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United States
Environmental Protection
Agency

Office of Water
Criteria and Standards Division
Washington, DC 20460

EPA-FL-830006-F

Final

ENVIRONMENTAL IMPACT STATEMENT (EIS) for JACKSONVILLE HARBOR, FLORIDA, OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

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METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measure

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	2.54	centimeters	cm
ft	feet	30.	centimeters	cm
yd	yards	0.9	meters	m
fm	fathoms	1.8	meters	m
mi	statute miles	1.6	kilometers	km
nmi	nautical miles*	1.9	kilometers	km

*1 nautical mile = 6.076 feet = 1.15 statute miles

		AREA		
in^2	square inches	6.5	square centimeters	cm^2
ft^2	square feet	0.09	square meters	m^2
yd^2	square yards	0.6	square meters	m^2
mi^2	square miles	2.6	square kilometers	km^2
nmi^2	square nautical miles	3.4	square kilometers	km^2
		MASS (weight)		
oz	ounces	28.	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2,000 lbs)	0.9	tonnes†	t

†1 tonne = 1,000 kg = 1 metric ton

		VOLUME		
fl oz	fluid ounces	30.	milliliters	ml
pt	pints	0.47	liters	l
qt	quarts	0.95	liters	l
gal	gallons	3.8	liters	l
ft^3	cubic feet	0.03	cubic meters	m^3
yd^3	cubic yards	0.76	cubic meters	m^3
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	0.55(°F) - 32	Celsius temperature	°C
		VELOCITY		
in/sec	inches per second	2.5	centimeters per second	cm/sec
ft/sec	feet per second	30.	centimeters per second	cm/sec
ft/min	feet per minute	0.5	centimeters per second	cm/sec
mph	miles per hour	1.6	kilometers per hour	kph
kn	knots**	51.	centimeters per second	cm/sec
kn	knots (nautical miles per hour)	1.9	kilometers per hour	kph

**1 knot = 1.15 mph

Approximate Conversions from Metric Measure

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
m	meters	0.6	fathoms	fm
km	kilometers	0.6	statute miles	mi
km	kilometers	0.5	nautical miles*	nmi

*1 nautical mile = 6.076 feet = 1.15 statute miles

		AREA		
cm^2	square centimeters	0.16	square inches	in^2
m^2	square meters	11.	square feet	ft^2
m^2	square meters	1.2	square yards	yd^2
km^2	square kilometers	0.4	square miles	mi^2
km^2	square kilometers	0.3	square nautical miles	nmi^2
		MASS (weight)		
g	grams	0.4	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes†	1.1	short tons (2,000 lb)	

†1 tonne = 1,000 kg = 1 metric ton

		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.1	quarts	qt
l	liters	0.3	gallons	gal
m^3	cubic meters	35.	cubic feet	ft^3
m^3	cubic meters	1.3	cubic yards	yd^3
		TEMPERATURE (exact)		
°C	Celsius temperature	1.8(°C) +32	Fahrenheit temperature	°F
		VELOCITY		
cm/sec	centimeters per second	0.4	inches per second	in/sec
cm/sec	centimeters per second	0.03	feet per second	ft/sec
cm/sec	centimeters per second	2.0	feet per minute	ft/min
cm/sec	centimeters per second	0.02	knots (nautical miles per hr)**	kn
kph	kilometers per hour	0.6	miles per hour	mph
kph	kilometers per hour	0.5	knots	kn

**1 knot = 1.15 mph

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ENVIRONMENTAL IMPACT STATEMENT (EIS) for JACKSONVILLE HARBOR, FLORIDA, OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

EPA

U. S. ENVIRONMENTAL PROTECTION AGENCY
Criteria and Standards Division
Washington, D.C. 20460

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ENVIRONMENTAL PROTECTION AGENCY

ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR JACKSONVILLE HARBOR, FLORIDA OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

Prepared by: U.S. Environmental Protection Agency
Criteria and Standards Division
Washington, D.C. 20460

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Summary Sheet

ENVIRONMENTAL IMPACT STATEMENT (EIS) FOR JACKSONVILLE HARBOR, FLORIDA OCEAN DREDGED MATERIAL DISPOSAL SITE DESIGNATION

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

ENVIRONMENTAL PROTECTION AGENCY
CRITERIA AND STANDARDS DIVISION

1. Type of action.

   (X) Administrative/Regulatory action
   ( ) Legislative action

2. Brief background description of the proposed action and purpose.

   The proposed action is the final designation of the existing Jacksonville Harbor, Florida, Ocean Dredged Material Disposal Site. The purpose of the action is to provide an environmentally acceptable ocean location for the disposal of materials dredged from the Jacksonville Harbor Channel System.

3. Summary of major beneficial and/or adverse environmental effects associated with the proposed action.

   The major benefit of the proposed action is the provision for an environmentally acceptable location for the disposal of dredged materials.

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Adverse effects associated with the proposed action include mounding, smothering of some benthic organisms, and possible changes in sediment texture.

4. Alternatives to the proposed action.

The alternatives to the proposed action are: (1) no action, which would allow the interim designation of the Jacksonville Harbor, Florida ODMDS to expire in February 1983, after which use of the site would be discontinued; and (2) use of an ocean disposal site other than the Existing Site (e.g., a new site in the deepwater Slope area of the Georgia Bight off Jacksonville).

5. Comments on the Draft EIS were requested from the following:

Federal Agencies and Offices

Council on Environmental Quality
Department of Commerce
  Maritime Administration
  National Marine Fisheries Service
  National Oceanic and Atmospheric Administration
Department of Defense
  Army Corps of Engineers
  Department of the Navy
Department to Health and Human Services
Department of the Interior
  Bureau of Land Management
  Bureau of Outdoor Recreation
  Fish and Wildlife Service
  Geological Survey
Department of State
Department of Transportation
  Coast Guard
National Science Foundation

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States and Municipalities

Duval County, Florida
City of Jacksonville
State of Florida

Private Organizations

American Littoral Society
Audubon Society
Center for Law and Social Policy
Center for Natural Areas
Environmental Defense Fund, Inc.
Jacksonville Offshore Fishing Club
League of Women Voters
National Academy of Sciences
National Wildlife Federation
Resources for the Future
Sierra Club
Smithsonian Institute
South Atlantic Fishery Management Council
Texas Instruments Inc.
Water Pollution Control Federation

Academic/Research Institutions

Duke University
Florida State University
Jacksonville University
Marine Institute, Jacksonville
Skidaway Institute of Oceanography
University of Georgia
University of Miami
University of North Florida/Sea Grant
Virginia Institute of Marine Science

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6. The draft statement has been officially filed with the Director, Office of Environmental Review, EPA.

7. Comments on the Final EIS are due 45 days from the date of EPA's publication of Notice of Availability in the Federal Register which is expected to be FEB 14 1983.

Comments should be addressed to:

Mr. Michael S. Moyer
Criteria and Standards Division (WH-585)
Environmental Protection Agency
Washington, D.C. 20460

Copies of the Final EIS may be obtained from:

Environmental Protection Agency
Criteria and Standards Division
Washington, D.C. 20460
(202) 755-2927

Environmental Protection Agency
Region IV
345 Courtland Street, NE
Atlanta, Georgia 30308

The Draft EIS may be reviewed at the following locations:

Environmental Protection Agency
Public Information Reference Unit, Room 2404 (rear)
401 M Street, SW
Washington, D.C. 20460

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Environmental Protection Agency
Region IV
345 Courtland Street, NE
Atlanta, Georgia 30365

U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
400 West Bay Street
Jacksonville, Florida 32232

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SUMMARY

PURPOSE OF AND NEED FOR ACTION

This Environmental Impact Statement (EIS) considers the final designation of a Jacksonville Harbor, Florida, Ocean Dredged Material Disposal Site (ODMDS). The proposed action is the final designation of the existing Jacksonville Harbor ODMDS. The purpose of the proposed action is to provide the most feasible and environmentally acceptable ocean location for the disposal of material dredged from the Jacksonville Harbor Channel System.

The Port of Jacksonville is a major port on the Atlantic coast of the southeast United States. Without dredging, operating depths through the Jacksonville Harbor Channel System would decrease, thus limiting economically important ship traffic to and from Jacksonville. Currently, disposal in the ocean is one of three alternative methods for disposal of dredged material. Material suitable for beach nourishment is deposited on Jacksonville beaches, and material unsuitable for disposal on the beach or in the ocean is deposited in upland sites.

The Environmental Protection Agency (EPA), the agency responsible for designating ocean disposal sites, approved the existing Jacksonville Harbor ODMDS (hereinafter, "Existing Site") for interim use in 1977 (40 CFR 228). The use of any site under interim designation will continue only if EPA grants the site final designation. EPA must either terminate the interim site or designate it for continued use by February 1983, when the Jacksonville Harbor ODMDS interim designation expires.

ALTERNATIVES INCLUDING THE PROPOSED ACTION

The alternatives considered in this EIS are: (1) the proposed action, (2) no action, and (3) use of an alternative ocean site (e.g., a new site in the deepwater Slope area of the Georgia Bight off Jacksonville). Taking no action towards final designation of the site for continued use, or terminating its

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further use, would mean to refrain from designating an EPA-approved ocean site for dredged material disposal. After expiration of the interim designation in February 1983, the net result would be that the CE would not have an EPA-approved, finally designated ocean site for disposal of dredged material from the Jacksonville Harbor Channel System. Therefore, the No-Action Alternative is not an acceptable alternative.

Land disposal alternatives are considered by the CE when evaluating the need for ocean disposal. Several upland disposal sites are utilized by the CE, U.S. Navy, and private dredge operators for material dredged from the Jacksonville Harbor Channel System when: (1) the quality of the material is unacceptable for ocean disposal, and (2) the cost to transport the material to an ocean site is economically prohibitive. Several land-based disposal sites are currently (1981) in use (e.g., Blount Island, Quarantine Island). Further evaluation of land disposal alternative is not part of EPA's responsibility in the designation of sites for ocean disposal.

Three general ocean environments off Jacksonville are considered as possible locations for disposal sites: (1) shallow-water (includes the Existing Site), (2) mid-Shelf, and (3) deepwater Slope. The mid-Shelf area is not considered a feasible location because of potential conflicts with biotic resources.

The two sites off Jacksonville considered as potentially suitable locations for a disposal site are (Figure S-1):

- The Existing Site (interim designation)—corner coordinates 30°21'30"N, 81°18'34"W; 30°21'30"N, 81°17'26"W; 30°20'30"N, 81°17'26"W; and 30°20'30"N, 81°18'34"W.

- A Deepwater Site—corner coordinates 30°21'30"N, 80°10'34"W; 30°21'30"N, 80°09'26"W; 30°20'30"N, 80°09'26"W; and 30°20'30"N, 80°10'30"W.

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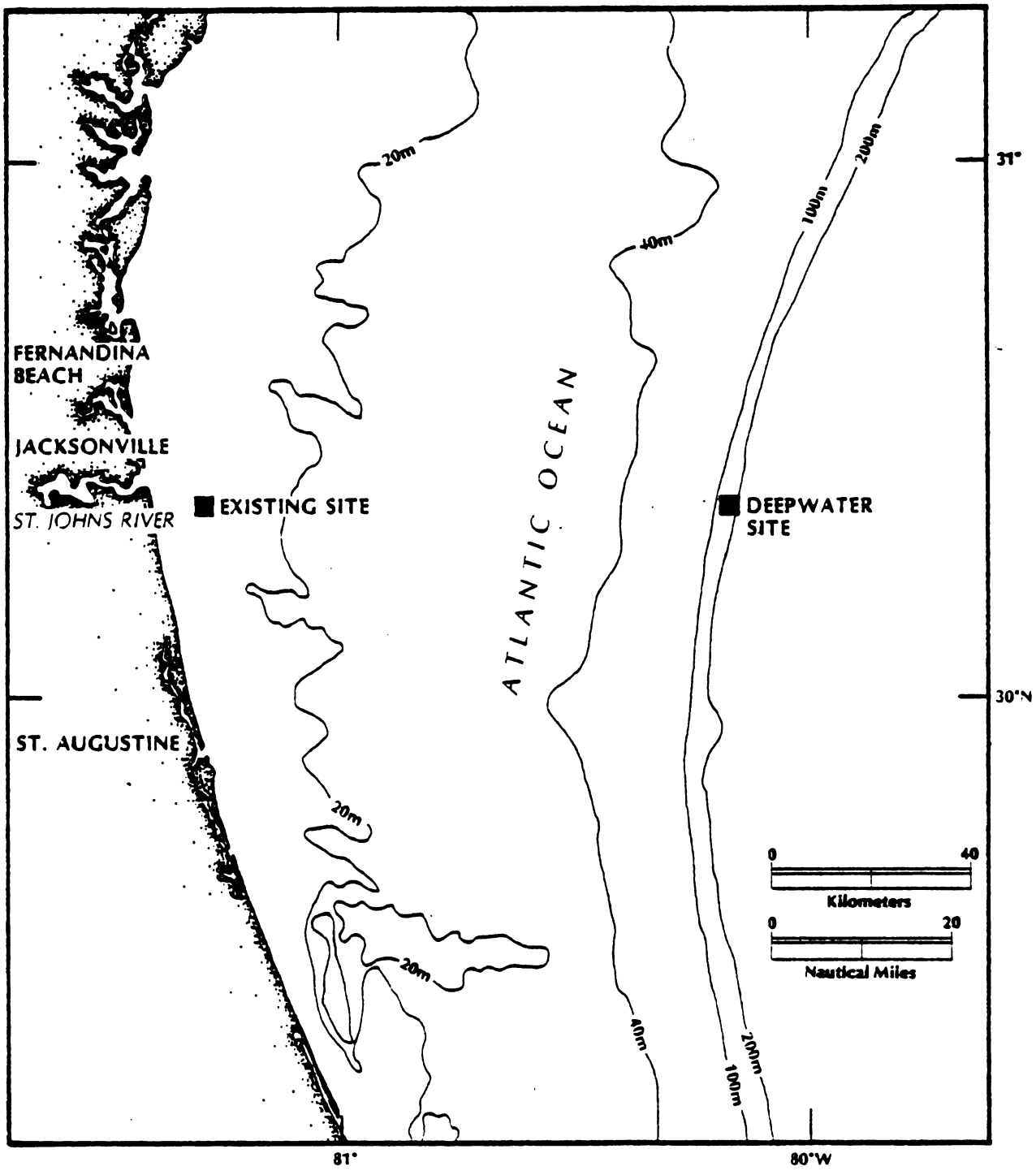

Figure S-1. Location of the Existing and Deepwater Sites Relative to the Mouth of the St. Johns River

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The Existing Site is approximately 5 nmi from the mouth of the St. Johns River and has been used for the disposal of dredged material from Jacksonville and Mayport Harbors since at least 1952. The site has not been used during some years as some of the dredged material is deposited in upland disposal areas or on some beaches. The average annual amount of material dumped during the 19 years in which ocean disposal has occurred was nearly 855,000 yd^3.

The Deepwater Site is more than 60 nmi from the mouth of the St. Johns River, off the Continental Shelf at depths from 150m to 200m. This site has not been used previously for dredged material disposal, and the potential effects of dredged sediments on indigenous organisms and resources are presently unknown.

The two alternative disposal sites are compared by application of the 11 specific site-selection criteria listed at 40 CFR 228.6(a) of the Ocean Dumping Regulations. The Existing Site fulfills all criteria for site selection at reasonable costs, and is preferred to the deepwater alternative.

AFFECTED ENVIRONMENT

Although severe tropical storms or hurricanes are not common, seasonal storms have a major influence on water characteristics and sediment chemistry in the vicinity of the Existing Site. Storms rework sediments and potentially affect benthic communities within the nearshore areas. The St. Johns River receives industrial, domestic, and agricultural wastes. Suspended materials in the river adsorb contaminants from the wastes and are transported to the ocean during ebb tides and storms.

The environment of the Deepwater Site is typical of the outer Shelf-Slope in the Georgia Bight and is strongly influenced by the Gulf Stream. The frictional drag caused by the Gulf Stream occasionally results in a strong northerly flowing current; velocity decreases with depth. When the Gulf Stream shifts eastward (offshore), a westerly drift across the Shelf occurs, introducing cold, nutrient-rich water onto the Shelf and creating local upwelling.

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Other important differences between the areas include higher biological productivity (plant material is produced faster and a generally coarser sediment type at the Existing Site relative to the Deepwater Site.

ENVIRONMENTAL CONSEQUENCES

Although a permanent mound up to 9 ft (2.7m) in height has been formed, previous disposal of dredged material at the Existing Site has had no significant adverse impacts on human health, economics, safety, or aesthetics. Mounding has not resulted in sufficient shoaling to create a navigational hazard. Minor, short-term adverse effects from dumping have also occurred at the Existing Site, including a temporary reduction in abundances of bottom-dwelling animals resulting from burial.

Disposal of dredged material is also expected to have a minimal effect at the Deepwater Site. Mounds are less likely to form because of greater depths and because dredged material would likely be dispersed over a large area by currents. Organisms at the site may be adapted to a regularly changing environment due to the changing influences of the Gulf Stream. Consequently, the communities may be able to withstand perturbations (e.g., dredged material dumping). In addition, the Deepwater Site is outside the principal commercial fishery resource area.

Disposal operations do not interfere with any long-term use of resources. The resources lost by disposal are sand for landfill and/or beach-nourishment projects, and money and energy expended for the dredging and transport operations. These losses are easily offset by the benefit to commerce from dredging the channel system.

CONCLUSION

The Existing Site is environmentally acceptable and the most economical site to receive material dredged from the Jacksonville Harbor Channel System. The Existing Site is, therefore, the preferred alternative.

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ORGANIZATION OF THE ENVIRONMENTAL IMPACT STATEMENT

The EIS is organized into six Chapters and one Appendix. Four Chapters comprise the main body of the EIS:

- Chapter 1 specifies the purpose and need for the Proposed Action (i.e., final designation of a Jacksonville Harbor ODMDS). Background information on the disposal of dredged material is presented, together with the legal framework guiding the EPA in the selection and designation of disposal sites. Responsibilities of the CE in disposal of dredged material in the ocean are discussed, as is the history of dredged material disposal at the Existing Site.

- Chapter 2 discusses alternative locations for the disposal of dredged material in the ocean and the No-Action Alternative. The Alternative Sites are evaluated using the 11 site selection criteria listed at 40 CFR 228.6(a). Guidelines for a monitoring plan are also presented.

- Chapter 3 describes the affected environment of the Alternative Sites.

- Chapter 4 describes the potential environmental consequences of dredged material disposal at the Alternative Sites.

Chapters 5 and 6 and Appendix A provide supplementary information. Chapter 5 lists the authors of the EIS. Chapter 6 contains the glossary, list of abbreviations, and references cited in the text. Appendix A presents the results of the EPA/Interstate Electronics Corporation (IEC) surveys of the Existing Site. Mathematical conversion factors are provided on the inside front cover.

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Chapter 1

PURPOSE OF AND NEED FOR ACTION

Shipping is a major component of commerce in Jacksonville Harbor, Florida. The port handles foreign and domestic cargo ships carrying millions of tons of goods annually. The Jacksonville Harbor Channel System also affords the only access to the Mayport Harbor naval facility. As a result of natural shoaling processes, the Channel System must be dredged to maintain operating depths between 30 and 42 feet (9m and 13m). Disposal in the ocean is the most feasible means of disposal for part of the dredged material. The action proposed in this EIS is the final designation of the most environmentally acceptable Jacksonville Harbor Ocean Dredged Material Disposal Site.

The action proposed in this Environmental Impact Statement (EIS) is the final designation for continuing use of an Ocean Dredged Material Disposal Site (ODMDS) near Jacksonville, Florida. The purpose of the proposed action is to provide the most environmentally acceptable location for the disposal of materials dredged from the Jacksonville Harbor Channel System. The EIS presents the information needed to evaluate the suitability of ocean disposal areas for final designation for continuing use, and is based on one of a series of disposal site environmental studies. The environmental studies and final designation process are being conducted in accordance with the requirements of the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA), as amended (86 Stat. 1052, 33 USCA Part 1401 et seq.); the Environmental Protection Agency's (EPA's) implementation of the Ocean Dumping Regulations and Criteria (40 CFR 220-229); and other applicable Federal environmental legislation.

Based on an evaluation of all reasonable alternatives, the proposed action in this EIS is to permanently designate the existing interim-designated Jacksonville Harbor ODMDS. The boundary coordinates of the site are: 30°21'30"N, 81°18'34"W; 30°21'30"N, 81°17'26"W; 30°20'30"N, 81°17'26"W; and 30°20'30"N, 81°18'34"W. The site is 4.5 nmi offshore, has an average depth of 14m, and an area of 1 nmi^2 (Figure 1-1).

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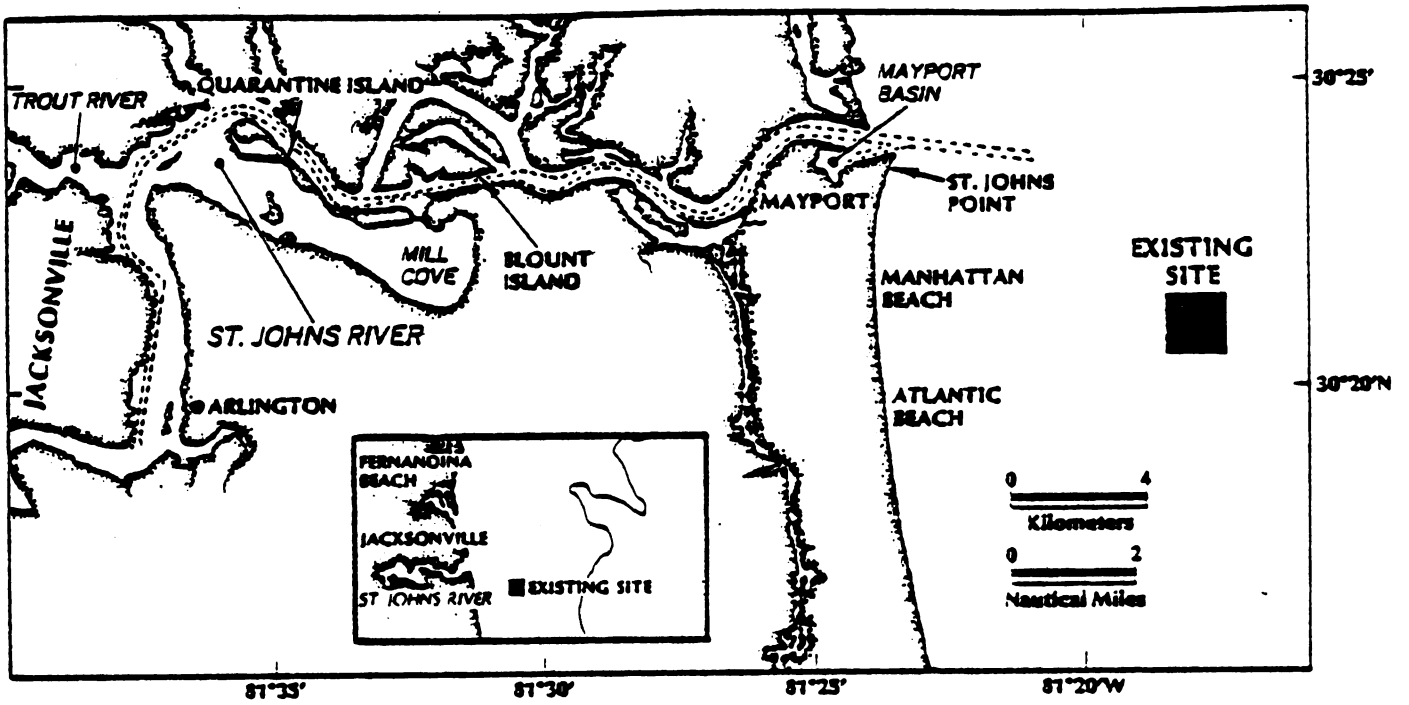

Figure 1-1. Existing Jacksonville Harbor ODMDS

The Jacksonville Harbor ODMDS, as delineated above, would be designated for the disposal of dredged material. The site may be used for disposal of the dredged material only after evaluation of each Federal project or permit application has established that the disposal is within site capacity and in compliance with the criteria and requirements of EPA and the U.S. Army Corps of Engineers (CE) regulations.

PURPOSE AND NEED

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

The MPRSA was enacted in October 1972. Congressional intent for this legislation as expressed in the act is:

> Sec. 2(b). The Congress declares that it is the policy of the United States to regulate the dumping of all types of materials into ocean waters and to prevent or strictly limit the dumping into ocean waters of any material which

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would adversely affect human health, welfare, amenities, or the marine environment, ecological systems, or economic potentialities.

(c). It is the purpose of this Act to regulate (1) the transportation by any person of material from the United States and, in the case of United States vessels, aircraft, or agencies, the transportation of material from a location outside the United States, when in either case the transportation is for the purpose of dumping the material into ocean waters, and (2) the dumping of material transported by any person from a location outside the United States if the dumping occurs in the territorial sea or the contiguous zone of the United States.

Title I of the MPRSA, which is the act's primary regulatory section, authorizes the Administrator of EPA (Section 102) and the Secretary of the Army acting through the CE (Section 103) to establish ocean disposal permit programs for nondredged and dredged materials, respectively. Title I also requires EPA to establish criteria, based on those factors listed in Section 102(a), for the review and evaluation of permits under the EPA and CE permit program. In addition, Section 102(c) of Title I authorizes EPA, considering criteria established pursuant to Section 102(a), to designate recommended ocean disposal sites or times for dumping of nondredged and dredged material.

CORPS OF ENGINEERS NATIONAL PURPOSE AND NEED

Section 103 of Title I requires the CE to consider in its evaluation of Federal projects and Section 103 permit applications the effects of ocean disposal of dredged material on human health, amenities, the marine environment, ecological systems, and economic potentialities. As part of this evaluation, consideration must be given to utilizing, to the extent feasible, ocean disposal sites designated by the EPA pursuant to Section 102(c). Since 1977, the CE has used those ocean disposal sites designated by EPA on an interim basis. Use of these interim-designated sites for ocean disposal has been an essential element of the CE's compliance with the requirements of the MPRSA and its ability to carry out its statutory responsibility for maintaining the Nation's navigation waterways. To continue to maintain the Nation's waterways, the CE considers it essential that environmentally acceptable ocean disposal sites be identified, evaluated, and permanently

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designated for continued use pursuant to Section 102(c). These sites will be used after review of each project has established that the proposed ocean disposal of dredged material is in compliance with the criteria and requirements of EPA and CE regulations.

CORPS OF ENGINEERS LOCAL NEED

The Port of Jacksonville is a major port on the Atlantic coast of the southeast United States. It is on the St. Johns River, approximately 20 nmi inland from the Atlantic Ocean, and is the largest deepwater port on the east coast of Florida (Figure 1-1). In 1978, approximately 15.7 million short tons of cargo passed through Jacksonville Harbor, with foreign trade accounting for approximately 40%, or 5.8 million tons (CE, 1978a). Principal exports were paper products, phosphate rock, fertilizers, chemicals, citrus products, naval stores, clay, scrap metal, feed, and general cargo. Principal imports included petroleum products, iron and steel products, pulpwood, cement, automobiles, lumber, chemicals, and general cargo. Eighty-one piers, wharfs, and docks are used in the Port of Jacksonville (CE, 1978b).

Continued use of the Port depends on routine dredging of Federal and non-Federal navigation channels and berthing areas. Natural shoaling processes would preclude passage of modern deep-draft vessels in the absence of dredging. Navigational channels are maintained for normal shipping traffic between 30 and 42 ft (9m and 13m) by Federal dredging projects. Private dredging firms are responsible for maintaining adequate water depths in berthing areas.

The CE has requested that the EPA permanently designate an ocean dumping site suitable for disposal of dredged material from the Jacksonville Harbor Channel System. Materials dredged from the Channel System have been dumped at sites on land and in the ocean; location of the dump sites is decided on a case-by-case basis, depending on environmental and economic considerations. For instance, contaminated material dredged from the Jacksonville Harbor Channel System is usually deposited in upland disposal sites (CE, 1975; U.S. Navy, 1978), and materials that comply with the environmental impact criteria at 40 CFR 227 are usually dumped in the ocean. However, active beach

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nourishment programs have substantially reduced the volumes of material to be dumped in the ocean. The annual volume of material actually dumped in the ocean averages approximately 855,000 yd^3 (see Chapter 2, Table 2-5).

EPA'S PURPOSE AND NEED

As previously stated, the CE has indicated a need for locating and designating environmentally acceptable ODMDS's to carry out its responsibilities under the MPRSA and other Federal statutes. Therefore, in response to the CE's stated need, EPA, in cooperation with the CE, has initiated the necessary studies pursuant to the requirements of 40 CFR 228.4(e) to select, evaluate, and possibly designate the most suitable sites for the ocean disposal of dredged material. This document has been prepared to provide the public and decisionmakers with relevant information to assess the impacts associated with the final designation for one of the sites proposed for final designation, the Jacksonville Harbor ODMDS. It is not anticipated that the CE will conduct any further environmental studies with respect to the selection of this site.

INTERIM DUMPING SITES

On 11 January 1977, EPA promulgated final Ocean Dumping Regulations and Criteria to implement MPRSA. The Regulations set forth criteria and procedures for the selection and designation of ocean disposal sites. In addition, the regulations designated 129 ocean sites for the disposal of dredged material to allow the CE to fully comply with the purpose and procedural provisions of the MPRSA. These sites could be used for an interim period by the CE, pending completion of site designation studies as required by the Regulations. Use of the interim-designated sites by the CE would be dependent on compliance with the requirements and criteria contained in EPA's Ocean Dumping Regulations and Criteria.

Those sites given interim designation were selected by EPA in consultation with the CE, with the size and location of each site based on historic use. The interim designation would remain in force for a period not to exceed

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3 years from the date of the final promulgation of the Regulations. However, due to the length of time required to complete the necessary environmental studies and operating restraints of both a technical and budgetary nature, environmental studies were not completed within the approved 3-year period. As a result, the Regulations were amended in January 1980 to extend the interim designation for those sites currently under study for a period not to exceed 3 years, while the remaining sites' interim status was extended indefinitely pending completion of studies and determination of the need for continuing use.

SITE STUDIES

In mid-1977, EPA, by contract, initiated environmental studies on selected nondredged material disposal sites. The studies were designed to characterize the sites' chemical, physical, and biological features and to provide the data needed to evaluate the suitability of each site for continuing use. All studies are being conducted in accordance with the appropriate requirements of Part 228 of the EPA Ocean Dumping Regulations and Criteria. Results of these studies are being used in the preparation of an EIS for each site where such a statement is required by EPA policy. The CE, to assist EPA in its national program for locating and designating suitable sites for the ocean disposal of dredged materials, agreed in 1979 to join the contract effort by providing funds for field surveys to collect and analyze baseline data. Data from each field survey and other relevant information are being used by EPA in its disposal-site evaluation study and in its EIS's to ascertain the acceptability of an interim site and/or another site(s) for final designation. In addition to providing funds, the CE agreed to further assist EPA by providing technical review and consultation.

The EPA, in consultation with the CE, selected 25 areas containing 59 interim-designated ODMDS's for study under the EPA contract. Regional priorities and possible application of the data to similar areas were considered in this selection process. For some selected areas, an adequate data base was found to exist; consequently, field studies for these areas were considered unnecessary for disposal-site evaluation studies. For the remaining selected areas, it was determined that surveys would be required for

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an adequate data base to characterize the areas' physical, chemical, and biological features and to determine the suitability of a site(s) in these areas for permanent designation. Field surveys were initiated in early 1979 and were completed in mid-1981.

The studies are directed to the evaluation of alternative ocean disposal sites for the disposal of dredged material in an area. Based on the data from the disposal-site evaluation study and other relevant information, an EIS will be prepared for each of the 25 selected areas. These EIS's only address those issues germane to the selection, evaluation, and final designation of environmentally acceptable ODMDS's. As a result, the data and conclusions contained in Chapters 2, 3, and 4 are limited to those significant issues relevant to site designation (i.e., analyses of impacts on site and adjacent area from the disposal of dredged material). Non-ocean disposal alternatives (e.g., upland, beach nourishment) are not addressed in the EIS's. However, in the event that non-ocean disposal alternatives have been previously addressed by Federal projects or Section 103 permit-application EIS's, a summary of the results and conclusion is included in Chapter 2.

SITE DESIGNATION

In accordance with the EPA's Ocean Dumping Regulations and Criteria, site designation will be by promulgation through formal rulemaking. The decision by EPA to designate a site(s) for continuing use will be based on appropriate Federal statutes, disposal-site evaluation study, EIS, supporting documentation and public comments on the Draft EIS, Final EIS, and the public notice issued as part of the proposed rulemaking.

In the event that the selected area(s) is deemed suitable for final designation, it is EPA's position that the site-designation process, including the disposal-site(s) evaluation study and the development of the EIS, fulfill all statutory requirements for the selection, evaluation, and designation of an ODMDS.

The EIS and supporting documents provide the necessary information to determine whether the proposed site(s) is suitable for final designation. In

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the event that an interim-designated site is deemed unacceptable for continuing use, the site's interim designation will be terminated and either the no-action alternative will be selected (no site being designated) or an alternative site(s) will be selected/designated. Furthermore, final site designation infers only EPA's determinations that the proposed site is suitable for the disposal of dredged material. Approval for use of the site will be determined only after review of each project to ensure that the proposed ocean disposal of dredged material is in compliance with the criteria and requirements of EPA and CE regulations.

LEGISLATION AND REGULATION BACKGROUND

FEDERAL LEGISLATION

Despite legislation dating back almost 100 years for the control of disposal into rivers, harbors, and coastal waters, ocean disposal of dredged material was not specifically regulated in the United States until passage of the MPRSA in October 1972. The first limited regulation was provided by the Supervisor of New York Harbor Act of 1888, which empowered the Supervisor (a U.S. Navy line officer) to prevent the illegal deposit of obstructive and injurious materials in New York Harbor, its adjacent and tributary waters, and Long Island Sound. In 1952, an amendment provided that the Secretary of the Army appoint a Corps of Engineers officer as Supervisor and, since that date, each New York District Engineer has automatically become the Supervisor of the Harbor. In 1958, an amendment extended the act to apply to the harbors of Hampton Roads, Virginia, and Baltimore, Maryland. Under the 1888 act, the Supervisor of the Harbor established sites in the Hudson River, Long Island Sound, and Atlantic Ocean for dumping certain types of materials. Further limited regulation was provided by the River and Harbor Act of 1899, which prohibited the unauthorized disposal of refuse into navigable waters (Section 13) and prohibited the unauthorized obstruction or alteration of any navigable water (Section 10).

The Fish and Wildlife Coordination Act was passed in 1958. Its purpose was "...to provide that wildlife conservation shall receive equal consideration

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and be coordinated with other features of water-resource development programs...." The law directed that water-resource projects, including channel deepening, be performed "with a view to the conservation of wildlife resources by preventing loss of and damage to such resources...." This was a first step towards concern for ocean areas. After the passage of this law, the CE (backed by judicial decisions) could refuse permits if the dredging or filling of a bay or estuary would result in significant unavoidable damage to the marine ecosystem.

Passage of the National Environmental Policy Act (NEPA) of 1969 (PL 91-190, 42 USC Parts 4321-4347, 1 January 1970) reflected public concern over the environmental effects of man's activities. Subsequently, particular attention was drawn to the effects of dredged materials by the River and Harbor Act of 1970 (PL 91-611). This act initiated a comprehensive nationwide study of dredged material disposal problems. Consequently, the CE established the Dredged Material Research Program (DMRP) in 1973, a 5-year, $30-million research effort. Objectives were (1) to understand why and under what conditions dredged material disposal might result in adverse environmental impacts, and (2) to develop procedures and disposal options to minimize adverse impacts (CE, 1977).

Two important acts were passed in 1972 that specifically addressed the control of waste disposal in aquatic and marine environments: (1) the Federal Water Pollution Control Act Amendments (FWPCA), later amended by the Clean Water Act of 1977, and (2) the MPRSA. Section 404 of the FWPCA established a permit program, administered by the Secretary of the Army acting through the Chief of Engineers, to regulate the discharge of dredged material into the waters of the United States (as defined at 33 CFR 323.2[a]). Permit applications are evaluated using guidelines jointly developed by EPA and the CE. Section 404(c) gives the EPA Administrator authority to restrict or prohibit dredged material disposal if the operation will have unacceptable adverse effects on municipal water supplies, shellfish beds and fishery areas (including spawning and breeding grounds), wildlife, or recreational areas. Procedures to be used by EPA in making such a determination are found at 40 CFR 231.

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MPRSA regulates the transportation and ultimate dumping of barged materials in ocean waters. The act is divided into three parts: Title I—Ocean Dumping, Title II—Comprehensive Research on Ocean Dumping, and Title III—Marine Sanctuaries. This EIS is concerned only with Title I of the act.

Title I, the primary regulatory section of MPRSA, establishes the permit program for the disposal of dredged and nondredged materials, mandates determination of impacts and alternative disposal methods, and provides for enforcement of permit conditions. The purpose of Title I is to prevent or strictly limit the dumping of materials that would unreasonably affect human health, welfare, or amenities, or the marine environment, ecological systems, or economic potentialities. Title I of the act provides procedures for regulating the transportation and disposal of materials into ocean waters under the jurisdiction or control of the United States. Any person of any nationality wishing to transport waste material from a U.S. port, or under a U.S. flag, to be dumped anywhere in the oceans of the world, is required to obtain a permit.

Title I prohibits the dumping into ocean waters of certain wastes, including radiological, biological, or chemical warfare agents, and all high-level radioactive wastes. In March 1974, Title I was amended (PL 93-253) to bring the act into full compliance with the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter, discussed below under "International Considerations." The provisions of Title I include a maximum criminal fine of $50,000 and jail sentence of up to 1 year for every unauthorized dump or violation of permit requirements, or a maximum civil fine of $50,000. Any individual may seek an injunction against an unauthorized dumper with possible recovery of all costs of litigation.

FEDERAL CONTROL PROGRAMS

Several Federal departments and agencies participate in the implementation of MPRSA requirements, with the lead responsibility given to EPA (Table 1-1). In October 1973, EPA implemented its responsibility for regulating ocean dumping under MPRSA by issuing the Final Ocean Dumping Regulations and Criteria (hereinafter "the Regulations" or "Ocean Dumping Regulations") which

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TABLE 1-1
RESPONSIBILITIES OF FEDERAL DEPARTMENTS AND AGENCIES
FOR REGULATING OCEAN DISPOSAL UNDER MPRSA

Department/Agency	Responsibility
U.S. Environmental Protection Agency	Issuance of waste disposal permits, other than for dredged material. Establishment of criteria for regulating waste disposal. Enforcement actions. Site designation and management. Overall ocean disposal program management. Research on alternative ocean disposal techniques.
U.S. Department of the Army Corps of Engineers	Issuance of permits for transportation of dredged material for disposal. Recommendation of disposal site locations.
U.S. Department of Transportation Coast Guard	Surveillance. Enforcement support. Issuance of regulations for disposal vessels. Review of permit applications.
U.S. Department of Commerce National Oceanic and Atmospheric Administration	Long-term monitoring and research. Comprehensive ocean dumping impact and short-term effect studies. Marine sanctuary designation.
U.S. Department of Justice	Court actions.
U.S. Department of State	International agreements.

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were revised in January 1977 (40 CFR 220-229). The Ocean Dumping Regulations established the procedures and criteria to apply for dredged material permits (Part 225), enforce permit conditions (Part 226), evaluate permit applications for environmental impact (Part 227), and designate and manage ocean disposal sites (Part 228).

OCEAN DUMPING EVALUATION PROCEDURES

The Ocean Dumping Regulations specify the procedures for evaluating the effects of dredged material disposal. The EPA and CE evaluate Federal projects and permit applications for non-Federal projects to determine (1) whether there is a demonstrated need for ocean disposal and that other environmentally sound and economically reasonable alternatives do not exist (40 CFR 227 Subpart C), and (2) compliance with the environmental impact criteria (40 CFR 227 Subparts B, D, and E). Figure 1-2 outlines the cycle used to evaluate the acceptability of dredged material for ocean disposal.

Under Section 103 of MPRSA, the Secretary of the Army is given the authority, with certain restrictions, to issue permits for the transportation of material dredged from non-CE projects for ocean disposal. For Federal projects involving dredged material disposal, Section 103(e) of MPRSA provides that "the Secretary [of the Army] may, in lieu of the permit procedure, issue regulations which will require the application to such projects of the same criteria, other factors to be evaluated, the same procedures, and the same requirements which apply to the issuance of permits..." for non-Federal dredging projects involving disposal of dredged material. Consequently, both Federal and non-Federal dumping requests undergo identical regulatory reviews. The only difference is that, after the review and approval of the dumping request, non-Federal projects are issued an actual permit. The CE is responsible for evaluating disposal applications and granting permits to dumpers of dredged materials; however, dredged material disposal sites are designated and managed by the EPA Administrator or his designee. Consequently, dredged material generated by Federal and non-Federal projects must satisfy the requirements of the MPRSA (as detailed in the Ocean Dumping Regulations) to be acceptable for ocean disposal.

