JULY 1987

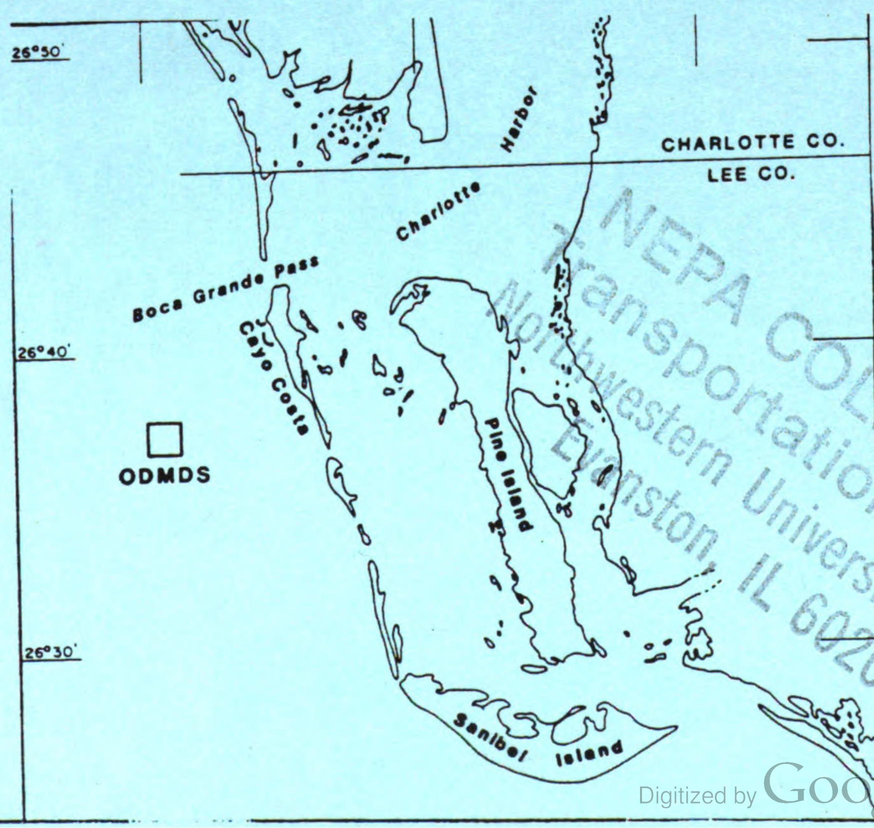
DRAFT ENVIRONMENTAL IMPACT STATEMENT
CHARLOTTE HARBOR, FLORIDA
AN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

Prepared by

U.S. Environmental Protection Agency,Region IV

Cooperating Agency

U.S. Army Corps of Engineers, Jacksonville District



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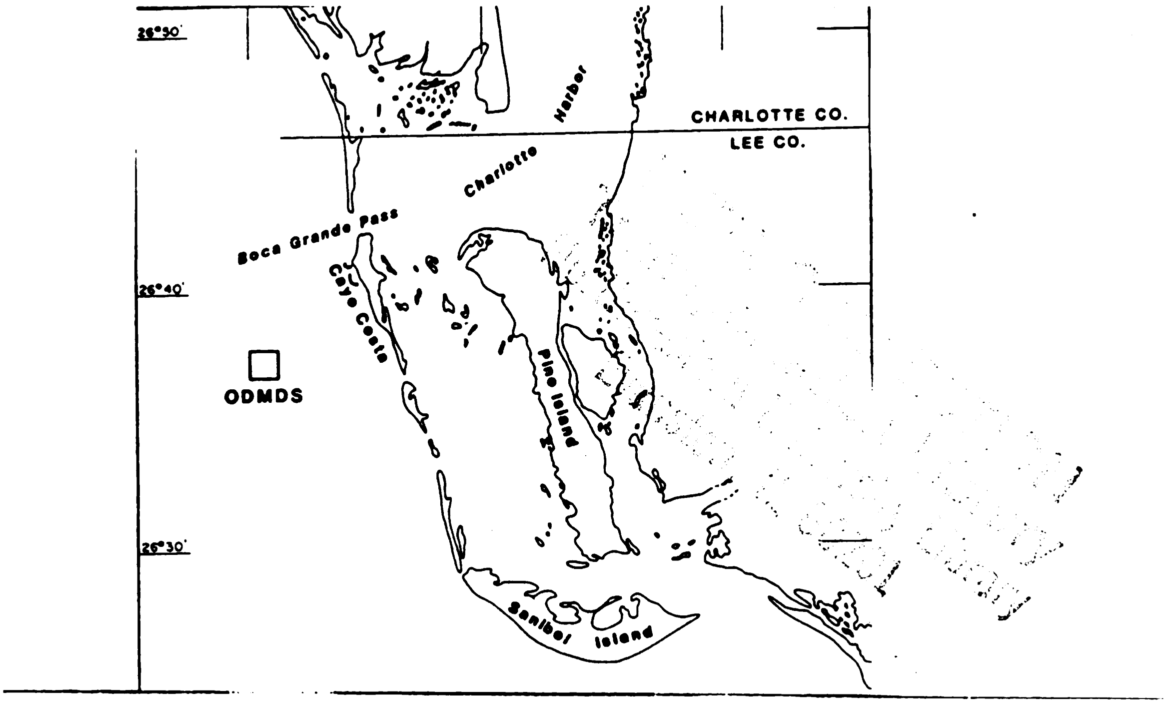

Draft Environmental Impact Statement
for the Charlotte Harbor, Florida
Dredged Material Disposal Site Designation

Prepared by

U.S. Environmental Protection Agency
Region IV

Cooperating Agency

U.S. Army Corps of Engineers
Jacksonville District

Attached is the draft environmental impact statement (DEIS) for the Charlotte Harbor, Florida ocean dredged material disposal site designation. This DEIS presents the information needed to evaluate and recommend areas for disposal of dredged material in the Gulf of Mexico offshore Charlotte Harbor, Florida.

Comments on this DEIS will be received until 45 days from the date of the publication of its Notice of Availability in the Federal Register. Comments should be addressed to:

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July 15, 1987
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ENVIRONMENTAL PROTECTION AGENCY
DRAFT
ENVIRONMENTAL IMPACT STATEMENT (EIS)
FOR
CHARLOTTE HARBOR, FLORIDA
OCEAN DREDGED MATERIAL DISPOSAL SITE
DESIGNATION

Prepared by: U.S. Environmental Protection Agency
in cooperation with:
The U.S. Army Corps of Engineers
Jacksonville District

ENVIRONMENTAL IMPACT STATEMENT
FOR
CHARLOTTE HARBOR, FLORIDA
OCEAN DREDGED MATERIAL DISPOSAL
SITE DESIGNATION

(X) Draft
( ) Final
( ) Supplement to Draft

Responsible agency: U.S. Environmental Protection Agency, Region IV in cooperation with the U.S. Army Corps of Engineers, Jacksonville District.

ABSTRACT: The proposed action is permanent designation of a Charlotte Harbor, Florida Ocean Dredged Material Disposal Site (ODMDS). The proposed site overlies the existing interim site located at coordinates: 26°37'36"N, 82°19'55"W; 26°37'36"N, 82°18'47"W; 26°36'36"N, 82°18'47"W; and 26°36'36"N, 82°19'55"W, located approximately four nautical miles (nmi)(7.4 km) west of Cayo Costa and six nmi (11.1 km) southwest of Boca Grande Pass. The purpose of this action is to recommend an environmentally acceptable location for the ocean disposal of dredged materials. Temporary, short-term environmental impacts include smothering of benthos and increases above the ambient of turbidity and sedimentation levels within the proposed site during disposal operations. Alternatives considered are no action and designation of an alternative disposal site.

Comments on this DEIS are due within 45 days from the date of the Notice of Availability published in the Federal Register. This date is __________.

Further information can be obtained from or comments addressed to:

Ms. Sally S. Turner, Chief
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OCEAN DREDGED MATERIAL DISPOSAL
FINAL DESIGNATION

1.00 SUMMARY

1.01 Major Conclusions and Findings. Criteria for the selection of ocean disposal sites are stated in sections 228.5 and 228.6 of the Ocean Dumping Regulations . Based on these criteria the interim Charlotte Harbor Ocean Dredged Material Disposal Site (ODMDS) is considered the preferred site for dredged material disposal. Boundary coordinates of the existing interim ODMDS are: 26°37'36"N, 82°19'55"W; 26°37'36"N, 82°18'47"W; 26°36'36"N, 82°18'47"W; and 26°36'36"N, 81°19'55"W. The proposed action does not exempt the use of the site from additional environmental review, nor does it exempt the dredged materials from compliance with Ocean Dumping Regulations and Criteria prior to disposal. Alternatives to the final designation of the interim site are no action and the designation of an ocean disposal site other than the interim site. The interim designation of the Charlotte Harbor ODMDS will expire in 1988 if final designation is not conferred.

Nearshore waters in the vicinity of the Charlotte Harbor ODMDS are partially to completely mixed, turbid, and typically well-oxygenated. Surficial sediments vary from coarse sand and shell fragments to fine sands. Sediment resuspension and transport is frequent during winter storms. Benthic communities are composed of small-bodied species with short generation times, characteristic of unstable sand substrates. Several commercially important finfish and shellfish species migrate through the nearshore areas to the adjacent coastal estuaries. Dredged sediments from the Charlotte Harbor entrance channel are coarse to fine sands, with some silt and shell hash, which are chemically and texturally similar to disposal site sediments.

The current site has been in use on an interim basis since 1978. Recent site surveys (Appendices A and B) detected no significant adverse effects to the water or sediment quality or cumulative changes in the biota which would be attributed to previous dumping. Concentrations of suspended particulate matter and trace metals in waters overlying the ODMDS were similar to those in adjacent stations. Similarly, sediment texture and sediment concentrations of trace metals and organics were characteristic of uncontaminated nearshore sediments. The dominant macrofauna and epifauna collected during the surveys were both seasonally and spatially variable. Large natural variabilities in species abundances can obscure detection of possible minor impacts from previous dumping. Nevertheless, organisms collected during the surveys were characteristic of the variable, benthic communities present throughout the nearshore southwest Florida area. Minor and temporary effects of dredged material disposal at the Charlotte Harbor ODMDS may be limited to increases in suspended sediment concentrations and smothering of benthic infauna. Nearshore waters are characteristically turbid, therfore minor increases in suspended particulate concentrations are not considered significant. Smothering of infaunal organisms is restricted to within site boundaries. Recolonization rates are dependent on the variable natural conditions.

1.02 Areas of Controversy. The U.S. Environmental Protection Agency is not aware of any areas of controversy associated with this proposed final designation. The current site meets all site selection criteria contained in sections 208.5 and 208.6 of the Ocean Dumping Regulations and has been in use on an interim designation since 1978.

1.03 Unresolved Issues. There are no unresolved issues relating to the environmental consequences of this site designation.

2.00 PURPOSE OF AND NEED FOR ACTION.

2.01 Purpose and Need for the Proposed Action. The purpose of the proposed action is to provide an environmentally acceptable location for the ocean disposal of dredged materials from Charlotte Harbor channel systems. The need for ocean disposal is determined on a case-by-case (project-by-project) basis as part of the process of issuing permits for ocean disposal. Disposal of dredged material in the ocean is regulated by provisions in section 103 of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA, PL 92-532). Land (upland) disposal alternatives are considered when evaluating the need for ocean disposal. This alternative is generally used for dredged material found unsuitable for ocean disposal.

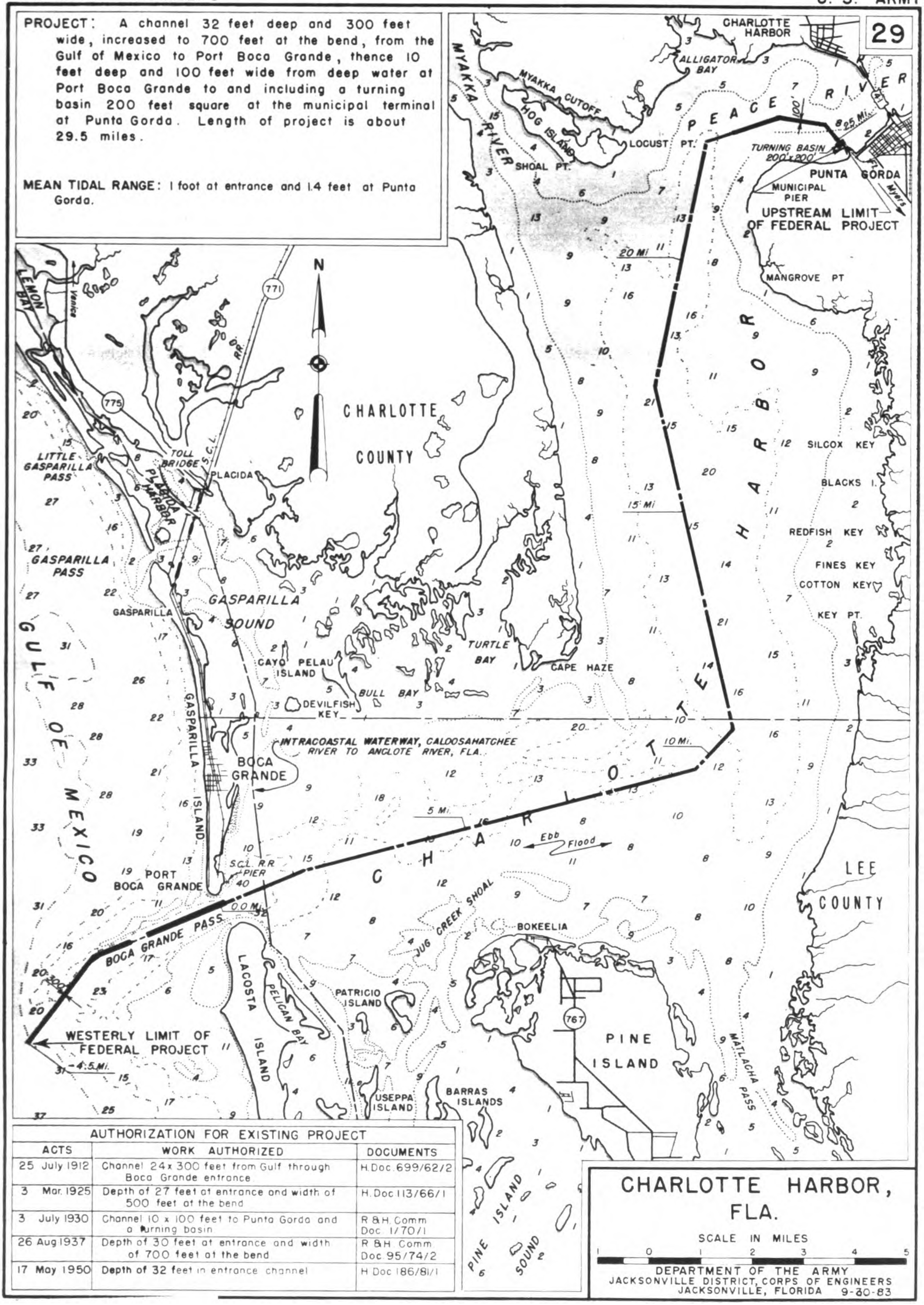
2.02 Charlotte Harbor Waterborne Commerce and Related Activities.

The Charlotte Harbor ports accommodated 877,126 tons of domestic commodities in 1982 (U.S. Army Corps of Engineers, 1982). Approximately every two years, the outer entrance channel to Charlotte Harbor must be dredged because natural processes cause it to shoal (Figure 1). The U.S. Army Corps of Engineers (CE) is responsible for planning the maintenance dredging and conducting the necessary dredging and disposal operations. For the CE's Jacksonville District to maintain the entrance channel to its authorized depths of 32 feet, approximately 250,000-300,000 yd^3 must be removed from the entrance channel every one and one-half to two years. The complete dredging history of Charlotte Harbor from 1913 to 1985 is described in Table 1 with a location map (Figure 2).

2.03 State of Florida - Charlotte Harbor Management Plan

The State of Florida has developed management plans for designated areas throughout the State, including Charlotte Harbor. These plans establish criteria and guidelines for wise use of environmentally sensitive areas. One objective of the Charlotte Harbor Management Plan, through the Florida Department of Environmental Regulation, is the requirement of all public works projects involving dredging and filling to have a long-term dredged material disposal plan which addresses location of the dredged material, manner of disposal, and a maintenance program. The proposed action would constitute partial fulfillment of this requirement.

CORPS OF ENGINEERS U. S. ARMY



PROJECT: A channel 32 feet deep and 300 feet wide, increased to 700 feet at the bend, from the Gulf of Mexico to Port Boca Grande, thence 10 feet deep and 100 feet wide from deep water at Port Boca Grande to and including a turning basin 200 feet square at the municipal terminal at Punta Gorda. Length of project is about 29.5 miles.

MEAN TIDAL RANGE: 1 foot at entrance and 1.4 feet at Punta Gorda.

AUTHORIZATION FOR EXISTING PROJECT

ACTS	WORK AUTHORIZED	DOCUMENTS
25 July 1912	Channel 24 x 300 feet from Gulf through Boca Grande entrance	H. Doc. 699/62/2
3 Mar. 1925	Depth of 27 feet at entrance and width of 500 feet at the bend	H. Doc 113/66/1
3 July 1930	Channel 10 x 100 feet to Punta Gorda and a turning basin	R & H. Comm Doc. 1/70/1
26 Aug 1937	Depth of 30 feet at entrance and width of 700 feet at the bend	R & H. Comm Doc 95/74/2
17 May 1950	Depth of 32 feet in entrance channel	H Doc 186/81/1

CHARLOTTE HARBOR, FLA.

SCALE IN MILES

1 0 1 2 3 4 5

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA 9-30-83

FIGURE 1

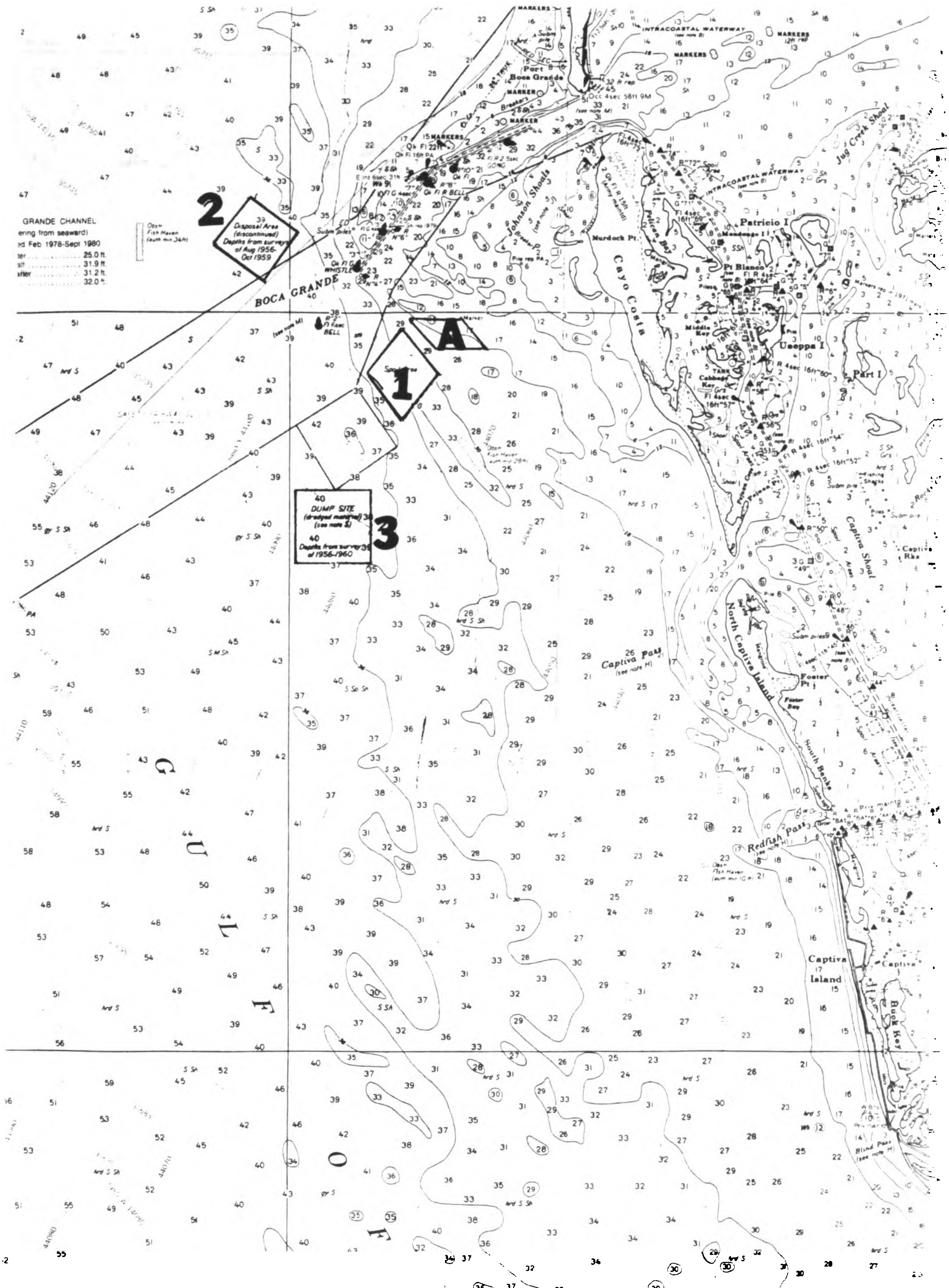


FIGURE 2 - Ocean Disposal Areas
1913-1985

TABLE 1
DREDGING HISTORY: CHARLOTTE HARBOR 1913 - 1985

PERIOD	DREDGE	CUBIC YARDS DREDGED	DISPOSAL AREA (See figure 2)
1913	Key West	316,444 (New Work)	There is no clear idica-tion of where this mater-ial was disposed. The disposal area was south of the channel in about the area labeled "A". Exact size and location are unknown.
5-25 Sep 1919	Benyuard	Not Reported	
22 May-11 Jly 1923	Caucus	96,500	
12 Apr-12 May 1926	Kingman	121,688	
24 Aug-14 Dec 1926	Kingman	550,950 (New Work)	
27 Feb-19 Apr 1929	Kingman	272,587	
1-18 Apr 1929	Absecon	45,610	
5 Oct-6 Nov 1931	Benyuard	308,661	
29 Jan-13 Aug 1936	Chinook	432,050	
15 Aug-19 Oct 1938	Atlantic	314,786 (New Work)	
12 Jun-5 Aug 1939	San Pablo	62,633 (New Work)	
6-31 Aug 1939	San Pablo	63,419	
10 Sep 1945 - 1 Mar 1946	San Pablo	384,160	
20 Dec 1949 - 20 Jan 1950	Hyde	132,000	
6-26 Apr 1952	Gerig	291,000	
3-14 Oct 1953	Langfitt	167,000	
19 Oct-2 Nov 1955	Langfitt	151,742	
- - - - -	- - - - -	- - - - -	- - - - -
2 Nov-15 Dec 1958	Hyde	135,504 (New Work)	D/A 1
7 Apr-7 May 1959	Gerig	289,563 (New Work)	D/A 1
16-20 Apr 1962	Gerig	80,715	D/A 1
28 Nov 1961 - 10 Jan 1962	Hyde	194,426	D/A 1
31 Jul-21 Aug 1963	Gerig	250,938	D/A 1
3-20 Apr 1965	Gerig	321,330	D/A 1
23 Feb-17 Mar 1966	Hyde	83,188	D/A 1
16-29 Jan 1967	Gerig	240,583	D/A 1
5-16 Nov 1967	Gerig	156,204	D/A 1
30 May-14 Jun 1969	McFarland	247,016	D/A 1
25 Feb-3 Mar 1970	Gerig	68,000	D/A 2
11-22 Apr 1971	Gerig	162,910	D/A 1
15 Jul-13 Aug 1973	Gerig	509,609	D/A 1
15-31 Jan 1975	Gerig	239,186	D/A 1
9-27 Apr 1976	Hyde	47,500	D/A 1
29 Aug-1 Oct 1976	Hyde	96,189	D/A 1
4 Apr-1 Sep 1978	McFarland	85,141	D/A 3
4 Apr-1 Sep 1978	Goethals	114,022	D/A 3
4 Apr-1 Sep 1978	Langfitt	220,140	D/A 3
26 Feb-25 Apr 1980	Sugar Island	238,784	D/A 3
22 Sep-15 Nov 1981	McFarland	244,062	Beach Disposal Gasparilla Island
Nov 1983-Feb 1984	Virginia	227,000	D/A 3
2 Aug-27 Sep 1985	Eagle	436,377	D/A 3

3.00 ALTERNATIVES INCLUDING THE PROPOSED ACTION

3.01 Introduction. The proposed action is the final designation of the interim Charlotte Harbor ODMDS. Alternatives to the proposed action include no action and designation of alternate ocean disposal site. The designation of an ODMDS does not preempt any other disposal alternative but does ensure that an ocean disposal alternative is available. Each disposal action will be evaluated on a case-by-case basis with the method of disposal that is in the best interest of the public being selected.

3.02 No Action Alternative.

By taking no-action, the present interim site will not receive final designation and the interim designation will expire in 1988. Consequently, the CE will not have an environmentally and economically acceptable EPA approved ODMDS offshore Charlotte Harbor after 1988. In order to dispose dredged material at sea the CE would have to identify an ocean disposal site and request approval from the EPA. This process results in the use of a site that has not been studied to the extent of an EPA designated site.

3.03 Alternative Sites Consideration.

Potential ocean dredged material disposal sites are evaluated based on selection factors and criteria contained in sections 228.5 and 228.6 of the Ocean Dumping Regulations. Preliminary screening of potential sites for the Charlotte Harbor ODMDS were conducted through review of historical and contemporary data. This screening concluded that the interim site was worthy of intensive study. On-site biological and oceanographic surveys were conducted at the interim site. Critical resources and uses in the area and the potential for adverse impacts were examined. Based on the results of this study it was concluded that the existing interim site (Figure 3) conforms to all specified ODMDS site selection criteria and is the preferred site. This selection is consistent with the Ocean Dumping Regulations which recommends that sites which have been historically used be selected when feasible. Therefore, no additonal investigations were made to evaluate other ocean disposal sites.

4.00 AFFECTED ENVIRONMENT

4.01 Physical Characteristics.

Circulation and Transport

Circulation on the inner Continental Shelf off Charlotte Harbor is complex in nature. There are four basic types of currents that influence waters in the interim ODMDS vicinity; (1) the major offshore current system, (2) wave induced littoral drift, (3) currents associated with the ebb and flood tides through Boca Grande Channel, and (4) wind generated currents.

