OCS STUDY
MMS 85-0088

FLORIDA BIG BEND SEAGRASS HABITAT STUDY

NARRATIVE REPORT

U.S. DEPARTMENT OF THE INTERIOR/MINERALS MANAGEMENT SERVICE

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NARRATIVE REPORT

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Minerals Management Service
New Orleans, Louisiana

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U.S. DEPARTMENT OF THE INTERIOR/MINERALS MANAGEMENT SERVICE

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EXECUTIVE SUMMARY
INTRODUCTION

Extensive seagrass/algal beds occur on the west Florida continental shelf between Ochlockonee Bay and Tarpon Springs--a region known as the Florida Big Bend (Figure 1). Recent industry interest in offshore oil and gas drilling in the Big Bend area has produced concerns about possible environmental impacts to benthic organisms, particularly seagrasses and associated biota. In response, the Minerals Management Service (MMS), as the Federal agency responsible for prediction and management of oil- and gas-related environmental impacts, initiated the Florida Big Bend Seagrass Habitat Study. Study results will be of use in buffer zone discussions associated with upcoming eastern Gulf of Mexico lease sales and in formulation of lease sale biological stipulations.

Until this study, overall seagrass distribution patterns within the Florida Big Bend area were poorly known. Previous seagrass studies in the area relied on published reports and diver surveys to estimate seagrass distribution near shore [water depths <10 m (<33 ft)]. Very little study was devoted to the seagrass/algal beds known or presumed to extend farther offshore. The Florida Big Bend Seagrass Habitat Study was designed to map seagrass distribution patterns in both nearshore and offshore portions of the Florida Big Bend area.

The objectives of the Florida Big Bend Seagrass Habitat Study were:

1) To map and inventory seagrass beds in the Big Bend area using a combination of aerial photography (remote sensing) and shipboard "ground truthing";

2) To determine the seaward extent of the major seagrass beds; and

3) To classify and delineate major benthic habitat types in the area.

The study consisted of three parts:

1) A pre-overflight ground-truthing cruise (Cruise 1);

2) Remote sensing overflight encompassing the study area; and

3) A post-overflight ground-truthing cruise (Cruise 2) to verify interpretation of remote sensing data.

Due to the lack of data on seagrass distributions in deep water, ground-truthing efforts focused on the deeper [10 to 20 m (33 to 66 ft)] portions of the study area. Also, remote sensing was not able to resolve bottom features across the entire depth range of the study area, and additional deepwater ground truthing was needed to supplement aerial photographic data used for habitat mapping.

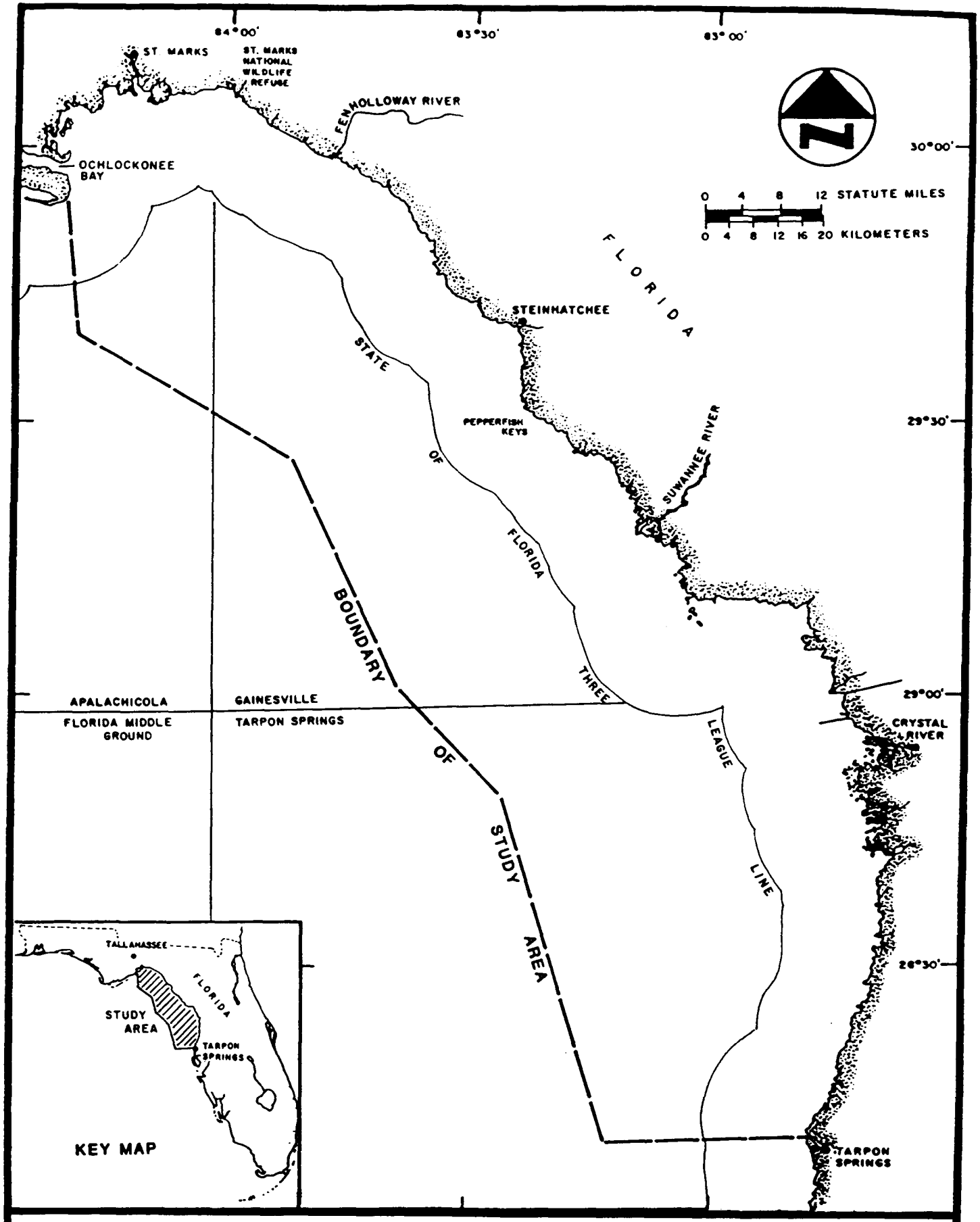

FIGURE 1. LOCATION OF THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

METHODS

During Cruise 1 (24 October to 1 November 1984), 1,232 km (144 mi) of seafloor between the 10- and 20-m depth contours were surveyed using a towed underwater television system (Figure 2). Loran-C navigational fixes and bottom type were recorded at 5-min intervals during television tows. Fifty representative Signature Control Stations (Figure 3) were established to aid aerial photographic interpretation by providing locations of known seagrass coverage. At each station, large, floating targets were deployed and divers took quantitative photographs of the seafloor to estimate seagrass density and species composition.

Between 30 October and 15 November 1984, aerial photographs were taken along 26 north-south flight lines (Figure 4) encompassing 2.1 million ha (5 million acres or 8,200 mi^2) of seafloor. Standard Kodak 23 cm x 23 cm (9 in. x 9 in.) color print film was used. Scale on all photographs was 1:40,000.

During Cruise 2 (19 to 27 February 1985), nine additional transects [174 km (108 mi)] were surveyed using towed divers and underwater television, and 11 of the 50 Signature Control Stations established during Cruise 1 were resampled using the same methods employed during the earlier cruise.

Aerial photographs were analyzed stereoscopically, and seagrass beds were categorized by density (dense, sparse, or patchy) as determined by interpreting "photo-signature characteristics" such as tone, color, texture, and size. Signatures of submerged seagrass beds ranged from dark blue-green offshore to light-medium brown in nearshore areas influenced by tidal fluctuations. Areas of nonvegetated sand bottom (white signature) and nonvegetated mud bottom (brown signature) were also recognized in the photographs. Live-bottom habitats characterized by hard corals, gorgonians, sponges, and other epibiota associated with low-relief rock outcrops or rock covered by a thin sand veneer could not be differentiated from surrounding seagrass beds at the 1:40,000 scale of the aerial photographs.

Six hundred photographs were interpreted and distributions of the major habitat types were outlined on clear acetate. These interpretations formed the basis for a 1:40,000 scale map of the study area. A reduced Composite Map (scale 1:25,000), which can be superimposed directly on the 1:250,000 scale MMS protraction diagrams, was produced.

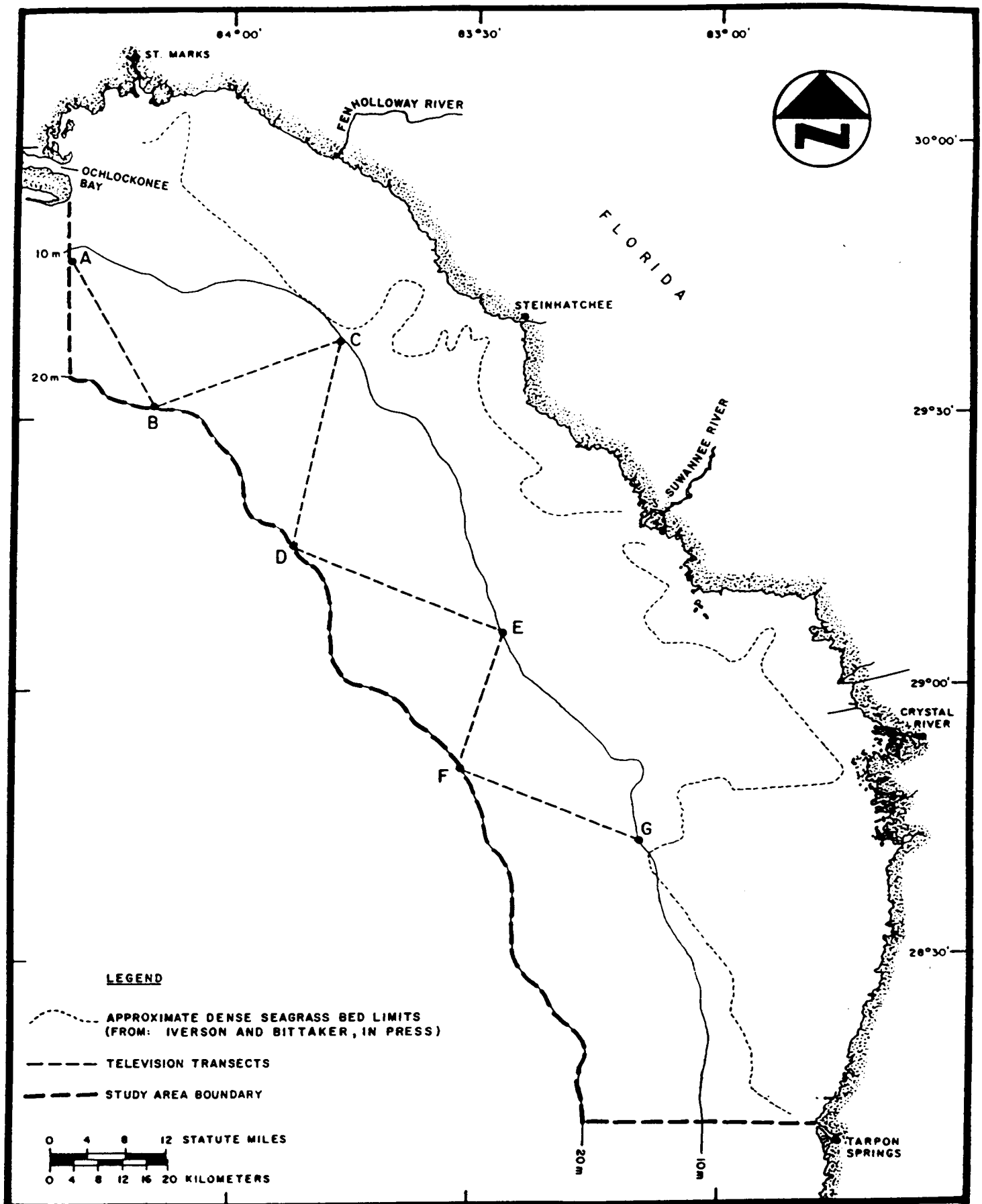

FIGURE 2. TELEVISION TRANSECTS SURVEYED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984).

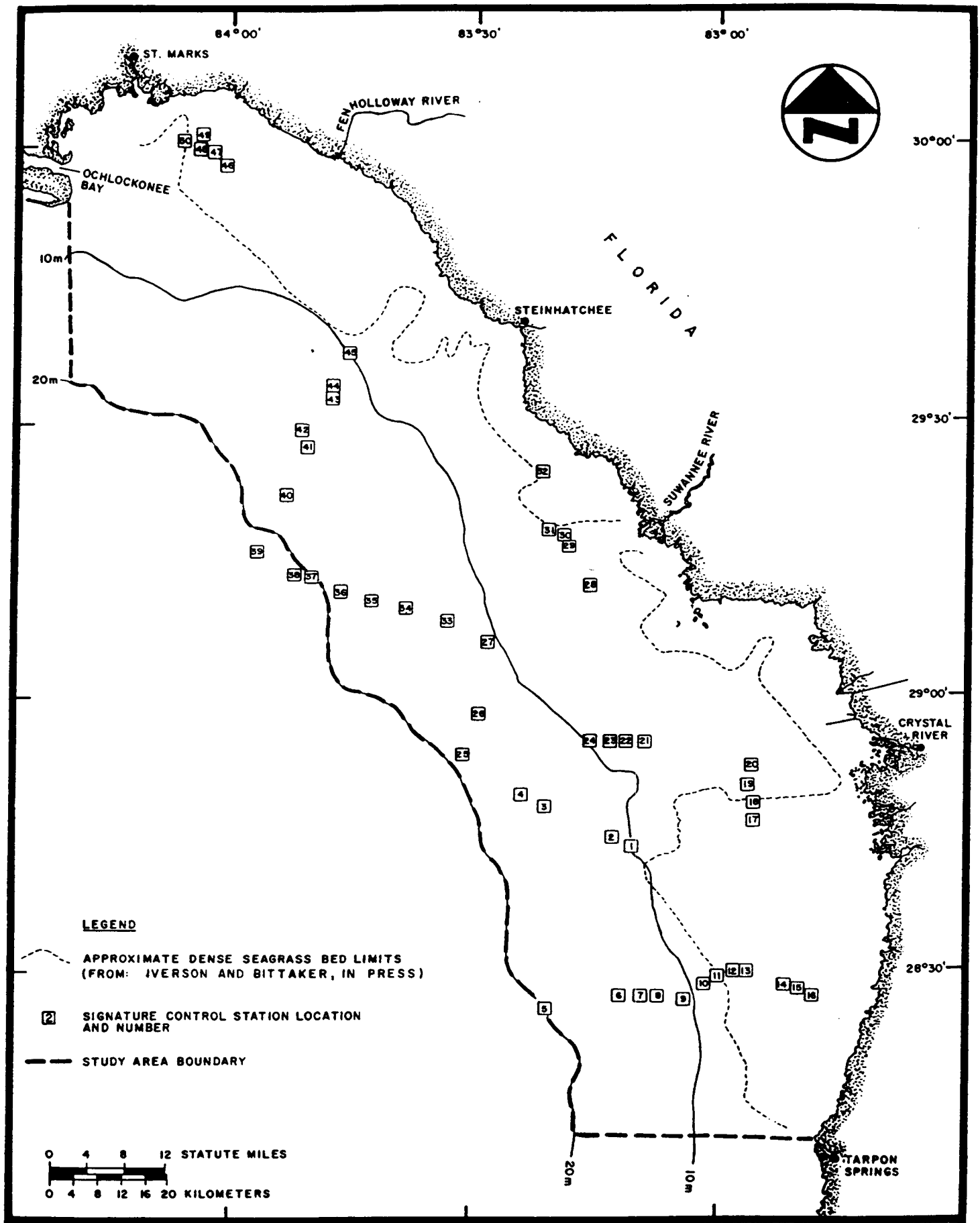

FIGURE 3 SIGNATURE CONTROL STATIONS ESTABLISHED AND SAMPLED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984).

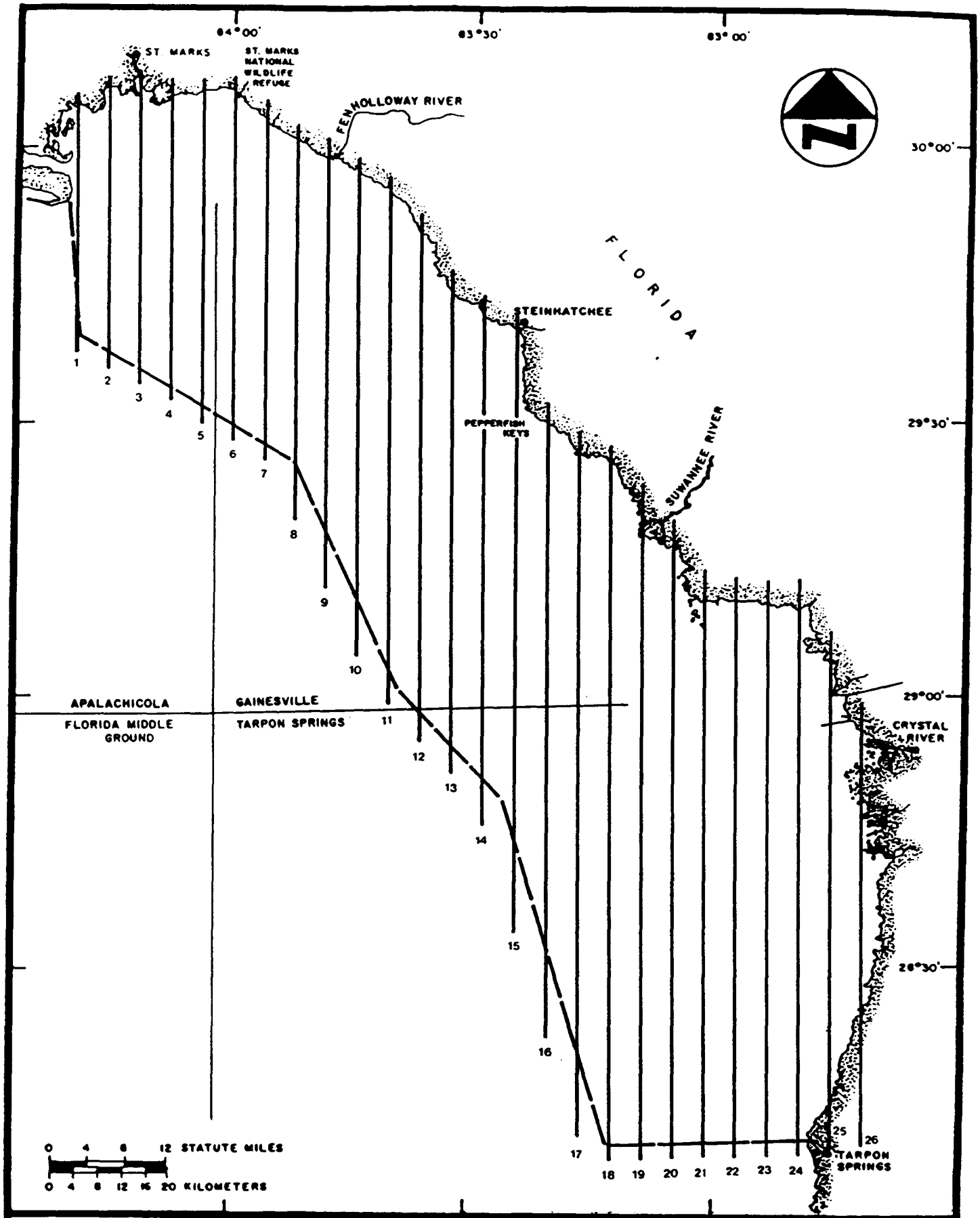

FIGURE 4. FLIGHT LINES FOR REMOTE SENSING IMAGERY.

RESULTS AND DISCUSSION

A total of 1.5 million ha (3.7 million acres) was mapped from the aerial imagery during the study (Figure 5). Mapping delineated 232,893 ha (575,479 acres) of dense seagrass beds, 498,034 ha (1,230,643 acres) of sparse seagrass beds, and 279,722 ha (691,195 acres) of patchy seagrass beds.

Study results indicate two major groupings or species associations of seagrasses in the Florida Big Bend area. An inner (nearshore) association of turtle grass (Thalassia testudinum), manatee grass (Syringodium filiforme), and shoalgrass (Halodule wrightii) occurs in water depths of less than 9 m (30 ft). Turtle grass and manatee grass form dense beds that are easily detected in aerial photographs, and only at the southern end of the study area do the dense beds extend into Federal waters (Figure 5). Seaward of these dense seagrass beds is a zone where five seagrass species are seen--turtle grass, manatee grass, shoalgrass, and two additional species: Halophila decipiens and H. engelmanni (neither has a universally recognized common name). Farther offshore, large areas of continental shelf between approximately the 10- and 20-m depth contours support a mixed macroalgal/seagrass assemblage in which the two Halophila species are the only vascular plants seen. This assemblage extends beyond the 20-m depth limit of this study and is abundant to at least the 23-m (75-ft) depth contour.