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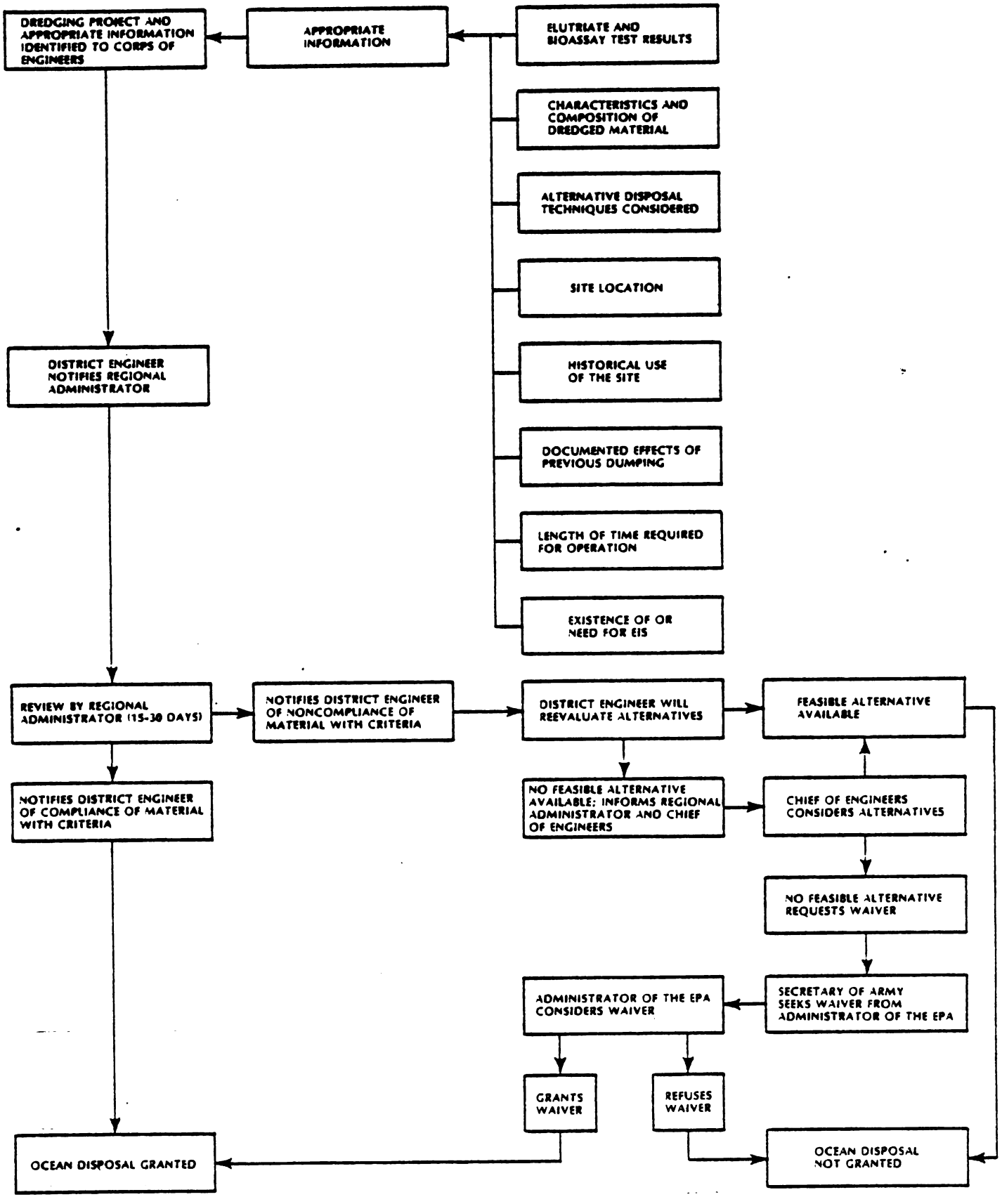

Figure 1-2. Dredged Material Evaluation Cycle

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ENVIRONMENTAL IMPACT CRITERIA

Section 103(a) of the MPRSA states that dredged material may be dumped into ocean waters after determination that "the dumping will not unreasonably degrade or endanger human health, welfare, or amenities, or the marine environment, or economic potentialities." This applies to the ocean disposal of dredged materials from both Federal and non-Federal projects. To ensure that dumping in the ocean will not unreasonably degrade or endanger public health and the marine environment, the Ocean Dumping Regulations restrict the transportation of all materials for dumping, specifically:

- Prohibited materials: High-level radioactive wastes; materials produced or used for radiological, chemical, or biological warfare; materials insufficiently described to apply the Criteria (40 CFR 227); and persistent inert synthetic or natural materials which float or remain suspended and interfere with fishing, navigation, or other uses of the ocean.

- Constituents prohibited as other than trace contaminants: Organo-halogens; mercury and mercury compounds; cadmium and cadmium compounds; oil; and known or suspected carcinogens, mutagens, or teratogens.

- Strictly regulated materials: Liquid waste constituents immiscible with or slightly soluble in seawater (e.g., benzene), radioactive materials, wastes containing living organisms, highly acidic or alkaline wastes, and wastes exerting an oxygen demand.

Dredged material is environmentally acceptable for ocean disposal without further testing if it satisfies any one of the following criteria:

- Dredged material is composed predominantly of sand, gravel, rock, or any other naturally occurring bottom material with particle sizes larger than silt, and the material is found in areas of high current or wave energy...

- Dredged material is for beach nourishment or restoration and is composed predominantly of sand, gravel, or shell...

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- When: (i) the material proposed for dumping is substantially the same as the substrate at the proposed disposal site; and (ii) the [proposed dredging] site...is far removed from known existing and historical sources of pollution so as to provide reasonable assurance that such material has not been contaminated by such pollution. (40 CFR 227.13[b])

If dredged material does not meet the above criteria, then further testing of the liquid, suspended particulate, and solid phases is required. The Ocean Dumping Regulations require that the liquid phase "not contain... constituents in concentrations which will exceed applicable marine water quality criteria after allowance for initial mixing" (40 CFR 227.6), and that "bioassays on the liquid phase of the dredged material show that it can be discharged so as not to exceed the limiting permissible concentration..." (40 CFR 227.13).

The suspended particulate and solid phases must be tested using bioassays which can demonstrate that dredged materials will not cause the "occurrence of significant mortality or significant adverse sublethal effects including bioaccumulation due to the dumping..." and that the dredged material "can be discharged so as not to exceed the limiting permissible concentration...." The bioassays ensure that "no significant undesirable effects will occur due either to chronic toxicity or to bioaccumulation." The required testing ensures that dredged material contains only constituents which are:

> (1) present in the material only as chemical compounds or forms (e.g., inert insoluble solid materials) non-toxic to marine life and non-bioaccumulative in the marine environment upon disposal and thereafter, or (2) present in the material only as chemical compounds or forms which, at the time of dumping and thereafter, will be rapidly rendered non-toxic to marine life and non-bioaccumulative in the marine environment by chemical and biological degradation in the sea; provided they will not make edible marine organisms unpalatable; or will not endanger human health or that of domestic animals, fish, shellfish, or wildlife. (40 CFR 227.6)

PERMIT ENFORCEMENT

Under MPRSA, the Commandant of the U.S. Coast Guard (USCG) is assigned responsibility by the Secretary of Transportation for conducting surveillance

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of disposal operations to ensure compliance with the permit conditions and to discourage unauthorized disposal. Alleged violations are referred to EPA for appropriate enforcement. Civil penalties include a maximum fine of $50,000; criminal penalties involve a maximum fine of $50,000 and/or a 1-year jail term. Where administrative enforcement action is not appropriate, EPA may request the Department of Justice to initiate relief actions in court for violations of the terms of MPRSA. Surveillance is accomplished by means of spot checks of dump vessels for valid permits, interception or escorting of dump vessels, use of shipriders, and aircraft overflights during dumping.

The Commandant of the Coast Guard has published guidelines for ocean dumping surveillance and enforcement in Commandant Instruction 16470.2B, dated 29 September 1976. An enclosure to the instruction is an Interagency Agreement between the CE and the USCG regarding surveillance and enforcement responsibilities over federally contracted ocean dumping activities associated with Federal Navigation Projects. Under the agreement, the CE "recognizes that it has the primary surveillance and enforcement responsibility over these activities." The CE directs and conducts the surveillance effort over CE contract dumpers engaged in ocean disposal activities, except in New York and San Francisco; the USCG retains primary responsibility for surveillance in these two areas. In all other areas, the USCG will respond to specific requests from the CE for surveillance missions. The USCG retains responsibility for surveillance of all dredged material ocean dumping activities which are not associated with Federal Navigation Projects.

OCEAN DISPOSAL SITE DESIGNATION

EPA is conducting studies of various disposal sites in order to determine their acceptability. The agency has designated a number of existing disposal sites for use on an interim basis until studies are completed and formal designation or termination of each site is decided (40 CFR 228.12, as amended 16 January 1980, 45 FR 3053).

Under Section 102(c) of MPRSA, EPA is authorized to designate sites and times for ocean disposal of acceptable materials. Therefore, EPA established criteria for site designation in the Regulations. These include general and

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specific criteria for site selection and procedures for designating the sites for disposal. If it appears that a proposed site can satisfy the general criteria, then the specific criteria for site selection will be considered. Once designated, the site may be monitored for adverse disposal impacts. The criteria for site selection and monitoring are detailed in Chapter 2.

INTERNATIONAL CONSIDERATIONS

The principal international agreement governing ocean dumping is the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (London Dumping Convention), which became effective in August 1975, upon ratification by 15 contracting countries including the United States (26 UST 2403: TIAS 8165). There are now 47 contracting parties. Designed to control dumping of wastes in the ocean, the Convention specifies that contracting nations will regulate disposal in the marine environment within their jurisdiction and prohibit disposal without permits. Certain hazardous materials are prohibited (e.g., radiological, biological, and chemical warfare agents, and high-level radioactive matter). Certain other materials (e.g., cadmium, mercury, organohalogens and their compounds; oil; and persistent, synthetic, or natural materials that float or remain in suspension) are also prohibited as other than trace contaminants. Other materials (e.g., arsenic, lead, copper, zinc, cyanides, fluorides, organo-silicon, and pesticides) are not prohibited from ocean disposal, but require special care. Permits are required for ocean disposal of materials not specifically prohibited. The nature and quantities of all ocean-dumped material, and the circumstances of disposal, must be periodically reported to the Inter-Governmental Maritime Consultative Organization (IMCO), which is responsible for administration of the Convention.

U.S. ocean dumping criteria are based on the provisions of the London Dumping Convention (LDC) and include all the considerations listed in Annexes I, II, and III of the LDC. Agreements reached under the LDC also allow exclusions from biological testing for dredged material from certain locations. These agreements are also reflected in the U.S. ocean dumping criteria. Thus, when a material is found to be acceptable for ocean dumping under the U.S. ocean dumping criteria, it is also acceptable under the LDC.

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Chapter 2

ALTERNATIVES INCLUDING THE PROPOSED ACTION

Two alternative disposal sites for dredged material from the Jacksonville Harbor Channel System are discussed. The 11 site-specific criteria listed at 40 CFR 228.6(a) provide the bases for comparing impacts associated with disposal at each site. Past ocean disposal at the Existing Site has not caused any significant adverse environmental effects which would preclude continues use of the site for dredged material disposal. Moveover, the Existing Site is the most economically acceptable location for ocean disposal. EPA proposes that the Existing Jacksonville Harbor ODMDS receive final designation.

EPA proposes that the existing Jacksonville Harbor ODMDS receive final designation for the disposal of material dredged from the Jacksonville Harbor Channel System. The alternatives considered were:

- No Action--the existing Jacksonville Harbor ODMDS would retain its interim designation until its expiration in February 1983, after which no EPA-approved ocean disposal site would be available for dredged material disposal.

- Proposed Action--designation of an existing Jacksonville ODMDS.

- Alternative Action--designation of an ocean site other than the Existing Jacksonville Harbor ODMDS.

The environmental implications and effects of each alternative listed above have been analyzed from available data and are presented in this chapter.

NO-ACTION ALTERNATIVE

The No-Action alternative to the proposed action would be to refrain from designating an EPA-approved ocean site for the disposal of dredged material from the Jacksonville Harbor Channel System. The Existing Site is currently designated on an interim basis. The interim designation is scheduled to expire

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in February 1983, unless formal rulemaking is completed earlier that either (1) designates the interim site for continuing use, or (2) selects and designates an alternative site.

By taking no action, the present ocean site would receive a final designation, nor would an alternative ocean disposal site be designated. Consequently, the CE would not have an EPA-recommended ocean disposal site available in the area. Therefore, the CE would be required to either: (1) justify an acceptable alternative disposal method (e.g., land based), or (2) develop information sufficient to select an acceptable ocean site for disposal or (3) modify or cancel a proposed dredging project that depends upon disposal in the ocean as the only feasible method for the disposal of dredged material. Based on these factors the No-Action Alternative is not considered to be an acceptable alternative to the proposed action.

LAND DISPOSAL

Land disposal alternative are considered by the CE when evaluating the need for ocean disposal. Several upland disposal sites are utilized by the CE, U.S. Navy, and private dredge operators for material dredged from the Jacksonville Harbor Channel System when: (1) the quality of the material is unacceptable for ocean disposal, and (2) the cost to transport the material to an ocean site is economically prohibitive. Several land-based disposal sites are currently (1981) in use (e.g., Blount Island, Ouarantine Island). Further evaluation of land disposal alternatives is not part of EPA's responsibility in the designation of sites for ocean disposal.

SELECTION OF ALTERNATIVE SITES

The general criteria (Ocean Dumping Regulations at 40 CFR 228.5) used in selection of an ocean disposal site are:

- **The dumping of materials into the ocean will be permitted only at sites or in areas selected to minimize**

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the interference of disposal activities with other activities in the marine environment, particularly avoiding areas of existing fisheries or shellfisheries, and regions of heavy commercial or recreational navigation.

- Locations and boundaries of disposal sites will be so chosen that temporary perturbations in water quality... can be...reduced to normal ambient seawater levels or to undetectable contaminant concentrations or effects before reaching any beach, shoreline, marine sanctuary, or known geographically limited fishery or shellfishery.

- The sizes of ocean disposal sites will be limited in order to localize any immediate adverse impacts and permit the implementation of effective monitoring and surveillance programs to prevent adverse long range impacts.

- ...wherever feasible, designate ocean dumping sites beyond the edge of the Continental Shelf and other such sites that have been historically used.

Using the general criteria listed above, three general ocean environments off Jacksonville are considered as possible locations for ocean disposal sites: (1) shallow water (depths less than 20m, up to approximately 20 nmi offshore), (2) mid-Shelf (depths from 20m to 80m, approximately 20 to 60 nmi offshore), and (3) deepwater Slope (depths greater than 100m, approximately 60 nmi offshore).

SHALLOW-WATER AREA

The Shallow-Water Area is defined in this EIS as that part of the Continental Shelf adjacent to the St. Johns estuary which extends seaward approximately 20 nmi to a depth of 20m. The nearshore area off Jacksonville is used for commercial and recreational fishing activities and is a principal area for shrimp and crab fisheries. Except for locations that have actually been identified as fishery resource areas (Moe, 1963), an ODMDS could be located within the Shallow-Water Area.

Disposal of material dredged from the Jacksonville Harbor Channel System has occurred previously in the Shallow-Water Area, primarily at a site 4.5 nmi

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off the mouth of the St. Johns River (i.e., Existing Site; Figure 2-1). Localized mounding has been the only long-term effect of disposal at the site (NAVOCEANO, 1973; Little and Young, 1979).

MID-SHELF AREA

A mid-Shelf disposal site is eliminated from further consideration for the following reasons:

- Numerous natural and artificial reefs and rock outcrops are scattered throughout the mid-Shelf region. Because these are important recreational and commercial fishing areas, temporary burial of organisms or changes in water quality resulting from disposal operations could adversely affect the reefs;

- No significant advantage over the Shallow-Water Area is provided in terms of initial mixing volumes; the depths of the mid-Shelf Area are only 3m to 5m deeper than the Existing Site; and

- No historical disposal of dredged material has occurred on the mid-Shelf.

DEEPWATER AREA

The Deepwater Area is approximately 60 nmi from the mouth of the St. Johns River, beginning on the upper portion of the Florida-Hatteras Slope, at depths greater than 100m. Deepwater areas of the Georgia Bight are considered favorable dredged material disposal locations by Pequegnat et al. (1978) because they are seaward of: (1) principal commercial fisheries and sport-fisheries, and (2) numerous patch reefs ("live-bottom") found on the mid-Shelf region.

The Deepwater Area is a feasible alternative for a dredged material disposal site. An ODMDS could be located anywhere within the area; however, a representative Deepwater Site (Figure 2-1), located 66 nmi off the mouth of

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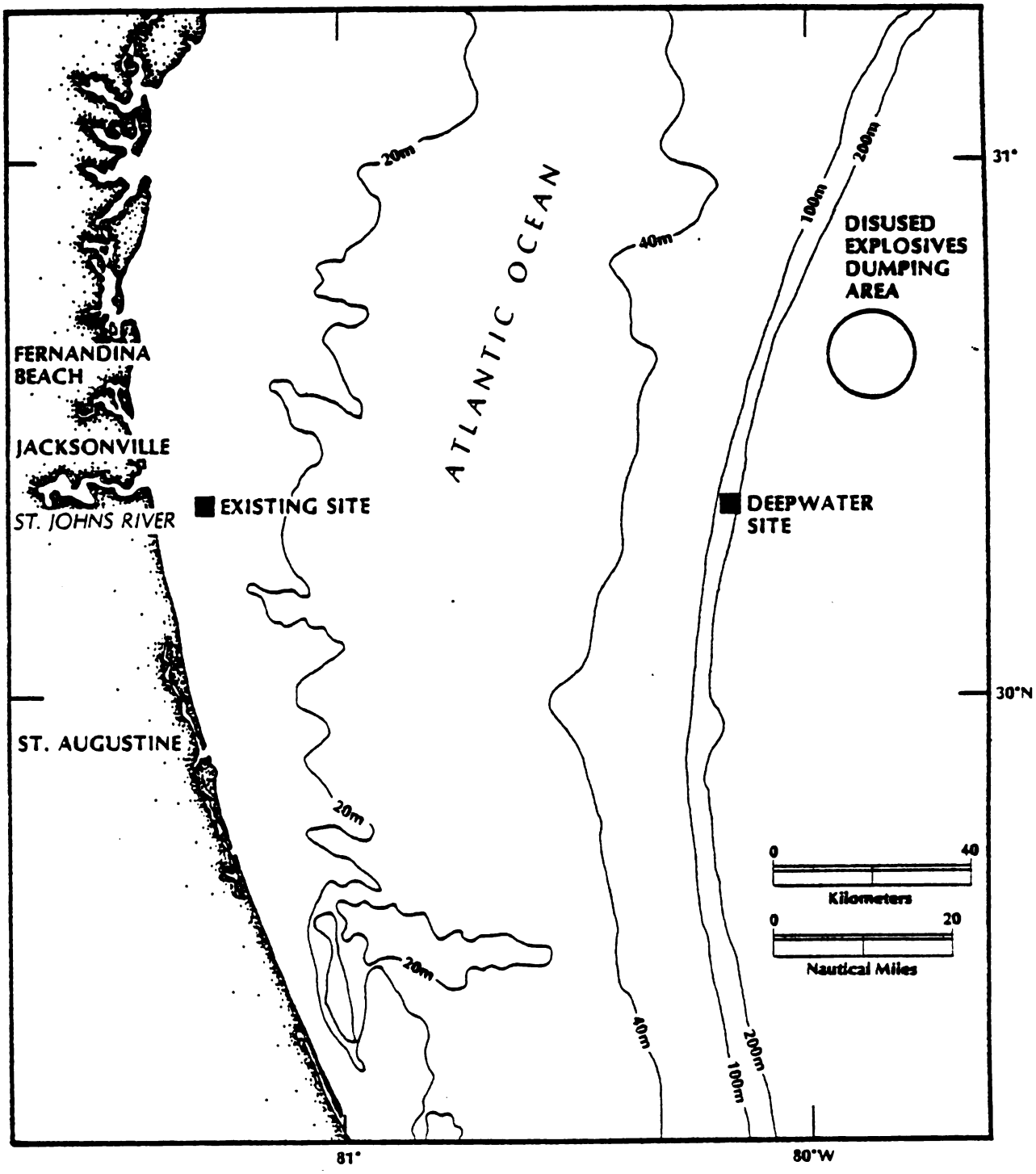

Figure 2-1. Existing and Deepwater Sites

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the St. Johns River, with a depth of 150m, will be evaluated for suitability as an ODMDS using the 11 criteria listed at 40 CFR 228.6 (Ocean Dumping Regulations).

DETAILED CONSIDERATION OF THE ALTERNATIVE SITES

The proposed action is the final designation of the existing Jacksonville Harbor ODMDS. This proposed action is based on site evaluations using the 11 specific criteria listed at 228.6(a) of the Ocean Dumping Regulations. EPA established these 11 criteria to constitute "...an environmental assessment of the impact of the site for disposal." The criteria are used to make critical comparisons between the alternative sites, and, using information contained in Chapter 3 and 4 of this EIS, are the bases for final site selection.

The Existing Site and Deepwater Site are considered below, within the context of the 11 site selection criteria.

(1) GEOGRAPHICAL POSITION, DEPTH OF WATER, BOTTOM TOPOGRAPHY AND DISTANCE FROM COAST [40 CFR 228.6(a)(1)]

EXISTING SITE

The geographical position of the Existing Site is shown in Figure 2-1 and described in Table 2-1. The site is approximately a square of 1 nmi^2 area, with its four corners at coordinates 30°21'30"N, 81°18'34"W; 30°21'30"N, 81°17'26"W; 30°20'30"N, 81°17'26"W; and 30°20'30"N, 81°18'34". Water depth ranges from 12m to 16m, and the bottom slopes an average of less than 1° to the east. Bottom topography is characterized by a large (up to 9 ft) mound in the center of the site, probably the result of past disposal activities (Little and Young, 1978).

DEEPWATER SITE

The Deepwater Site (Figure 2-1) is beyond the Continental Shelf, in water depths greater than 150m (Table 2-1). The 1-nmi^2 site is being considered to

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TABLE 2-1
GEOGRAPHIC AND PHYSICAL CHARACTERISTICS OF THE ALTERNATIVE SITES

Parameter	Existing Site	Deepwater Site
Center Coordinates	30°21'00"N 81°18'00"W	30°21'00"N 80°10'08"W
Water Depth (m)	12-16	150-200
Area (nmi^2)	1.0	1.0
Distance Offshore (nmi)	4.5	66
Bottom Characteristics		
Bathymetry	Fairly smooth; some irregular mounding; slope less than 1° to the east	Smooth; slope less than 1° to the east
Sediment Type	Primarily fine sand; patches of silt and clay sporadically distributed	Sand and silty clay

minimize the distance from the Jacksonville Harbor Entrance Channel and to maintain depths greater than 150m. The corner coordinates of the site are 30°21'30"N, 80°10'34"W; 30°21'30"N, 80°09'26"W; 30°20'30"N, 80°09'26"W; and 30°20'30"N, 80°10'34"W. The site overlies part of the Florida-Hatteras Slope which separates the Shelf and the Blake Plateau. Water depths range from 150m to 200m and the bottom topography consists of a gradual slope of less than 1° (Uchupi, 1967). Bottom sediments consist of sand and silty clays (Dillon et al., 1975). No known disposal activites have occurred at the site; however, an abandoned dump site for explosives is located to the northeast (Figure 2-1).

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(2) 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)]

EXISTING SITE

Areas for breeding, spawning, nursery and/or passage of commercially and recreationally important finfish and shellfish species occur on a seasonal basis in and near the St. Johns River (CE, 1975). The effects of dredged material disposal on these activities are unknown; however, past dredged material disposal at the Existing Site have not caused detectable, significant or irreversible adverse impacts on living resources (see Chapter 4).

Shrimp migrate to and from the St. Johns River during April through October, thus considerable efforts are made by the CE to schedule major dredging and disposal projects before April or after October. Adult menhaden (coast herring) generally occur within 32 nmi off the coast (Roberts and Able, 1974), and young menhaden use the St. Johns River as a nursery area (Reintjes and Pacheco, 1966; CE, 1975).

DEEPWATER SITE

Pequagnat et al. (1978) recommended that the region east of the 100m isobath (which includes the Deepwater Site) could be used as a disposal site to avoid mid-Shelf reef and live-bottom communities that provide for a valuable finfish and shellfish industry. The principal criteria considered in selecting the region were:

(1) The shrimp fishery is located at or shoreward of the 40m isobath.

(2) The principal commercial finfishery is located at or shoreward of the 80m isobath (much of it to the south is inside the 40m isobath).

(3) The sandstone ledges supporting hard bottom communities are discontinuous and lie within the 100m isobath.

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Commercially important demersal fish occur in low numbers beyond the 100m isobath (Barans and Burrell, 1976). No known breeding, spawning, nursery, feeding, or passage area for living resources are known to exist in the immediate vicinity of the Deepwater Site.

(3) LOCATION IN RELATION TO BEACHES AND OTHER AMENITY AREAS [40 CFR 228.6(a)(3)]

EXISTING SITE

The major amenity areas in the vicinity of the Existing Site are the Jacksonville beaches and offshore fishing areas. Because dredged material has not been reported to have been transported onto the beaches after 28 years of the site's existence (NAVOCEANO, 1973; Little and Young, 1979), disposal at the Existing Site will not affect Jacksonville Beach, more than 4.5 nmi away.

Popular fishing areas, including natural and artificial reefs, are east (seaward) of the Existing Site. The center of the disposal site is within a favorite angling area, receiving intense fishing pressure for surface-water species during the summer months (Moe, 1963). However, previous disposal operations at the site apparently have not prompted severe objection from local fishermen.

DEEPWATER SITE

The Deepwater Site is sufficiently far (66 nmi) from shore that dredged material released at this site would not reach coastal beaches or other amenity areas.

(4) TYPES AND QUANTITIES OF WASTES PROPOSED TO BE DISPOSED OF, AND PROPOSED METHODS OF RELEASE, INCLUDING METHODS OF PACKING THE WASTE, IF ANY [40 CFR 228.6(a)(4)]

Dredged material released at approved disposal sites must conform to the EPA dredged-material criteria in the Ocean Dumping Regulations (40 CFR 227). The material dumped at an offshore disposal site results from dredging

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the Jacksonville Harbor Channel System. An annual average (based on 19 years of actual use) of 855,000 yd^3 of dredged material has been dumped at the Existing Site (see "Permissible Material Loading" section, below). However, the quantity of material to be dumped at the disposal site is highly variable and depends upon the requirements of the Jacksonville Harbor Channel System.

Sediments dredged from the outer Entrance Channel are predominately sand and shell (Pittsburgh Testing Laboratory, unpublished). Materials dredged from areas other than the outer Entrance Channel and Bar range from sand to silty clay (CE, 1975; CE-Jacksonville District, 1978). The majority of dredged material dumped at the Existing Site is environmentally acceptable for ocean disposal, in accordance with 40 CFR 227.13(b,c). However, several loads (see Table 2-5) of unacceptable material dredged from Mayport Harbor have been dumped at the site under emergency permits (NAVOCEANO, 1973).

Hopper dredge, barge, and scow combinations are the usual vehicles of transport for the dredged material. None of the material is packaged in any manner.

(5) FEASIBILITY OF SURVEILLANCE AND MONITORING [40 CFR 228.6(a)(5)]

EXISTING SITE

The U.S. Coast Guard (USCG) is not currently conducting surveillance at the Existing Site; however, surveillance would be relatively easy because the site is close to Jacksonville. Either shore-based observers or day-use boats could be used for surveillance.

Monitoring (discussed in detail later in this chapter) is feasible at the Existing Site.

DEEPWATER SITE

Surveillance (by shipriders or aircraft) and monitoring of the Deepwater Site are feasible, but would be more difficult and expensive because of the greater distance offshore.

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(6) DISPERSAL, HORIZONTAL TRANSPORT AND VERTICAL MIXING CHARACTERISTICS OF THE AREA, INCLUDING PREVAILING CURRENT DIRECTION AND VELOCITY, IF ANY [40 CFR 228.6(a)(6)]

EXISTING SITE

General surface circulation in the vicinity of the Existing Site is composed of a weak tidal current superimposed on a strongecurrent (NAVOCEANO, 1973). During autumn and winter the drift is southwesterly; during spring and summer it is northeasterly. Bottom currents are usually weak (averaging 2.1 cm/s), although velocities up to 31 cm/s have been measured (NAVOCEANO, 1973). In general, transport of suspended solids from dredged material disposal will depend primarily upon the speed and direction of the wind and secondarily upon the direction of tidal currents (NAVOCEANO, 1973).

Significant long-term accumulation or mounding of dredged material has been detected at the Existing Site by high-resolution profiling at the disposal site conducted before and after disposal operations (Little and Young, 1978). Mounds containing a high percentage of consolidated fine material are not easily resuspended and may resist erosion.

DEEPWATER SITE

Mounds of relatively fine-grained dredged material would be less likely to form at the Deepwater Site because of dispersion due to the greater depth of the site and to the effects from the Gulf Stream. Surface currents at the Deepwater Site are influenced by the strong (140 cm/s) northerly flowing surface current of the Gulf Stream (Richardson et al., 1969). Although the bottom velocity of the Gulf Stream decreases to less than 20 cm/s in the vicinity of the Deepwater Site, the total transport of water, which is almost uniform with depth, increases as the Gulf Stream flows north (Richardson et al., 1969). Thus, the Deepwater Site may provide greater dispersion of dredged material prior to settling than the Existing Site.

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(7) EXISTENCE AND EFFECTS OF CURRENT AND PREVIOUS DISCHARGES AND DUMPING IN THE AREA (INCLUDING CUMULATIVE EFFECTS) [40 CFR 228.6(a)(7)]

EXISTING SITE

Dredged material disposal has produced no significant adverse effects on the water quality at the Existing Site (see Appendix A; NAVOCEANO, 1973; Little and Young, 1979). Changes in water quality as a result of disposal operations have been of short duration (minutes) and have been confined to relatively small areas. No major differences in finfish and shellfish species or numbers were found in recent surveys within and adjacent to the Existing Site (see Appendix A).

Past use of the Existing Site has created a localized mound (see Chapter 3, Figure 3-8; Little and Young, 1978) and temporary disturbances of benthic infauna and demersal fish assemblages (see Appendix A; NAVOCEANO, 1973). High variability in diversity and density of benthic communities within the nearshore region normally exists (see Chapter 3). This natural variability may obscure the identification of impacts due to past use of the Existing Site. However, no adverse, cumulative effects are evident from previous disposal operations.

DEEPWATER SITE

Previous dredged material disposal has not occurred at or in the vicinity of this alternative site.

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(8) 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)]

EXISTING SITE

Shipping, fishing, and recreational activities occur in the vicinity of the Existing Site. Previous dredged material disposal operations occasionally have interfered with fishing activities when the material was short-dumped or inadvertently dropped in transit to the disposal site (Roland, personal communication*).

Shipping fairways are not designated in the Georgia Bight. The Existing Site is situated southeast of the Entrance Channel and no conflicts between shipping and disposal operations have been reported to the CE in the 28 years the site has been in existence.

No resource developments occur in the immediate vicinity of the Existing Site, and no mineral extraction or desalination projects are expected in the vicinity of the site. The Existing Site and surrounding area are not of special scientific importance; aquaculture activities presently do not occur in the vicinity of the Existing Site.

DEEPWATER SITE

Disposal at the Deepwater Site is not expected to interfere with shipping. Fisheries would not be affected by disposal in deep water because most of the commercial and recreational fisheries are confined to waters shallower than 100m.

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* M. Roland, M. Roland Seafood Co., Mayport, FL. 1980.

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Disposal at the Deepwater Site should not significantly affect future mineral extraction activities on the Blake Plateau because of the dispersive characteristics when using a deepwater disposal site. The Deepwater Site is not currently included in active or proposed oil and gas lease areas (BLM, 1980b).

(9) THE 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)]

EXISTING SITE

Investigations of dredged material disposal operations at the Existing Site (see Appendix A; NAVOCEANO, 1973; Little and Young, 1979) have indicated that disposal has had no significant adverse effects on water quality (e.g., dissolved nutrients, trace metals, dissolved oxygen, or pH).

Phytoplankton and zooplankton studies revealed natural seasonal differences in species composition. Diatoms usually dominate the phytoplankton community, although dinoflagellates are abundant during summer (Hulburt and MacKenzie, 1971; Roberts, 1974b). Calanoid copepods dominate the zooplankton community, contributing up to 95% of the total numbers (Bowman, 1971).

Fish and shrimp dominate the nekton community adjacent to the Existing Site, and species are typical of those reported from the coastal waters all along the Georgia Bight. Several of these species are commercially and recreationally important, including the brown and white shrimp, and various reef fishes (Moe, 1963; Anderson, 1970).

The benthic community in the vicinity of the Existing Site is characteristic of silty sands (Texas Instruments Inc., 1979). The community is highly diverse in species but low in abundance and biomass; polychaetes are the dominant benthic species (Tenore, 1979).

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DEEPWATER SITE

The water quality of the Deepwater Site is variable, ranging from optically pure ocean water to water upwelled by the meandering of the Gulf Stream. Commercially exploitable species (fishes, shrimps, scallops) are conspicuously absent or occur in low numbers in the vicinity of the Deepwater Site (Struhsaker, 1969). Polychaetes typically dominate the benthic community (Tenore, 1979).

Disposal at the Deepwater Site should not adversely affect the existing water quality or ecology of the site primarily because of dispersion and dilution.

(10) POTENTIALITY FOR THE DEVELOPMENT OR RECRUITMENT OF NUISANCE SPECIES IN THE DISPOSAL SITE [40 CFR 228.6(a)(10)]

There are no components in the dredged material or consequences of its disposal which would attract or result in recruitment of nuisance species to the Existing or Deepwater Sites. Previous surveys at the Existing Site (see Appendix A; NAVOCEANO, 1973) did not detect the development or recruitment of nuisance species.

(11) 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 Florida Historical Preservation Officer reported that no natural or cultural features of historical importance exist at or near the Existing and Deepwater Sites (Morrell, personal communication*).

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* L. R. Morrell, Florida State Divison of Archives, 1980

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CONCLUSIONS

A summary of the 11 site-selection criteria for the two alternative sites is presented in Table 2-2.

The Existing Site is compatible with the criteria used for site evaluation, at reasonable costs, in preference to the deepwater alternative. The following criteria are considered extremely relevant in the selection of the Existing Site as the favorable alternative site for the disposal of dredged material. These criteria are indicated by an asterisk (*) in Table 2-2.

- The Existing Site is 4.5 nmi from the mouth of the St. Johns River, whereas the Deepwater Site is more than 60 nmi from shore. (Criterion 1). Disposal costs and energy consumption involved in use of the Deepwater Site would be significantly greater than for the Existing Site due to greater transportation demands.

- Dredged material has been dumped at the Existing Site, but the effects of disposal have been localized. The Deepwater Site has not been used for dredged material disposal. (Criterion 7)

CHARACTERISTICS OF DREDGED MATERIAL

PHYSICAL CHARCTERISTICS

The composition of dredged material dumped at the Existing Site has been extremely variable, ranging from rock to clay. The majority of the dredged material destined for disposal in the ocean is composed of silt (5% to 22%) and clay (14% to 74%; Little et al., 1977). The disposal of gravel and rock were associated with the Jacksonville Harbor Deepening Project, completed in 1977. Sediments dredged to maintain the Entrance Channel and certain reaches of the St. Johns River downstream from Jacksonville are predominantely fine- to medium-grained sands. Although much of this latter material is acceptable for beach nourishment, excess sediment may be dumped at an ocean disposal site.

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TABLE 2-2
SUMMARY OF THE 11 SPECIFIC CRITERIA OF THE OCEAN DUMPING REGULATIONS AS APPLIED TO THE TWO ALTERNATIVE DISPOSAL SITES

Criterion	Existing Site	Deepwater Site
*1. Geographical position, depth of water, bottom topography and distance from coast.	4.5 nmi off the mouth of the St. Johns River; 12m to 16m water depths; bottom is fairly smooth with a gradual slope to the east (seaward); a mound is present as a result of dumping.	More than 60 nmi off the mouth of the St. Johns River; 150m to 200m water depths; bottom slopes gradually to the east (seaward).
2. Location in relation to breeding, spawning, nursery, feeding, or passage areas of living resources in adult or juvenile phases.	Living resources breed and spawn in and near the St. Johns River; the nearshore regions are important fish and invertebrate passage areas.	No known breeding, spawning, nursery, feeding, or passage area for living resources are known to exist in the immediate vicinity of the site.
3. Location in relation to beaches and other amenity areas.	At least 4.5 nmi offshore from Jacksonville beaches; some recreational fishing occurs within the Existing Site, but most is associated with nearby natural and artificial reefs which are east of the Existing Site.	No beaches or other amenity areas in the vicinity.
4. Types and quantities of wastes proposed to be disposed of, and proposed methods of release, including methods of packing the waste, if any.	Approximately 855,000 yd^3 of material per year is dredged from the Jacksonville Harbor Channel System; material ranges in size from sand to silty clays; hopper dredge, barge, or scow combinations carry and release the unpackaged material.	Same as for the Existing Site.
5. Feasibility of surveillance and monitoring.	Surveillance by shore-based observers or day-use boats possible; monitoring is feasible.	Surveillance by shipriders or aircraft possible; monitoring is feasible.
6. Dispersal, horizontal transport and vertical mixing characteristics of the area, including prevailing current direction and velocity, if any.	Surface drift is southwest during fall and winter; drift is northeast during spring and summer. Transport dependent upon wind speed and direction, and upon tidal currents.	Greater dispersion of the and material when dumped due to depth of the site and to the effects from the Gulf Stream.
*7. Existence and effects of current and previous discharges and dumping in the area (including cumulative effects).	The site has received dredged material since at least 1952; only adverse environmental effects are a temporary reduction in the numbers of bottom-dwelling organisms, and a mound near the center of the disposal site.	Area has never received dredged material.
8. Interference with shipping, fishing, recreation, mineral extraction, desalination, fish and shellfish culture, areas of special scientific importance and other legitimate uses of the ocean.	Prior interference with fishing due to short dumping; mineral extraction and desalination do not occur; previous disposal operations have not interfered with other legitimate uses of the ocean.	Fishing, desalination, and recreation do not occur; disposal operations should not interfere with other uses of the ocean.
9. The existing water quality and ecology of the site as determined by available data or by trend assessment or baseline surveys.	Several site-specific studies indicate that the water quality and ecology of the site have not been adversely affected by disposal; diatoms dominate the phytoplankton community, calanoid copepods dominate the zooplankton, while the nekton community is dominated by fish and shrimp; polychaetes dominate the benthic community.	Water quality ranges from clean oceanic Slope Water to upwelled Gulf Stream water; polychaetes typically dominate the benthic community.
10. Potentiality for the development or recruitment of nuisance species in the disposal site.	Dredged material has no components which would favor development or recruitment of nuisance species.	Same as for the Existing Site.
11. Existence at or in close proximity to the site of any significant natural or cultural features of historical importance.	No features of historical importance at or near the site.	Same as for the Existing Site.

* A criterion especially relevant to site selection

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CHEMICAL CHARACTERISTICS

Chemical characteristics of dredged materials from Jacksonville Harbor and Mayport Harbor are summarized in Table 2-3. Chemical oxygen demand (COD) and concentrations of total organic carbon (TOC) and oil and grease are relatively high and generally indicative of the organic nature and associated sorbtive capacity of silt and clay sediments. Mayport Harbor sediments have two to three times the organic load as those from Jacksonville Harbor. Trace-metal concentrations in sediments from the Jacksonville Harbor Channel System are not excessive, but do show evidence of anthropogenic contamination (CE, 1975). High concentrations of oil and grease and trace metals in sediments from Mayport Harbor have been cause for environmental concern in the past (NAVOCEANO, 1973; Little and Young, 1979). Information on the degree of trace organic (e.g., polychlorinated biphenyl) contamination of dredged materials from Jacksonville and Mayport Harbors is lacking. No detectable quantities of these contaminants were found in the sediments from Jacksonville shipyards (Table 2-4; EG&G, 1980).

USE OF THE SITE

The general area of the Existing Site has been used for the disposal of dredged material since 1952 (Lancaster, personal communication*). In 1972 and 1973, investigations monitoring the effects of disposal determined that the majority of the dredged material had been deposited about 0.5 nmi east of the designated disposal site boundaries (NAVOCEANO, 1973). Since 1973, the site has been used within its present boundaries. In order to locate the actual site, a permanent buoy was positioned at the center of the disposal site in 1977 and is mantained by the USCG (Little et al., 1977).

* B. Lancaster, CE-Jacksonville District. 1980.