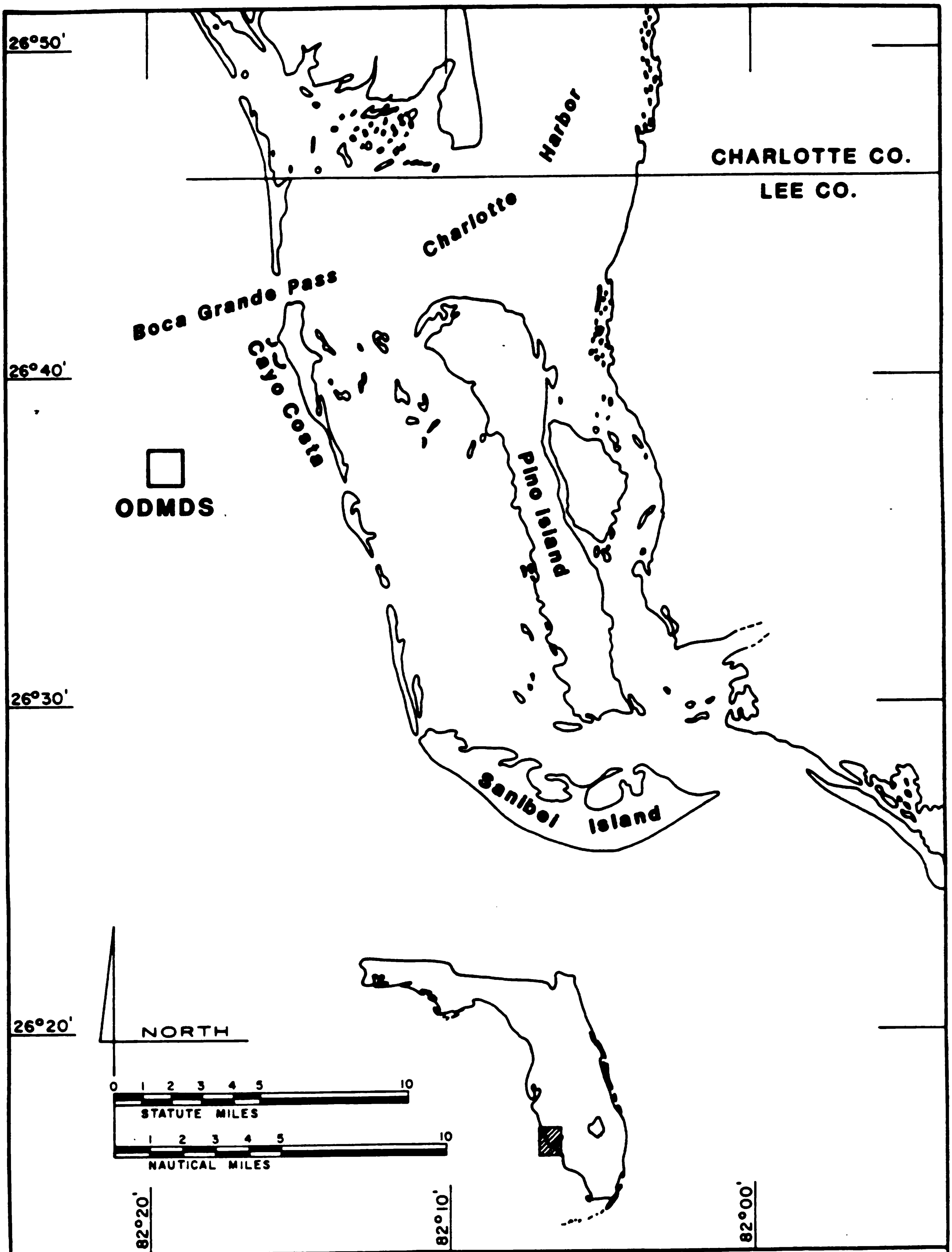


FIGURE 3

GENERAL LOCATION MAP

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

The Gulf Loop Current dominates the circulation pattern in the offshore waters of the eastern Gulf (Jones et al., 1973). On the Continental Shelf off Charlotte Harbor, this Loop Current, moving clockwise, drives a standing cyclonic (counterclockwise) eddy which moves coastal waters to the north. Both the Loop Current and resultant eddies exhibit considerable variability.

Taylor (1974) reports a net southerly littoral drift in the coastal waters off Charlotte Harbor. While a dominant current along the coast, this littoral drift is probably not of major significance in waters over 1.8 m (6 ft) deep (Missimer and Associates, 1985).

In the ODMDS vicinity, circulation is primarily influenced by tidal and wind driven currents. These patterns are both complex and variable, dependent upon interactions between wind, tides, and bottom morphology. Tidal currents at the ODMDS may have the capacity to transport fine-grain sediment (Missimer and Associates, Inc., 1985). High winds associated with major weather systems may also generate currents capable of transporting sediment. Currents are generally greatest in surface waters and become progressively weaker with depth.

Prevailing winds in the area are from the east over most of the year, although the strongest winds are predominantly from the north and east (Continental Shelf Associates, 1981; Drew and Schomer, 1984). Such winds contribute to sediment movement offshore.

<u>Light Attenuation</u>

Results of a recent survey (see Appendix A) indicate that, in the winter, waters in the disposal site vicinity are relatively clear. During this survey, a significant portion of surface insolation reached the bottom in depths approaching 40 ft (12.2 m). Within the ODMDS vicinity, light penetration was greatest at locations farthest removed from Boca Grande Channel and estuarine influence.

4.02 <u>Geological Characteristics</u>

Depths at the Charlotte Harbor interim ODMDS range from 39 to 44 ft. (11.9 to 13.4 m). In the immediate ODMDS vicinity, the average declivity of the Continental Shelf is approximately 3.6 ft. (1.1 m) per nautical mile (1.85 km). A bathymetric map of the study area is presented in Figure 4.

Surficial sediments in the disposal site vicinity are variable in composition, ranging from coarse sand and shell fragments to fine sands. Sediments of the area can best be described as "moderately" sorted. A detailed analysis of site sediments is presented in Appendix A.

4.03 <u>Chemical Characteristics</u>

<u>Toxic Constituents</u>

In December, 1985, samples were collected from near-bottom waters in the Charlotte Harbor ODMDS vicinity to identify water quality impacts which may

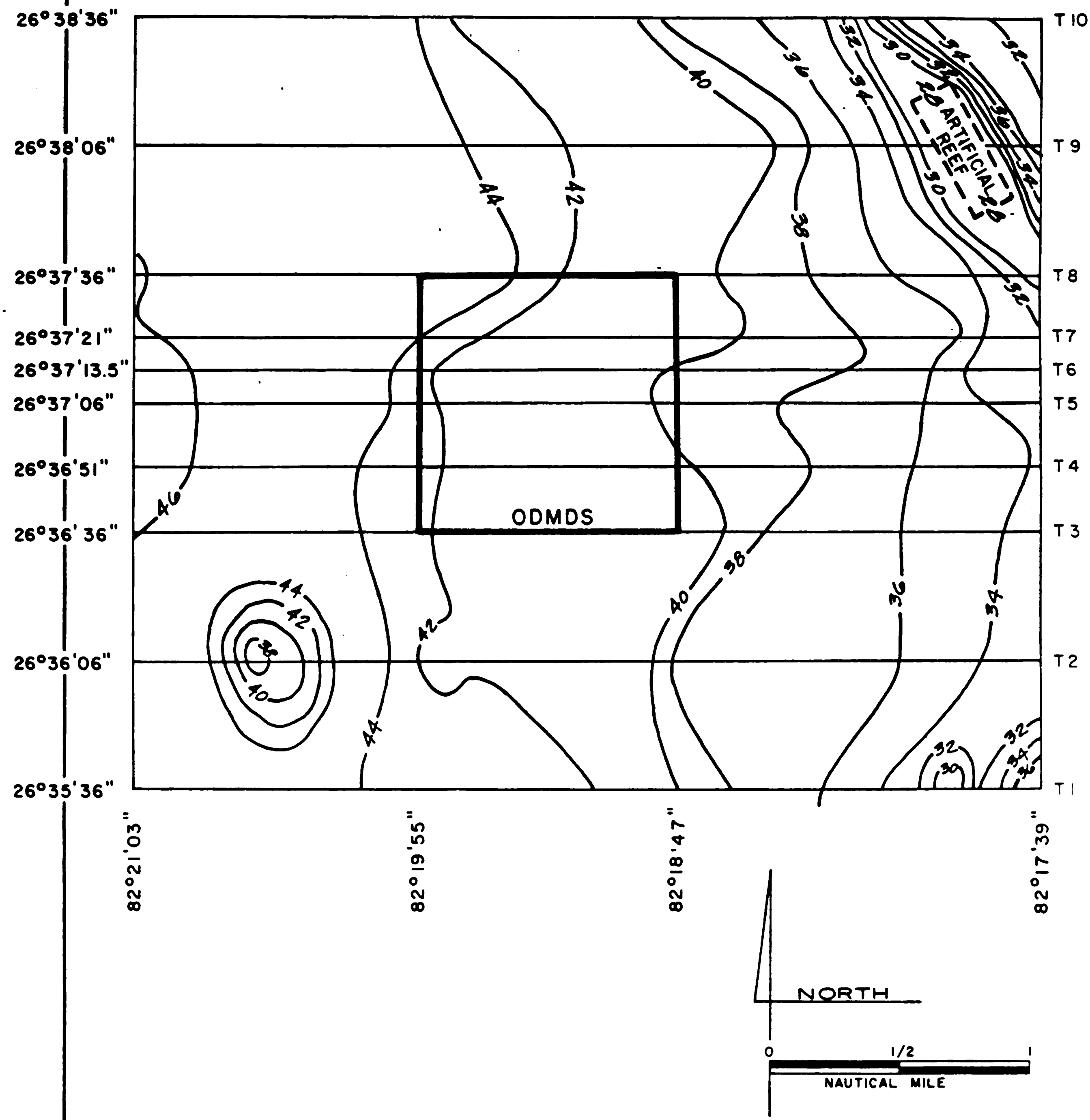


FIGURE 4

BATHYMETRIC MAP

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

have resulted from prior use of the site and to establish baseline conditions (see Appendix A). The specific groups of potential contaminants selected for investigation included pesticides, polychlorinated biphenyls (PCB's), and high molecular weight hydrocarbons. None of these compounds were found in detectable concentrations in near-bottom waters sampled at sites outside and within the boundaries of the designated interim ODMDS.

Samples for the analysis of selected trace metals were also collected from near-bottom waters in December, 1985. The metals tested for were mercury, cadmium, and lead. Neither mercury nor lead were present in detectable concentrations. Low concentrations of cadmium were found in two samples taken within and one taken outside ODMDS boundaries. These concentrations were typical and below the average cadmium levels found in seawater (see appendix A).

Dissolved Oxygen

Dissolved oxygen concentrations in the disposal site vicinity were measured in December, 1985 (Appendix A). Concentrations were similar at sites within the ODMDS and in surrounding areas. DO concentrations measured in disposal area surface waters between dawn and dusk averaged about 8.0 ppm. No DO stratification was noted. Generally, concentrations decreased less than 1 ppm between the surface and bottom. DO concentrations were typically at or above saturation and rarely varied from saturation by more than 15 percent.

Solids (Suspended Solids and Turbidity)

Suspended solids concentrations measured in disposal area bottom waters in December, 1985 (Appendix A) ranged from 5 to 22 mg/l. No differences were observed between sites located within the ODMDS and those in the surrounding area. Higher suspended solid concentrations were found at sites closest to shore and lower concentrations at sites south of the ODMDS and farthest removed from Boca Grande Channel. The U.S. Geological Survey (USGS, 1985) has reported similar suspended solids concentrations for area waters, ranging from 0 to 19 mg/l and averaging 10 mg/l.

Turbidity levels of 10 NTUs and under were measured in the area in December, 1985 (Appendix A). The USGS reports lower turbidity levels, ranging from 0.1 to 0.6 NTU for a site located off Boca Grande in the general ODMDS vicinity. These turbidity levels appear normal, nearshore waters in this area are characteristically turbid and daily levels can be highly variable.

Sediment Chemistry

Sediment samples were taken from within and outside of the site boundaries for sediment chemistry analysis (appendix A). Levels of trace metals (mercury, cadmium, and lead) and pesticides were low in all samples. Concentrations of PCB's, high molecular weight hydrocarbons, total organic carbon, and oil and grease were highest in a sample collected from a station located north of the ODMDS. This station was located in an area heavily used by both commercial and recreational vessels near Boca Grande Channel and within Charlotte Harobor's deep water anchorage. The results show no indication of an increase in contaminant levels in sediments collected at the Charlotte Harbor interim ODMDS.

4.04 Biological Characteristics

Benthic Macroinfauna

The benthic macroinfauna of the study area are dominated by polychaete worms and crustaceans. A December, 1985 survey of the benthos of the ODMDS vicinity (Appendix A) found that these two groups accounted numerically for over eighty percent of the benthic invertebrates. Similar findings have been reported by Environmental Science and Engineering (1978) for stations located near Boca Grande Pass.

Polychaete species characteristic of the ODMDS vicinity include *Paraprionospio* sp., *Mediomastus* sp., *Prionspio* sp., and *Polygordius* sp. Crustaceans common to the area include the amphipods, *Ampelisoa* sp., *Corophium* sp., and *Melita* sp., cumaceans, and decapods of the super-family Thalassinoidea and the family Paguridae. Molluscs and oligochaete worms were also common though less abundant components of the benthic macroinfauna, generally comprising less than ten percent of the community in number. The cephalochordate *Branchiostoma floridae* was also common throughout the disposal area. Results of a December, 1985 survey (Appendix A) do not indicate consistent differences in benthic macroinvertebrate diversity between stations located within the ODMDS and those located in nearby environs.

Data from one ODMDS station was suggestive of a site recovering from disposal related impacts. While the abundance of invididuals at this site was relatively low, organisms colonizing the site were similar to those established in nearby, physically similar sediments, outside the ODMDS.

Epibenthic Invertebrates

Epibenthic invertebrates collected from the disposal area vicinity in December, 1985 include the crab (*Portunus spinimanus*), conch (*Strombus alatus*), pink shrimp (*Penaeus duorarum*), and sea urchin (*Opiophraymus* sp.) (Appendix A). These species are characteristic of the epibenthos of shallow sand bottoms of the West Florida Shelf.

Hardbottom Communities

No natural reefs or hard bottom communities have been identified within a 4.2 nmi (7.8 km) radius of the disposal area (figure 5). An underwater video survey was made of the interim site and surrounding bottom up to a distance of five and three quarters nautical miles away. The EPA's research vessel OSV *Anderson* conducted this survey from March 23 to 29, 1985. Three video transects were run (figure 6); transect 1 within and adjacent to the

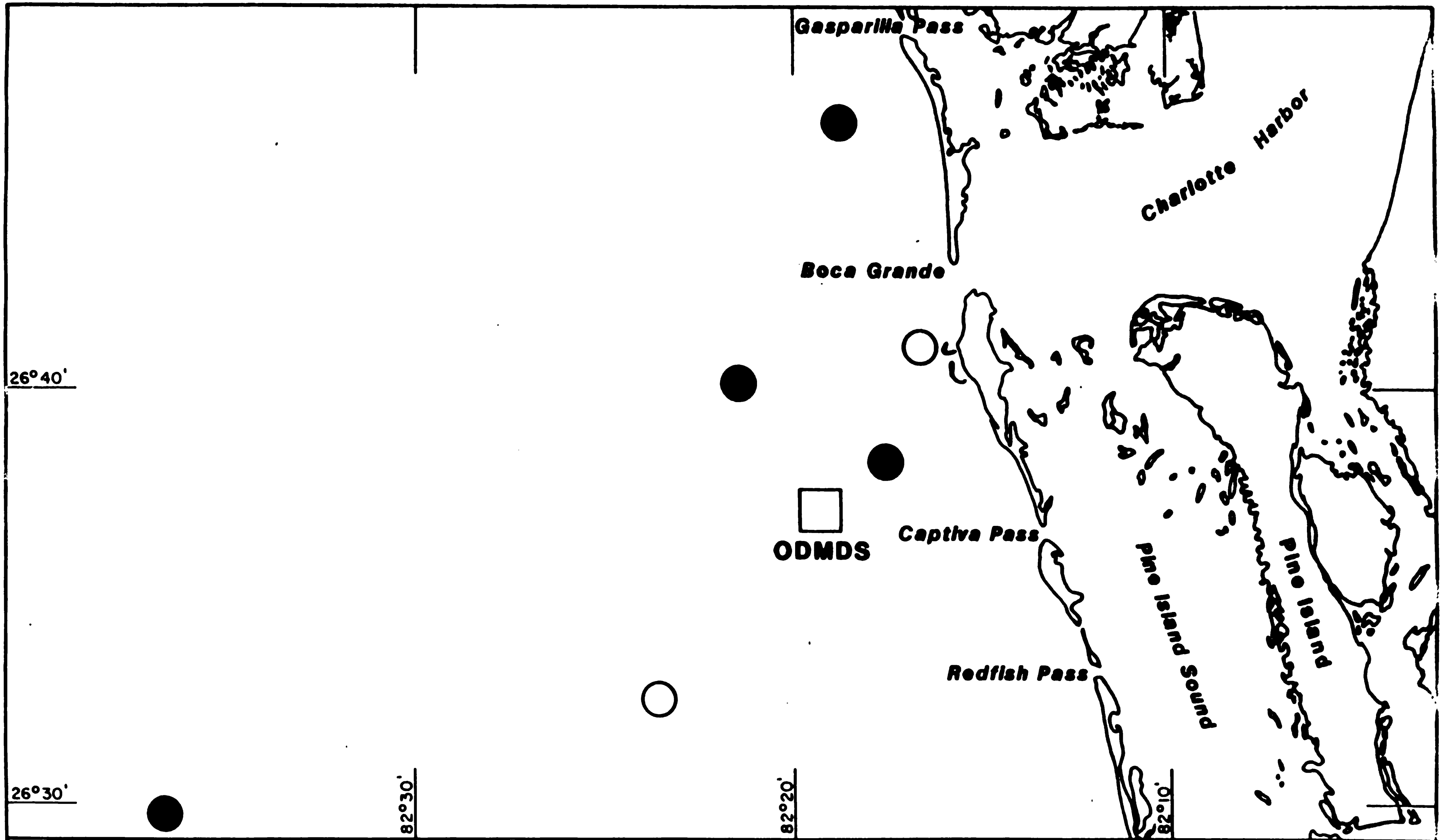


FIGURE 5

NATURAL AND ARTIFICIAL REEFS

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

○ Natural Reef
● Artificial Reef

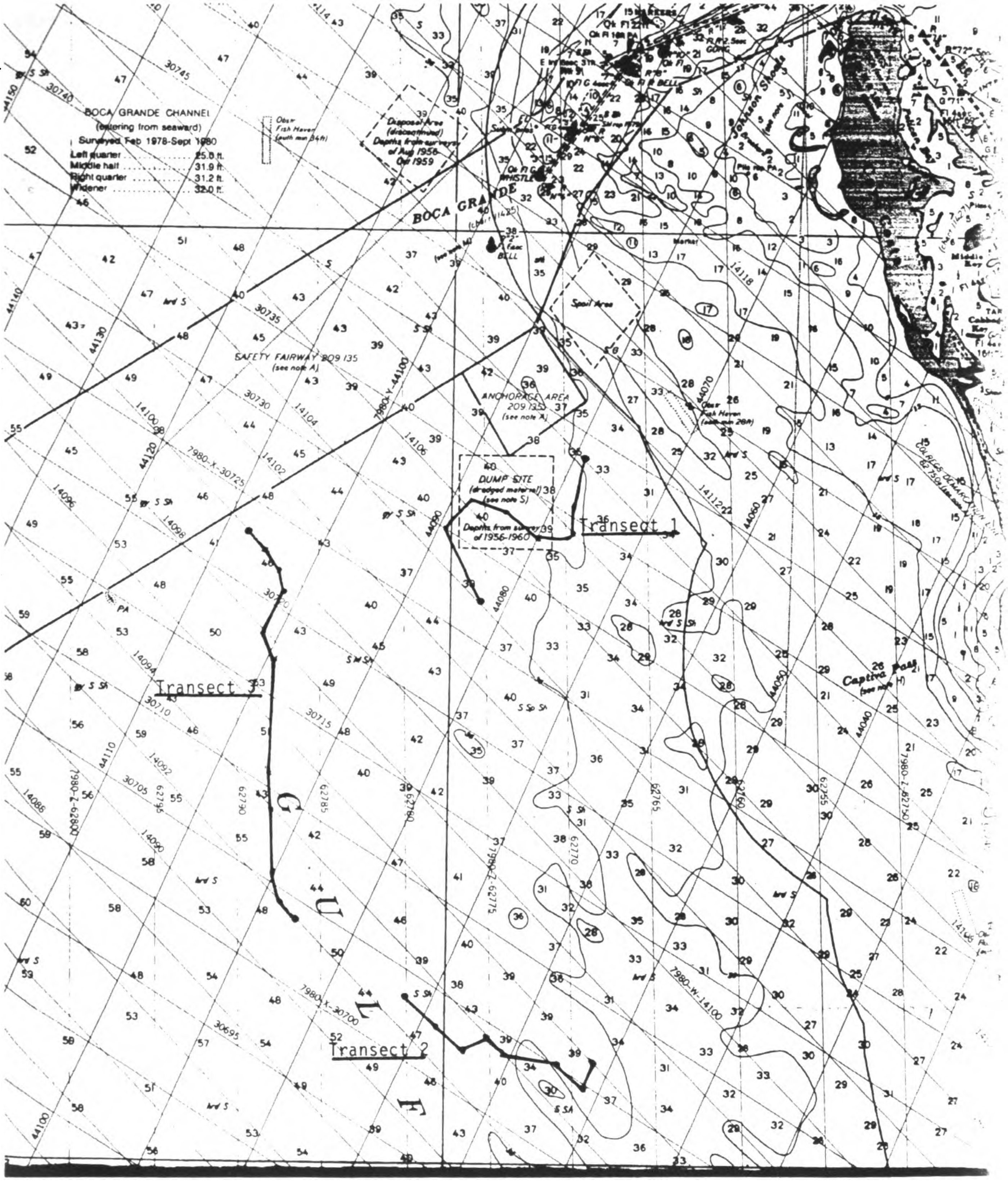


FIGURE 6. Video Transect Locations. March 23-29,1985
Charlotte Harbor ODMDS.

interim site; transect 2 five and three quarter nmi south; and transect 3 three nmi west. Transect 1 featured a flat sandy bottom both within the site and adjacent to the site. Transect 2 and 3 both showed flat sandy bottom with small and large areas containing sponges and corals along various segments of the transects.

Fish

The Charlotte Harbor estuarine complex is regarded as an extremely valuable nursery ground for fishes of importance to both sport and commercial fisheries (Taylor, 1974). Fishes within the estuary have been inventoried by Finucane (1965), Gunter and Hall (1965), and Wang and Raney (in Taylor, 1974). These authors found the most abundant inshore fishes to be the bay anchovy (Anchoa mitchilli) and the pinfish (Lagodon rhomboides). Wang and Raney (1971) listed the next most abundant species as silver perch (Bairdiella chrysura), pigfish (Orthopristis chrysopterus), silver jenny (Eucinostomus gula), and sand seatrout (Cynoscion arenarius). Other endemic and abundant fish in the Charlotte Harbor estuary include the striped mullet (Mugil cephalus), tidewater silverside (Menidia beryllina), spot (Leiostomus xanthurus), sea oatfish (Arius felis), hogchoker (Trinectes maculatus), mosquitofish (Gambusia affinis), and scaled sardine (Harengula jaquana).

Fishes endemic to coastal hard bottom communities near Sarasota have been reported by Smith (1976). The offshore fish fauna is relatively uniform along Florida's west coast, and this account is also applicable to waters off Charlotte Harbor. This author found that the most common fishes at hard bottom reef areas in water 12-18m deep were red grouper (Epinephelus morio), gag (Mycoeroperca microlepis), scamp (M. phenax), belted sandfish (Serranus subligarius), whitespotted soapfish (Rypticus maculatus), gray snapper (Lutjanus griseus), and white grunt (Haemulon plumieri). Other abundant species included sheepshead (Archosargus probatocephalus), cubbyu (Equetus umbrosus), blue angelfish (Holacanthus bermudensis), cocoa damselfish (Pomacentrus variabilis), slippery dick (Halichoeres bivittatus), hogfish (Lachnolaimus maximus), seaweed blenny (Blennius marmoreus) and gray triggerfish (Balistes capriscus).

Fish were collected by trawl from the ODMDS vicinity in a December, 1985 survey (Appendix A). Species collected were pelagic or representative of sand bottom environments. The most abundant species collected was white grunt (Haemulon plumieri). Other species represented in trawl samples were sand perch (Diplectrum formosum), lizardfish (Synodus foetens), leopard sea robin (Prionotus scitulus), spanish grunt (Haemulon macrostomum), planehead filefish (Monacanthus hispidus), and scrawled cowfish (Lactophrys tricornis).

Endangered and Threatened Species

A number of aquatic species which are classified by the Florida Game and Fresh Water Fish Commission (FGFWFC), the U.S. Fish and Wildlife Service

(USFWS), and the National Marine Fisheries Service (NMFS) as endangered, threatened, or of special concern are found in Charlotte Harbor area coastal waters. A listing of these species and their regulatory status is given in Table 2.

Five species of marine turtles which are listed as threatened or endangered occur in area waters. These include the green turtle (Chelonia mydas), hawksbill turtle (Eretmochelys imbricata), Kemp's ridley turtle (Lepidochelys kempii), leatherback turtle (Dermochelys coriacea), and the loggerhead turtle (Caretta caretta). Of these sea turtles, only the loggerhead regularly nests on Florida's west coast, mainly on barrier islands such as Sanibel Island (FGFWFC, 1980).

Table 2. Endangered or Threatened Species of the Charlotte Harbor ODMDS Area Classified by State and Federal Agencies.

Common Name	Scientific Name	State	Federal
REPTILES			
Green turtle	*Chelonia mydas*	T	T
Hawksbill turtle	*Eretmochelys imbricata*	E	E
Kemp's ridley turtle	*Lepidochelys kempii*	E	E
Leatherback turtle	*Dermochelys coriacea*	E	E
Loggerhead turtle	*Caretta caretta*	T	T
MAMMALS			
West Indian manatee	*Trichechus manatus*	E	E
Finback whale	*Balaenoptera physalus*	E	E
Humpback whale	*Megaptera novaeangliae*	E	E
Right whale	*Eubalaena glacialis*	E	E
Sei whale	*Balaenoptera borealis*	E	E
Sperm whale	*Physeter macrocephalus (catodon)*	E	E

State: Listed by the Florida Game and Fresh Water Fish Commission

Federal: Listed by the U.S. Fish and Wildlife Service

Legend: E = Endangered
T = Threatened

Five species of whales listed as endangered by both federal and state agencies may occur in the area. These are the finback whale (Balaenoptera physalus), humpback whale (Megaptera novaeangliae), right whale (Eubalaena glacialis), sei whale (Balaenoptera borealis), and the sperm whale (Physeter macrocephalus). The right whale, sperm whale, and humpback whale have been documented in the waters off southwest Florida (Caldwell and Caldwell, 1973). Taylor (1974) reports that the sperm whale has been observed in the Gulf off Charlotte Harbor.

Manatees (Trichechus manatus) primarily inhabit inshore waters and are found in the Charlotte Harbor area throughout the year. Manatees tend to concentrate in areas with vascular aquatic vegetation, within channels at least 2 meters deep, where warm water is available during winter cold snaps, and where there are sources of fresh water. Principal threats to manatees include power boats, poaching, vandalism, and habitat destruction (FGFWFC, 1980). The proposed action is located well outside the preferred habitat and usual range of the manatee. Several species of marine mammals in addition to those listed as threatened or endangered occur or may occur in area waters. The most abundant and widespread mammal in coastal waters is the bottlenose dolphin (Tursiops truncatus) while the spotted dolphin (Stenella plagiodon) is probably the most common species offshore (Campbell and Campbell, 1973). There have been numerous reports of strandings of the short-finned pilot whale (Globicephala macrohyncha) along the southwest Florida coast. Other marine mammals of which there are infrequent (sometimes singular or unverified) records from tne waters off this coast, are are the Antillean beaked whale (Mesoplodon europaeus), pygmy sperm whale (Kogia breviceps), goose-beaked whale (Ziphius cavirostris), killer whale (Orcinus orca), common dolphin (Delphinus delphis), longsnouted dolphin (Stenella longirostris), bridled dolphin (Stenella frontalis), and the California sea lion (Zalophus californianus) (Campbell and Campbell, 1973).

The disposal of dredged material at the proposed site will not affect listed species under jurisdiction of the NMFS and the USFWS. The area of the site is small in comparison to their total available ocean habitat and these species range over large areas of ocean. There is no indication that any past disposal activities have had any adverse effects on any of these species.

The NMFS and USFWS have concurred with the determination that populations of endangered and threatened species under their jurisdictions will not be effected by the final designation of the proposed site (Appendix C).

4.05 Dredged Sediment Charcteristics

Core borings were taken from the entrance channel by the U.S. Army Corps of Engineers prior to the 1983 maintenance dredging operations. These samples were composed of fine to medium quartz sand with traces of silt and clays. Chemical analysis of the water and sediment elutriate test is presented in Table 3.

Table 3. Water and Sediment Elutriate Test Results
Boca Grande Pass Entrance Channel, March 1979 (Corps of Engineers).