Turtle grass (Plate 1) and manatee grass are the largest seagrass species in the Big Bend area, and their blades trap sediment from the water column, thereby helping to build seagrass beds. Shoalgrass and the two species of Halophila are much smaller (Plate 2) and generally are considered to be fringing or pioneer species that inhabit the margins of major seagrass beds and tolerate environmental conditions not suitable for the larger species.

The unique aspect of seagrass communities in the Florida Big Bend area is the extended nature of the deeper, fringing zone dominated by H. decipiens, H. engelmanni, and various macroalgal species. Ground-truthing data indicate that macroalgae account for an average of 21% of total blade density seen here. Ground-truthing data also indicate approximately 44% of the area mapped on the basis of aerial photographs as sparse or patchy seagrass beds consisting of live-bottom habitats that could not be differentiated from seagrass beds in the aerial imagery.

In addition to the spatial zonation patterns of seagrasses noted in this study, seasonal variability in seagrass bed density and species composition was evident, especially in the sparse offshore beds. At most offshore Signature Control Stations sampled during Cruise 2 (February), blade densities were 50% to 90% lower than those noted during Cruise 1 (October to November), and H. decipiens had disappeared. Halophila engelmanni persisted during the interim between cruises, but many instances of wave stress and uprooting were evident during Cruise 2 (Plate 3). Temperature, light, and wave action are likely to be important variables influencing both spatial and seasonal abundance patterns in the seagrass beds.

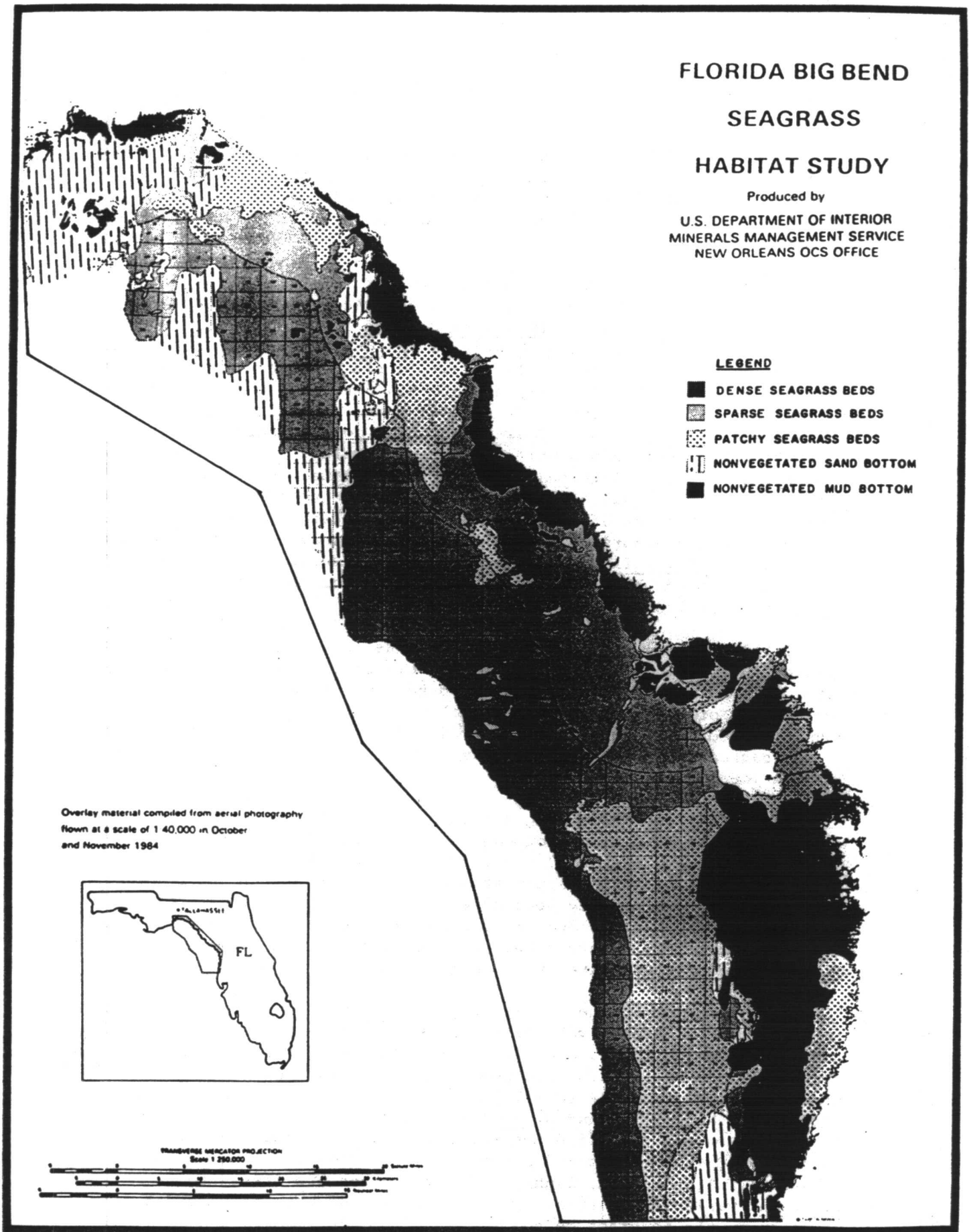

FIGURE 5. FLORIDA BIG BEND SEAGRASS HABITAT STUDY COMPOSITE MAP BASED ON AERIAL INTERPRETATION ALONE (PHOTOGRAPHIC REDUCTION).

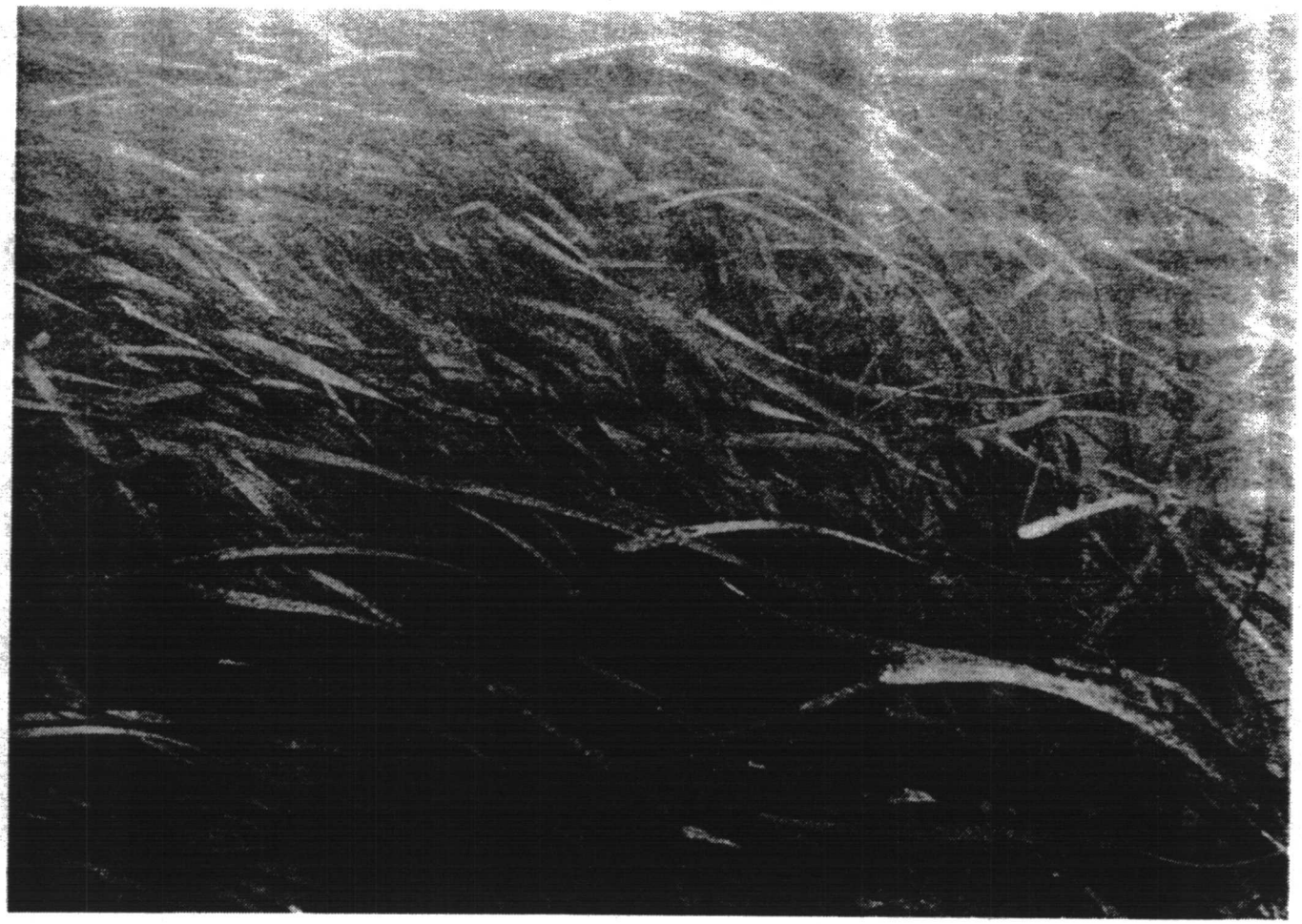

PLATE 1. A NEARSHORE THALASSIA TESTUDINUM SEAGRASS BED.

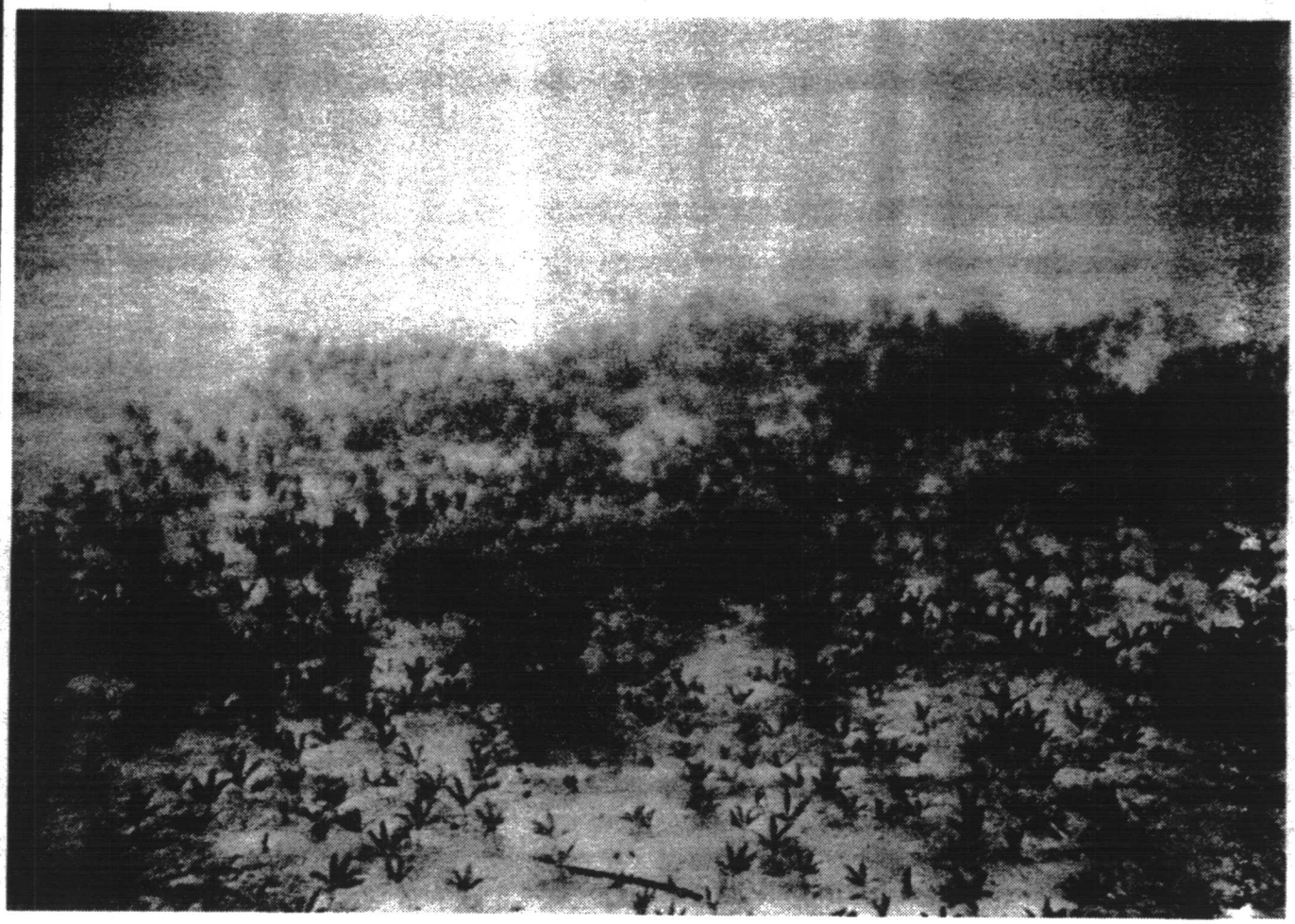

PLATE 2. A SPARSE, OFFSHORE SEAGRASS BED DOMINATED BY HALOPHILA ENGELMANNI.

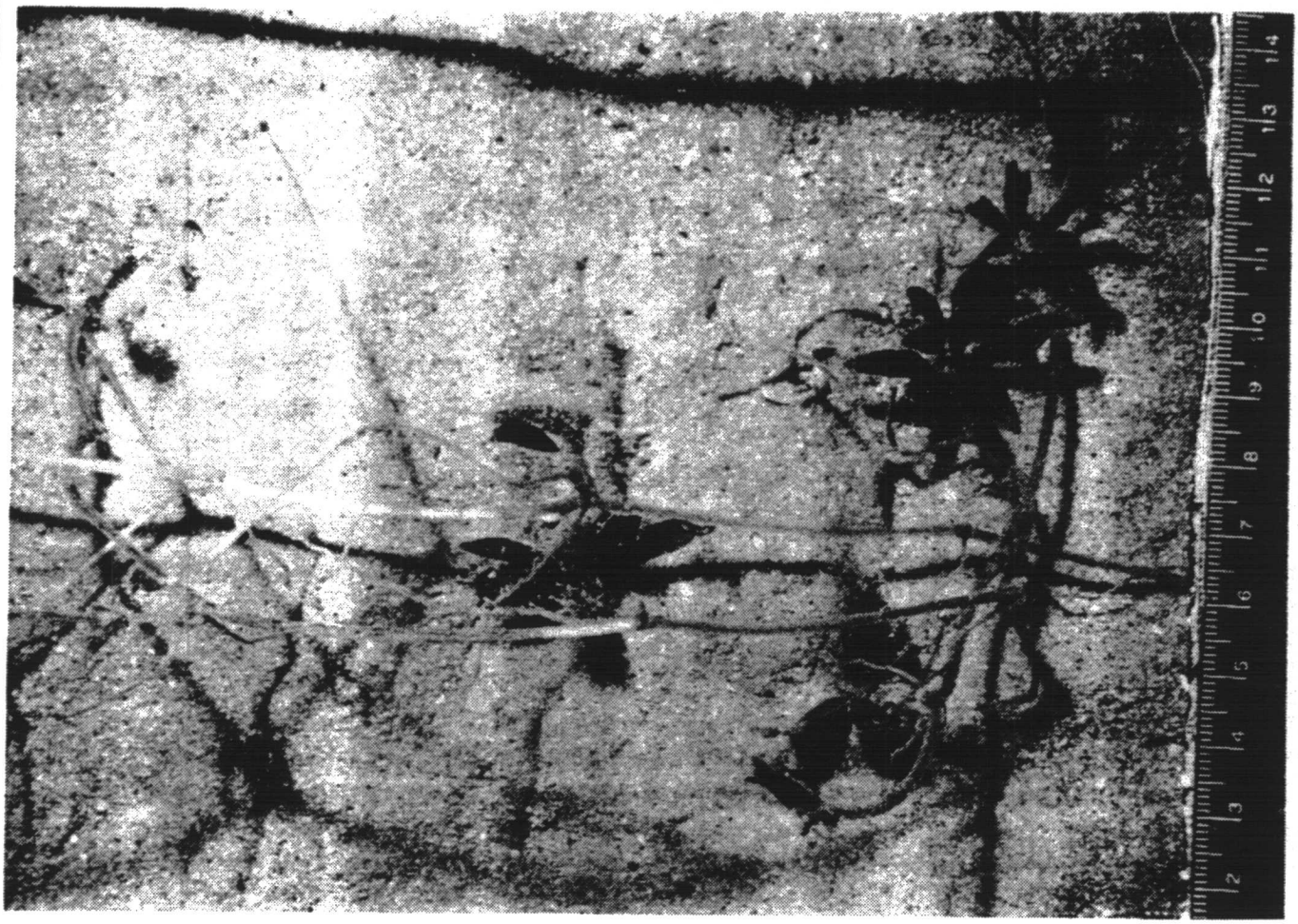

PLATE 3. UPROOTED HALOPHILA ENGELMANNI SEEN IN AN OFFSHORE SEAGRASS BED DURING CRUISE 2 (FEBRUARY 1985).

The ecology of deepwater seagrass/algal beds in the Florida Big Bend area has not been studied, but these habitats could play important roles in this productive environment. Future studies should focus on primary productivity, influential environmental variables, and associated flora and fauna of Big Bend area seagrass beds.

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ACKNOWLEDGEMENTS

The Florida Big Bend Seagrass Habitat Study Narrative Report was written by M. John Thompson and Neal W. Phillips of Continental Shelf Associates, Inc. The authors wish to express their appreciation to the following individuals who have helped to ensure the quality of the report:

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ABSTRACT

Seagrass distribution in the Florida Big Bend area was mapped using a combination of aerial and ground-truthing photographic surveys. Of the total area mapped [1.5 million ha (3.7 million acres or 5,830 mi^2)], 16% was characterized as dense seagrass beds, 33% as sparse seagrass beds, and 19% as patchy seagrass beds.

Species zonation patterns were similar to those observed elsewhere in Florida and the Caribbean. There is a nearshore zone of pioneer or fringing species--primarily Halodule wrightii and (occasionally) Halophila decipiens; a zone of dense bed-forming Thalassia testudinum and Syringodium filiforme; and an offshore zone where fringing or pioneer species (primarily Halophila decipiens and Halophila engelmanni, with some Halodule wrightii in shallower water) again appear. The unique feature of the Florida Big Bend area seagrass zonation pattern is the extended nature of this offshore fringing zone. Offshore fringing or pioneer species grow from a depth of 10 m (33 ft) out to depths greater than 20 m (66 ft).

Within the offshore sparse seagrass beds, macroalgae accounted for an average of 21% of total blade density. Live bottom was interspersed with seagrass beds throughout the study area and probably accounted for approximately 44% of the area between the 10- and 20-m depth contours mapped on the basis of aerial photography as sparse or patchy seagrass beds.

1.0 INTRODUCTION

The curve of Florida's west coast between Ochlockonee Bay and Tarpon Springs defines an area known as the Florida Big Bend. The productive continental shelf of the Florida Big Bend is considered valuable by both environmental and commercial fishing concerns. The area was nominated as a Marine Sanctuary under National Marine Sanctuary Site Evaluations of 7 June 1983 (Chelsea International Corporation, 1983), and placed on the Site Evaluation list for further study and consideration (48 Federal Register 35568-1983).

Recently, the Florida Big Bend region has also become a focus of oil and gas industry interest; in November 1983, the Federal government leased nine blocks for petroleum exploration on the outer continental shelf (OCS) in the area. The State of Florida, required under Section 19 of the OCS Lands Act to evaluate the consistency of the lease sale with the State's coastal zone management plan, raised the lack of detailed information concerning seagrass beds and live-bottom habitats in this area as a critical issue. Subsequently, in legislation attached to "Supplemental Appropriations for the Fiscal Year Ending 30 September 1984" (House of Representatives Report No. 98-551), the Federal government established a one-year leasing moratorium on OCS lease blocks within 48 km (30 mi) of the Florida coastline from Apalachicola south to Monroe County.

To remedy the lack of information on seagrass beds during the moratorium and prior to the upcoming OCS Lease Sale 94 scheduled for December 1985, the Minerals Management Service (MMS), as the Federal agency responsible for prediction and management of oil and gas related environmental impacts, initiated the Florida Big Bend Seagrass Habitat Study. The study was to provide area-specific data for possible buffer zone discussions associated with Lease Sale 94. In addition, the study would provide supporting data for development of biological stipulations and evaluation of lease block specific plans of exploration or development.

1.1 Background

Seagrasses and macroalgae have long been recognized as important primary producers in marine habitats (Mann, 1973; McRoy and McMillan, 1977). They are also known to provide nursery grounds for sport and commercial fish species and habitat for many larval and adult invertebrates critical to nearshore food chains (Zimmerman and Livingston, 1976; Phillips, 1978; Dawes et al., 1979).