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TABLE 2-3
CHEMICAL CHARACTERISTICS OF DREDGED MATERIAL
FROM JACKSONVILLE AND MAYPORT HARBORS DUMPED AT THE EXISTING SITE

Constituent	Concentration (mg/kg)	
	Jacksonville Harbor	Mayport Harbor
Volatile Solids	44,200	96,000
T.V.S. Formula EC	53,800	95,700
Total Organic Carbon	8,200	20,700
Chemical Oxygen Demand	41,450	84,700
Oil and Grease	455	2,100
Kjeldahl-Nitrogen-N	880	2,495
Ammonia-N	-	158
Nitrate-N	-	0.34
Nitrite-N	-	0.04
Total Phosphorus-P	-	3,570
Soluble Phosphorus-P	-	8.87
Arsenic	14	5
Beryllium	0.9	0.9
Cadmium	0.5	0.75
Chromium	15	26
Copper	2	15
Iron	17,000	23,000
Lead	11	21
Mercury	0.2	0.2
Nickel	9	11
Selenium	0.1	0.5
Vanadium	16	19
Zinc	22	58

Sources: CE, 1975; CE-Jacksonville District, 1978

PERMISSIBLE MATERIAL LOADINGS

The Existing Site has received approximately 16 million yd^3 of dredged material (including volumes of material dumped 0.5 nmi east of the site) since 1952. Annual material loadings at the site have varied from 0 to 3.4 million yd^3, averaging 855,000 yd^3 for the 19 years the site has actually been used (Table 2-5). Even though the disposal of dredged material from the Jacksonville Harbor Channel System has caused only localized mounding at the site, an upper limit cannot be determined for the amount of dredged material that can be dumped at the Existing Site. If accelerated disposal rates occur

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TABLE 2-4
AVERAGE CONCENTRATION OF CONTAMINANTS RELEASED DURING STANDARD ELUTRIATE TEST OF MATERIALS DREDGED FROM JACKSONVILLE AND MAYPORT HARBORS

Constituents	Jacksonville	Mayport
Total Organic Carbon mg/liter	8	-
Ammonia-N mg/liter	1.9	-
Organic-N mg/liter	0.7	-
Total Phosphorus-P, mg/liter	0.04	-
Ortho Phosphate-P, mg/liter	0.03	-
Arsenic µg/liter	BD	-
Cadmium µg/liter	0.2	0.3
Chromium µg/liter	BD	BD
Copper µg/liter	0.5	1.3
Iron µg/liter	33	-
Lead µg/liter	1.8	8.2
Mercury µg/liter	BD	-
Nickel µg/liter	2.9	6.5
Zinc µg/liter	2.7	3.8

BD = Below detection limits

Sources: CE-Jacksonville District, 1978; Little and Young, 1978

and are observed in later monitoring programs to produce appreciable adverse effects, disposal operations would be altered in accordance with the Ocean Dumping Regulations (40 CFR 228.11) in order to reduce effects.

DISPOSAL METHODS

Present disposal methods practiced by the CE at the Existing Site are acceptable for future dumping. The material is dredged, transported by hopper dredge, barge or scow combination, and discharged from underwater ports while the vessel is underway and within the boundaries of the disposal site.

TYPES OF MATERIALS

Currently, only acceptable material from the dredging of the Jacksonville Harbor Channel System are permitted at the Existing Site (Table 2-6). Other dredged material would not be accepted at the site unless the material conforms to the criteria (40 CFR 227.13) of the Ocean Dumping Regulations.

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TABLE 2-5
HISTORICAL DISPOSAL VOLUMES OF DREDGED MATERIAL AT THE EXISTING SITE
(cubic yards)

Year	Origin of Dredged Material		Total
	Jacksonville Harbor	Mayport Harbor	
1952*	247,000	NR	247,000
1953*	444,000	NR	444,000
1954*	334,252	415,043	749,295
1956*	197,500	NR	197,500
1960*	NR	2,046,901	2,046,901
1961*	746,586	NR	746,586
1962*	NR	11,826	11,826
1963*	600,675	557,311	1,157,986
1965*	754,883	NR	754,883
1967*	376,992	NR	376,992
1968*	759,706	NR	759,706
1969*	NR	961,916	961,916
1971-2	NR	2,006,504	2,006,504
1974	NR	968,310	968,310
1976	73,000	NR	73,000
1977	1,567,545	1,789,700	3,357,245
1978	NR	202,962	202,962
1979	NR	84,330	84,330
1980	1,077,562	NR	1,077,562
Total Cumulative Volume	7,179,701	9,044,803	16,224,474

Total Annual Average Volume
(based on 19 years of actual use) = 853,920

* Center of site shifted 0.5 nmi east of the Existing Site

NR - none reported

Source: G. Holmes, personal communication, CE-Jacksonville District. 1980.

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TABLE 2-6
PRESENT AND POTENTIAL PERMITS FOR OCEAN DUMPING OF DREDGED MATERIAL AT THE JACKSONVILLE HARBOR ODMDS

Application Number	Applicant/ Permittee	Location	Quantity (cubic yds)	Sediment Type	Issue Date	Expirati Date
73B-1538*	U.S. Navy, Mayport	Mayport Harbor	1,000,000	Silt	8 Feb 74	31 Dec
76L-0521	Jacksonville Shipyards, Inc.	Jacksonville Harbor	30,000	Silt	27 May 77	27 May
80-1162	Jacksonville Shipyards, Inc.	Jacksonville Harbor	110,000	River silt	14 Aug 80	14 Aug
80-1161	Jacksonville Shipyards, Inc.	Jacksonville Harbor	66,000	Silt	14 Aug 80	14 Aug
80J-2163	U.S. Navy	Jacksonville Harbor	773,000	Silt	Pending	

* This permit was modified to exclude ocean disposal on 14 June 1979.

MONITORING

The primary purpose of a monitoring program is to determine whether or not disposal at a site is significantly affecting adjacent areas and to detect the presence of long-term adverse effects. Consequently, a monitoring plan must survey the site and surrounding areas, including control sites and areas most likely to be affected (as determined by environmental factors, such as prevailing current and sediment transport) by disposal operations. The results of an adequate survey should provide an early indication of potential adverse effects outside the site. The CE, Jacksonville District, currently requires monitoring of environmental conditions when disposal operations are active at the Existing Site.

A preliminary assessment of the major monitoring requirements for the Jacksonville Harbor ODMDS should initially include (but not necessarily be limited to) the basic plan presented in Table 2-7. The proposed monitoring program is based on the results of past surveys (NAVOCEANO, 1973; Little and Young, 1979; Interstate Electronics Corporation, see Appendix A) of the

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TABLE 2-7
MAJOR MONITORING REQUIREMENTS FOR THE JACKSONVILLE HARBOR ODMDS

Requirement	Purpose
(1) Bathymetric survey/analysis	• To determine movement (if any) of dredged material outside the site. • Aids in prudent site management by detecting excessive mounding.
(2) Sediment grain-size analysis	• Further aids in tracking the migration of sediments out of the site.
(3) Chemical analysis of select trace contaminants in sediments	• Total organic carbon, chlorinated hydrocarbons, and trace metal (mercury, cadmium, and lead) concentrations would record long-term trends of accumulation in the sediments. Also aids in determining migration of dredged materials.
(4) Chemical analysis of tissues from commercially important benthic organisms (e.g., demersal fish, crabs, small clams, and shrimp)	• Monitors subtle changes in levels of trace contaminants which may be induced by the presence of dredged material. • In situ verification to substantiate laboratory tests of potential for bioaccumulation.

Existing Site and the present CE monitoring requirements. The purpose of this program is to concentrate on those aspects of disposal that critically affect environmental quality and site management.

The requirements of the monitoring plan for the proposed site can be evaluated by applying the following considerations:

MOVEMENT OF MATERIALS INTO ESTUARIES OR MARINE SANCTUARIES OR ONTO OCEAN-FRONT BEACHES, OR SHORELINES

Little et al. (1978) has indicated a southward movement of dredged material at the Existing Site. Sediment transport can be monitored by grain-size

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analysis of sediments along north-south transect lines; dredged materials from the Jacksonville Harbor Channel System are mainly silt and clay, whereas Shelf sediments are almost exclusively sand. Dredged material transport can also be evaluated by comparative assessment of contaminant concentrations (e.g., trace metals, TOC, chlorinated hydrocarbons) in the sediments.

MOVEMENT OF MATERIALS TOWARD PRODUCTIVE FISHERY OR SHELLFISHERY AREAS

The Existing Site is adjacent to the nearshore shrimping grounds, which are located between the Existing Site and the coastline. Consequently, accidental misplacement or short-dumping of dredged materials within the nearshore area may disrupt the fishery. Sediment analysis along east-west transect lines can monitor the movement of dredged materials toward the fishing grounds.

ABSENCE FROM THE DISPOSAL SITE OF POLLUTION-SENSITIVE BIOTA CHARACTERISTIC OF THE GENERAL AREA

The benthic infaunal and epifaunal communities at the site may undergo changes in composition and abundance as a result of dredged material disposal. Pollution-sensitive species such as hard corals and gorgonians are not found at the Existing Site or the adjacent area, but do occur on the natural and artificial reefs located seaward of the Existing Site. Because much of the dredged material is composed of silt and clay, appropriate testing and analysis of dredged sediments are required to determine the environmental acceptability of materials for ocean disposal. Potentially harmful contaminants are unlikely in material that is deemed environmentally acceptable for ocean disposal; thus, pollution-sensitive biota should not be significantly affected by the disposal of dredged material, and monitoring is not recommended.

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PROGRESSIVE, NON-SEASONAL, CHANGES IN WATER QUALITY OR SEDIMENT COMPOSITION AT THE DISPOSAL SITE, WHEN THESE CHANGES ARE ATTRIBUTABLE TO MATERIALS DISPOSED OF AT THE SITE

Temporary changes in water turbidity during disposal operations have been detected at the Exisiting Site (NAVOCEANO, 1973); however, predisposal levels are reestablished after cessation of disposal operations (NAVOCEANO, 1973). Sediment composition within the site may be altered as a result of disposal of silty material on otherwise sandy sediments. Progressive transition to sediments containing a higher percentage of silt and clay is inevitable with continued use of the Existing Site. Changes in the composition of sediments at and near the disposal site should be monitored and evaluated by grain-size analysis.

PROGRESSIVE, NON-SEASONAL, CHANGES IN COMPOSITION OR NUMBERS OF PELAGIC, DEMERSAL, OR BENTHIC BIOTA AT OR NEAR THE DISPOSAL SITE, WHEN THESE CHANGES CAN BE ATTRIBUTED TO THE EFFECTS OF MATERIALS DISPOSED OF AT THE SITE

Demersal fauna, such as fishes and large motile invertebrates, are presumably affected minimally by disposal operations. Monitoring the abundance of demersal species would provide little interpretive information because of the transitory occurrence of these species.

Benthic infauna are more sensitive to perturbations caused by dredged material disposal because of their sedentary nature; thus, they may serve as effective indicators for determining impacts. Benthic sampling should occur during the spring or summer, when the diversity and abundance of organisms are highest (see Appendix A). Surveys of benthic infauna are not considered a major monitoring requirement, however, because natural processes may also affect abundance and species composition.

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ACCUMULATION OF MATERIAL CONSTITUENTS (INCLUDING WITHOUT LIMITATIONS, HUMAN PATHOGENS) IN MARINE BIOTA AT OR NEAR THE SITE

Perhaps the most important potential adverse effect of dredged material disposal is on marine organisms, especially those of commercial value that serve as food for man. Laboratory assessments, such as bioassays and bioaccumulation, are performed under specific controlled conditions that may not be representative of the environmental dynamics at the Existing Site and may not predict the long-term effects of dredged material contaminants on the resident organisms. If the CE had reason to believe that dredged material contained trace constituents which could be bioaccumulated, they could initiate the monitoring of these constituents in selected marine species. Because shrimps, crabs, and demersal fishes are too mobile to detect a possible source of contamination, small bivalves may be used for monitoring purposes at the Existing Site. Determination of tissue contaminant levels in commercially important organisms within and adjacent to the disposal site, and subsequent comparisons to a representative control area, would provide data for prudent site management. Because of the biomass required for in situ bioaccumulation assessments, surveys should be performed during the spring or summer when densitites of benthic organisms are highest. Contaminants such as mercury, cadmium, lead, and chlorinated hydrocarbons should be considered as parameters analyzed in tissue samples. Temporal comparisons of tissue contamination should be made on organisms of similar age/size, collected at the same time of the year.

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Chapter 3

AFFECTED ENVIRONMENT

Chapter 3 describes the environmental characteristics of the existing Jacksonville Harbor ODMDS and alternative Deepwater Site, and provides a regional overview. Biological, physical, chemical, and geological conditions are influenced by Gulf Stream intrusions and coastal runoff. Continental Shelf sediments are characteristically moderately sorted sand. Reefs and hard bottom areas are scattered over the breadth of the Shelf and are considered to be sufficiently unique and sensitive to require protection from man-induced perturbations. The Georgia Bight has diverse benthic and nektonic communities, supporting productive commercial and recreational fisheries.

This chapter describes the environmental characteristics that may be affected by dredged material disposal operations off Jacksonville. Characteristics which are susceptible to significant adverse impacts generally are categorized as either geological, chemical, or biological. Ancillary information, such as physical oceanography and meteorology, is presented because these natural physical processes also influence the fate and impact of the released dredged material. Commercial and recreational resources which may be affected by dredged material disposal are discussed in detail. Specific information relating to each of the viable alternative disposal sites is presented. A historical assessment of the use and associated environmental affects of dredged material disposal at the Existing Site is discussed. Detailed information from recent surveys of the Existing Site is presented in Appendix A.

PREVIOUS SURVEYS

Major environmental surveys of the Existing and Deepwater Sites and their vicinities are listed in Table 3-1. Sufficient site-specific information is contained in the surveys to characterize the affected environments (summarized in this chapter) and to evaluate the environmental consequences of dredged

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TABLE 3-1
PRINCIPAL ENVIRONMENTAL SURVEYS
OF THE ALTERNATIVE SITES

Survey	Citation
1. Oceanographic observations in the Georgia Bight	Atkinson, 1975, 1976, 1978 O'Malley et al., 1978
2. Final EIS, Oil and Gas Lease Sale No. 43	BLM, 1977
3. Draft EIS, Oil and Gas Lease Sale No. 56	BLM, 1980a
4. Microbial processes and biomass on the southeastern Continental Shelf	University of Georgia, Institute of Ecology, 1978
5. Environmental Assessment, Industrial/ Berthing Wharf, U.S. Naval Station, Mayport, Florida	U.S. Navy, 1972, 1978
6. Environmental investigations of the Jacksonville Harbor ODMDS	Little and Young, 1978, 1979 Little et al., 1977, 1978
7. South Atlantic OCS Benchmark Program, 1977 Report	Texas Instruments Inc., 1979
8. A socio-economic environmental baseline summary for the South Atlantic region between Cape Hatteras, North Carolina, and Cape Canaveral, Florida. Vols. I-V	Jacobson, 1974 May et al., 1974 Roberts, 1974a Ruzecki, 1974 Zeigler and Patton, 1974

material disposal (summarized in Chapter 4). Studies of lesser scope or of a more peripheral nature are cited in these reports and may be referred to for further information.

SITE ENVIRONMENT

CLIMATE

Climatic parameters of interest at an ODMDS are air temperature, rainfall, wind patterns, and the occurrences of storms and fog. Air temperature interacts with surface waters and may influence the vertical stability of the water during warm periods. Rainfall increases freshwater runoff, thereby decreasing surface salinity and intensifying the vertical stratification of

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the water. Coastal runoff contributes suspended sediment and various chemical contaminants. Winds and storms generate waves and currents which can resuspend and transport dredged material. A high incidence of fog during particular seasons might affect navigational safety and limit disposal operations.

The temperate to sub-tropical climate of the Georgia Bight is influenced by the location of the Azores High pressure system. In winter, the Azores High usually is centered far offshore, thereby allowing polar air masses to venture into the southeastern states. However, the cold air masses usually assume a northeasterly course before reaching the Jacksonville area. Thus, the city seldom experiences strong winds or severe cold periods (Ruzecki, 1974). During the spring, the Azores High migrates northwest, reaching its most northern extent in summer. Concomitantly, major frontal activity declines and weather in the Jacksonville area is characterized by showers and thunderstorms, high temperatures and humidities, and weak southerly winds (BLM, 1977).

The annual mean air temperature for Jacksonville is 21°C (Ruzecki, 1974). The hottest months are June, July, and August when temperatures average above 27°C; December, January, and February are the coolest months with a mean temperature of 13°C. Temperatures fall to freezing or below about 12 times per year.

The Jacksonville area receives an annual average of 54.5 inches (138.5 cm) of rainfall. The greatest rainfall occurs in late summer (Figure 3-1), usually in the form of local thundershowers (Ruzecki, 1974). Measurable quantities of rainfall usually are recorded during each month.

Radiation fog frequently forms after sunset but tends to be restricted to the coastal regions (BLM, 1977). Although these fogs do not extend far offshore, they may seriously restrict harbor activities. Fog is frequent in winter, rolling in with any easterly wind and often remaining over the Jacksonville Harbor Entrance Channel when it has cleared elsewhere. Heavy fog occurs approximately 34 days per year with the winter months having the highest incidence (Figure 3-2).

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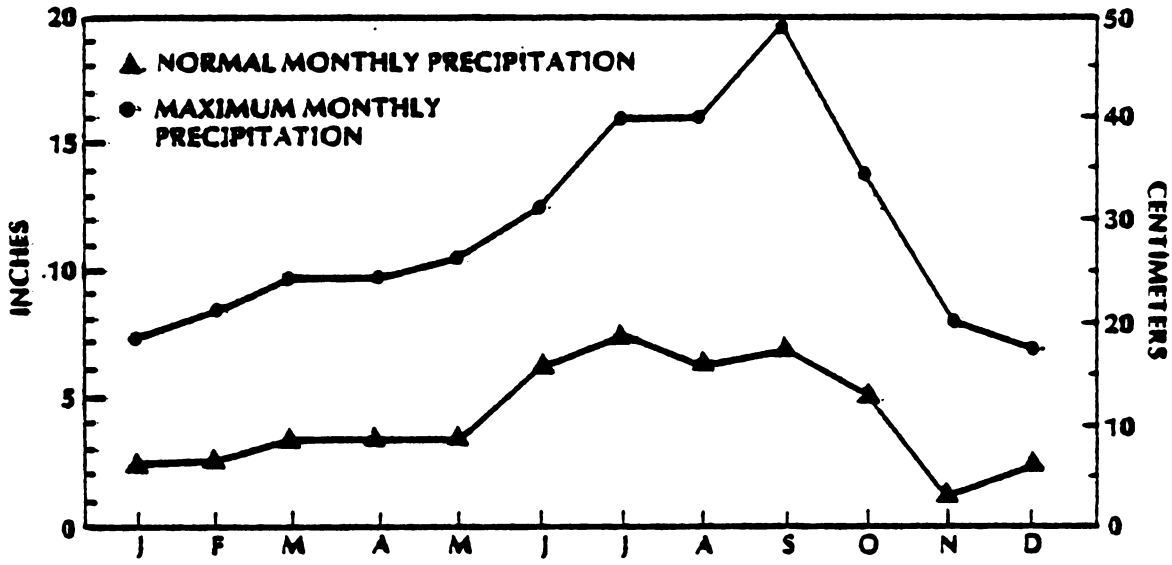

Figure 3-1. Total Monthly Precipitation for Jacksonville
Source: Ruzecki, 1974

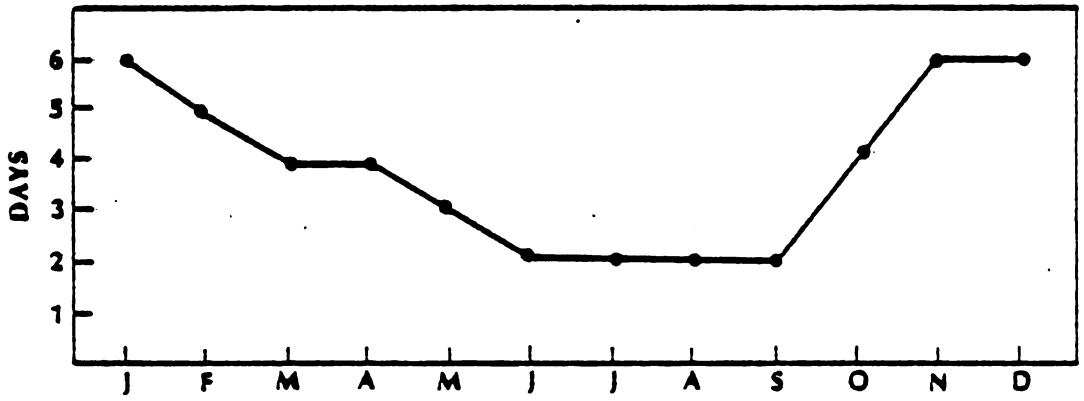

Figure 3-2. Average Number of Days Per Month with Heavy Fog at Jacksonville
Source: Ruzecki, 1974

Although the Jacksonville area is within the hurricane belt, this section of the coastline has less than a 2% annual probability of being struck by a hurricane (BLM, 1977). Three hurricanes have passed near Jacksonville since 1901. Waves from the most recent hurricane (David, 25 August to 7 September 1979) may have affected the sea floor at the Existing Site, even though the hurricane was well out to sea. Most tropical cyclones reaching this latitude have traveled similar paths or have lost much of their energy before reaching Jacksonville.

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PHYSICAL CHARACTERISTICS

Physical oceanographic parameters control the extent of sediment dispersion and transport and the dilution characteristics of dissolved chemical species, thereby strongly influencing the chemical and biological environment at an ODMDS. Strong temperature or salinity gradients inhibit mixing of surface and bottom waters; however, waves may provide sufficient energy to reduce such vertical stratification. Waves and current energy determine the dynamics of sediment transport into and out of an ODMDS.

HYDROGRAPHY

Three hydrographic regimes exist over the Continental Shelf of the Georgia Bight: (1) coastal, (2) Shelf, and (3) Gulf Stream. The Existing Site is in the coastal region; the Deepwater Site is on the Florida-Hatteras Slope, west of the Continental Slope, but still influenced by the Gulf Stream (Figure 3-3). River discharge and nearshore oceanographic processes, such as waves and tidal currents, characterize the coastal zone. The St. Johns River provides the most significant freshwater discharge (averaging 374 m^3/s; Jacobson, 1974) off Jacksonville, and the coastal region is a partially mixed zone of ocean and river water extending 10 to 20 km offshore (BLM, 1980a). Fresh water generated by river discharges form a distinct boundary between coastal and shelf waters (BLM, 1980a). The degree of mixing between Shelf and coastal water masses is dependent upon the intensity of horizontal and vertical density gradients and tidal and wind generated currents (Blanton and Atkinson, 1978).

Shelf Waters (20 to 60 nmi offshore) are influenced more by periodic Gulf Stream intrusions than by coastal weather patterns (BLM, 1980a; Atkinson et al., 1978). Shelf Waters are characterized by fairly constant water temperatures and salinities, and low concentrations of suspended sediments and nutrients. However, summer upwelling coupled with Gulf Stream intrusions supply cold, nutrient-rich waters to the Shelf (Blanton et al., 1981).

The Gulf Stream is a high-velocity (100 to 300 cm/s), northerly flowing current that separates waters of the Sargasso Sea from waters on the

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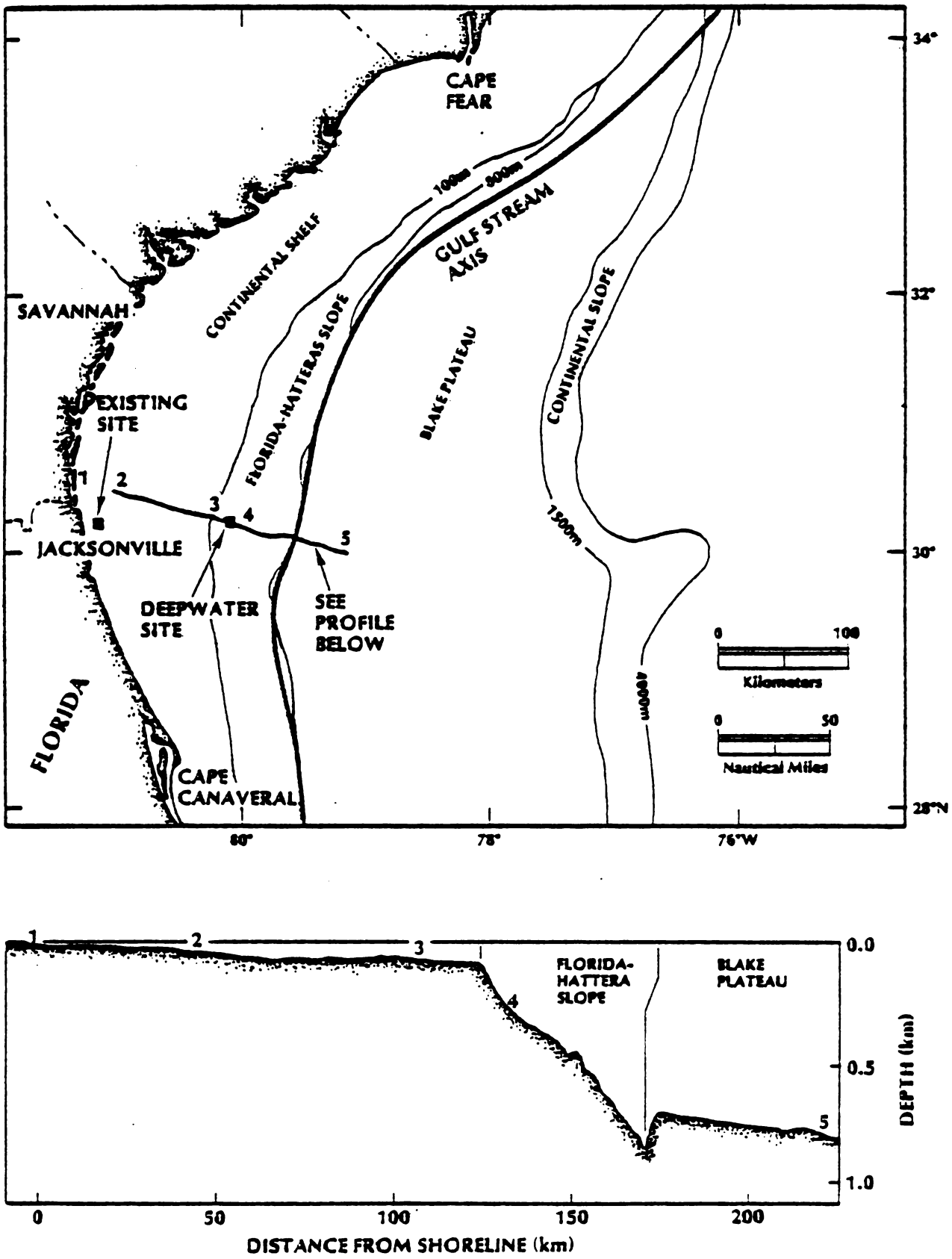

Figure 3-3. Location of the Existing and Deepwater Sites in Relation to the Hydrographic Regimes of the Georgia Bight
Sources: Adapted from Uchupi, 1967; Emery and Zarudzki, 1967

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Continental Shelf (von Arx, 1962). A warm-water core is present near the surface of the current, with a high-salinity (36 parts per thousand [°/oo]) core centered 100m to 200m below the surface (Jacobson, 1974). The axis of the Gulf Stream is approximately 90 nmi due east of Jacksonville (Figure 3-3).

CIRCULATION

The fate of dredged material released at an ocean disposal site is influenced strongly by prevailing currents. Surface currents control the speed, direction, and dispersion characteristics of plumes generated by disposal operations. Secondary transport of deposited dredged sediments is related to the velocity of bottom currents and ambient sediment grain size (Figure 3-4).

Wind and semidiurnal tidal interactions are the principal factors determining the speed and direction of nearshore currents off Jacksonville. Tidally induced currents typically are rotary in the open ocean; however, studies at the Existing Site indicate that the predominant tidal current is rectilinear with directions of 350°T and 150°T on flood and ebb, respectively (NAVOCEANO, 1973). Average surface current velocity (non-tidal) at the Existing Site ranges from 20 to 30 cm/s, flowing southwest in fall and winter and northeast during spring and summer (NAVOCEANO, 1973). Bottom currents typically are weak, averaging 2 to 11 cm/s, although they have been recorded as high as 31 cm/s (NAVOCEANO, 1973). In general, the transport of suspended material will depend primarily on the speed and direction of the wind, with secondary transport influenced by the direction of tidal currents.

Circulation on the outer Continental Shelf is affected primarily by wind, rotary tidal currents, and occasional intrusions of the Gulf Stream. The Gulf Stream exerts a northward frictional drag on much of the water over the Continental Shelf, which occasionally results in strong currents to the north. This effect is more pronounced toward the eastern edge of the Shelf because of the proximity to the Gulf Stream. The velocity of the Gulf Stream off Jacksonville decreases significantly with depth (Figure 3-5). Velocities at the surface reach 180 cm/s and diminish to less than 20 cm/s along the bottom (Richardson et al., 1969).

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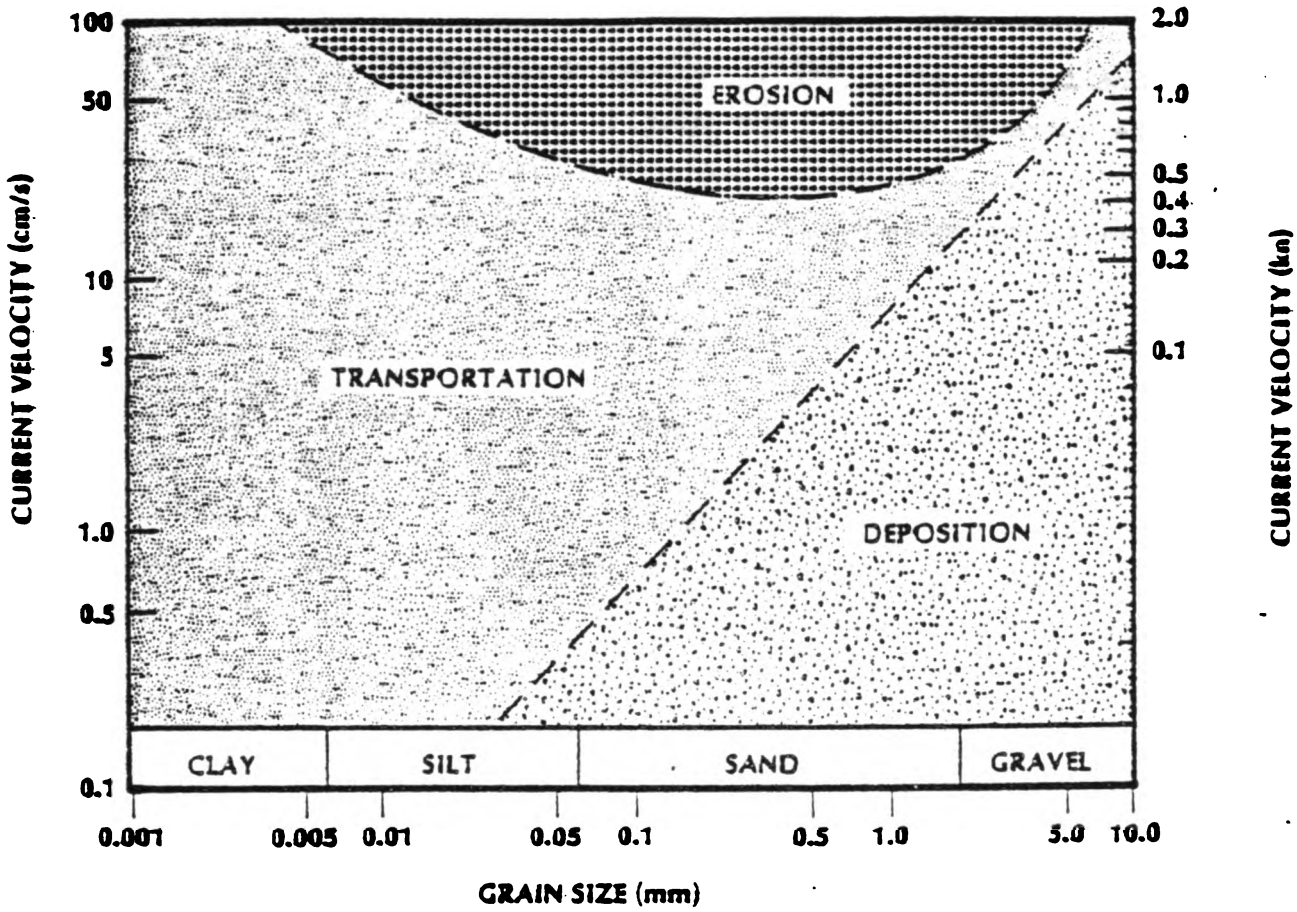

Figure 3-4. Diagrammatic Representation Showing the Relationship Between Current Velocity and its Potential to Deposit, Transport, or Erode Sediments of Various Grain Sizes Source: Hjulstrom, 1939

The Gulf Stream influence probably dominates the current regime in the vicinity of the Deepwater Site. Although this site is situated approximately 25 to 30 nmi west of the main axis of the Gulf Stream, residual current shear and meandering current filaments of the Gulf Stream probably dominate the surface and bottom currents.

TEMPERATURE AND SALINITY

Water temperature and salinity of the Shelf in the Georgia Bight generally increase with distance from shore. Several rivers and coastal marshes along the coast contribute to the reduced salinity of nearshore waters. Off the coasts of Georgia and Northern Florida, the effect of land drainage extends from 5 to 10 nmi offshore (BLM, 1980a). Salinity varies seasonally (from less

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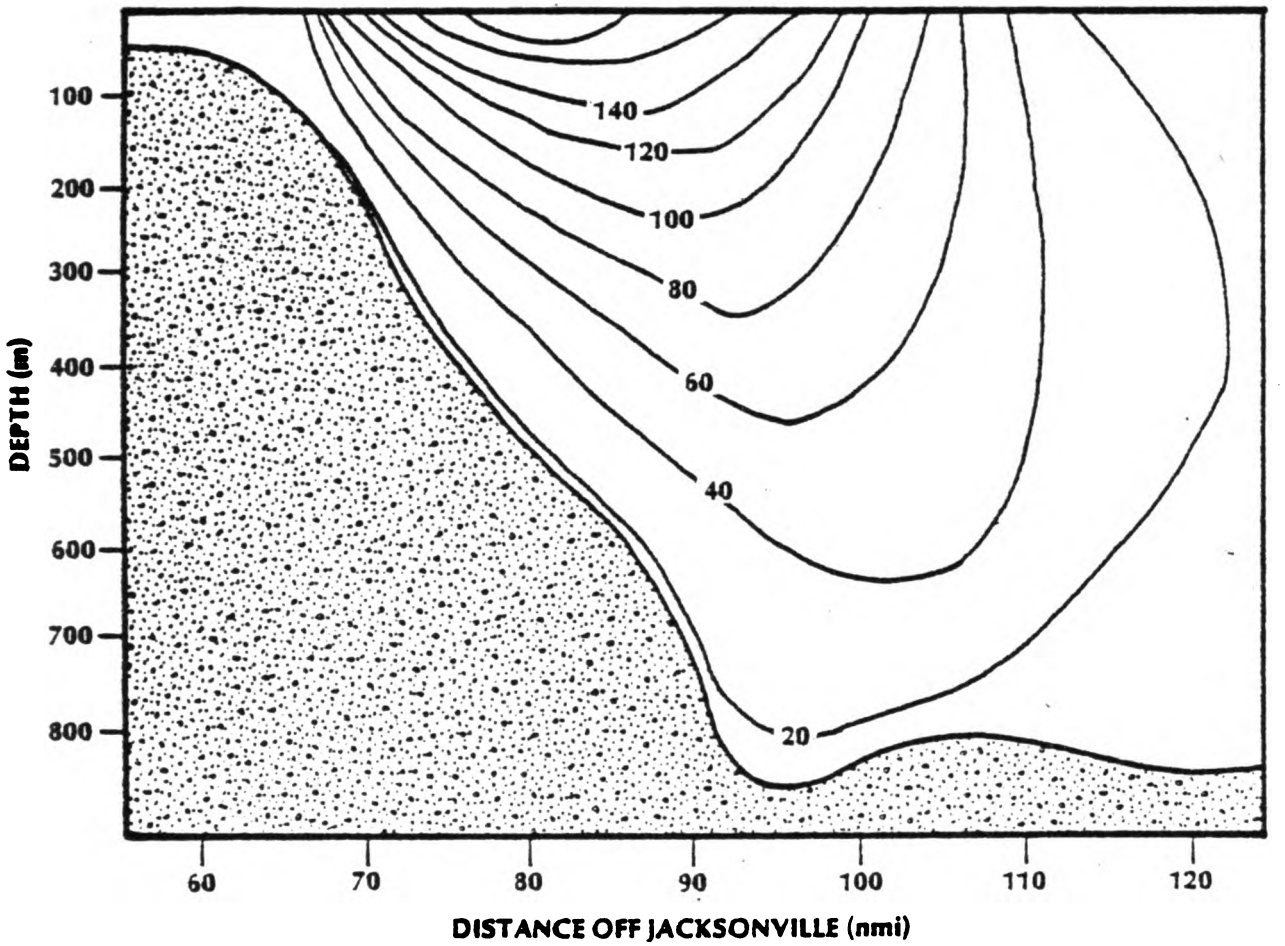

Figure 3-5. Cross-sectional Downstream Velocity of the Gulf Stream off Jacksonville, Florida (Velocities in cm/s) Source: Richardson et al., 1969

than 32°/oo to 36°/oo; Anderson et al., 1961), depending upon the proximity of river discharge (O'Malley et al., 1978). Nearshore salinity gradients are tidally influenced and reach a maximum during tidal ebb when brackish riverine water overlies more saline water. The magnitude and vertical stability of salinity and temperature gradients depend upon the volume of freshwater discharge and the extent of vertical mixing induced by tides, winds, and waves (Blanton and Atkinson, 1978).

Weak thermoclines and haloclines are characteristic of the Existing Site (see Appendix A, Tables A-3 and A-4). Lowest salinities occur at the site during periods of maximum discharge from the St. Johns River (April); however,

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the net decrease is rarely more than 2°/oo (NAVOCEANO, 1973). Water temperatures are influenced seasonally by ambient air temperatures, with temperatures along the bottom usually within 1.5°C of the surface water temperature. The absence of strong stratification suggests vertical mixing of the water.

The physical characteristics of the water column at the Deepwater Site are controlled primarily by the Gulf Stream. Salinity profiles near the Deepwater Site indicate isohaline conditions with a salinity of about 36°/oo (Figure 3-6). Thermal stratification is present during most of the year (Atkinson, 1975, 1976; O'Malley et al., 1978). However, because of vertical mixing induced by the velocity shear of the Gulf Stream, strong sharp thermoclines do not develop and temperature gradually decreases with depth (Figure 3-6). Temperatures along the bottom are fairly constant, whereas surface temperatures vary seasonally from about 20°C to 28°C.

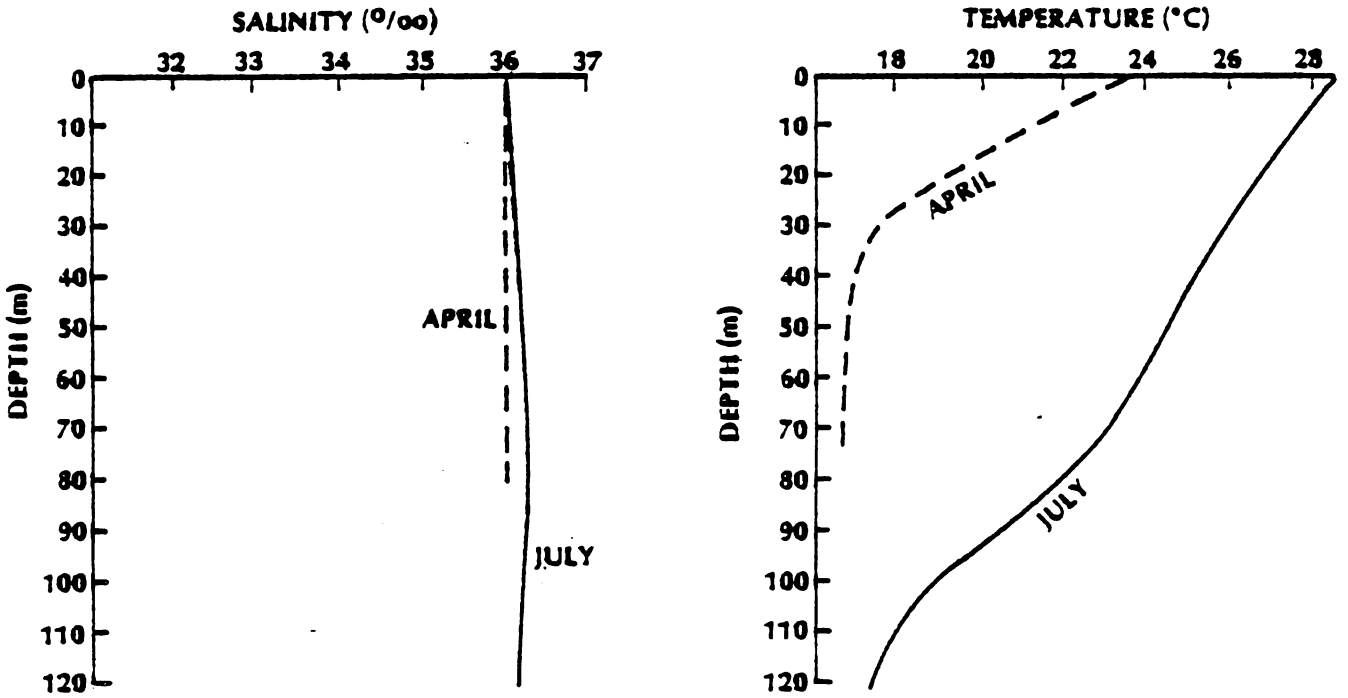

Figure 3-6. Vertical Profiles of Salinity and Temperature near the Deepwater Site
Sources: Atkinson, 1975, 1976

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WAVES

Waves play an important role in the transportation and deposition of sediments. Wave-generated transport is limited to areas where the water depth is less than one-half the wave length. Therefore, this discussion is applicable only to shallow-water areas, such as the Existing Site.