Parameter	Sample No. 1 Receiving Water	Elutriate	Sample No. 2 Receiving Water	Elutriate
Nitrogen, ammonia,mg/l	0.02	0.55	0.04	0.39
Ortho,phosphorous, mg/l	0.02	0.10	0.02	0.12
Oil,grease,mg/l	8.9	9.0	3.1	4.7
Lead,ug/l	4.0	3.7	1.9	3.3
Zinc,ug/l	22	36	11	32
Iron,ug/l	5.0	4.0	4.0	7.5
Nickel,ug/l	0.7	3.6	0.6	3.5
Copper,ug/l	1.0	1.6	0.7	1.6
Maganese,ug/l	<0.5	<0.5	<0.5	<0.5
Mercury,ug/l	<0.5	<0.5	<0.5	<0.5
Selenium,ug/l	<5	<5	<5	<5
PCB's,total,ug/l	<2	<2	<2	<2

4.06 Commercial and Recreational Fisheries Resources

A variety of commercially important species are harvested from ODMDS area waters. This fishery has been described by Prochaska and Cato (1975) and by Landrum and Prochaska (1980). Finfish of commercial significance include striped (black) mullet (Mugil cephalus), spotted seatrout (Cynoscion nebulosus), pompano (Trachinotus carolinus), grouper (Mycteroperca sp. and Epinephelus sp.), red snapper (Lutjanus campechanus), and red drum (Sciaenops ocellata). Other important fisheries include pink shrimp (Penaeus duorarum), blue crab (Callinectes sapidus), and stone crab (Menippe meroenaria).

Most commercial fishing in the area is concentrated in inshore and nearshore waters and at offshore reefs and hard bottom areas. Mullet and spotted seatrout are predominantly taken in bays and estuaries. Pompano are caught in bays and along beaches. Some commercial pompano fishing is conducted in nearshore waters, generally in depths of less than 20 ft (6m). Red drum are also seasonally abundant in inshore and shallow coastal waters.

Commercial grouper and snapper fishing is generally conducted in deeper waters of the middle Shelf. These species are associated with hard bottom areas and sites with significant bathymetric relief.

The area's crab fishery is located primarily in the shallow waters of the Charlotte Harbor estuarine complex. Blue crabs are generally trapped along channel banks while stone crabs are taken from grassbeds and rocky areas. Pink shrimp are harvested for both food and bait from inshore and nearshore waters in the study area. Some shrimping activity may take place in the ODMDS vicinity, however, principal offshore shrimping grounds are located in deeper waters to the north (Sanibel Grounds) and south (Cape Romano Grounds) of the ODMDS (Bielsa et al., 1983). This species spawns in area waters throughout much of the year. Pink shrimp catches are highest from November to March (Puckett, 1985, pers. comm.).

The Charlotte Harbor area supports an active recreational fishery. Taylor (1974) lists the most highly prized sport fish as tarpon (Megalops atlantica), snook (Centropomus undecimalis), sheepshead (Archosarqus Probatocephalus), spotted seatrout (Cynoscion nebulosus), grey snapper (Lutjanus griseus), and red drum (Sciaenops ocellata). King mackerel (Scomberomorus cavalla), and spanish mackerel (S. maculatus) are also popular area game fish.

Sport fisheries may be divided into coastal fisheries, bottom fisheries, and pelagic fisheries (Rivas and Bullis, 1974). The majority of recreational fishing effort along the southwest Florida coast is spent along the beach and in brackish rivers, bays, and sounds (Bell et al., 1982). The primary species caught by coastal fishermen are spotted seatrout and sand seatrout (Cynoscion arenarius), porgies (Calamus spp.), croaker (Micropogon undulatus), black drum (Pogonias chromis), red drum, grunts (Haemulon spp.), and snook.

Bottom fishing concentrates on species of grouper (Epinephelus spp. and Mycteroperca spp.) and snapper (Lutjanus spp.). These species are generally taken from natural or artificial reefs and from hard-bottom areas. The location of natural and artificial reef areas in the ODMDS vicinity is shown in Figure 5 (Florida Sea Grant, 1979; Aska and Pybas, 1983; Puckett, 1985, pers. comm.).

The pelagic fishery concentrates on tarpon, king mackerel, spanish mackerel, pompano, dolphin (Coryphaena hippurus), tunas (Euthynnus spp.)., and cobia (Rachycentron canadum). Tarpon are a very popular game fish in the area and are primarily fished in the vicinity of passes, particularly Boca Grande Pass, in the spring and summer. King and spanish mackerel are widely fished in the area's coastal and nearshore waters, and are occasionally caught in the bays. Pompano, as well as jacks (Carangidae spp.) and blue fish (Pomatomus saltatrix), are popular game fish taken from inshore and nearshore waters and beaches. Dolphin and tunas are generally taken in deeper waters, beyond the ODMDS. Cobia are taken in coastal waters throughout the area and are generally found near buoys, markers, or floating debris.

4.07 Recreational Activities

The waters of the Charlotte Harbor area support a wide variety of recreational activities. Recreational fishing has been addressed in section 4.06 of this document. Inshore and coastal waters are also utilized for swimming, skiing, sailing, boating, surfing, skin diving, and SCUBA diving.

Inshore and nearshore waters are subject to the greatest recreational use. There are five Aquatic Preserves in the area; Cape Haze, Gasparilla Sound - Charlotte Harbor, Matlacha Pass, Pine Island Sound, and Estero Bay. These preserves, administered by the Florida Department of Natural Resources, are shown in Figure 7. The four aquatic preserves in the Charlotte Harbor estuarine system cover over 200 square miles, or approximately 90 percent of the surface water area of that system.

Several parks, preserves, recreational areas, and wildlife reserves are found along coastal portions of Charlotte and Lee Counties. These areas have been listed in Table 4 and shown in Figure 8. These include areas falling under federal, state, local, and private jurisdiction.

4.08 Shipping

The major entrance channel to Charlotte Harbor is Boca Grand Channel. This navigation channel extends in a southwesterly direction from Boca Grande Pass and passes approximately 0.8 nmi (1.5 km) to the north of the ODMDS. The deep water anchorage for Charlotte Harbor is located adjacent to the north boundary of the ODMDS.

4.09 Mineral Resources

There are no mineral extraction or desalination operations occurring in the Charlotte Harbor ODMDS vicinity and the EPA is not aware of any mineral resources in the area. Oil and gas reserves may exist on the Outer Continental Shelf (OCS) off Charlotte Harbor but the extent of such reserves is unproven at present.

5.00 ENVIRONMENTAL CONSEQUENCES

5.01 Introduction. An environmental assessment of potential impacts was performed based on criteria found in 40 CFR Parts 228.5, "General criteria for the selection of sites," and 228.6, "Specific criteria for site selection." These criteria deal with site evaluation in regards to requirements for effective ODMDS management to prevent unreasonable degradation of the marine environment. Each criterion is addressed as it relates to the site's suitability as a disposal site and/or it's ability to receive dredged material.

5.02 Geographical Position, Depth of Water, Bottom Topography and Distance From Coast (40 CFR 228.6 [a][1])

The general location of the Charlotte Harbor ODMDS is shown in Figure 3 and the boundary coordinates are referred to in the summary seciton. The site is located approximately 4 nmi. (7.4 km) west of the shore of Cayo Costa and about 6 nmi. (11.1 km) southwest of Boca Grande Pass. The bottom topography at the interim ODMDS site is relatively flat with a gentle westerly slope (Figure 4). Depths at the site range from 39 to 44 feet (11.9 to 13.4 m). In the ODMDS vicinity the average declivity of the bottom is approximately 3.6 ft (1.1 m) per nautical mile (1.85 km).

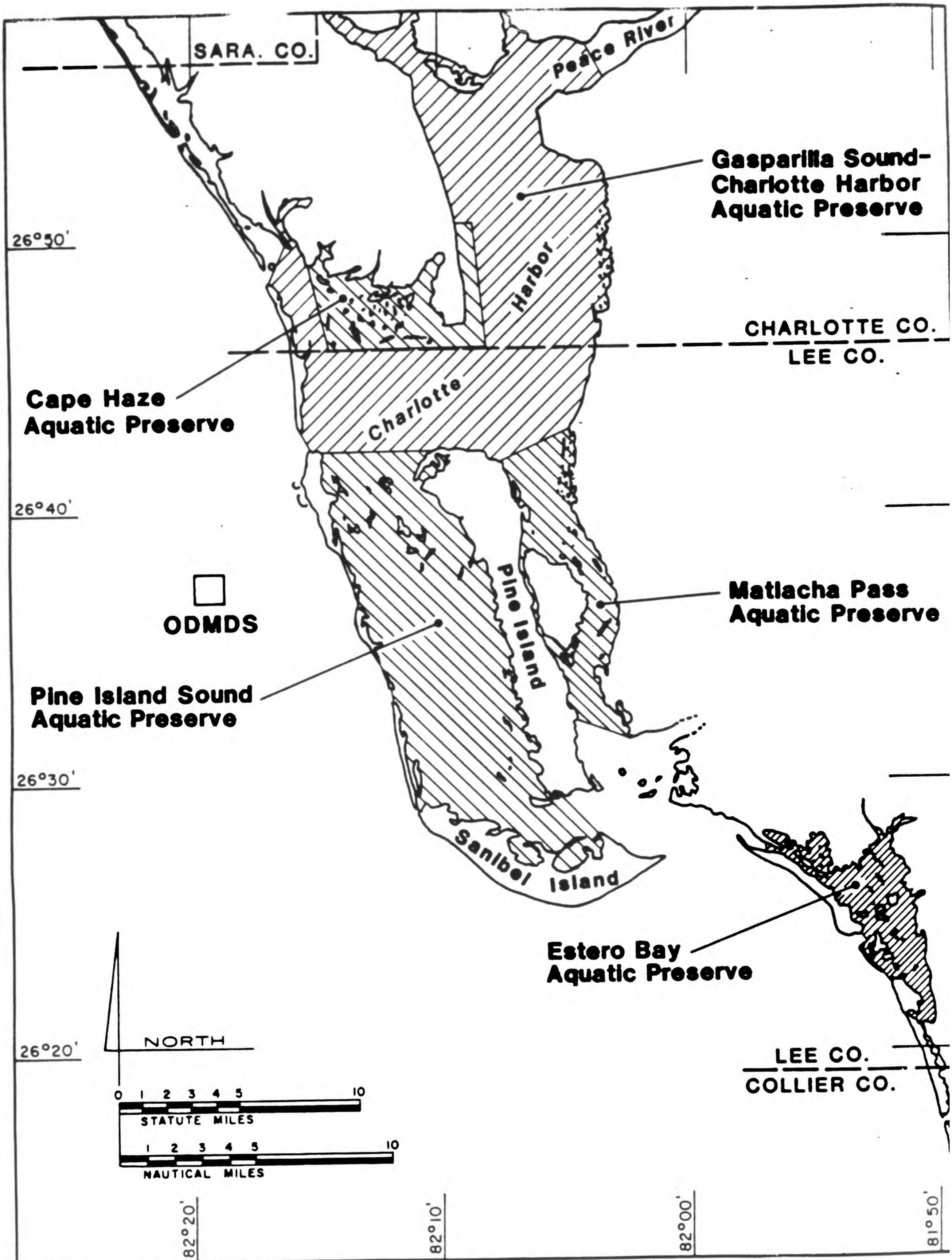


FIGURE 7

AQUATIC PRESERVE AREAS

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

Table 4. Protected Areas, Recreation Sites, and Wildlife Refuges in the Charlotte Harbor ODMDS Study Area.

Map No.	Protected Area	Jurisdiction
1	Charlotte Harbor Wetlands	Florida
2	Alligator Creek-Big Mound Creek	Private
3	Island Bay National Wildlife Refuge	Federal
4	Cayo Costa	Lee County
5	Cayo Costa Island	Florida
6	Little Pine Island	Nature Conservancy
7	Little Pine Island	Florida
8	North Captiva Island	Florida
9	Pine Island National Wildlife Refuge	Federal
10	Matlacha Pass National Wildlife Rufuge	Federal
11	Carl Johnson Park	Lee County
12	Sanibel Island	Nature Conservancy
13	J.N. "Ding" Darling National Wildlife Refuge	Federal
14	Sanibel Island Special Feature Site	Florida

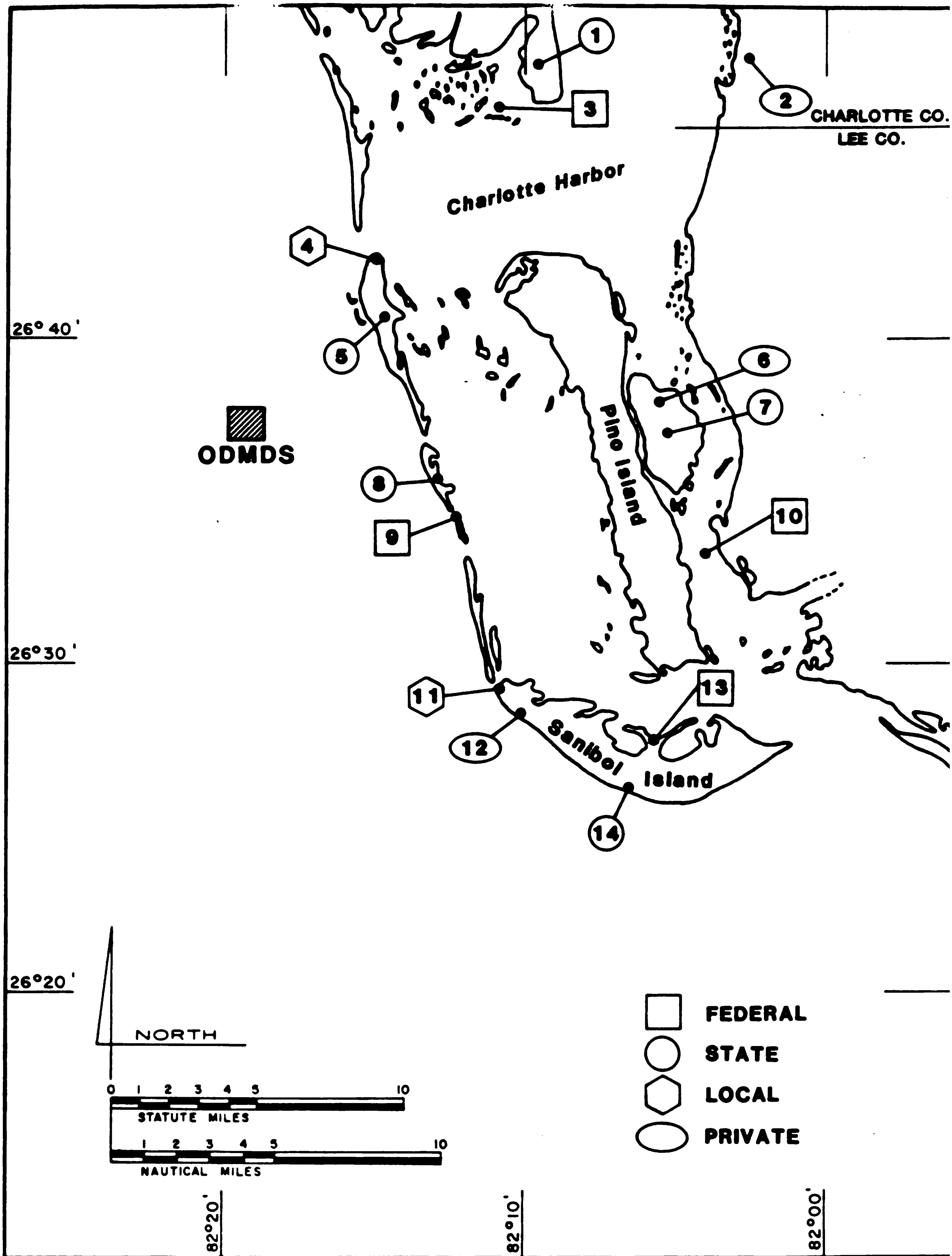


FIGURE 8

PARKS AND PROTECTED AREAS

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

5.03 Location in Relation to Breeding, Spawning, Nursery, Feeding or Passage Areas of Living Resources in Adult or Juvenile Phases (40 CFR 228.6 [a][2])

A great deal is known about the general life cycle of area fish and shellfish. Many of the area's species spend their adult lives in the offshore region but are estuary dependent in that their juvenile stages utilize a low salinity estuarine nursery region. Specific migration routes, from offshore to the estuaries and return, in the Charlotte Harbor area are unknown. The candidate site is, however, at least six nautical miles southwest of Boca Grande Pass and thus would not hinder migratory passage. In addition, the site is not known to be located in any major breeding or spawning areas for fish or shellfish.

The impact of previous disposal on breeding, spawning, nursery, and passage activities has not been specifically documented; however, the effects of dumping at the disposal site on these activities are likely to be minimal for the reasons stated above. Due to the mobility of adult finfish there will be no adverse impacts on pelagic species.

5.04 Location in Relation to Beaches and Other Amenity Areas (40 CFR 228.6 [a][3])

As discussed in section 4.07, area beaches, parks, aquatic preserves, and other amenity areas are located east of the interim ODMDS. The nearest beach and shore-related amenity (Cayo Costa) is four nmi. east of the proposed site. Tidal and storm generated currents may disperse materials dumped at the site. Prevailing winds in the area are from the east for most of the year and the strongest winds are from the north and east. Such winds would tend to move sediments offshore and away from beaches and amenity areas. It is unlikely that there will be any appreciable quantities of dredged material transported onto beaches. No adverse impacts to these beaches has been associated with previous dredged material disposal at the interim site. Final designation of the interim site will not adversely impact recreation, coastal development, or other uses o the shoreline.

No natural reefs or hard bottom areas have been identified in the immediate vicinity of the existing ODMDS. The closest hard bottom area identified lies just south of Boca Grande Pass, approximately 4.2 nmi. (7.8 km) from the ODMDS. One artificial reef is located in relative proximity to the existing disposal site. This reef is located approximately 1.1 nmi. (2.1 km) northeast of the ODMDS.

5.05 Types and Quantities of Waste to be Disposed of, and Proposed Methods of Release, Including Methods of Packing the Waste, If Any (40 CFR 228.6 [a][4])

Materials proposed to be disposed of at the site will be sediments dredged from Boca Grande Pass and Boca Grande Channel. These sediments are predominantly poorly sorted fine to medium sands, with low organic content (Corps of Engineers, 1983). All dredged materials deposited at ocean disposal sites must comply with EPA dredged material criteria for ocean dumping permits as specified in the Ocean Dumping Regulations (40 CFR Part 227).

Dredged materials may be transported to the disposal site by barge or hopper dredge.

5.06 Feasibility of Surveillance and Monitoring (40 CFR 228.6 [a][5])

The proximity of the Charlotte Harbor interim ODMDS to shore would allow for either on-shore or shipboard surveillance. The site's relatively shallow waters would facilitate surveillance and monitoring of disposal impacts. Baseline data collected at the site (Appendix A) well serve as reference information for future monitoring and aid in assessing conditions resulting from disposal. The survey of the interim site, which collected the data used in this DEIS has shown that the site is easily accessible for surveillance and monitoring.

5.07 Dispersal, Horizontal Transport, and Vertical Mixing Characteristics of the Area Including Prevailing Current Direction and Velocity, If Any (40 CFR 228.6 [a][6])

Studies of the interim ODMDS conducted on the OSV Anderson showed no mounding in the disposal area. Materials disposed there had been dispersed by the complex current patterns described in Section 4 of this document. Future maintenance dredged material would also be dispersed. In the ODMDS vicinity, tidal and wind driven currents probably control circulation. These patterns are both complex and variable, and are dependent upon interactions between wind, tides, and bottom morphology. Tidal currents at the ODMDS may have the capacity to transport fine-grain sediment (Missimer and Associates, 1985). High winds associated with major weather systems may also generate currents capable of transporting bottom sediments. Prevailing winds in the area are from the east for most of the year and strongest winds are from the north and east (Continental Shelf Associates, 1981; Drew and Schomer, 1984). Such winds tend to move sediments offshore. Because currents generally abate with depth, dispersion and mixing would probably be greatest in surface waters and lessen progressively with depth.

Studies conducted in the Gulf of Mexico off Charlotte Harbor indicate that water column stratification is unlikely (Jones, et al., 1973; U.S. Geological Survey, 1985). Recent studies conducted at the ODMDS (see Appendix A) also yielded no evidence of stratification. Mixing and dispersal of sediments should occur throughout the water column.

5.08 Existence and Effects of Current and Previous Discharges and Dumping in the Area (Including Cumulative Effects)(40 CFR 228.6 [a][7])

Between 1913 and 1955, approximately 3,711,230 cubic yards of material were disposed of in the waters off Charlotte Harbor, at an unspecified location (Figure 2, "A"). From 1958 to 1976, about 5,214,861 cubic yards of dredged material were placed at a designated disposal site located approximately 1.3 nmi (2.4 km) to the north-northeast of the ODMDS (Figure 2, "1"). In 1970 68,000 cubic yards of dredged material were placed at a disposal area located approximately 3.5 nmi (6.5 km) north of the present ODMDS, on the northern edge of the Boca Grande Channel (Figure 2, "2"). Since 1978 approximately 3.2 million cubic yards of dredged material have been disposed of at the interim site. Dredged material disposal at the interim ODMDS has produced no apparent long-term effects on water quality or on the physical and chemical composition of site sediments (see Appendix A). No long-term major ecological effects attributable to disposal operations were identified in a recent survey of the ODMDS vicinity (Appendix A). Benthic communities near the center of the ODMDS have apparently been impacted and are recovering from recent disposal activities. Organisms colonizing the impacted areas are similar to those at nearby unimpacted areas with physically similar sediments.

5.09 Interference with Shipping, Fishing, Recreation, Mineral Extraction, Desalination, Fish and Shellfish Culture, Areas of Special Scientific Importance, and Other Legitimate Uses of the Ocean (40 CFR 228.6 [a][8])

The Charlotte Harbor interim ODMDS is located adjacent to Charlotte Harbor's deep-water anchorage and within 0.8 nmi. (1.5 km) of the Boca Grande Ship Channel. Use of this site to date has not interfered with shipping and continued intermittent use of the site should not disrupt either commercial shipping or recreational boating.

Most commercial and recreational fishing activity is concentrated in inshore and nearshore waters. Grouper and snapper are generally taken from deeper waters of the middle Shelf or from natural hard bottom areas and artificial reefs. No natural hard bottom areas occur in proximity to the ODMDS. One artificial reef is located approximately 1.1 nmi. (2.1 km) northeast of the ODMDS. No adverse impacts to this reef have been reported from dredged material disposal operations to date. The U.S. EPA does not anticipate any significant effects on commercial or recreational fisheries resources due to the proposed action.

Endangered and threatened species will not be adversely affected by the proposed action. Recreational and scientific resources are extensive throughout the area but are not geographically limited to the Charlotte Harbor ODMDS or nearby waters. No mineral extraction, desalination, or mariculture activities occur or are anticipated in the vicinity of the proposed ODMDS. Any future exploration for oil, gas, or other mineral resources should not be affected by the proposed action.

5.10 Existing Water Quality and Ecology of the Site as Determined by Available Data or by Trend Assessment or Baseline Surveys (40 CFR 228.6 [a][9])

As indicated by the elutriate data in Table 3, material dredged in 1979 contained dissolved ammonia, orthophosphorous, oil and grease, and heavy metals that could be released into the water column. The concentrations of these were only moderately above receiving water concentrations and not enough to be of concern relative to standards or probable effects. Materials proposed for ocean disposal in the future would have to meet sediment quality requirements contained in the Ocean Dumping Regulations.

Sediments at the Charlotte Harbor disposal site are similar in nature to those under consideration for proposed future disposal. A recent survey (Appendix A) detected no differences in surficial sediment quality between sampling stations located within the ODMDS and those located in surrounding areas. Based on these results, there is no evidence that impacts or alterations to sediment quality have resulted from prior disposal site utilization. Impacts of dredged material disposal upon organisms in the water column are difficult to assess but are generally considered to be minimal and temporary (Pequegnat et al, 1981). Most mobile organisms (nekton) can avoid disposal operations and localized areas of poor water quality. Non-mobile (planktonic) organisms such as phytoplankton, zooplankton, and icthyoplankton entrained within the disposal plume will be directly affected. The impacts of disposal on these organisms is difficult to assess in light of the high natural variability of planktonic communities. Significant long-term impacts beyond the ODMDS boundaries are not anticipated. The physical similarity of the sediments proposed for disposal to those currently found at the disposal site should minimize the potential for long-term changes in faunal composition. A recent survey (Appendix A) found that benthic communities within the Charlotte Harbor ODMDS were generally similar to those of the surrounding area.

5.11 Potentiality for the Development or Recruitment of Nuisance Species in the Disposal Site (40 CFR 228.6 [a][10])

The similarity of dredged materials to the sediments of the disposal site and surrounding areas should make the development or recruitment of undesirable species unlikely. No nuisance species have been reported in the interim ODMDS or at nearby, previously utilized disposal sites.

5.12 Existence at or in Close Proximity to the Site of Any Significant Natural or Cultural Features of Historical Importance (40 CFR 228.6 [a][11])

The State Historic Preservation Officer has stated that the final designation of the interim Charlotte Harbor ODMDS will not have any adverse impacts on archeological or cultural sites of national, state, or local significance (refer to appendix C).

5.13 Unavoidable Adverse Environmental Effects and Mitigating Measures

Possible adverse effects associated with disposal include the temporary degradation of water quality at the disposal site and the smothering of a portion of the benthic community. Minor changes in bathymetry and sediment texture within the ODMDS may also occur. Excessive mounding should not occur because the frequency of dredging and proposed volumes of dredged material will be relatively low. Also, judicious disposal methods will be practiced along with periodic monitoring of the site's bathymetry.

Impacts outside the ODMDS should be minimal and mitigating measures to protect the contiguous environment should not be necessary. Periodic monitoring and routine surveillance will be conducted to ensure that impacts are restricted to the ODMDS. Sediments proposed for disposal will also be analyzed to ensure that they continue to be physically compatible with ODMDS sediments and do not contain toxic contaminants.

5.14 Relationship Between Short-term Uses and Long-Term Productivity

Disposal operations have been conducted at the proposed ODMDS since 1978 and in the general vicinity since 1913. No significant impact to the resources of the area due to disposal operations has been observed or reported. It is not anticipated that short-term perturbations at the site will significantly affect the long-term productivity of the area or interfere with the long term use of any resources at the candidate site.

5.15 Irreversible or Irretrievable Commitments of Resources. Resources irreversibly or irretreivably committed through the use of the proposed site will include: (1) loss of some potentially recyclable material (i.e., sand for land fill); and (2) loss of some benthic organisms that will be smothered during disposal.

6.00 LIST OF PREPARERS. See Table 5.

7.00 Statement Receipients. This DEIS is being sent for review and comment to the following agencies and public:

Federal Agencies

U.S. Department of Commerce, Washington, D.C.
Federal Highway Administration, Tallahassee, Florida
Seventh Coast Guard District, Miami, Florida
U.S. Department of Interior, Washington, D.C.
Federal Emergency Management Administration, Washington, D.C.
Federal Emergency Management Administration, Atlanta, Georgia
Federal Maritime Commission, Washington, D.C.

The following people were primarily responsible for the preparation of this document.