Extensive seagrass beds occur in the Florida Big Bend area (Phillips, 1960; Moore, 1963; Earle, 1972; McNulty et al., 1972; Enos and Perkins, 1977; Iverson and Bittaker, in press). Species reported include Thalassia testudinum and Syringodium filiforme, which develop dense stands in the nearshore zone; and Halodule wrightii, Halophila decipiens, and H. engelmanni, which are considered to be fringing or pioneer species

seen around the edges of the major beds. Macroalgal species of Caulerpa, Udotea, Penicillus, and Sargassum are also common in seagrass beds (Iverson and Bittaker, in press).

Early studies summarized published reports on seagrass distributional patterns and qualitatively estimated the acreage of seagrass beds and live-bottom areas in the eastern Gulf of Mexico (Phillips, 1960; Moore, 1963; Earle, 1972; Parker et al., 1983). Between 1974 and 1980, Iverson and Bittaker (in press) used teams of scuba divers to map the major nearshore seagrass beds in the Florida Big Bend area. Several seagrass mapping studies using combinations of aerial imagery interpretation and direct observation have been performed at sites along Florida's northwest coast (Withlacoochee Regional Planning Council, 1982; Continental Shelf Associates, Inc., 1983, 1984, 1985).

Currently, overall distributional patterns and total acreages of seagrasses within the Big Bend area are poorly documented. Mr. James Barkuloo [personal communication, U.S. Fish and Wildlife Service (USFWS), Panama City Office] has stated that major seagrass beds extend to at least 35 km (22 mi) offshore. Halophila decipiens has been reported growing in a water depth of 30 m (98 ft) off the southwest Florida coast (Woodward-Clyde Consultants and Continental Shelf Associates, Inc., 1985), and H. decipiens and H. engelmanni are reported to form monotypic stands to at least the 20-m (66-ft) depth range off northwestern Florida (Dr. R. Iverson, 1985, personal communication, Florida State University).

1.2 Description of the Study Area

The Florida Big Bend Seagrass Habitat Study area encompasses approximately 1.5 million ha (3.7 million acres or 5,830 mi^2) of seafloor (Figure 1.1). Several large western Florida rivers discharge into the area, which is characterized as an extensive shallow inner continental shelf. Freshwater discharges vary with upland rainfall, but periodically they introduce considerable turbidity into nearshore waters (Schroeder, 1975).

Geologically, this portion of the west Florida continental shelf is composed of the Apalachicola Embayment in the north and the Ocala Uplift in the south. Offshore sediments are predominantly a quartz-carbonate sand mixture (Doyle and Sparks, 1980). The seafloor is characterized by large expanses of low-relief, hard bottom that is either exposed or overlain by a thin veneer of sand and shell fragments. Unconsolidated limestone cobbles, boulders, and higher relief ledges are occasionally noted (Woodward-Clyde Consultants, 1979; Continental Shelf Associates, Inc., 1981).

Seasonal climatic patterns in this area are driven by the Bermuda High during spring and summer and a secondary clockwise weather cell which develops over the Gulf during fall and winter (Jordan, 1973; Molinari and Mayer, 1980). These conditions generally produce southerly winds in spring and summer and northerly winds during fall and winter.

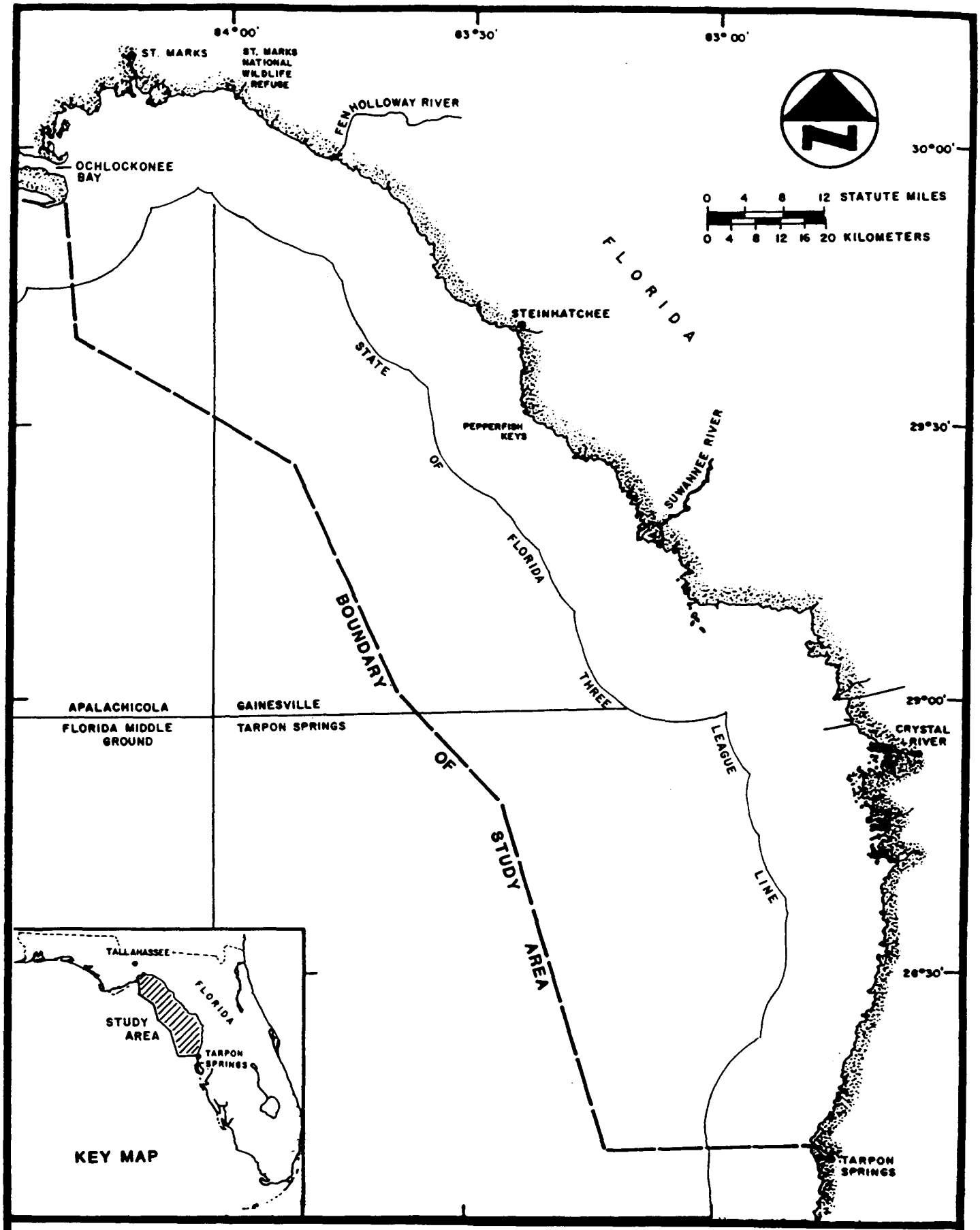

FIGURE 1.1. LOCATION OF THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

Mean summer air temperature is approximately 28°C (82°F) in summer and 18°C (64°F) in winter.

Throughout most of the year, water temperatures closely parallel air temperatures and the shelf is considered to be isothermal. At the deeper extremes of the study area, summer bottom temperatures are reported to be occasionally 5°C cooler than surface temperatures (State University System of Florida, Institute of Oceanography, 1973).

Nearshore currents appear to be tidally driven (Marmorino, 1983), whereas offshore currents show a high degree of correlation with wind stress (Mitchum and Sturges, 1982). Cross-shelf current speeds are generally less than 5 cm s^{-1} (0.1 kn), whereas isobathic currents are normally in the 10 cm s^{-1} (0.2 kn) range and occasionally reach 35 cm s^{-1} (0.7 kn).

1.3 Study Objectives

The specific objectives of the Florida Big Bend Seagrass Habitat Study were:

1) To inventory and map seagrass beds in the Florida Big Bend area by combining aerial remote sensing and extensive ground truthing;
2) To determine the seaward extent of major seagrass beds within the study area; and
3) To classify and delineate major ecological habitat types in the study area.

1.4 Study Products

In addition to this Narrative Report, products from the Florida Big Bend Seagrass Habitat Study include a four-volume Photographic Atlas composed of aerial imagery (1:40,000 scale) with clear acetate overlays delineating habitats, and a 1:250,000 scale Composite Map showing major acreages of seagrass habitat on the MMS Protraction Diagrams of the Florida Big Bend area.

2.0 MATERIALS AND METHODS

2.1 Study Design

The study consisted of three parts: (1) a pre-overflight ground-truthing cruise (Cruise 1); (2) remote sensing overflights encompassing the study area; and (3) a post-overflight ground-truthing cruise (Cruise 2) to verify interpretation of remote sensing data. During Cruise 1 (24 October to 1 November 1984), 1,232 km (144 mi) of seafloor between the 10- and 20-m depth contours were surveyed using a towed underwater television system, and 50 representative Signature Control Stations were established and sampled to aid aerial photographic interpretation by providing locations of known seagrass coverage. During the remote sensing overflights (30 October to 15 November 1984), aerial photographs were taken along 26 north-south flight lines. During Cruise 2 (19 to 27 February 1985), additional transects in the deep portion of the study area were surveyed using towed divers and an underwater television system, and 11 of the 50 Signature Control Stations were resampled using the same methods employed during the earlier cruise.

The MMS-defined study area encompassed the coastline from the mouth of Ochlockonee Bay east and south to Tarpon Springs and offshore to the 20-m depth contour (Figure 1.1). The seaward boundary was set at the 20-m depth contour because seagrasses were not expected to occur beyond this depth. Also, even under the best possible conditions, remote sensing techniques were not expected to allow delineation of submerged seagrass at depths greater than 20 m.

2.2 Remote Sensing Overflights

Aerial mapping and delineation of submerged habitats present several problems not encountered in terrestrial remote sensing, including water column turbidity, surface glare, wave action, and signature color shifts with increasing water depth (Atwell et al., 1975). Despite the problems, the value of aerial remote sensing in aquatic habitats has been recognized in numerous studies (Conrad et al., 1968; Thompson, 1974, 1976, 1978; Orth and Moore, 1983; Continental Shelf Associates, Inc., 1983, 1984).

Remote sensing overflights were scheduled for October because seagrasses in the Florida Big Bend area are reported to be at their most dense during that time (Dr. Richard Iverson, 1985, personal communication, Florida State University). October also coincides with cooler weather and reduced upland drainage; therefore the water column was expected to be clear at that time.

Twenty-six north-south flight lines were plotted to encompass the study area (Figure 2.1). The MMS set study area boundaries at the 20-m depth contour, but the 25-m depth contour was selected as the boundary for flight line planning in order to ensure complete coverage.

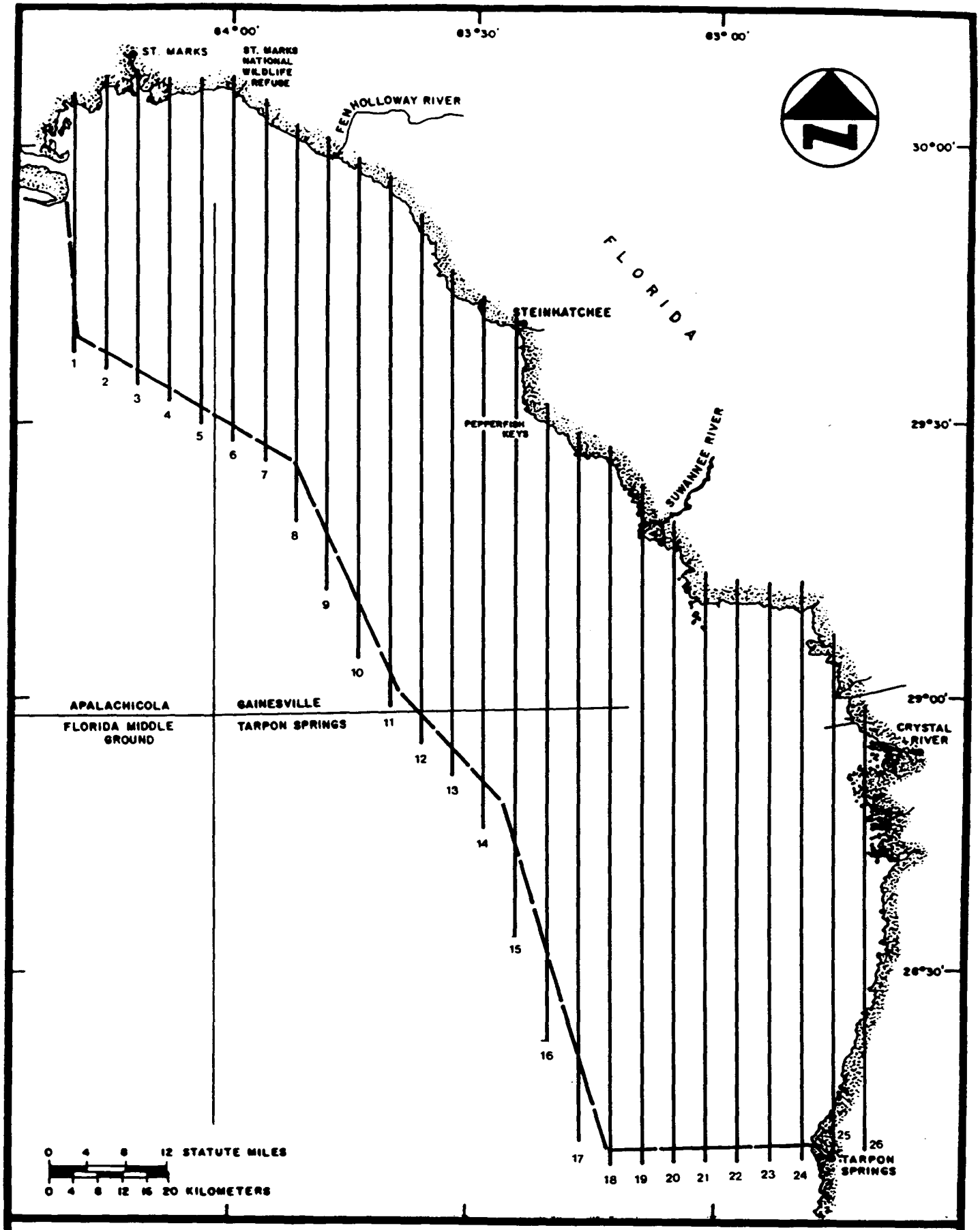

FIGURE 2.1. FLIGHT LINES FOR REMOTE SENSING IMAGERY.

Consequently, the area of coverage [2.1 million ha (5 million acres or 8,200 mi^2)] was slightly greater than the contract-specified study area.

Table 2.1 lists the specifications and weather requirements for the aerial survey. Table 2.2 lists the dates and weather/optical conditions for each flight line surveyed. Generally, weather and water column conditions were excellent, and the quality and resolution depth on all imagery exceeded expectations. Seagrass beds could be mapped to a depth of 16 m (53 ft) in the southern portions of the study area (Cedar Keys to Tarpon Springs), and generally to a depth of 12 m (39 ft) across the entire study area. The 1:40,000 scale imagery allowed delineation of a considerable amount of detail within specific seagrass beds, especially in the shallower [<10 m (<33 ft)] portions of the study area.

The survey aircraft used was equipped with a Loran-C navigational system. Beginning and end points for each flight line were plotted as latitude and longitude coordinates to the nearest 0.01 min and entered into the memory of the Loran-C unit. Throughout all flights, the aircraft's position was constantly tracked and a visual display showing deviation from the flight line was viewed by the pilot. Using this heading and distance display of position relative to flight line, the pilot was able to maintain a course accurate to within $\pm$305 m ($\pm$1,000 ft) of the plotted flight line. This accuracy level at the required scale exceeded normal terrestrial survey requirements.

Several types of film/filter combinations have previously been used to map marine habitats. Kodak photogrammetric 23 cm x 23 cm (9 in. x x 9 in.), standard color aerial print film was used. Scale on all imagery was 1:40,000, with forward and side overlaps on all negatives of 60% and 40%, respectively.

Forward overlap of the photographs was calculated using the Loran-C display of true ground speed. Ground speed divided by a constant based on the camera lens' focal length and the film format (negative size) yielded the correct exposure interval for the required overlap of frames. Real-time exposure intervals used in this study ranged from 45 to 60 s depending on wind conditions.

2.3 Ground-Truthing Cruises

Previous data concerning nearshore seagrass beds in the Florida Big Bend area are available in published scientific literature. Therefore, the MMS decided to concentrate ground-truthing efforts for the Florida Big Bend Seagrass Habitat Study in the offshore portion of the study area (between the 10- and 20-m depth contours) where seagrass habitats are less well described. Aerial imagery was not expected to resolve bottom features across the entire depth range of this study, and ground-truthing in the deeper portions of the study area was required to supplement the remotely collected data on seagrass distribution.

Two ground-truthing cruises were conducted. During the pre-overflight cruise (Cruise 1), offshore portions of the study area

TABLE 2.1. AERIAL IMAGERY SPECIFICATIONS.

Area:	The Florida Big Bend area from the mouth of Ochlockonee Bay east and south to Tarpon Springs and offshore to the 25-m contour
Purpose:	Delineation of submerged habitats in sufficient detail for subsequent mapping
Film:	Kodak color print
Format:	9 in. by 9 in.
Altitude:	20,000 ft above sea level
Scale:	1:40,000 photograph scale (1 in. = 3,333 ft)
Camera:	Zeiss RMK/A aerial mapping camera
Focal Length:	6 in. (152 mm)
Forward Overlap:	60%
Side Overlap:	40%
Cloud Cover:	Not to exceed 5%
Sun Angle:	Not to exceed 55°
Sun Glare:	Not to exceed 30% of frame
Sea State:	No visible white caps

TABLE 2.2. FLIGHT LINES, DATES, AND CONDITIONS UNDER WHICH AERIAL IMAGERY WAS OBTAINED.

Date	Flight Line	Exposure No. From	Exposure No. To	Conditions
30 Oct	26	001	010	Good
30 Oct	25	012	022	Broken off because of clouds
30 Oct	24	023	034	Broken off because of clouds
1 Nov	24	035	037	Good
1 Nov	23	038	053	Good
1 Nov	22	054	068	Good
1 Nov	21	069	099	Good
1 Nov	20	100	128	Fair - Clouds at north end
1 Nov	19	129	164	Fair - Clouds at north end
2 Nov	20	192	197	Repeat northern part of line
2 Nov	19	198	202	Repeat northern part of line
8 Nov	10	002	032	Good
8 Nov	8	034	058	Good
8 Nov	6	059	078	Good
8 Nov	4	079	099	Good
8 Nov	2	101	117	Good
8 Nov	1	118	134	Good
8 Nov	3	136	153	Good
8 Nov	5	154	174	Good
8 Nov	7	176	180	Broken off because of smoke
8 Nov	7	181	191	Repeat north end
8 Nov	9	192	198	Broken off because of smoke
8 Nov	9	199	215	Repeat south end
8 Nob	11	217	243	Broken off because of smoke
8 Nov	12	244	270	Broken off because of smoke
9 Nov	12	271	272	Good - Repeat line
9 Nov	13	273	300	Good
9 Nov	12	301	305	Good - Repeat line
9 Nov	11	306	313	Good - Repeat line
9 Nov	9	314	320	Good
9 Nov	7	322	325	Good
9 Nov	14	326	356	Good
9 Nov	15	358	392	Good
9 Nov	18	393	434	Good
9 Nov	17	436	458	Good
9 Nov	17	001	018	Good
9 Nov	16	021	057	Good
9 Nov	22	058	068	Repeat due to cloud cover
9 Nov	23	063	066	Repeat due to cloud cover
9 Nov	24	067	075	Repeat due to cloud cover
9 Nov	23	016	080	Repeat due to cloud cover
13 Nov	20	001	009	Good
13 Nov	19	010	017	Good
13 Nov	17	018	037	Good

TABLE 2.2. (CONCLUDED).

Date	Flight Line	Exposure No. From	Exposure No. To	Conditions
13 Nov	16	038	073	Good
13 Nov	22	074	077	Good
13 Nov	24	078	091	Good
13 Nov	25	092	101	Good
14 Nov	23	001	019	Good
14 Nov	22	020	038	Good
14 Nov	24	040	045	Good
14 Nov	25	046	052	Good

were surveyed using an underwater television system; then 50 Signature Control Stations were selected and sampled. During the post-overflight cruise (Cruise 2), towed divers and the underwater television system were used to verify mapped signatures and to supplement remote sensing data in deeper areas. Eleven of the 50 Signature Control Stations were resampled to assess seasonal variations in mapped seagrass bed densities.

2.3.1 Cruise 1: Pre-Overflight

Cruise 1 was conducted during 24 October to 1 November 1984. Specific objectives were:

1) To survey the deep portions of the study area [10 to 20 m (33 to 66 ft) water depth] using underwater television; and
2) To select, mark, and sample representative Signature Control Stations.

Six transects (Figure 2.2) covering approximately 1,323 km (144 mi) of the continental shelf between the 10- and 20-m depth contours were surveyed between 25 and 28 October 1984 using an underwater television system (Figure 2.3). Loran-C navigational fixes were taken at 5-min intervals along these transects and the seafloor habitat type (see Section 2.5.1) was recorded at each fix mark.