Off the coast of Jacksonville, seas less than 4 ft (1.2m) occur annually about 60% of the time, and wave heights greater than 12 ft (3.7m) occur less than 1% of the time (Jacobson, 1974). During the spring and summer, the majority of the sea waves are small and from the south and southwest. The larger waves are primarily from the north and northeast and occur during autumn and winter (Figure 3-7). Storm waves are sufficiently large to cause resuspension of bottom sediments within the nearshore area (Butman and Pfirman, 1979).

GEOLOGICAL CHARACTERISTICS

Geological information relevant to an ODMDS includes bathymetry, bottom character, and characteristics of sediment and dredged material. Bathymetric data provide information on bottom stability, persistence of sediment mounds, and shoaling. Sediment grain size and organic content influences the population and diversity of the resident benthic biota. Sediment grain size is also commonly used to characterize dredged material and to indicate potential changes in biotic and chemical characteristics, especially when dredged material is significantly different from disposal site sediments.

The Georgia Bight is the marine portion of the Southeast Georgia Embayment. It is bounded by Cape Fear, North Carolina, to the north, Cape Canaveral, Florida, to the south, and the Florida-Hatteras Slope to the east (Figure 3-3). The Existing Site is located on the broad, shallow Continental Shelf, which ranges in width from 33 km off Cape Hatteras, to 135 km between Charleston, South Carolina, and Jacksonville (Dillon et al., 1975). The Continental Shelf is an extension of the Atlantic Coastal Plain, which slopes eastward on the order of 1° (Dillon et al., 1975). Bottom topography on the Continental Shelf is generally smooth except for the few irregularities such as algal and coral reefs, sand waves, and wave-cut terraces (Edsall, 1979).

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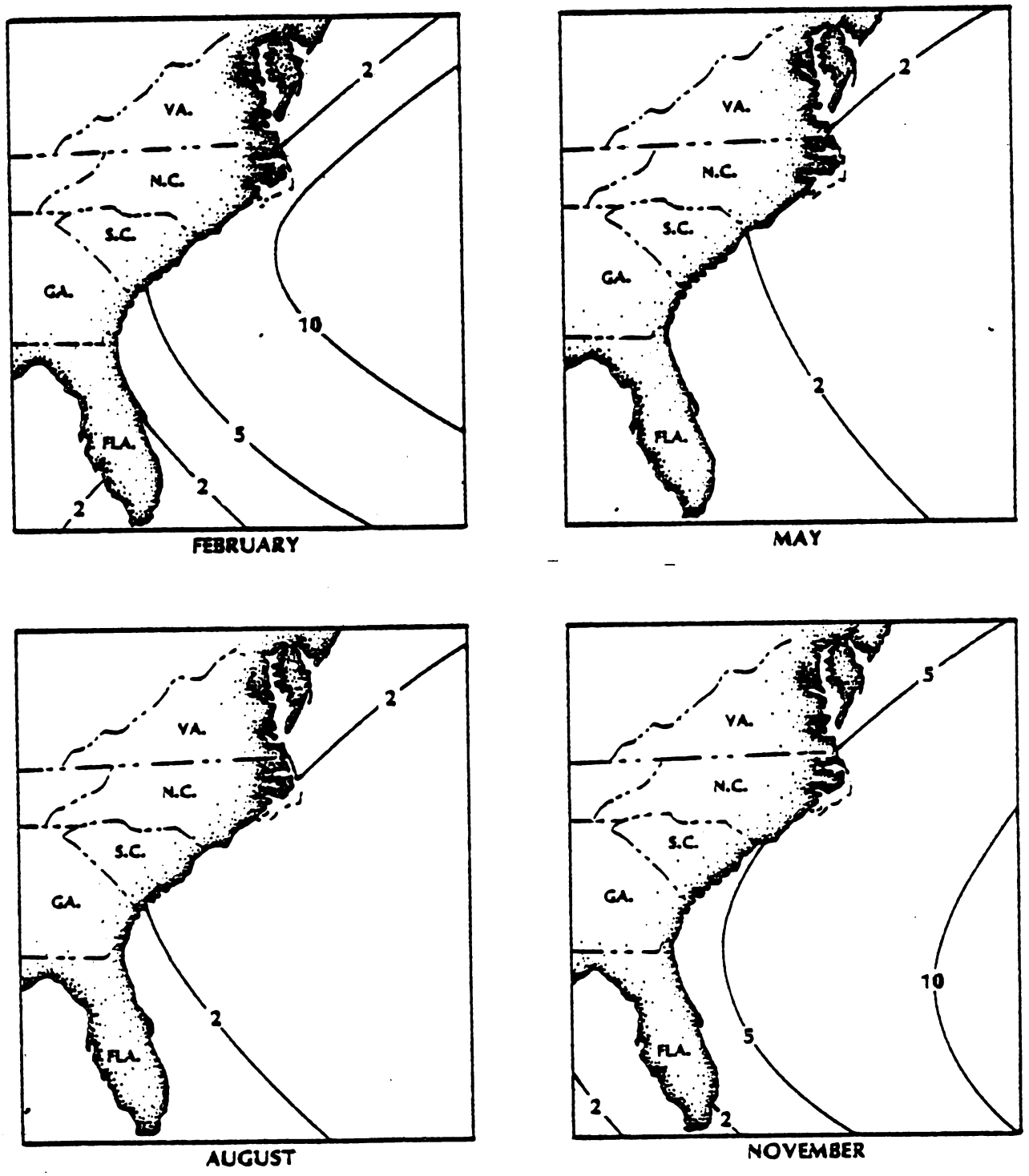

Figure 3-7. Percent Frequency of Waves Greater than 12 ft (3.7m) Height along the Georgia Bight
Source: NOAA, 1973

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A net change map of the Existing Site from 1973 to 1978 indicates mounding near the center (Figure 3-8). A small amount of dredged material has been transported to the south, as demonstrated by bathymetric, physical, and chemical analyses of the sediments (NAVOCEANO, 1973; Little and Young, 1979).

The Florida-Hatteras Slope off Jacksonville is considered atypical in that it is a low-gradient (less than 1°), low-relief Continental Slope, interupted by a broad flat terrace (Blake Plateau) at a depth less than 700m (Uchupi, 1967; Emery and Uchupi, 1972). The Deepwater Site is located on the upper Slope at a depth of 150m (Figure 3-3).

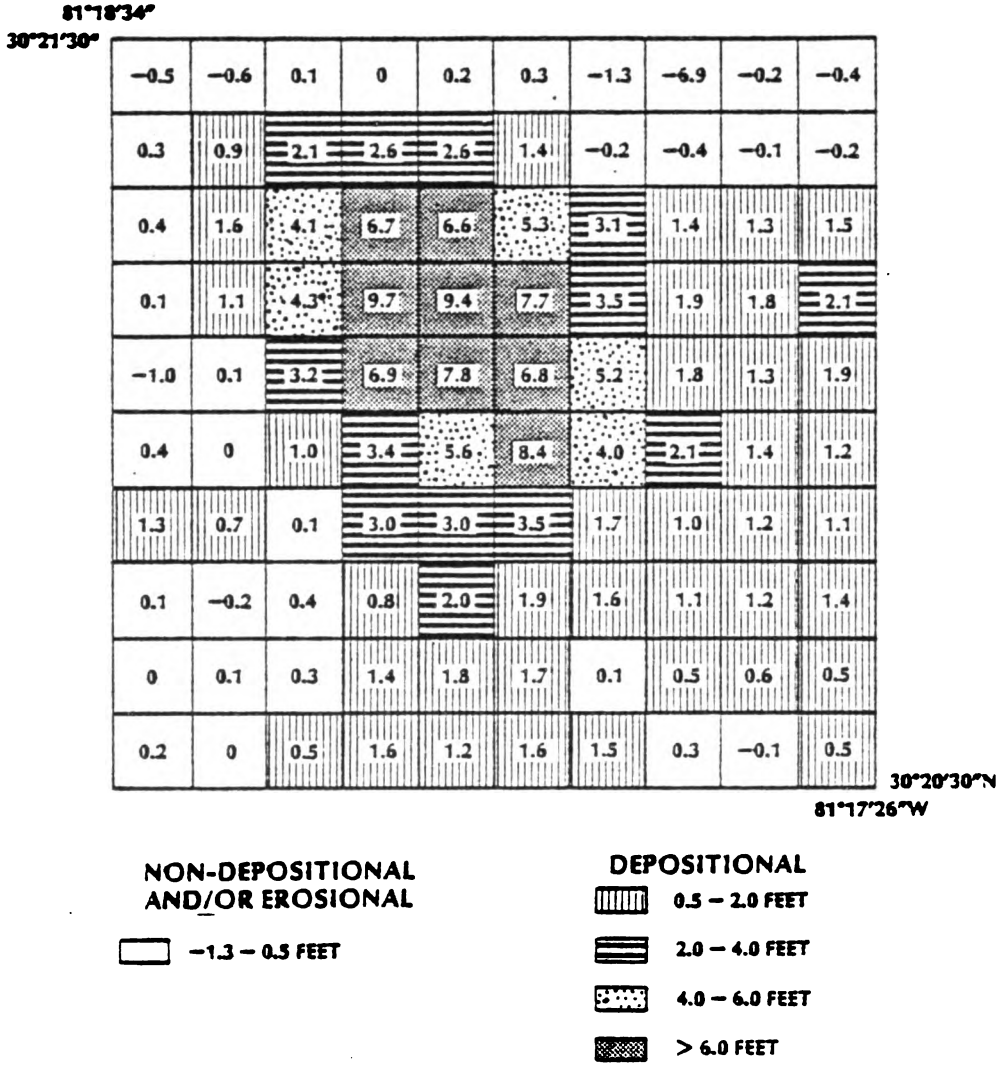

Figure 3-8. Net Bathymetry Changes of the Existing Site from 1973 to 1978 Showing Mound Formation near the Center of the Site
Sources: Modified from NAVOCEANO, 1973; Little and Young, 1978

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SEDIMENTS

Nearshore bottom sediments off Jacksonville are primarily fine or silty sands; mid-Shelf sediments are medium sand with occasional small patches of coarse sand; and Shelf-break sediments are principally fine sand (Figure 3-9). Sedimentary deposits off the northeast coast of Florida are fairly well defined, with terrigenous sands nearshore and calcareous sands offshore (Figure 3-10). Although grain-size is relatively uniform, sediment patchiness does occur, indicating the absence of intense long- or cross-shelf transport and mixing (Butman and Pfirman, 1979).

Sediments on the nearshore Shelf in the vicinity of the Existing Site are predominantly sand. However, sediments within the Existing Site generally contain higher percentages of silt and clay than those outside (see Appendix A, Table A-10). Sediment characteristics at the Deepwater Site are not well known, but generalized information (Figures 3-9 and 3-10) suggests that fine carbonaceous sands and silty clays predominate along the western edge of the Florida-Hatteras Slope. Sediments on the Florida-Hatteras Slope generally are prograding (Uchupi and Emery, 1967).

REEFS

Three general types of reefs can be identified in the Georgia Bight (Henry and Giles, 1979): (1) low-relief reefs, less than 0.5m of relief; (2) moderate-relief reefs, 2m or more of relief; and (3) Shelf-edge reefs. Low-relief reefs are subjected to periodic sand covering and generally support sparse benthic communities. Moderate-relief reefs support a large benthic and pelagic community; reefs in this category are commonly referred to as patch reefs, live bottoms, or hard bottoms. Shelf-edge reefs are located on the Shelf break and support a large faunal community.

Natural reefs are composed of exposed limestone, shell, sand and gravel, and sponge and coral growths (NOAA, 1980). These reefs are widely scattered on the Continental Shelf. In addition to naturally occurring reefs, numerous

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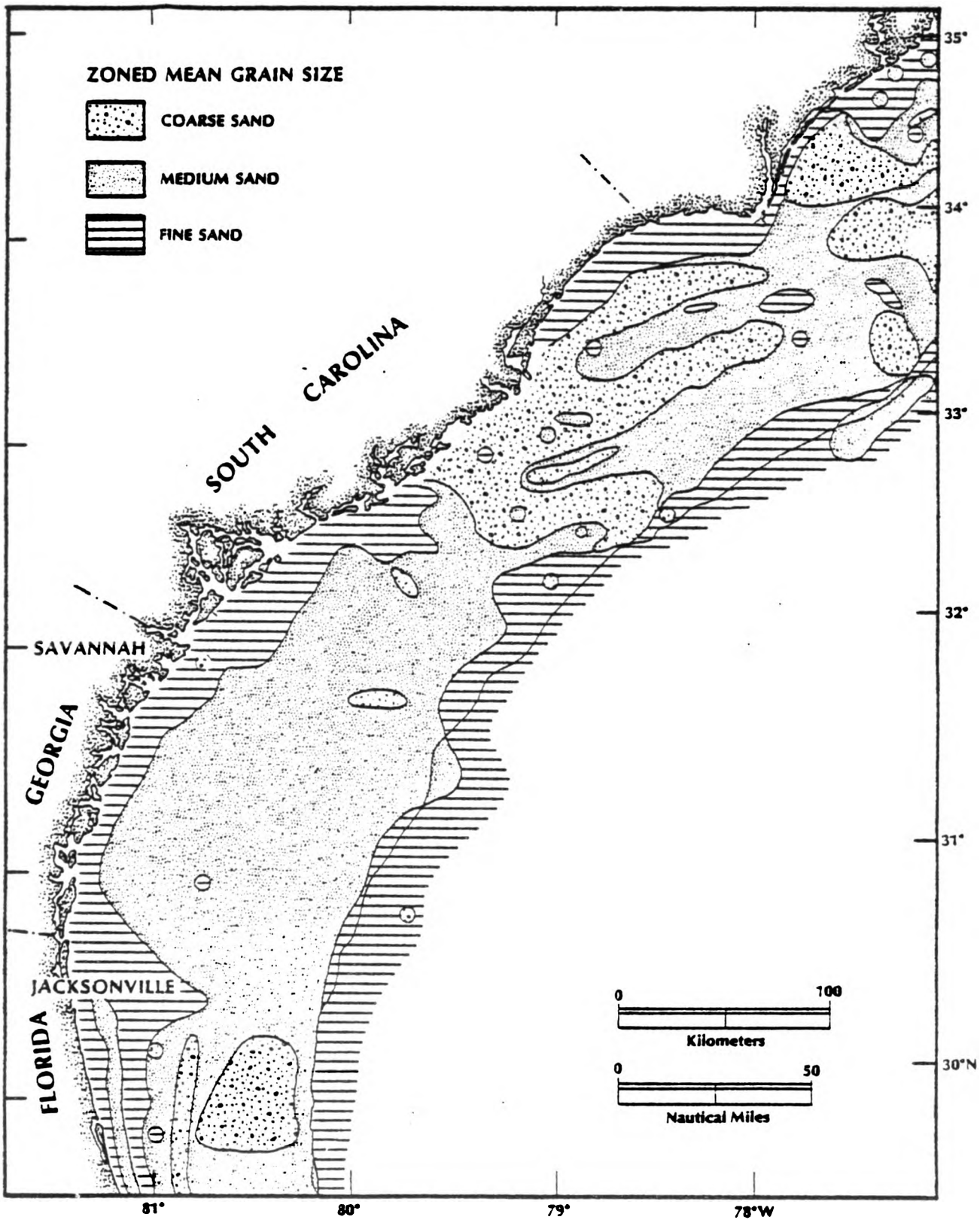

Figure 3-9. Sediment Grain Size on the Continental Shelf of the Georgia Bight
Source: Pilkey et al., 1979

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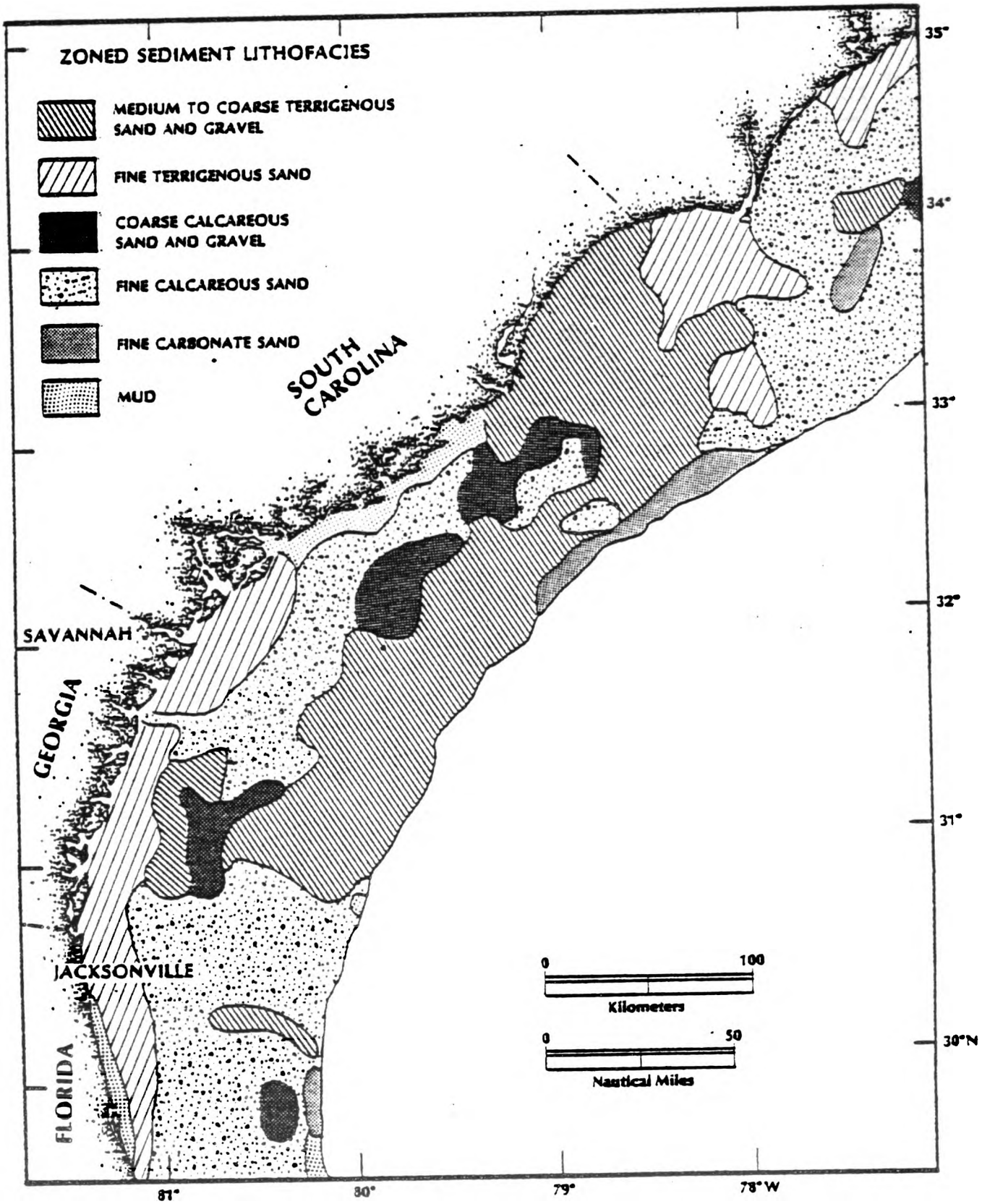

Figure 3-10. Sediment Lithofacies on the Continental Shelf of the Georgia Bight
Source: Pilkey et al., 1979

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artificial reefs have been established to provide additional habitats for recreational fishing and diving. Artificial reefs are composed of various types of material, including car bodies, tires, scrap Liberty ships, concrete blocks, and rubble (Florida Sea Grant Program, 1979). Both natural and artificial reefs are common on the mid-Shelf just east of the Existing Site and to the west of the Deepwater Site (Figure 3-11).

CHEMICAL CHARACTERISTICS

WATER COLUMN

Chemical parameters pertinent to evaluation of an ODMDS include suspended solids, nutrients important to phytoplankton growth (e.g., nitrates and phosphates), dissolved and particulate trace metals (e.g., cadmium, mercury, and lead), and hydrocarbons (e.g., polychlorinated biphenyls [PCB's], dichlorodiphenyl trichloroethane [DDT], and phenols). Potential impacts depend on the concentrations of constituents released from dredged material, and physical factors such as mixing and dilution rates. However, because of low-level releases, dilution, and the transient nature of water masses, adverse effects are expected to be minor in most cases.

High concentrations of suspended solids can reduce light penetration through the water column (thereby inhibiting phytoplankton productivity), or clog respiratory structures of fishes and other organisms. Nutrients are essential for growth and reproduction of phytoplankton; however, under certain conditions and at elevated levels, these nutrients can promote eutrophication and subsequent depletion of dissolved oxygen.

Several trace elements are necessary micronutrients for life processes of organisms. However, elements such as mercury and cadmium, can be toxic or accumulated when present in relatively high levels in water or in food sources. Many chlorinated and petroleum hydrocarbons are also toxic and can be bioaccumulated in some forms when ingested in sufficient quantity by marine organisms.

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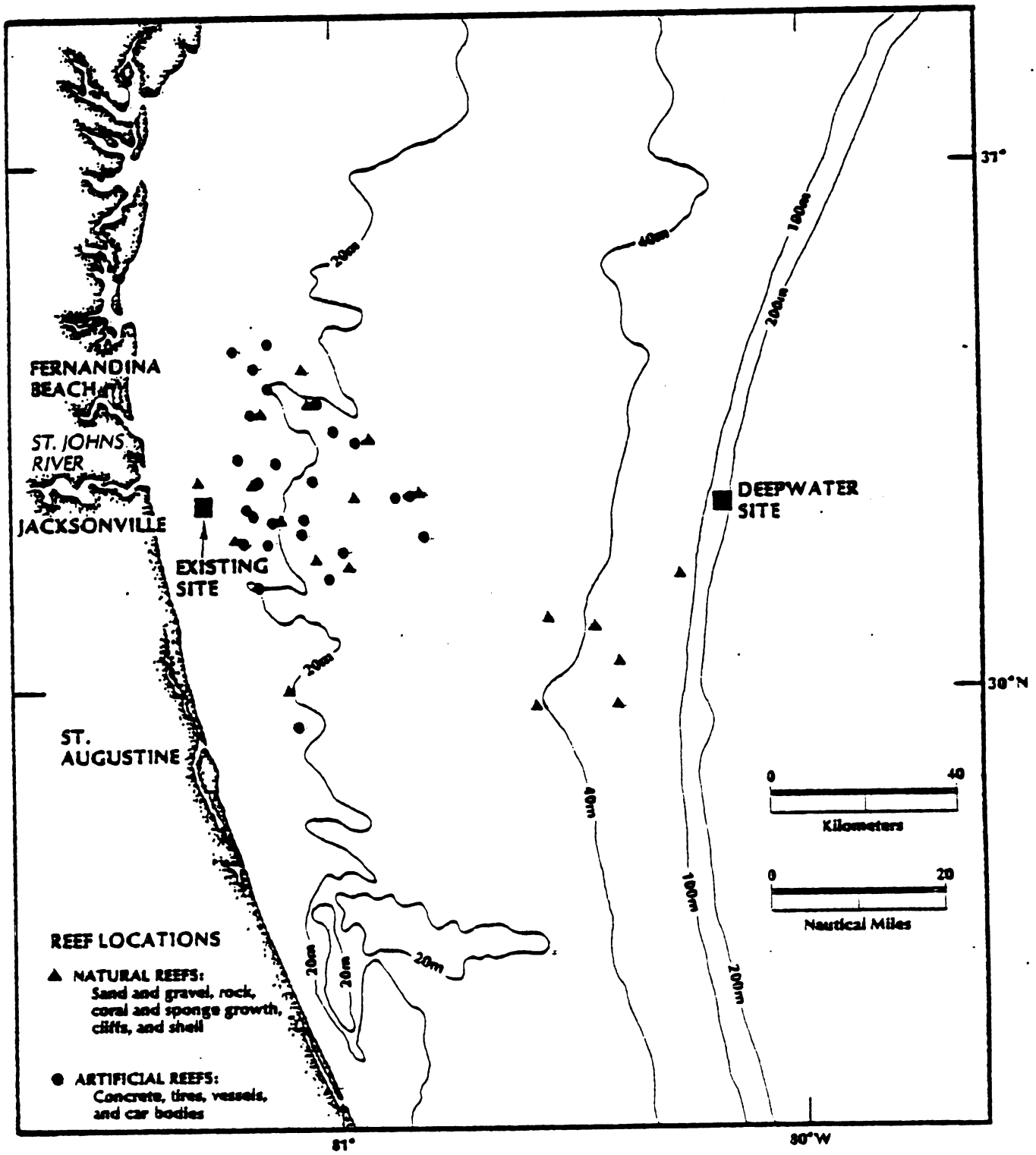

Figure 3-11. Natural and Artificial Reefs off Jacksonville
Source: Florida Sea Grant Program, 1979

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Chemistry data for the Deepwater Site are unavailable. However, because of the greater distances from anthropogenic sources, concentrations of chemical contaminants at the Deepwater Site are expected to be low.

Turbidity

Turbidity in near-bottom waters of the Georgia Bight correlate with suspended sediment concentrations (Bothner, 1979). Because of river discharges and resuspension of bottom sediments by waves and currents, suspended sediment concentrations in the Georgia Bight are highest near the coast and decrease rapidly seaward (Manheim et al., 1970).

Water clarity at the Existing Site is influenced by storm-water runoff and other coastal processes. The St. Johns River transports suspended particulates and nutrients to the nearshore region, including the Existing Site. Waves, storm surges, and wind can resuspend bottom sediments and increase suspended particulates in the water, especially along the bottom. The concentration of suspended particles within and adjacent to the Existing Site ranged from about 1 to 4 mg/liter during recent surveys by EPA and Interstate Electronics Corporation (IEC); values were higher near the bottom than at the surface (see Appendix A, Table A-7).

Oceanic waters in the vicinity of the Deepwater Site are substantially less turbid than the nearshore waters. The total suspended load usually is less than 0.1 mg/liter at the surface and bottom throughout the year (Doyle et al., 1979). Frequent intrusions and meanderings of the Gulf Stream across the Continental Slope and Shelf may contribute to elevated levels of turbidity over the middle and outer Shelf by resuspending bottom sediments (Bothner, 1979).

Nutrients

Nutrients (e.g., phosphates, nitrates, ammonia species, and silicates) are essential to the growth of phytoplankton. Nutrients can be released in measurable quantities during disposal operations, but the overall nutrient enrichment of the receiving water (i.e., after initial mixing) is rarely of sufficient magnitude to measurably alter its productivity.

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Nutrient concentrations in areas within 40 km of the coast of the Georgia Bight are determined by three factors: (1) the input of "new" nutrients via rivers, (2) the balance between bacterial regeneration and phytoplankton utilization, and (3) the intrusion of upwelled, nutrient-rich Gulf Stream water onto the Shelf (BLM, 1980a).

Rivers commonly transport relatively large loads of nutrients to the ocean; but this nutrient load apparently is restricted to within 20 km of the coast within the Georgia Bight (BLM, 1980a). The Existing Site lies within this zone; however, nutrient concentrations are low, probably as a result of rapid biological uptake. Nearshore waters do not exhibit vertical gradients of dissolved nutrients (Figure 3-12). Nitrogen-to-phosphorus ratios indicate that phytoplankton productivity is nitrogen limited.

River runoff provides little, if any, nutrients to the middle and outer Shelf region. Nutrients are introduced into these waters by massive upwelling along the Shelf break, caused by Gulf Stream intrusions. This shift advects deep nutrient-laden waters into the euphotic zone and onto the Shelf (Blanton et al., 1981). In the absence of upwelling, nutrients are vertically stratified at the Deepwater Site (Figure 3-12).

Surface waters (less than 50m depth) have low nutrient concentrations due to biological uptake, but concentrations increase with depth (over 50m) as bacterial and chemical decomposition regenerate nutrients from organic matter. The Georgia Bight lacks a subsurface Shelf reservior of high nutrient water, thus upwelling of nutrient-rich water located at depth seaward of the Shelf is the dominant source of nutrients for the outer Shelf.

Trace Metals

Trace metals in the water of the Georgia Bight are derived from land drainage (storm-water runoff) and industrial waste discharges (Windom et al., 1971). Suspended particulates, both biogenic and terrigenous, often

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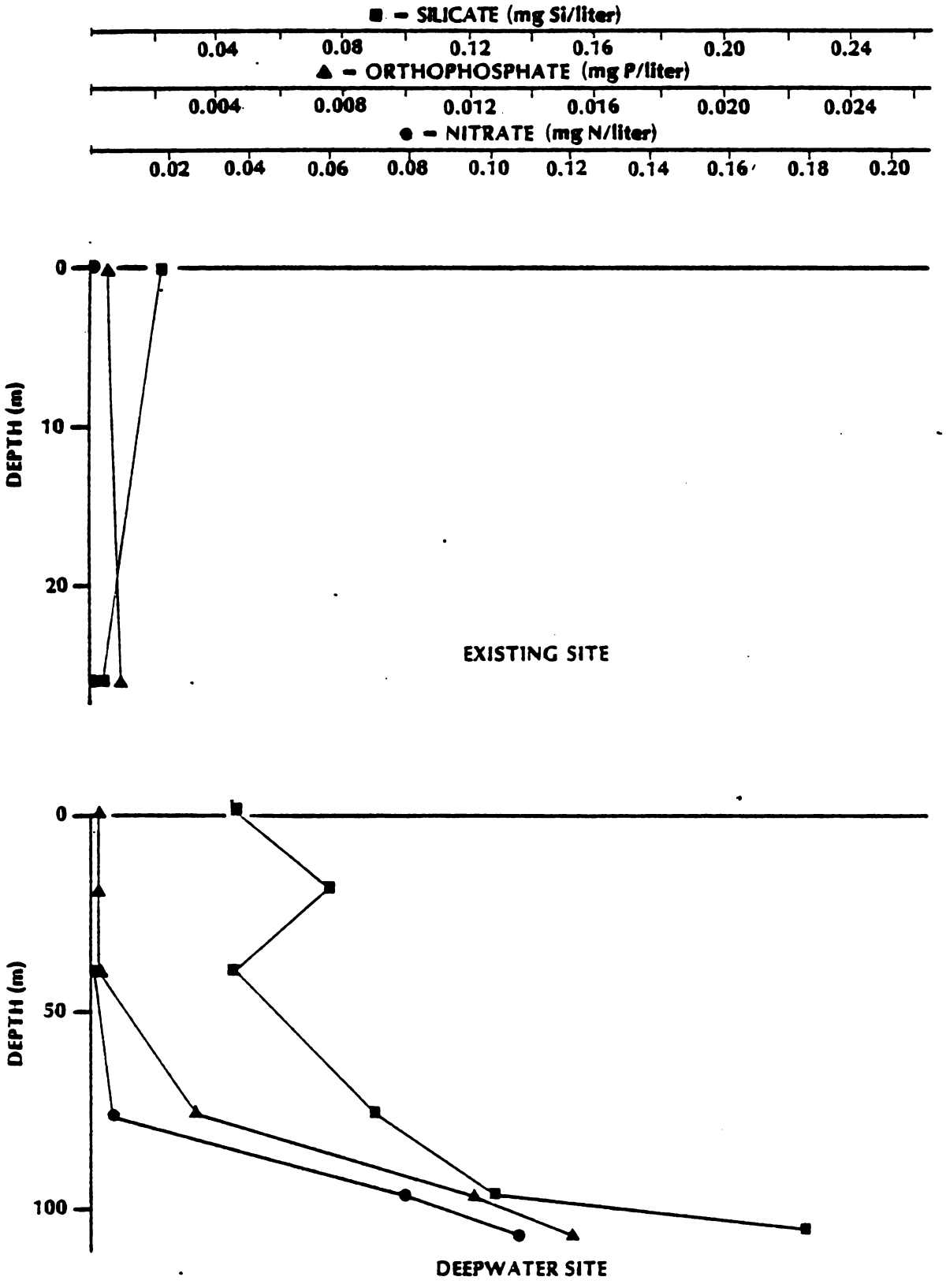

Figure 3-12. Vertical Profiles of Selected Nutrient Concentrations in Waters at the Existing and Deepwater Sites
Sources: Atkinson, 1975, 1976

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attain elevated levels of trace contaminants by advection, biological activity, adsorption, flocculation, precipitation, and co-precipitation. As a result, contaminants may be transported to the benthos, or to the food chain, or both (Windom and Betzer, 1979).

Trace-metal concentrations in the water at the Existing Site generally are low. Recent surveys (see Appendix A) indicate that mercury, cadmium, and lead concentrations at the Existing Site and the surrounding area are far below the EPA (1976) water-quality levels (see Appendix A, Table A-5).

Dissolved Oxygen

Surface and bottom waters within and surrounding the Existing Site were well oxygenated at all depths during the EPA/IEC surveys in March and December 1979 (see Appendix A, Table A-8); bottom waters reflected a slight decrease in dissolved oxygen relative to surface waters. Historical surveys (NAVOCEANO, 1973) of the site have never recorded the presence of either anoxic water or dissolved-oxygen concentrations below the water quality criterion of 5 mg/liter (EPA, 1976).

Dissolved-oxygen concentrations in the vicinity of the Deepwater Site also are near saturation, ranging from greater than 7 mg/liter to 5 mg/liter. Surface waters (to 70m) usually contain dissolved oxygen at concentrations greater than 6 mg/liter. Below the surface zone, concentrations are somewhat lower, but rarely fall below 5 mg/liter (O'Malley et al., 1978).

SEDIMENTS

A variety of trace contaminants, such as trace metals, petroleum and chlorinated hydrocarbons, and total organic carbon (TOC), can accumulate in bottom sediments. Elevated levels of sediment contaminants are generally the result of anthropogenic inputs such as municipal and industrial waste disposal, urban and agricultural runoff, atmospheric fallout, and accidental spillage.

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Sediments that contain appreciable quantities of silt and clay have a greater adsorptive capacity for trace contaminants than coarser sediments because of their large surface area-to-volume ratios and charge densities. Accumulation of trace elements and chlorinated and petroleum hydrocarbons in sediments can have short- and long-term negative effects on marine organisms. Many benthic organisms are non-selective deposit feeders, ingesting substantial quantities of bottom sediments. The potential for bioaccumulation of trace sediment contaminants (mercury, cadmium, lead, and some chlorinated hydrocarbons) by these organisms is of particular environmental concern.

Nearshore Continental Shelf and Florida-Hatteras Slope sediments off northeastern Florida contain low concentrations of trace metals (Table 3-2). Trace-metal concentrations in the sediments of the Georgia Bight indicate no detectable contamination from present-day sources (Bothner et al., 1979); most trace metals are positively correlated with the silt and clay content of the sediment (Windom and Betzer, 1979). Weak acid-soluble trace metals, a rough indicator of the bio-available fraction, range from 20% to 100% of the total trace-metal concentrations in the sediment (Table 3-3).

Sediments within the Existing Site and the adjacent area show a high degree of heterogeneity for most trace contaminants. Past surveys (NAVOCEANO, 1973; Little and Young, 1978) of the Existing Site generally indicate that highest contaminant levels occur in the center of the Existing Site, where the

TABLE 3-2
AVERAGE CONCENTRATIONS OF CADMIUM, COPPER, LEAD, AND ZINC IN SEDIMENTS FROM THE INNER SHELF AND THE FLORIDA-HATTERAS SLOPE

Location (Depth)	Trace Metal Concentration (mg/kg)			
	Cadmium	Copper	Lead	Zinc
Shelf (15m to 20m)	0.04	0.60	3.1	1.8
Slope (100m to 200m)	0.02	0.27	2.5	2.2

Source: Windom and Betzer, 1979

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TABLE 3-3
AVERAGE PERCENT OF TRACE METALS IN WEAK ACID-SOLUBLE FRACTION OF GEORGIA BIGHT SEDIMENTS

Location	Trace Metal (%)			
	Cadmium	Copper	Lead	Zinc
Shelf (15m to 20m)	100	36	18	62
Slope (100m to 200m)	100	33	22	72

Source: Windom and Betzer, 1979

greatest accumulation of dredged material was found. However, during the EPA/IEC surveys in 1979 (see Appendix A, Table A-12) levels of trace metals from sediments were low and showed no consistent difference between sediments inside and outside the disposal site. Cadmium and lead concentrations at the Existing Site were similar in magnitude and range to those reported for other nearshore areas of the Georgia Bight (Windom and Betzer, 1979). Sediment mercury concentrations were low and were positively correlated ($p < 0.01$) with the silt and clay content of the sediments. Lead and cadmium concentrations were not correlated with grain size.

Oil and grease and TOC concentrations showed similar variability within and adjacent to the site (see Appendix A, Table A-9). Concentrations of oil and grease and TOC were positively correlated ($p < 0.05$) with the silt and clay content of the sediments. Anthropogenic petroleum hydrocarbons may account for some of the oil and grease content of the sediments within and adjacent to the center of the disposal site (see Appendix A, Table A-11). Marine biogenic hydrocarbons apparently are not principal components of the total hydrocarbons adsorbed by sediments.

Chlorinated hydrocarbons (CHC's) are not naturally occurring contaminants of marine sediments and their presence is due solely to anthropogenic activity. Low concentrations of pesticide residues and PCB's were present in sediments at the Existing Site and surrounding area (see Appendix A,

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Table A-6). Although the data are quite limited, concentrations of CHC's were higher in the Existing Site sediments relative to sediments from the surrounding area.

BIOLOGICAL CHARACTERISTICS

Biota in the water and benthic environments of the ODMDS are described in this section. Water column biota include phytoplankton, zooplankton, and nekton; benthic biota are composed of infaunal and epifaunal organisms. Benthic biota, especially the infauna, are generally sedentary and cannot readily emigrate from an area of disturbance. The infauna, therefore, can be important indicators of environmental conditions. Dredged material disposal will have only short-term effects on planktonic communities because of their natural patchiness and the transient nature of the water masses they inhabit. Nekton generally are not adversely affected by dredged material disposal because of their high mobility.

PHYTOPLANKTON

Phytoplankton populations of the Georgia Bight are composed primarily of diatoms, dinoflagellates, and coccolithophorids (Table 3-4). The phytoplankton of the Shelf waters usually are dominated by diatoms (Hulburt, 1967); however, dinoflagellates often become abundant during the summer months (Roberts, 1974b). Coccolithophorids are frequently abundant in the outer Shelf waters and are ubiquitous in the Gulf Stream.

Phytoplankton standing crops generally are higher nearshore than offshore; however, considerable patchiness occurs and is correlated with nutrient availability. Coastal and estuarine runoff and Gulf Stream intrusions provide essential nutrients for phytoplankton growth, thereby resulting in greater abundances of phytoplankton within the nearshore and Shelf-edge waters (Atkinson et al., 1978). High concentrations of chlorophyll a in Shelf waters are attributed to intrusion of nutrient-laden Gulf Stream water (Tenore et al., 1978).

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TABLE 3-4
PHYTOPLANKTON SPECIES TYPICALLY FOUND IN THE WATERS OF THE GEORGIA BIGHT

DIATOMS	DINOFLAGELLATES
Asterionella japonica	*Amphidium* sp.
Bacteriastrum cosmosum	*Ceratium furca*
Chaetoceros affinis	*C. fusus*
C. decipines	*C. tripos*
Eucampia zoodiacus	*Gymnodinium* sp.
Leptocylindrus danicus	
Nitzschia closterium	COCCOLITHOPHORIDS
N. delicatissum	*Coccolithys huxleyi*
N. serriata	*Syracosphera mediteranea*
Navicula sp.	*S. pulchra*
Rhizosolenia alata	
R. stolterfothii	CHRYSOPHYTA
Skeletonema costatum	*Rhodomonas amphioxeia*
Thassionema nitzschoides	
HAPTOPHYTA	
Phaeocystis pouchetii	

Sources: Hulburt and MacKenzie, 1971; Marshall, 1971

ZOOPLANKTON

Zooplankton of the Georgia Bight usually are composed of copepods, chaetognaths, urochordates, coelenterates, pteropods, decapods, and a variety of planktonic larvae. During most of the year, holoplanktonic forms tend to dominate the Shelf zooplankton; peak abundances occur in spring and autumn (Herman, 1979). Calanoid copepods typically are the most abundant group and, at times, constitute up to 95% of the total population. Specific groups of calanoid copepods are associated with the Coastal, Shelf, and Oceanic waters of the Georgia Bight (Table 3-5). Urochordates (larvaceans, doliolids, and salps) and chaetognaths usually are minor components of the zooplakton, but seasonal peaks of abundance may occur during the summer and fall (BLM, 1977).

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TABLE 3-5
GROUPS OF CALANOID COPEPODS ASSOCIATED WITH THE DIFFERENT WATER MASSES IN THE GEORGIA BIGHT

Coastal	Shelf	Oceanic
Acartia tonsa	*Paracalanus parvus*	*Calanus minor*
Labidocera aestira	*Centropages furcatus*	*Undinula vulgaris*
	Eucalanus pileatus	*Euchaeta marina*
	Temora turbinata	*Clausocalanus furcatus*

Source: Bowman, 1971

In general, nearshore waters contain a higher standing stock and fewer number of species of zooplankton than offshore waters.

Shrimp, crab, and fish larvae are more abundant on the Shelf and become fairly uncommon further offshore (BLM, 1977). Maximum concentrations of planktonic larvae generally occur during the spring; however, many larvae also are present in summer and fall. Shrimp larvae exhibit greatest abundance on the inner-Shelf during the spring, where they may comprise up to 16% of the total zooplankton present.