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U.S. ENVIRONMENTAL PROTECTION AGENCY, REGION IV

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Name	Discipline/Expertise	Experience	Project Role
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Mr. William W. Hamilton	Environmental Assessment	President, Conservation Consultants, Inc.; 17 years	Project Advisor
Mr. Lawrence J. Swanson	Fisheries Resources, Aquatic Biology	Staff Scientist, Conservation Consultants, Inc.; 13 years Research Assistant, University of Miami; 1 year	Field Team Coordination, Fish and Epibenthic Invertebrate Taxonomy
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Ms. Elaine C. James	Clerical Services, Word Processing	Document Coordinator, Conservation Consultants, Inc.; 10 years	Document Production

OTHERS:

Savannah Laboratores, Inc.: Analytical Chemistry; Water, Sediments, and Tissues
Taxonomic Association, Inc.: Benthic Macroinvertebrate Taxonomy

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U.S. Department of Agriculture, U.S. Forest Service, Atlanta, Georgia
U.S. Department of Agriculture, Agriculture Stabilization and Conservation Service, Gainesville, Florida
U.S. Department of Commerce, National Marine Fisheries Service, St. Petersburg, Florida
U.S. Department of Commerce, National Marine Fisheries Service, Panama City, Florida
U.S. Department of Interior, Minerals Management Service, New Orleans, Louisiana
U.S. Department of Interior, Fish and Wildlife Service, Atlanta, Georgia
U.S. Department of Interior, Fish and Wildlife Service, Jacksonville, Florida
U.S. Department of Interior, Fish and Wildlife Service, Vero Beach, Florida
Department of Energy, Washington, D.C.
Department of Energy, Atlanta, Georgia
Advisory Council on Historic Preservation, Washington, D.C.
Department of Health and Human Services, Washington, D.C.
Department of Housing and Urban Development, Atlanta, Georgia
Department of Health and Human Services, Center for Disease Control, Atlanta, Georgia

State Agencies

Department of Environmental Regulation, Tallahassee, Florida
Department of Natural Resources, Tallahassee, Florida
Florida Game and Fresh Water Fish Commission, Tallahassee, Florida
Executive Office of the Governor, Tallahassee, Florida
State Planning and Development Clearinghouse, Tallahassee, Florida

Other

Honorable Lawton M. Chiles, Senator, Florida
Honorable Bob Graham, Senator, Florida
Honorable Connie Mack, Congressman, 13th District, Florida
Florida Wildlife Federation, West Palm Beach, Florida
The Nature Conservancy, Winter Park, Florida
Sierra Club, Jacksonville, Florida
National Audubon Society, Southeast Regional Office, Charleston, South Carolina
Sierra Club, Florida Chapter, Tallahassee, Florida
Florida Audubon Society, Maitland, Florida
Environmental Information Center, Winter Park, Florida
Isaak Walton League of America, Palmetto, Florida
Charlotte County, Board of County Commissioners, Punta Gorda, Florida

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APPENDIX A

SURVEY METHODS, RESULTS. AND INTERPRETATIONS

APPENDIX A

Environmental Survey in the Vicinity of
The Charlotte Harbor Ocean Dredged
Material Disposal Site
Charlotte Harbor, Florida

December, 1985

CONSERVATION CONSULTANTS, INC.
Environmental Scientists and Engineers
Post Office Box 35
Palmetto, Florida 33561

APPENDIX A

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APPENDIX A

This appendix details the methods and results of an environmental survey of the Charlotte Harbor interim Ocean Dredged Material Disposal Site (ODMDS) vicinity. This survey was conducted by Conservation Consultants, Inc. (CCI) on December 11 through 13, 1985.

A.1 METHODS

A.1.1 Location of Study Area and Sampling Locations

The Charlotte Harbor interim ODMDS is a one square nautical mile area with the following corner coordinates:

(NW) 26°37'36" N 82°19'55" W	(NE) 26°37'36" N 82°18'47" W
(SW) 26°36'36" N 82°19'55" W	(SE) 26°36'36" N 82°18'47" W

The general location of the ODMDS is shown in Figure A-1. Eight sampling stations were located in the Charlotte Harbor study area. The relationship of these stations to the designated interim ODMDS is shown in Figure A-2. The location and the type of sampling conducted at each of these stations is given in Table A-1.

A.1.2 Physical and Geological Characteristics

A.1.2.1 Bathymetry

A bathymetric survey was conducted along ten transects in the Charlotte Harbor ODMDS study area (figure A-3). Each of these transects was approximately three nautical miles in length and oriented in an east-west direction. Transects were established to run between 82°17'39" and 82°21'03" west longitude at the following latitudes.

Transect No.	Latitude (N)
CH-T1	26°35'36"
CH-T2	26°36'06"
CH-T3	26°36'36"
CH-T4	26°36'51"
CH-T5	26°37'06"
CH-T6	26°37'13.5"
CH-T7	26°37'21"
CH-T8	26°37'36"
CH-T9	26°38'06"
CH-T10	26°38'36"

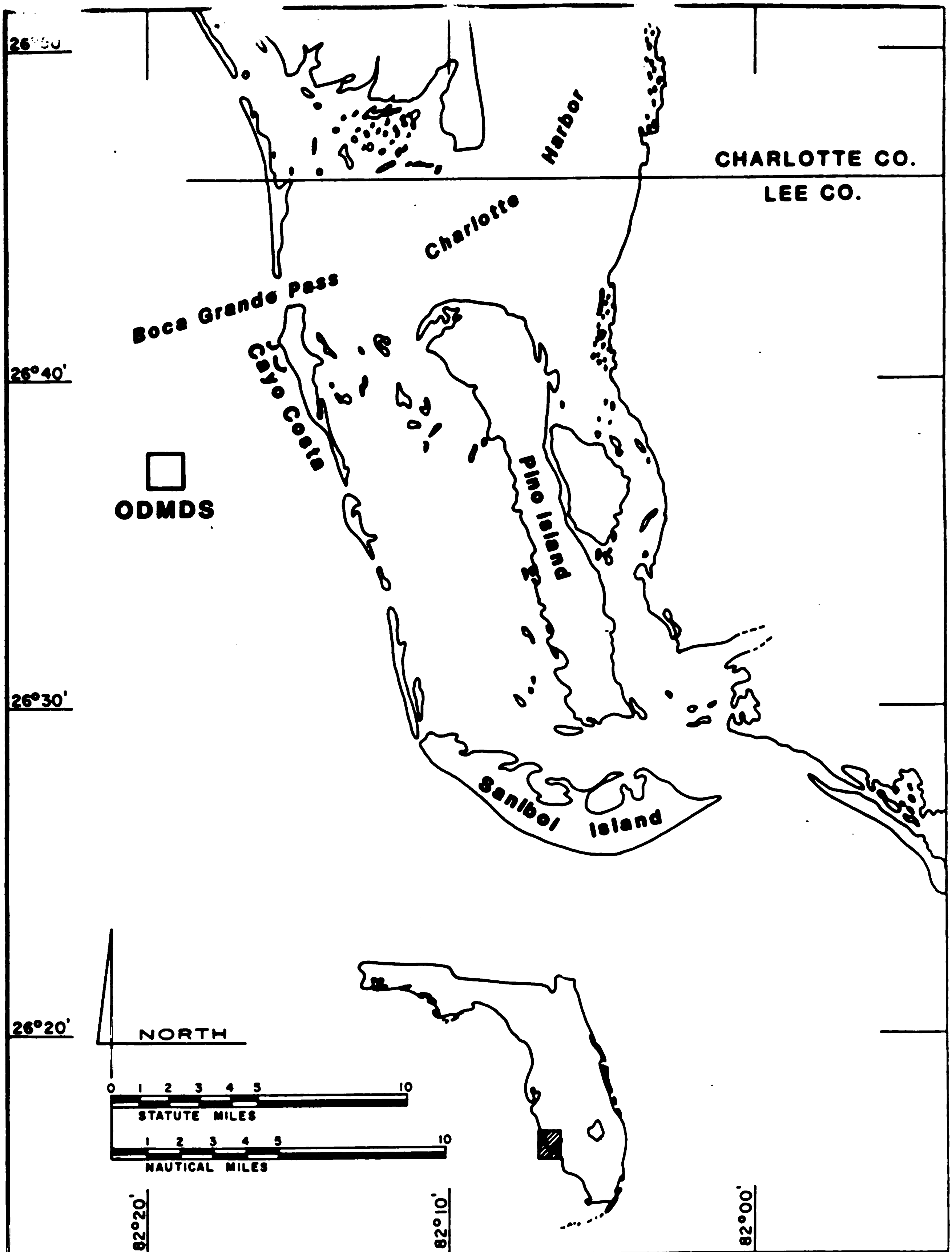


FIGURE A-1

GENERAL LOCATION MAP

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

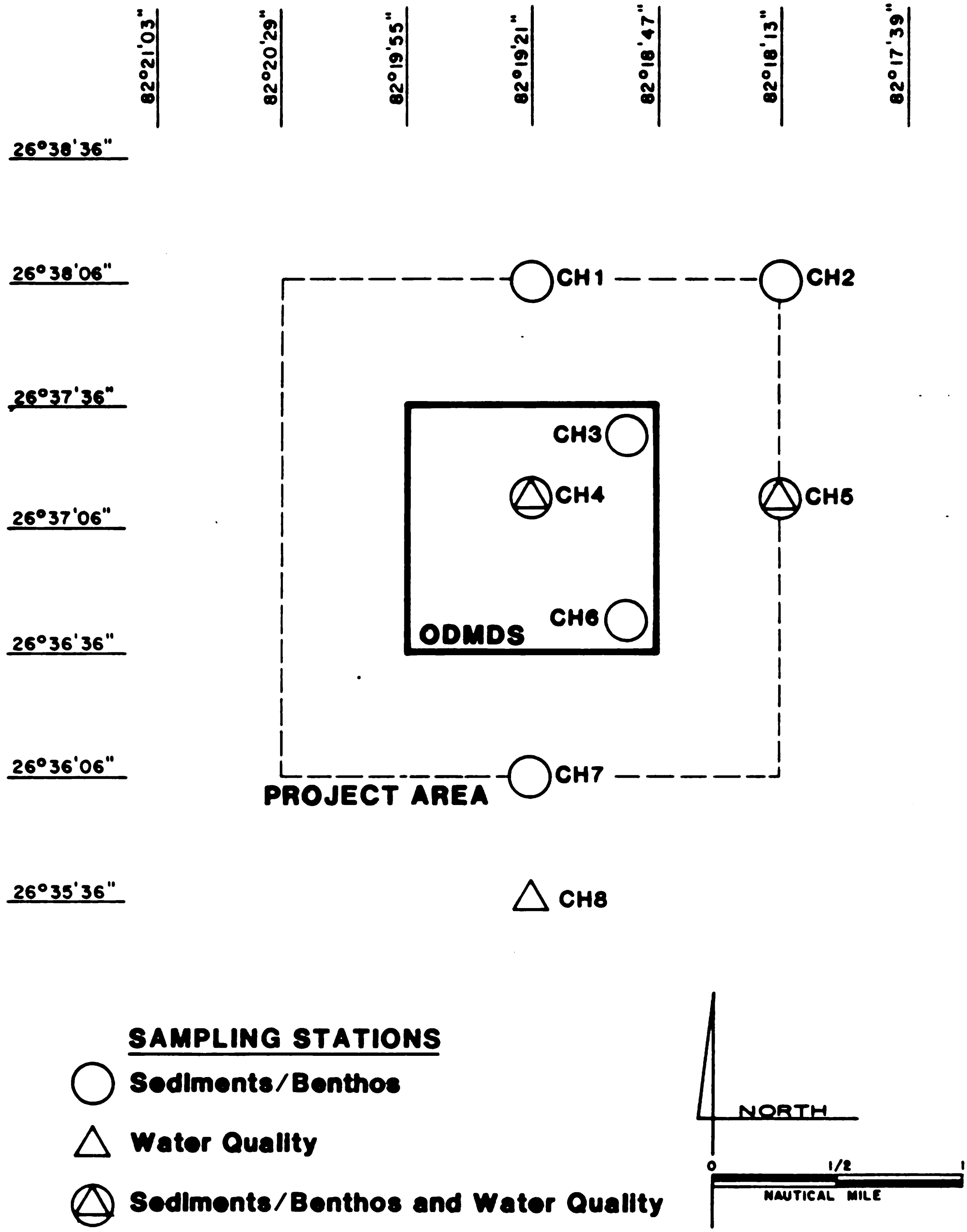


FIGURE A-2

SAMPLING STATION LOCATIONS

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

Table A-1. Station Locations and Types of Samples Collected from the Charlotte Harbor ODMDS Study Area.

Station No.	Latitude (N)	Longitude (W)	Samples Collected
CH-1	26°38'06"	82°19'21"	Sediments Benthic Invertebrates Trawl
CH-2	26°38'06"	82°18'13"	Sediments Benthic Invertebrates
CH-3	26°37'28.5"	82°18'55.5"	Sediments Benthic Invertebrates
CH-4	26°37'13.5"	82°19'21"	Sediments Benthic Invertebrates Trawl
CH-5	26°37'13.5"	82°18'13"	Sediments Benthic Invertebrates Water Quality
CH-6	26°36'43.5"	82°18'55.5"	Sediments Benthic Invertebrates
CH-7	26°36'06"	82°19'21"	Sediments Benthic Invertebrates Trawl
CH-8	26°35'36"	82°19'21"	Water Quality

CH-T1 and CH-T2 were located approximately 1.0 and 0.5 nautical miles south of the ODMDS, respectively. Transect CH-T1 crossed sampling Station CH-8 while CH-T2 crossed Station CH-7. CH-T10 and CH-T9 were established about 1.0 and 0.5 nautical miles north of the disposal site, respectively. Transect CH-T9 crossed sampling stations CH-1 and CH-2. The remaining six transects traversed the OOMOS. Each of the ten transects extended approximately 1.0 nautical mile (1.85 km) beyond both the east and west boundaries of the ODMDS.

A.1.2.2 Hydrography

In-situ profiles of temperature, salinity, dissolved oxygen, and pH were made at each sampling station. These profiles were made at 3 ft. (0.91 m) intervals, using a Hydrolab 4000 multiple electrode meter.

A.1.2.3 Granulometry

Sediment samples were collected from each of the seven sediment sampling stations with a ponar grab sampler. Subsamples of the relatively undisturbed grab samples were taken with 3 cm (i.d.) Plexiglass coring tubes for granulometric analyses. These tubes were pushed into the sediment, sealed top and bottom with rubber stoppers and then removed. The top ten centimeters of each core was then extruded into a labeled plastic bottle and transported to the laboratory for analysis.

Grain size determinations generally followed the procedures outlined by Pequegnat et al. (1981) in U.S. Army Waterways Experiment Station Technical Report EL-81-1; Procedural Guide for Designation Surveys of Ocean Dredged Material Disposal Sites. Samples were first wet sieved through a 62 um sieve, using a 5 g/l sodium hexametaphosphate dispersant, to separate the sand-shell fraction from the silt-clay fraction. The sand-shell fraction then underwent grain size analysis by dry sieving, while pipette analysis was used to quantify the silt clay fraction. A Tyler Sieve Shaker (Model R-X24) and nested 8-inch brass sieves with mesh sizes of 2.0, 1.0, 0.5, 0.25, 0.177, 0.12, and 0.06 mm were used to conduct the sieve analysis.

A.1.3 Chemical Characteristics

A.1.3.1 Water Quality.

Grab samples for chemical analysis were collected from approximately one meter off the bottom at each of the three designated water quality sampling stations. Methods of preservation and analysis are summarized in Table A-2.

A.1.3.2 Sediment Chemistry

Sediment samples for chemical analysis were taken with a ponar grab sampler. Well-mixed composite samples were collected from each station for analysis. Upon collection, sediment samples were placed in labeled glass jars and kept on ice until delivered to the laboratory.

Two methods were used for the extraction of sediment samples, as recommended by Pequegnat, et al. (1981). Five of the seven samples collected were treated by seawater elutriation and two by weak acid (0.1 N HCl) partial extraction. Methods used for the chemical analysis of the seawater and acid elutriates are given in Table A-2.

A.1.4 Biological Characteristics

A.1.4.1 Benthic Macroinvertebrates

Benthic macroinvertebrates were sampled by ponar dredge at seven stations in the Charlotte Harbor ODMDS study area. The ponar dredge samples 0.054 square meters of sediment surface.

Five samples, representing 0.27 square meters of bottom surface, were taken at each station.

Upon collection, samples were fixed in a ten percent solution of buffered Formalin to which a stain, rose bengal (200 mg/l), had been added. This stain concentrates in animal tissues and facilitates the effective recovery of organisms for analysis.

In the laboratory, samples were sieved through a 500 u mesh and re-preserved in a 70 percent solution of isopropyl alcohol. The sieved samples were then sorted under a dissecting microscope to recover all benthic organisms. At least 30 percent of all samples were cross-checked to ensure the efficiency of sample processing.

Following sorting, identifications and counts were made under a dissecting microscope. Representative specimens have been preserved in a reference collection.

A.1.4.2 Meiofauna

Two meiofauna samples were collected at each of the seven benthic sampling stations in the Charlotte Harbor ODMDS study area. Meiofauna samples were taken by coring sediments collected bv ponar dredge with a 3 cm (1.2 in) i.d. Plexiglass coring tube. The coring tube was then capped at both ends, removed from the sediment, and the top 20 cm (7.87 in) of material extruded into a labeled sample container. Meiofauna samples were preserved in a 5 percent solution of buffered Formalin to which a stain, rose bengal (200 mg/l), had been added.

In the laboratory, meiofaunal samples were first sieved through a 500 u mesh screen to remove representatives of the macrobenthos. The remaining material was passed through a 64 u sieve, and the portion retained sorted to remove meiofauna. All counts and identifications were made under a binocular dissecting microscope at a magnification of 25 X.

Table A-2. Methods of Chemical Analysis of Water, Sediment, and Tissue Samples

Parameter	Sample Type	Preservation	Analytical Methods
Cadmium	Water	Nitric Acid	Atomic Absorption Spectrophotometry/Graphite Fu
	Sediment	Chilled	Atomic Absorption Spectrophotometry/Graphite Fu
	Tissue	Chilled	Atomic Absorption Spectrophotometry/Graphite Fu
Lead	Water	Nitric Acid	Atomic Absorption Spectrophotometry/Graphite Fu
	Sediment	Chilled	Atomic Absorption Spectrophotometry/Graphite Fu
	Tissue	Chilled	Atomic Absorption Spectrophotometry/Graphite Fu
Mercury	Water	Nitric Acid	Atomic Absorption Spectrophotometry/Cold Vapor
	Sediment	Chilled	Atomic Absorption Spectrophotometry/Cold Vapor
	Tissue	Chilled	Atomic Absorption Spectrophotometry/Cold Vapor
Chlorinated Hydro-carbons (PCB's) and Pesticides)	Water	Chilled	Gas Chromatography/Electron Capure Detector
	Sediment	Chilled	Gas Chromatography/Electron Capure Detector
	Tissue	Chilled	Gas Chromatography/Electron Capure Detector
HMW Hydrocarbons	Water	Chilled	Gas Chromatography/Electron Capure Detector
	Sediment	Chilled	Gas Chromatography/Electron Capure Detector
	Tissue	Chilled	Gas Chromatography/Electron Capure Detector
Total Suspended Solids	Water	Chilled	Gravimetric
		Chilled	
		Chilled	
Total Organic Carbon	Sediment	Chilled	Wet Combustion/Infrared Detector
Oil and Grease	Sediment	Chilled	Soxhlet Extraction (hexane)
Turbidity diment	Water	Chilled	Nephelometry

Note 1. Analytical methods followed those outlineed in Pequegnat (1981) U.S. Army Waterways Experment station, Technical Report EL-81-1; Procedural Guide for Designation Surveys of Ocean Dredqed Material Disposal Sites.

Note 2. PCB's = Polychlorinated Biphenyls
HMW = High Molecular Weight

A.1.4.3 Macroepifauna

Macroepifauna were collected by trawl at three sites in the study area. Two 10 minute tows with a 10 ft. (3.1 m) trawl were made at each site. The wet weight biomass of each sample was determined immediately after collection with a Hanson (Model 600) spring scale.

Following biomass determination, organisms were counted and identified to the extent possible in the field. Those organisms which were selected for tissue analyses were removed at this time, identified, weighed, and placed on ice. All other organisms were preserved in a 10 percent Formalin solution. Upon return to the laboratory, taxonomic verifications were made and all samples were placed in storage.

A.1.4.4 Tissue Analyses

Tissues for analysis were taken from macroepifaunal organisms collected by trawl as described in Section A.1.4.3. Edible or soft tissues were removed from each of the specimens selected for analysis. These tissues were frozen and transported in a chilled state to the laboratory for analysis.

Tissue constituents analyzed and methods of analysis are given in Table A-2.

A.2 RESULTS AND DISCUSSION

A.2.1 Physical and Geological Characteristics

A.2.1.1 Bathymetry

Bathymetric profiles of the Charlotte Harbor interim ODMDS reveal little topographic relief. Depths recorded at the ODMDS ranged from 39 ft (11.9 m) to 44 ft (13.4 m).

A bathymetric map of the ODMDS vicinity is presented as Figure A-3. Little mounding or evidence of disposal operations is apparent. Some mounds potentially associated with spoil disposal were identified northeast and southwest of the ODMDS.

A.2.1.2 Hydrography

Hydrographic profiles were made at each of the eight stations in the study area. Measurements of temperature, salinity, pH and dissolved oxygen were taken at 3 ft (0.91 m) intervals.

These profiles are presented in Table A-3. Temperature and salinity values fall within the range expected, and previously reported (Jones et al, 1973; U.S. Geological Survey, 1985), for study area waters.

Dissolved oxygen (DO) concentrations ranged from 6.9 to 8.1 ppm. Waters were near or above saturation with respect to DO at all stations and throughout the water column. Both the concentration and the percent saturation of oxygen was highest in surface waters, reflecting the productive and

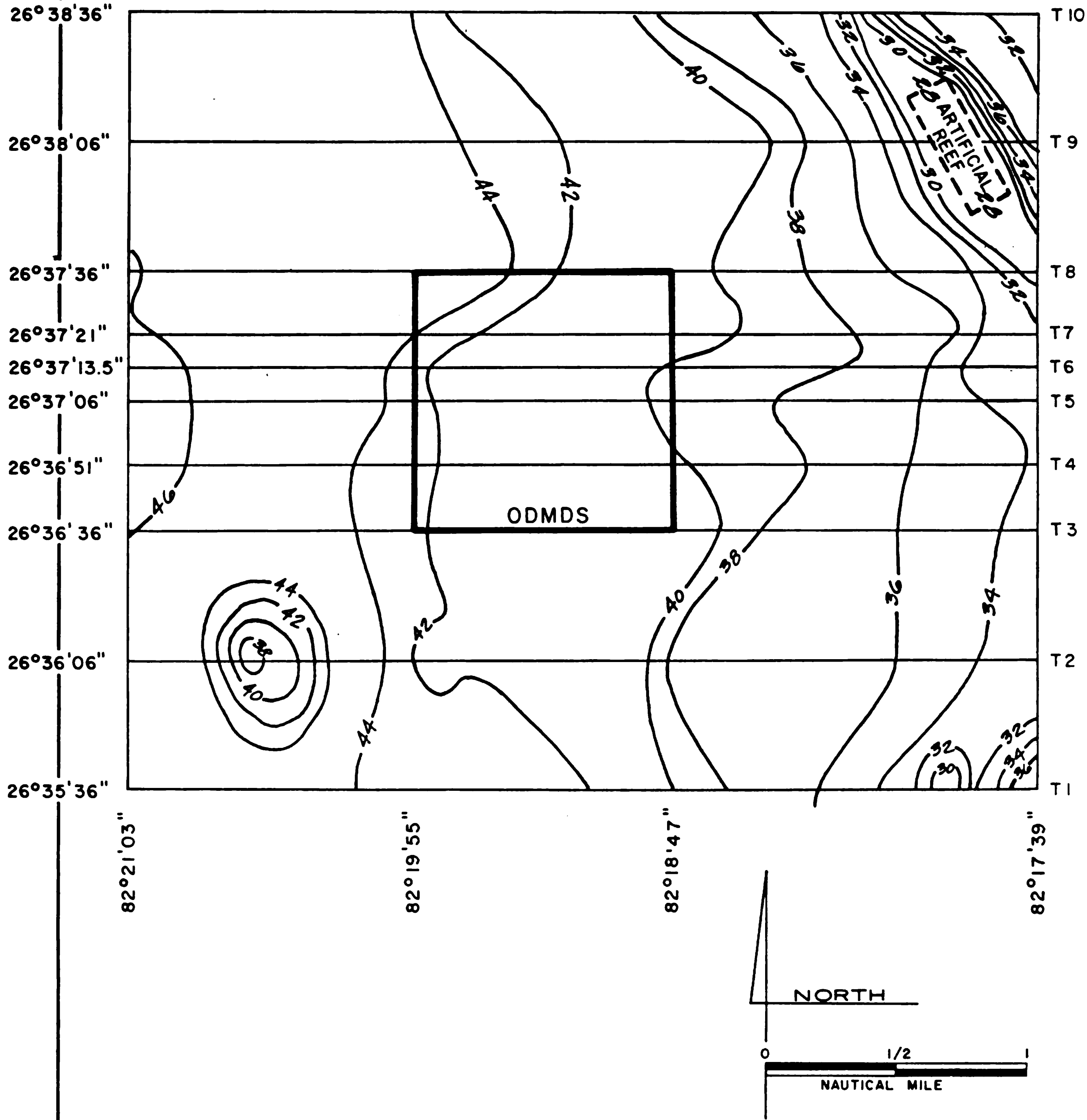


FIGURE A-3

BATHYMETRIC MAP

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

Table A-3. Physical and Chemical Characteristics of Waters in the Charlotte Harbor Ocean Dredged Material Disposal Site Vicinity; December 12, 1985.

Station	Time	Depth (Ft.)	Temperature (C)	Salinity (ppt)	pH	Dissolved Oxygen (ppm)	Dissolved Oxygen % Saturation
CH-1	0815	3	21.6	34.4	7.6	8.1	113
		6	21.6	34.4	7.6	8.1	113
		9	21.7	34.4	7.6	8.1	113
		12	21.7	34.4	7.7	8.1	113
		15	21.7	34.4	7.7	8.0	111
		18	22.0	34.8	7.7	7.5	105
		21	22.0	34.8	7.7	7.4	103
		24	22.1	34.8	7.7	7.3	103
		27	22.1	34.8	7.7	7.1	100
		30	22.1	34.8	7.7	7.1	100
		33	22.1	34.8	7.7	7.0	98
		36	22.1	34.8	7.7	7.0	98
		37	22.1	34.8	7.7	7.0	98
CH-2	0948	3	21.9	34.4	7.5	7.6	106
		6	21.9	34.6	7.6	7.7	118
		9	21.9	34.6	7.6	7.6	116
		12	21.9	34.6	7.6	7.6	116
		15	21.9	34.7	7.7	7.6	116
		18	21.9	34.7	7.7	7.4	103
		21	21.9	34.7	7.7	7.3	102
		24	21.9	34.7	7.7	7.3	102
		27	22.0	34.8	7.7	7.0	98
		30	22.0	34.8	7.7	6.9	97
		32	22.0	34.8	7.7	6.9	97
CH-3	1157	3	22.2	34.7	7.6	7.9	111
		6	22.2	34.7	7.6	7.9	111
		9	22.2	34.7	7.7	7.8	110
		12	22.2	34.7	7.7	7.8	110
		15	22.0	34.7	7.7	7.8	110
		18	22.1	34.7	7.7	7.8	110
		21	22.0	34.7	7.7	7.7	118
		24	22.1	34.8	7.7	7.3	103
		27	22.1	34.8	7.7	7.2	101
		30	22.1	34.8	7.7	7.2	101
		33	22.1	34.8	7.7	7.1	100
		36	22.1	34.8	7.7	7.1	100

Table A-3. Continued

Station	Time	Depth (Ft.)	Temperature (C)	Salinity (ppt)	pH	Dissolved Oxygen (ppm)	Dissolved Oxygen % Saturation
CH-4	1328	3	22.2	34.7	7.7	7.9	111
		6	22.2	34.7	7.7	7.9	111
		9	22.2	34.7	7.7	7.9	111
		12	22.2	34.7	7.7	7.8	110
		15	22.1	34.7	7.7	7.8	110
		18	22.1	34.7	7.7	7.7	118
		21	22.1	34.7	7.7	7.7	118
		24	22.0	34.7	7.7	7.6	107
		27	22.0	34.7	7.7	7.5	105
		30	22.0	34.8	7.7	7.5	105
		33	22.1	34.8	7.7	7.4	104
		36	22.1	34.8	7.7	7.5	105
		37	22.1	34.8	7.7	7.3	103
CH-5	1424	3	22.3	34.6	7.8	8.0	112
		6	22.3	34.7	7.7	8.0	112
		9	22.3	34.7	7.7	8.0	112
		12	22.3	34.7	7.7	8.0	112
		15	22.2	34.7	7.7	7.9	111
		18	22.1	34.7	7.7	7.8	110
		21	22.1	34.7	7.7	7.6	107
		24	22.0	34.7	7.7	7.3	103
		27	22.0	34.7	7.7	7.2	101
		30	22.0	34.8	7.7	7.2	101
		33	22.0	34.8	7.7	7.2	101
CH-6	1518	3	22.3	34.8	7.8	7.9	111
		6	22.3	34.8	7.8	7.9	111
		9	22.3	34.8	7.8	7.9	111
		12	22.3	34.8	7.8	7.9	111
		15	22.3	34.8	7.8	7.8	110
		18	22.3	34.8	7.8	7.8	110
		21	22.2	34.8	7.8	7.8	110
		24	22.2	34.8	7.8	7.8	110
		27	22.1	34.8	7.8	7.7	118
		30	22.1	34.8	7.7	7.6	107
		33	22.1	34.8	7.7	7.6	107
		36	22.1	34.8	7.7	7.6	107
		38	22.1	34.8	7.7	7.5	105

Table A-3. Continued

Station	Time	Depth (Ft.)	Temperature (C)	Salinity. (ppt)	pH	Dissolved Oxygen (ppm)	Dissolved Oxygen % Saturation
CH-7	1605	3	22.6	35.0	7.7	8.0	113
		6	22.7	35.0	7.7	8.0	113
		9	22.6	35.0	7.8	8.0	113
		12	22.6	35.0	7.8	7.9	112
		15	22.6	35.0	7.8	7.9	112
		18	22.6	35.0	7.8	7.9	112
		21	22.5	34.9	7.8	7.9	112
		24	22.6	25.0	7.8	7.9	112
		27	22.5	34.9	7.8	7.8	111
		30	22.5	34.9	7.8	7.8	111
		33	22.5	34.9	7.8	7.8	119
		36	22.3	34.9	7.8	7.7	119
		37	22.3	34.9	7.8	7.7	119
CH-8	1652	3	22.7	35.0	7.8	8.1	115
		6	22.7	35.0	7.8	8.0	113
		9	22.7	35.0	7.8	8.0	113
		12	22.7	35.0	7.8	8.0	113
		15	22.7	35.0	7.8	8.0	113
		21	22.7	35.0	7.8	7.9	112
		24	22.7	35.0	7.8	7.9	112
		27	22.7	35.0	7.8	7.9	112
		30	22.6	35.0	7.8	7.9	112
		33	22.6	35.0	7.8	7.8	111
		36	22.6	35.0	7.8	7.7	119
		37	22.6	35.0	7.8	7.8	111

respiratory processes dominating surface water and benthic environments, respectively. Oxygen stratification with depth was generally less than 1 ppm, typical of a well-mixed system.