Data from the initial television surveys and from previous studies (seagrass survey conducted by the USFWS, State of Florida, and Florida State University in June 1984; Iverson and Bittaker, in press), were the basis for selection of 50 Signature Control Stations (Figure 2.4). These stations were established between 28 October and 1 November 1984. Marking and sampling methods for the Signature Control Stations are described in Section 2.4.

2.3.2 Cruise 2: Post-Overflight

Cruise 2 was conducted between 19 and 27 February 1985. Specific objectives were:

1) To determine the outer boundary of seagrass growth using towed divers and underwater television;
2) To investigate areas of questionable signatures detected in the aerial imagery; and
3) To resample as many as possible of the originally designated Signature Control Stations to obtain data on the seasonal variability of seagrass beds.

Prior to Cruise 2, a preliminary 1:250,000 scale composite map was developed to identify areas where ground-truthing efforts should focus. Objectives in generation of this map were to differentiate boundaries between inshore and offshore seagrass assemblages, delineate the maximum depth of seagrass resolution obtained on the aerial imagery, and note any specific areas where obtained signatures were difficult to interpret.

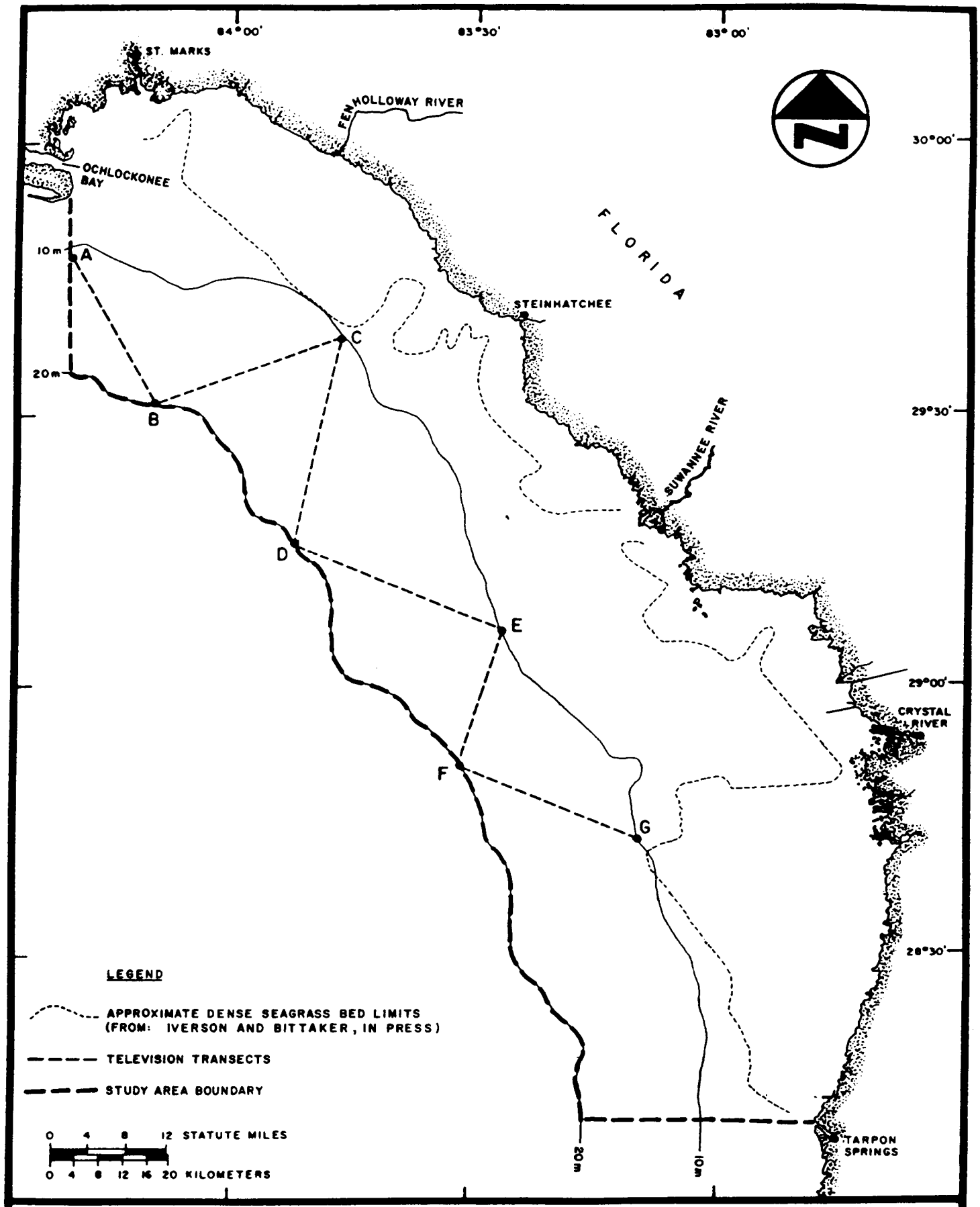

FIGURE 2.2. TELEVISION TRANSECTS SURVEYED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984).

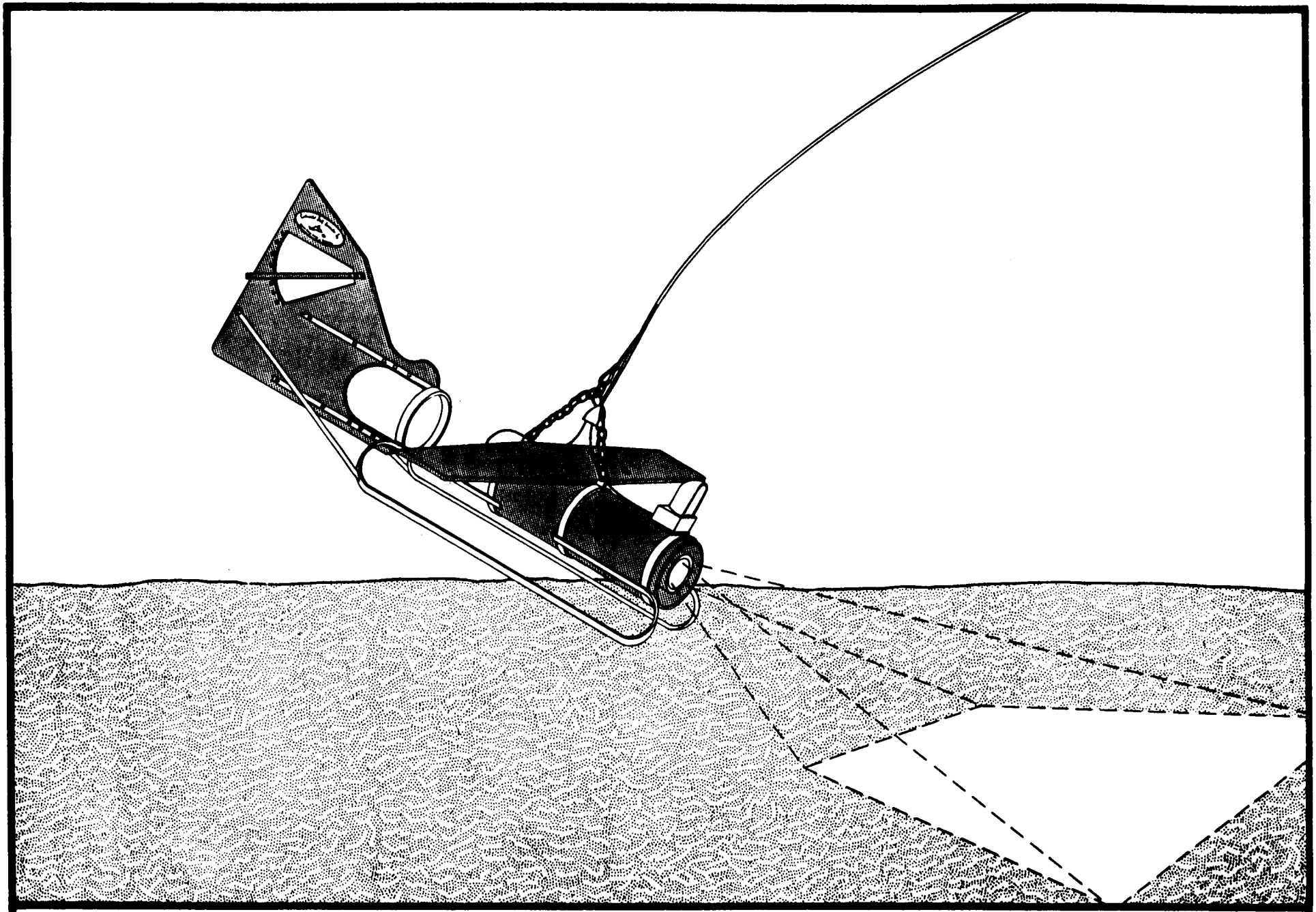

FIGURE 2.3. UNDERWATER TELEVISION SYSTEM.

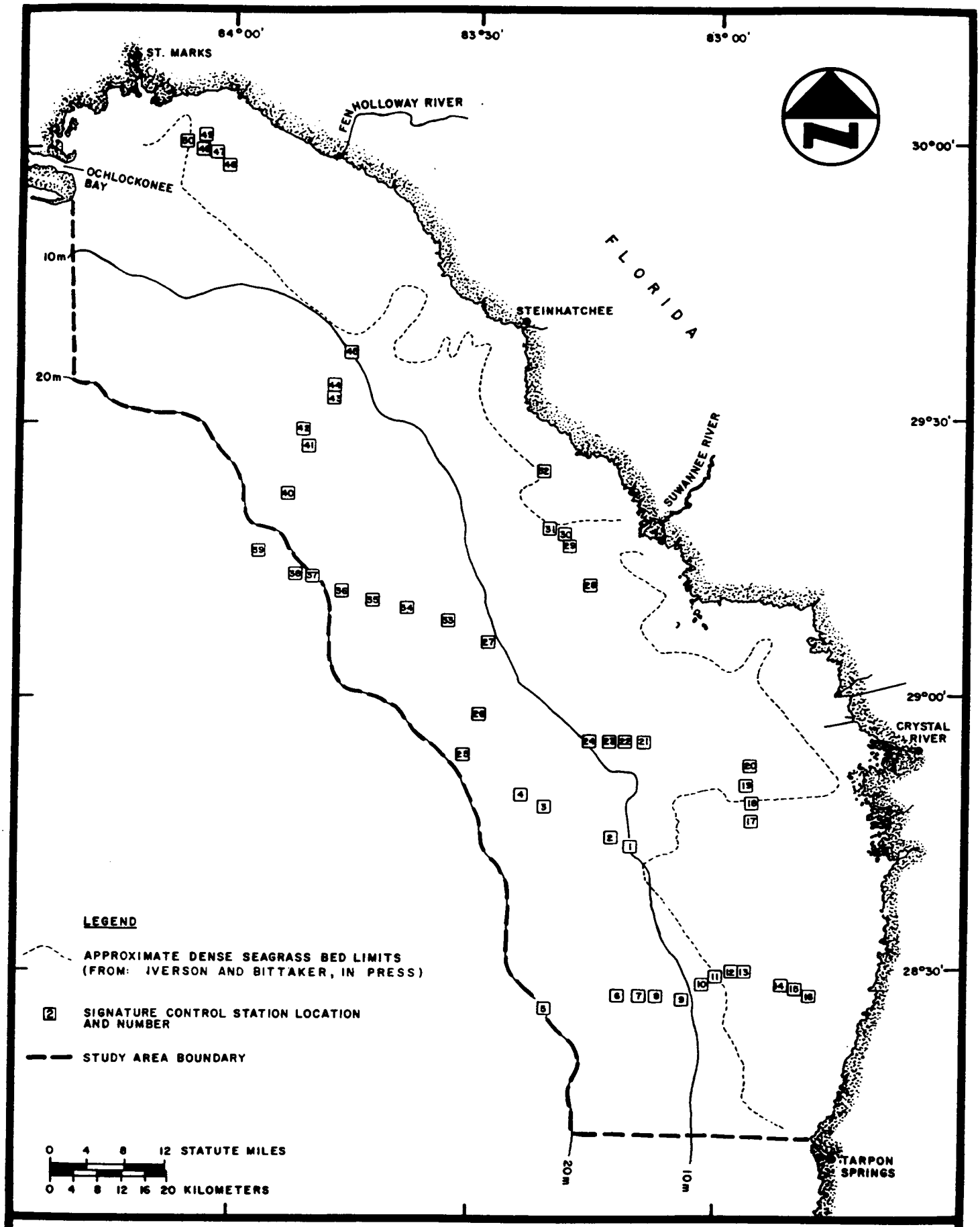

FIGURE 2.4. SIGNATURE CONTROL STATIONS ESTABLISHED AND SAMPLED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984).

Nine transects were surveyed during Cruise 2 (Figure 2.5). Three transects were surveyed using towed divers to approximately the 17-m (55-ft) depth contour, then completed using the underwater television system. The six other transects were surveyed entirely by towed divers. In all, 174 km (108 mi) of seafloor were surveyed during Cruise 2--102 km (64 mi) by towed divers and 72 km (45 mi) by underwater television.

Methods for television surveys were the same as those used for Cruise 1. Diver surveys were conducted using a towed dive sled. Towed divers maintained constant voice contact with a monitoring station on board ship and reported changes in habitat type as they passed over the seafloor. Habitat classifications were noted at 2-min intervals along each transect. These classifications were recorded on audiotape and in data logs along with the navigational fixes taken aboard ship.

Eleven of the 50 Signature Control Stations established during Cruise 1 were resampled during Cruise 2 (Figure 2.6). One station (9) was sampled twice to recheck blade density estimates. Methods were the same as for Cruise 1 (Section 2.4). However, the qualitative habitat photography was not repeated during this second ground-truthing effort.

2.4 Signature Control Stations

Fifty quantitative Signature Control Stations were established in areas representative of the habitat types seen during Cruise 1. The Signature Control Stations were established to provide quantitative data on seagrass densities within remotely mapped areas and to aid in the interpretation of questionable signatures seen in the aerial imagery.

The stations were buoyed with a target designed to be visible on the aerial imagery, and their precise locations were recorded. International orange, 3 m x 3.7 m (10 ft x 12 ft) plastic tarps were chosen as targets. These tarps were attached to a buoyed frame made of schedule-80 PVC pipe (Figure 2.7). Five cylindrical, 15-kg (33-lb), styrofoam buoy cylinders provided flotation for this frame. Twenty-three-kilogram (50-lb) railroad iron weights were attached to each corner of the target buoy when it was deployed.

Two divers conducted photographic sampling at each station. One diver used a Nikonos II camera loaded with Kodak Plus-X film, equipped with a Nikonos 28-mm lens, close-up attachment, and Subsea 100 w s^{-1} strobe to take 10 quantitative photographs of the seafloor and epibiota. The Nikonos 28-mm lens and close-up attachment produce a photograph showing exactly 343.6 cm^2 (53.3 $in.^2$) of the seafloor, allowing a quantitative assessment of blade density. During the same sampling dive, a second diver photographed the general habitat in the area using a Nikonos II camera loaded with Kodak Tri-X film. This camera was equipped with a 35-mm lens, and the purpose of these photographs was to provide an overall, qualitative view of the habitat which could be used by subsequent reviewers to compare one station with another.

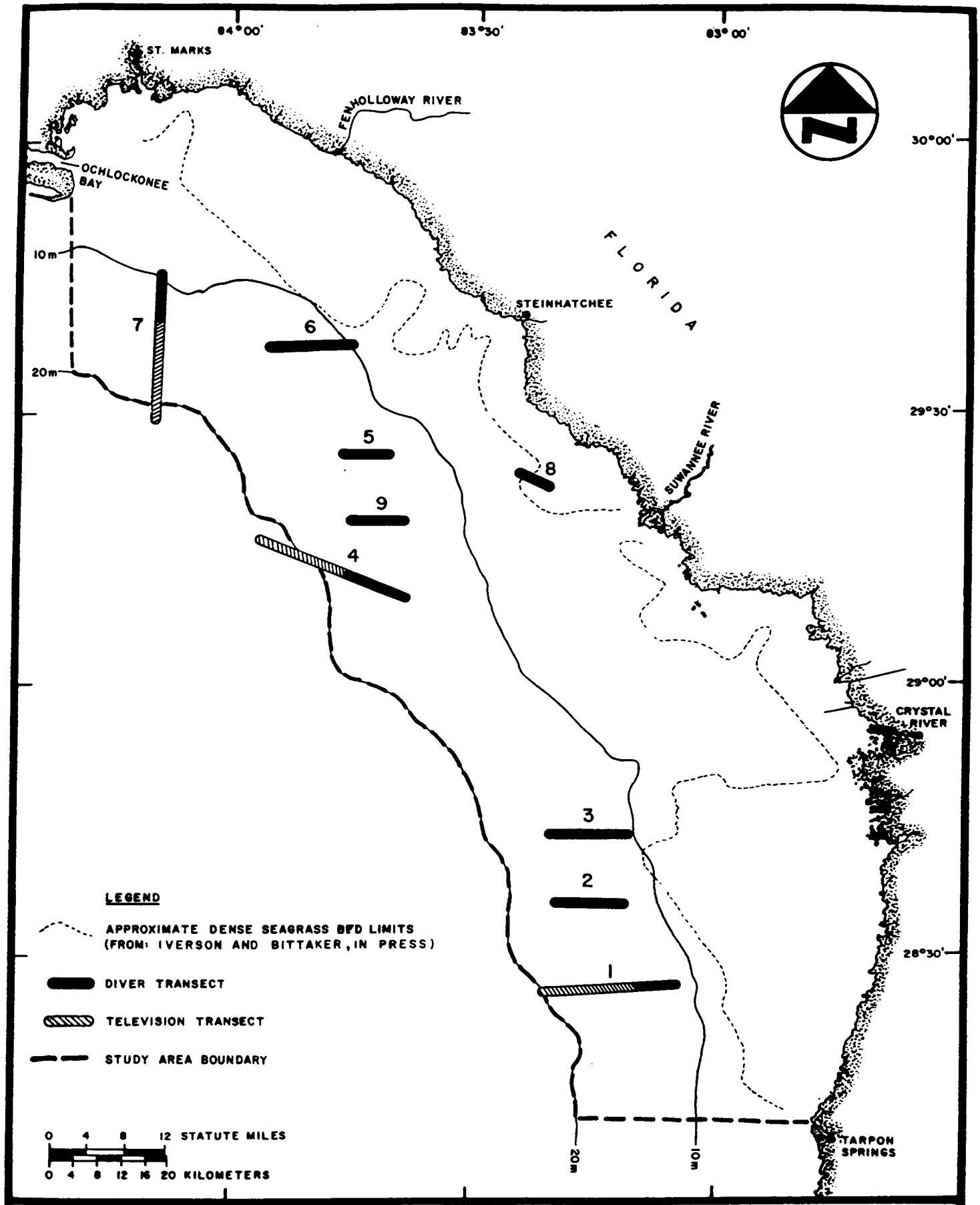

FIGURE 2.5 DIVER AND TELEVISION TRANSECTS SURVEYED DURING CRUISE 2 (19-27 FEBRUARY 1985).

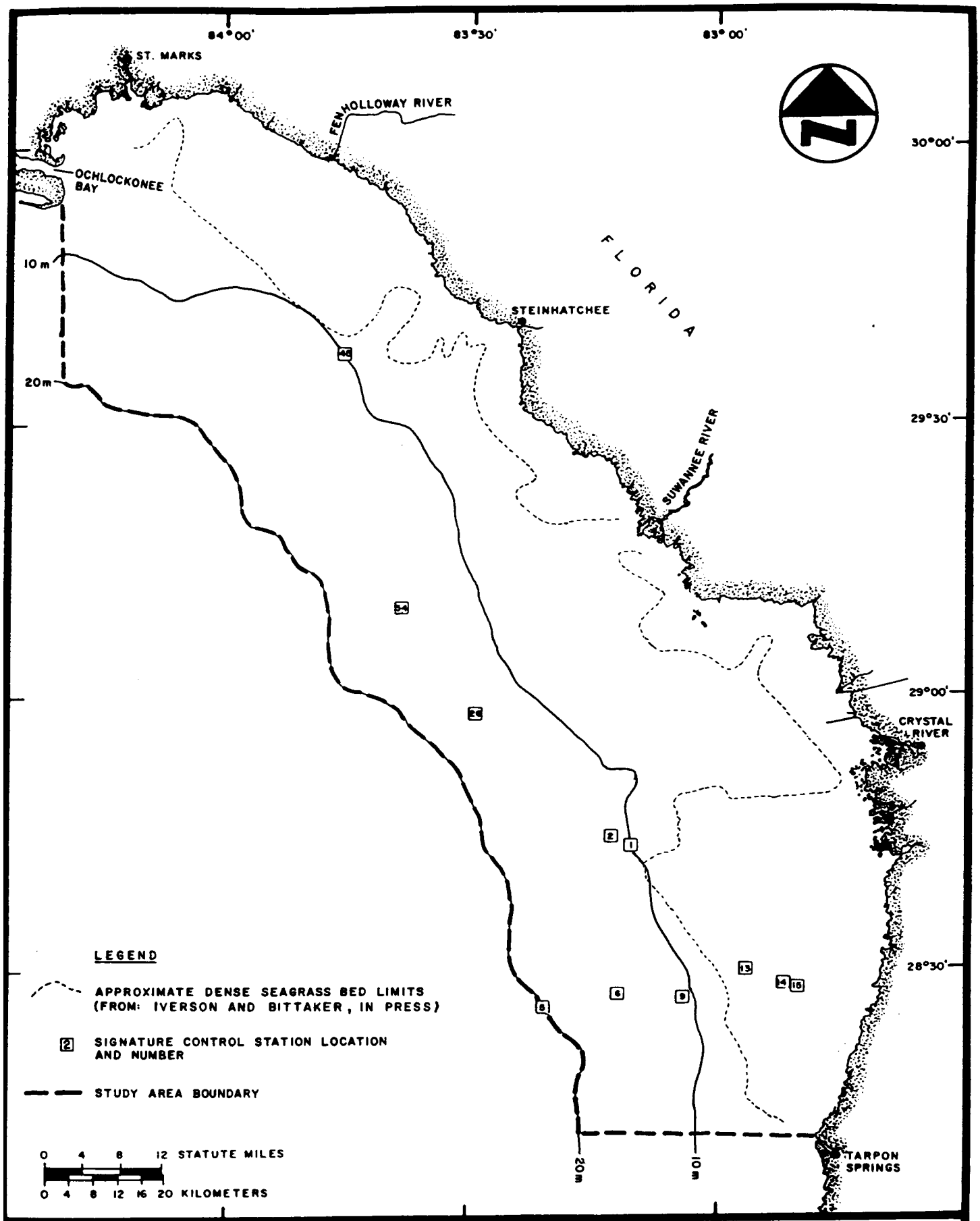

FIGURE 2.6. SIGNATURE CONTROL STATIONS SAMPLED DURING CRUISE 2 (19-27 FEBRUARY 1985).

