mollusca										
Polyplacophora							38	0.2	138	0.5
Scaphapoda							19	0.1		
Gastropoda	19	1.1			285	3.5	38	0.2	114	0.4
Bivalvia	247	14.4	114	2.1	627	7.6			152	0.6
Annelida										
Polychaeta										
Errant	19	1.1	285	5.3	57	0.7	57	0.4	950	3.6
Sedentary	133	7.7	482	9.0	5263	63.8	5871	41.0	4674	17.0
Arthropoda										
Pycnogonida							19	0.1		
Nymphon sp.					19	0.2				
Crustacea										
Ostracoda	19	1.1	19	0.3	114	1.4	152	1.1	171	0.7
Copepoda										
Cyclopoida									38	0.1
Calanoida	19	1.1	76	1.4			114	0.8	152	0.6
Harpacticoida			190	3.5	19	0.2	190	1.4	627	2.4
Malacostraca										
Cumacea										
Oxyurostylis smithi	57	3.3	19	0.3						
Leptocuma minor	228	13.3	19	0.3	76	0.9	38	0.2		
Cyclaspis varians					171	2.1	19	0.1	551	2.1
Tanaidacea										
Leptognatha caeca	57	3.3								
Heterotanais limicola					76	0.9	1539	11.0	38	0.1
Tanais cavolini					38	0.5				
Leptochelia rapax					133	1.6				
Isopoda										
Cyathura sp.	19	1.1								
Serolis sp.	19	1.1								
Paranthura sp.							19	0.1		
Unidentified					57	0.7	19	0.1		
Amphipoda										
Gammaridea	57	3.3			323	3.9	285	2.0	1501	5.7
Haustoridae					152	1.8	19	0.1	266	1.0
Caprellidea										
Phtisica marina							95	0.7	361	1.4
Mysidacea										
Heteromysis formosa							171	1.2		
Necomysis americana									19	0.07
Unidentified			19	0.3	57	0.7				
Decapoda										
Penaeidae larvae					38	0.5			38	0.1
Brachyura					38	0.5				
Echinodermata										
Echinoidea										
Arbaciidae					19	0.2	19	0.1		
Ophiuroidea					19	0.2				
Holothuroidea			19	0.1						
Chordata										
Cephalochorda										
Branchiostoma caribaeum			133	2.4	190	2.3	152	1.1		
Number of Taxa	13		15		23		23		18	
Total Density	1710		5327		8243		14003		26225	

dominant organisms in the borrow area, comprising 40.3 and 19.5 percent of the total average population, respectively. The remainder of the population was composed of various species of mollusks, arthropods (some penaeid larvae as well as other small crustaceans) and members of several other groups.

The total number of taxa collected varied between stations from 3 at Stations 1 to 23 at Stations 3 and 4. The average number of taxa collected in the borrow area was 18.4.

Generally the number and kinds of invertebrates increased from south to north in the borrow area. This is probably due to the change in consistency and types of substrate available as habitat. The bottom material at the southern stations was composed of fragmented limestone and was of uniform consistency. The substrate in the northerly stations, especially Station 5, was composed of varying proportions of sand, shell, and rocky materials. As in most natural systems, the more diverse substrate increases the availability of habitat and provides greater protection for the invertebrates, thus the types and numbers increased.

REEF SURVEY

During the week of 20 May 1974, visual observations were made by SCUBA at five localities along the outer reef east of Miami Beach (plate 1), and at one station in the vicinity of Fowey Rocks Light (National Ocean Survey, Coast and Geodetic Survey Chart 1248). At these stations, water depth varied from 18 to 55 feet and visibility was less than 20 feet, except in the Fowey Rocks area where it was estimated at about 40 feet. Moderate northerly surface and bottom currents were encountered during both rising and falling tidal stages. Even though weather was calm during all dives, turbidity from maintenance dredging in Government Cut reduced visibility at reefs off Miami Beach to about five feet at low tide. In addition, these reefs were uniformly covered by a fine layer of calcareous silt which presumably arose from the same dredging operation.

Silt tolerant octocorallians dominated the reefs in the Miami area, but at Fowey Rocks the reef had a much more normal appearance. Observations at each station were recorded on Ascot paper[1], and are included here in table A-2.