Values for pH ranged from 7.5 to 7.8 and were slightly lower than would generally be expected for well-mixed coastal waters. The PH of well-mixed marine waters, in equilibrium with the atmosphere, ranges from about 8.1 to 8.3 (Sverdrup et al, 1942). Lower values are associated with runoff from freshwater systems or the release of CO2 by heterotrophic organisms during the breakdown of organic matter. The U.S. Geological Survey (USGS, 1985) reports pH values r@nging from 8.1 to 8.3 for nearby coastal and estuarine waters.

Total suspended solids (TSS) concentrations were also measured in samples taken from near bottom waters at each station in the study area. Results of these TSS analyses are presented in Table A-4. TSS levels ranged from 5 to 22 mg/l. These values @re comparable to those previously reported from nearby waters (USGS, 1985). TSS levels were highest at stations located closest to Boca Grande Channel.

Turbidity is defined as the optical property of a sample which causes light to be scattered and absorbed rather than transmitted in straight lines. Turbidity is commonly measured with a nephelometer, which measures scattered light, and is reported in NTUs (nephelometric turbidity units). Turbidity can be highly variable in coastal waters. Turbidity samples were taken from bottom waters at Stations CH-4, CH-5, and CH-8. Values of 10 NTUs were measured at CH-4 and CH-5 and a value of 4.2 NTU at CH-8. The USGS (1985) reports average surface water values of 0.3 NTU for a coastal site near the ODMDS and 2.0 NTU for a station at Boca Grande Pass.

Water clarity was vertically profiled at stations CH-1 through CH-7, using a transmissometer. Results, illustrated in Figures A-4a and A-4b, do not indicate the presence of a zone of high turbidity in the water column. Light attenuation, while varying between stations, was found to be relatively uniform with depth.

A.2.1.3 Granulometry

The grain size distributions of sediments collected in the study area are presented in Table A-5 and are illustrated in Figures A-5a and A-5b. Table A-6 gives descriptive statistics for the granulometric analyses.

Mean grain size varied considerably between the stations sampled. Mean grain sizes were largest at Stations CH-1 and CH-3; stations with a high content of shell and coarse sand. Mean grain size was smallest at Station CH-2, where sediments were comprised primarily of fine sands and silt. Station CH-5 sediments were made up of coarse to medium sands. Fine sands were the predominant component of sediments collected from stations CH-4, CH-6, and CH-7.

Table A-4. Total Suspended Solids Concentrations and Turbidity Levels in Samples Taken From Near Bottom Waters at Stations in the Charlotte Harbor ODMDS Vicinity.

Station	Depth (ft)	Total Suspended Solids (mg/l)	Turbidity (NTU)
CH-1	37	15	--
CH-2	32	20	--
CH-3	36	13	--
CH-4	37	18	10
CH-5	30	22	10
CH-6	36	7	--
CH-7	37	8	--
CH-8	37	5	4.2

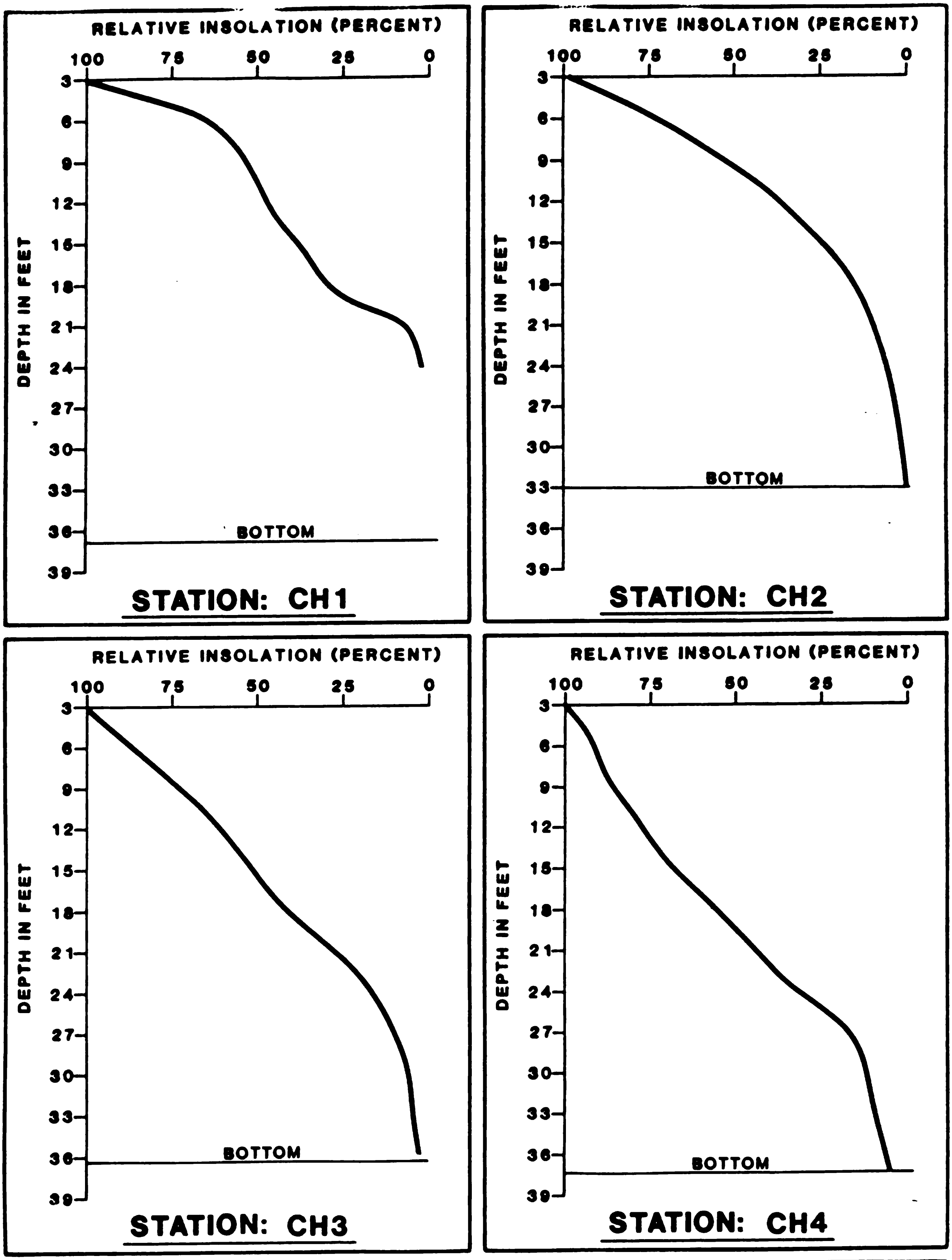


FIGURE A-4a

LIGHT ATTENUATION CURVES

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

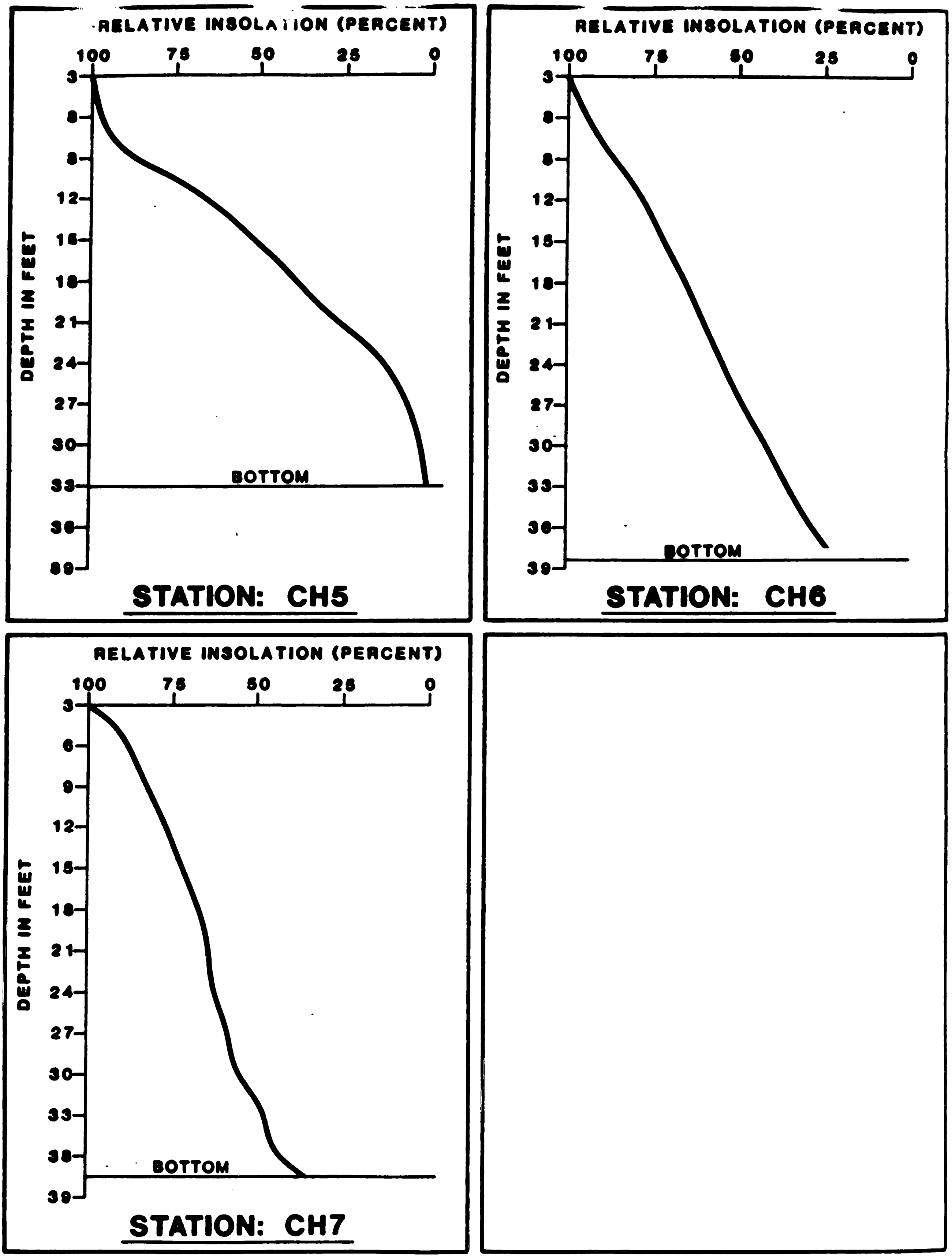


FIGURE A-4b

LIGHT ATTENUATION CURVES

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

Table A-5. Grain Size Distribution of Sediments Collected from the Charlotte Harbor ODMDS Study Area.

	Percent Composition					
	Shell (≤ - 1 phi)	Coarse Sands (-1 to 1 phi)	Medium Sands (1 to 2 phi)	Fine Sands (2 to 4 phi)	Silt (4 to 8 phi)	Clay (≥ 8 phi)
CH-1	39	49	9	1	<1	2
CH-2	1	3	3	75	18	0
CH-3	51	24	5	18	<1	2
CH-4	1	4	26	69	<1	<1
CH-5	17	47	20	9	<1	6
CH-6	2	6	24	67	<1	1
CH-7	<1	3	8	83	<1	5

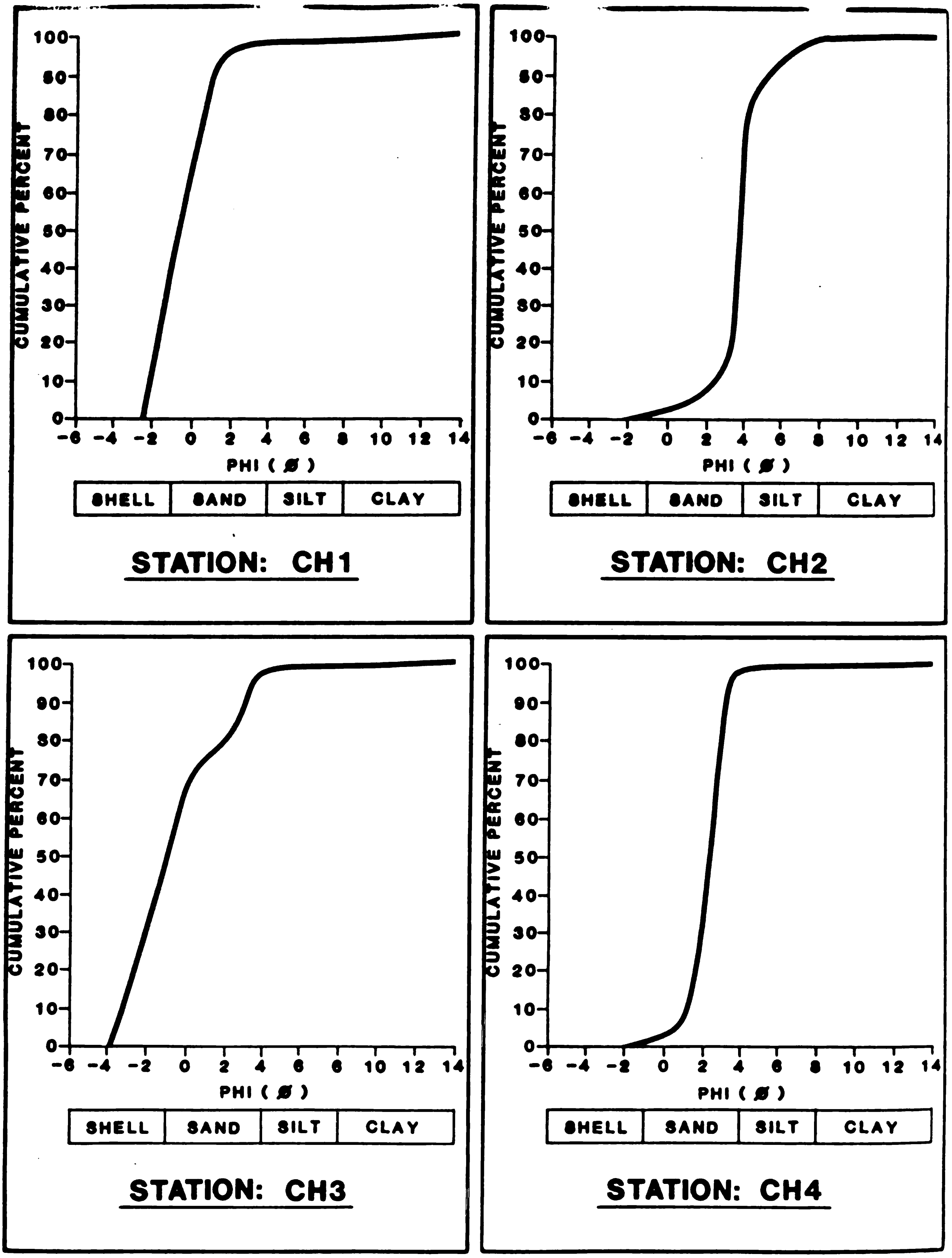
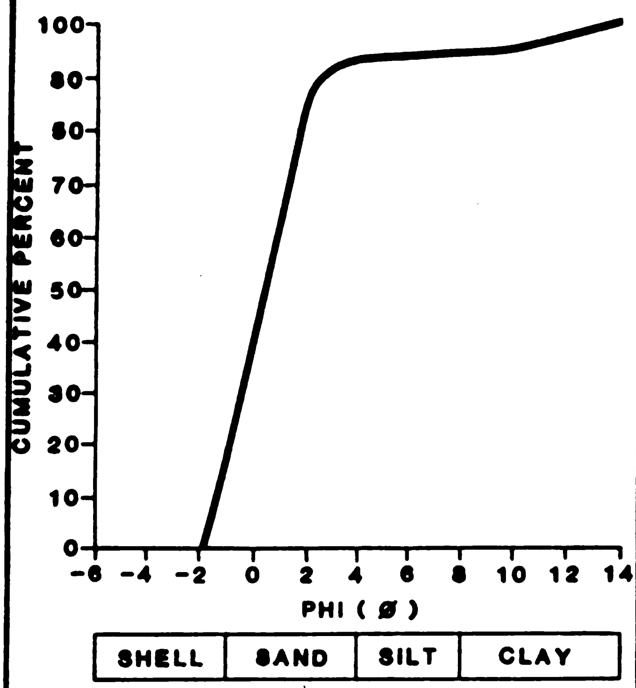


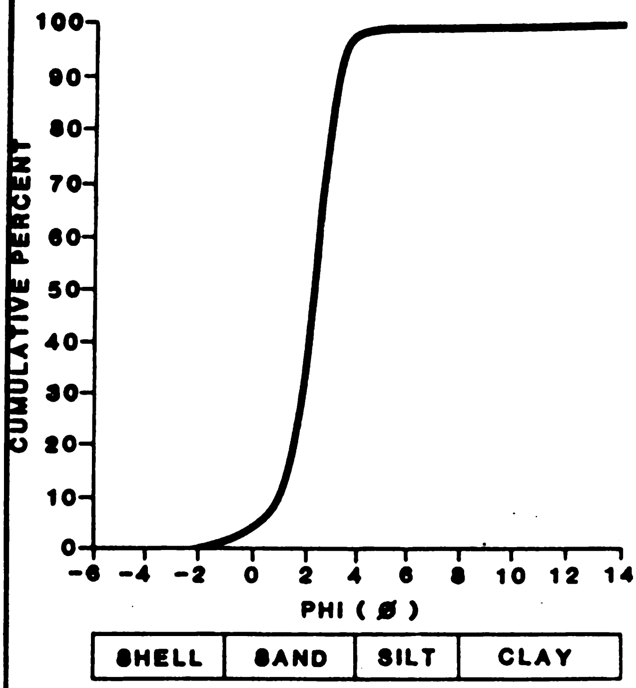
FIGURE A-5a

SEDIMENT COMPOSITION

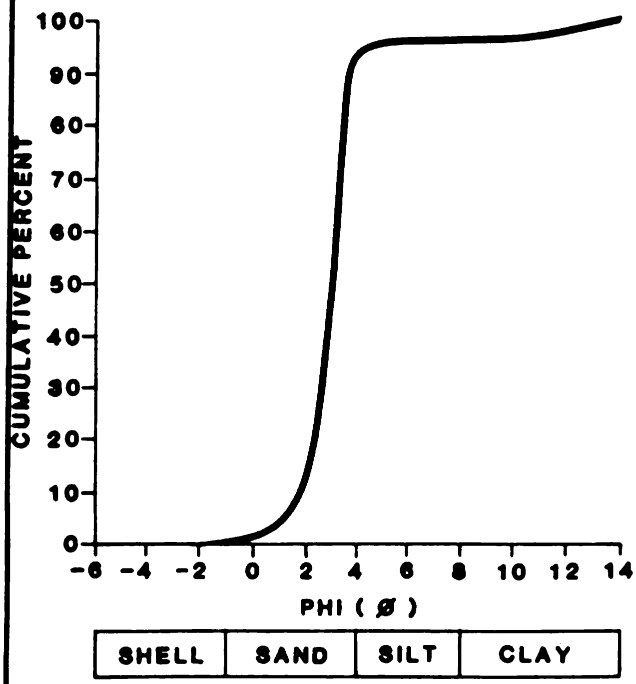
Ocean Dredged Material Disposal Site Charlotte Harbor, Florida



STATION: CH5



STATION: CH6



STATION: CH7

FIGURE A-5b

SEDIMENT COMPOSITION

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

Table A-6. Summary Results of the Granulometric Analysis of Sediments from the Charlotte Harbor ODMDS Study Area.

Station	Mean* (phi)	Mode* (phi)	Inclusive* Standard Deviation (phi)
CH-1	-0.5	-1.0	1.1
CH-2	4.0	4.0	1.0
CH-3	-0.3	-1.0	2.0
CH-4	2.3	2.0	0.8
CH-5	0.5	1.0	2.5
CH-6	2.3	2.5	0.8
CH-7	2.8	4.0	0.8

*As determined from graphical interpretation of granulometric data.

Inclusive graphic standard deviations were calculated as a measure of the uniformity or sorting of sediments. Values for this statistic generally range from 0.35 phi for well-sorted sediments to 4.00 phi or more for poorly sorted, non-uniform sediments (Pequegnat et al, 1981). Surficial sediments collected in conjunction with this study were moderately sorted, with inclusive standard deviation values ranging from 0.8 phi to 2.5 phi.

A.2.2 Chemical Characteristics

A.2.2.1 Water Quality

Water samples for chemical analysis were collected from approximately one meter off the bottom at Stations CH-4, CH-5, and CH-8. These samples were analyzed for selected trace metals, pesticides, polychlorinated biphenyls (PCBs), and high molecular weight hydrocarbons. The results of the analyses conducted are presented in Table A-7.

Mercury, cadmium, and lead were the trace metals tested for in this investigation. Mercury and lead concentrations were below analytical detection limits in all samples. Cadmium was detected in samples taken from Station CH-4, at the center of the ODMDS, and Station CH-8, located south of the ODMDS. Cadmium concentrations at CH-4 and CH-8 were 0.06 and 0.04 ug/1, respectively. The Environmental Protection Agency (EPA, 1976) cites Fleischer (1974) who reported an average concentration of cadmium in seawater of about 0.15 ug/1. A natural seawater concentration of 0.008 ug/1 has been reported by Kester et al. (1983). EPA water quality criteria call for no more than 5 parts per billion (= ug/1) in marine waters.

Samples from near bottom waters were also analyzed to determine the presence and concentration of PCBs, pesticides, and high molecular weight hydrocarbons. None of these constituents were present in detectable concentrations.

A.2.2.2 Sediment Chemistry

Sediments were collected from each of the sediment/benthos stations for chemical analyses. Constituents analyzed were trace metals, pesticides, polychlorinated biphenyls (PCBs), high molecular weight hydrocarbons, total organic carbon (TOC), and oil and grease. Metals were extracted from sediments at Stations CH-1, CH-2, CH-3, CH-5, and CH-6 by seawater elutriation. Weak acid extraction (0.1 N HCl) was used to extract metals from sediments collected at CH-4 and CH-7. Results of sediment chemistry analyses are presented in Table A-8.

Concentrations of mercury, and lead were below detection in all seawater elutriates. Cadmium was detected in the elutriates from Stations CH-3 and CH-5. The concentration of cadmium was highest at the latter station, located outside the ODMDS.

Levels of mercury, cadmium and lead in acid leachates were not indicative of selective concentration in ODMDS sediments.

Table A-7. Results of Chemical Analyses of Near Bottom Waters Collected from the Charlotte Harbor ODMDS Study Area.

Parameter	Station CH-4	CH-5	CH-8
Trace Metals			
Mercury, ug/l	<0.2	<0.2	<0.2
Cadmium, ug/l	0.06	<0.05	<0.05
Lead, ug/l	<0.5	<0.5	<0.5
Pesticides			
Alpha-BHC, ppb	<0.005	<0.005	<0.005
Gamma-BHC, ppb>	<0.006	<0.006	<0.006
Heptachlor, ppb	<0.02	<0.02	<0.02
Beta-BHC, ppb	<0.03	<0.03	<0.03
Aldrin, ppb	<0.009	<0.009	<0.009
Heptachlor Epoxide, ppb>	<0.02	<0.02	<0.02
4,4'-DDE, ppb	<0.02	<0.02	<0.02
4,4'-DDD, ppb	<0.05	<0.05	<0.05
4,4'-DDT, ppb	<0.06	<0.06	<0.06
o,p'-DDD, ppb	<0.1	<0.1	<0.1
o,p'-DDT, ppb	<0.1	<0.1	<0.1
Chlordane, ppb	<0.1	<0.1	<0.1
Dieldrin, ppb	<0.03	<0.03	<0.03
Endrin, ppb	<0.06	<0.06	<0.06
Total PCB's as Archlor 1254, ppb	<0.0004	<0.0004	<0.0004
High Molecular Weight Hydrocarbons			
Volume of sample extracted, ml	1500	1500	1500
Weight of extractables, ppm	<5.0	<5.0	<5.0
Aliphatics and aromatics, ppb	<0.0005	<0.0005	<0.0005
Resolved hydrocarbons, ppb	<0.0005	<0.0005	<0.0005
Unresolved hydrocarbons, ppb	<0.0005	<0.0005	<0.0005
Sum of n-alkanes, ppb	<0.0005	<0.0005	<0.0005
Sum of even n-alkanes, ppb	<0.0005	<0.0005	<0.0005
Sum of odd n-alkanes, ppb	<0.0005	<0.0005	<0.0005

ppm = parts per million (mg/l).
ppb = parts per billion (ug/l).

Table A-8. Results of Chemical Analyses of Sediments Collected From the Charlotte Harbor ODMDS Study Area.