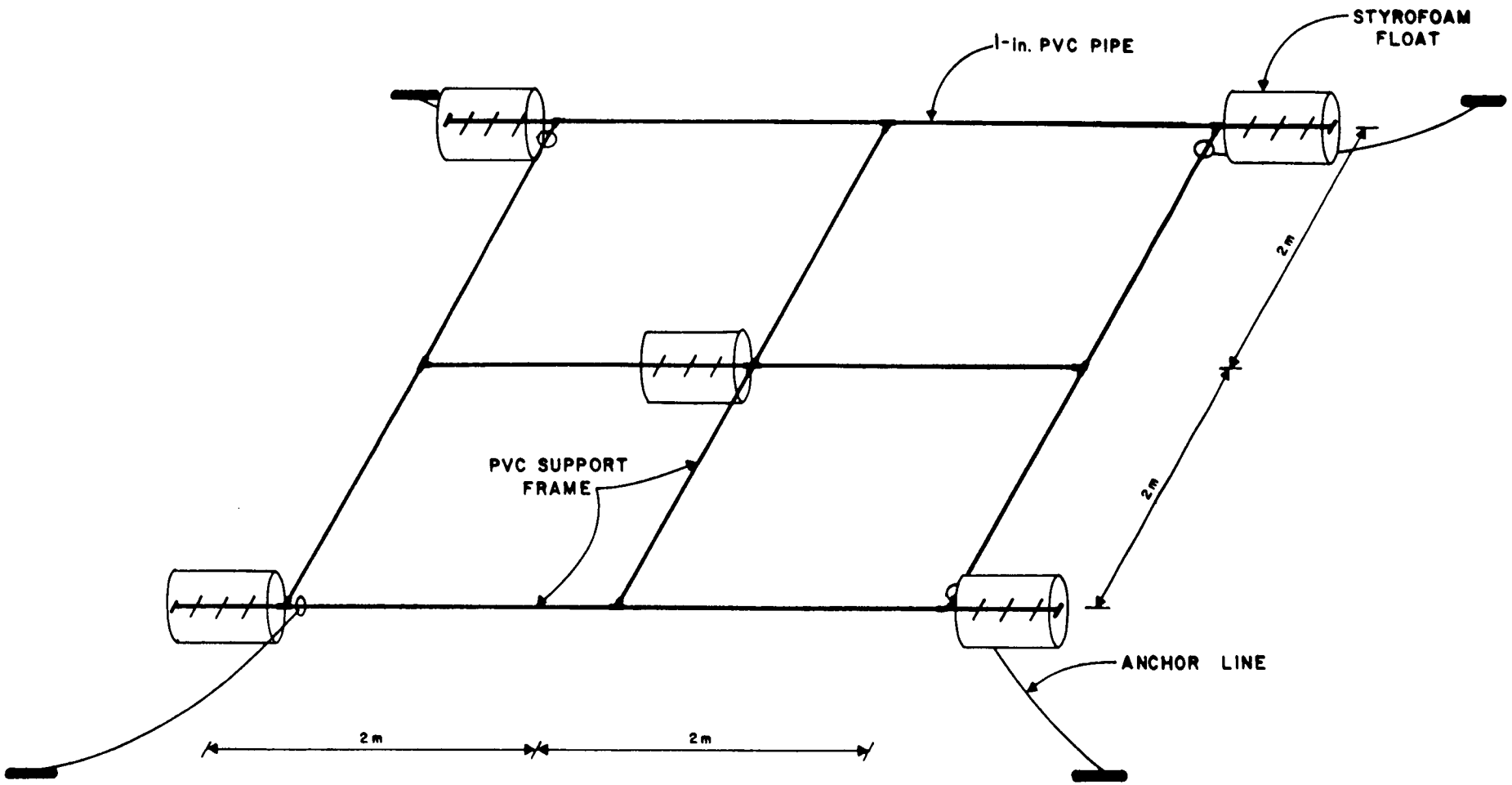

FIGURE 2.7. SCHEMATIC DIAGRAM OF AERIAL TARGET BUOYS.

In the dense nearshore seagrass beds formed by Thalassia testudinum and Syringodium filiforme, the depth of field provided by the Nikonos close-up attachment proved to be too limited to focus properly on individual blades. In these areas, the close-up attachment was removed from the camera and a bar marked in 10-cm (3.9-in.) intervals was used to establish a scale in each photograph.

Diver debriefings were conducted after each dive. The divers recorded their observations on audiotape and in log books for later review.

2.5 Data Analysis and Mapping

2.5.1 Ground-Truthing Data

Quantitative photographs taken at the Signature Control Stations were analyzed to determine blade densities. The close-up photographs each encompassed a fixed area of 343.6 cm^2 (53.3 $in.^2$), and blade counts were straightforward. In the dense, nearshore seagrass beds where the close-up attachment was not used, an area of 0.5 m^2 (5.4 ft^2) was delineated on each photographic print using the scale bar present in the photograph, and blades were counted within this area. Results were tabulated for use in the interpretation of aerial photographs.

Initially, eight categories of seafloor habitat type were established for the Cruise 1 ground-truthing surveys:

1) Dense seagrass and algae;
2) Sparse seagrass and algae;
3) Patchy seagrass and algae (areas where seagrass and algae occurred in dense clumps or stands separated from each other by expanses of unvegetated bottom);
4) Dense live bottom;
5) Sparse live bottom;
6) Patchy live bottom (areas where individual outcrops of live bottom were separated from each other by expanses of bare or vegetated bottom);
7) Bare (unvegetated) sand bottom; and
8) Bare (unvegetated) mud bottom.

These classifications were selected to maintain consistency between this study and the "Assessment of Fisheries Habitat" study being conducted by the Florida Department of Natural Resources for the U.S. Office of Ocean and Coastal Resource Management, National Oceanic and Atmospheric Administration.

Both quantitative data from the Signature Control Stations and qualitative data (habitat classifications and observations) obtained during the television and diver surveys were used to evaluate seagrass bed signatures on the aerial photographs. Map overlays prepared from the ground-truthing efforts were used to expand the habitat classifications delineated from remote imagery and to indicate seagrass habitat

distribution in depths where remote imagery failed to resolve the seafloor.

2.5.2 Remote Sensing Data

Remote imagery was analyzed stereoscopically, and seagrass beds were differentiated by density types. Identification of density types required interpretation of "photo-signature characteristics" such as tone, color, texture, and size. Signatures from submerged seagrass beds ranged from dark blue-green in the offshore areas to a light-to-medium density brown in nearshore areas influenced by tidal fluctuations. Areas of nonvegetated sand (a white signature generally showing sand wave features) and mud (dark brown signature) bottoms were also delineated and mapped.

Signature Control Station targets could not be resolved on the aerial imagery without significant enlargement of the photographic prints. The size and color of targets deployed at the Signature Control Stations were selected on the basis of recommended guidelines (Slater, 1975), but because the targets lay flat, they offered no vertical relief to attract the interpreter's eye during normal stereoscopic analysis. Although the targets could be located when the photographs were enlarged, this process proved costly and time-consuming. Therefore, the interpreters relied solely on navigational fixes to locate the Signature Control Stations.

Due to signature similarities between seagrass beds and the low-relief coral, sponge, and gorgonid assemblages frequently seen within them, live bottom could not be differentiated from seagrass habitat at the 1:40,000 imagery scale. For this reason, the eight habitat classifications originally developed for the ground-truthing surveys were reduced to five for mapping based on aerial photographs. These five categories were:

1) Dense seagrass beds;
2) Sparse seagrass beds;
3) Patchy seagrass beds;
4) Nonvegetated sand bottom; and
5) Nonvegetated mud bottom.

The percentage incidence of live bottom within areas mapped (from remote sensing data) as seagrass beds was estimated on the basis of the ground-truthing data.

Six hundred aerial photographs were interpreted. The major signatures were outlined on clear acetate and classified according to the five categories listed above. The clear acetate interpretations formed the basis for a map encompassing the entire study area at a scale of 1:40,000. From this map, a reduced, Composite Map at a scale of 1:250,000 was produced to be superimposed on the existing 1:250,000 MMS Protraction Diagrams. The photographs were incorporated into the Florida Big Bend Seagrass Habitat Study Photographic Atlas (Continental Shelf Associates, Inc. and Martel Laboratories, Inc., 1985).

3.0 RESULTS AND DISCUSSION

A total of 1.5 million ha (3.7 million acres or 5,830 mi^2) of seafloor were mapped during the aerial overflights. Results are presented in the Florida Big Bend Seagrass Habitat Study Photographic Atlas (Continental Shelf Associates, Inc. and Martel Laboratories, Inc., 1985). Figure 3.1 is a photographic reduction of the 1:250,000 scale Composite Map from the atlas. Figure 3.2 illustrates seagrass distribution based upon both remote sensing and ground survey data. Aerial mapping and ground-truthing delineated 232,893 ha (575,479 acres or 899 mi^2) of dense seagrass beds, 498,034 ha (1,230,643 acres or 1,923 mi^2) of sparse seagrass beds, and 279,722 ha (691,195 acres or 1,080 mi^2) of patchy seagrass beds within the Florida Big Bend area.

Results of the ground-truthing transect surveys are presented in Appendices A and B (Cruises 1 and 2, respectively). Quantitative sampling results from the Signature Control Stations are shown in Appendices C and D.

The remote sensing and ground-truthing data were generally in agreement, but minor discrepancies were evident in some areas due to differences in viewing scale. For example, in some areas, diver or television surveys indicated bare sand or mud bottom, whereas the aerial photographs showed patchy seagrass beds. Also, as noted previously, live bottom could not be distinguished from seagrass habitat in the aerial photographs.

3.1 Seagrass Bed Species Composition and Zonation

There are two major seagrass species associations in the Florida Big Bend area. A nearshore, shallow-water association of *Thalassia testudinum*, *Syringodium filiforme*, and *Halodule wrightii* occurs in water depths less than 9 m (30 ft). These species form major, dense seagrass beds that were easily detectable on the aerial imagery (Figure 3.1). Seaward of this association are large areas characterized by overlapping mixtures of algal, seagrass, and live-bottom habitats. There is a broad area of patchy seagrass beds where five species of seagrasses (the three mentioned above along with *Halophila decipiens* and *H. engelmanni*) may overlap. Farther offshore, there are large areas covered by beds of fringing seagrasses and algae. *Halophila decipiens* and *H. engelmanni* are the only vascular plants seen in this offshore association. Attached macroalgae in these beds include several different forms of *Caulerpa sertularioides*, as well as *C. lanuginosa*, *C. mexicana*, *Udotea* sp., *Penicillus* sp., *Halimeda* sp., and *Sargassum* sp.

In the southernmost portion of the study area, between Crystal River and Tarpon Springs, the nearshore assemblage consisting of *T. testudinum*, *S. filiforme*, and an outer fringing zone of *Halodule wrightii* extends into water depths of approximately 9 m (30 ft). Throughout the rest of the study area, this group of species is restricted to water depths less

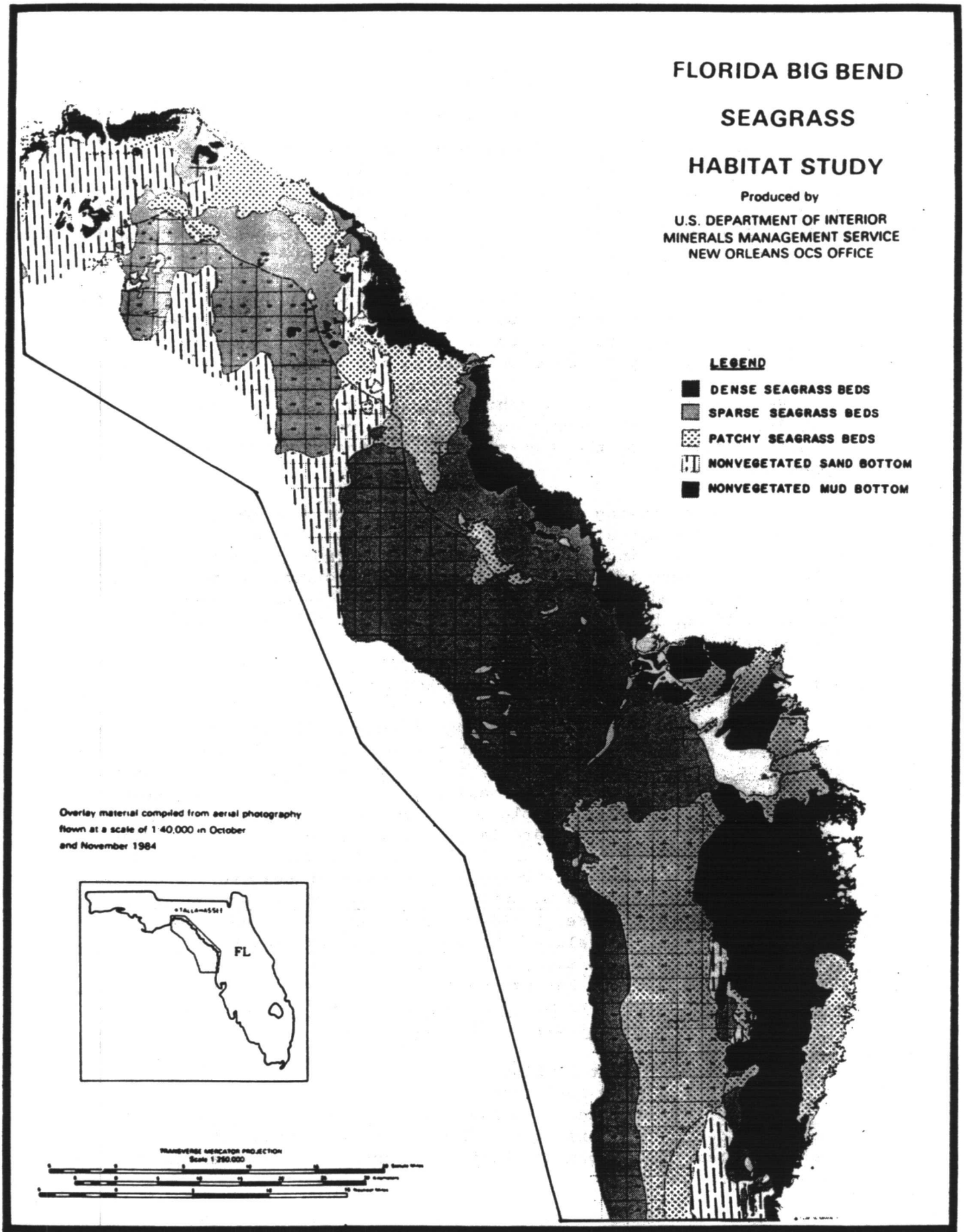

FIGURE 3.1. FLORIDA BIG BEND SEAGRASS HABITAT STUDY COMPOSITE MAP BASED ON AERIAL INTERPRETATION ALONE (PHOTOGRAPHIC REDUCTION).

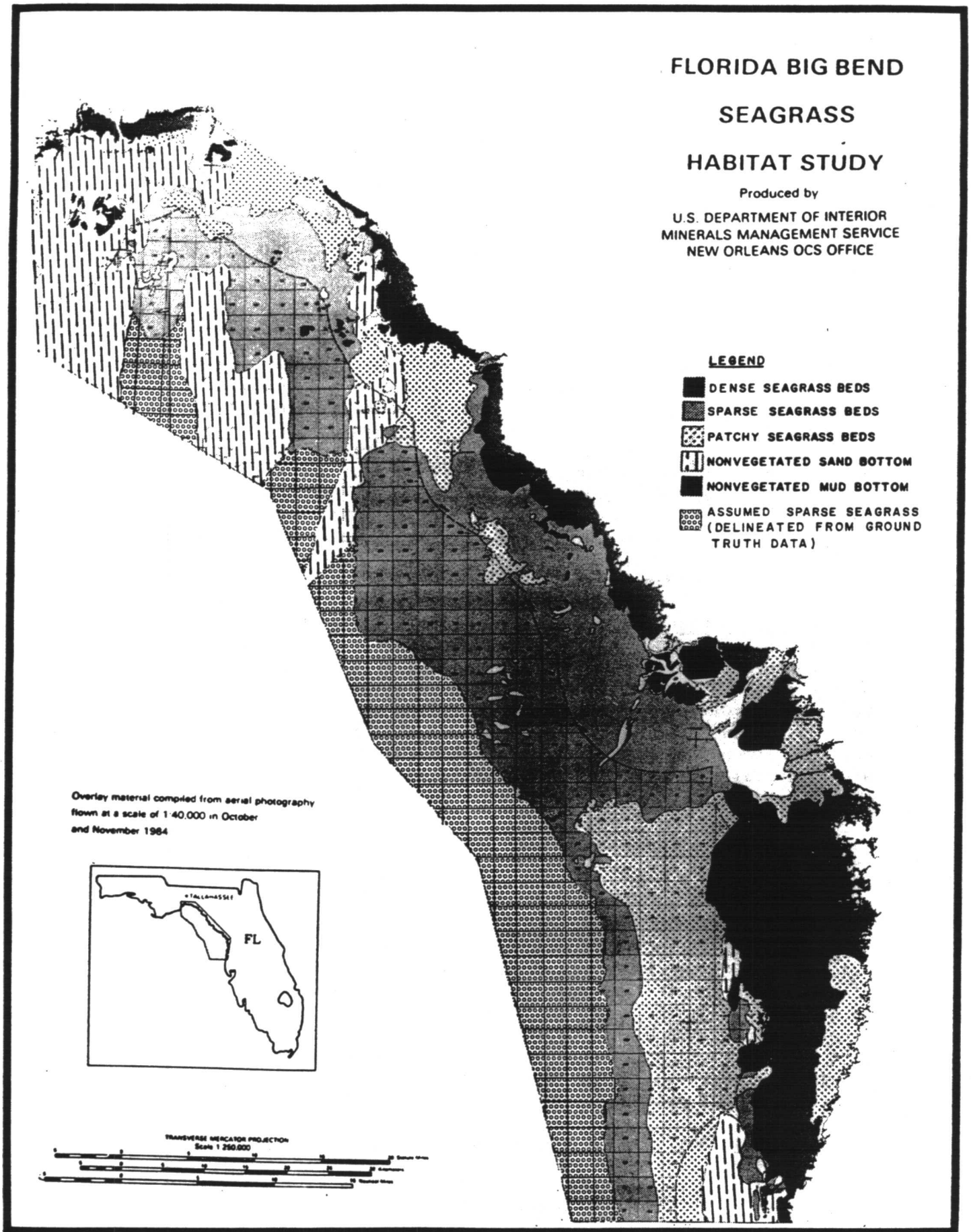

FIGURE 3.2. FLORIDA BIG BEND SEAGRASS HABITAT STUDY COMPOSITE MAP BASED ON AERIAL AND GROUND TRUTHING DATA (PHOTOGRAPHIC REDUCTION).

than 6 m (20 ft), thus being entirely within State, rather than Federal, waters.

Species zonation patterns within the nearshore seagrass assemblage of the Florida Big Bend area resemble those previously described for St. Joseph Sound (off Clearwater), Tampa Bay, Charlotte Harbor, and the Indian River on Florida's east coast (Phillips, 1960; Thompson, 1978; Continental Shelf Associates, Inc., 1984). There is an inner fringe of Halophila decipiens, a middle zone of T. testudinum, an outer dense zone of S. filiforme, and a final outer fringing zone of Halodule wrightii, which may be accompanied by Halophila engelmanni.