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[1] Ascot Underwater Paper. Appleton Papers, Inc., P. O. Box 348, Appleton, Wisconsin 54911.

TABLE A-2

Reef organisms recorded at five stations off Miami Beach, and one near Fowey Rocks Light, 20-24 May 1974.*

STATION 1

Depth - 45 feet.

Scientific Name	Common Name
PORIFERA	
Dasychalina cyathina	Vase sponge
Unidentified sponges (2)	
CNIDARIA	
Millepora alcicornis	Fire coral
Unidentified anemone	
Briareum asbestinum	Soft coral
Unidentified soft corals (2)	
Dichocoenia stokesii	Star coral
Diploria labyrinthiformes	Brain coral
Meandrina brasiliensis	Rose coral
Monastrea annularis	Star coral
Solenastrea hyades	Star coral
Donax	
ANNELIDA	
Phragmatopoma lapidosa	Reef worm
Unidentified serpulid (1)	Plume worm
Emerita	
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
PISCES	
Eupomacentrus leucostictus	Beaugregory
E. partitus	Bicolor damselfish
Haemulon aurolineatum	Tomtate
Halichoeres bivattatus	Slippery dick
Lutjanus analis	Mutton snapper
Thalassoma bifasciatum	Bluehead

*Field identifications should be regarded as tentative.

TABLE A-2 (Continued)

STATION 2

Depth - 38 feet.

Scientific Name	Common Name
PORIFERA	
Dasychalina cyathina	Vase sponge
Spheciospongia vesparia	Loggerhead sponge
CNIDARIA	
Briareum asbestinum	Soft coral
Unidentified soft corals (2)	
Diploria clivosa	Brain coral
Eusmilia fastigiata	Flower coral
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
Eucidaris tribuloides	Pencil urchin
UROCHORDATA	
Unidentified ascidiaceans (2)	
PISCES	
Epinephelus sp.	Grouper
Eupomacentrus partitus	Bicolor Damselfish
Gillellus sp.	Stargazer
Serranus tigrinus	Harlequin bass

TABLE A-2 (Continued)

STATION 3

Depth - 55 feet.

Scientific Name	Common Name
PORIFERA	
Dasychalina cyathina	Vase sponge
Spheciospongia vesparia	Loggerhead sponge
Unidentified sponges (2)	
CNIDARIA	
Millepora alcicornis	Fire coral
Millepora complanata	Fire coral
Unidentified anemone	
Briareum asbestinum	Soft coral
Unidentified soft corals (3)	
Diploria clivosa	Brain coral
Meandrina brasiliensis	Rose coral
Monastrea cavernosa	Star coral
Solenastrea hyades	Star coral
ANNELIDA	
Maldanid egg cases	Bamboo worm
Unidentified serpulid (1)	Plume worm
ARTHROPODA	
Stenorynchus seticornis	Arrow crab
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
UROCHORDATA	
Unidentified ascidiaceans (2)	
PISCES	
Acanthurus coeruleus	Blue Tang
Caranx sp.	Jack
Chaetodon sp.	Butterfly fish
Epinephalus sp	Grouper
Eupomacentrus partitus	Bicolor damselfish
Halichoeres bivattatus	Slippery dick
Holacanthus bermudensis	Blue angelfish
Lactophrys bicaudalis	Spotted trunkfish
Scorpaena plumieri	Spotted scorpionfish
Thalassoma bifasciatum	Bluehead

TABLE A-2 (Continued)

STATION 4

Depth - 30 feet.

Scientific Name	Common Name
PHAEOPHYTA	
Dictyota sp.	
PORIFERA	
Dasychalina cyathina	Vase sponge
Unidentified sponges (4)	
CNIDARIA	
Millepora alcicornis	Fire coral
Briareum asbestinum	Soft coral
Gorgonia flabellum	Sea fan
Unidentified soft corals (3)	
Meandrina brasiliensis	Rose coral
Monastrea cavernosa	Star coral
ANNELIDA	
Unidentified serpulid (1)	Plume worm
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
PISCES	
Acanthurus chirurgus	Doctorfish
Caranx sp.	Jack
Epinephelus sp.	Grouper
Haemulon aurolineatum	Tomtate
Haemulon sp.	Grunt
Halichoeres bivattatus	Slippery dick
Holacanthus bermudensis	Blue angelfish
Lutjanus sp.	Snapper
Pomacanthus arcuatus	Gray angelfish
Thalassoma bifasciatum	Bluehead
Unidentified filefish	

TABLE A-2 (Continued)

STATION 5

Depth - 45 feet.