PARAMETERS	STATION						
	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7
Trace Metals							
Mercury (in seawater elutriate), * ug/1	<0.2	<0.2	<0.2	----	<0.2	<0.2	----
Cadmium (in seawater elutriate), * ug/1	<0.05	<0.50	0.06	----	0.10	<0.05	----
Lead (in seawater elutriate), ug/1	<0.5	<0.5	<0.5	----	<0.5	<0.5	----
Mercury (in acid leachate), ** ug/g, dry	----	----	----	0.04	----	----	0.04
Cadmium (in acid leachate), ug/g, dry	----	----	----	0.20	----	----	0.23
Lead (in acid leachate), ug/g, dry	----	----	----	0.49	----	----	0.34
Pesticides							
Alpha-BHC, ug/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Gamma-BHC, ug/kg	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Heptaclor, ug/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Beta-BHC, ug/kg	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Aldrin, ug/kg	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Heptachlor Epoxide, ug/kg	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04
4.4'-DDE, ug/kg	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
4,4'-DDD, ug/kg	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
4,4'-DDT ug/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDD, ug/kg.	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
o,p'-DDT, ug/kg.	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	<0.4
Chlordane, ug/kg.	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dleldrin, ug/kg.	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Endrin, ug/kg	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total PCB's as Archlor 1254, ug/kg	2	<0.8	<0.8	<0.8	<0.8	<0.8	<0.8

Table A-8. (Continued)

PARAMETER	STATION CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7
High Molecular Weight Hydrocarbons							
Wet weight of sample extracted, g	250	250	250	250	250	250	250
Dry weight of sample extracted, g	203	178	210	190	200	210	205
Percent dry weight of wet weight	81	71	84	76	80	84	82
Weight of extractables, ppm, dry	290	53	42	51	49	32	35
Aliphatics are aromatics, ppm, dry	0.21	0.11	0.12	0.1	0.09	0.05	0.07
Resolved hydrocarbons, ppm, dry	0.25	0.15	0.18	0.1	0.12	0.10	0.11
Unresolved hydrocarbons, ppm, dry	0.15	0.05	0.12	0.9	0.12	0.04	0.07
Sum of n-alkanes, ppm, dry	0.05	<0.02	<0.02	<0.2	<0.02	<0.02	<0.02
Sum of even n-alkanes, ppm, dry	0.03	<0.02	<0.02	<0.2	<0.02	<0.02	<0.02
Sum of odd n-alkanes, ppm, dry	0.02	<0.02	<0.02	<0.2	<0.02	<0.02	<0.02
Unresolved hydrocarbons/resolved hydrocarbons	0.60	0.60	0.67	0.56	1.1	0.40	0.64
Total organix caronnn, mg/g	3.8	2.4	2.6	2.1	3.7	1.6	1.2
Oil and grease, ug/g	340	47	49	43	41	36	30

* Seawater elutriation conducted in accordance with Environmental Protection Agency/Corps of Engineers Technical Report EPA/CE-81-1. Sedimen: water (1:4, vol/vol).

** Acid extraction with 0.1 N HCL in accordance with Corps of Engineers Technical Report EL-81-1.

Pesticides levels were below analytical detection limits in all samples.

Levels of PCB's, high molecular weight hydrocarbons, total organic carbon, and oil and grease were highest in the sediment sample collected from Station CH-1. This station is located in Charlotte Harbor's designated deep water anchorage and is the sampling point closest to Boca Grande Channel. Elevated levels of anthropogenic contaminants at this station probably reflect this station's proximity to these areas used by commercial shipping. Analytical results give no indication of increased contaminant levels in ODMDS sediments.

A.2.3 Biological Characteristics

A.2.3.1 Benthic Macroinvertebrates

Almost 2,500 benthic macroinvertebrates representing 150 taxa were collected from the seven benthic sampling stations in the study area. The mean abundance and overall diversity of the infauna, composited for each station, is summarized in Table A-9. A listing of the benthic macroinvertebrates collected from the Charlotte Harbor ODMDS study area is presented in Appendix B, Table B-1. The taxonomic composition, abundance, and diversity of benthic macroinvertebrates collected from each grab sample taken at each station is presented, by station, in Appendix B Tables B-2 through B-8.

The mean density of the benthic macroinfauna ranged from 711 organisms/m^2 at Station CH-4, at the center of the ODMDS, to 2,239 organisms at Station CH-1, located north of the disposal site. The mean macroinfaunal density, averaged over all seven sampling stations in the study area, was 1,340 organisms/m^2.

Shannon-Weaver diversities, calculated for all the organisms collected from each station, ranged from 3.74 to 5.02. Values in this range are often considered characteristic of stable environments. No distinct patterns in diversity were noted.

Based on a quantitative analysis of the benthic data, it appears that Station CH-4, at the center of the ODMDS, may have been impacted by prior disposal operations. Both the number of organisms and the number of taxa represented in samples from this station are low in relation to the other stations. This may be reflective of conditions during the recolonization and recovery period following disposal.

Station CH-7 is located 0.5 nmi (0.93 km) south of the disposal site and over 1.0 nmi (1.85 km) south of CH-4. This site also supported a relatively low number of taxa and exhibited a relatively low diversity. There is no evidence that this station has been impacted by disposal activities. Station CH-6, located between CH-4 and CH-7 supported a relatively high number of taxa and had a high diversity.

Table A-9. Mean Abundance and Overall Diversity of Benthic Macroinvertebrates Collected from Stations in the Charlotte Harbor ODMDS Study Area.

Station	Abundance (Organisms/m^2)*	Number of Taxa**	Shannon-Weaver Diversity**
CH-1	2239 ± 854	55	4.31
CH-2	1180 ± 488	48	4.51
CH-3	1930 ± 1068	62	4.79
CH-4	711 ± 391	37	4.01
CH-5	1113 ± 538	43	4.58
CH-6	1162 ± 394	55	5.02
CH-7	1048 ± 520	38	3.74

* Value given is the mean ± one standard deviation of the five samples taken at each station.

** Calculated based on a composite of five samples.

The composition of the benthic macroinvertebrate community, by major taxonomic group, is given in Table A-10. Polychaete worms comprised the largest group, accounting for 58 percent of all organisms enumerated. Crustaceans, primarily cumaceans, amphipods, and decapods, were next in abundance, accounting for about 25 percent of the benthic invertebrates sampled. Molluscs were common and comprised approximately 7 percent of the areawide benthic community. Oligochaete worms were also represented in samples from five of the seven stations.

Twenty-nine polychaete families were represented in samples. Table A-11 presents the numerical distribution of these families at each station in the study area and Table A-12 ranks the top five polychaete families at each station. Spionidae was the most abundant polychaete family in the study area and at Stations CH-1, CH-2, CH-3, CH-4, and CH-7. This speciose family is primarily composed of opportunistic deposit feeders. Second in overall numeric importance was the family Capitellidae. The Capitellidae are also widely distributed opportunistic deposit feeders and were most abundant at Stations CH-1 and CH-3. Archiannelids were the dominant polychaetes at Station CH-5 while the Syllidae were dominant at CH-7. The families Chrysopetalidae and Glyceridae were also well represented in samples.

The most abundant polychaete species was the spionid Prionospio sp. which accounted for over ten percent of the benthic macroinvertebrates collected in this survey. Other common and abundant polychaete species included the spionids Paraprionospio sp., Prionospio cerrifirra, and Paraprionospio pinnata, the capitellid, Mediomastus sp., the archiannelid Polygordius sp., the glycerid Hemipoda sp., and the eunicid, Eunice vittata.

Crustaceans were most abundant at Stations CH-3 and CH-4, within the ODMDS, and accounted for over half of the benthic organisms collected at CH-4. Crustacean abundance was lowest at CH-1. Amphipods were the dominant crustacean order at Stations CH-1, CH-2, and CH-3, cumaceans at CH-4 and CH-7, and decapods at CH-5 and CH-6.

Molluscs were common though not abundant components of the benthic infauna. Molluscs were most numerous at Stations CH-1, CH-2, and CH-3 and least abundant at CH-4 and CH-5.

Families best represented in samples were Nuculanidae, Veneridae, Arcidae, and Semelidae.

Because they are small in size and poorly described taxonomically, marine oligochaetes typically receive little attention. This group accounted for ten percent of total benthic community numbers at CH-4 and eight percent at CH-7.

The filter-feeding cephalochordate, Branchiostoma floridae was also collected in samples from all stations except CH-2 and CH-7. Members of this genus are commonly associated with coarse sediments.

Table A-10. Benthic Macroinvertebrate Community Composition; by Major Group.

Station	Percent Abundance				
	Molluscs	Polychaetes	Oligochaetes	Crustaceans	Others
CH-1	8	75	5	3	9
CH-2	10	64	-	20	6
CH-3	8	57	-	30	5
CH-4	2	34	10	51	3
CH-5	1	61	2	22	14
CH-6	7	60	2	23	8
CH-7	10	56	8	26	-
Average	7	58	4	25	6

Table A-11. Polychaete Family Abundance at Stations in the Charlotte Harbor ODMDS Vicinity.

Polychaete Family	Station/Mean Abundance (No./m^2) CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	Mean Family Abundance (No/m^2)
Amphaeretidae	---	---	8	---	---	---	---	1
Arabellidae	4	---	4	---	---	---	---	1
Archiannelida	---	---	48	---	196	96	33	53
Capitellidae	286	19	237	26	41	93	15	102
Chrysopetalidae	203	---	63	---	71	48	---	55
Cirratulidae	4	---	11	7	15	---	12	7
Dorvilleidae	26	---	19	---	4	11	---	9
Eunicidae	226	---	29	---	4	26	---	41
Glyceridae	70	7	48	4	63	130	8	47
Goniadidae	---	8	---	11	---	---	---	3
Hesionidae	82	4	---	---	---	4	---	13
Lumbrineridae	63	79	22	---	15	34	8	32
Magelonidae	---	122	15	8	19	---	11	25
Maldonidae	---	8	---	---	---	---	---	1
Neptyidae	---	64	4	---	38	4	59	24
Nereidae	11	11	93	---	11	4	---	19
Onuphidae	---	4	---	---	8	4	8	3
Ophelidae	19	---	12	---	26	30	---	12
Oweniidae	---	33	---	23	---	---	8	9
Paraonidae	26	4	22	8	34	15	11	17
Phyllodocidae	49	30	19	---	7	4	4	16
Pilargidae	4	4	19	12	15	---	---	8
Polynoidae	---	30	---	---	---	4	11	6
Porvellidae	---	---	---	---	---	4	---	<1
Sabellidae	11	---	19	---	8	---	---	5
Sigalionidae	---	---	4	---	---	---	---	<1
Spionidae	560	323	349	145	56	53	400	269
Syllidae	34	---	53	---	49	136	---	39
Terebellidae	---	11	4	---	---	---	---	2
Polychaete Abundance (No/m^2)	1678	761	1101	244	680	700	588	821
Total Polychaete Families	17	17	22	9	19	18	13	29

Table A-12. Numerical Ranking of Polychaete Families Collected from Stations in the Charlotte Harbor ODMDS Vicinity.

Station	Rank By Abundance				
	1	2	3	4	5
CH-1	Spionidae	Capitellidae	Eunicidae	Chrysopetalidae	Hesionidae
CH-2	Spionidae	Magelonidae	Lumbrineridae	Nephtyidae	Oweniidae
CH-3	Spionidae	Capitellidae	Nereidae	Chrysopetalidae	Syllidae
CH-4	Spionidae	Capitellidae	Oweniidae	Pilargidae	Goniadidae
CH-5	Archiannelida	Chrysopetalidae	Glyoeridae	Spionidae	Syllidae
CH-6	Syllidae	Glyceridae	Archiannelida	Capitellidae	Spionidae
CH-7	Spionidae	Nephtyidae	Archiannelida	Capitellidae	Cirratulidae
Overall	Spionidae	Capitellidae	Chrysopetalidae	Archiannelida	Glyceridae

Three similarity indices were used to aid in the classification and evaluation of the benthic macroinfauna collected at stations in the Charlotte Harbor ODMDS vicinity. Indices used were the Morisita index, Bray-Curtis index, and a simple matching index. The Morisita and Bray-Curtis indices are quantitative and take into account both the occurrence and the abundance of organisms. The simple matching index is qualitative and is based solely on the presence of common species in samples compared.

Cluster analyses were conducted based on the above determinations of similarity. Similar results were obtained using each of the three techniques. Clustering resulted in the identification of three distinct groups. One group includes Stations CH-1, CH-3, CH-5, and CH-6. A second group consists of Stations CH-4 and CH-7. Station CH-2 is an outlier and forms a third group. Results of the cluster analyses are depicted in Figures A-6, A-7, and A-8.

The largest group of stations, while clustered in terms of faunal similarity, includes a diversity of benthic habitat types. Stations CH-5 and CH-6 were the most similar pair of stations sampled. Sediments at CH-5 were predominantly coarse sand while those at CH-6 were predominantly fine sand. Sediments at Stations CH-1 and CH-3 are similar and were comprised of very coarse sand and shell hash. These stations were also paired in terms of faunal composition. This cluster of stations includes sampling loci located within the ODMDS (CH-3 and CH-6) and outside ODMDS boundaries (CH-1 and CH-5).

Stations CH-4 and CH-7 supported similar benthic communities and provided similar substrate. Sediments sampled at both stations were comprised primarily of fine sands. Station CH-4 is located at the center of the ODMDS while Station CH-7 is located 0.5 nmi south of the disposal site's southern boundary.

Station CH-2 was dissimilar from the other stations in both faunal composition and sediment texture. Sediments at CH-2 were predominantly very fine sand and silt.

It is interesting to note that Stations CH-4 and CH-7 appear to be more similar when compared using the simple matching (presence/absence) index than when compared using quantitative indices which also compare taxon abundances. This may reflect recolonization at CH-4 following disposal operations. While a similar assemblage of infaunal species may be colonizing the similar sediments at the two stations, these taxa may not yet have increased in number at CH-4 to saturate the available habitat.

Simple matching also groups Station CH-2 more closely with Stations CH-4 and CH-7 than do the more quantitative Morisita and Bray-Curtis indices.

Based on this analysis of benthic infaunal communities in the Charlotte Harbor ODMDS vicinity, the following observations can be made.

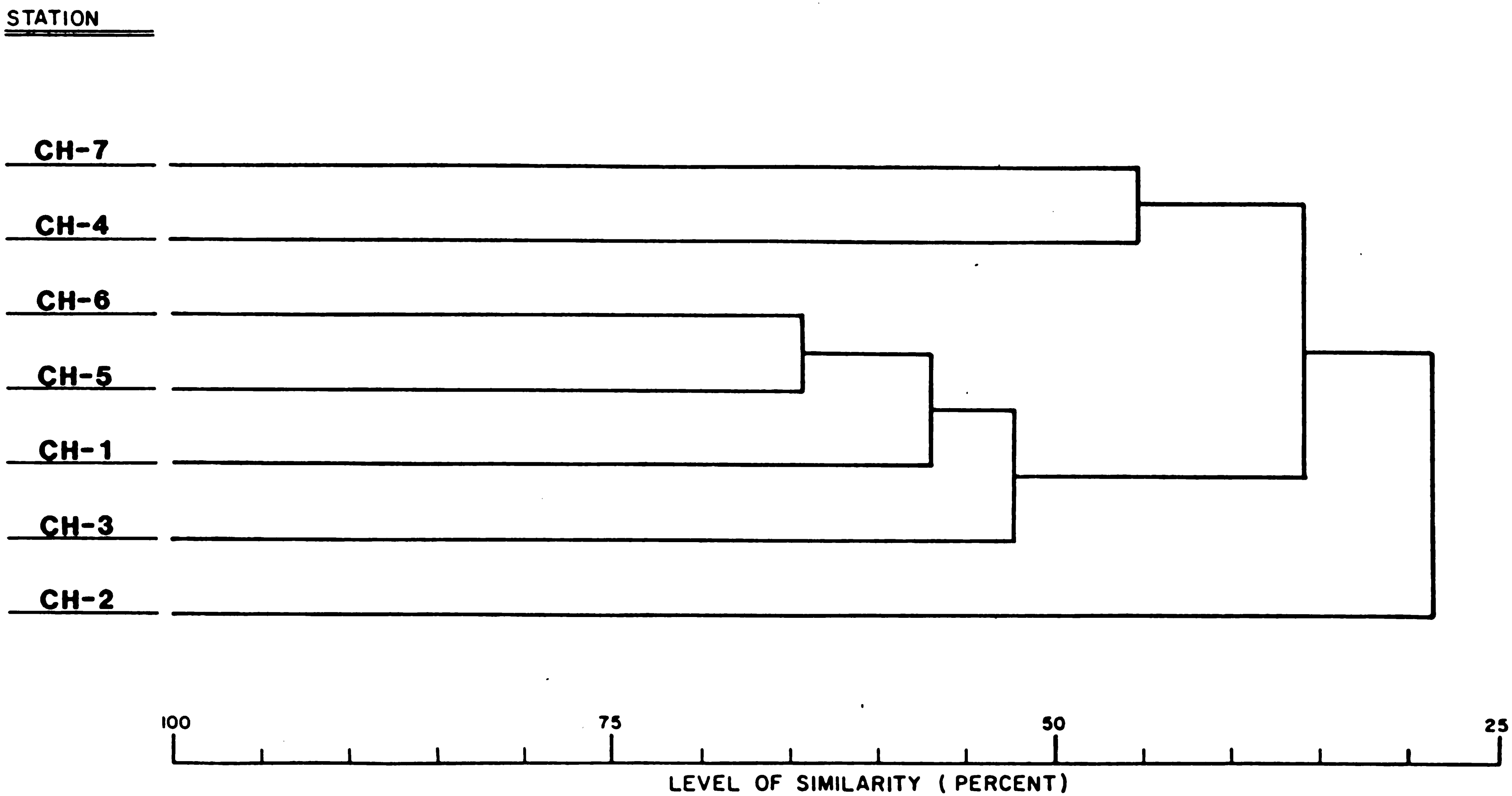


FIGURE A-6

CLUSTER DENDOGRAM SHOWING STATION ASSOCIATIONS BASED ON BENTHIC MACROINVERTEBRATE SIMILARITY AS DETERMINED USING THE MORISITA INDEX

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

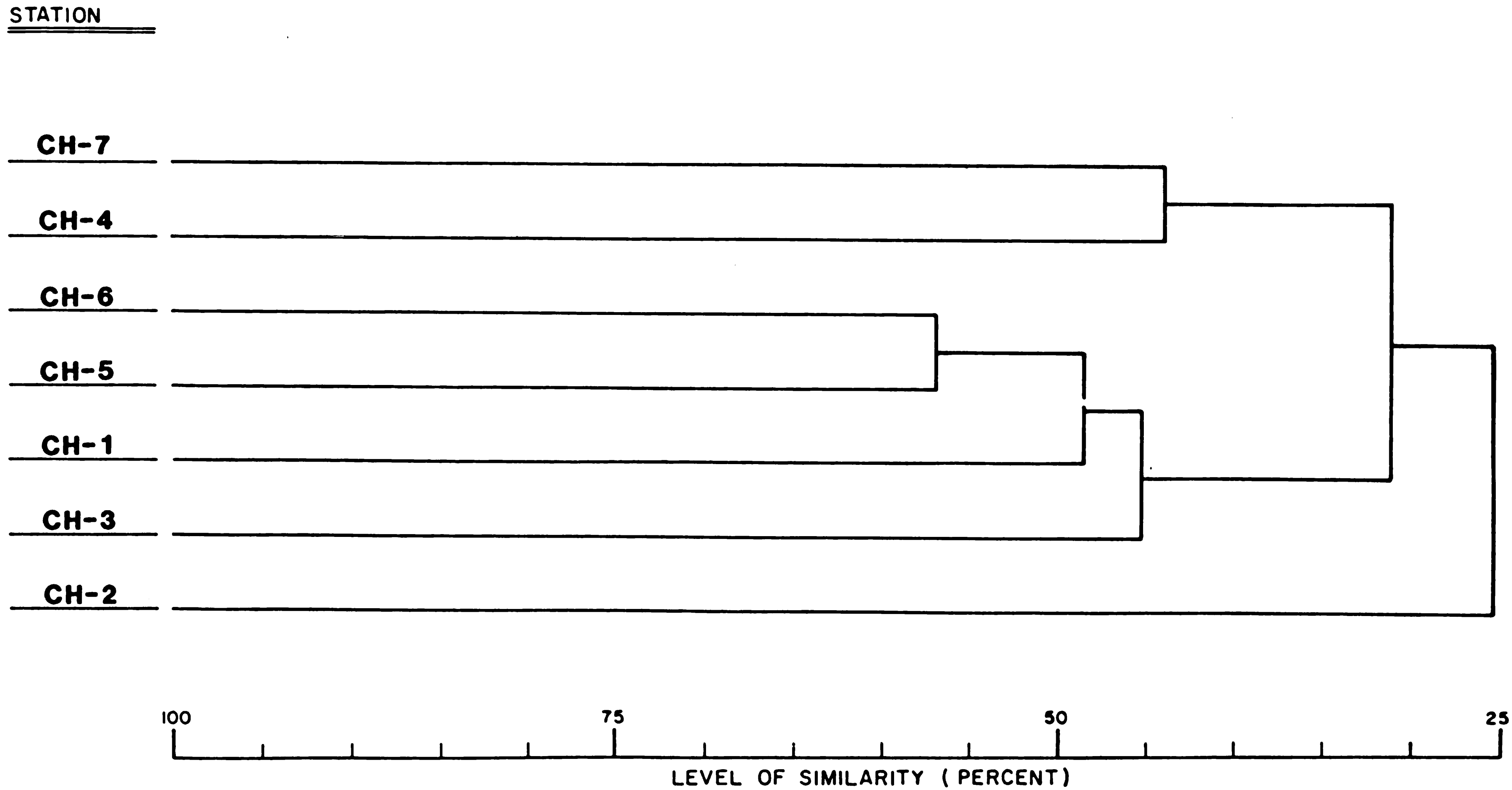


FIGURE A-7

CLUSTER DENDOGRAM SHOWING STATION ASSOCIATIONS BASED ON BENTHIC MACROINVERTEBRATE SIMILARITY AS DETERMINED USING THE BRAY-CURTIS INDEX

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

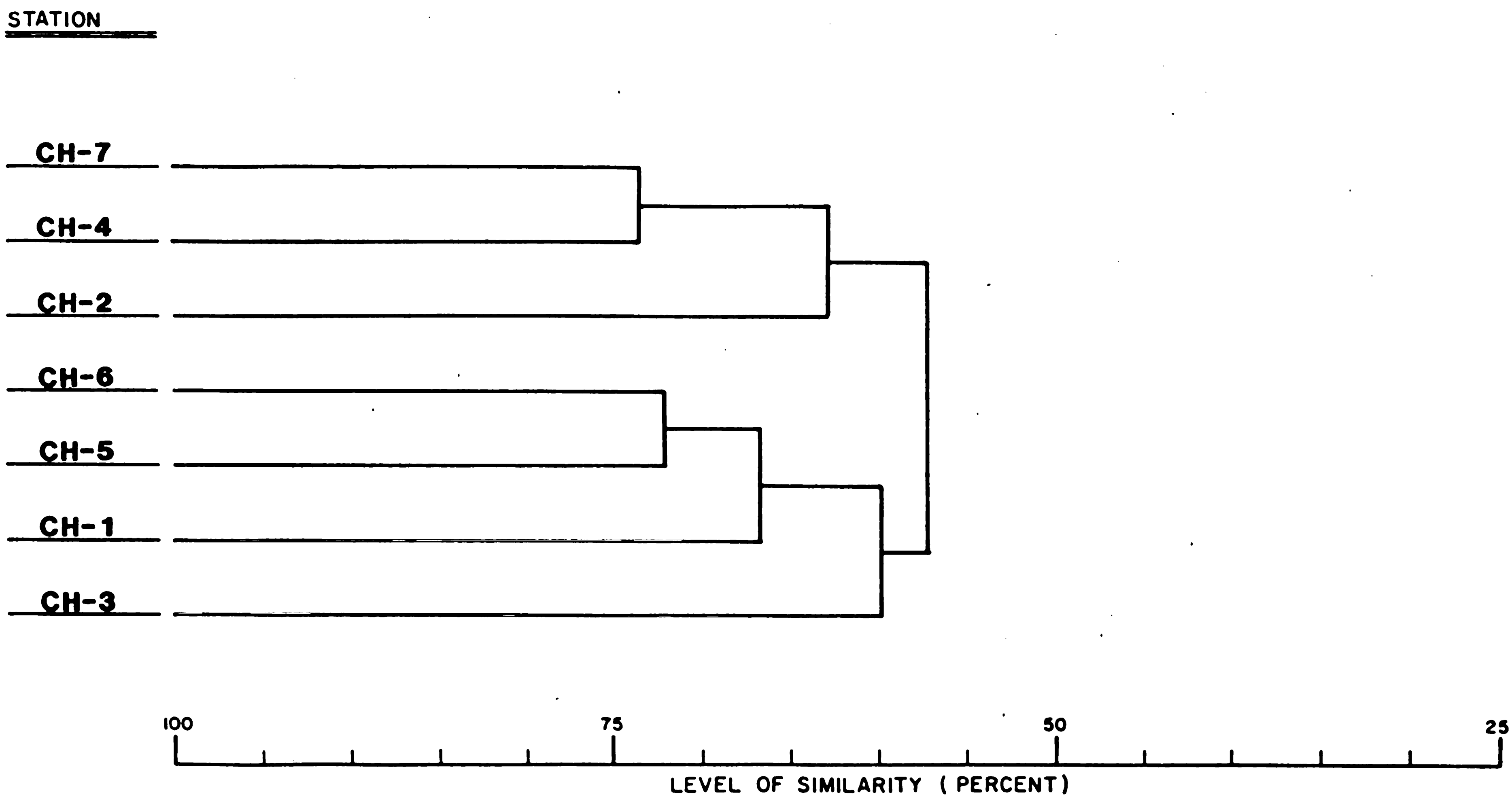


FIGURE A-8
CLUSTER DENDOGRAM SHOWING STATION ASSOCIATIONS BASED ON BENTHIC MACROINVERTEBRATE SIMILARITY AS DETERMINED BY SIMPLE MATCHING (PRESENCE/ABSENCE)
Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

1. Polychaete worms and crustaceans dominated the benthic infauna numerically.

2. In terms of abundance, number of taxa, and diversity, consistent differences between stations located within the ODMDS and those outside the ODMDS were not observed. Localized impacts at CH-4 were noted.

3. Cluster analyses do not reveal differences between benthic communities at stations located within the disposal site and those in surrounding areas. Faunal differences observed are more likely related to substrate character or other undetermined environmental variables.

4. The benthic community at CH-4 may be recovering from prior disposal operations. Samples from this site had both a low number of taxa and a low abundance of organisms. Fauna colonizing this site are similar to those established in nearby unimpacted, physically similar sediments.

A.2.3.2 Meiofauna

The composition and abundanoe of meiofauna collected from the study area is given in Table A-13. Nematodes were the most abundant meiofaunal organisms, accounting for over 70 percent of the organisms collected from all stations, except CH-1. Turbellarians and cyclopid copepods were also common.

A.2.3.3 Macroepifauna

Table A-14 lists the fish and invertebrates collected in replicate trawls at Stations CH-1, CH-4, and CH-7. Eight species of fish were represented by the 29 individuals collected. White grunt (*Haemulon plumieri*) was the most abundant species collected. Other fish species included spotfin mojarra (*Eucinostomus argenteus*), sand perch (*Diplectrum formosum*) and lizardfish (*Synodus foetens*).

Epibenthic macroinvertebrates were not abundant in trawl samples. Those collected included the crab *Portunus spinimannus* and several echinoderms; starfish, a sea urchin, and a brittle star. The only representative of a commercially important species was a pink shrimp (*Penaeus duorarum*) collected at Station CH-7.

Table A-13. Meiofauna Collected from Stations in the Charlotte Harbor Interim Ocean Dredged Material Disposal Site Vicinity.

TAXA Phylum Class Subclass Order	Station/Replicate/Abundance*														Mean Abundance
	CH-1		CH-2		CH-3		CH-4		CH-5		CH-6		CH-7		
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	
Plathelminthes															
Turbellaria	14	5	5	2	39	62	37	28	32	26	30	25	36	48	28
Nematoda	53	25	165	363	236	274	473	295	212	248	185	187	777	1079	327
Gastrotricha		4			10	1	17	8	4	7	1		4	8	5
Kinorhyncha	1	1	1	2	1	1	1		1	2		1		2	1
Annelida															
Polychaeta															
(larve)	5	7				4	3	2	2	6	1	4		4	3
Tardigrada							3					1			<1
Arthopoda															
Crustacea															
(nauplii)			1	1		1	2		3	9	1		4	1	2
Copepoda															
Harpacticoida				1		13	2	5	1		2	5		2	2
Cyclopoida	72	21	36	14	21	6	23	5	32	42	3	4	22	7	22
TOTAL ABUNDANCE	145	63	208	283	307	362	561	343	287	340	223	227	843	1551	

cm^2 of sediment surface area.