NEKTON

Nekton are organisms that remain suspended in the water column and are able to swim against currents. Fish, cephalopods (squid and octopus), crustaceans (shrimp and swimming crabs), reptiles (turtles), and marine mammals comprise the general nektonic groups of the Georgia Bight (BLM, 1980b).

The distribution of demersal fish inhabiting the Continental Shelf of the Georgia Bight is determined primarily by temperature, bottom topography and substrate composition (Struhsaker, 1969). Rich assemblages of demersal fish congregate around the numerous reefs located off the coast of Jacksonville because of the shelter and associated abundance of benthic organisms that serve as food (NMFS, 1978; Moe, 1963).

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Struhsaker (1969) classified demersal fish habitats into five general types: (1) coastal, (2) open-Shelf, (3) reef, (4) Shelf-edge, and (5) lower-Shelf. The Existing and Deepwater Sites are located within the coastal and lower-Shelf habitats, respectively.

The coastal habitat ranges over a generally smooth, sand to sandy-silt, bottom to depths of 16m to 20m. The fish are primarily of the drum family, including croakers, spot, kingfish, silver perch, sea trouts, red drum, and black drum. The coastal zone also provides the principal habitat for the shrimp (Penaeus sp.) and crab fisheries of the Georgia Bight. The lower-Shelf habitat supports low densities of butterfish, spotted hake, and spot (Struhsaker, 1969).

Shrimp are an important commercial element within the Georgia Bight (BLM, 1977); the majority of the shrimp biomass comprises three species. Adult white shrimp (Penaeus setiterus) spawn offshore in waters ranging from 10m to 35m. Pink shrimp (P. duorarum) spawn in depths of 25m to 45m, and brown shrimp (P. aztecus) from 25m to 70m in depth (Knopf, 1970); however, their spawning grounds are less well known than those of the white shrimp. All three species utilize estuaries such as the St. Johns River Estuary as nursery grounds for postlarval and juvenile stages (Eldridge and Goldstein, 1975). Young shrimp actively move out of the estuaries into deeper water when they are between 4 and 6 months old (Knopf, 1970).

A detailed assessment of the nekton at the Deepwater Site site is lacking; however, generalized information provides an adequate description (Struhsaker, 1969; Barans and Burrell, 1976; BLM, 1977). The Deepwater Site probably supports a nektonic assemblage similar to the Shelf-edge region. Fishes inhabiting this zone are generally tropical forms, such as seabasses, snappers, groupers, and porgies.

Five species of sea turtles inhabit the Georgia Bight off Jacksonville: Kemp's Ridley (Lepidochelys kempii), Hawksbill (Eretmochelys imbricata), Leatherback (Dermochelys coriacea), Loggerhead (Caretta caretta) and Green (Chelonia mydas). Stretches of the sandy beaches along the eastern Florida coast are marine turtle nesting habitats (Carr and Carr, 1978).

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The Georgia Bight supports seasonal and permanent populations of cetaceans (whales, dolphins, and porpoises), sirenians (manatees), and pinnipeds (Table 3-6). The distribution of whales in the Georgia Bight encompassess the full expanse of the Continental Shelf. Therefore, whales may pass through any alternative disposal site situated off the coast of northeastern Florida. Three species of marine mammals may utilize the St. Johns River Estuary: the Atlantic bottlenosed dolphin, Florida manatee, and harbor seal. Manatees winter in the warmer river waters and then disperse along the coast during the summer (Caldwell and Caldwell, 1974).

BENTHOS

The benthic community inhabiting the Continental Shelf off Jacksonville can be divided into two categories: (1) a macrofaunal community associated with the soft substratum of the Shelf and Slope, and (2) a diverse epifaunal community associated with various reef outcrops (termed "live-bottom").

Many studies of these communities have been conducted throughout the Georgia Bight Shelf, but only a few have examined the Shelf off Jacksonville. In 1973, the U.S. Naval Oceanographic Office conducted a characterization study at the Existing Site. A diverse macroinfaunal community was defined and no long-term impact from previous dumpings could be determined. The Bureau of Land Management (BLM, 1977) reviewed and summarized pertinent benthic studies from the Georgia Bight, including communities off Jacksonville. In conjunction with the BLM (1977) study, Texas Instruments Inc. (1979) conducted a detailed survey of the Georgia Bight. Biotic and abiotic parameters were measured at 50 sites along seven transects from Cape Fear, South Carolina to Daytona Beach, Florida. Texas Instruments' Stations A (30°23'N, 81°20'W) and B (30°23'N, 81°15'W) were within 2.5 and 3.0 nmi of the Existing Site, respectively (Figure 3-13). Results from this transect (Transect No. 6), therefore, represent the best source of historical data for the Existing Site, and will be used extensively in the following discussion. Additional data are derived from the EPA/IEC surveys conducted within and adjacent to the Existing Site (see Appendix A).

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TABLE 3-6
SPECIES OF MARINE MAMMALS KNOWN TO OCCUR BETWEEN CAPE HATTERAS, NORTH CAROLINA, AND CAPE CANAVERAL, FLORIDA

Common Name	Scientific Name	Population	Migration	Distribution	Primary Food Sources
Risso's dolphin	*Grampus griseus*	Stable	No data	S. Carolina-Florida	Fish and squid
Saddleback dolphin	*Delphinus delphis*	Stable	No data	No data	No data
Bottlenose dolphin	*Tursiops truncatus*	Stable	Northward-summer; southward-winter	Inshore N. Carolina-Florida	Fish, squid, and crustaceans
Spinner dolphin	*Stenella longirostris*	Stable	No data	N. Carolina-Florida	Squid
Bridled dolphin	*S. frontalis*	Stable	No data	N. Carolina-Florida	Squid and small fish
Spotted dolphin	*S. plagiodon*	Stable	Continental Shelf-moves inshore spring; close to shore-spring and summer	N. Carolina-Florida	Squid
Harbor porpoise	*Phocoena phocoena*	Stable	No data	Pamlico South-N. Carolina	Bottom fish, mollusks, and crustaceans
West Indian manatee (Florida)	*Trichechus manatus*	Stable and increasing	Northward in summer into shallow waters and warmer springs and rivers	S. Carolina-Florida	Aquatic vegetation
California sea lion	*Zalophus californianus*	Feral species few	No data	S. Carolina-Florida	Squid and small fish
Harbor seal	*Phoca vitulina concolor*	Feral species few	No data	N. Carolina-NW Florida	Fish, mollusks, and crustaceans
Hooded seal	*Cystophora cristata*	Feral species few	No data	N. Carolina-Florida	Fish, mollusks, and crustaceans

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TABLE 3-6. (continued)

Common Name	Scientific Name	Population	Migration	Distribution	Primary Food Sources
*Black right whale	*Eugalena glacialis	Increasing	Inshore movement-January-March	N. Carolina-Florida	Zooplankton-copepods
*Humpback whale	*Megaptera novaeangliae	Increasing	Southward-winter	N. Carolina-Florida	Krill and schooling fish
*Sei whale	*Balaenoptera acutorostrata	Declining	No data		Krill, schooling fish, and copepods
Bryde whale	B. edeni	Stable	No data	N. Carolina-Florida	Schooling fish and pelagic crustaceans
*Fin whale	*B. physalus	No data	No data	N. Carolina-Florida	Krill, squid, and small fish
False killer whale	Pseudora crassidens	Stable	No data	N. Carolina-Florida	Squid and large fish
Killer whale	Orcinus orca	Stable	No data	N. Atlantic-Florida	Squid, fish, sea turtles, sea birds, and other marine mammals
Short-finned pilot Whale	Globicephala macrorhyncha	Stable	No strong seasonal movement	N. Carolina-Florida	Squid and fish
*Sperm whale	*Physeter catodon	Above maximum sub-stanance levels	Northward-spring and summer; south-ward-fall	N. Carolina-Florida	Squid and fish
Pygmy killer whale	Feresa attenuata	Stable	None	Florida	Squid
Pygmy sperm whale	Kogia breviceps	Stable	None	N. Carolina-Florida	Squid
Dwarf sperm whale	K. simus	Stable	No data	N. Carolina-Florida	Squid
Antillean beaked whale	Mesoplodon europaeus	Stable	No data	N. Carolina-Florida	Squid
True's beaked whale	M. mirus	Stable	No data	N. Carolina-Florida	No data
Dense beaked whale	M. densirostris	Stable	No data	N. Carolina-Florida	Squid
Goose beaked whale	Ziphus cavirostris	Stable	No data	N. Carolina-Florida	Squid
Rough-toothed whale	Steno bredanensis	Stable	No data	N. Carolina-Florida	Squid

* Endangered species

Source: Caldwell and Caldwell, 1974

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Macroinfauna

Macroinfauna inhabiting the soft substratum of the Georgia Bight has been divided into three assemblages regulated by oceanographic factors (Day et al., 1971; BLM, 1977; and Texas Instruments Inc., 1979). The inshore assemblage occurs within the turbulent zone, extending from the surf zone to a depth of 20m (BLM, 1977). The other two assemblages are associated with the Outer Continental Shelf (40m to 120m depth), and the upper Continental Slope (160m to 205m depth).

The macroinfaunal community of all three zones can be considered highly diverse in species, but of low abundance and biomass. Table 3-7 presents winter and summer results along Texas Instruments' Transect No. 6. In general, the large number of species coupled with low individual abundances resulted in high species diversity values. Winter density and biomass was greater than summer, and inshore and Shelf areas supported a greater abundance and biomass of organisms than the Slope.

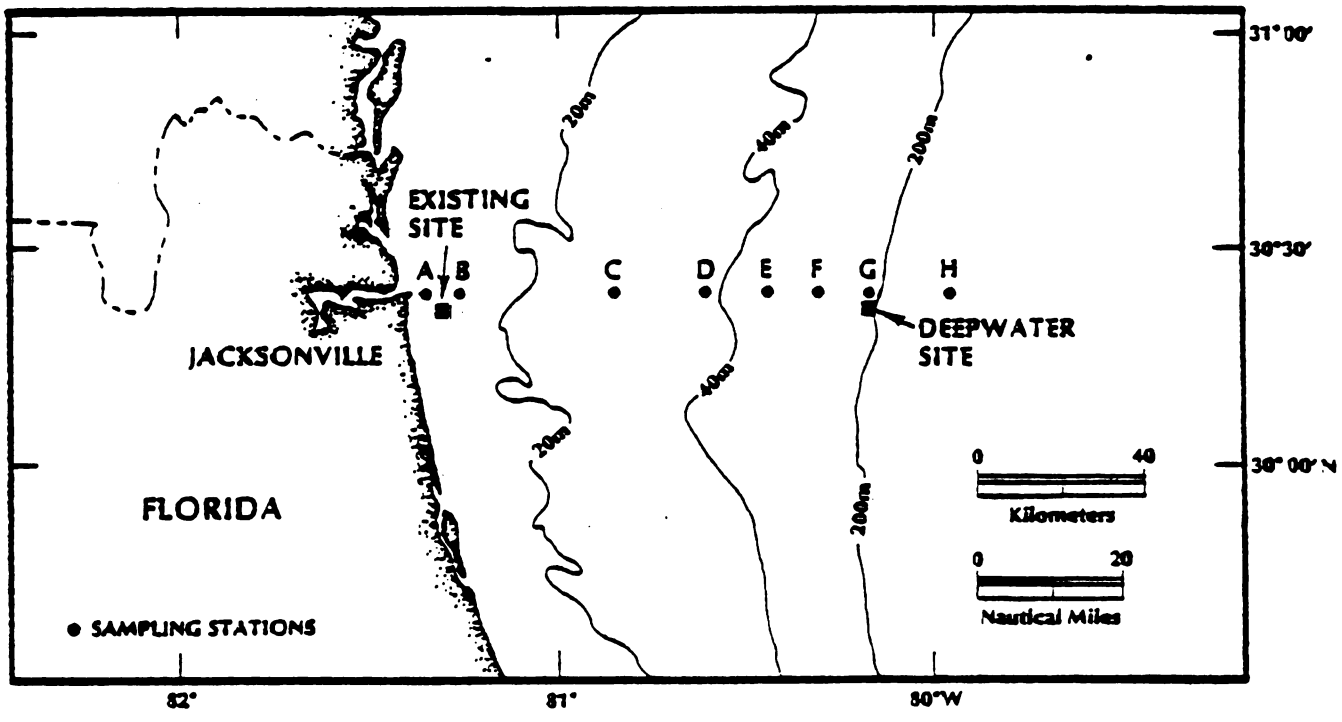

Figure 3-13. Station Locations of Texas Instruments' Survey, Transect No. 6
Source: Texas Instruments Inc., 1979

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TABLE 3-7
SUMMARY OF BENTHIC MACROFAUNA SURVEYS OFF JACKSONVILLE DURING THE SOUTH ATLANTIC BENCHMARK PROGRAM OF 1977. SIX REPLICATES WERE COLLECTED AT EACH STATION.

Station	Depth (m)	Mean Density (#/0.06m^2)		Mean Biomass (ash-free dry; mg/0.06m^2)		Total Taxa		Diversity (H')	
		Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
A	17	200	82	2,308	334	106	116	4.01	4.27
B	15	494	628	3,813	2,903	204	300	4.99	4.74
C	26	379	170	1,038	674	230	191	5.00	4.88
D	35	346	220	1,432	1,831	238	223	4.92	5.06
E	39	448	155	5,773	4,698	248	183	5.20	4.61
F	48	377	154	3,503	1,664	225	191	5.15	5.13
G	134	128	139	1,717	821	129	117	4.66	4.19
H	360	22	18	66	58	52	50	3.10	2.39

* See Figure 3-13 for station locations.

Source: Tenore, 1979

An analysis of feeding or trophic types was conducted using Texas Instruments' Transect No. 6 data to further characterize the macroinfaunal assemblage offshore from the Jacksonville area. Species comprising greater than 0.3% of the total abundance were assigned to one of four feeding categories: (1) deposit feeders which ingest sediment grains and detritus and feed on microbiota adhering to the particles; (2) suspension feeders which strain the water column with various structures to entrap and ingest food particles; (3) carnivores which capture and ingest live animals; and (4) omnivores which utilize many different food sources (such as plant or animal tissue, or sediment deposits) depending on environmental conditions. Trophic information from each station is summarized in Figure 3-14.

In the vicinity of the Existing Site, omnivores were best represented by polychaetes (Heteromorpha spp., Streptosyllis arenae) and unidentified neptantian decapods; carnivorous species consisted mainly of nemertine ribbon worms and polychaetes (Goniada brunnea and Glycera oxycephala). Spinonid

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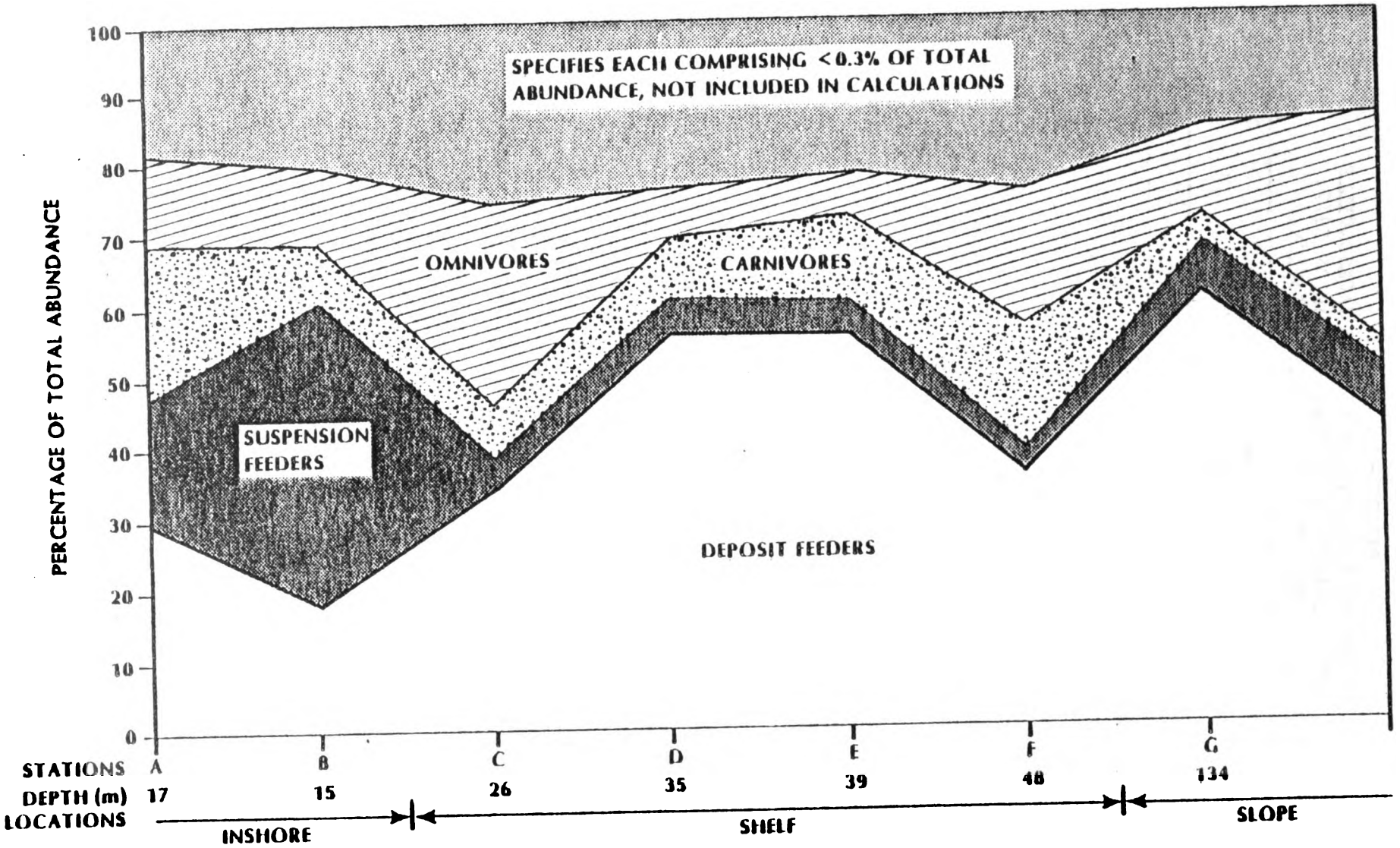

Figure 3-14. Proportion of Feeding Types at Each of Six Stations along Transect No. 6
Source: Texas Instruments Inc., 1979

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polychaetes (Prionospio spp.), many amphipod species, and the bivalve Parvilucina multilineuta dominated the deposit feeding species. Suspension feeders were best represented by the polychaete Sabellaria vulgaris, the gastropod Crepidula plana, and the cephalochordate Branchiostoma sp.

Middle to outer Shelf and Slope stations generally were similar in faunal and trophic structure in that deposit were feeders predominant.

Epifauna

Epifaunal species off Jacksonville can be classified into two groups (George and Staiger, 1979): (1) assemblages associated with rocky outcrops, termed "live-bottom" communities; and (2) species associated with the soft substratum. Only soft-bottom communities (in the vicinity of the Existing Site) will be discussed.

Fauna of soft-bottom communities are dominated by crustaceans and echinoderms. Crustaceans are best represented by commercial shrimp (Penaeus duorarum) and swimming crabs (Portunus gibbesii, Ovalipes stephensoni). The most abundant echinoderms are sandstars (Luidia clathrata, Astropecten articulatus) and the keyhole urchin (Mellita quinquesperforata).

In summary, the benthic communities inhabiting the Shelf off Jacksonville are diverse in species, but low in overall abundance. The majority of macroinfauna are small-bodied polychaetes and crustaceans typical of unstable sandy environments. Larger epifaunal species living on the soft bottom are mainly omnivorous or carnivorous crustaceans and echinoderms which feed on smaller infaunal organisms or detritus.

ENDANGERED SPECIES

Several endangered marine species occur throughout the Georgia Bight (Table 3-8), including the hawksbill and leatherback turtles, the Florida manatee, and the brown pelican (BLM, 1977). No breeding site or large congregations of any endangered marine species has been identified in the area of either the Existing or Deepwater Site.

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TABLE 3-8
ENDANGERED MARINE SPEICES OCCURING IN THE GEORGIA BIGHT

Common Name	Scientific Name
Short-nosed sturgeon	*Acipenser brevirostrum*
Leatherback turtle	*Dermochelys coriacea*
Hawksbill turtle	*Eretmochelys impricata*
Loggerhead turtle	*Caretta caretta*
Oliver Ridley turtle	*Lepidochelys olivacea*
Atlantic ridley	*Lepidochelys kempii*
American alligator	*Alligator mississipiensis*
Brown pelican	*Pelacanus occidentalis*
Humpback whale	*Megaptera novaengliae*
Right whale	*Eubalaena* sp.
Sei whale	*Balaenoptera borealis*
Blue whale	*B. musculus*
Finback whale	*B. physalus*
Sperm whale	*Physeter catodon*
Florida manatee	*Trichechus manatus*

Source: BLM, 1977

PRESENT AND POTENTIAL ACTIVITIES IN THE VICINITY OF THE ALTERNATIVE SITES

COMMERCIAL FISHERIES

Commercial fisheries in the Georgia Bight contribute about 6% of the total U.S. catch, in terms of weight and value (BLM, 1980a). On an annual basis, the Florida east coast fisheries comprise 30% of the value and 22% of the weight of the total fishery within the Georgia Bight (BLM, 1980a). Jacksonville is one of the major fishing ports in the Bight.

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Shrimp is the most valuable commercial fishery resource of the South Atlantic States (BLM, 1977; NMFS, 1980). During the last 25 years, the total catch of shrimp has remained fairly stable at 25 million pounds per year (Eldridge and Goldstein, 1975). Shrimp are considered to be an annual crop due to their short life span. Brown shrimp (Penaeus aztecus) and white shrimp (Penaeus setiterus) account for the majority of the catch off Jacksonville (Roland, personal communication*) and are caught primarily in coastal waters between May and December (Table 3-9; Anderson, 1970).

Many shrimp fishermen engage in other fisheries, such as reef fishes (snapper, grouper) and royal red shrimp. These fisheries are among the ten most valuable in Florida (Figure 3-15), but their success is highly dependent upon the productivity associated with the artificial reef areas, such as those

TABLE 3-9
COMMERCIAL SHRIMP LANDINGS FOR THE EAST COAST OF FLORIDA
(PERCENTAGE OF TOTAL GEORGIA BIGHT
CATCH IS SHOWN IN PARENTHESES.)

Species	Pounds	Dollars
White shrimp (Penaeus setiterus)	1,454,290 (15.6)	3,826,729 (18.1)
Brown shrimp (Penaeus aztecus)	320,187 (5.3)	786,845 (6.8)
Rock shrimp (Sicyonia brevirostris)	151,067 (100)	146,489 (100)
Pink shrimp (Penaeus duorarum)	8,776 (0.8)	28,550 (1.5)
Royal shrimp (Hymenopenaeus robustus)	10,574 (100)	24,030 (100)

Source: NMFS, 1980

*M. Roland, M. Roland Seafood Co., Mayport, FL. 1980

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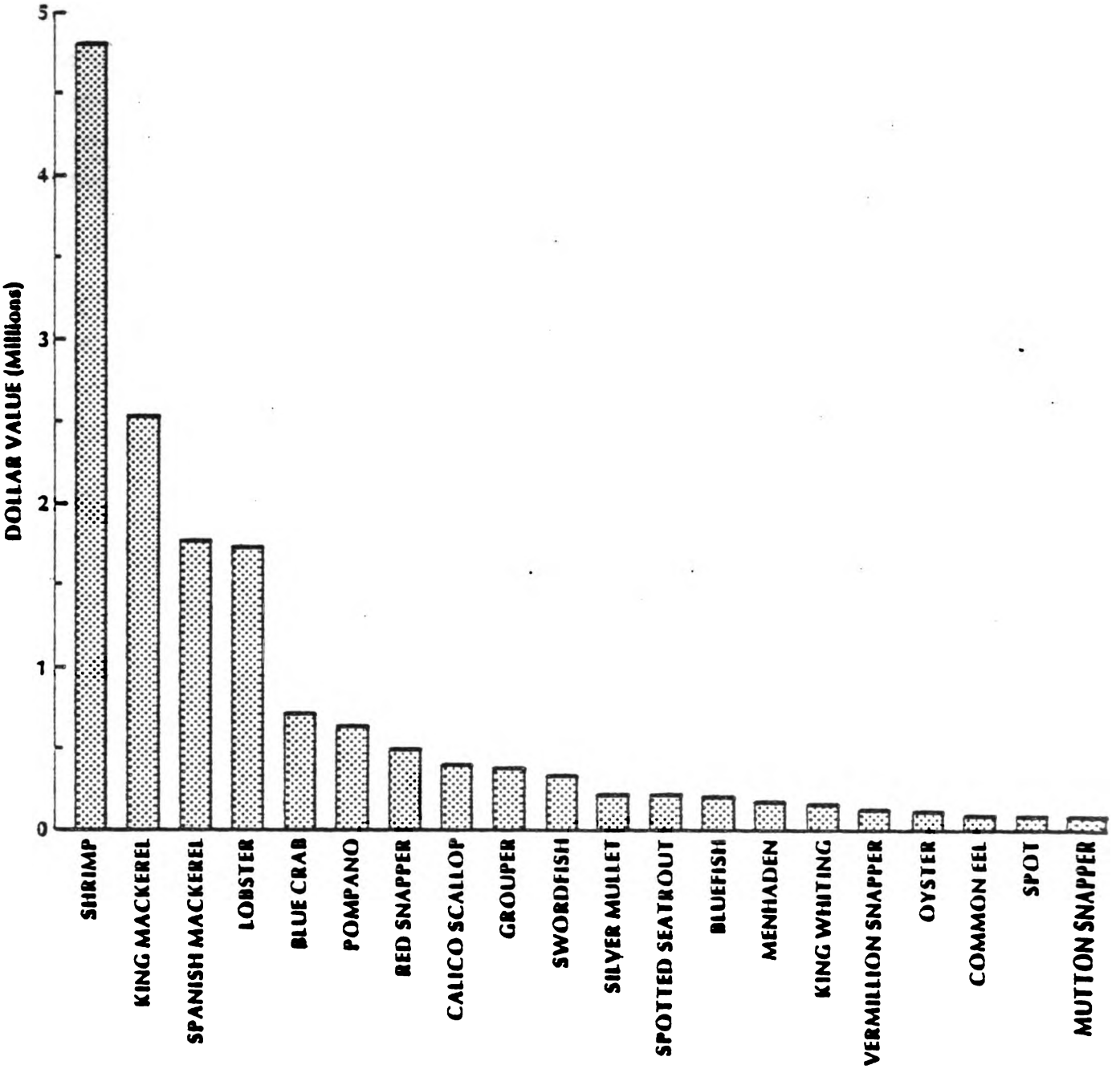

Figure 3-15. 1976 Dollar Value of the Major Commercial Fish and Shellfish Species from the Florida East Coast. Only species contributing greater than $100,000 have been included.
Source: NMFS, 1980

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off Jacksonville. Reef fishes provide for a productive commercial fishery off northeast Florida. Snapper, pompano, and grouper are the most valuable and frequently caught of the reef fishes off Jacksonville (NMFS, 1980). The royal red shrimp (Hymenopenaeus robustus) fishery is limited to those few commercial vessels capable of trawling at depths from 350m to 500m (Bullis and Rathjen, 1959).

The Atlantic (Brevoortia tyrannus) and yellowfin (B. smittii) menhaden fisheries dominate the total commercial catch of the Florida east coast (NMFS, 1980). However, their dollar value ranks only fifteenth (Figure 3-15), as menhaden are not utilized as a food fish for man. The fishery is confined mainly to the mid-Shelf region of the Georgia Bight, although young menhaden utilize estuaries as nursery grounds (Reintjes, 1960; BLM, 1977).

King (Scomberomorus cavalla) and Spanish mackerel (S. maculatus) also are important components of the commercial fishery off Jacksonville. These species have similar ranges throughout the Georgia Bight; however, king mackerel usually occur in waters deeper than 15m whereas Spanish mackerel venture closer to shore. Both species are pelagic, often congregating in schools over reefs and wrecks and around buoys (Roberts and Able, 1974; Manooch, 1978).

Large concentrations of calico scallops (Argopecten gibbus) are found on the Continental Shelf (Figure 3-16) in water depths between 20m and 80m, from Fort Pierce (south of Cape Canaveral) to the St. Johns River (Cummins, 1971). Scallops are distributed intermittantly over the Shelf with individual beds oriented in north-south bands ranging from 30m to 100m in width, and up to 50m in length (Cummins, 1971). The greatest concentration of calico scallops occurs off Cape Canaveral; however, commercial concentrations also occur off Jacksonville (BLM, 1977; Cummins, 1971). The commercial catch of calico scallops has increased in recent years as a result of improvements in harvesting and processing equipment (BLM, 1977).

Commercially important species of fish and shellfish were collected in trawls conducted in and adjacent to the existing disposal site by EPA/IEC (see Appendix A). Applied Biology, Inc. (1979) reported similar results from

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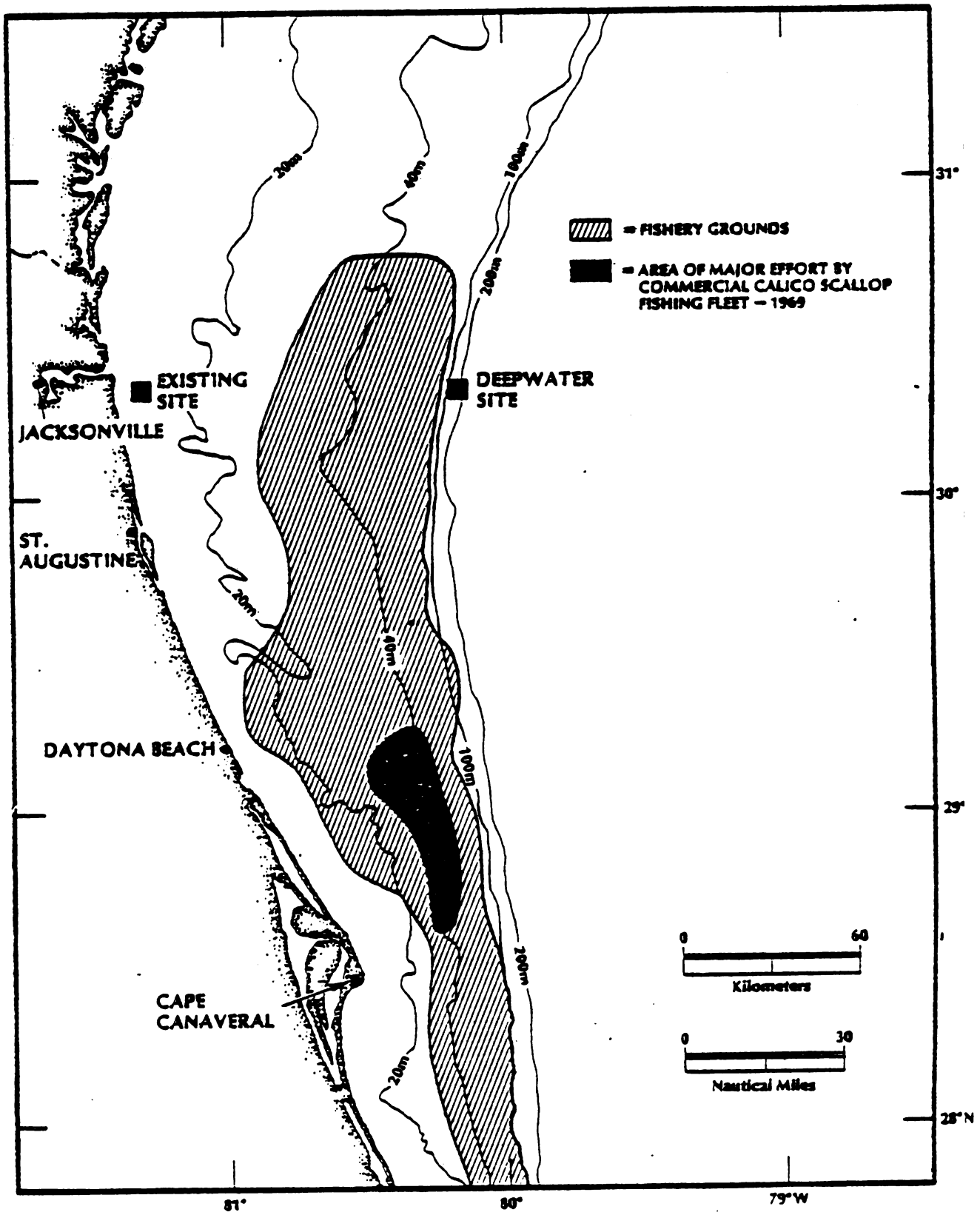

Figure 3-16. Commercial Concentrations of Calico Scallops Located and Exploited by Fishing Vessels
Source: Cummins, 1971

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trawls taken at sand borrow and control areas situated about 1 nmi east of the Existing Site. Commercial shrimp fishermen avoid trawling near the Existing Site; shrimp are not common because the area is too far offshore.

No fishery activity is known to exist in the vicinity of the Deepwater Site.

RECREATIONAL FISHING

Although no records equivalent to commercial landings exist for recreational fishing, national estimates suggest that recreational fishing yields twice the benefits (employment, etc.) and 40% of the food for human consumption relative to commercial fisheries (NMFS, 1980). Recreational fishing also is a principal motivator behind the success of other outdoor recreational activities, such as boating. Recreational fishing is a major source of revenue for Florida.

Recreational fishing is most intense during spring and summer off northeastern Florida (Moe, 1963). Most fishermen pursue the demersal fishes associated with the natural and artificial reefs of the mid-Shelf region, such as snapper, grouper, black seabass, porgies, and grunts. However, mid-water predators (e.g., cobia, mackerel, jacks, baracuda, and sharks) also are commonly caught near the reefs. Recreational finfish sought in the coastal zone include: drum, croaker, spot, flounder, seatrout, cobia, sheepshead, mackerel, striped bass and shad (NMFS, 1980). Some popular fishing locations off Jacksonville (Figure 3-17) are described by Moe (1963) and most fish are associated with reefs or other areas of irregular bathymetry. Intense seasonal fishing for pelagic migratory species occurs near the Existing Site, adjacent to the mouth of the St. Johns River (Moe, 1963).

Recreational fishermen may also take 10% to 15% of the total shrimp catch within the Georgia Bight. It is unlikely that recreational shrimping would be important at either the Existing or Deepwater Sites because both areas are seaward of the major shrimping grounds.

No recreational fishing is known to exist in the vicinity of the Deepwater Site.

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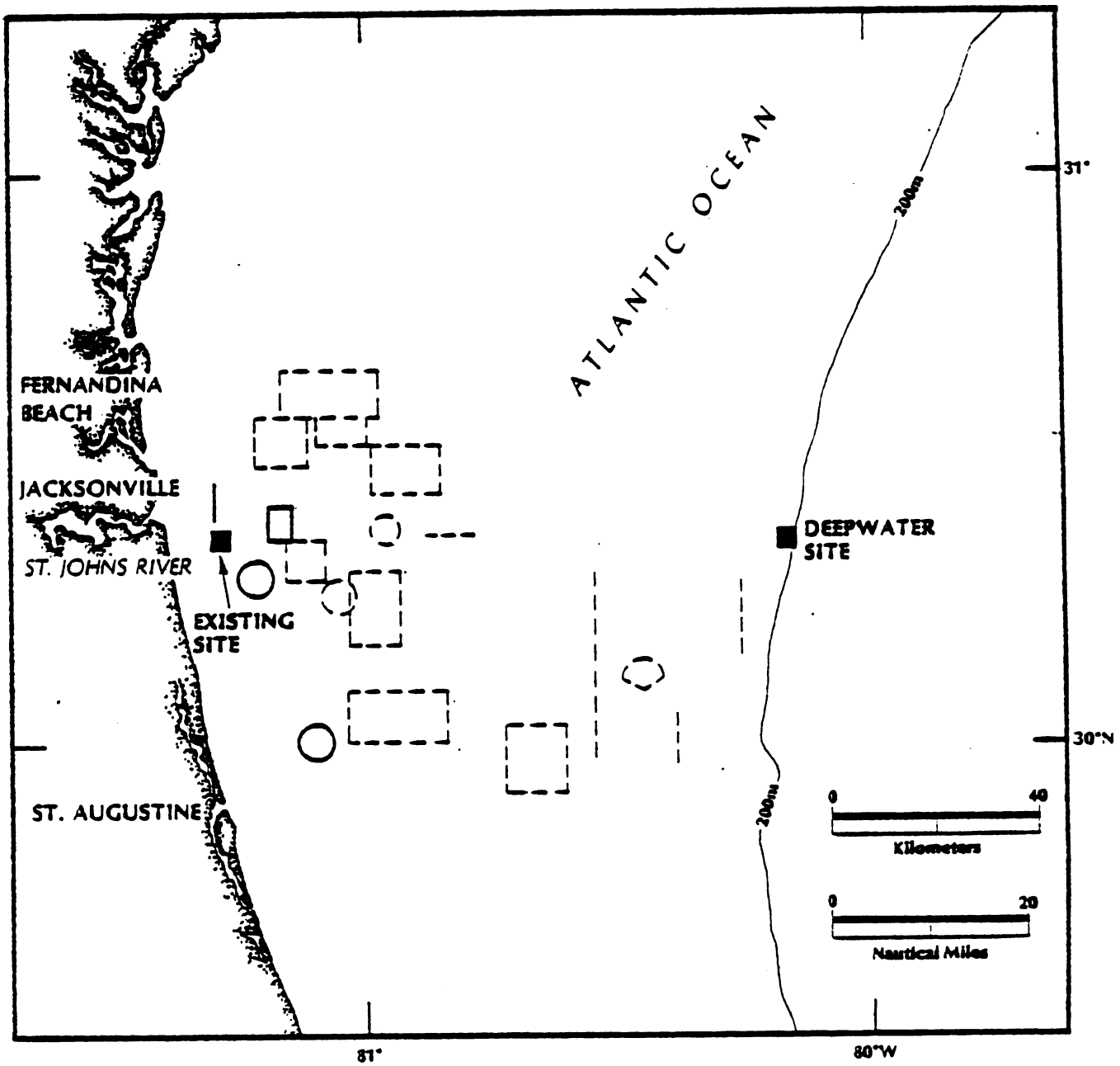

——— (SOLID LINES) = PRIMARILY SURFACE FISHING AREAS

Spanish mackerel
King mackerel
Bonita
Barracuda
Amberjack
Tarpon
Cobia

---- (DASHED LINES) = PRIMARILY BOTTOM FISHING AREAS

Black grouper
Gag grouper
Red grouper
Sea trout
Spade fish
Sea bass
Flounder
Mutton snapper
Red snapper
Vermillion snapper
Yellow-eyed snapper

Figure 3-17. Sportfishing Locations off Jacksonville
Source: Moe, 1963

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RECREATION

The marine environment of northeastern Florida provides outstanding recreational opportunities for residents and tourists, and generates considerable revenue for local business and the State. In 1975, approximately $289 million were spent on activities associated with marine recreational fishing (e.g., tackle, bait, boats, fuel, services). This exceeded the amount recorded by any other state along the Gulf or Atlantic coasts (BLM, 1980a). Other important recreational activities in Florida include swimming, beachcombing, boating, sailing, and diving (Table 3-10).

Beaches extending from Jacksonville (St. Johns River) to St. Augustine attracted nearly one million people in 1978, resulting in over $400 million of tourist expenditures (Florida Division of Tourism, 1979). Commercial and private recreational facilities and establishments (e.g., resort beach communities, amusement parks, marinas and piers, souvenir shops, restaurants, lodging and entertainment facilities) serve residents and tourists and provide employment for thousands of people.

TABLE 3-10
MARINE RECREATIONAL ACTIVITIES OF FLORIDA*

Activity	Thousands of People Participating Annually
Swimming	4,026
Beachcombing	2,760
Saltwater fishing	2,101
Pleasure boating	1,847
Shellfishing	989
Sailing	598
Diving	462

* Includes participation in recreational activites associated with both Atlantic and Gulf Coasts of Florida.

Source: Mabry et al., 1977

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SHIPPING

The Port of Jacksonville is important to the economy of the United States and Florida. Jacksonville is the busiest port in the Georgia Bight, with a total shipping volume of 15.7 million tons in 1978 (CE, 1978a). Collectively, the port receives approximately twice the tonnage of goods as it exports; in 1978 approximately 10.2 million tons were received, whereas about 5 million tons were exported. Foreign commerce contributes approximately 40% of the total shipping tonnage; with imports outweighing exports by a factor of two (CE, 1978a).

MILITARY USAGE

The U.S. Naval Station at Mayport is one of the most active naval facilities on the east coast of the United States. The Naval Station is on the south bank of the St. Johns River, seaward of downtown Jacksonville (Figure 1-1). Mayport turning basin is adjacent to the Jacksonville Harbor entrance channel, and provides direct and immediate access to the ocean for naval vessels. The station occupies 3,500 acres of land and serves as home port for five major components of the Atlantic Fleet, a helicopter fleet airwing, and several training and administrative units. The existing facilities provide berthing for both deep- (e.g., aircraft carriers) and medium-draft naval ships.

The Georgia Bight sea and air space are utilized by the Department of Defense for testing and training of surface, submarine, and air units of the Armed Forces. The fleet operating area extends from approximately 40 to 200 nmi off Jacksonville (U.S. Navy, 1972).

MINERAL RESOURCES

Intensive exploratory surveys of the Georgia Bight determined specific areas where oil and gas resources might be found. Two areas on the outer Continental Shelf have been offered for lease for oil and gas exploration and development (Lease Sale Nos. 43 and 56); less than half of the tracts offered are currently leased (Figure 3-18). The Existing and Deepwater Sites are outside the lease sale areas.