Scientific Name	Common Name
PHAEOPHYTA	
Dictyota sp.	
PORIFERA	
Dasychalina cyathina	Vase sponge
Spheciospongia vesparia	Loggerhead sponge
Unidentified encrusting sponges (3)	
CNIDARIA	
Millepora alcicornis	Fire coral
Millepora complanata	Fire coral
Unidentified anemones (2)	
Briareum asbestinum	Soft coral
Gorgonia flabellum	Sea fan
Unidentified soft corals (3)	
Diploria clivosa	Brain coral
Eusmilia fastigiata	Flower coral
Meandrina brasiliensis	Rose coral
Monastrea annularis	Star coral
ANNELIDA	
Unidentified amphinomid (1)	Fire worm
Unidentified serpulid (1)	Plume worm
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
UROCHORDATA	
Unidentified ascidiaceans (2)	
PISCES	
Abudefduf sazatilis	Sergeant major
Acanthurus chirurgus	Doctorfish
Acanthurus coeruleus	Blue tang

TABLE A-2 (Continued)

STATION 5 (Continued)

Scientific Name	Common Name
PISCES (Continued)	
Caranx sp.	Jack
Chaetodon sp.	Butterfly fish
Epinephelus sp.	Grouper
Eupomacentrus leucostictus	Beaugregory
Eupomacentrus partitus	Bicolor damselfish
Gillellus sp.	Stargazer
Haemulon aurolineatum	Tomtate
Haemulon sp.	Grunt
Halichoeres bivattatus	Slippery dick
Holacanthus bermudensis	Blue angelfish
Lutjanus sp.	Snapper
Pomacanthus arcuatus	Gray angelfish
Pomacanthus paru	French angelfish
Serranus tigrinus	Harlequin bass
Thalassoma bifasciatum	Bluehead

TABLE A-2 (Continued)

STATION 6

Depth - 18 feet.

Scientific Name	Common Name
PHAEOPHYTA	
Dictyota sp.	
PORIFERA	
Dasychalina cyathina	Vase sponge
Spheciospongia vesparia	Loggerhead sponge
Unidentified sponges (6)	
CNIDARIA	
Millepora alcicornis	Fire coral
Millepora complanata	Fire coral
Briareum asbestinum	Soft coral
Gorgonia flabellum	Sea fan
Gorgonia ventalina	Sea fan
Unidentified soft corals (4)	
Unidentified anemones (3)	
Acropora cervicornis	Staghorn coral
Acropora palmata	Elk horn coral
Diploria clivosa	Brain coral
Diploria labyrinthiformes	Brain coral
Eusmilia fastigiata	Flower coral
Manicina areolata	Rose coral
Monastrea cavernosa	Star coral
Porites porites	Finger coral
Solenastrea hyades	Star coral
Unidentified stony corals (4)	
MOLLUSCA	
Chama sp.	Jewel box
Pteria colymbus	Atlantic wing oyster
ANNELIDA	
Unidentified amphinomid (1)	Fire worm
Unidentified sabellid (1)	Plume worm
Unidentified serpulid (1)	Plume worm

TABLE A-2 (Continued)

STATION 6 (Continued)