Table A-14. Fish and Invertebrates Collected by Trawl from Stations in the Charlotte Harbor ODMDS Vicinity.

Station	Replicate	Scientific Name	Common Name	Number	Species Wet Weight (g)	Total Sample Wet Weight (g)
		Fish				
CH 1	A	*Eucinostomus argenetus*	Spotfin mojarra	3	31	265
		Haemulon plumieri	White grunt	8	234	
CH 1	B	----------	----------		-	0
		Fish				
CH 4	A	*Eucinostomus argenteus*	Spotfin mojarra	1		
		Haemulon plumeri	White grunt	6	168	
		Lactophrys tricornis	Scrawled Cowfish	1	104	300
		Fish				
CH 4	B	*Diplectrum formosum*	Sand perch	2	67	
		Prionotus scitulus	Leopard sea robin	1	16	
		Invertebrates				
		Pinctada imbricata	Pearl oyster	2	30	
		Strombus alatus	Conch	1	22	
		Echinaster sp.	Starfish	2	26	
		Portunus spinimannus	Portunid crab	2	27	188
		Fish				
CH 7	A	*Synodus foetens*	Lizardfish	1	124	124
		Fish				
CH 7	B	*Diplectrum formosum*	Sand perch	2	109	
		Haemulon macrostomum	Spanish grunt	1	107	
		Monacanthus hispidus	Planehead filefish	1	8	
		Synodus foetens	Lizardfish	2	206	
		Invertebrates				
		Lytechinus varieqatus	Sea urchin	1	95	
		Oipiopharagmus sp.	Brittle star	1	1	
		Penaeus duorarum	Pink shrimp	1	9	
		Portunus spinimannus	Portunid crab	2	22	527

4.2.3.4 Tissue Analyses

From the trawl collections made at Stations CH-1, CH-4, and CH-7, several species of fish were selected for tissue analysis. Invertebrates were not collected in sufficient quantity for analysis. Constituents measured were trace metals, pesticides, PCB's and high molecular weight hydrocarbons. Species selected for analysis were white grunt (*Haemulon plumieri*), sand peroh (*Diplectrum formosum*), and lizardfish (*Synodus foetens*). Results of fish tissue analyses are presented in Table A-15.

Mercury concentrations were lowest in lizardfish and comparable in white grunt and sand perch. Tissue concentrations in fish collected from the ODMDS were slightly higher than those collected from stations located outside the ODMDS. Overall, mercury levels ranged from 0.02 to 0.06 ug/l on a wet weight basis.

Cadmium concentrations were highest in white grunt samples and lowest in lizardfish. Differences potentially associated with dredged material disposal are not apparent.

Levels of lead and pesticides were below detection in all tissue samples. Polychlorinated biphenyls (PCBs) were only detected in one sample. PCBs were present at 0.05 mg/kg in a white grunt sample collected at Station CH-1, north of the ODMDS.

Analyses of high molecular weight hydrocarbons did not indicate that these compounds were concentrated in the tissues of fish collected from the ODMDS.

Table A-15. Results of Tissue Analyses of Fish Species Collected from the Charlotte Harbor ODMDS Study Area.

PARAMETER*	CH-1 *Haemulon plumieri* White grunt)	CH-4 *Haemulon plumieri* (White grunt)	CH-4 *Diplectrum formosum* (Sand perch)	CH-7 *Diplectrum formosum* (Sand perch)	CH-7 *Synodus foetens* (Lizardfish)
Trace Metals					
Mercury ug/g	0.04	0.06	0.05	0.04	0.02
Cadmium ug/g	0.017	0.012	0.007	0.005	0.004
Lead ug/g	0.03	<0.03	<0.03	<0.03	<0.03
Pesticides					
Alpha-BHC, mg/kg	0.00007	<0.00007	<0.00007	<0.00007	<0.00007
Gamma-BHC, mg/kg	0.00009	<0.00009	<0.00009	<0.00009	<0.00009
Heptachlor, mg/kg	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Beta-BHC, mg/kg	0.0003	<0.0003	<0.0003	<0.0003	<0.0003
Aldrin, mg/kg	0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Heptachlor Epoxide, mg/kg	0.0002	<0.0002	<0.0002	<0.0003	<0.0002
4,4'-DDE, mg/kg	0.0003	<0.0003	<0.0003	<0.0003	<0.0003
4,4'-DDD, mg/kg	0.0004	<0.0004	<0.0004	<0.0004	<0.0004
4,4'-DDT, mg/kg	0.0004	<0.0004	<0.0004	<0.0004	<0.0004
o,p'-DDD, mg/kg	0.001	<0.001	<0.001	<0.001	<0.001
o,p'-DDT, mg/kg	0.001	<0.001	<0.001	<0.001	<0.001
Chlordane, mg/kg	0.001	<0.001	<0.001	<0.001	<0.001
Dieldrin, mg/kg	0.0002	<0.0002	<0.0002	<0.0002	<0.0002
Endrin, mg/kg	0.0004	<0.0004	<0.0004	<0.0004	<0.0004
Total PCBs as Archlor 1254, mg/kg	0.05	<0.006	<0.006	<0.006	<0.006

Table A-15. Continued

PARAMETER*	Station / Species	CH-1 Haemulon plumieri White grunt)	CH-4 Haemulon plumieri (White grunt)	CH-4 Diplectrum formosum (Sand perch)	CH-7 Diplectrum formosum (Sand perch)	CH-7 Synodus foetens (Lizardfish)
Molecular Weight Hydrocarbons						
Wet weight of sample extracted, g		100	100	100	100	100
Weight of extractables, ppm		890	740	1100	650	780
Aliphatics ard aromatics, ppm		0.37	0.37	0.21	0.24	0.23
Resolved hydrocarbons, ppm		0.51	0.54	0.30	0.43	0.52
Unresolved hydrocarbons, ppm		0.12	0.15	0.09	0.18	0.17
Sum of n-alkanes, ppm		0.17	0.13	0.06	0.06	0.06
Sum of even n-alkanes, ppm		0.07	0.08	0.03	0.04	0.04
Sum of odd n-alkanes, ppm		0.10	0.05	0.03	0.02	0.02
Unresolved hydrocarbons/resolved hydrocarbons		0.24	0.30	0.30	0.41	0.33
Ratio:odd n-alkanes/even n-alkanes		1.4	0.62	1.0	0.50	0.50
Ratio:phythane/n-c18		0.25	0.10	0.20	0.32	0.27
Ratio:pristane/n-c17		0.50	0.46	0.43	0.45	0.27

* All results are expressed on a wet-weight basis.

APPENDIX B

BETHNIC MACROINFAUNA

Table B-1. Benthic Macroinvertebrates Collected from Stations in the Charlotte Harbor ODMDS Study Area.

- Phylum
  - Class
    - Order
      - Family
        - Genus Species

- Anthozoa
- Rhynchocoela
- Aschelminthes
  - Nematoda
- Mollusca
      - Chaetopleuridae
        - *Chaetopleura* sp.
      - Epitoniidae
      - Fasciolariidae
        - *Leucozonia* sp.
      - Lepetidae
      - Olividae
        - *Olivella* sp.
      - Arcidae
        - *Barbatia* sp.
      - Cardidae
      - Nuculanidae
      - Ostreidae
      - Plicatolidae
        - *Plicatula gibbosa*
      - Semelidae
      - Tellinidae
      - Veneridae
        - Chione sp.
        - *Gemma gemma*
- Annelida
  - Polychaeta
      - Archiannelida
        - *Polygordius* sp.
        - *Potamilla* sp.
      - Amphaeretidae
      - Arabellidae
        - *Arabella* sp.
      - Capitellidae
        - *Mediomastus* sp.
      - Chrysopetalidae
        - *Bhwania heteroseta*
        - *Bhwania* sp.
      - Cirratulidae
        - *Caulleriella* sp.
        - *Cirriformia* sp.

Table B-1. (Continued)

Phylum Class Order Family Genus Species
Dorvilleidae
Eunicidae
Eunice vittata
Eunice sp.
Lysidice ninetta
Lysidice sp.
Glyceridae
Clycera americana
Clycera sp.
Hemipodus roseus
Hemipodus sp.
Goniadidae
Goniada littorea
Goniada sp.
Hesionidae
Podarkeopsis levifuscina
Lumbrineridae
Lumbrineris ernesti
Lumbrineris latreilli
Lumbrineris tenuis
Lumbrineris verllli
Lumbrineris sp.
Magelonidae
Magelona sp. A
Magelona sp.
Maldanidae
Asychis elonqatus
Nephtyidae
Aglaophamus verilli
Aglaophamus sp.
Nephtys sp.
Nereidae
Ceratonereis sp.
Nereis lamellosa
Nereis sp.
Onuphidae
Diopatra cuorea
Ophelidae
Armandia sp.

Table B-1. (Continued)

Phylum Class Order Family Genus Species
Oweniidae
Myriochele oculata
Mydriochele sp.
Owenia sp. A
Owenla sp.
Paraonidae
Aricidea cerrutii
Aricieda sp.
Phyllodocidae
Phyllodoce arenae
Phyllodoce sp.
Pilargidae
Ancistrosyllis sp.
Sigambra tentaculata
Sigambra sp.
Ancistrosyllis carolinensis
Ancistrosyllis sp.
Siqambra tentaculata
Polynoidae
Harmothoe sp.
Porvellidae
Sabellidae
Sabellaris sp.
Sigalionidae
Siqalion sp.
Spionidae
Paraprionospio pinnata
Paraprionospio sp.
Polydora sp.
Prionospio Cirriferra
Prionospio sp.
Scolelepis texana
Scolelepis sp.
Spiophanes bombyx
Streblospio benedicti
Syllidae
Brania wellfleetensis
Brania sp.
Exogone sp.
Opisthodonta sp.
Sphaerosvllis sp.

Table B-1. (Continued)

Phylum
Class
Order
Family
Genus Species
Trypanosyllis parvidentata
Trypanosyllis sp.
Terebellidae
Polycirrus sp.
Oligochaeta
Oligochaeta sp.
Sipuncula
Aspidosiphonidae
Asoidosiphon sp.
Arthropoda
Crustacea
Amphipoda
Ampeliscidae
Ampelisca sp.
Amphithoidae
Cymadusa sp.
Aoridae
Lembos sp.
Bateidae
Batea sp.
Caprellidae
Corophidae
Corophium sp.
Lilljeborgiidae
Listrella sp.
Melitidae
Melita sp.
Melitidae sp.
Oedicerotidae
Monoculodes sp.
Photidae
Hanchelidium sp.
Phoxocephalidae
Harpinia sp.
Tironidae
Syrrhoe sp.
Cumacea
Bodotriidae
Leuconidae
Decapoda
megalopa
zoeae

Table B-1. (Continued)

Phylum Class Order Family Genus Species
Alpheidae
Alpheus sp.
Thalassinoidea
Calappidae
Calaopa sp.
Crangonidae
Hippolytidae
Paguridae
Parthenopidae
Sergestidae
Lucifer faxoni
Penaeidae
Pinnixidae
pinnixia sp.
Porcellanidae
Euceramus sp.
Callianassidae
Upoqebia sp.
Xanthidae
Natantia
Isopoda
Paracerceis sp.
Xanathura sp.
Munnidae
Munna sp.
Mysidacea
Mysidae
Mysidopsis sp.
Tanaidacea
Echinodermata
Echinoidea
Arbaciidae
Arbacia sp.
Ophiuroidea
Chordata
Branchiostoma floridae

Table B-2. Benthic Macroinvertebrates Collected from Station CH-1 in the Charlotte Harbor ODMDS Study Area.

phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Rhynchocoela	74					15
Mollusca						
Nuculanidae	19	56	74	167	74	78
Plicatolidae						
Plicatula gibbosa		19	19			8
Tellinidae	19					4
Veneridae						
Chione sp.	93	185	37	74	37	85
Gemme gemma	19	19	19	19		15
Annelida						
Polychaeta						
Arabellidae	19					4
Capitellidae		37			37	15
Mediomastus sp.	667	130	167	389		271
Chysopetalidae						
Bhwania heteroseta		333	333			133
Bhwania sp.				296	56	70
Cirratulidae						4
Dorvilleidae			19	74	37	26
Eunicidae						
Eunice vittata	296	407	148			170
Einice sp.				185	19	41
Lysidice ninetta	37					7
Lysidice sp.			19			4
Lysidice sp.			19			4
Glyceridae	111					22
Hemipodus roseus		56				11
Hemipodus sp.			130	19	37	37
Hesionidae		185	111	93	19	82
Lumbrineridae						
Lumbrineris latreilli	74					15
Lumbrineris sp.		19	19	185	19	48
Nereidae	19	37				11
Ophelidae						
Armandia sp.				93		19
Paraonidae						
Aricidea cerrutii			19			4
Aricidea sp.		37		56	19	22
Phyllodocidae						
Phyllodoce sp.			19			4

Table B-2. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance ($Organisms/m^2$)
Pilargidae						
Ancistrosyllis carolinensis	19					4
Ancistrosyllis sp.		19	19	185		45
Sabellidae						
Potamilla sp.				56		11
Spionidae	19					4
Paraprionospio pinnata	19					4
Paraprionospio sp.			19			4
Prionospio sp.	333	556	611	796	426	544
Scolelepis texana	19					4
Syllidae		56			19	15
Brania sp.				37		7
Exogone sp.			19		19	8
Sphaerosyllis sp.			19			4
Oligochaeta	241	74	204	37		111
Arthropoda						
Crustacea						
Amphipoda				19		4
Bateidae						
Batea sp.		19	19			8
Melitidae		37				7
Melita sp.	19		37			11
Tironidae						
Syrrhoe sp.	19	19				8
Cumacea						
Bodotriidae	37	19				11
Leuconidae	19					4
Decapoda						
Paguridae				37		7
Pinnixidae						
Pinnixia sp.				56		11
Mysidacea						
Mysidae						
Mysidopsis sp.		19				4
Echinodermata						
Ophiuroidea	19	37	19	56	19	30
Echinoidea						
Arbaciidae						
Arbacia sp.	19	56	19	19	19	26

Table B-2. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m²) 1	2	3	4	5	Mean Abundance (Organisms/m²)
Choradata						
Branchiostoma floridae		130	167	259	19	115
Total Abundance	2229	2580	2304	3207	875	
Mean Abundance; Station Composite						2239
Number of Taxa	24	26	26	23	16	
Total Taxa; Station Composite						55
Shannon-Weaver Diversity	3.41	3.79	3.68	3.77	2.91	
Diversity; Station Composite						4.31

Table B-3. Benthic Macroinvertebrates Collected from Station CH-2 in the Charlotte Harbor ODMDS Study Area.

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Anthozoa		37			19	11
Rhynochocoela	19	37	56		37	30
Mollusca						
Epitoniidae		19		19		8
Arcidae	19					4
Cardidae				37		7
Semelidae	19	130	37	37	37	52
Tellinidae	19	74	37		37	33
Veneridae	19	37	19		19	19
Annelida						
Polychaeta						
Capitellidae	19		56			15
Mediomastus sp.		19				4
Glyceridae						
Glycera americana	37					7
Goniadiae						
Goniada littorea	19		19			8
Hesionidae						
Podarkeopsis levifuscina					19	4
Lumbrineridae						
Lumbrineris ernesti					19	4
Lumbrineris latreilli						
Lumbrineris tenuis			19			
Lumbrineris verilli						4
Lumbrineris sp.	93	37	130	56	19	67
Magelonidae						
Magelona sp. A	37	37	259	185	93	122
Maldanidae						
Asychis elonqatus		19			19	8
Nephtyidae						
Aglaophamus verilli	74	56	19	19	130	60
Nephtys sp.			19			4
Nereidae						
Nereis lamellosa		56				11
Onuphidae						
Diopatra cuprea		19				4
Oweniidae			37			7
Myriochele oculata			37			7
Owenia sp. A	37		37		19	19
Paraonidae						
Aricidea sp.				19		4

Table B-3. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m2) 1	2	3	4	5	Mean Abundance (Organisms/m2)
Phyllodocidae						
Phyllodoce arenae	19					4
Pilargidae						
Sigambra tentaculata	37	19	74		19	30
Polynoidae						
Harmothoe sp.	19	19	56	37	19	30
Spionidae	241	19	315	37	185	159
Paraprionospio pinnata	111	389	167	19	74	152
Prionospio cirriferra						4
Spiophanea bombyx		19				4
Streblospio benedicti				19		4
Terebellidae			37		19	11
Oligochaeta			19			4
Arthropoda						
Crustacea						
Amphipoda		130		19	37	37
Ampeliscidae						
Ampelisca sp.	167	204	74		93	108
Aoridae						
Lembos sp.		37				7
Corophidae						
Corophium sp.		19				4
Lilljeborgiidae						
Listrella sp.		37	19		19	15
Tironidae						
Syrrhoe sp.		19				4
Cumacea						
Leuconidae		37	19			11
Decapoda						
Pinnixidae						
Pinnixia sp.		93	37	19	19	34
Isopooda						
Munnidae						
Munna sp.					37	7
Mysidacea						
Mysidae						
Mysidopsis sp.	19	37				11

Table B-3. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Echinodermata						
Ophiuroidea		19	19		37	15
Total Abundance	1024	1693	1636	522	1025	
Mean Abundance; Station Composite						1180
Number of Taxa	19	29	26	13	23	
Total Taxa; Station Composite						48
Shannon-Weaver Diversity	3.61	4.13	4.02	3.18	3.04	
Diversity; Station Composite						4.51

Table B-4. Benthic Macroinvertebrates Collected from Station CH-3 in the Charlotte Harbor ODMDS Study Area.

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Mollusca						
Ischnochitonidae						
Chaetopleura sp.		37				7
Fasciolariidae						
Leucozonia sp.	37					7
Lepetidae					19	4
Olividae						
Olivella sp.		19				4
Arcidae						
Barbatia sp.	111	37		19	148	63
Nuculanidae	19	37		74	37	33
Semelidae					56	11
Veneridae	19	37		74	37	33
Annelida						
Polychaeta						
Amphaeretidae		19	19			8
Arabellldae						
Arabella sp.					19	4
Archiannelida						
Polygordius sp.	241					48
Capitellidae					37	7
Mediomastus sp.	278	37	19	352	463	230
Chrysopetalidae						
Bhwania sp.	19	148	56	37	56	63
Ciratulidae						
Caulleriella sp.		37				7
Caulleriella sp.			19			4
Dorvilleidae	19	37	37			19
Eunicidae						
Eunice sp.	56	19		37		22
Eunice sp.					37	7
Glyceridae						
Hemipodus sp.	56	148		37		48
Lumbrineridae						
Lumbrineris sp.		37				
Magelonidae				19	56	22
Magelona sp.		19			56	15
Nephtyidae						
Aglaophamus sp.	19					4

Table B-4. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Nereidae						
Ceratonereis sp.		19		19		8
Nereis sp.	204	74	19	19	111	85
Ophelidae						
Armandia sp.	19				19	8
Armandia sp.					19	4
Paraonidae						
Aricidea sp.		19	19		19	11
Aricidea sp.		19	19		19	11
Phyllodocidae						
Phyllodoce sp.	19	19	19		37	19
Pilargidae						
Sigambra sp.				19		4
Ancistrosyllis sp.		74				15
Sabellidae						
Sabellaria sp.	56				37	19
Sigalionidae						
Siqalion sp.	19					4
Spionidae						
Paraprionospio sp.		74	56	19	56	41
Polydora sp.	74	74				30
Prionospio sp.	56	889	56	130	241	274
Scolelepis sp.				19		4
Syllidae						
Exogone sp.	19			19		8
Opisthodonta sp.	74			37		22
Trypanosyllis sp.	19	37			56	22
Terebellidae						
Polycirrus sp.		19				4
Arthropoda						
Crustacea						
Amphipoda	37	19		19		15
Xanathura sp.		19				4
Amphelisciidae						
Ampelisca sp.	19					4
Corophidae					19	4
Corophidae sp.	815			37	93	189
Lilljeborgiidae						
Listrella sp.					19	4
Melitidae						
Melita sp.	667				111	156
Melitidae sp.				56		11

Table B-4. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Cumacea						
Leuconidae		37	19	19		15
Decapoda						
megalopa			19		19	8
Alpheidae						
Alpheus sp.	19			19		8
Hippolytidae	37	37	19		19	22
Paguridae	93	74	56	204	19	89
Parthenopidae				19		4
Penaeidae	74	19				19
Porcellanidae						
Euceramus sp.				19		4
Xanthidae	19	56	19		19	23
Tanaidacea					37	7
Echinodermata						
Ophiuroidea	167	19		19	37	48
Chordata						
Branchiostoma floridae	56	37	37		19	30
Total Abundance	3417	2283	581	13@4	2064	
Mean Abundnace; Station Composite						1930
Number of Taxa	31	33	18	24	33	
Total Taxa; Station Composite						62
Shannon-Weaver Diversity	3.83	3.82	3.96	3.75	4.30	
Diversity; Station Composite						4.79

Table B-5. Benthic Macroinvertebrates Collected from Station CH-4 in the Charlotte Harbor ODMDS Study Area.

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Nematoda			19	19	19	11
Mollusca						
Epitoniidae		37				7
Semelidae		37				7
Annelida						
Polychaeta						
Capitellidae						
Mediomastus sp.	74		56			26
Cirratulidae			37			7
Glyceridae						
Glycera americana					19	4
Goniadidae						
Goniada sp.	19	19	19			11
Magelonidae						
Magelona sp.	19		19			8
Oweniidae						
Myriochele sp.			74			15
Owenia sp.			@9	19		8
Paraonidae						
Aricidea sp.			19		19	8
Pilargidae						
Ancistrosyllis sp.	19					4
Siqambra sp.		19				4
Siqambra tentaculata				19		4
Spionidae	56			56	37	30
Paraprionospio pinnata				74	37	22
Paraprionospio sp.	74		56			26
Prionospio cirriferra				167		33
Prionospio sp.	56	56	56			34
Oligochaeta	278		93			74
Arthropoda						
Crustacea						
Amphipoda						
Ampeliscidae						
Ampelisca sp.			19			4
Corophidae				19		4
Lilljeborgiidae						
Listrella sp.	37					7
Oedicerotidae						
Monoculodes sp.				37		7

Table B-5. (Continued)

Phylum / Class / Order / Family / Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m^2)
Photidae						
Synchelidium sp.	19					4
Phoxocephalidae						
Harpinia sp.				19		4
Tironidae						
Syrrhoe sp.	19					4
Cumacea						
Bodotriidae	74	.19	74	19	19	41
Ieuconidae	333	93	444	111	148	226
Decapoda						
megalopa		19	19	37	19	19
zoeae	19	19		19		11
Crangonidae		74				15
Sergestidae						
Lucifer faxoni	19					4
Callianassidae						
Upogebia sp.	19					4
Isopoda						
Munnidae						
Munna sp.	37					7
Echinodermata						
Ophiuroidea	19					4
Chordata						
Branchiostoma floiridae	19					4
Total Abundance	1209	392	1023	615	317	
Mean Abundnace; Station Composite						711
Number of Taxa	19	10	15	13	8	
Total Taxa; Station Composite						37
Shannon-Weaver Diversity	3.40	3.05	2.99	3.21	2.45	
Diversity; Station Composite						4.01

Table B-6. Bethnic Macroinvertebrates Collected from Station CH-5 in the Charlotte Harbor OMDS Study Area.

Phylum Class Order Family Genus Species	Replicate/(Organisms/m^2) 1	2	3	4	5	Mean Abundance (Organisms/m2)
Rhynchocoela	130		37		37	41
Nematoda	74		56			26
Mollusca						
Olividae						
Olivella sp.				19		4
Arcidae		19				4
Semelidae	19					4
Tellinidae		19		19		8
Annelida						
Polychaeta						
Archiannelida						
Polygordius sp.	333	315	111	222		196
Capitelliade						
Mediomastus sp.	74	37	56	19	19	41
Chrysopertalidae						
Bhwania heteroseta		19				4
Bhwania sp.	185			130	19	67
Cirratulidae		19		37		11
Cirriformia sp.					19	4
Dorvilleidae	19					4
Eunicidae						
Eunice sp.	19					4
Gluyceridae						
Hemipodus sp.	204		93		19	63
Lumbrineridae						
Lumbrineris sp.	56		19			15
Magelonidae						
Magelona sp.	37		37	19		19
Nephtyidae						
Aglaophamus verilli			19	74		19
Aglaophamus sp.	93					19
Nereidae						
Nereis sp.		19			37	11
Onuphidae						
Diopatra cuprea		19		19		8
Ophelidae						
Armandia sp.	56			74		26
Paraonidae						
Aricidea sp.	74	56		19	19	34
Phyllodocidae						
Phyllodoce sp.					37	7

Table B-6. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m2) 1	2	3	4	5	Mean Abudance (Organisms/m2)
Pilargidae						
Ancistrosyllis sp.	37		19		19	15
Sabellidae						
Sabellaria sp.		19			19	8
Spionidae						
Paraprionospio sp.				19	19	8
Prionospio sp.		130	37	74		48
Syllidae		19				4
Exogone sp.			74			15
Sphaerosyllis sp.	93					19
Trypanosyllis sp.	19		37			11
Oligochaeta	93					19
Arthropoda						
Crustacea						
Amphipoda						
Carellidae		19				4
Corophidae		56			19	15
Photidae					56	11
Cumacea						
Leuconidae	19	56	19	56	74	45
Decapoda						
megalopa	19					4
Thalassinoidea	148	130	93	19	19	82
Paguridaea						
Paguridae	19					4
Echinodermata						
Ophiuroideaa	56	19	19		19	23
Chordata						
Branchiostoma floridae		204	37	37	56	67
Total Abundance	1987	1267	782	856	673	
Mean Abunbance; Station Composite						1113
Number of Taxa	23	20	17	16	18	
Total Taxa; Station Composite						43
Shannon-Weaver Diversity	4.03	3.60	3.82	3.46	3.73	
Diversity; Station Composite						4.58

Table B-7. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m2) 1	 2	 3	 4	 5	Mean Abundance (Organisms/m2)
Polynoid						
Harmothoe sp.	19					4
Porvellidae	19					4
Spionidae				37	19	11
Paraprionospio sp.	19	19				8
Prionospio cirriferra			19			4
Prionospio sp.	56	37		56		30
Syllidae		19		19		8
Brania wellfleetensis			93			19
Brania sp.	111	37		56	19	45
Sphaerosyllis sp.	19	19		19	93	30
Trypanosyllis parvidentata			19			4
Trypanosyllis sp.	74		56	19		30
Sipuncula						
Aspidosiphonidae						
Aspidosiphon sp.					19	4
Arthropoda						
Crustacea						
Amphipoda						
Caprellidae			37	19		11
Cumacea						
Leuconidae		19	19		74	22
Decapoda						
megalopa			37		19	11
Thalassinoidea	74	93	56	111	74	82
Calappidae						
Callappa sp.	19					4
Paguridae	37		19	74		26
Pinnixia sp.		37	56			19
Porcellanidae						
Euceramus sp.		19				4
Natantia						
Isopoda						
Sphaeromidae						
Paracerceis sp.			130			26
Anthuridae						
Xanathura sp.				37		7
Mysidacea						
Mysidae						
Mysidopsis sp.	19	37	74	56	19	41
Tanaidacea			19			4

Table B-7. (Continued)

Phylum / Class / Order / Family / Genus Species	Replicate/(Organisms/m2) 1	2	3	4	5	Mean Abundance (Organisms/m2)
Polynoidae						
Harmothoe sp.	19					4
Porvellidae	19					4
Spionidae				37	19	11
Paraprionospio sp.	19	19				8
Prionospio cirriferra			19			4
Prionospio sp.	56	37		56		30
Syllidae		19		19		8
Brania wellfleetensis			93			19
Brania sp.	111	37		56	19	45
Sphaerosvllis sp.	19	19		19	93	30
Trypanosyllis parvidentata			19			4
Trypanosyllis sp.	74		56	19		30
Sipuncula						
Aspidosiphonidae						
Aspidosiphon sp.					19	4
Arthropoda						
Crustacea						
Amphipoda						
Caprellidae			37	19		11
Cumacea						
Leuconidae		19	19		74	22
Decapoda						
megalopa			37		19	11
Thalassinoidea	74	93	56	111	74	82
Calappidae						
Callappa sp.	19					4
Paguridae	37		19	74		26
Pinnixia sp.		37	56			19
Porcellanidae						
Euceramus sp.		19				4
Natantia						
Isopoda						
Sphaeromidae						
Paracerceis sp.			130			26
Anthuridae						
Xanathura sp.				37		7
Mysidacea						
Mysidae						
Mysidopsis sp.	19	37	74	56	19	41
Tanaidacea			19			4

Table B-7. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m2) 1	 2	 3	 4	 5	Mean Abundance (Organisms/m2)
Echinodermata						
Ophiuroidea	56	19	19	93		37
Chordata						
Branchiostoma floridaee	56	111	56	74	37	67
Total Abundance	1155	1449	1157	1526	524	
Mean Abundance; Station Composition						1162
Number of Taxa	24	24	27	26	15	
Total Taxa; Station Composite						55
Shannon-Weaver Diversity	4.21	4.10	4.42	4.08	3.59	
Diversity; Station Composite						5.02

Table B-8. Bethnic Macroinvertebrates Colledcted from Station CH-7 in the Charlotte Harbor ODMDS Study Area.