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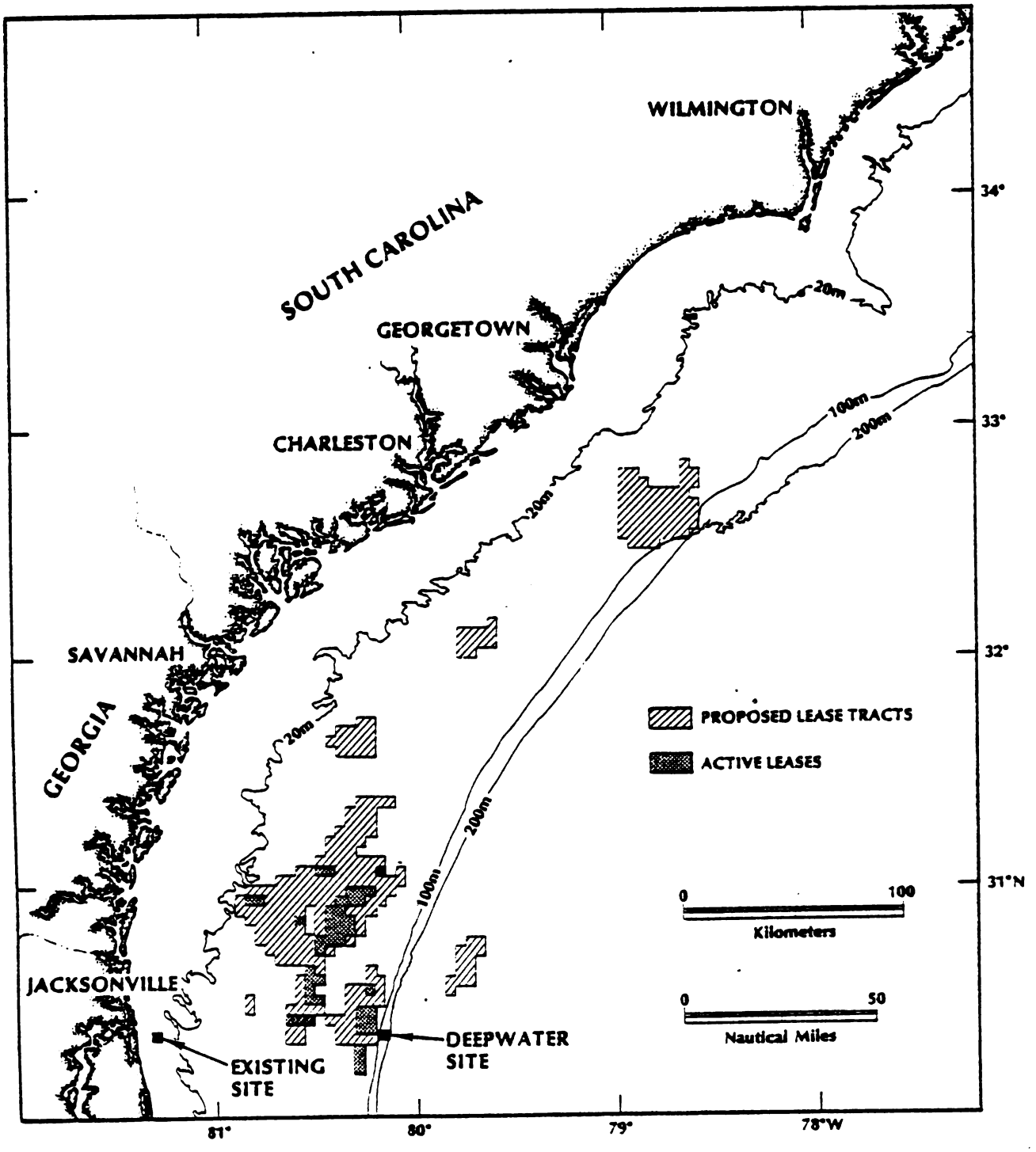

Figure 3-18. Areas Offered for Lease by BLM for Offshore Oil and Gas Exploration
Sources: BLM, 1977, 1980a

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Chapter 4

ENVIRONMENTAL CONSEQUENCES

Disposal of dredged material at the Existing Site has resulted in some modifications of the bottom topography, but no long-term, adverse effects have been demonstrated. Short-term impacts are burial of some organisms and decreased abundance of some species at the site. Impacts associated with disposal at the Deepwater Site are reduced by: (1) diluting and dispersing capacity of the deeper receiving waters, (2) relatively smaller biomass of organisms which would be affected, and (3) limited use of the deep ocean for human activities. Environmental changes are acceptable as long as areas outside the site are not adversely affected.

This chapter examines available scientific and analytical data to determine the environmental consequences of dredged material disposal at the alternative sites evaluated in Chapter 2. The environmental effects include:

- Environmental changes directly affecting public health (specifically, on commercial or recreational fisheries) and safety (navigational hazards);
- Effect of disposal operations on aesthetics;
- Environmental consequences of dredged material disposal on biota, water chemistry, and sediments of the sites;
- Unavoidable adverse environmental effects and mitigating measures;
- Relationships between short-term use and long-term productivity; and
- Irreversible or irretrievable committments of resources which would occur if the proposed action is implemented.

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EFFECTS ON PUBLIC HEALTH AND SAFETY

Evaluation of potential adverse effects on humans caused by the disposal of dredged material in the ocean is a fundamental aspect of the EIS. The nature of the disposal operation and type of material to be dumped may have direct or subtle effects upon public health and safety. Many health hazards may not be obvious; the potential for bioaccumulation of toxic chemicals from dredged material by organisms that may be consumed by the public is of primary concern. Similarly, dredged material harboring pathogenic bacteria and viruses may limit recreational water-sport activities and human consumption of fish and shellfish taken from the disposal site vicinity. Navigational hazards may develop from excessive shoaling of dredged material at the site and from movement of disposal vessels to and from the site.

INTRODUCTION OF POTENTIALLY HARMFUL TOXINS AND/OR ORGANISMS

Potential effects on human health, resulting from the consumption of marine organisms, can be evaluated from bioassay and bioaccumulation tests performed on marine organisms. Bioassay and bioaccumulation tests indicate that material dredged from Jacksonville Harbor does not pose any potential human health hazard (Jones, Edmunds and Associates, 1979). Bioassay and bioaccumulation tests have not been conducted on sediments dredged from Mayport Harbor.

INTERFERENCE WITH NAVIGATION

Navigational safety should not be adversely affected by disposal operations at the Existing Site. Although there is some risk of collision wherever the hopper dredges are operating or in transit to the site, the probability is negligible considering the short-term and intermittant schedule of disposal operations. No incidence of such problems have been reported during previous use of the site.

Mounding of previously deposited dredged material at the Existing Site has occurred (NAVOCEANO, 1973; Little and Young, 1979), but it has not restricted traffic and has not been attributed to any recorded accident. Long-term use

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of the Existing Site eventually may result in shoaling to the point where deep-draft vessels might have difficulty passing through the site. As a worst case example, if the Existing Site were shoaled to the extent that necessitated total navigational avoidance, only a 10% reduction in the effective harbor approach would be realized.

Mounding of dredged material would not influence navigation at the Deepwater Site because of the great water depths (over 100m). Dredged material dumped into this area will be diluted and dispersed (Bokuniewicz et al., 1978), thus mounding is unlikely.

EFFECTS ON AESTHETICS

Aesthetics of nearshore waters and beaches would most likely be unaffected by dredged material disposal activities. Nearshore waters are naturally turbid and the disposal of dredged material at the Existing Site would not leave a permanently detectable surface plume. No material will be transported by prevailing currents to the recreational beaches of Jacksonville (NAVOCEANO, 1973; Little and Young, 1979).

The Deepwater Site is approximately 66 nmi from the nearest land, thus disposal would not adversely affect beaches. A turbidity plume would be apparent to nearby ships during disposal but would be short-term and would not be visible from shore.

EFFECTS ON THE ECOSYSTEM

Effects of dredged material disposal on the marine ecosystem are of considerable public concern. Whereas some effects are large-scale and immediately apparent, others are subtle; it is frequently difficult to differentiate between changes due to natural fluctuations and those resulting from human perturbations. The consequence of effects may be difficult to interpret in light of incomplete knowledge of biological pathways, ecology of organisms, and community dynamics. However, such effects may have

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far-reaching consequences (e.g., damage to fisheries), or may be minor or inconsequential. Long-term effects are the most difficult to assess because effects are often indirect and may be cumulative, with potentials for adverse environmental consequences.

Effects of dredged material on the ecosystem depends upon several factors: physical and chemical characteristics of the dredged sediments, degree of similarity between dredged sediments and those of the site, amount of material to be dumped, frequency of disposal, nutrients associated with dredged material, and turbidity associated with disposal operations. The physical and biological characteristics of the receiving environment are also equally important. Effects of dredged material disposal may be lessened by locating disposal sites in an area where mixing and dilution are maximized, where sediments occasionally are disturbed, and/or where biological sensitivity is low.

The following discussion is divided into sections pertaining to effects on: (1) water quality, (2) sediment quality, (3) biota, and (4) recreation and economics.

EFFECTS ON WATER QUALITY

TURBIDITY

Dredged material disposal causes an immediate increase in turbidity of the receiving waters. Duration of the turbidity plume formed depends on particle size, currents, and turbulent mixing (Wright, 1978). Sediment suspensions are unavoidable but short-term.

Changes in turbidity may be both beneficial and adverse to the environment. Beneficial effects may include the release of nutrients and the adsorption of undesirable chemical contaminants by the turbidity plume (Stern and Stickle, 1978).

Adverse effects of turbidity include temporary and local decreases in light penetration (possibly reducing photosynthesis), mechanical abrasion of the

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filter-feeding and respiratory structures of animals, and adsorbtion of essential nutrients from the water (Cairns, 1968). However, numerous studies have concluded that the suspended loads are unlikely to cause any short- or long-term adverse effects. Most organisms are not seriously affected by suspended sediments in the water (Hirsch et al., 1978). The exceptions are those in systems sensitive to water clarity, such as coral reefs and kelp beds (Hirsch et al., 1978; Stern and Stickle, 1978). None of these systems occur within or in the immediate vicinity of the Existing Site.

Disposal of dredged material at the Deepwater Site will also form a turbidity plume. The descending material will encounter a thermocline within 100m (see Chapter 3), and the settling cloud may experience some horizontal spreading before reaching the bottom. However, because the Deepwater Site is also influenced by currents from the adjacent Gulf Stream, the turbidity plume is expected to dissipate rapidly.

DISSOLVED OXYGEN

Dredged sediments contain substances which are susceptible to oxidation by dissolved oxygen, thus the sediments often exert a slight oxygen demand as they descend through the water column. The initial oxygen decrease depends partly on the type of material dumped: lowest demands occur for clean sand and gravel, highest demands for anoxic and organically rich sediments (Baram et al., 1978). These changes are unlikely to produce harmful effects on fishes or other organisms, unless dissolved oxygen levels are depressed prior to dumping. Because waters at the Existing and Deepwater Sites are well oxygenated, no adverse effects are anticipated.

NUTRIENTS

Deposition of dredged material may release nutrients in the water column. Nutrient release may stimulate phytoplankton growth; but in high concentrations, nutrients (e.g., ammonia) can become toxic to some organisms (Pequegnat et al., 1978). The potential occurrence of either effect is dependent upon the concentrations of constituents released, environmental factors (including dissolved oxygen levels), and mixing and dilution rates.

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Elutriate tests on representative Jacksonville and Mayport Harbor sediments indicate that nutrients are released in concentrations far less than background levels (CE-Jacksonville District, 1978; Little and Young, 1979). Therefore, no adverse effects from disposal of dredged material are expected at either the Existing or Deepwater Sites.

TRACE ELEMENTS AND CHLORINATED HYDROCARBONS

Disposal of dredged material in the ocean usually does not increase concentrations of trace metals in the water column. Manganese is generally the trace metal most likely to be released; however, manganese "is generally not toxic and is a required micronutrient" (Brannon, 1978).

Results of elutriate tests on Jacksonville and Mayport Harbor sediments indicate that trace elements were either not released or released in concentrations far below background levels (CE-Jacksonville District, 1978; Little and Young, 1979). Similar results were found by EPA/IEC in tests of sediments within and adjacent to the Existing Site (see Appendix A). In a similar manner, disposal at the Deepwater Site is unlikely to adversely affect water quality.

Unlike trace metals and nutrients, chlorinated hydrocarbons (CHC's) do not naturally occur in dredged sediments, and the presence of these substances is due to anthropogenic (human) contamination (Brannon, 1978). Natural processes may concentrate them in bottom sediments (Burks and Engler, 1978); CHC's are relatively insoluble and thus are rapidly sorbed (adsorbed and absorbed) to sediments. Only limited quantities are released to interstitial waters (Burks and Engler, 1978).

Elutriate analyses of sediments from the Existing Site for chlorinated hydrocarbons have not been performed.

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EFFECTS ON SEDIMENT QUALITY

Contaminants in dredged material generally are not released into the water following disposal, but remain associated with the solid fraction of the material (Brannon, 1978). Solid-phase, liquid-phase, and suspended particulate-phase bioassays on appropriately sensitive marine organisms demonstrated that material dredged from Jacksonville Harbor poses no serious or unacceptable hazard to the marine environment (Jones, Edmunds and Associates, 1979; Little and Young, 1979; EG&G, 1980). Solid-phase bioaccumulation tests indicated that sensitive marine organisms did not significantly bioaccumulate contaminants (e.g., trace metals, petroleum hydrocarbons, pesticides, and PCB's) from Jacksonville Harbor dredged material (Jones, Edmunds and Associates, 1979; EG&G, 1980). The data indicate that the contaminants are tightly bound to the sediments, thus disposal at any site is not expected to produce significant adverse environmental effects.

EFFECTS ON BIOLOGICAL CONDITIONS

PLANKTON

Dumping of dredged material will cause a short-term increase in turbidity, resulting in a temporary decrease in light penetration with a concomitant reduction of photosynthetic activity (Stern and Stickle, 1978). No long-term changes in dissolved nutrients, trace metal concentrations, or phytoplankton primary productivity have been attributed to the disposal of dredged material (Wright, 1978; Hirsch et al., 1978). No short- or long-term adverse effects on plankton are expected at either the Existing or Deepwater Site.

NEKTON

Transient turbidity plumes associated with the disposal of dredged material poses no significant threat to fishes. Suspended particles can cause gill damage, reducing fish respiratory surface area (Ritchie, 1970), but this type of gill damage has not been positively identified as harmful to fish in terms of overall survival. Turbidity plumes associated with dredged material disposal are so brief that these changes probably do not occur to any significant degree.

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During periods of high turbidity, pelagic fish probably swim to more favorable areas. More sedentary fish (e.g., flatfishes) usually have a higher tolerance to suspended particles, thereby minimizing the effects of suspended solids on their respiration (O'Connor et al., 1977).

After dumping, fish may be attracted to disposal sites by the exposure of food items in the dredged material and by the mound formed by dumping (Oliver et al., 1977). Adverse effects are not expected because (1) disposal has only short-term, transient effects on water-column parameters, (2) foraging activity by fish is not restricted to the mound, and (3) fish have not been shown to accumulate contaminants associated with dredged material from the Jacksonville Harbor Channel System.

BENTHOS

The most significant adverse impacts of dredged material disposal have been observed in the benthos (Wright, 1978). The benthos are affected by burial and smothering, which temporarily reduce abundances of benthic species. The intensity of this effect varies with the type of dredged material, thickness of the overburden resulting from dumping, frequency of dumping, the benthic organisms involved, and the physical processes occurring in the receiving environment.

Benthic organisms collected in the area of the Existing Site were characteristic of shallow-water, sandy environments of the Georgia Bight (Roberts, 1974c; Texas Instruments Inc., 1979; ABI, 1979). They were mainly small-bodied polychaetes and amphipods which feed and live in the upper few centimeters of sediment. Many of the species (particularly the polychaete species Prionospio and Mediomastus and various amphipods and cumaceans) are capable of quickly recolonizing disturbed sediments because of their high reproductive potential (Grassle and Grassle, 1974). Therefore, if dredged material is similar in composition to sediments within the disposal area, the introduced material should be recolonized by the same species (Oliver et al., 1977). Material dredged from the Jacksonville Harbor Channel System has varied from rock to silts and clays (see Chapter 2). Thus, the possibility exists that the bottom habitat at the Existing Site may be altered.

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Studies of the effects of dredged material disposal on deepwater benthic organisms are virtually non-existent. However, in support of deepwater disposal of dredged material, Pequegnat et al. (1978) noted that the density of organisms in deepwater sites is much less than the density of organisms in shallow-water sites. A similar situation exists off Jacksonville; infauna at the Deepwater Site are less dense and diverse than the infauna communities near the Existing Site.

The Deepwater Site is also influenced by the meandering of the Gulf Stream. Thus, it is frequently subjected to strong currents, which may transport and/or erode bottom sediments. Presumably, the benthic communities have adapted to this type of perturbation. Even though the velocity of the Gulf Stream decreases with depth, currents could still disperse and dilute any dredged material dumped at the Deepwater Site. Consequently, no significant long-term perturbations to the benthic communities are expected.

THREATENED AND ENDANGERED SPECIES

Threatened and endangered species in the area off Jacksonville are highly mobile and therefore could avoid any area in which dumping was occurring. The feeding ranges of such species are sufficiently large so that the infrequent dumping activities should not significantly affect their feeding activities. In addition, the area of the disposal site is small compared to the total feeding area available to such species. Thus, it is unlikely that threatened and endangered species would be adversely affected by the disposal of dredged material at either the Existing or Deepwater Sites.

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EFFECTS ON RECREATION AND ECONOMICS

FISHERIES

Shrimp fishing grounds for commercial and recreational fishermen are located shoreward of the Existing Site (Roland, personal communication*), whereas commercial and recreational fin fisheries are concentrated around the numerous reefs located seaward of the Existing Site. Past use of the Existing Site for disposal of dredged material has not resulted in any known adverse impacts on fishing. However, short-dumping of dredged materials has interfered with fishing operations (Roland, personal communication*).

There is no known commercial fishery at the Deepwater Site; therefore, no conflicts with site use are anticipated.

COMMERCIAL SHIPPING

Use of either the Existing or Deepwater Site should not conflict with normal commercial shipping traffic to and from the Port of Jacksonville, provided routine navigational precautions are observed. The presence of hopper dredges at the Existing Site may represent an obstacle to vessels approaching the harbor entrance from the south; however, this is considered a minor problem because no conflicts have been recorded by the CE from previous site use. Shipping traffic is negligible or non-existent at the Deepwater Site, thus no conflicts would be expected.

MILITARY USAGE

The U.S. Naval Station at Mayport Harbor is a major port-of-call for all U.S. Naval vessels of the Atlantic Fleet. The Existing and Deepwater Sites are in waters used by the U.S. Navy and other vessels of the Atlantic Fleet during transit between Mayport Harbor and the southern missile range of the

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* M. Roland, M. Roland Seafood Co., Mayport, FL. 1980.

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Atlantic Fleet Weapons Training Facility. Neither site, however, is in a restricted area, and military use will not affect final designation. Coordination between the U.S. Navy and the CE regarding dredging and disposal operations is expected, thus the possibility of conflicts will be further reduced.

RECREATION

Adverse effects on Jacksonville beaches are not expected because of prevailing currents and because no impacts have been reported during past disposal activities.

Most of the recreational fishing and sport diving activities occurring off Jacksonville are associated with the natural and artificial reefs on the mid-Shelf seaward of the Existing Site. Recreational fishing occurs around the Existing Site and may be disturbed temporarily as a result of disposal operations. Any adverse impacts on sportfishing and diving activities are expected to be minimal and short-lived. However, the infrequent and transitory nature of disposal operations are not expected to produce significant adverse impacts.

No interference with recreational activities is anticipated from use of the Deepwater Site.

MINING AND OIL AND GAS EXPLORATION

The CE has utilized several sand deposits off Jacksonville for beach nourishment projects. A sand borrow site approximately 1 nmi east of the Existing Site has been used for this purpose since 1976 (Saunders, personal communication*). This site continues to produce high quality sand, despite disposal at the nearby Existing Site. Consequently, continued use of the Existing Site for dredged material disposal should not affect the quality of sand from the borrow area.

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* L. Saunders, CE-Jacksonville Dist., 1980

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Oil and gas exploration in the Georgia Bight indicates that the middle and outer Continental Shelf may contain sufficient quantities of oil and gas for exploitation. Both the Existing Site and the Deepwater Site are outside the oil and gas lease sale tract areas.

TRANSPORTATION OF DREDGED MATERIAL TO THE SITE

Minor disruptions of harbor and channel traffic will occur as a result of transportation and disposal of dredged material. Most of these disturbances are associated with the dredging operations and subsequent transport of the dredged material out of the harbor, where shipping and recreational boat traffic may cause congestion. Such inconveniences will occur regardless of the location of a disposal site.

Transportation costs for hauling dredged material from the dredging area to an ocean disposal site may represent a large part of the cost of a dredging operation. Expenses for fuel, labor, and equipment rental are directly related to the distance between the dredging site and the disposal area and to the total time necessary to dump the material. The CE-Jacksonville District estimates that disposal costs will increase at the rate of $0.10/yd^3/nmi for additional distances beyond that of the Existing Site. Thus, the additional cost for transporting dredged materials to the Deepwater Site would be $5.30/yd^3 or approximately $4.5 million to transport 855,000 yd^3 of dredged material. Therefore, disposal of dredged material at the Deepwater Site is an expensive alternative compared to use of the Existing Site.

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS AND MITIGATING MEASURES

Potential unavoidable adverse effects that may occur within the sites under consideration include:

- Accumulation of dredged material on the ocean floor;

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- Generation of a turbidity plume which will temporarily lower water quality;

- Smothering of less motile benthic biota by burial under dredged material; and

- Further alteration of sediment composition that would affect organism abundance, diversity, and possibly community structure at a site.

Some of the unavoidable adverse effects, are of short duration and of limited impact due to the rapid dilution of the material after release. Other impacts pose little environmental consequence because of the limited size of the site. However, changes within a site are acceptable as long as areas outside the site are not affected.

A monitoring program would detect any unacceptable adverse effects that might occur outside the general boundaries of the site. The monitoring plan will concentrate on the benthic environment to determine possible long-term adverse effects on the benthic community and to determine dredged material distribution on the bottom.

RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Disposal operations do not interfere with the long-term use of any resources at either of the alternative sites. Commercial fishing and sportfishing at and near the Existing Site should not be significantly affected because the site constitutes only a small portion of the Georgia Bight inhabited by commercially important species. The Deepwater Site is outside the principal economic and sport fisheries region off Jacksonville. It is not anticipated that short-term impacts at either alternative disposal site would significantly affect the long-term productivity of the area. Any short-term losses will be offset by the benefit to commerce from the dredging of the Jacksonville Harbor Channel System.

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IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES

Several resources will be irreversibly or irretrievably committed by the proposed action:

- Loss of some potentially recyclable material (i.e., sand for landfill),
- Loss of energy in the form of fuel required to power the hopper dredges to and from the disposal site,
- Loss of economic resources due to costs associated with disposal in the ocean, and
- Loss of some benthic organisms at the site which are buried during disposal operations.

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CHAPTER 5

COORDINATION

PREPARERS OF THE DRAFT EIS

The Draft EIS was issued by the Environmental Protection Agency's Ocean Dumping EIS Task Force. This document was based on a Preliminary Draft prepared by Interstate Electronics Corporation Contract No. 68-01-4610. Reviews and revisions were prepared by Michael S. Moyer. Additional reviews and support were provided by the members of the EIS Task Force:

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PREPARERS OF PRELIMINARY DRAFT OF THE EIS

Preparation of the Jacksonville Preliminary Draft EIS was a joint effort of the scientific and technical staffs of Interstate Electronics Corporation, Anaheim, California. Table 5-1 presents the authors of each section.

TABLE 5-1
LIST OF PREPARERS

Author	Summary	Chapter 1	2	3	4	5	6	Appendix A
J. Markus		X	X	X	X	X	X	X
J. Coyer	X	X	X	X	X	X	X	X
J. Dorsey				X				X
B. Lee	X	X	X	X	X	X	X	X
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PRINCIPAL AUTHOR OF PRELIMINARY DRAFT

The principal author of the Preliminary Draft EIS was Mr. John Markus. Mr. Markus received an M.S. in Environmental Engineering from the University of Southern California, and M.S. and B.A. degress in Biological Science from California State University, Fullerton.

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Mr. Dorsey authored the benthic biology section of Chapter 3 and Appendix A. He received his M.A. and B.S. in Marine Science from California State University, Long Beach, and is expected to receive his Ph.D. from Melbourne University, Australia.

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Mr. Lee assisted in the preparation of the geology section in Chapter 3. He received his M.S. and B.S. in Geology from the University of Pittsburg, Pennsylvania, and Colgate University, New York, respectively.

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Ms. Jones assisted in the preparation of Chapter 3. She received her B.S. in Biology from the University of South Carolina.

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MS. BETSY DEBLOIS

Ms. DeBlois assisted in the preparation of the physical oceanography section of Chapter 3. She received her B.S. in Ocean Engineering from Florida Atlantic University.

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Mr. Heaton authored the Physical and Chemical Parameters section in Appendix A. He received a B.S. degree in Chemistry from State University of New York, Oneonta, and an M.S. in Marine Environmental Sciences from the Marine Sciences Research Center, State University of New York, Stony Brook.

REVIEWERS OF THE PRELIMINARY DRAFT EIS

The entire Preliminary Draft EIS was edited and reviewed by Drs. Richard Terry and Andy Lissner of IEC. Additional technical reviews were provided by Dr. Robert Tait, Messrs. Mack Sullivan and Monteith Heathon, and Ms. Karen Green.

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COMMENTERS ON THE DRAFT EIS

The following persons submitted comments on the DEIS. The letters and responses are in Appendix B.

Letter Number	Commenter
1	Frank S. Lisella, Ph.D. Chief, Environmental Affairs Group Environmental Health Services Division Center for Disease Control Atlanta, GA 30333
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Chapter 6

GLOSSARY, ABBREVIATIONS, AND REFERENCES

GLOSSARY

ABUNDANCE — The number of individuals of a species inhabiting a given area. Normally, a community of several component species will inhabit an area. Measuring the abundance of each species is one way of estimating the comparative importance of each component species.

ADSORB — To adhere in an extremely thin layer of molecules to the surface of a solid or liquid.

AMBIENT — Pertaining to the undisturbed or unaffected conditions of an environment.

ANTHROPOGENIC — Relating to the effects or impacts of man on nature. Construction wastes, garbage, and sewage sludge are examples of anthropogenic materials.

ASSEMBLAGE — A group of organisms sharing a common habitat.

BASELINE CONDITIONS — The characteristics of an environment before the onset of an action which can alter that environment; any data serving as a basis for measurement of other data.

BENTHOS — All marine organisms (plant or animal) living on or in the bottom of the sea.

BIOACCUMULATION — The uptake and assimilation of materials (e.g., heavy metals) leading to elevated concentrations of the substances within organic tissue, blood, or body fluid.

BIOASSAY — A method for determining the toxicity of a substance by the effect of varying concentrations on growth or survival of suitable plants, animals or micro-organisms; the concentration which is lethal to 50% of the test organisms or causes a defined effect in 50% of the test organisms, often expressed in terms of lethal concentration (LC_{50}) or effective concentration (EC_{50}), respectively.

BIOTA — Animals and plants inhabiting a given region.

BOD — Biochemical Oxygen Demand or Biological Oxygen Demand; the amount of dissolved oxygen required by aerobic micro-organisms to degrade organic matter in a sample of water usually held in the dark at 20°C for 5 days; used to assess the potential rate of substrate degradation and oxygen utilization in aquatic ecosystems.

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CONTINENTAL SHELF	That part of the Continental Margin adjacent to a continent extending from the low water line to a depth, generally 200m, where the Continental Shelf and the Continental Slope join.
CONTINENTAL SLOPE	That part of the Continental Margin consisting of the declivity from the edge of the Continental Shelf down to the Continental Rise.
CURRENT METER	An instrument for measuring the speed of a current, and often the direction of flow.
DEMERSAL	Living at or near the bottom of the sea.
DENSITY	The mass per unit volume of a substance, usually expressed in grams per cubic centimeter (1 g water in reference to a volume of 1 cc @ 4°C).
DIATOMS	Microscopic phytoplankton characterized by a cell wall of overlapping silica plates. Sediment and water column populations vary widely in response to changes in environmental conditions.
DISPERSION	The dissemination of discharged matter over large areas by natural processes, e.g., currents.
DISSOLVED OXYGEN	The quantity of oxygen (expressed in mg/liter, ml/liter or parts per million) dissolved in a unit volume of water. Dissolved oxygen (DO) is a key parameter in the assessment of water quality.
DIVERSITY (Species)	A statistical concept which generally combines the measure of the total number of species in a given environment and the number of individuals of each species. Species diversity is high when it is difficult to predict the species or the importance of a randomly chosen individual organism, and low when an accurate prediction can be made.
DOMINANT SPECIES	A species or group of species which, because of their abundance, size, or control of the energy flow, strongly affect a community.
EBB CURRENT, EBB TIDE	Tidal current moving away from land or down a tidal stream.
ECOSYSTEM	The organisms in a community together with their physical and chemical environments.
EPIFAUNA	Animals which live on or near the bottom of the sea.
ESTUARY	A semienclosed coastal body of water which has a free connection to the sea, commonly the lower end of a river, and within which the mixing of saline and fresh water occurs.

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FAUNA	The animal life of any location, region, or period.
FINFISH	Term used to distinguish "normal" fish (e.g., with fins and capable of swimming) from shellfish, usually in reference to the commercially important species.
FLOOD TIDE, FLOOD CURRENT	Tidal current moving toward land, or up a tidal stream.
HOPPER DREDGE	A self-propelled vessel with capabilities to dredge, store, transport, and dispose of dredged materials.
INDICATOR SPECIES	An organism so strictly associated with particular environmental conditions that its presence is indicative of the existence of such conditions.
INFAUNA	Aquatic animals which live in the bottom sediment.
INITIAL MIXING	Dispersion or diffusion of liquid, suspended particulate, and solid phases of a waste material which occurs within 4 hours after dumping.
INTERIM DISPOSAL SITES	Ocean disposal sites tentatively approved for use by the EPA.
INVERTEBRATES	Animals lacking a backbone or internal skeleton.
LONGSHORE CURRENT	A current which flows in a direction parallel to a coastline.
MAIN SHIP CHANNEL	The designated shipping corridor leading into a harbor.
MAINTENANCE DREDGING	Periodic dredging of a waterway, necessary for continued use of the waterway.
MIXED LAYER	The upper layer of the ocean which is well mixed by wind and wave activity.
MONITORING	As used herein, observation of environmental effects of disposal operations through biological and chemical data collection and analyses.
NEKTON	Free swimming aquatic animals which move independently of water currents.
NUISANCE SPECIES	Organisms of no commercial value, which, because of predation or competition, may be harmful to commercially important organisms.
PARAMETER	Values or physical properties which describe the characteristics or behavior of a set of variables.

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PELAGIC	Pertaining to water of the open ocean beyond the Continental Shelf and above the abyssal zone.
PERTURBATION	A disturbance of a natural or regular system; any departures from an assumed steady state of a system.
PHYTOPLANKTON	Minute passively floating plant life in a body of water; the base of the food chain in the sea.
PLANKTON	The passively floating or weakly swimming, usually minute animal and plant life in a body of water.
POLYCHAETA	The largest class of the phylum Annelida (segmented worms); benthic marine worms distinguished by paired, lateral, fleshy appendages provided with bristles (setae) on most segments.
PROGRADE	The seaward advance of the shoreline resulting from sediment deposition.
PYCNOCLINE	A vertical density gradient in a body of water, positive with respect to depth, and much greater than the gradients above and below it.
RECRUITMENT	Addition to a population of organisms by reproduction or immigration of new individuals.
RUNOFF	That portion of precipitation upon land which ultimately reaches streams, rivers, lakes and oceans.
SALINITY	The amount of salts dissolved in water; expressed in parts per thousand ($^{o}/oo$, or ppt).
SECCHI DISK	A white, black or varicolored disc, 30 centimeters in diameter, used to measure water transparency (clarity).
SHELF WATER	Water which originates in, or can be traced to the Continental Shelf, differentiated by characteristic temperature and salinity.
SHELLFISH	Any invertebrate, usually of commercial importance, having a rigid outer covering, such as a shell or exoskeleton; includes some molluscs and arthropods; term is the counterpart of finfish.
SHIPRIDER	A shipboard observer, assigned by the U.S. Coast Guard to ensure that a waste-laden vessel is dumping in accordance with permit specifications.
SLOPE WATER	Water which orginates from, occurs at, or can be traced to the Continental Slope, differentiated by characteristic temperature and salinity.

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SPECIES	A group of morphologically similar organisms capable of interbreeding and producing fertile offspring.
STANDARD ELUTRIATE ANALYSIS	A test used to determine the types and amounts of constituents which can be extracted from a known volume of sediment by mixing with a known volume of water.
SUBSTRATE	The solid material upon which an organism lives, or to which it is attached (e.g., rocks, sand).
SURVEILLANCE	Systematic observation of an area by visual, electronic, photographic, or other means for the purpose of ensuring compliance with applicable laws, regulations, permits, and safety.
SUSPENDED SOLIDS	Finely divided particles of a solid temporarily suspended in a liquid (e.g., soil particles in water).
THERMOCLINE	A vertical temperature gradient in some layer of a body of water, which is appreciably greater than the gradients above or below it; a layer in which such a gradient occurs.
TRACE METAL OR ELEMENT	An element found in the environment in extremely small quantities; usually includes metals constituting 0.1% (1,000 ppm) or less, by weight, in the earth's crust.
TURBIDITY	Cloudy or hazy appearance in a naturally clear liquid caused by a suspension of colloidal liquid droplets, fine solids, or small organisms.
ZOOPLANKTON	Weakly swimming animals whose distribution in the ocean is ultimately determined by current movements.

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ABBREVIATIONS

BLM	Bureau of Land Management
C	Centigrade
CE	U.S. Army Corps of Engineers
CFR	Code of Federal Regulations
cm	centimeter
yd^3	cubic yard(s)
DMRP	Dredged Material Research Program
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FR	Federal Register
g	gram(s)
hr	hour(s)
IEC	Interstate Electronics Corporation
IMCO	Inter-Governmental Maritime Consultative Organization
kg	kilogram(s)
km	kilometer(s)
kn	knot(s)
m	meter(s)
µg	microgram(s)
mg	milligram(s)
mm	millimeter(s)
MPN	most probable number
MPRSA	Marine Protection, Research, and Sanctuaries Act
N	north
NAVOCEANO	Naval Oceanographic Office
NEPA	National Environmental Policy Act
ng	nanogram(s)
nmi	nautical mile(s)
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean Dredged Material Disposal Site
PL	Public Law
ppb	parts per billion
ppm	parts per million

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ppt	parts per thousand ($^{o}/oo$)
s	second(s)
SD	standard deviation
T	true
TOC	total organic carbon
W	west
yr	year(s)

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Appendix A

SURVEY METHODS, RESULTS, AND INTERPRETATIONS

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Appendix A

SURVEY METHODS, RESULTS, AND INTERPRETATIONS

Field surveys at the Jacksonville Harbor ODMDS were conducted in March and December 1979 by Interstate Electronics Corporation (IEC) under contract to the EPA (Contract Number 68-01-4610). The purpose of the surveys was to collect biological, chemical, geological, and physical oceanographic data to assess the effects of dredged material disposal on the marine environment, and to augment historical information from the area. A major consideration of survey design was to determine whether any adverse effects measured within the ODMDS were detectable outside of the site boundaries.

Methods of data collection, results, and interpretations of the survey data are presented in the following sections. Survey data are compared briefly with historical data; a more comprehensive treatment is presented in Chapter 3 of this EIS.

METHODS

All survey operations were conducted using the Ocean Survey Vessel ANTELOPE. Loran-C and radar range and bearing positioning were used for navigation.

Stations 1 to 5 were located inside the ODMDS, and control Stations 6 to 10 were positioned in predominantly upcurrent-downcurrent directions outside the site (Figure A-1). Station locations were designed to determine whether transport of dredged material was occurring outside of the site boundaries. Sampling requirements, coordinates, and water depths for all stations are presented in Table A-1. Because of navigation error and the position of the disposal mound near the center of the site, all samples except those from Station 1 were generally outside the dredged material mound. However, transport processes within the area may move materials from the mound to other areas.

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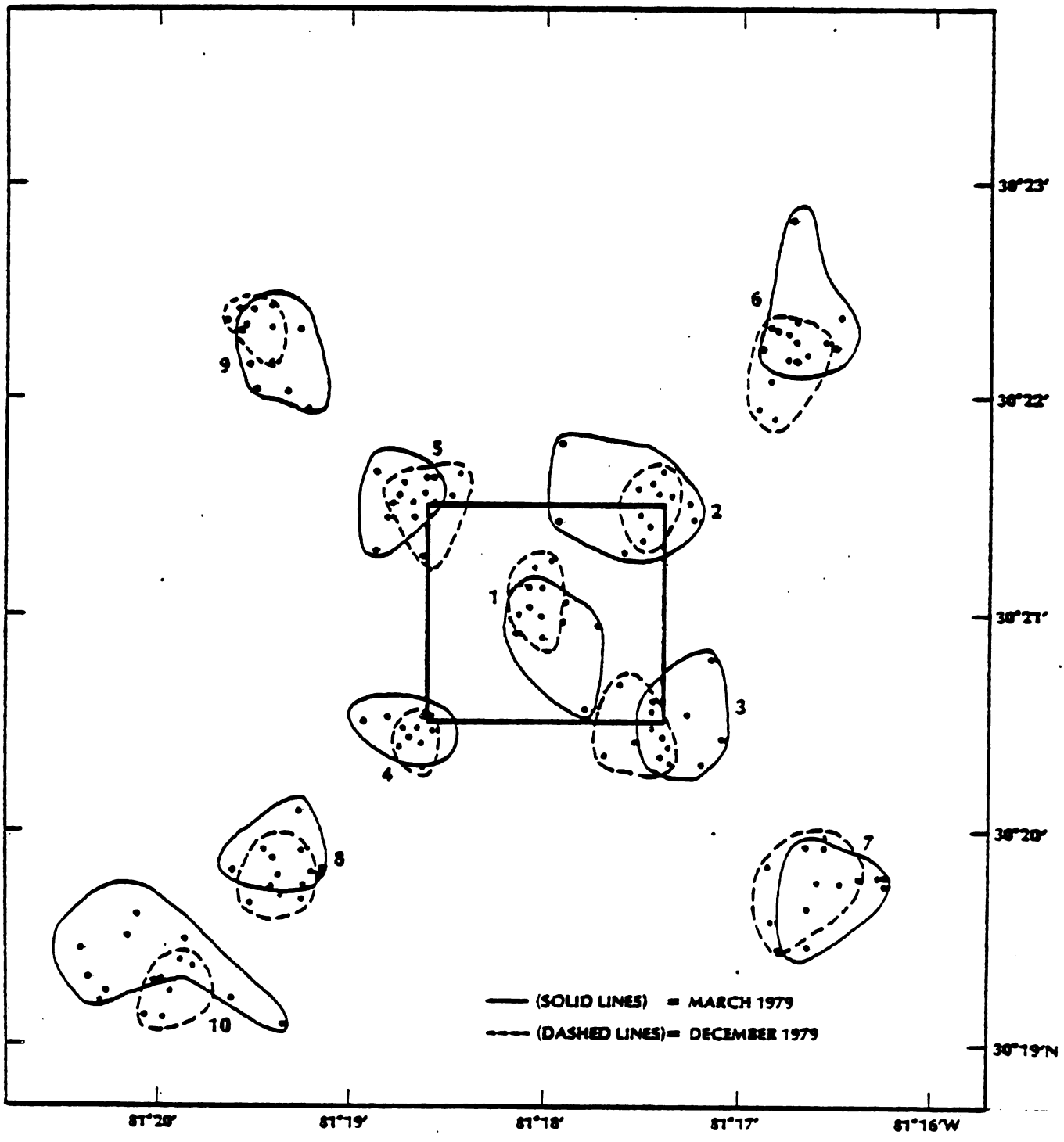

Figure A-1. Station Locations, EPA/IEC Survey of the Jacksonville Harbor ODMDS, March and December 1979

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TABLE A-1
SAMPLING REQUIREMENTS--JACKSONVILLE HARBOR ODMDS

	WATER COLUMN										SEDIMENT									BIOTA		
	INSTRUMENT ARRAY 1 PROFILE/ STATION		WATER SAMPLING ROSETTE								BOX CORER									DREDGE/TRAWL		
			GO-FLOW 2 SAMPLES/STATION SURFACE AND BOTTOM						GO-FLOW TEFLON LINED 1 SAMPLE/ STATION MIDWATER		GEOLOGICAL - CHEMICAL 2 CORES/STATION							BIOLOGY 5 CORES/ STATION		EPIFAUNA & MACROINFAUNA TISSUES 2 TRAWLS/SITE		
STATION NUMBER	PROFILES OF SALINITY, pH TEMPERATURE & TURBIDITY	CALIBRATION SAMPLES: SALINITY, TURBIDITY, pH, & TEMPERATURE	SUSPENDED SOLIDS	DISSOLVED OXYGEN	DISSOLVED TRACE METALS	PARTICULATE TRACE METALS	CHLORINATED HYDROCARBON SCAN	GRAINSIZE, ARTIFACTS	TOTAL ORGANIC CARBON	TRACE METALS	CHLORINATED HYDROCARBON SCAN *	ELUTRIATE	OIL & GREASE	PETROLEUM HYDROCARBON SCAN	GRAIN SIZE & ARTIFACTS	MACROINFAUNA, TAXONOMY	TOTAL & FECAL COLIFORMS	TRACE METALS **	CHLORINATED HYDROCARBON SCAN **	TOTAL & FECAL COLIFORMS **	MACROFAUNA, TAXONOMY	PETROLEUM HYDROCARBON SCAN
1	●	●	●	●	QC	QC	QC	QC	●	QC	QC	●	●	●	●	●	●	QC	QC	●	●	●
2								●	●	●			●		●	●						
3								●	●	●			●		●	●						
4								●	●	●			●		●	●						
5								●	●	●			●		●	●						
6	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
7	●	●	●	●				●	●	●			●		●	●						
8	●	●	●	●				●	●	●			●		●	●						
9	●	●	●	●				●	●	●			●		●	●						
10								●	●	●			●		●	●						

STATIONS

NUMBER	1	2	3	4	5	6	7	8	9	10
LATITUDE	30°21.0'N	30°21.6'N	30°20.6'N	30°20.5'N	30°21.5'N	30°22.1'N	30°19.8'N	30°19.9N	30°22.1'N	30°19.4'N
LONGITUDE	81°18.0'W	81°17.4'W	81°17.4'W	81°18.6'W	81°18.6'W	81°16.8'W	81°16.7'W	81°19.3'W	81°19.3'W	81°19.9'W
DEPTH	13m	17m	17m	13m	15m	18m	16m	14m	14m	15m

QC - ONE QUALITY CONTROL SAMPLE WILL BE TAKEN IN ADDITION TO THE SAMPLES BEING COLLECTED AT THE DESIGNATED STATION.