Scientific Name	Common Name
ARTHROPODA	
Panulirus argus	Spiny lobster
Stenopus hispidus	Coral shrimp
Stenorynchus seticornis	Arrow crab
ECHINODERMATA	
Diadema antillarum	Long spined sea urchin
Eucidaris tribuloides	Pencil urchin
Lytechinus variegatus	Common sea urchin
UROCHORDATA	
Unidentified ascidiaceans (4)	
PISCES	
Abudefduf saxatilis	Sergeant major
Acanthurus chirurgus	Doctorfish
Acanthurus coeruleus	Blue tang
Anisotremus virginicus	Porkfish
Aulostomus maculatus	Trumpet fish
Caranx sp.	Jack
Chaetodon sp.	Butterfly fish
Epinephelus sp.	Grouper
Equetus lanceolatus	Jackknife fish
Eupomacentrus dorsopunicans	Dusky damselfish
Eupomacentrus leucostictus	Beaugregory
Eupomacentrus partitus	Bicolor damselfish
Gillellus sp.	Stargazer
Gobiosoma sp.	Goby
Haemulon aurolineatum	Tomtate
Haemulon sp.	Grunt
Halichoeres bivattatus	Slipper dick
Halichoeres radiatus	Pudding wife
Holacanthus bermudensis	Blue angelfish
Holacanthus tricolor	Rock beauty
Holocentrus sp.	Squirrelfish
Lactophrys bicaudalis	Spotted trunkfish
Lutjanus analis	Mutton snapper
Pomacanthus arcuatus	Gray angelfish
Pomacanthus paru	French angelfish
Scarus guacamaia	Rainbow parrotfish
Scorpaena plumieri	Spotted scorpionfish
Serranus tigrinus	Harlequin bass
Sphoeroides sp.	Puffer
Sphyraena barracuda	Barracuda
Thalassoma bifasciatum	Bluehead
Unidentified filefish	

TABLE A-2 (Continued)

Fish species recorded from the project area

PISCES	
Chondrichthyes	
Squaliformes	
Orectolobidae	
Nurse shark	*Ginglymostoma cirratum*
Odontaspididae	
Sand tiger	*Odontaspis taurus*
Carcharhinidae	
Tiger shark	*Galeocerdo cuvieri*
Sphyrnidae	
Bonnethead	*Sphyrna tiburo*
Rajiformes	
Rhinobatidae	
Atlantic guitarfish	*Rhinobatos lentiginosus*
Torpedinidae	
Lesser electric ray	*Narcine brasiliensis*
Rajidae	
Rounded skate	*Raja texana*
Dasyatidae	
Yellow stingray	*Urolophus jamaicensis*
Roughtail stingray	*Dasyatis americana*
Myliobatidae	
Spotted eagle ray	*Aetobatis narinari*
Mobulidae	
Atlantic manta	*Manta birostris*
Osteichthyes	
Elopiformes	
Elopidae	
Tarpon	*Megalops atlantica*
Anguilliformes	
Muraenidae	
Blackedge moray	*Gymnothorax nigromarginatus*

TABLE A-2 (Continued)

Clupeiformes	
Engraulidae	
Bay anchovy	*Anchoa mitchilli*
Myctophiformes	
Synodontidae	
Inshore lizardfish	*Synodus foetens*
Sand diver	*S. intermedius*
Snakefish	*Trachinocephalus myops*
Batrachoidiformes	
Batrachoididae	
Gulf toadfish	*Opsanus beta*
Gadiformes	
Ophidiidae	
Key brotula	*Ogilbia cayorum*
Atheriniformes	
Cyprinodontidae	
Rainwater killifish	*Lucania parva*
Gasterosteiformes	
Syngnathidae	
Lined seahorse	*Hippocampus erectus*
Dwarf seahorse	*H. zosterae*
Chain pipefish	*Syngnathus louisianae*
Dusky pipefish	*S. floridae*
Gulf pipefish	*S. scovelli*
Fringed pipefish	*Micrognathus crinigerus*
Whitenose pipefish	*Corythoichthys albirostris*
Perciformes	
Centropomidae	
Snook	*Centropomus undecimalis*
Serranidae	
Black sea bass	*Centropristis striata*
Rock hind	*Epinephelus adscensionis*
Jewfish	*E. itijara*
Red grouper	*E. morio*
Gag	*Mycteroperca microlepis*
Scamp	*M. phenax*
Yellowfin grouper	*M. venenosa*
Priacanthidae	
Bulleye	*Cookeolus boops*
Bigeye	*Priacanthus arenatus*
Glasseye snapper	*P. cruentatus*
Short bigeye	*Pristigenys alta*

TABLE A-2 (Continued)