Phylum / Class / Order / Family / Genus Species	Replicate/Organisms/m2) 1	2	3	4	5	Mean Abundance (Organisms/m2)
Mollusca						
Epitoniidaeae	167	19	19	37	37	56
Olividae						
Olivella sp.					19	4
Semelidae	19					4
Tellinidae		37	37	74		30
Veneridae				37		7
Annelida						
Polychaeta						
Archiannelida						
Polygordius sp.				56	111	33
Capitellidae		37	19	19		15
Cirratulidae	19		19			8
Cirriformia sp.	19					4
Glyceridae						
Glycera sp.					19	4
Hemipodus sp.		19				4
Lumbrineridae						
Lumbrineris sp.			19	19		8
Magelonidae						
Magelona sp.	19		17			11
Nephtyidae						
Aglaophamus sp.	19	111	74	74	19	59
Onuphidae	19	19				8
Oweniidae						
Owenia sp.	19		19			8
Paraonidae						
Aricidea sp.		56				11
Phyllodocidae						
Phyllodoce sp.	19					4
Polynoidae						
Harmothoe sp.	19		37			11
Spionidae						
Paraprionospio sp.	481	167	370	352	352	344
Prionospio sp.		167	19	37	56	56
Oligochaeta	148	111	111	74		89
Arthropoda						
Crustacea						
Amphipoda						
Ampelisicdae						
Ampelisca sp.			19	19		8

Table B-8. (Continued)

Phylum Class Order Family Genus Species	Replicate/(Organisms/m2) 1	2	3	4	5	Mean Abundance (Organisms/m2)
Amphithoidae						
Cymadusa sp.	204		19			45
Corophidae		37				7
Oedicerotidae						
Monoculodes sp.		19	19			8
Photidae						
Synchelidium sp.					19	4
Cumacea	556	111				133
Decapoda						
zoeae	74					15
Thalassinoidea	56					11
Sergestidae						
Lucifer faxoni	19					4
Pinnixidae						
Pinnixia sp.	19			37		11
Callianassidae						
Upogebia sp.	19					4
Natantia			19			4
Isopoda						
Munnidae						
Munna sp.	19					4
Mysidacea						
Mysidae			19			4
Mysidopsis sp.	19		19			8
Echinodermata						
Ophiuroidea				19		4
Total Abundance	1952	910	894	873	613	
Mean Abundance; Station Composite						1048
Number of Taxa	21	13	18	14	7	
Total Taxa; Station Composite						38
Shannon-Weaver Diversity	3.18	3.29	3.19	3.06	1.93	
Diversity; Station Composite						3.74

APPENDIX C

PERTINENT CORRESPONDENCE

FLORIDA DEPARTMENT OF STATE
George Firestone
Secretary of State
DIVISION OF ARCHIVES,
HISTORY AND RECORDS MANAGEMENT
The Capitol, Tallahassee, Florida 32301-8020
(904) 488-1480

February 7, 1986

In Reply Refer to:

Mike Wisenbaker
Historic Sites Specialist
(904) 487-2333

Mr. A. J. Salem
Department of the Army
Jacksonville District, Corps of Engineers
P. O. Box 4970
Jacksonville, Florida 32232-0019

RE: Your Letter of January 24, 1986
Cultural Resource Assessment Request
DEIS for EPA interim designated Charlotte Harbor Ocean
Dredged Material Disposal Site, Lee County, Florida

Dear Mr. Salem:

In accordance with the procedures contained in 36 C.F.R., Part 800 ("Procedures for the Protection of Historic and Cultural Properties"), we have reviewed the above referenced project for possible impact to archaeological and historical sites or properties listed, or eligible for listing, in the National Register of Historic Places. The authorities for these procedures are the National Historic Preservation Act of 1966 (Public Law 89-665) as amended by P.L. 91-243, P.L. 93-54, P.L. 94-422, P.L. 94-458 and P.L. 96-515, and Presidential Executive Order 11593 ("Protection and Enhancement of the Cultural Environment").

A review of the Florida Master Site File indicates that no archaeological or historical sites are recorded for the project area. Furthermore, because of the location and/or nature of this project, it is considered highly unlikely that any significant, unrecorded sites will be affected and/or exist in the vicinity. Therefore, it is the opinion of this office that the proposed project will have no effect on any sites listed, or eligible for listing, in the National Register Historic Places, or otherwise of national, state or local significance. It is also consistent with Florida's historic preservation laws and regulations and may proceed without further involvement with this agency.

If you have any questions concerning our comments, please do not hesitate to contact us.

Your interest and cooperation in helping to protect Florida's archaeological and historical resources are appreciated.

Sincerely,

George W. Percy
State Historic
Preservation Officer

GWP/efk

January 24, 1986

Environmental Resources Branch
Planning Division

State Historic Preservation Officer
Florida Department of State
Division of Archives, History and Records Management
The Capitol
Tallahassee, Florida 32301-8074

Dear Sir:

The Corps of Engineers, Jacksonville District, is preparing a draft environmental impact statement for final designation of the EPA interim designated Charlotte Harbor Ocean Dredged Material Disposal Site. The interim site is located approximately four miles offshore, in depths of 40 feet, at coordinates 26°37'36"N, 82°19'55"W; 26°37'36"N, 82°18'47"W; 26°36'36"N, 82°18'47"W; and 26°36'36"N, 82°19'55"W (Enclosure 1). This site has been used in the past for the disposal of dredged material from Maintenance dredging in Boca Grande Pass.

In conformance with the National Historic Preservation Act we request your comments.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosure

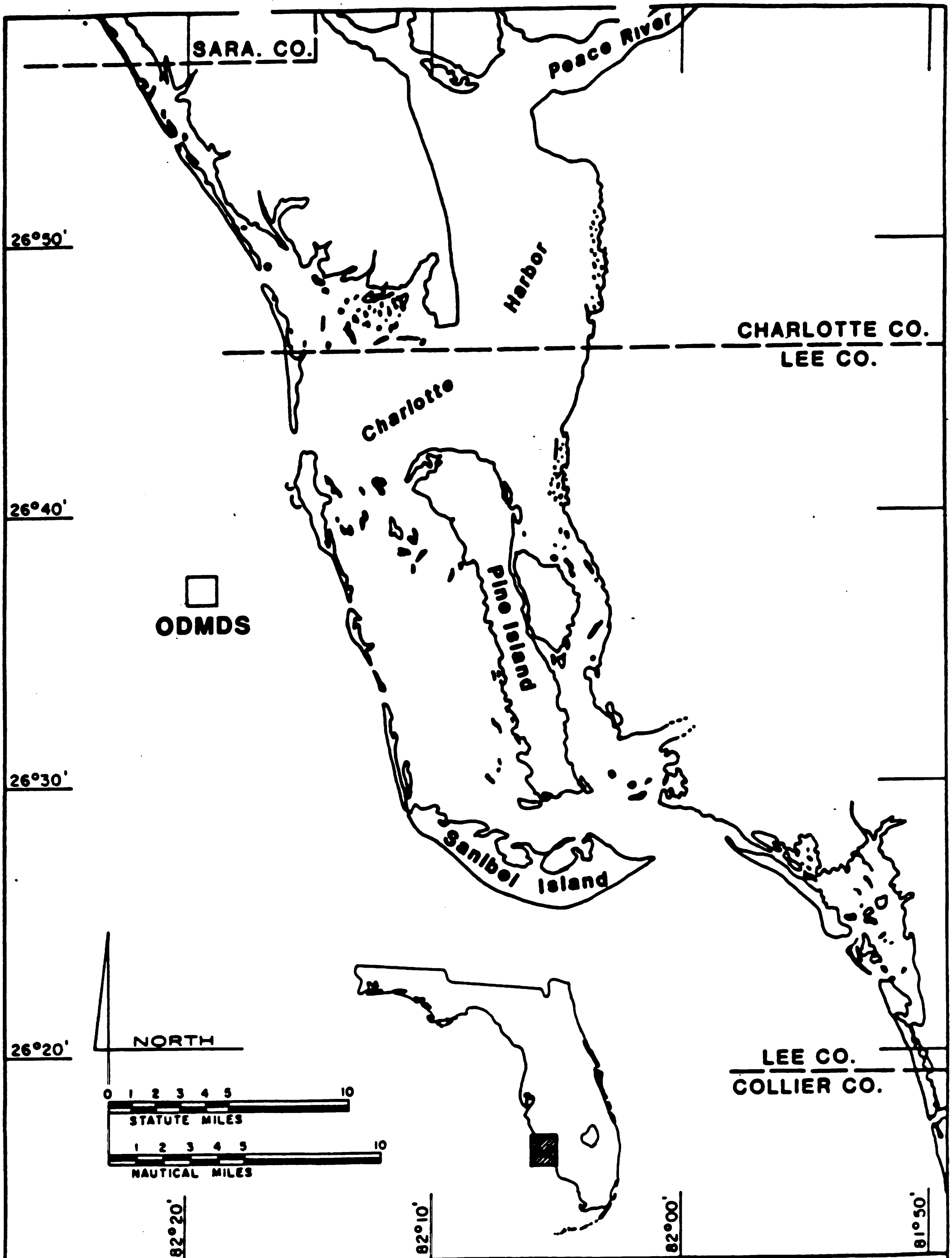


FIGURE 1

STUDY AREA

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, FL 33702

February 13, 1986 F/SER23:PWR:dcp

Mr. A. J. Salem
Chief, Planning Division
Jacksonville District, COE
P. O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Salem:

This responds to your February 3, 1986, letter regarding the proposed final designation of the Charlotte Harbor Ocean Dredge Material Disposal Site. This site is presently designated as an interim site by the U.S. Environmental Protection Agency (EPA) and has historically been used by the Corps of Engineers (COE) for disposal of dredged material from the Boca Grande Pass. A biological assessment (BA) was transmitted pursuant to Section 7 of the Endangered Species Act of 1973 (ESA).

We have reviewed the BA and concur with your determination that populations of endangered/threatened species under our purview would not be affected by the proposed action.

This concludes consultation responsibilities under Section 7 of the ESA. However, consultation should be reinitiated if new information reveals impacts of the identified activity that may affect listed species or their critical habitat, a new species is listed, the identified activity is subsequently modified or critical habitat determined that may be affected by the proposed activity. If you have any new information or questions concerning this consultation, please contact Mr. Paul Raymond, Fishery Biologist, at FTS 826-3366.

Sincerely yours,

Charles A. Oravetz

Charles A. Oravetz, Chief
Protected Species Management Branch

cc: F/M412
F/SER11

February 3, 1986

Environmental Resources Branch
Planning Division

Mr. Charles A. Oravetz
Chief, Protected Species Management Branch
National Marine Fisheries Service
Southeast Regional Office
9450 Koger Boulevard
St. Petersburg, Florida 33702-2496

Dear Mr. Oravetz:

Enclosed is the biological assessment (Enclosuee 1) regarding the proposed final designation of the Charlotte Harbor Ocean Dredged Material Disposal Site and effects on endangered species. This information was prepared by the Corps of Engineers in compliance with Section 7 of the Endangered Species Act, as amended.

Based on a review of the considered action and on available scientific literature the Corps of Engineers has determined that there will be no effect on listed species under NMFS jurisdiction.

If you have any questions regarding this action please contact Mr. Paul Schmidt at FTS 946-1691.

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures

SECTION 7
ENDANGERED SPECIES ACT
BIOLOGICAL ASSESSMENT
CHARLOTTE HARBOR OCEAN DREDGED MATERIAL DISPOSAL SITE
FINAL DESIGNATION

1. Project Location and Description. The Charlotte Harbor Ocean Dredged Material Disposal Site (ODMDS) has been historically used by the Jacksonville District for disposal of dredged material from the Boca Grande Pass. Dredging in Boca Grande Pass was performed in 1978, 1980, 1981, and 1983. A total of approximately 1,128,051 cubic yards have been disposed of at the site during this time. The material consisted of fine quartz, slightly shelly, light gray sand. Future disposal will be approximately 250,000-300,000 cubic yards every 1.5 to 2.0 years consisting of same sediments as in the past. At present, the Charlotte Harbor ODMDS is being used under interim designation by the U.S. Environmental Protection Agency (EPA). Final EPA designation approval is contingent upon baseline oceanographic surveys and preparation of an Environmental Impact Statement (EIS). The Charlotte Harbor interim site is located about four miles offshore of Cayo Costa, in depths of approximately 40 feet, with latitude and longitude coordinates of: 26°37'36"N., 82°19'55"W.; 26°37'36"N., 82°18'47"W.; 26°36'36"N., 82°18'47"W.; and 26°36'36"N., 82°19'55"W. (Enclosure 2).

2. Identification of Listed Species and Critical Habitat in the Area of the Proposed Action. The listed species (under the jurisdiction of the NMFS) occurring in the area having the potential to be affected are:

Green turtle (*Chelonia mydas* - E)
Kemp's (Atlantic) ridley (*Lepidochelys kempii* - E)
Hawksbill turtle (*Eretmochelys imbricata* - E)
Loggerhead turtle (*Caretta caretta* - T)
Leatherback turtle (*Dermochelys coriacea* - E)
Fin whale (*Balaenoptera physalus* - E)
Humpback whale (*Megaptera novaeangliae* - E)
Right whale (*Eubalaena glacialis* - E)
Sei whale (*Balaenoptera borealis* - E)
Sperm whale (*Physeter catodon* - E)

There is no designated critical habitat in the vicinity of the proposed action.

3. Assessment of Potential Impacts on Listed Species by the Proposed Activity.

a. Sea Turtles.

Pelagic Stage. The listed sea turtles (green, Kemp's ridley, hawksbill, loggerhead, and leatherback) spend most of their life as open ocean inhabitants although the green and loggerhead are known to spend time in lagoons

Enclosure 1

and estuaries. The food preferences of the five species are: green - seagrasses and algae; Kemp's ridley - invertebrates (crabs, shrimp, sea urchins); hawksbill - sponges and barnacles; loggerhead - molluscs and crustaceans; and leatherback - jellyfish, sea urchins, squid, and crustaceans (Rudloe, 1979). Only the loggerhead nests on west coast Florida beaches although sightings of the other species occur in the Gulf of Mexico. Several of these species make use of coral reefs as forage or resting areas. No coral reefs exist in the vicinity of the ODMDS.

b. Cetaceans.

(1) Fin whale. Fin whales are cosmopolitan; in the western North Atlantic they occur from Greenland south to the Gulf of Mexico. Sightings and strandings in the Gulf have occurred in the northern section along Florida, Louisiana, and Texas. An isolated Gulf of Mexico population has been suggested by certain authors (Schmidly, 1981). Mating and calving occurs during the winter in offshore waters.

(2) Humpback whale. This species occurs in all oceans. Humpbacks migrate in distinct patterns; in late fall and early winter they begin to migrate southward from the western Atlantic to the Caribbean for breeding and calving. In the western North Atlantic humpbacks feed only in northern waters and not while they are in the Caribbean (Schmidly, 1981). A humpback was sighted offshore of Tampa over twenty years ago.

(3) Right whale. In the western North Atlantic right whales are distributed from Iceland to Florida and the Gulf of Mexico. Sightings in the Gulf of Mexico are rare; there had been a sighting of a right whale offshore of Manatee County, Florida in the early 1960's. Most right whale sightings occur along the east coast of Florida and northward along Georgia and South Carolina.

(4) Sei whale. Sei whales have a wide distribution in waters of the western North Atlantic from the Gulf of Mexico and the Caribbean to Nova Scotia and Newfoundland but records of their occurrence in the Gulf of Mexico are limited to strandings from Campeche, Mexico and from the coasts of Mississippi and Louisiana (Schmidly, 1981). The distribution and migration of sei whales are poorly known.

(5) Sperm whale. Sperm whales occur throughout the oceans of both Eastern and Western Hemisphere's but occur mostly in the temperate and tropical latitudes of the Atlantic and Pacific Oceans. In the Gulf of Mexico their occurrence (based on sightings and captures) is limited to waters beyond 200 meters and primarily beyond the 1,000 fathom contour.

4. Conclusions. Based on past dredged material disposal operations, anticipated future disposal needs, and on the occurrence and distribution of endangered species in the area, the Corps of Engineers has determined that the final designation of the Charlotte Harbor ODMDS will have no effect on listed species.

LITERATURE CITED

Rudloe, J. Time of the Turtle. A.A. Knopf. 1979.

Schmidly, D.J. 1981. Marine Mammals of the Southeastern U.S. Coast and Gulf of Mexico. U.S. Fish and Wildlife Service. FWS/OBS-80-41

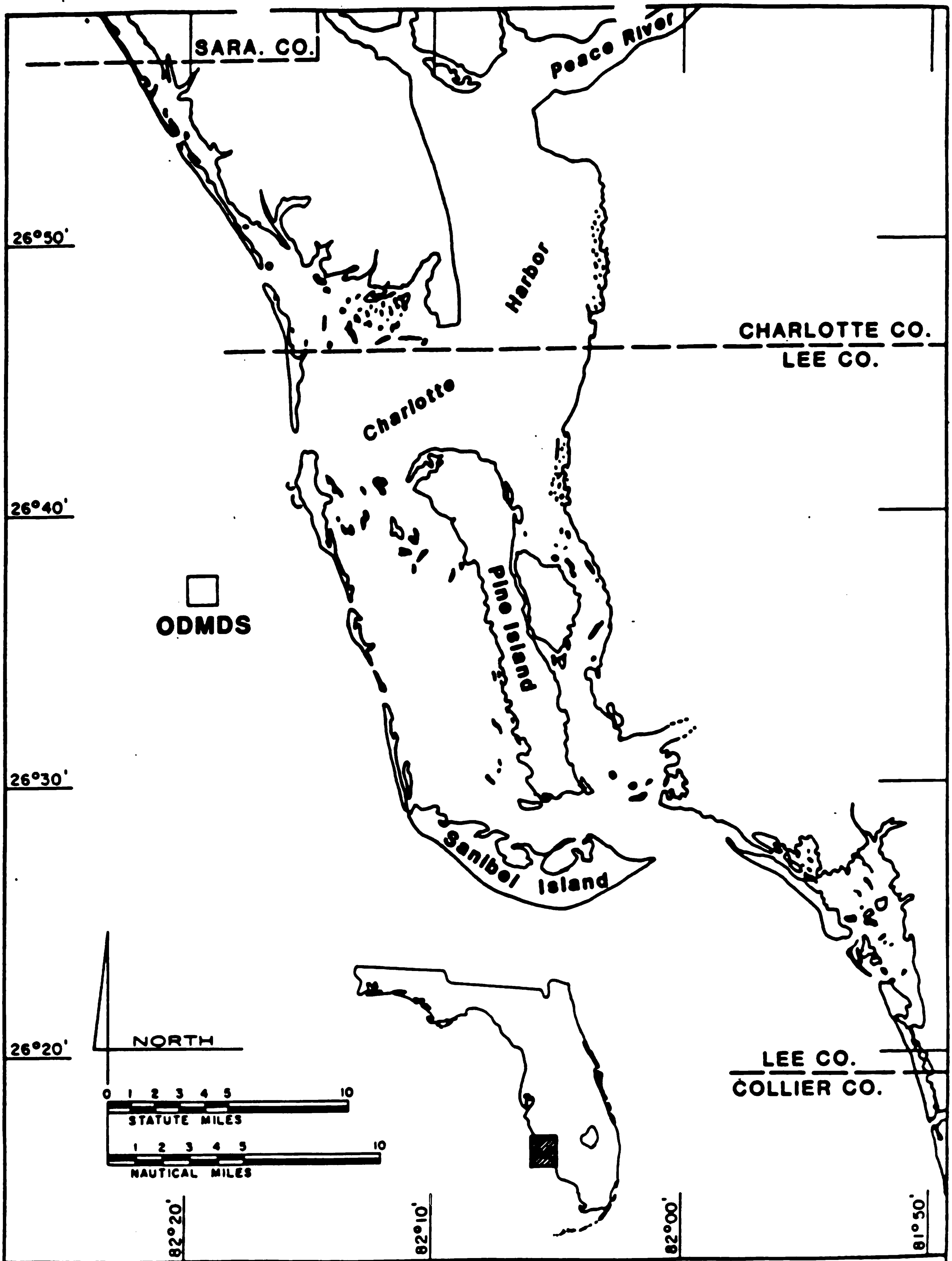


FIGURE 1

STUDY AREA

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida

United States Department of the Interior
FISH AND WILDLIFE SERVICE
ENDANGERED SPECIES FIELD STATION
2747 ART MUSEUM DRIVE
JACKSONVILLE, FLORIDA 32207

April 8, 1987

Mr. A. J. Salem
Chief, Planning Division
Jacksonville District
Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

FWS Log No. 4-1-87-174

Dear Mr. Salem:

This is in response to your letter dated March 25, 1987, regarding the final designation of ocean dredged material disposal sites (ODMDS) off Charlotte Harbor and Fort Myers Beach.

Based on the information provided in your letter, we concur with the Corps' determination that the proposed actions will have no effect on the manatee. The proposed ODMDS are located far enough off shore so as not to interfere with manatee movements.

This does not constitute a Biological Opinion as described in Section 7 of the Endangered Species Act. However, it does fulfill the requirements of the Act and no further action on your part is required. If modifications are made in the project or if additional facts involving potential impacts on listed species arise, you should contact this office. We request a copy of the permit when issued.

Sincerely yours,

David J. Wesley

David J. Wesley
Field Supervisor

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

March 25, 1987

Environmental Resources Branch
Planning Division

Mr. David J. Wesley
Field Supervisor, Endangered Species Field Station
Fish and Wildlife Service
2747 Art Museum Drive
Jacksonville, Florida 32207-5023

Dear Mr. Wesley:

In accordance with the interagency cooperation provisions under Section 7 of the ESA, as amended, the Jacksonville District is initiating informal consultation as specified in 50 CFR Part 402.13.

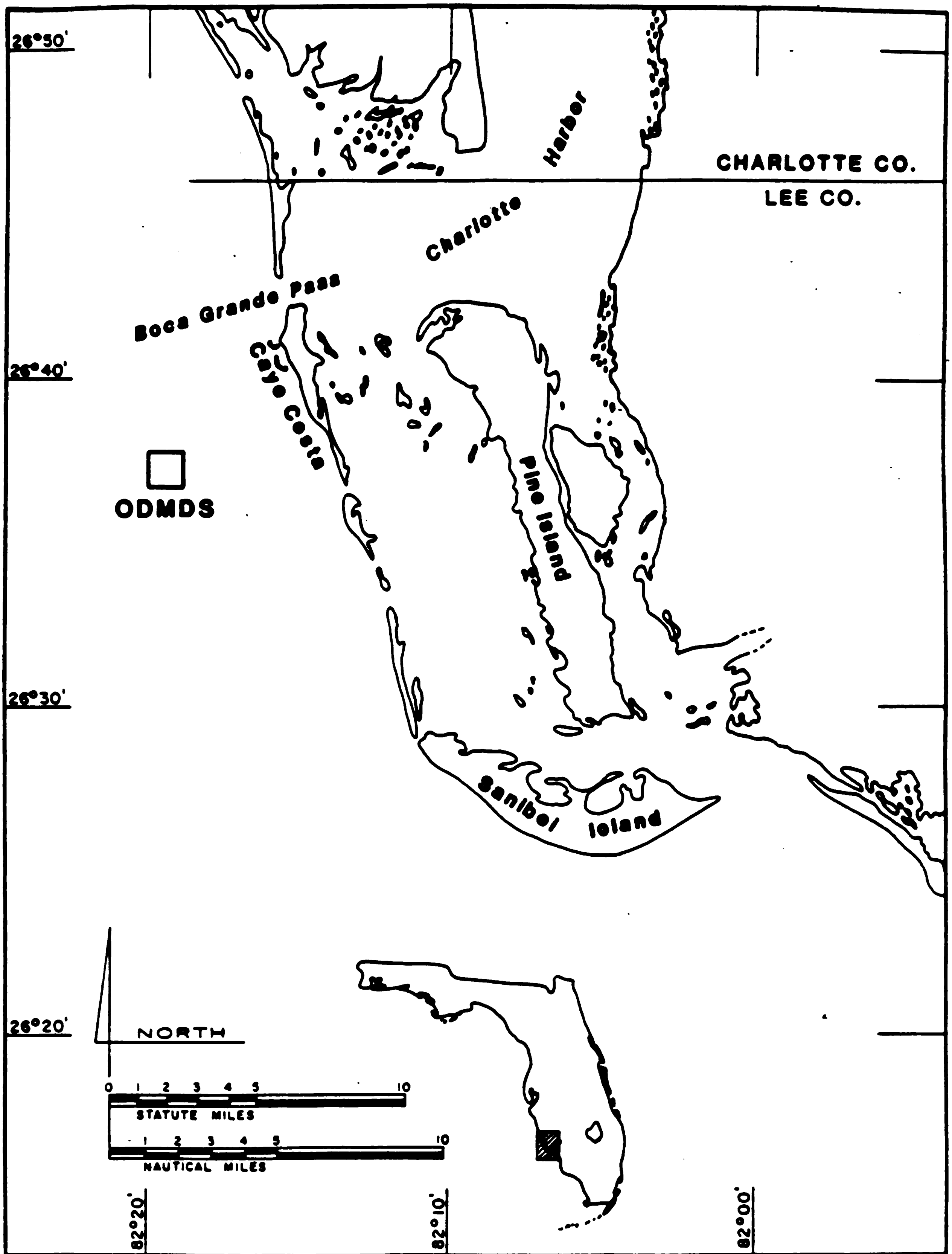
The EPA in cooperation with the Jacksonville District is conducting the required studies for the final designation of ocean dredged material disposal sites (ODMDS) off Charlotte Harbor and Fort Myers Beach (Enclosure 1). The Jacksonville District has evaluated the proposed action in regards to potential impacts to the manatee. The distance from Cayo Costa to the Charlotte Harbor proposed ODMDS is four nmi.; nine nmi. separate Estero Island from the Fort Myers Beach candidate site.

Based on the life history requirements of the manatee and the administrative nature of ODMDS designation, the Corps of Engineers determines that the proposed actions will have no effect on the manatee. If you have any questions concerning this determination please contact Mr. Paul Schmidt (FTS 946-1691).

Sincerely,

A. J. Salem
Chief, Planning Division

Enclosures



FIGURE

26° 37' 36" N, 82°19'55" W
26° 37' 36" N, 82° 18' 47" W
26° 36' 36" N, 82° 18' 47" W
26° 36' 36" N, 82° 19' 55" W

GENERAL LOCATION MAP

Ocean Dredged Material Disposal Site Charlotte Harbor, Florida