* - COMPOSITE SAMPLE FROM BOTH BOX CORES AT EACH DESIGNATED STATION.

** - COMPOSITE SAMPLES FROM ALL DREDGES/TRAWLS, PLUS SAMPLES OF OPPORTUNITY FOR GEOLOGICAL - CHEMICAL BOXCORES; SPECIES IDENTIFIED ONBOARD SHIP BEFORE ANALYSES OR PRESERVATION.

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Physical oceanographic measurements and coliform analyses were performed aboard the ANTELOPE; all other detailed chemical, geological, and biological analyses were performed at shore-based laboratories listed in Table A-2.

Sampling equipment, procedures, and preservation methods were in accordance with the "Oceanographic Sampling and Analytical Procedures Manual" (IEC, 1980). A summary of these methods is presented in the following sections.

WATER-COLUMN MEASUREMENTS

Shipboard Procedures

Conductivity and temperature were measured with a Plessey CTD, and data were stored on magnetic tape. A rosette sampler equipped with 30-liter Go-Flo bottles was used to collect surface and near-bottom samples for suspended solids and dissolved oxygen, and for salinity and temperature calibration samples; mid-depth samples were collectd for analysis of dissolved and perticulate trace metals and chlorinated hydrocarbons (CHC's). Salinity samples were analyzed with a Beckman Model RS7-C salinometer. Surface and bottom water temperatures were measured using reversing or bucket thermometers. Turbidity was measured with a Hach Model 2100-A turbidimeter; dissolved oxygen was determined using a modified Winkler method (Strickland and Parsons, 1972); and pH was measured with a Beckman Model 4500 pH meter. Water samples for total suspended solids and trace metals (particulate and dissolved) analyses were transferred from Go-Flow bottles to 2-liter pressure

TABLE A-2
LABORATORIES PERFORMING ANALYSES OF
SAMPLES FROM JACKSONVILLE HARBOR ODMDS

Biology	Chemistry	Geology
Taxon Salem, MA	Erco Cambridge, MA	Erco Cambridge, MA
*Dr. Reish CSU Long Beach Long Beach, CA	*LFE Environmental Richmond, CA	

* Denotes quality control laboratory

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filtration bottles, then filtered through Nucleopore filters. The filtrate was collected for dissolved trace metals analysis in precleaned bottles acidified with Ultrex nitric acid. Measured water volumes were pressure-fed directly from Go-Flo bottles through an Amberlite XAD resin column for extraction of chlorinated hydrocarbons (Osterroht, 1977). Filters, for particulate trace metals and suspended solids, and resin columns for CHC's were processed in a positive pressure clean hood and frozen until analyzed.

Laboratory Methods

Total suspended solids were determined gravimetrically on an electrobalance (Meade et al., 1975). Filters containing particulate trace metal samples were leached for 2 hours with 1N Ultrex nitric acid. Leachates were analyzed for cadmium and lead by graphite furnace atomic absorption spectrophotometry (AAS), and for mercury by cold-vapor AAS (EPA, 1979).

Dissolved mercury was analyzed by cold vapor AAS following an acid-permanganate digestion and reduction with hydroxylamine and stannous sulfates (EPA, 1979). Dissolved cadmium and lead were concentrated using a chelation-solvent extraction method (Sturgeon et al. 1980), and analyzed by graphite furnace AAS.

CHC's were eluted from resin columns with acetonitrile. The eluate was extracted three times with hexane, evaporated to near dryness, fractionated on a florisil column, and analyzed by electron capture gas chromatography (Osterroht, 1977). The chromatogram was scanned for the presence of PCB's (Arochlor 1016, 1221, 1232, 1242, 1248, 1254, 1260, and 1262), and various pesticides and derivatives (aldrin, dieldrin, endrin, heptachlor, βBHC, DDT, DDD, DDE, and heptachlor epoxide).

GEOCHEMISTRY AND GRAIN-SIZE ANALYSIS

Shipboard Procedures

Fifty grams of sediment were removed from each of seven 0.065-m^2 box cores per station, and frozen for grain-size analysis. Sediment samples for

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geochemical analyses (trace metals, oil and grease, total organic carbon [TOC], and CHC's) were collected from the surface 2 cm of two cores per station, stored in acid-cleaned Teflon jars, and frozen.

Laboratory Methods

Sediment grain size was determined by washing sediment samples through 2,000- and 62-um mesh sieves to separate gravel, sand, and silt/clay fractions (Folk, 1978). Sand/gravel fractions were separated with 1 phi (ϕ) interval sieves, dried, and weighed. The silt/clay fractions were analyzed using a pipette method (Rittenhouse, 1933).

Trace metals (cadmium and lead) were leached from 5g to 10g of sediments for 2 hours with 25 ml of 1N nitric acid, and analyzed by graphite furnace AAS. Mercury was leached from 5g to 10g of sediment at 95°C with aqua regia and potassium permanganate, reduced using hydroxylamine sulfate and stannous sulfate, and analyzed by cold-vapor AAS (EPA, 1979).

Oil and grease were extracted from 100g sediment samples with an acetone-hexane mixture, dried and quantified gravimetrically according to the method of APHA (1976). TOC in sediments was measured with a Perkin-Elmer Model 240 Elemental Analyzer (Gibbs, 1977).

CHC's were soxhlet extracted from sediment samples using a 1:1 acetone-hexane solvent. The extract was evaporated, cleaned using a florisil column, fractionated on a silicic acid column, and analyzed by electron capture gas chromatography (EPA, 1974). An additional acid cleanup step was required for analysis of PCB's. Petroleum hydrocarbons were extracted from sediments with a methylene dichloride-methanol azeotropic mixture, and analyzed by column and glass capillary gas chromatography (Brown et al., 1979).

Elutriate analyses were performed in accordance with the specifications of EPA (1977). Sediments and unfiltered disposal site water were mixed at a 1:4 ratio, and mechanical- and air-agitated for 30 minutes. After a 1-hour settling period, test water was filtered, acidified with Ultrex hydrochloric acid, and analyzed for trace metals using techniques described above.

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BIOLOGICAL MEASUREMENTS (Including Tissue Chemistry and Coliforms)

Shipboard Procedures

Five macrofaunal samples were collected at each station using a 0.065-m^2 box core and washed through a 0.5-mm screen; organisms were preserved in 10% formalin in seawater and stored until analysis. Two 3.5-cm diameter subcores were taken from one box core at each station for the first survey at the site, and preserved for enumeration of meiofauna.

Approximately 30g of sediments from the surface 1 cm of the geochemical box cores were collected with a sterile spoon into a sterile container and refrigerated. Approximately 10g to 15g of this pooled sample were analyzed for total and fecal coliforms using a modified Most Probable Number (MPN) method (APHA, 1976); the analysis was initiated within 6 hours after collection.

Two trawls, one inside and one outside of the site, were conducted using a 7.6m Otter trawl to collect epifauna for analysis of tissue concentrations of CHC's, trace metals, and total and fecal coliforms. In addition, information from the catch was used to further characterize the benthic and nektonic communities.

Epifauna from the trawls were sorted in stainless steel trays and enumerated. Specimens were transferred from the trays to acid-rinsed plastic buckets, and then into plastic bags and frozen for trace metal analyses. Additional specimens were transferred to stainless steel buckets with stainless steel forceps, wrapped in aluminum foil, placed in polyethylene bags, and frozen for CHC analysis. If available, at least three representative members of each commercially valuable species (e.g., clams) were placed in clean bags and refrigerated until total and fecal coliform analyses were initiated. A maximum of 50g of the tissue was used; analysis was initiated within 6 hours after collection, following a modified MPN procedure.

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Laboratory Methods

Six dominant macrofauna species were selected by IEC biologists for enumeration in all samples. Selection of species was based on the inspection of initial laboratory data (species abundance throughout the site), feeding type, and known association with environmental conditions, particularly substrates. Each of the six dominant species were enumerated in all five station replicates; mean species abundances were calculated for each station. Nematodes and harpacticoid copepods were separated from the meiofauna samples and counted. All samples were transferred to 70% alcohol for storage.

Analysis of cadmium and lead concentrations in tissues followed techniques described by EPA (1977). Approximately 5g to 10g of homogenized tissue were digested with nitric acid and hydrogen peroxide while heated. The digests were then evaporated, diluted to volume with deionized water, and analyzed with flame or flameless AAS. Mercury concentrations in tissues were determined by digestion of an 8g to 10g sample with concentrated nitric and sulfuric acids and potassium permanganate, reduction of the ionized mercury with hydroxylamine and stannous sulfate, and analysis with cold-vapor AAS (EPA, 1979).

Tissue analyses for CHC's required homogenization of 50g of tissue with sodium sulfate, extraction with hexane, cleanup, fractionation, and analysis with electron capture gas chromatography (EPA, 1974).

COMPUTER DATA ENTRY AND ANALYSIS

All data were entered into the Interstate's computerized Oceanic Data and Environmental Evaluation Program data base (ODEEP). Statistical analyses included calculation of means, variances, map plots, correlations, and analysis of variance. Statistics were run for the various partitions in the data: surveys, stations, station depth, and cast number for each variable analyzed. Correlations were run between parameter values measured for individual sediment samples (casts).

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RESULTS

PHYSICAL AND CHEMICAL PARAMETERS

HYDROGRAPHY

Water depths in the survey area ranged from a minimum of 13m at Stations 1 and 4 to a maximum of 18m at Station 6, located in the northeast corner of the study area (Figure A-1).

For both surveys, temperature showed a slight decrease (approximately 0.5°C) with greater distance from land. March temperatures decreased from about 13.8°C at the surface to about 12.5°C near the bottom. December temperatures showed no consistent variation with depth and ranged between 17.0 and 18.3°C (Table A-3).

Salinity during the March survey increased with depth (about 0.4°/oo to 1.6°/oo) and with distance from land (approximately 1°/oo to 2°/oo) for the stations sampled (Table A-4). The overall range for March was 32.4°/oo at the surface (inshore Station 9) to 35.2°/oo near the bottom at offshore Station 7. In December, salinities ranged from 26.3°/oo at the surface (Station 9) to 33.6°/oo at the bottom (Station 1). Based on the other temperature and salinity data collected, the relatively low salinities for Station 7, which is influenced by the warm and saline Gulf Stream, may be incorrect. Little stratification was present during March or December.

WATER COLUMN CHEMISTRY

Trace metal (lead, mercury, cadmium) and CHC levels were less than 0.4 µg/liter for both dissolved and particulate phases, with lead present at the highest levels (Tables A-5 and A-6). Levels of pesticides and PCB's were generally undetectable except for a small amounts of op'DDE (dichlorodiphenylethylene) and pp'DDE (0.4 ng/liter and 0.7 ng/liter, respectively) within the ODMDS. Concentrations of suspended particulate matter were normal for coastal waters, ranging from 0.8 to 5.3 mg/liter (Table A-7); this parameter was determined for the March survey only.

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TABLE A-3
TEMPERATURES (°C) RECORDED FROM THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

	Station*									
	1		6		7		8		9	
Depth	March	December	March	December	March	December	March	December	March	December
Surface (0 to 2m)	13.2†	17.3	13.0	17.0	13.3	17.1	13.8	17.5	13.5	17.5
Bottom (12 to 15m)	12.3†	18.3	12.2	17.0	12.5	18.3	12.3	17.2	12.3†	17.0

* See Figure A-1 for station locations
† Values are means of two samples

TABLE A-4
SALINITIES (°/oo) RECORDED FROM THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

	Station*									
	1		6		7		8		9	
Depth	March	December	March	December	March	December	March	December	March	December
Surface (0 to 2m)	33.055†	32.476	-	31.956	33.700	30.437	32.904	31.961	32.352	26.299
Middepth (7 to 9m)	-	33.109	34.424	32.988	-	-	-	-	32.816	-
Bottom (12 to 15m)	34.552†	33.598	34.835	33.462	35.213	30.101	34.298	32.850	34.682	30.175

* See Figure A-1 for station locations
† Values are means of two samples

TABLE A-5
WATER COLUMN CONCENTRATIONS (µg/liter) OF SELECTED TRACE METALS IN THE VICINITY OF THE EXISTING SITE AS MEASURED BY EPA/IEC IN MARCH AND DECEMBER 1979.

	March			December			Water Quality Criteria*	
Location/Metal	Dissolved	Particulate	Total	Dissolved	Particulate	Total	24-Hour Average	Single Measurement
Station 1 (Center of Site)								
Mercury	0.045	< 0.023	<0.068	< 0.030	0.002	<0.032	0.025	3.7
Cadmium	0.090	0.006	0.096	0.065	0.005	0.070	4.5	59
Lead	0.072	0.054	0.126	0.098	0.024	0.122	-	-
Station 6 (NE of Site)								
Mercury	0.022	< 0.033	<0.055	< 0.030	0.002	<0.032	0.025	3.7
Cadmium	0.044	0.012	0.056	0.104	0.013	0.117	4.5	59
Lead	0.380	0.233	0.613	0.288	0.041	0.329	-	-

* 45 FR 79318 et seq.

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TABLE A-6
WATER (ng/liter) AND SEDIMENT (ng/g) CONCENTRATIONS OF PESTICIDES AND PCB's WITHIN (STATION 1) AND ADJACENT (STATION 6) TO THE JACKSONVILLE HARBOR ODMDS. BASED ON EPA/IEC SURVEY IN DECEMBER 1979.

	Water Column				Sediment					
	March		December		March		December*			
Constituent	Sta 1	Sta 6	Sta 1	Sta 6	Sta 1	Sta 6	Sta 1		Sta 6	
Aldrin	†	†	†	†	†	†	†	†	†	†
Dieldrin	†	†	†	†	†	†	†	†	†	†
Endrin	†	†	†	†	†	†	†	†	†	†
βBHC	†	†	†	†	†	†	†	†	†	†
Heptachlor	†	†	†	†	†	†	†	†	†	†
op'DDE	†	†	0.37	†	†	†	1.31	0.09	0.09	0.09
pp'DDE	0.7	†	†	†	†	†	0.08	0.05	0.04	†
pp'DDD	†	†	†	†	†	†	†	†	†	†
pp'DDT	†	†	†	†	†	†	†	†	†	†
Hept. Epox.	†	†	†	†	†	†	†	†	†	†
Methoxychlor	†	†	†	†	†	†	†	†	†	†
Chlordane	†	†	†	†	†	†	†	†	†	†
PCB's:										
1016	†	†	†	†	†	†	0.9	†	†	†
1221	†	†	†	†	†	†	†	†	†	†
1232	†	†	†	†	†	†	†	†	†	†
1242	†	†	†	†	†	†	†	†	†	†
1246	†	†	†	†	†	†	†	†	†	†
1254	†	†	†	†	6.0	0.8	14.56	2.51	0.19	0.4
1260	†	†	†	†	†	†	†	†	†	†
1262	†	†	†	†	†	†	†	†	†	†

* Duplicate samples from separate box cores
† Below detection limits

KEY: βBHC = hexachlorocyclohexane
op'DDE = op'dichlorodiphenylethylene
pp'DDE = pp'dichlorodiphenylethylene
pp'DDD = pp'dichlorodiphenyldichloroethane
pp'DDT = pp'dichlorodiphenyltrichloroethane
Hept. Epox. = heptachlor epoxide

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TABLE A-7
TOTAL SUSPENDED SOLID CONCENTRATIONS (mg/liter) IN THE WATER AT THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

	March		December	
Station*	Surface	Bottom	Surface	Bottom
1	2.5	1.3	1.2	3.8
9	2.5	2.0	2.4	5.3
6	3.1	1.3	3.2	2.1
7	3.3	2.8	1.7	2.4
8	0.8	1.7	2.4	3.9

* See Figure A-1 for station locations

Dissolved oxygen levels indicated that waters in the survey area were well oxygenated and exhibited no clear spatial trends. Results for both surveys were similar, with a surface maximum of 9.0 mg/liter, and a bottom minimum of 7.2 mg/liter (Table A-8). Dissolved oxygen levels were consistently greater near the surface (0.4 to 1.3 mg/liter) than near the bottom for all stations sampled.

SEDIMENT PARAMETERS

Sediment type and chemical parameters indicated patchy distributions in the vicinity of the Jacksonville Harbor ODMDS. These data were analyzed using two approaches: (1) comparison of the center station with the other nine stations; Station 1 appears to be the only sample set collected within the site proper; and (2) comparison of Stations 1 through 5 (at the center and near the corners of the site) with Stations 6 through 10 (located well outside the site). The assumption for the latter comparison is that any spreading and transport of deposited materials would be more likely to affect the stations near the site than the more distant control stations.

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TABLE A-8
DISSOLVED OXYGEN CONCENTRATIONS AT THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN 1979.

Station	Depth (m)	mg/liter	% Saturation	N
		March 1979		
1	Surface (2m)	8.9	107	4
	Mid (8m)	8.1	97*	2
	Bottom (15m)	8.2	98	2
6	Surface (9m)	8.2	100	2
	Bottom (14m)	7.7	92	2
7	Surface (2m)	8.5	103	3
	Bottom (14m)	8.1	98	2
8	Surface (0m)	9.0	110	2
	Bottom (14m)	8.1	97	2
9	Surface (2m)	8.9	108	4
	Bottom (14m)	8.0	96	2
		December 1979		
1	Surface (2m)	8.1	106	2
	Bottom (12m)	7.6	102	2
6	Surface (2m)	8.5	110	2
	Bottom (15m)	7.2	94	2
7	Surface (2m)	8.6	110	2
	Bottom (13m)	7.5	98	2
8	Surface (2m)	8.6	112	2
	Bottom (12m)	7.4	97	1
9	Surface (2m)	8.0	101	2
	Bottom (12m)	7.9	101	2

* Values based on temperature and salinity measurements obtained at 12m

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Table A-9 presents sediment data collected during the two surveys. Grain size variations were large, with percent fines (silt plus clay) varying from 1.0% to about 29.0%. The majority of samples, however, contained less than 15% fines (Tables A-9 and A-10). Sand was generally the dominant sediment type; gravel (>2 mm) content was high (>10%) at only two stations. In general, the sediments of the area were variable, exhibiting no consistent trend.

Trace metal distributions were variable, but generally at low levels. Mercury concentrations were similar for both surveys (Table A-9). Cadmium and lead concentrations generally showed large increases from the March to the December survey (Table A-9). The cause of these increases is not clear from the survey data, but may have been an artifact of the analyses.

Total organic carbon (TOC) concentrations were generally low (<5 mg/g) with a few high values found within the site (e.g., 29 mg/g at Station 1 during March). Contrary to the lead and cadmium data, the TOC data indicate a decrease from March to December at most stations (Table A-9). Again, the reason for this decrease is unclear. Oil and grease values generally were low, but highly variable, with no clear differences between surveys. Highest oil and grease values (up to 473 mg/kg) appeared to be randomly distributed.

CHC's (Table A-6) generally were undetectable, with the exception of op'DDE, pp'DDE, and PCB's (Arochlors 1016 and 1254). Levels of these compounds were all less than 15 ng/g, with highest concentrations for both surveys at Station 1. Because sediments were analyzed only from two stations (1 and 6), comparisons between surveys are not warranted. Based on replicates for a given station, these compounds also appear to be heterogeneously distributed. Petroleum hydrocarbons are primarily of anthropogenic origin and are found in sediments both within and adjacent to the disposal site (Table A-11).

When Station 1 is compared with the other stations, no clear differences are evident. Trace metals and oil and grease levels at Station 1 are intermediate relative to values found at the other stations (Table A-9). The

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TABLE A-9
SEDIMENT PARAMETERS FOR THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

Station*	Replicate	TOC (mg/g)		Mercury (ng/g)		Cadmium (ng/g)		Lead (ng/g)		% Fines†		Oil and Grease (mg/kg)	
		March	December	March	December	March	December	March	December	March	December	March	December
1	1	29.10	2.00	7	<0.3	8	16	<15	840	15.0	17.3	137	343
	2	6.90	4.30	1	2	9	26	<15	640	3.4	4.2	80	33
2	1	1.90	2.60	3	5	21	28	320	780	0.7	7.9	37	66
	2	4.45	0.91	5	3	4	28	<15	1,300	1.8	0.0	69	69
3	1	1.40	3.40	3	2	22	56	430	2,200	2.0	14.6	98	164
	2	5.30	0.54	6	12	14	32	<15	780	10.0	19.9	336	473
4	1	0.40	3.00	3	1	20	50	365	1,100	1.4	0.0	29	11
	2	8.90	0.62	4	1	50	28	430	1,000	2.1	0.6	36	8
5	1	6.50	0.79	4	1	10	11	<15	720	11.7	0.0	166	29
	2	1.50	5.90	5	29	17	28	260	770	1.8	21.2	28	416
6	1	0.50	0.33	14	3	<1.5	213	<15	990	1.6	2.0	135	15
	2	4.30	1.40	6	1	3	36	<15	920	4.8	1.6	190	30
7	1	3.30	1.40	7	1	<1.5	40	<15	840	4.1	0.4	277	15
	2	1.70	1.30	2	1	19	43	270	590	1.0	0.7	23	10
8	1	1.50	0.74	5	1	11	42	270	910	2.9	0.0	80	6
	2	5.50	0.82	40	1	<1.5	44	<15	630	43.9	1.0	296	5
9	1	4.10	1.70	7	1	13	24	310	830	1.0	0.0	20	19
	2	0.70	1.00	3	1	8	28	185	910	0.9	0.0	19	17
10	1	5.10	1.90	5	5	9	26	350	1,800	1.4	6.8	44	89
	2	4.30	1.80	3	7	8	26	200	830	10.2	12.5	42	270

* See Figure A-1 for station locations.
† Values listed for % fines are for samples from which sediment chemical analyses are derived. A total of seven sediment samples were examined for grain size for each survey. These data are summarized elsewhere in this appendix.

% fines = silt + clay (<0.0625mm)
mg/kg = ppm
ng/g = ppb

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TABLE A-10
MEAN PERCENT OF SILT AND CLAY IN SEDIMENTS FROM THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

Station	% Gravel		% Sand		% Fines	
	March	December	March	December	March	December
1	15.6 (18.1)	4.1 (4.1)†	55.4 (20.1)	88.7 (8.0)†	29.0 (21.9)	7.2 (5.1)†
2	2.7 (1.9)	3.4 (4.7)	88.9 (13.1)	87.1 (7.7)	8.3 (12.7)	9.0 (8.4)
3	9.0 (20.0)	0.4 (0.6)	85.0 (19.3)	85.4 (12.1)	6.0 (3.9)	14.3 (12.2)
4	0.2 (0.2)	0.5 (0.4)	92.3 (12.5)	96.3 (2.1)	7.5 (12.5)	3.3 (2.2)
5	2.0 (1.5)	8.4 (11.5)	82.5 (14.4)	74.5 (17.3)	15.5 (14.3)	16.9 (14.6)
6	0.7 (0.8)	1.6 (3.0)	96.2 (1.4)	94.8 (7.1)	3.1 (1.4)	3.6 (7.1)
7	1.0 (0.7)	0.8 (0.4)	96.3 (1.5)	98.2 (0.6)	2.7 (1.8)	1.1 (0.5)
8	1.0 (1.1)	1.0 (1.2)	81.2 (17.9)	97.8 (1.0)	17.8 (18.4)	1.0 (0.6)
9	1.4 (1.5)	1.6 (1.2)	95.2 (3.7)	88.0 (23.7)	3.4 (2.8)	10.2 (24.3)
10	6.9 (8.2)*	11.5 (14.7)	79.1 (27.4)*	81.7 (17.5)	14.0 (27.8)*	6.7 (6.1)

* n = 11
† n = 6

Notes: ± one standard deviation; all n = 7 except where noted; values were generated from seven replicate sediment cores

maximum TOC value (29.1 mg/g) was found at Station 1 for the March survey, but in December, the value for Station 1 was in the middle of the range for all stations.

Table A-12 compares mean concentrations determined for each sediment parameter at dump site stations (1 through 5) with those at background stations (6 through 10). Considering the large standard deviations, most parameters show little or no differences inside versus outside the site. Mean TOC, lead, and percent fines values were greater inside relative to outside the site for both surveys, but the differences were not large and usually not statistically significant.

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TABLE A-11
SUMMARY OF SEDIMENT HYDROCARBON ANALYSES WITHIN AND ADJACENT TO THE EXISTING SITE. BASED ON EPA/IEC SURVEY, DECEMBER 1979.

Station Number*/ Sample Number	TOC (mg/g)	Wet weight (g)	Dry weight (g)	Liquid weight (μg/g)	Total f_1 GRAV (μg/g)	Resolved f_1 GC (μg/g)	CPI	AKL/ ISO	f_1/TOC ($\times 10^4$)	Total f_2 GRAV (μg/g)	Resolved f_2 GC (μg/g)	Source classi-fication†
1/1	2.0	81.4	49.8	343	48	0.56	4.0	0.21	240	26	2.0	3/1
1/2	4.3	68.0	53.7	32	1	0.04	2.1	3.6	2	4	0.34	4/3
6/2	0.33	65.8	52.8	15	1	0.14	5.0	3.4	30	1	0.18	5
6/4	1.4	60.0	49.5	30	2	0.08	3.6	2.6	14	1	0.29	5

* See Figure A-1 for station locations.

† Source classifications:

Source 1 - terrigenous biogenic materials

Source 2 - marine biogenic materials

Source 3 - chronic petroleum contamination

Source 4 - pyrogenic polynuclear aromatic hydrocarbons

Source 5 - fuel oil

Source 6 - crude or bunker oil

TOC = Total organic carbon

f_1 = Aliphatic hydrocarbons

f_2 = Aromatic hydrocarbons

GRAV = Gravimetric analysis

GC = Gas chromatograph

ALK/ISO = Alkanes/isoprenoids

CPI = Carbon reference index (C_{26}-C_{30})

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TABLE A-12
MEAN TRACE CONTAMINANT CONCENTRATIONS IN SEDIMENTS FROM THE EXISTING SITE (IN) AND ADJACENT AREAS (OUT). BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

Contaminant	Location	March	December
Total Organic Carbon (mg/g)	In	6.6 (8.4)	2.4 (1.8)
	Out	3.1 (1.8)	1.2 (0.5)
Mercury (ng/g)	In	4.1 (1.7)	5.6 (8.9)
	Out	9.2 (11.3)	2.2 (2.1)
Cadmium* (ng/g)	In	17.5 (12.9)	30.3 (13.6)
	Out	7.6 (5.8)	52.2 (57.0)
Lead* (ng/g)	In	188 (188.7)	1,013 (462)
	Out	164.5 (137)	925 (332.4)
Oil and grease (mg/kg)	In	101.6 (94.9)	161.2 (180.3)
	Out	112.6 (107.1)	47.6 (81.9)
Silt and clay (%)	In	13.3 (9.5)	10.1 (5.5)
	Out	8.2 (7.2)	4.5 (3.9)

* Weak acid leachable

Notes: In calculation of means values below detection limits assumed to equal detection limits; ± one standard deviation; n = 10

TRACE METALS AND CHLORINATED HYDROCARBONS IN ORGANISMS

Tissues from two species, a sea urchin (*Arbacia punctulata*) and a shrimp, (*Parapenaeus longirostris*) were analyzed for trace constituents (Table A-13). All values are low, but little can be concluded from such a small sample. No historical data from the area for these species were available for comparison.

ELUTRIATE TESTS

Elutriate tests for trace metals were performed in triplicate on two sediment samples collected in December: one from within the site (Station 1) and one from outside the site (Station 6). Ordinarily, the site water for the elutriate test is analyzed for background values prior to mixing with

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TABLE A-13
CONCENTRATIONS (ng/g) OF TRACE METALS AND CHLORINATED HYDROCARBONS IN TISSUES COLLECTED AT THE JACKSONVILLE HARBOR ODMDS. ALL OTHER CHC'S IN THE STANDARD SCAN WERE UNDETECTED. BASED UPON EPA/IEC SURVEY IN MARCH 1979.

Station*	Organism	Mercury	Cadmium	Lead	CHC
1	Urchin (*Arbacia punctulata*)	29.0	644.0	1470.0	5.5 (pp'DDE)
6	Shrimp (*Parapenaeus longirostris*)	<9.0	67.0	<250.0	2.7 (pp'DDE)

* See Figure A-1 for station locations

sediment; however, this analysis was not performed. Therefore, comparisons of trace metal levels in test water will be made with levels measured for water in the region during the surveys.

The elutriate tests produced variable results but no substantial release of trace metals was indicated (Table A-14). The test on sediments from Station 1 produced values for mercury, cadmium, and lead which were within the range of water column concentrations (Table A-5) measured during both surveys. One of three replicates for the Station 6 sediments produced values of 0.3 µg/liter for dissolved cadmium and 2.2 µg/liter for dissolved lead (Table A-14), compared to observed maxima during the surveys of 0.1 µg/liter and 0.4 µg/liter, respectively (Table A-5). This release did not occur in the other two replicate tests on this sample. In any case, metal concentrations of this magnitude are well below any known levels of toxicity for cadmium and lead.

BIOLOGICAL PARAMETERS

MEIOFAUNA

The nematode-to-harpacticoid copepod ratio may act as a signature for differences in sediment type. Raffaelli and Mason (1981) report a negative correlation between the nematode:harpacticoid copepod ratio and median

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TABLE A-14
CHEMICAL AND SEDIMENTOLOGICAL DATA ELUTRIATE TEST FOR TRACE METALS.
BASED ON EPA/IEC SURVEY IN DECEMBER 1979.

Station*	Replicate	Trace Metals (µg/liter)		
		Mercury	Cadmium	Lead
1	1	<0.05	0.09	<0.27
1	2	<0.05	0.02	<0.27
1	3	<0.05	0.06	<0.27
6	1	<0.05	0.30	2.2
6	2	<0.05	0.11	<0.26
6	3	<0.05	0.05	<0.26

*See Figure A-1 for station locations

particle size. Additionally, as the organic content of fine sand increases, deposit-feeding nematodes increase and/or copepods decrease, leading to a higher nematode:harpacticoid copepod ratio. Therefore, a ratio between these two groups may prove to be a monitoring tool to study shifts in grain size.

Meiofauna results from the EPA/IEC surveys of the Existing Site and surrounding areas are inconclusive, but may provide baseline values for subsequent monitoring. The nematode:harpacticoid copepod ratios ranged from 3.8 to 146.0. The lowest values occurred at Stations 2, 3, and 7, located within the boundaries of dredged materials from Mayport Harbor deposited in 1973 by the U.S. Navy (Figure A-2; NAVOCEANO, 1973). The highest value was calculated for Station 1, at the center of the disposal site.

MACROFAUNA

A total of 110 species were collected over both surveys: 64 in March and 69 in December (Table A-15). Polychaete worms were most abundant during both surveys, followed by amphipods and bivalves (Table A-16). Bivalve species more abundant in December.

The seven dominant species over both surveys were the polychaetes Mediomastus ambiseta, Prionospio cristata, Spio pettiboneae, and Glycera oxycephala, the cumacean Oxyurostylis smithi; the amphipod Trichophoxus

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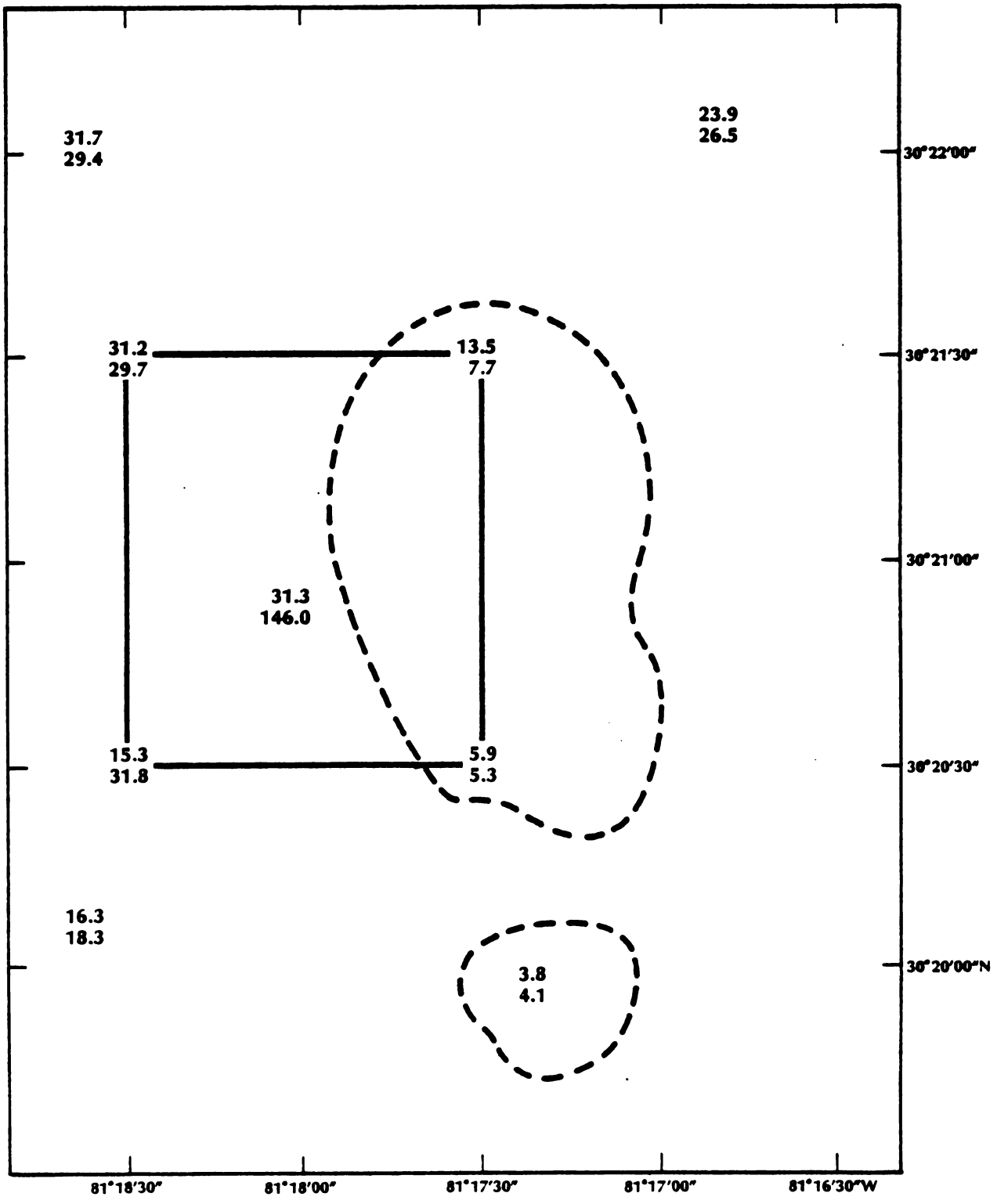

NEMATODE: HARPACTICOID COPEPOD RATIO

Figure A-2. Nematode:Harpacticoid Copepod Ratio within the Existing Site and Surrounding Areas. Dashed lines delineate the location of dredged material from Mayport Harbor deposited by the Navy in 1973. Ratios based on EPA/IEC Survey in March 1979.

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TABLE A-15
MACROFAUNAL SPECIES COLLECTED FROM THE EXISTING SITE AND SURROUNDING AREA. BASED ON EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979.

Species	Mar	Dec	Species	Mar	Dec
NEMERTINEA:			P. dayi	X	X
Nemertea:	X		P. nr. steenstrupi		X
Tubulanus pellucidus	X	X	Spio pettiboneae	X	X
			Spiophanes bombyx	X	X
ANNELIDA:			S. missionensis		X
Oligochaeta	X	X	Magelona phyllisae	X	X
Polychaeta:		X	Caulleriella killariensis		X
Sigambra wassi	X		Tharyx acutus		X
Synelmis albini		X	T. annulosus	X	
Podarke obscura	X		Aedicera belgicae	X	
Parapionosyllis longicirrata	X		Aricidea fauveli	X	
Syllis gracilis		X	A. fragilis	X	
Ceratocephale loveni	X	X	A. jeffreysii	X	
Ceratonereis irratibilis	X		A. suecica	X	
Hesionidae		X	A. taylori		X
Nereis lamellosa	X		A. wassi		X
N. pelagica	X		Aricidea sp.	X	
N. succinea		X	Cirrophorus lyriformis		X
N. virens	X	X	Paraonis fulgens		X
Aglaophamus verrilli		X	P. gracilis	X	
Nephtys picta	X	X	P. pygoenigmatica	X	
Glycera dibranchiata		X	Armandia maculata		X
G. oxycephala	X	X	Asabellides oculatus	X	X
G. papillosa	X		Mediomastus ambiseta	X	X
G. tesselata	X		Ampharete americana	X	
Goniada norvegica		X	Protodrilus symbioticus	X	X
Goniadella gracilis	X				
Goniadides carolinae		X	MOLLUSCA:		X
Diopatra cuprea		X	Bivalvia:	X	
Onuphis nebulosa	X		Astarte subequilatera		X
Protdorvillea kefersteini	X	X	Macrocallista nimbosa		X
Lumbrineris tenuis		X	Corbula swiftiana		X
L. tetraura	X		Corbula sp.		X
Nerinides unidentata	X		Strigilla mirabilis		X
Prionospio cirrifera	X	X	Parvilucina multilineata		X
P. cristata	X	X	Crassinella lunulata		X

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TABLE A-15 (Continued)

Species	Mar	Dec	Species	Mar	Dec
C. martinicensis		X	Isopoda:		
Modiolus modiolus		X	*Edotea triloba*	X	
Macoma mera		X	Ostracoda:		
Tellina versicolor	X	X	*Sarsiella capsula*		X
Bivalve sp. C	X		Decapoda:		
Bivalve sp. D	X		Anomura	X	
Bivalve sp. F	X		*Pagurus longicarpus*	X	
Gastropoda:			*Pagurus* sp.		X
Natica pusilla		X	*Pinnixa chaetopterana*		X
Cylichna verrilli	X		*Callianassa atlantica*		X
Turridae		X			
Acteocina candei		X	SIPUNCULA:		
			Sipunculoidea	X	
ARTHROPODA:		X	Golfingiidae		X
Cumacea:					
Oxyurostylis smithi	X	X	ECHINODERMATA:		X
Cyclaspis varians	X		Asteroidea:		
Amphipoda:			*Asterias* sp.	X	
Trichophoxus floridanus	X	X	Ophiuroidea:		
Platyischnopus mirabilis	X	X	*Ophiophragmus wurdemani*		X
Protohaustorius wigleyi	X	X	Holothuroidea:		
Acanthohaustorius millsi		X	*Thyone briareus*		X
A. intermedius	X	X			
Unciola serrata	X	X	CHORDATA:		
Unciola sp.	X		Cephalochordata:		
Tiron sp.		X	*Branchiostoma caribaeum*	X	X
Lembos websteri	X				
Microprotopus sp.	X				
Oedicerotidae	X				
Batea catharinensis	X				
Cerapus tubularis	X				

floridanus; and the bivalve *Tellina versicolor*. Except for *G. oxycephala*, all species are motile, small-bodied (less than 2 cm) deposit feeders, which live in the top few centimeters of sediment (Table A-17). *Glycera oxycephala* is motile in sandy sediments and probably carnivorous (Fauchald and Jumars, 1979), growing to 7 cm in body length.