Farther offshore, Halophila decipiens and H. engelmanni are seen in large mixed or monotypic stands. These seagrass beds encompass a large area, but grass density within the stands is low in comparison with that of the inshore seagrass beds. The offshore seagrass, algal, and live-bottom assemblages were visible to an average depth of 12 m (39 ft) on the remote imagery. Ground-truthing data indicate this assemblage persists in approximately the same concentration from this depth to the outer limits of the study area [20 m (66 ft)]. Transects C to D and D to E from Cruise 1, and Transects 1, 4, and 7 of Cruise 2 were deliberately extended beyond the boundaries of the study area in an effort to determine the maximum depth for this assemblage.

Thalassia testudinum and Syringodium filiforme were the major bed forming seagrass species seen in the Florida Big Bend area. The foliage of these species alters the mean grain size of sediments accumulating within a bed as compared with those accumulating outside (Taylor and Lewis, 1970; Orth, 1977), in effect creating the persistent feature of the bed in the environment. Halodule wrightii and Halophila engelmanni are seen around the outer fringes of these major beds, but these species are essentially pioneer or fringing species and are believed not to actively build the bed.

Thalassia testudinum is morphologically the largest Gulf of Mexico seagrass species, having blade lengths of up to 75 cm (30 in.) and widths of 1.4 cm (0.55 in.) or more. Its rhizomes may reach 1 cm (0.39 in.) in diameter and grow to a depth of 15 cm (6 in.) below the surface sediments. The blades of S. filiforme are approximately as long as those of T. testudinum, but the former are round and only 2 to 4 mm (0.08 to 0.16 in.) in diameter. Syringodium filiforme rhizomes are smaller in diameter than those of T. testudinum and do not grow as deeply below the surface. Halodule wrightii in the nearshore seagrass beds has a blade length of approximately 15 cm (6 in.) and a width of only 1 to 2 mm (0.04 to 0.08 in.). Its rhizomes are small and located within the top few centimeters of bottom sediment (McMillan, 1978; Thompson, 1978; Iverson and Bittaker, in press).

Halophila decipiens and H. englemanni are the smallest seagrasses seen in the Big Bend area. Their growth form differs from that of the other three species. A single shoot rises from a very small rhizome and in the case of H. decipiens produces two pennate leaves at a height of

approximately 2.54 cm (1 in.). With H. englemanni the leaf stalk or shoot rises to a height of approximately 5 cm (2 in.), then puts out six, evenly spaced, cylindrically pennate leaves (Plate 3.1). Leaves in both species may range from 2.5 to 3.0 cm (1 to 1.25 in.) in length, and from 0.6 to 0.7 cm (0.24 to 0.28 in.) in width. During this study, mature blades of both Halophila sp. were frequently seen to be encrusted with epiphytes (Plate 3.2).

3.2 Blade Density

Appendix C summarizes blade counts at the Signature Control Stations sampled during Cruise 1. At stations located in nearshore Thalassia-Syringodium beds, blade density ranged from 41 blades m^{-2} in areas characterized as sparse to 309 blades m^{-2} in areas characterized as dense. At the offshore seagrass stations dominated by Halophila sp. and macroalgae, blade density ranged from 374 to 2,657 blades m^{-2}. Nearly all of the seagrass stations at water depths greater than 9 m (30 ft) were characterized as sparse (in terms of bottom coverage) despite this range of blade densities. Because of size differences among seagrass species, equivalent blade densities do not necessarily correspond to equivalent bottom coverage. For example, in the nearshore beds, T. testudinum normally covered 90% to 100% of the bottom with blade counts of only 200 m^{-2}, whereas in the offshore beds characterized by Halophila sp., bottom coverage rarely exceeded 30%, even when blade counts exceeded 1,000 m^{-2}. Plates 3.3 through 3.6 illustrate the relative density of coverage by T. testudinum and H. engelmanni.

Algal blades contributed 2% to 70% of the total blade density of the offshore seagrass beds during Cruise 1 (Table 3.1). On the average, 21% of the apparent density of seagrasses in these outer or offshore beds is attributable to algae.

3.3 Seasonal Variability

A comparison of data gathered during the two ground-truthing cruises indicates considerable seasonal variation in seagrass beds within the Florida Big Bend area. The winter dieback of nearshore T. testudinum and S. filiforme beds is well documented (Phillips, 1960; Earle, 1972; McMillan, 1979), but little prior information was available on seasonality of the deep, offshore H. decipiens and H. engelmanni beds.

Substantial reductions (>50%) in seagrass blade density were evident at 7 of the 11 Signature Control Stations resampled during Cruise 2 (February 1985) (Stations 2, 5, 6, 9, 13, 15, and 34) (Appendix D). Six of these stations were located within the offshore area typified by sparse seagrass beds of Halophila sp. and algae, and one (15) was located within a T. testudinum bed. At three other offshore stations (1, 26, and 45), there was either no change or a slight increase in blade density between cruises. Low blade densities were recorded at these three stations during Cruise 1, and the apparent increase may simply reflect spatial variability within these habitats.

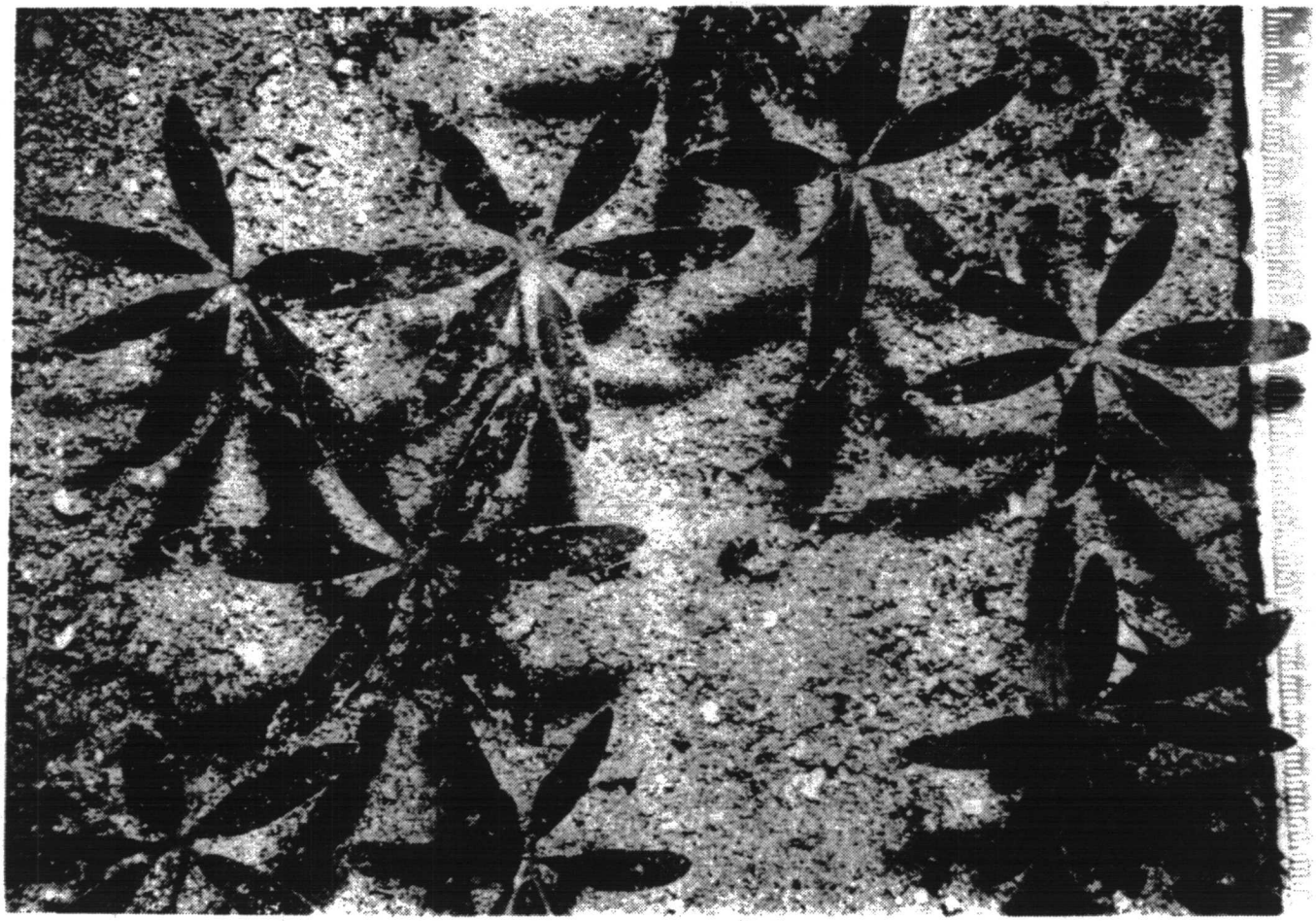

PLATE 3.1. HALOPHILA ENGELMANNI IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

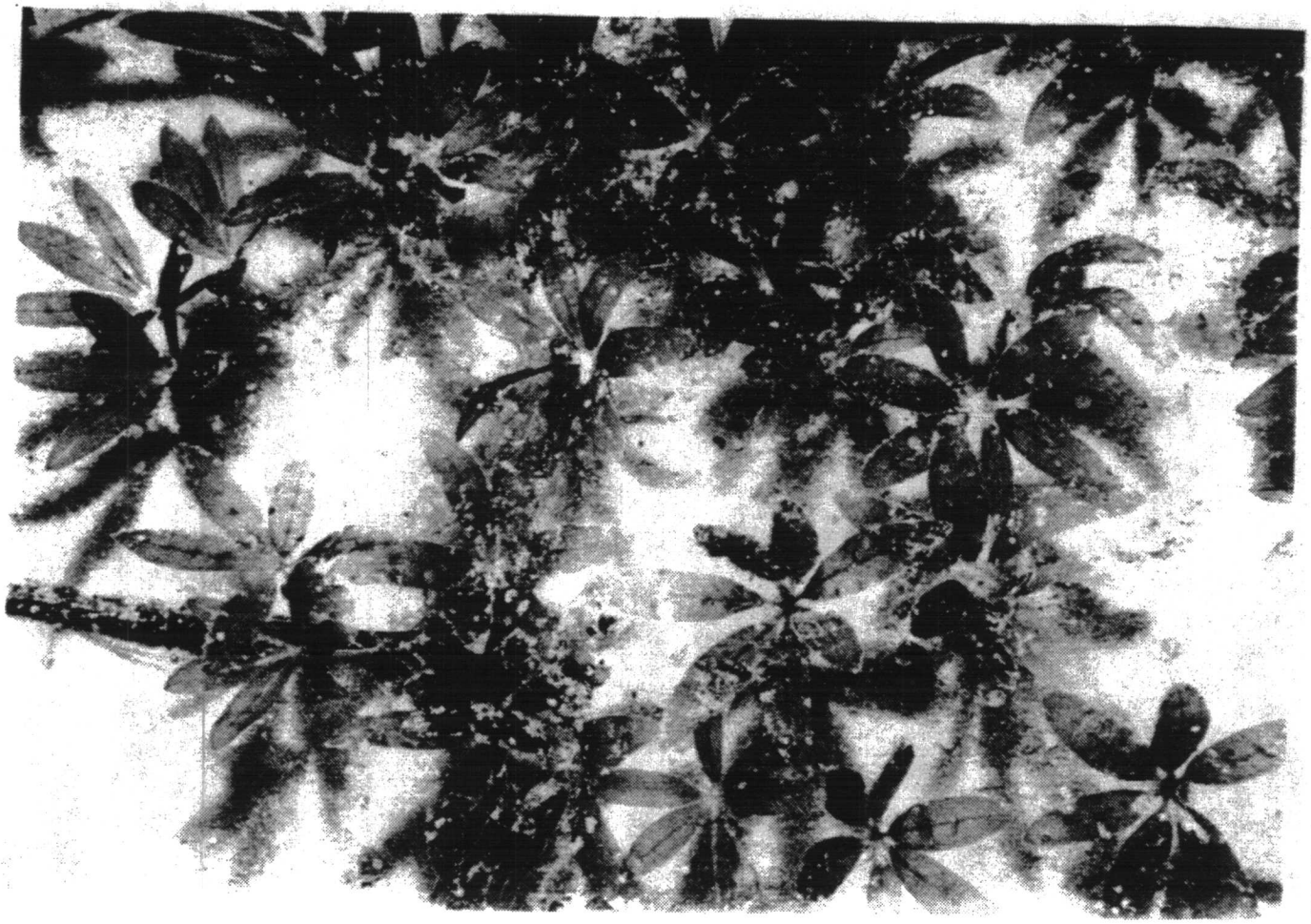

PLATE 3.2. HALOPHILA ENGELMANNI BLADES SHOWING INCRUSTATION BY EPIPHITES AT SIGNATURE CONTROL STATION NUMBER 35 IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

PLATE 3.3. THALASSIA TESTUDINUM SEAGRASS BED IN THE NEARSHORE PORTION IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

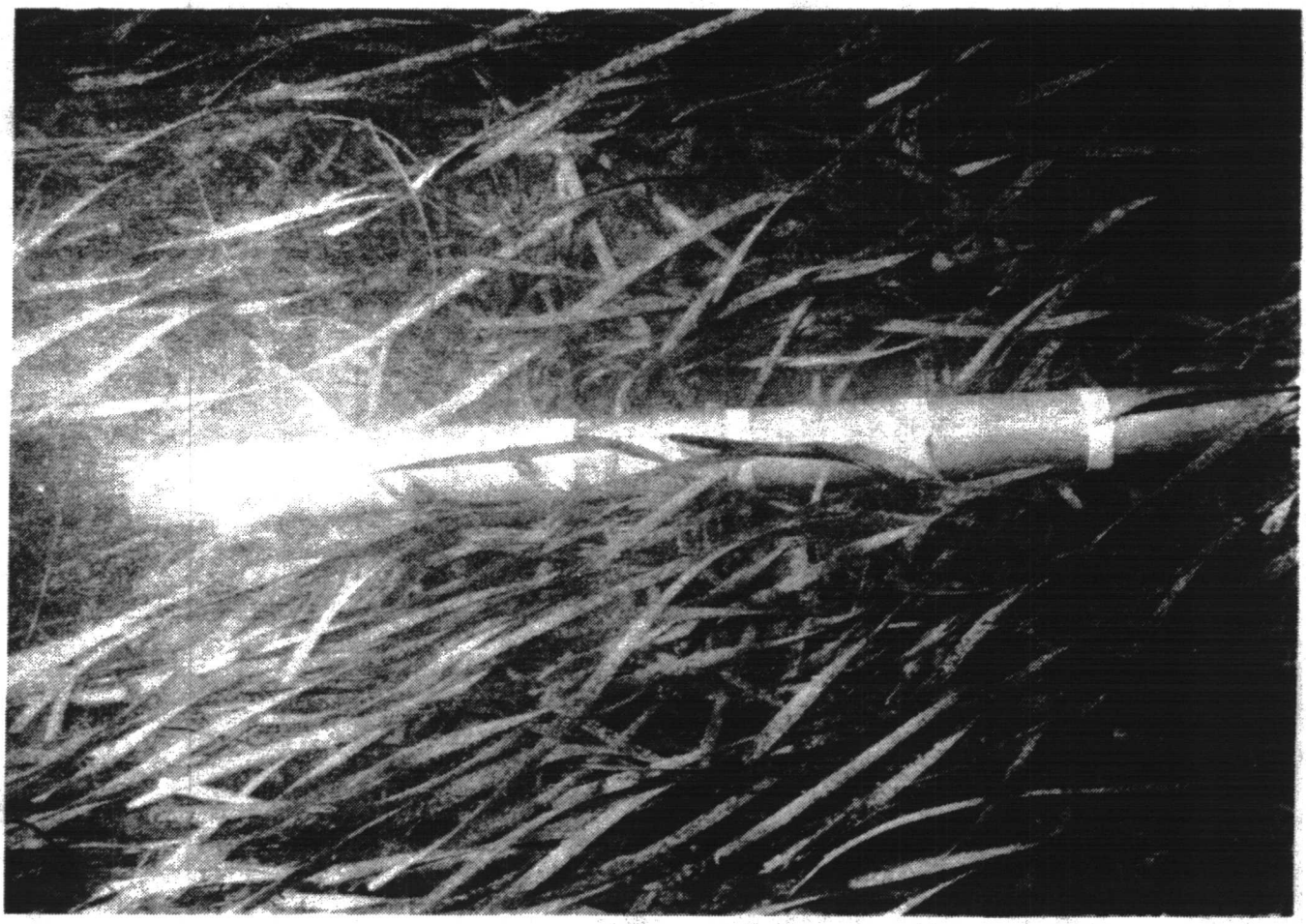

PLATE 3.4. QUANTITATIVE PHOTOGRAPH SHOWING RELATIVE BOTTOM COVERAGE BY THALASSIA TESTUDINUM AT SIGNATURE CONTROL STATION NUMDER 16 IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

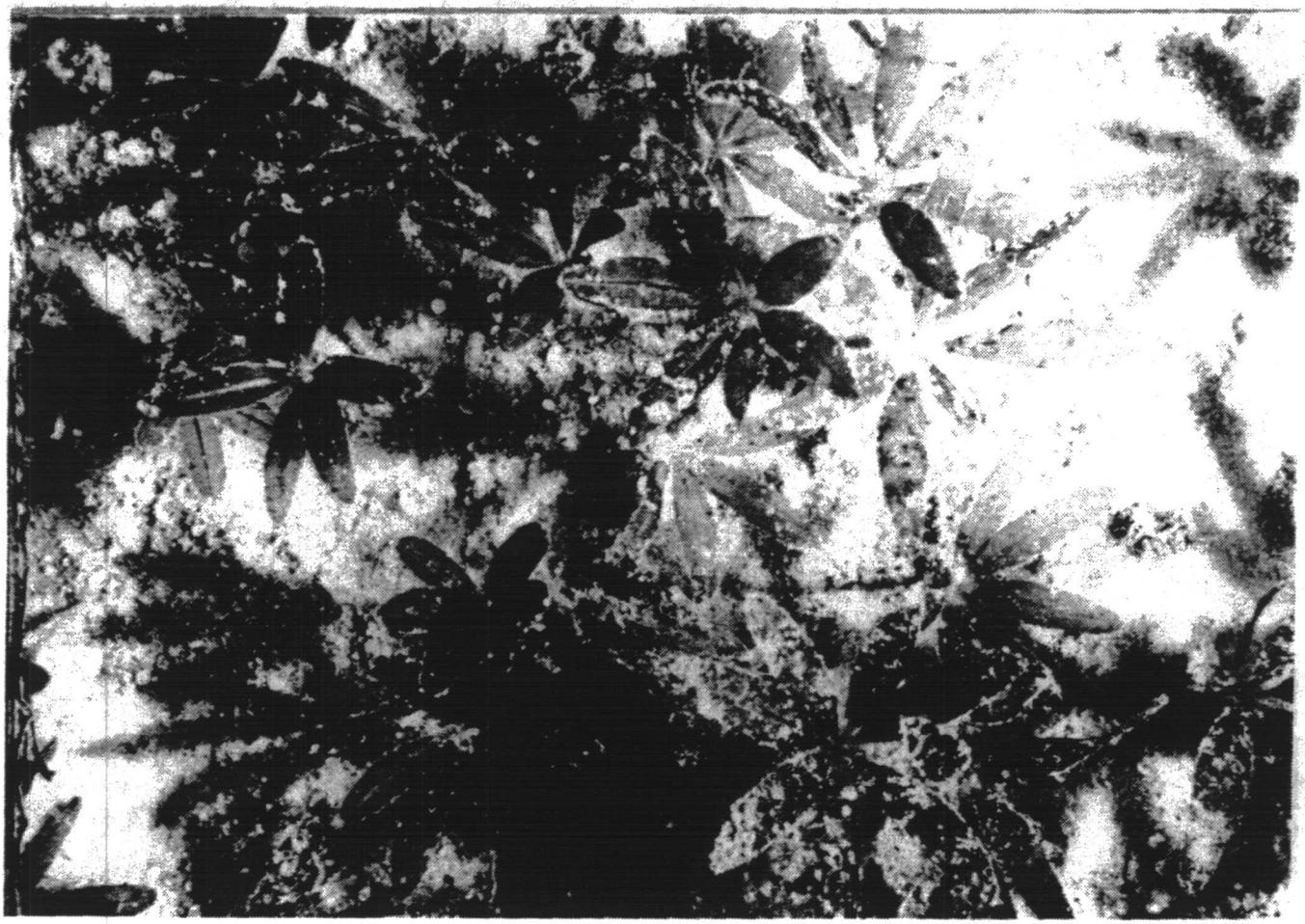

PLATE 3.5. QUANTITATIVE PHOTOGRAPH SHOWING RELATIVE BOTTOM COVERAGE BY HALOPHILA ENGELMANNI AT SIGNATURE CONTROL STATION NUMBER 34 IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