Apogonidae	
Bronze cardinalfish	*Astrapogon alutus*
Conchfish	*A. stellatus*
Pomatomidae	
Bluefish	*Pomatomus saltatrix*
Rachycentridae	
Cobia	*Rachycentron canadum*
Carangidae	
Yellow jack	*Caranx bartholomaei*
Blue runner	*C. crysos*
Crevalle jack	*C. hippos*
Horse-eye jack	*C. latus*
Bar jack	*C. ruber*
Florida pompano	*Trachinotus carolinus*
Permit	*T. falcatus*
Palometa	*T. goodei*
Greater amberjack	*Seriola dumerili*
Coryphaenidae	
Dolphin	*Coryphaena hippurus*
Lutjanidae	
Mutton snapper	*Lutjanus analis*
Schoolmaster	*L. apodes*
Red snapper	*L. campechanus*
Gray snapper	*L. griseus*
Dog snapper	*L. jocu*
Lane snapper	*L. synagris*
Yellowtail snapper	*Ocyurus chrysurus*
Vermillion snapper	*Rhomboplites aurorubens*
Gerreidae	
Spotfin mojarra	*Eucinostomus argenteus*
Silver jenny	*E. gula*
Pomadasyidae	
Tomtate	*Haemulon aurolineatum*
Black grunt	*H. carbonarium*
Sailors choice	*H. parrai*
White grunt	*H. plumieri*
Bluestriped grunt	*H. sciurus*

TABLE A-2 (Continued)

Sparidae	
Sheepshead	*Archosargus probatocephalus*
Grass porgy	*Calamus arctifrons*
Saucereye porgy	*C. calamus*
Spottail pinfish	*Diplodus holbrooki*
Pinfish	*Lagodon rhomboides*
Red porgy	*Pagrus sedecim*
Sciaenidae	
Spotted seatrout	*Cynoscion nebulosus*
Weakfish	*C. regalis*
Black drum	*Pogonias cromis*
Silver perch	*Bairdiella chrysura*
Mullidae	
Spotted goatfish	*Pseudupeneus maculatus*
Epphippidae	
Atlantic spadefish	*Chaetodipterus faber*
Scaridae	
Emerald parrotfish	*Nicholsina usta*
Blue parrotfish	*Scarus coeruleus*
Mugilidae	
Striped mullet	*Mugil cephalus*
Sphyraenidae	
Great barracuda	*Sphyraena barracuda*
Polynemidae	
Atlantic threadfin	*Polydactylus octonemus*
Opistognathidae	
Mottled jawfish	*Opistognathus maxillosus*
Clinidae	
Banded blenny	*Paraclinus fasciatus*
Marbled blenny	*P. marmoratus*
Blennidae	
Florida blenny	*Chasmodes saburrae*
Callionymidae	
Spotted dragonet	*Callionymus pauciradiatus*

TABLE A-2 (Continued)

Gobiidae	
Tiger goby	*Gobiosoma macrodon*
Code goby	*G. robustum*
Crested goby	*Lophogobius cyprinoides*
Scombridae	
King mackerel	*Scomberomorus cavalla*
Spanish mackerel	*S. maculatus*
Istiophoridae	
White marlin	*Tetrapturus albidus*
Sailfish	*Istiophorus platypterus*
Scorpaenidae	
Barbfish	*Scorpaena brasiliensis*
Plumed scorpionfish	*S. grandicornis*
Triglidae	
Leopard searobin	*Prionotus scitulus*
Pleuronectiformes	
Bothidae	
Ocellated flounder	*Ancylopsetta quadrocellata*
Three-eyed flounder	*A. dilecta*
Peacock flounder	*Bothus lunatus*
Eyed flounder	*B. ocellatus*
Gulfstream flounder	*Citharichthys arctifrons*
Horned whiff	*C. cornutus*
Spotted whiff	*C. macrops*
Bay whiff	*C. spilopterus*
Spotfin flounder	*Cyclopsetta fimbriatta*
Fringed flounder	*Etropus crossotus*
Smallmouth flounder	*E. microstomus*
Gray flounder	*E. rimosus*
Shrimp flounder	*Gastropsetta frontalis*
Fourspot flounder	*Hippoglossina oblonga*
Slim flounder	*Monolene antillarum*
Deepwater flounder	*M. sessilicauda*
Gulf flounder	*Paralichthys albigutta*
Southern flounder	*P. lethostigma*
Broad flounder	*P. squamilentus*
Windowpane	*Scophthalmys aquosus*
Shoal flounder	*Syacium gunteri*
Dusky flounder	*S. papillosum*