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TABLE A-16
NUMBER OF MACROFAUNAL SPECIES COLLECTED
DURING EPA/IEC SURVEYS IN 1979

Taxon	March		December	
	Number	Percent	Number	Percent
Nemertea	2	3.2	1	1.5
Annelida:				
Polychaeta	37	59.7	34	51.5
Oligochaeta	1	1.6	1	1.5
Mollusca:				
Bivalvia	3	4.8	11	16.7
Gastropoda	1	1.6	3	4.5
Arthropoda:				
Cumacea	2	3.2	1	1.5
Amphipoda	11	17.7	7	10.6
Isopoda	1	1.6	0	0.0
Ostracoda	0	0.0	1	1.5
Decapoda	1	1.6	3	4.5
Sipunculida	1	1.6	1	1.5
Echinodermata	1	1.6	2	3.0
Chordata	1	1.6	1	1.5
Total	62	99.9	66	99.9

Mean abundances of the seven species at each station for both surveys are given in Table A-18. Four of the species (M. ambiseta, P. cristata, O. smithi, and S. pettiboneae) were more abundant in March than in December.

Spatial averaging plots were compiled for each species displaying density patterns within the study area. Mediomastus ambiseta, P. cristata, O. smithi, and S. pettiboneae were more abundant in the northern-to-western part of the study area (Figures A-3 to A-6); densities were less in the southeastern section which usually incorporated part of the disposal site. In contrast, G. oxycephala and T. floridanus displayed an opposite trend. Both species were generally more abundant in December than in March, and greater densities

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TABLE A-17
BIOLOGICAL NOTES AND DENSITY PATTERNS OF THE SEVEN DOMINANT SPECIES WITHIN THE STUDY AREA

Species	Biological Notes	Density Patterns
Mediomastus ambiseta	Capitellid polychaete; small threadlike body (<2.0 cm); burrowing deposit feeder; probably with short life cycle; muddy sand	Abundant in March, lower density through center of dump site and southeast section of study area; abundance low in December, very low density in southeast study area
Oxyurostylis smithi	Cumacean crustacean; small-bodied (<1.0 cm) surface deposit feeder; sand	Abundant in March, low density in center of site and southeast study area; abundance low in December, uniform except for very low density in southwest corner of dump site
Spio pettiboneae	Spionid polychaete; small-bodied (≤2.0 cm); tubiculous, surface, deposit, or suspension feeder; probably with short life cycle; sand to sandy mud	Abundant in March, less dense in December; density patterns similar to that of *O. smithi*
Prionospio cristata	Same as for *S. pettiboneae*	Abundant in March, less dense in December; higher density in western part of study area, grades to low density in southeastern study area
Trichophoxus floridanus	Amphipod crustacean; small-bodied (<0.5 cm); deposit feeder; medium-fine unstable sands	Less abundant in March than December; lower densities in northwestern part of study area
Glycera oxycephala	Glycerid polychaeta; long, slender, up to 7 cm; carnivore	Less abundant in March than December; higher densities in southern part of study area
Tellina versicolor	Tellinid clam; small-bodied (≤1.7 cm, deposit feeder	More abundant in December than March; no spatial patterns

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TABLE A-18
RANK AND MEAN DENSITY OF FIVE REPLICATES FOR THE SEVEN DOMINANT SPECIES WITHIN THE STUDY AREA

Species	Rank		Station																			
			1		2		3		4		5		6		7		8		9		10	
	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec	Mar	Dec
Mediomastus ambiseta	1	1	17.8	10.8*	50.4	2.4	397.0	0.0	59.8	0.0	278.6	2.6	51.2	45.2	0.0	0.4	255.6	0.6	145.4	10.0	546.4	7.2
Oxyurostylis smithi	2	3	6.4	1.5*	23.0	4.2	16.2	6.0	103.6	0.0	21.4	3.4	124.0	1.8	32.2	1.2	56.4	1.0	222.0	5.8	135.2	3.4
Spio pettibonese	3	4	14.4	8.5*	13.8	1.4	10.4	0.6	8.2	2.0	15.0	2.2	21.8	2.2	14.2	1.6	12.4	1.4	58.6	3.0	33.6	2.2
Prionospio cristata	4	2	22.0	2.5*	6.6	0.4	5.4	0.0	1.0	0.0	14.4	5.8	3.4	13.2	0.2	0.2	0.8	0.0	16.4	2.4	24.4	7.0
Trichophoxus floridanus	5	5	1.2	3.0*	1.2	0.8	0.6	1.4	0.8	1.6	0.2	0.6	1.2	3.4	5.4	5.0	0.8	2.4	0.8	2.8	3.0	0.8
Glycera oxycephala	6	7	0.0	1.5*	0.2	0.0	0.8	0.6	1.8	2.4	0.4	0.0	0.4	0.0	1.2	1.6	0.4	2.8	0.4	0.4	0.2	1.6
Tellina versicolor	7	6	0.2	0.0*	0.4	3.4	1.0	4.4	1.0	1.8	0.2	1.2	1.0	2.0	0.8	2.8	0.4	2.2	0.0	2.8	0.0	0.2

* n = 4; all others n = 5;

Note: Mean individuals/0.06 m^2

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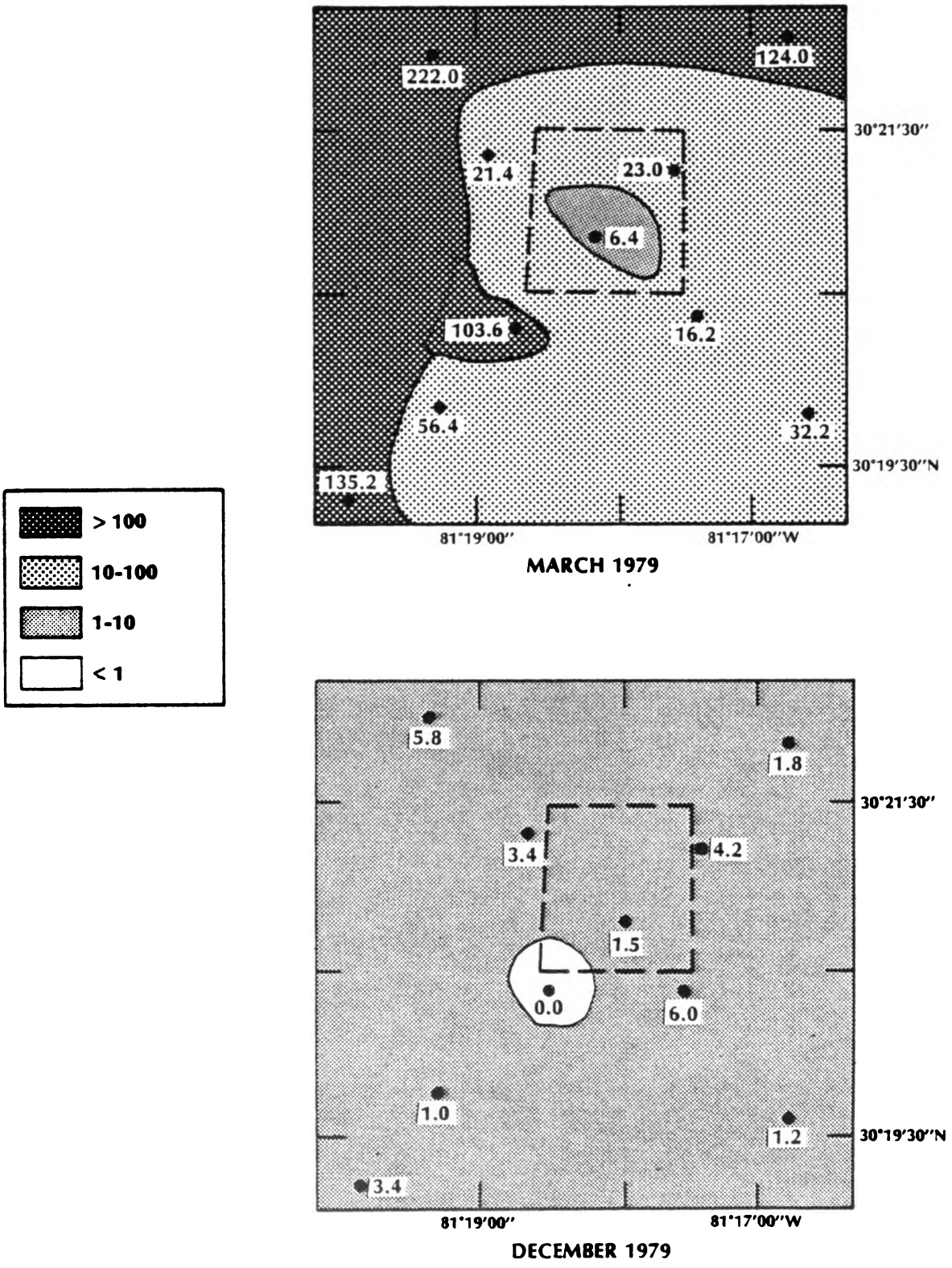

Figure A-5. Density of the Polychaete Oxyurostylis smithi within the Existing Site (dashed line) and Surrounding Area. Based on EPA/IEC surveys in March and December 1979. (Mean Individuals/0.06 m^2; n = 5 except Station 1 December where n = 4)

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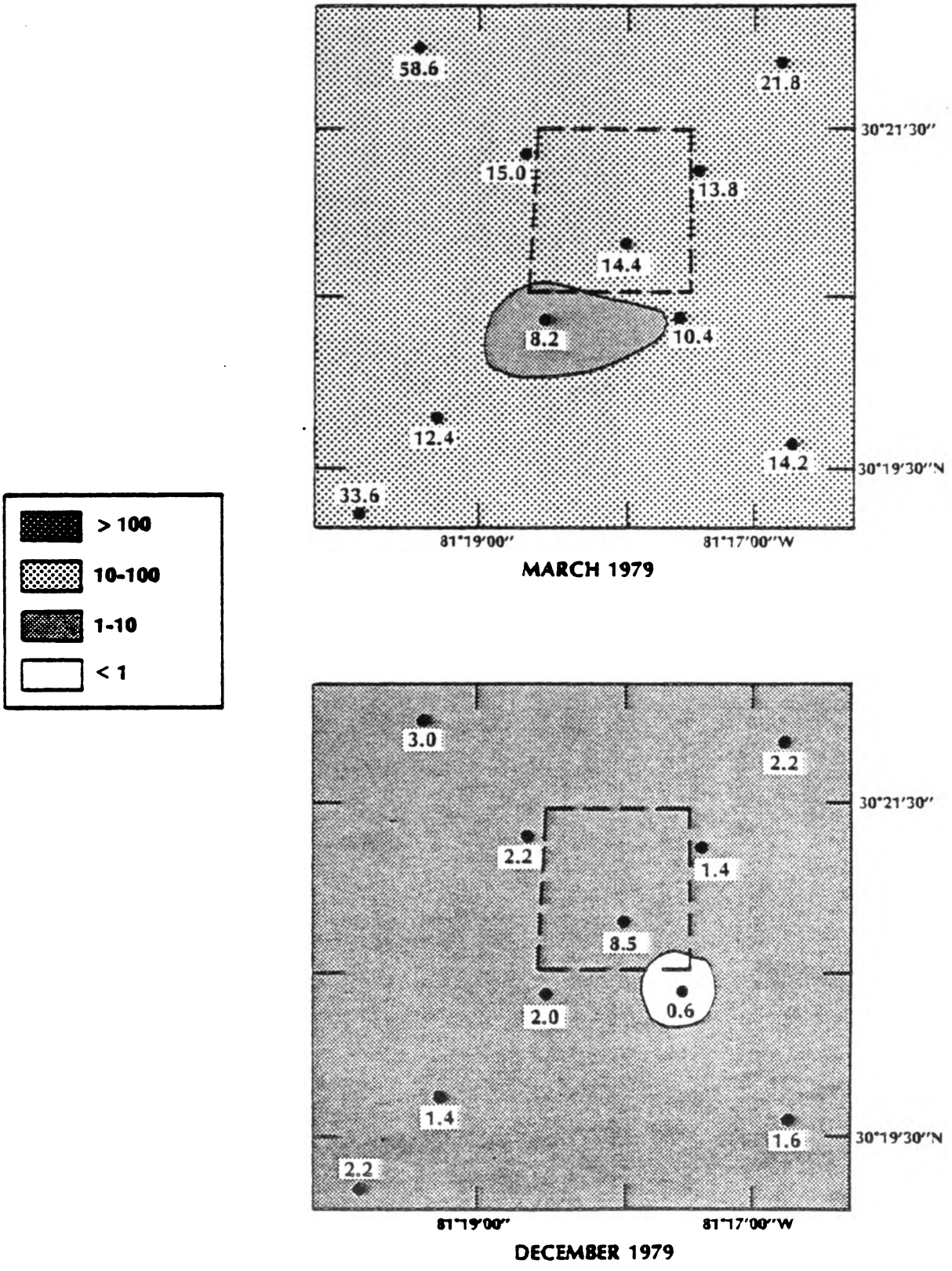

Figure A-6. Density of the Polychaete Spio pettiboneae within the Existing Site (dashed line) and Surrounding Area. Based on EPA/IEC surveys in March and December 1979. (Mean Individuals/0.06 m^2; n = 5 except Station 1 December where n = 4)

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occurred in the southeastern part of the study area (Figures A-7 and A-8). Tellina versicolor also was more abundant in December, but no spatial pattern was evident.

Abundance of each dominant species was tested using two-way analysis of variance on $\log_{10}$ (X+1) transformed data (Table A-19). Glycera oxycephala was the only species not significantly different between surveys; T. floridanus and T. versicolor increased in density, whereas the remaining species became less abundant by the second survey in December. These changes in density most likely reflected seasonal oscillations in the populations. Mean densities were significantly different between stations for all species except S. pettiboneae and T. versicolor.

Changes in patterns of temporal and spatial density were widespread and not limited to the area of the ODMDS. Also, high variability was found among several of the dominant species. For example, during March, M. ambiseta showed considerable differences among replicate samples; values ranged from 4 to 1,359 and 4 to 2,468 individuals per replicate at Stations 3 and 9, respectively. These data suggest that macrofaunal populations are highly variable,

TABLE A-19
RESULTS OF TWO-WAY ANALYSIS OF VARIANCE FOR
DENSITIES OF DOMINANT SPECIES BETWEEN SURVEYS AND STATIONS

Species	Survey		Station		Interaction	
	F-Ratio	Probability	F-Ratio	Probability	F-Ratio	Probability
Mediomastus ambiseta	39.514	< 0.001*	2.037	0.046*	2.178	0.032*
Prionospio cristata	19.833	< 0.001*	5.081	< 0.001*	0.974	0.468 NS
Spio pettiboneae	32.107	< 0.001*	1.192	0.312 NS	0.696	0.711 NS
Oxyurostylis smithii	152.473	< 0.001*	4.312	< 0.001*	3.959	< 0.001*
Glycera oxycephala	2.138	0.148 NS	2.221	0.029*	1.248	0.279 NS
Trichophoxus floridanus	4.116	0.046*	3.728	0.001*	0.599	0.794 NS
Tellina versicolor	18.213	< 0.001*	1.930	0.059 NS	1.049	0.409 NS

* Significant
NS = Nonsignificant

Note: Data transformed $\log_{10}$ (X+1) before analysis

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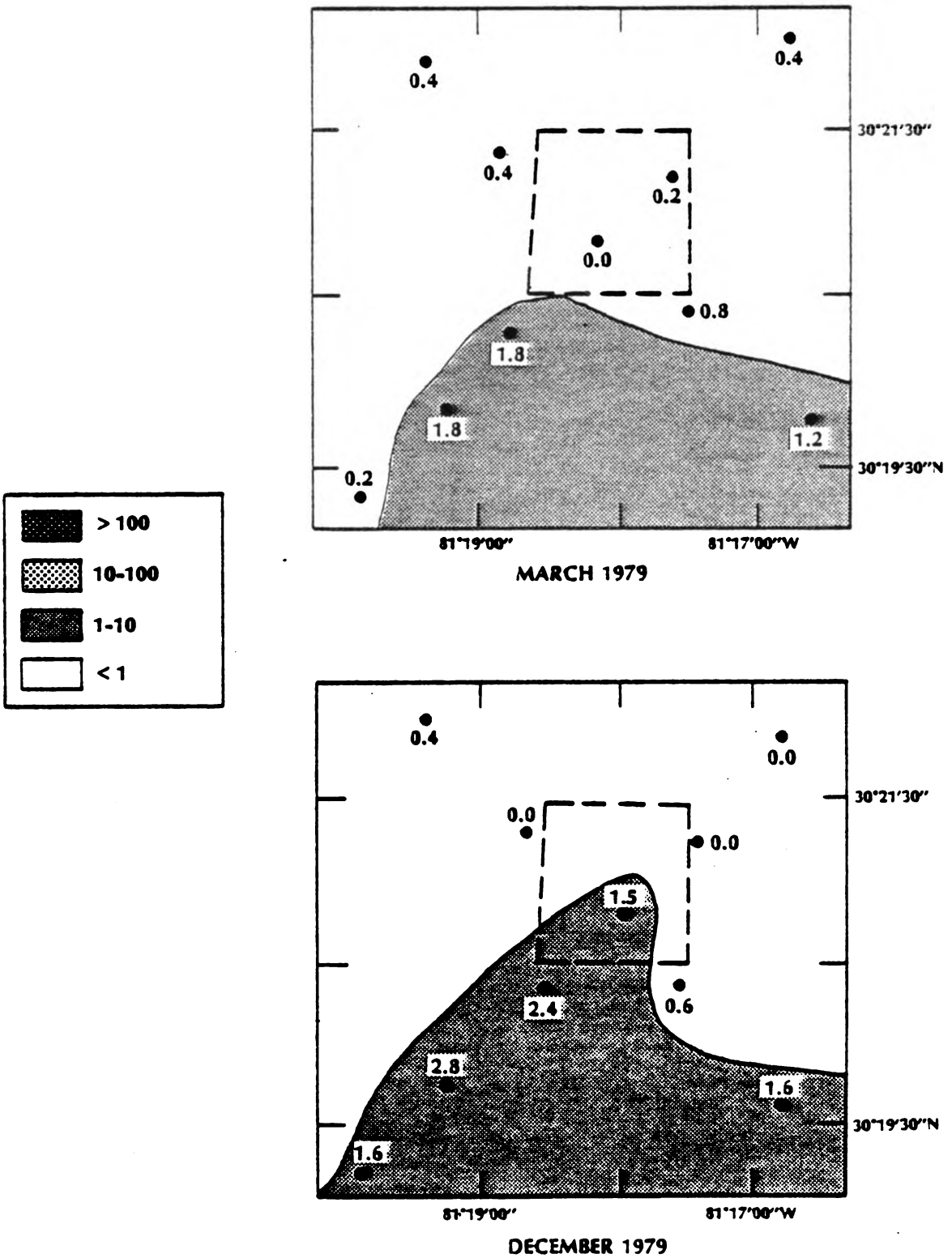

Figure A-7. Density of the Polychaete Glycera oxycephala within the Existing Site (dashed line) and Surrounding Area. Based on EPA/IEC surveys in March and December 1979. (Mean Individuals/0.06 m^2; n = 5 except Station 1 December where n = 4)

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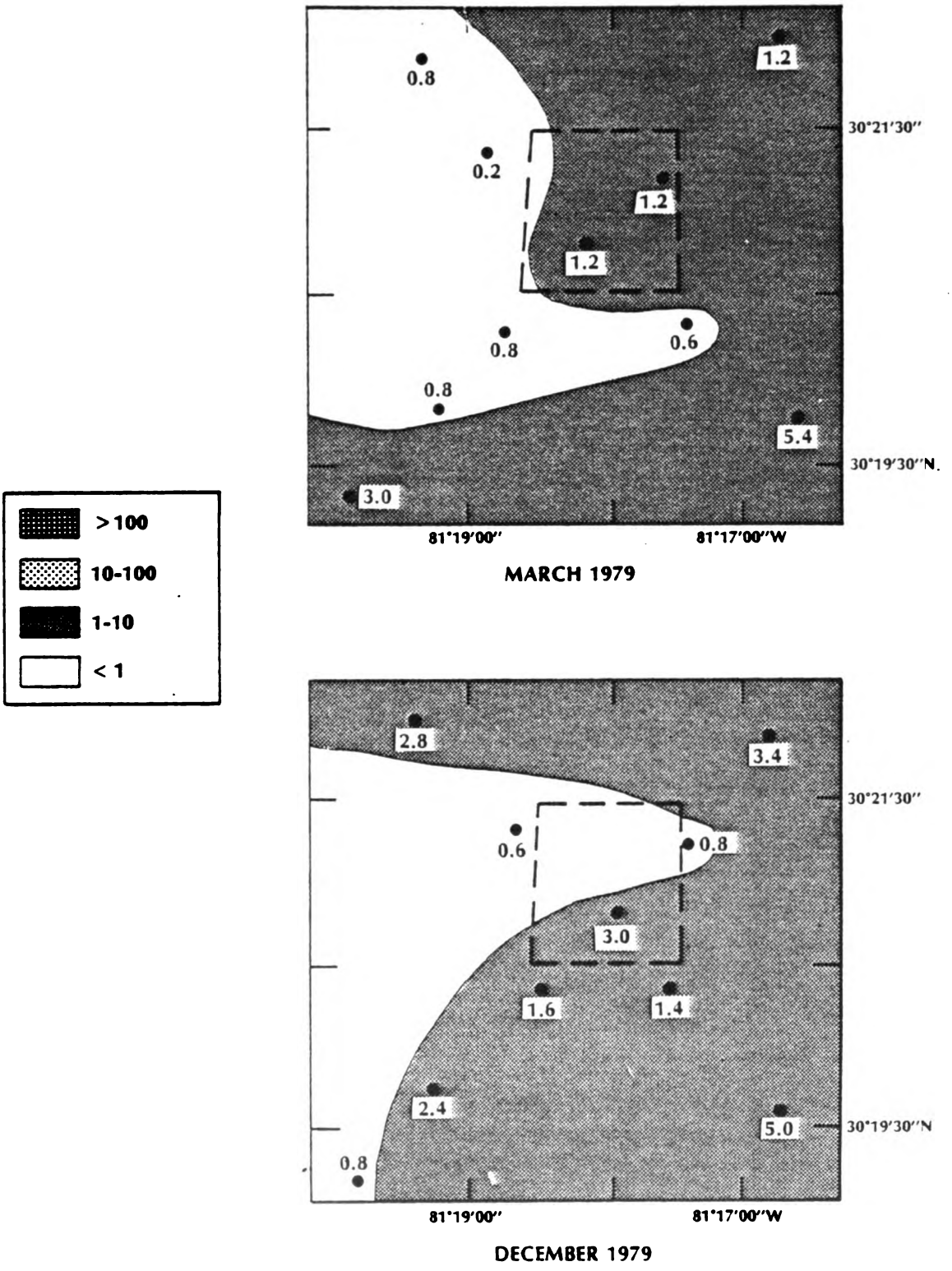

Figure A-8. Density of the Polychaete Trichophoxus floridanus within the Existing Site (dashed line) and Surrounding Area. Based on EPA/IEC surveys in March and December 1979. (Mean Individuals/0.06m^2; n = 5 except Station 1 December where n = 4)

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both temporally and spatially, throughout the entire area. Therefore, because of this variability, the effects of disposal of dredged material on macrofaunal populations could not be isolated from natural fluctuations of these populations.

Due to the high variance displayed among replicate values at each station, seasonal and disposal effects can not be separated. This heterogeneity in the patterns of abundance and distribution of species make attempts to isolate effects of disposal on their populations difficult.

EPIFAUNA AND DEMERSAL FISH

Epifaunal invertebrates and fish generally were similar throughout the entire study area. Several commercially important species of fish were collected, including black sea bass, spot, Gulf and northern kingfish, Gulf Stream flounder, and windowpane flatfish. Commercial crustaceans included swimming and lady crabs. In all cases, the numbers of individuals were low.

A variety of invertebrate species and fish were collected inside and outside the disposal area during the two surveys (Table A-20). The low number of organisms captured in the disposal area reflects the difficulties in trawling and dredging during December. Therefore, specific comparisons between the two surveys cannot be made.

TOTAL AND FECAL COLIFORMS

Total and fecal coliforms were analyzed in sediment samples collected during both EPA/IEC surveys from a station within the site (Station 1) and one control station (Station 6). No tissue samples were collected. The data (Table A-21) showed that total and fecal coliforms were present in high numbers in March but were indeterminate in December. Insufficient data were available to make meaningful comparisons on the distribution of coliforms at the site.

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TABLE A-20
NUMBERS OF FISH AND INVERTEBRATES COLLECTED BY TRAWL WITHIN (STATION 1) AND OUTSIDE (STATION 6) THE EXISTING SITE DURING THE EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979

Scientific Name	Common Name	Station 1		Station 6	
		March	December	March	December
FISH					
Anchoa hepsetus	Striped anchovy			X	X
Balistes carolinensis	Triggerfish				X
Centropristis striatus	Black sea bass	X		X	X
Citharichthys arctifrons	Gulf Stream flounder	X		X	
Leiostomus xanthurus	Spot	X		X	X
Menticirrhus littoralis	Gulf kingfish			X	
M. saxatilis	Northern kingfish	X			X
Osmerus mordax	Rainbow smelt				X
Prionotus scitulus	Leopard searobin	X		X	
P. carolinus	Northern searobin				X
Scopthalmus aquosus	Windowpane			X	X
Stenotomus chrysops	Scup	X			X
Symphurus plagiusa	Blackcheek tonguefish	X		X	
Urophycis regius	Spotted hake			X	
INVERTEBRATES					
Renilla reniformis	Sea pansy			X	
Cubomedusae	Box jellyfish				X
Ctenophora sp. A	Comb jellyfish	X			
Glyceridae	Bloodworm polychaete	X			
Lepidonotus sp.	Scaleworm polychaete			X	
Nephtys squamosa	Polychaete			X	
Nereidae	Clam worm polychaete			X	
Polychaeta sp. A	Polychaete			X	
Hepatus epheliticus	Calico crab			X	
Ovalipes ocellatus	Lady crab			X	
Panopeus herbstii	Crab	X			
Parapanaeus longirostris	Shrimp	X		X	
Portunus gibbesi	Swimming crab			X	
P. spinimanus	Swimming crab				X
Squilla empusa	Mantis shrimp	X		X	
Illex illecebrosus	Flying squid			X	X
Lolliguncula brevis	Brief squid	X			
Barnea truncata	Clam		X		
Bivalve sp. E	Clam	X			
Onchidoris sp.	Nudibranch			X	
Arbacia punctulata	Common sea urchin	X	X		
Encope emarginata	Sand dollar				X
Asterias forbesi	Common seastar	X		X	
Astropecten comptus	Sand seastar			X	
A. duplicatus	Sand seastar				X
Ophiura brevispina	Brittle star			X	
Luidia alternata	Sea star				X

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TABLE A-21
SEDIMENT TOTAL AND FECAL COLIFORM COUNTS WITHIN (STATION 1) AND OUTSIDE (STATION 6) THE SITE DURING THE EPA/IEC SURVEYS IN MARCH AND DECEMBER 1979

	March		December	
Station	Total Coliforms (MPN/100g)	Fecal Coliforms (MPN/100g)	Total Coliforms (MPN/100g)	Fecal Coliforms (MPN/100g)
1	780	200	<143	<143
6	2,200	200	<118	<118

CONCLUSIONS

No clear trends could be determined from water-column data collected during the EPA/IEC surveys. However, some general remarks can be made. Weak thermoclines and haloclines were present at the Existing Site. Surface and bottom waters were well oxygenated. Finally, trace metal concentrations in the water at the Existing Site were low, far below EPA water quality levels.

For certain chemical parameters (e.g., TOC, percent fines) and for a given survey, the sediment data suggest recognizable effects of dredged material disposal. However, considering the limited data set and the variability of sediments in the site vicinity, no firm conclusions of dumping effects can be determined.

The benthos living in the vicinity of the Existing Site consisted of a diverse assemblage of organisms. Quantitative information regarding the dominant species showed very high temporal and spatial variability and is typical of small-bodied, motile polychaetes and crustaceans which inhabit unstable sand environments. Due to this variability, detection of community changes brought about by disposal activities is not posssible due to the "background noise" from seasonal changes.

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APPENDIX B

COMMENTS AND RESPONSES TO COMMENTS ON THE DRAFT EIS

The Draft EIS (DEIS) was issued June 28, 1982. The public was encouraged to submit written comments. This Appendix contains copies of written comments received by EPA on the DEIS. Responses to comments were handled at two levels:

- Comments correcting facts presented in the EIS or providing additional information have been incorporated into the text and noted in this section.

- Specific comments, which were not appropriately treated as text changes, have been numbered in the margins of the letters, and responses have been prepared for each numbered item.

The EPA sincerely thanks those who commented on the DEIS, especially those who submitted detailed criticisms which reflected a thorough analysis of the EIS. A list of the commenters by name and agency is presented in Chapter 5.

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DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Centers for Disease Control
Atlanta, Georgia 30333
(404) 262-6649

June 23, 1982

Mr. William C. Shilling
Criteria and Standards Division (WH-585)
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Shilling:

1-1 We have reviewed the Draft Environmental Impact Statement for the final designation of a Jacksonville Harbor, Florida, Ocean Dredged Material Disposal Site. We are responding on behalf of the U.S. Public Health Service and are offering the following comments for your consideration in preparing the Final EIS.

The public health effects of the proposal appear to have been adequately addressed. These effects should be minimal provided dredged materials are free of hazardous materials that would pose a potential health hazard. Periodic recertification of sediment to be dredged and investigation and monitoring when necessary of selected onsite fauna should prevent the occurrence of any potentially adverse public health effects. Selected onsite fauna should be studied for potential long-term food-chain effects from dredged material contamination.

1-2 Please explain how "short-dumping of dredged materials interfered with fishing operations."

We appreciate the opportunity to review this Draft EIS. Please send us one copy of the final document when it becomes available. Should you have any questions about our comments, please contact Mr. Robert Kay of my staff at FTS 236-6649.

Sincerely yours,

Frank S. Lisella

Frank S. Lisella, Ph.D.
Chief, Environmental Affairs Group
Environmental Health Services Division
Center for Environmental Health

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
Washington, D.C. 20230

OFFICE OF THE ADMINISTRATOR

June 28, 1982

Mr. William C. Shilling
Criteria and Standards Division (WH-585)
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Shilling:

2-1 This is in reference to your draft environmental impact statement entitled "Jacksonville Harbor, Florida Ocean Dredged Material Disposal Site Designation." The enclosed comments from the National Oceanic and Atmospheric Administration are forwarded for your consideration.

Thank you for giving us an opportunity to provide these comments, which we hope will be of assistance to you. We would appreciate receiving two copies of the final environmental impact statement.

Sincerely,

Joyce M. Wood
Director
Office of Ecology and Conservation

Enclosures:

Memo from : Andrew Robertson
Office of Marine Pollution Assessment

Letter from: Richard J. Hoogland
National Marine Fisheries Service

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
OFFICE OF MARINE POLLUTION ASSESSMENT
Rockville, Maryland 20852
JUN 23

TO: PP/EC - Joyce Wood

FROM: RD/MP - Andrew Robertson

SUBJECT: Comments on DEIS 8502.12 Jacksonville Harbor Dredged Material Disposal Site Designation

This DEIS appears adequate to support the continuation of an ocean dumping practice which has gone on without demonstrated severe effects for 30 years. As an information document, however, it falls short in several areas. Some of these are particular to this DEIS, and some seem to be inherent in the site designation process.

2-2 A document of this type should address the overall disposal problem. This document does not discuss the dredged material disposal problem comprehensively at all, but states only that consideration of land based alternatives is not part of the site designation process.

2-3 Presumably, material is tested and if it fails to meet current ocean dumping criteria, it is disposed of on land. This should be discussed in the DEIS, as should the overall strategy for managing the waste disposal problem in the Jacksonville area. Such a management strategy should be developed before a DEIS for ocean disposal is prepared.

2-4 A major question which is not addressed is the desirability of creating a mound of material at a site versus a policy of maximum dispersion of the material. The questions of long-term sediment and contaminant budgets are also not addressed. Where do the sediments and contaminants which are dumped finally go, and what is the influence of an occasional severe event such as a hurricane? Such long-term considerations might influence the choice of a disposal location in terms of ultimate impact on the ecosystem.

2-5 The determination of sediment constituents by the contractor was not adequate. Pathogens and most trace organics were not examined at all; such an analysis should always be done where dredged material from an industrialized region is to be ocean dumped. Quality control for trace metals was unacceptable. On p. A-14 the contractor attributes 100-fold variations in lead and cadmium to "an artifact of the analysis," but gives no further information. Trace metals, trace organics and pathogens should all be systemactically measured at the outset of the monitoring program. Documentation of quality control, including sampling procedures and measurement techniques is needed.

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2-6 The influence of river flow on circulation and possible sediment transport should be discussed. If an estuarine-type circulation develops in the near coastal region, this could move bottom material and dissolved constituents back toward the river mouth. Much more consideration should be given to this factor; at least, some notion of vertical and horizontal salinity gradients by season in the outer river and near coastal region should be provided.

2-7 It is stated on p. 2-8 that because shrimp migrate into the St. Johns River between April and October, the Corps of Engineers makes a "considerable effort" to schedule dredging and disposal for other months. The importance of this migration should be much more extensively discussed, and perhaps some consideration should be given to developing a mechanism for "seasonal site designation" for this and similar sites. Such a designation would restrict disposal operations to periods of minimal impact.

2-8 Because of the existence of strong gradiants in regions of river outflow, there should have been a discussion of the relative merits of various sites within 10 km or so at the river mouth. It is possible that moving the site only a few km might significantly change the impact of disposal. If such an evaluation is not possible with existing data it should be incorporated into the monitoring programs.

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Region
9450 Koger Boulevard
St. Petersburg, FL 33702

June 18, 1982

F/SER61/EK
(813)893-3503

US Environmental Protection Agency
Office of Water, Criteria and Standard Division
Washington, D. C. 20460

Dear Sir:

2-9 The National Marine Fisheries Service has reviewed the Draft Environmental Impact Statement (DEIS) for the Jacksonville Harbor Dredged Material Disposal Site Designation. The DEIS evaluates the factors involved in the designation of the existing interim offshore dredged material disposal site as a final ocean dumping site for certain material from the periodic maintenance dredging of Jacksonville Harbor.

General Comments

The DEIS adequately describes the commercial and sport fishery resources of the general area and the specific area to be impacted. It also adequately addresses existing commercial and sport fishing uses of the resources in the disposal site area.

During our review, we identified some areas of discussion that appeared contradictory or were confusing. In general, Chapter 2 has statements concerning fishery resources and fishing activities at the interim site that indicate there is an abundance of these resources and fishing activities at the site. Chapter 4 appears to contradict the statements in Chapter 2. Please refer to our specific comments.

Specific Comments

2-10 Page xiv, paragraph 2. The deepwater site is the only alternative ocean dumping site evaluated in the DEIS. The text states that potential effects of dredged material disposal on indigenous organisms and resources are presently unknown. It seems that potential impacts at the deep-water site should be addressed in order to adequately compare the environmental effects at the two sites.

2-11 Page 2-3, paragraph 2; Page 2-8, paragraph 1; Page 2-9, paragraph 2; and Page 2-14, paragraph 4 establish the shallow-water site as an area of commercial and recreational fishing activities, that areas for breeding, spawning, nursery and/or passage of commercially and recreationally important finfish and shellfish species occur in the area but the effect of disposal on these activities are unknown, that the center of the disposal site is within a favorite angling area, and that fish and shrimp dominate the nekton community adjacent to the existing site. No detailed evaluation of impacts positive or negative upon these factors is given.

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2-12 Page 4-10, paragraph 1 appears to contradict the statements on Page 2-8, paragraph 1 and Page 2-9, paragraph 2.

2-13 Page 2-8, paragraph 3. We agree with the recommendation of Pequegnot et al. (1978).

As a result of our review of the DEIS, we recommend that the deep-water site be chosen as the designated ocean disposal site rather than the interim site. We base that recommendation on the statements in the DEIS as cited above and upon the criteria comparison provided in Table 2-2, Page 2-17 of the document.

We appreciate the opportunity to review this document and provide you with our comments.

Sincerely yours,

Richard J. Hoogland, Chief
Environmental Assessment Branch

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United States Department of the Interior

OFFICE OF ENVIRONMENTAL PROJECT REVIEW

Southeast Region / Suite 1384
Richard B. Russell Federal Building
75 Spring Street, S.W. / Atlanta, Ga. 30303

June 28, 1982

ER-82/844

Mr. William C. Shilling
Criteria and Standards Division (WH-585)
Environmental Protection Agency
Washington, D.C. 20460

Dear Mr. Shilling:

3-1 The Department of the Interior has reviewed the draft environmental statement for the Jacksonville Harbor Dredged Material Disposal Site Designation.

As both the existing shallow area and alternative deepwater sites lie outside the boundaries of existing and proposed OCS oil and gas lease areas, we see little potential for operational conflicts. We therefore have no objection to the proposed action and no additional comments to offer.

Thank you for the opportunity to review this document.

Sincerely,

James H. Lee

James H. Lee
Regional Environmental Officer

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Responses to Comments

1-1 EPA appreciates the review and comments provided by the Centers for Disease Control, Department of Health and Human Services.

1-2 "Short-dumping" of dredged material is the releasing of dredged materials before the closest boundary of the side is reached, i.e., "short" of the designated site. Such a practice could cover a hard-bottomed area used as a feeding area for fish and a spawning ground for shrimp.

2-1 EPA appreciates the review and comments provided by the National Oceanic and Atmospheric Administration, Department of Commerce.

2-2 It is not the purpose of this document to "discuss the dredged material disposal problem comprehensively". Rather, the purpose of the EIS is to present information relevant to propose for designation an acceptable ocean disposal site for the Jacksonville Harbor area.

2-3 As stated in the Ocean Dumping Regulations [40 CFR 227.13(c)] "when dredged material proposed for ocean dumping does not meet the criteria of paragraph (b) of this section [dealing with acceptable material], further testing of the liquid, suspended particulate, and solid phases, as defined in §227.32, is required." Section 227.13(c) further states "based on the results of such testing, dredged material can be considered to be

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environmentally acceptable for ocean dumping only under the following conditions: (3) Bioassays on the suspended particulate and solid phases show that it can be discharged so as not to exceed the limiting permissible concentrations as defined in paragraph (b) of §227.27." It is the Regional Administrator's responsibility for assuring that the proposed dumping for each project will comply with the criteria [§225.2(d)].

Reference to the above regulations is made on page 1-8, paragraph 1 of the EIS.

2-4 As stated in the Ocean Dumping Regulations [40 CFR 228.5(d)] "sizes of ocean disposal sites will be limited in order to localize for identification and control any immediate adverse impacts and permit the effective monitoring and surveillance programs to prevent long-range impacts." Many of the issues raised by the commenter are presently being investigated at various ocean sites. Until such time as definitive answers are forthcoming, EPA will continue its policy of keeping disposal sites as small as feasible in compliance with the requirements of 228.5(d).

2-5 As described under Laboratory Methods (page A-6) of Appendix A, the analyses performed on the sediment samples taken at each of the ten stations were very extensive. Tables showing the results give only the mean values of the numerous samples taken. Although the distribution of sediment parameters were variable, EPA feels the survey plan in this area was adequate. Inclusion of the quality control data in the EIS was not deemed appropriate. All quality control data is available from EPA upon request.

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Pathogens were measured in the sediments (see Table A-21), but "no meaningful comparisons in the distribution of the coliforms at the site" could be made. EPA agrees with the commenter that more analysis for pathogens is necessary and will recommend that the Region include a comprehensive study in its monitoring program.

2-6 Numerous surveys mentioned in the DEIS have been conducted to monitor currents within and around the Existing Site. There is no evidence to indicate that significant volumes of dredged materials are flowing back toward the river mouth. Little and Young (1978) have shown a progressive bed-load movement of the dredged material in a southerly direction. In addition, dredged material has not been reported to have been transported onto the beaches after 28 years of the site's existence (see page 2-9 of EIS). Future monitoring at the disposal site would detect any net directional shoreward flow of the disposed dredged material.

2-7 The importance of the migration has been cited (p. 2-6) and the CE has taken steps to minimize the effects of their disposal activities on the shrimp population.

2-8 The efficacy of dumping the dredged material at other sites was considered (see pp. 2-2 to 2-6). However, based on the historical use of the Existing Site and the absence of significant adverse environmental effects at this site, other alternative areas were ultimately ruled out. If future data gathered during the monitoring programs indicates the necessity of moving the location of the Existing Site, a change can be made at that time.

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2-9 EPA appreciates the review and comments provided by the National Marine Fisheries Service, Southeast Region.

2-10 While specific potential effects of dredged material disposal on indigenous organisms at the deepwater site are unknown, enough is known about the deepwater environment in this area to conclude that effects would likely be insignificant due to: 1) dispersal of the material over a larger area by the currents; and 2) organisms at the deepwater site are likely adapted to a regularly changing environment due to the changing influences of the Gulf Stream (see page xv of EIS).

2-11 Impacts on these areas are given on page 4-10, paragraph 1 and page 4-11, paragraph 3 of the EIS.

2-12 The two paragraphs cited are not in direct contradiction. While studies designed to determine specific effects of disposal practices on the activities listed have not been conducted i.e., fish surveys before and after disposal, past use of the cite has not resulted in any detectable, significant or irreversible adverse impacts on living resources.

Specific effects on the biological communities at the site are discussed on pages 4-7 to 4-9.

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12-13 In light of the historical use of the Existing Jacksonville ODMDS and the absence of "significant adverse impacts on human health, economics, safety, or aesthetics", as demonstrated in the EIS, EPA supports designation of the Existing Site as the preferred alternative.

3-1 EPA appreciates the review and comments provided by the Department of Interior, Southeast Region.

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