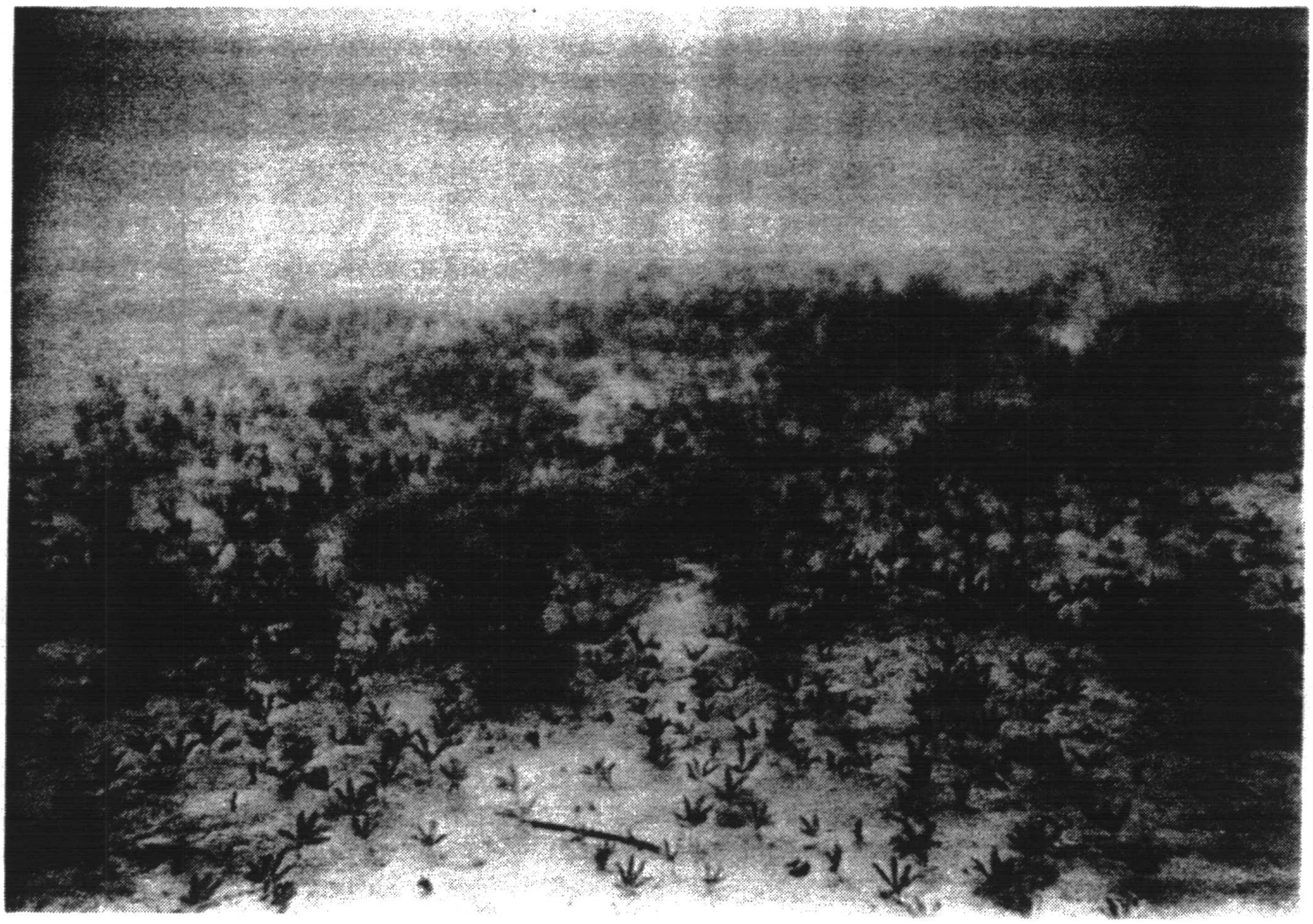

PLATE 3.6. QUALITATIVE PHOTOGRAPH OF HALOPHILA ENGELMANNI BED AT SIGNATURE CONTROL STATION NUMBER 34 IN THE FLORIDA BIG BEND SEAGRASS HABITAT STUDY AREA.

TABLE 3.1. DENSITIES AND PERCENTAGE CONTRIBUTION OF ALGAL BLADES AT SIGNATURE CONTROL STATIONS DURING CRUISE 1.

Station	Algal Species	No. Algal Blades m^{-2}	No. Algal Blades as Percentage of Total
1	*Caulerpa sertularioides*	92	70
2	*C. prolifera*	15	2
3	*C. prolifera*	80	21
	C. mexicana	107	29
4	*C. prolifera*	100	14
	C. lanuginosa	166	22
5	*C. sertularioides*	167	43
6	*C. sertularioides*	70	9
	C. mexicana	48	6
7	*C. sertularioides*	22	5
9	*C. prolifera*	79	3
	C. sertularioides	4	0.2
37	*C. sertularioides*	46	8
	Udotea sp.	25	4
38	*C. sertularioides*	11	1
	C. lanuginosa	48	3
41	*C. sertularioides*	11	1
	C. prolifera	67	7
	Udotea sp.	19	2
42	*C. sertularioides*	90	18
	C. mexicana	60	12
43	*Udotea* sp.	19	11
44	*C. sertularioides*	42	5
	Udotea sp.	4	0.4
45	*C. sertularioides*	58	12
	C. prolifera	17	3

Halophila decipiens, a numerical dominant at many offshore stations during Cruise 1, was absent from all nine offshore stations resampled during Cruise 2. Halophila engelmanni persisted at some stations but at reduced blade densities. Algae did not appear to show the marked reductions noted for seagrasses, but several incidences of winter dieback in individual plants were noted (Plate 3.7).

During Cruise 2, evidence of wave or current stress was frequently observed at offshore stations and transects. Uprooted H. engelmanni was commonly seen (Plate 3.8), and several incidences of apparent erosion of H. engelmanni beds by wave or current action were noted during diver tows. Although the Halophila rhizomes are small, they appear to exert a stabilizing effect on the sediments. Sand waves were reduced or absent in grass bed areas, and where wave or current action destroyed a portion of a bed, a scooping out or scouring process similar to that described for seagrasses in the Florida Keys (Ginsburg and Lowenstam, 1958) was noted.

At two nearshore stations (14 and 15) resampled during Cruise 2, marked reductions in T. testudinum blade density were noted (Appendix D). Winter stress in the form of increased leaf litter and dead portions on individual leaves could be seen at both these stations, but there was no evidence of erosion or destruction by wave action within the beds.

3.4 Live-Bottom Habitats

Analysis of television and diver tow transects surveyed during both Cruises 1 and 2 indicates that live-bottom areas make up approximately 342,213 ha (836,000 acres), or 44% of the 777,756 ha (1.9 million acres) designated as sparse and patchy seagrass in the composite map generated from aerial imagery. These live-bottom habitats were distributed evenly throughout the offshore area surveyed and could not be segregated into distinct zones. Patchy live-bottom was also seen within the nearshore [<10 m (<33 ft)] portion of the study area, but this area was not surveyed with an intensity allowing any estimation of total coverage. It appears that virtually the entire study area consists of a thin sand veneer over a hard calcareous platform which has been aerially weathered and eroded during past lower sea level stands. These visual observations from diver and television tows agree with geophysical data from a number of past studies (State University System of Florida, Institute of Oceanography, 1975; Neurauter, 1979; Woodward-Clyde Consultants, 1979).

3.5 Seagrass Beds in the Shelf Ecosystem

The full range of environmental factors affecting seagrass distribution in the Florida Big Bend area has not been studied. Light penetration is probably a major factor determining the distribution of both the nearshore and offshore seagrass species groupings seen (McMillan, 1978; Wiginton and McMillan, 1979; Williams and McRoy, 1982), but substrate type and temperature are also important environmental variables affecting seagrass beds (McMillan, 1979; McMillan and Phillips, 1979; Pulich, 1983; Iverson and Bittaker, in press). Wave action and

PLATE 3.7. CAULERPA SERTULARIOIDES BLADES SHOWING PARTIAL DIEBACK DURING WINTER SAMPLING.

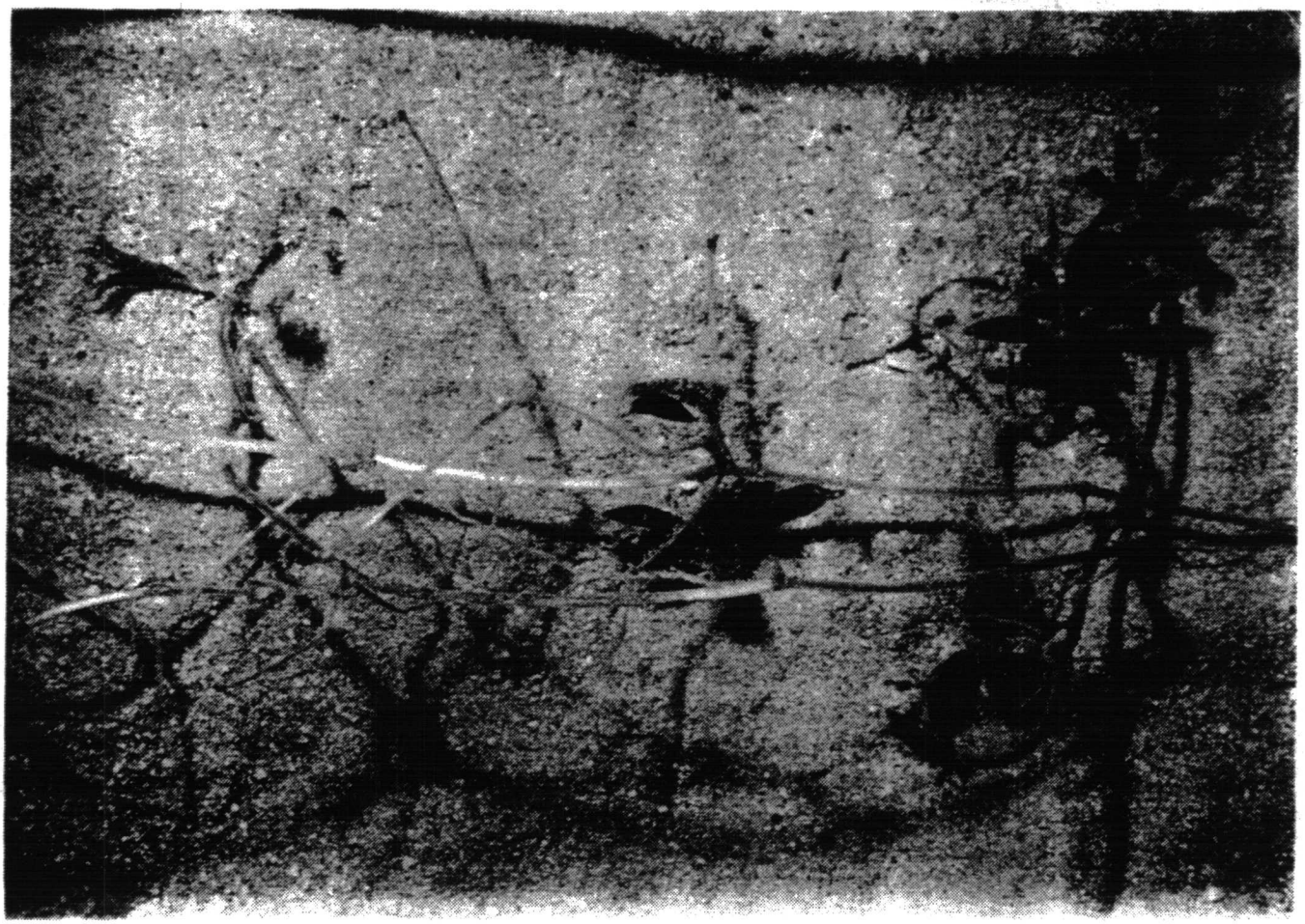

PLATE 3.8. UPROOTED HALOPHILA ENGELMANNI SEEN AT SIGNATURE CONTROL STATION NUMBER 26 DURING WINTER SAMPLING.

sediment transport are significant winter stress factors in the offshore seagrass beds, as evidenced by the uprooted Halophila engelmanni seen during Cruise 2.

The present study was designed to map and describe Florida Big Bend area seagrass beds; ecological interrelationships were not investigated. Although nearshore seagrass beds are the subject of ongoing ecological research, little information is available concerning the productivity and faunal associations of the deep, offshore seagrass beds. Consequently, their roles and importance within the continental shelf ecosystem are currently unknown.

4.0 RECOMMENDATIONS FOR ADDITIONAL RESEARCH

In view of the extent of the mixed seagrass, macroalgal, and live-bottom assemblages seen on the northwestern Florida continental shelf in the Florida Big Bend area, additional studies on these communities seem appropriate. Such studies should be directed toward identifying the depth limits, primary productivity, seasonality in species composition and distribution, and associated fauna of the seagrass beds. The offshore seagrass assemblages undoubtedly are important to the overall productivity of the western Florida shelf and their presence may be important in relation to the many commercially valuable fish and invertebrate species harvested there.

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6.0 GLOSSARY

ASSEMBLAGES - A group of two or more species occupying a specific habitat. These species may or may not be interrelated ecologically.

DIEBACK - Winter foliage reduction seen in various plant species.

FORWARD OVERLAP - Used in remote sensing to mean the amount or percentage area two photographs taken along the same flight line have in common.

GROUND-TRUTHING - Used in remote sensing to refer to the process of physically obtaining data from a target area in order to verify data obtained remotely.

MACROALGAE - Algal species visible to the naked eye.

MONOTYPIC STAND - A group of plants all of the same species.

NUMERICAL DOMINANT - A species designated as dominated solely on the basis of numbers of individuals.

PIONEER OR FRINGING SPECIES - Species found growing around the outskirts of climax communities. Within the climax community these species are out-competed, but their ability to resist harsher environmental conditions allows them to survive in areas less favorable to the climax species association . Pioneer species modify the habitat in some way that will eventually favor the establishment and growth of the climax species. Fringing species merely survive on the outskirts of the major community because of their environmental tolerances.

SIDE OVERLAP - Used in remote sensing to refer to the amount or percentage area two photographs taken on adjacent flight lines have in common.

SIGNATURE - Used in remote sensing to refer to any characteristic or series of characteristics by which material may be recognized.

SIGNATURE CONTROL STATIONS - Used in this study to refer to specific stations where ground truth data was obtained as an interpretation tool to aid in validating specific signatures seen in remote imagery.

SPECIES ASSOCIATIONS - Used to refer to plant climax communities dominated by more than one species which form natural units of vegetation.

SPECIES ZONATION PATTERNS - Patterns within a large community in which certain species or groups of species are usually seen.

7.0 APPENDICES

APPENDIX A

CRUISE 1 TELEVISION SURVEY RESULTS

APPENDIX A. CRUISE 1 TELEVISION SURVEY RESULTS.

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
A to B	20	29°41.87'	84°76.57'	7	Sand Bottom
A to B	21	29°41.62'	84°16.41'	7	Sand Bottom
A to B	22	29°41.48'	84°16.29'	4	Dense Live Bottom
A to B	23	29°41.39'	84°16.24'	6	Patchy Live Bottom
A to B	24	29°41.16'	84°16.05'	7	Sand Bottom
A to B	25	29°40.98'	84°15.94'	1	Dense Seagrass and Algae
A to B	26	29°40.90'	84°15.86'	1	Dense Seagrass and Algae
A to B	27	29°40.67'	84°15.72'	6	Patchy Live Bottom
A to B	28	29°40.44'	84°15.56'	6	Patchy Live Bottom
A to B	29	29°40.16'	84°15.40'	7	Sand Bottom
A to B	30	29°39.89'	84°15.25'	2	Sparse Caulerpa and Sand
A to B	31	29°39.68'	84°15.09'	2 + 5	Sparse Seagrass, Algae, and Live Bottom
A to B	32	29°39.53'	84°14.99'	4	Dense Live Bottom
A to B	33	29°39.47'	84°14.96'	4	Dense Live Bottom
A to B	34	29°39.25'	84°14.81'	4	Dense Live Bottom
A to B	35	29°39.02'	84°14.64'	4 + 1	Dense Live Bottom and Seagrass
A to B	36	29°38.78'	84°14.47'	2	Sparse Seagrass and Algae
A to B	37	39°38.55'	84°14.33'	6	Patchy Live Bottom
A to B	38	29°38.32'	84°14.18'	6	Patchy Live Bottom
A to B	39	29°38.05'	84°14.01'	6	Patchy Live Bottom
A to B	40	29°37.96'	84°13.95'	4	Dense Live Bottom
A to B	41	29°37.81'	84°13.85'	6	Patchy Live Bottom
A to B	42	29°37.54'	84°13.69'	1	Dense Seagrass Algal Assemblage
A to B	43	29°37.30'	84°13.48'	2	Sparse Algae
A to B	44	29°37.04'	84°13.20'	6	Patchy Live Bottom
A to B	45	29°36.78'	84°13.10'	6 + 1	Patchy Live Bottom with Dense Seagrass and Algae
A to B	46	29°36.53'	84°12.94'	6 + 2	Patchy Live Bottom with Sparse Algae
A to B	47	29°36.26'	84°12.80'	6 + 2	Patchy Live Bottom with Sparse Algae
A to B	48	29°36.01'	74°12.64'	2	Sparse Algal Assemblage
A to B	49	29°35.77'	84°12.47'	6	Patchy Live Bottom
A to B	50	29°35.55'	84°12.34'	4	Dense Live Bottom
A to B	51	29°35.32'	84°12.19'	4	Dense Live Bottom
A to B	52	29°35.09'	84°12.02'	4	Dense Live Bottom
A to B	53	29°34.84'	84°11.85'	4	Dense Live Bottom
A to B	54	29°34.61'	84°11.66'	2	Sparse Algae
A to B	55	29°34.39'	84°11.50'	6 + 2	Patchy Live Bottom and Algae
A to B	56	29°34.13'	84°11.36'	2	Sparse Algae

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
A to B	57	29°33.88'	84°11.23'	2	Sparse Algae
A to B	58	29°33.64'	84°11.03'	5	Sparse Live Bottom
A to B	59	29°33.38'	84°10.88'	5	Sparse Live Bottom
A to B	60	29°33.15'	84°10.71'	2	Sparse Algae
A to B	61	29°32.90'	84°10.56'	2	Sparse Algae
A to B	62	29°32.64'	84°10.40'	6	Patchy Live Bottom
A to B	63	29°32.40'	84°10.23'	6	Patchy Live Bottom
A to B	64	29°32.16'	84°10.05'	6	Patchy Live Bottom
A to B	65	29°31.88'	84°09.85'	2	Sparse Algae
B to C	66	29°31.09'	84°09.33'	6	Patchy Live Bottom
B to C	67	29°31.97'	84°08.98'	3	Patchy Algal Assemblage
B to C	68	29°32.02'	84°08.67'	3	Patchy Algal Assemblage
B to C	69	29°32.09'	84°08.33'	3	Patchy Algal Assemblage
B to C	70	29°32.17'	84°08.03'	6	Patchy Live Bottom
B to C	71	29°32.30'	84°07.72'	6	Patchy Live Bottom
B to C	72	29°32.35'	84°07.42'	6	Patchy Live Bottom
B to C	73	29°32.44'	84°07.13'	6	Patchy Live Bottom
B to C	74	29°32.57'	84°06.82'	6	Patchy Live Bottom
B to C	75	29°32.62'	84°06.52'	6	Patchy Live Bottom
B to C	76	29°32.67'	84°06.20'	6	Patchy Live Bottom
B to C	77	29°32.75'	84°05.89'	6 + 2	Patchy Live Bottom and Algae
B to C	78	29°32.84'	84°05.57'	6	Patchy Live Bottom
B to C	79	29°32.90'	84°05.23'	6	Patchy Live Bottom
B to C	80	29°33.02'	84°04.94'	6	Patchy Live Bottom
B to C	81	29°33.07'	84°04.60'	6	Patchy Live Bottom
B to C	82	29°33.18'	84°04.29'	6	Patchy Live Bottom
B to C	83	29°33.23'	84°03.97'	2	Sparse Algae
B to C	84	29°33.33'	84°03.65'	3	Patchy Algal Assemblage
B to C	85	29°33.42'	84°03.33'	4	Live Bottom
B to C	86	29°33.47'	84°03.01'	6	Patchy Live Bottom
B to C	87	29°33.58'	84°02.69'	6	Patchy Live Bottom
B to C	88	29°33.65'	84°02.35'	6	Patchy Live Bottom
B to C	89	29°33.75'	84°02.05'	6 + 2	Algae and Patchy Live Bottom
B to C	90	29°33.76'	84°01.90'	1	Seagrass and Algal Assemblage
B to C	91	29°33.82'	84°02.73'	2	Sparse Seagrass
B to C	92	29°33.91'	84°01.41'	2	Sparse Seagrass
B to C	93	29°33.97'	84°01.07'	2	Sparse Seagrass
B to C	94	29°34.02'	84°00.71'	2 + 5	Sparse Seagrass and Sparse Live Bottom
B to C	95	29°31.14'	84°00.39'	6	Patchy Live Bottom

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
B to C	96	29°34.24'	84°00.05'	6 + 2	Patchy Live Bottom and Algae
B to C	97	29°34.35'	83°59.70'	2	Sparse Algal Assemblage
B to C	98	29°34.44'	83°59.36'	2 + 5	Sparse Algae and Live Bottom
B to C	99	29°34.54'	83°59.00'	2 + 5	Sparse Algae and Live Bottom
B to C	100	29°34.60'	83°58.64'	2 + 5	Sparse Algae and Live Bottom
B to C	101	29°34.29'	83°58.42'	2 + 5	Sparse Algae and Live Bottom
B to C	102	29°34.40'	83°58.05'	2 + 6	Sparse Algae and Patchy Live Bottom
B to C	103	29°34.48'	83°57.67'	2 + 6	Sparse Algae and Patchy Live Bottom
B to C	104	29°34.60'	83°57.34'	3 + 6	Patchy Algae Assemblage and Patchy Live Bottom
B to C	105	29°34.74'	83°56.93'	1 + 6	Dense Seagrass and Patchy Live Bottom
B to C	106	29°34.87'	83°56.36'	1 + 6	Dense Seagrass and Patchy Live Bottom
B to C	107	29°35.00'	83°55.96'	1	Dense Seagrass and Algae
B to C	108	29°35.14'	83°55.50'	1	Dense Seagrass and Algae
B to C	109	29°35.27'	83°55.01'	6	Patchy Live Bottom
B to C	110	29°35.42'	83°54.44'	6	Patchy Live Bottom
B to C	111	29°35.57'	83°54.04'	6 + 2	Patchy Live Bottom and Sparse Algae
B to C	112	29°35.68'	83°53.53'	1	Dense Seagrass and Algae
B to C	113	29°35.84'	83°53.05'	3	Patchy Seagrass and Algae
B to C	114	29°35.98'	83°52.56'	2	Sparse Algae
B to C	115	29°36.11'	83°52.10'	3	Patchy Algal Assemblage
B to C	116	29°36.25'	83°51.61'	3 + 5	Patchy Algae and Sparse Live Bottom
B to C	117	29°36.39'	83°51.17'	6	Patchy Live Bottom
B to C	118	29°36.52'	83°50.73'	3	Patchy Seagrass and Algae
B to C	119	29°36.68'	83°50.22'	2 + 5	Sparse Algae and Live Bottom
B to C	120	29°36.78'	83°49.80'	2	Sparse Seagrass Algal Assemblage
B to C	121	29°36.91'	83°49.35'	1	Dense Seagrass and Algae
B to C	122	29°37.05'	83°48.91'	6	Patchy Live Bottom
B to C	123	29°37.17'	83°48.45'	7	Sand Bottom
B to C	124	29°37.30'	83°48.00'	7	Sand Bottom
B to C	125	29°37.44'	83°47.53'	2	Sparse Algae
B to C	126	29°37.56'	83°47.09'	2	Sparse Algae

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
B to C	127	29°37.69'	83°46.62'	6	Patchy Live Bottom
B to C	128	29°37.83'	83°46.15'	3	Patchy Algal Assemblage
B to C	129	29°37.88'	83°45.86'	6	Patchy Live Bottom
C to D	130	29°37.76'	83°45.75'	3 + 6	Patchy Seagrass and Live Bottom
C to D	131	29°37.34'	83°45.92'	2	Sparse Seagrass and Algae
C to D	132	29°36.94'	83°46.14'	1 + 5	Sand with Sparse Live Bottom
C to D	133	29°36.54'	83°46.34'	1	Bare Sand showing Bioturbation
C to D	134	29°36.12'	83°46.54'	1	Sand Bottom with Bioturbation
C to D	135	29°35.73'	83°46.74'	1	Sand Bottom
C to D	136	29°35.32'	83°46.99'	1 + 5	Sand Bottom and Sparse Live Bottom
C to D	137	29°34.91'	83°47.14'	1 + 5	Sand Bottom and Sparse Live Bottom
C to D	138	29°34.50'	83°47.35'	1	Sand Bottom
C to D	139	29°34.11'	83°47.55'	1	Sand Bottom
C to D	140	29°33.70'	83°47.75'	1 + 6	Sand Bottom and Patchy Live Bottom
C to D	141	29°33.31'	83°47.94'	1	Sand Bottom and Patchy Live Bottom
C to D	142	29°32.92'	83°48.13'	2	Sparse Algae
C to D	143	29°32.54'	83°48.31'	2 + 5	Sparse Algae Live Bottom
C to D	144	29°32.16'	83°48.52'	5	Sparse Live Bottom
C to D	145	29°31.76'	83°48.71'	1 + 2	Sand and Sparse Algae
C to D	146	29°31.40'	83°48.89'	1 + 6	Sand and Patchy Live Bottom
C to D	147	29°30.99'	83°49.11'	1	Seagrass and Algae
C to D	148	29°30.59'	83°49.29'	6 + 3	Patchy Live Bottom and Seagrass
C to D	149	29°30.20'	83°49.51'	6 + 3	Patchy Live Bottom and Seagrass
C to D	150	29°29.80'	83°49.69'	1	Dense Seagrass and Algae
C to D	151	29°29.39'	83°49.91'	6	Patchy Live Bottom
C to D	152	29°28.99'	83°50.08'	1 + 6	Dense Seagrass and Patchy Live Bottom
C to D	153	29°28.61'	83°50.30'	1 + 4	Dense Seagrass and Live Bottom
C to D	154	29°28.19'	83°50.48'	6 + 3	Patchy Live Bottom and Algae
C to D	155	29°27.99'	83°50.64'	6 + 3	Patchy Live Bottom and Algae
C to D	156	29°27.61'	83°50.75'	4	Dense Live Bottom
C to D	157	29°27.40'	83°50.89'	7 + 2	Sand and Sparse Algae

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
C to D	158	29°27.00'	83°51.06'	7 + 2	Sand and Sparse Algae
C to D	159	29°26.59'	83°51.26'	7 + 2	Sand and Sparse Algae
C to D	160	29°26.19'	83°51.47'	6 + 3	Patchy Live Bottom and Algae
C to D	161	29°25.79'	83°51.67'	6 + 3	Patchy Live Bottom and Algae
C to D	162	29°25.40'	83°51.89'	6 + 3	Patchy Live Bottom and Algae
C to D	163	29°24.98'	83°52.07'	6 + 3	Patchy Live Bottom and Algae
C to D	164	29°24.50'	83°52.26'	6 + 3	Patchy Live Bottom and Algae
C to D	165	29°24.18'	83°52.47'	6 + 3	Patchy Live Bottom and Algae
C to D	166	29°23.77'	83°52.67'	6 + 3	Patchy Live Bottom and Algae
C to D	167	29°23.36'	83°52.85'	6	Patchy Live Bottom
C to D	168	29°22.97'	83°53.07'	6	Patchy Live Bottom
C to D	169	29°22.55'	83°53.28'	1	Dense Seagrass and Algae
C to D	170	29°22.15'	83°54.47'	1 + 5	Dense Seagrass and Sparse Live Bottom
C to D	171	29°21.41'	83°53.85'	1 + 5	Dense Seagrass and Sparse Live Bottom
C to D	172	29°20.99'	83°54.04'	6 + 3	Patchy Live Bottom and Seagrass
C to D	173	29°20.55'	83°54.24'	4	Dense Live Bottom
C to D	174	29°20.17'	83°54.45'	6 + 2	Patchy Live Bottom and Sparse Algae
C to D	175	29°19.74'	83°54.66'	6 + 2	Patchy Live Bottom and Sparse Algae
C to D	176	29°19.42'	83°55.28'	5 + 2	Sparse Live Bottom and Algae
C to D	177	29°18.98'	83°55.27'	5 + 2	Sparse Live Bottom and Algae
C to D	178	29°18.58'	83°55.43'	5 + 2	Sparse Live Bottom and Algae
C to D	179	29°18.18'	83°55.67'	6	Patchy Live Bottom
C to D	180	29°17.73'	83°55.83'	6	Patchy Live Bottom
C to D	181	29°17.31'	83°56.04'	6 + 2	Patchy Live Bottom and Algae
C to D	182	29°16.82'	83°56.22'	6 + 2	Patchy Live Bottom and Algae
C to D	183	29°16.43'	83°56.41'	1 + 4	Dense Seagrass and Live Bottom

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
C to D	184	29°16.06'	83°56.57'	1 + 4	Dense Seagrass and Live Bottom
C to D	185	29°15.74'	83°56.70'	1 + 4	Dense Seagrass and Live Bottom
C to D	186	29°15.43'	83°56.81'	1 + 4	Dense Seagrass and Live Bottom
C to D	187	29°15.15'	83°56.97'	1 + 4	Dense Seagrass and Live Bottom
C to D	188	29°14.84'	83°57.10'	6 + 1	Patchy Live Bottom with Dense Seagrass
D to E	189	29°14.59'	83°57.00'	6 + 1	Patchy Live Bottom with Dense Seagrass
D to E	190	29°14.48'	83°56.66'	6 + 1	Patchy Live Bottom with Dense Seagrass
D to E	191	29°14.37'	83°56.27'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	192	29°14.25'	83°55.83'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	193	29°14.14'	83°55.41'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	194	29°14.03'	83°54.99'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	195	29°13.92'	83°54.59'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	196	29°13.77'	83°54.15'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	197	29°13.63'	83°53.75'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	198	29°13.54'	83°53.23'	4	Dense Live Bottom
D to E	199	29°13.40'	83°52.76'	6 + 2	Patchy Live Bottom and Sparse Algae
D to E	200	29°12.26'	83°52.34'	1	Dense Algae and Seagrass
D to E	201	29°13.16'	83°51.93'	3	Patchy Seagrass and Algae
D to E	202	29°13.01'	83°51.54'	1	Dense Seagrass and Algae
D to E	203	29°12.91'	83°51.16'	4	Dense Live Bottom
D to E	204	29°12.80'	83°50.77'	6	Patchy Live Bottom
D to E	205	29°12.71'	83°50.37'	1	Dense Seagrass and Algae
D to E	206	29°12.57'	83°49.89'	1	Dense Seagrass and Algae
D to E	207	29°12.45'	83°49.49'	7 + 2	Sand and Sparse Algae
D to E	208	29°12.33'	83°49.07'	3 + 5	Patchy Seagrass and Algae with Sparse Live Bottom
D to E	209	29°12.22'	83°48.70'	3 + 6	Patchy Seagrass and Patchy Live Bottom

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
D to E	250	29°07.15'	83°30.92'	2	Sparse Seagrass and Algae
D to E	251	29°07.04'	83°30.55'	2	Sparse Seagrass and Algae
D to E	252	29°06.91'	83°30.15'	2	Sparse Seagrass and Algae
D to E	253	29°06.83'	83°29.72'	2 + 6	Sparse and Patchy Live Bottom
D to E	254	29°06.71'	83°29.30'	6	Patchy Live Bottom
D to E	255	29°06.58'	83°28.87'	6	Patchy Live Bottom
D to E	256	29°06.46'	83°28.42'	6	Patchy Live Bottom
D to E	257	29°06.35'	83°27.96'	2	Sparse Seagrass and Algae
D to E	258	29°06.25'	83°27.50'	2	Sparse Seagrass and Algae
D to E	259	29°06.12'	83°27.08'	2	Sparse Seagrass and Algae
E to F	260	29°05.78'	83°27.14'	2	Sparse Seagrass and Algae
E to F	261	29°05.44'	83°27.32'	6	Patchy Live Bottom
E to F	262	29°05.12'	83°27.41'	7	Bare Sand Bottom
E to F	263	No Fix		7	Bare Sand Bottom
E to F	264	29°04.33'	83°27.65'	7	Bare Sand Bottom
E to F	265	29°05.91'	83°27.88'	6	Patchy Live Bottom
E to F	266	29°03.42'	83°28.02'	7	Bare Sand Bottom
E to F	267	29°02.95'	83°28.19'	7	Bare Sand Bottom
E to F	268	29°02.57'	83°28.30'	7	Bare Sand Bottom
E to F	269	29°02.12'	83°28.43'	7	Bare Sand Bottom
E to F	270	29°01.75'	83°28.85'	7	Bare Sand Bottom
E to F	271	29°01.35'	83°28.67'	2	Sparse Seagrass and Algae
E to F	272	29°00.95'	83°28.81'	6	Patchy Live Bottom
E to F	273	29°00.56'	83°28.90'	6	Patchy Live Bottom
E to F	274	29°00.17'	83°28.90'	6	Patchy Live Bottom
E to F	275	28°59.77'	83°29.16'	2	Sparse Seagrass and Algae
E to F	276	28°59.37'	83°29.26'	2 + 6	Sparse Seagrass Algae and Live Bottom
E to F	277	28°58.95'	83°29.41'	2 + 6	Sparse Seagrass Algae and Live Bottom
E to F	278	28°58.52'	83°29.57'	4	Dense Live Bottom
E to F	279	28°58.36'	83°29.62'	4	Dense Live Bottom
E to F	280	28°58.14'	83°29.69'	2	Sparse Seagrass and Algae
E to F	281	28°57.76'	83°29.80'	4	Dense Live Bottom
E to F	282	28°57.40'	83°29.92'	4	Dense Live Bottom
E to F	283	28°57.01'	83°30.07'	4	Dense Live Bottom
E to F	284	28°56.62'	83°30.15'	4	Dense Live Bottom
E to F	285	28°56.21'	83°30.26'	4	Dense Live Bottom
E to F	286	28°55.84'	83°30.46'	4	Dense Live Bottom
E to F	287	28°55.48'	83°30.51'	3 + 6	Patchy Seagrass and Live Bottom

APPENDIX A. (CONTINUED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
E to F	288	No Fix		3 + 6	Patchy Seagrass and Live Bottom
E to F	289	No Fix		2	Sparse Seagrass and Algae
E to F	290	28°54.28'	83°30.82'	2	Sparse Seagrass and Algae
E to F	291	28°53.91'	83°30.88'	6	Patchy Live Bottom
E to F	292	28°53.54'	83°31.07'	2	Sparse Seagrass and Algae
E to F	293	28°53.14'	83°31.24'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
E to F	294	28°52.76'	83°31.34'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
E to F	295	28°52.35'	83°31.46'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
E to F	296	28°51.94'	83°31.62'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	297	28°51.79'	83°31.17'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	298	28°51.60'	83°30.87'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	299	28°51.45'	83°30.38'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	300	28°51.24'	83°29.97'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	301	28°51.04'	83°29.55'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	302	28°50.89'	83°29.07'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	303	28°50.69'	83°28.62'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	304	28°50.52'	83°28.17'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	305	28°50.34'	83°27.69'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	306	28°50.15'	83°27.30'	2 + 6	Patchy Seagrass, Algae, and Live Bottom
F to G	307	28°49.97'	83°26.83'	6	Patchy Live Bottom
F to G	308	28°49.78'	83°26.39'	6	Patchy Live Bottom
F to G	309	28°49.61'	83°25.95'	6	Patchy Live Bottom
F to G	310	28°49.44'	83°25.52'	7	Bare Sand Bottom
F to G	311	28°49.26'	83°25.08'	2	Sparse Seagrass and Algae
F to G	312	28°49.09'	83°24.67'	2	Sparse Seagrass and Algae
F to G	313	28°48.91'	83°24.24'	2	Sparse Seagrass and Algae
F to G	314	28°48.77'	83°23.80'	2	Sparse Seagrass and Algae
F to G	315	28°48.53'	83°23.44'	2	Sparse Seagrass and Algae

APPENDIX A. (CONCLUDED).

Transect	Fix No.	Latitude	Longitude	Habitat Code	Description
F to G	316	28°48.39'	83°23.02'	2	Sparse Seagrass and Algae
F to G	317	28°48.22'	83°22.61'	2	Sparse Seagrass and Algae
F to G	318	28°48.06'	83°22.23'	6	Patchy Live Bottom
F to G	319	28°47.97'	83°21.84'	6	Patchy Live Bottom
F to G	320	28°47.76'	83°21.54'	6	Patchy Live Bottom
F to G	321	28°47.61'	83°21.19'	2	Sparse Seagrass and Algae
F to G	322	28°47.45'	83°20.84'	2	Sparse Seagrass and Algae
F to G	323	28°47.31'	83°20.48'	2	Sparse Seagrass and Algae
F to G	324	28°47.21'	83°20.23'	1	Dense Seagrass and Algae
F to G	325	28°47.15'	83°20.16'	1	Dense Seagrass and Algae
F to G	326	28°47.05'	83°19.77'	4	Dense Live Bottom
F to G	327	28°46.85'	83°19.45'	6	Patchy Live Bottom
F to G	328	28°46.73'	83°19.11'	6	Patchy Live Bottom
F to G	329	28°46.63'	83°18.71'	6	Patchy Live Bottom
F to G	330	28°46.47'	83°18.39'	2	Sparse Seagrass and Algae
F to G	331	28°46.37'	83°18.05'	2	Sparse Seagrass and Algae
F to G	332	28°46.21'	83°17.68'	2	Sparse Seagrass and Algae
F to G	333	28°46.04'	83°17.31'	6	Patchy Live Bottom
F to G	334	28°45.80'	83°16.96'	2	Sparse Seagrass and Algae
F to G	335	28°45.53'	83°16.51'	2	Sparse Seagrass and Algae
F to G	336	28°45.36'	83°16.12'	1	Dense Seagrass and Algae
F to G	337	28°45.21'	83°15.68'	1	Dense Seagrass and Algae
F to G	338	28°45.04'	83°15.27'	1	Dense Seagrass and Algae
F to G	339	28°44.91'	83°15.86'	1	Dense Seagrass and Algae
F to G	340	28°44.71'	83°14.44'	1	Dense Seagrass and Algae
F to G	341	28°45.58'	83°14.02'	2	Sparse Seagrass and Algae
F to G	342	28°44.40'	83°13.59'	2	Sparse Seagrass and Algae
F to G	343	28°44.39'	83°13.44'	4	Dense Live Bottom
F to G	344	28°44.27'	83°13.31'	4	Dense Live Bottom
F to G	345	28°44.18'	83°13.00'	4	Dense Live Bottom
F to G	346	28°44.02'	83°12.60'	2	Sparse Seagrass and Algae
F to G	347	28°43.90'	83°12.17'	4	Dense Live Bottom
F to G	348	28°43.75'	83°11.76'	2	Sparse Seagrass and Algae
F to G	349	28°43.60'	83°11.34'	2	Sparse Seagrass and Algae
F to G	350	28°43.43'	83°10.94'	1	Dense Seagrass and Algae
F to G	351	28°43.29'	83°10.51'	4	Dense Live Bottom

Habitat Codes:
1 = Dense Seagrass and Algae
2 = Sparse Seagrass and Algae
3 = Patchy Seagrass and Algae
4 = Dense Live Bottom
5 = Sparse Live Bottom
6 = Patchy Live Bottom
7 = Bare Sand Bottom
8 = Bare Mud Bottom.

APPENDIX B

CRUISE 2 DIVER AND TELEVISION SURVEY RESULTS

APPENDIX B. CRUISE 2 DIVER AND TELEVISION SURVEY RESULTS.

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
1*	1	14287.7	45171.0	7	Bare Sand Bottom
1*	2	14287.2	45172.1	7	Bare Sand Bottom
1*	3	14287.0	45173.1	7	Bare Sand Bottom
1*	4	14286.7	45174.0	7	Bare Sand Bottom
1*	5	14286.4	45175.2	7	Bare Sand Bottom
1*	6	14286.1	45176.4	7	Bare Sand Bottom
1*	7	14285.7	45177.4	3	Patchy Seagrass
1*	8	14285.3	45178.7	7	Bare Sand Bottom
1*	9	14285.2	45179.2	-	--
1*	10	14285.0	45179.5	7	Bare Sand Bottom
1*	11	14284.7	45180.2	3	Patchy Seagrass and Algae
1*	12	14284.4	45181.2	3	Patchy Seagrass and Algae
1*	13	14284.1	45181.0	7	Bare Sand Bottom
1*	14	14283.8	45183.6	6	Patchy Live Bottom
1*	15	14283.4	45183.9	6	Patchy Live Bottom
1*	16	14283.1	45184.7	6	Patchy Live Bottom
1*	17	14282.1	45184.2	7	Bare Sand Bottom
1*	18	14281.8	45185.3	7	Bare Sand Bottom
1*	19	14281.6	45186.3	7	Bare Sand Bottom
1*	20	14281.2	45187.4	3	Patchy Seagrass and Algae
1*	21	14281.0	45188.6	3	Patchy Seagrass and Algae
1*	22	14280.7	45189.7	3	Patchy Seagrass and Algae
1*	23	14280.5	45190.8	5	Sparse Live Bottom
1*	24	14280.2	45191.8	5	Sparse Live Bottom
1*	25	14279.9	45193.0	7	Bare Sand Bottom
1*	26	14279.6	45194.0	3	Patchy Algal Assemblage
1*	27	14279.3	45195.2	7	Bare Sand Bottom
1*	28	14279.1	45196.2	3	Patchy Algal Assemblage
1*	29	14278.8	45197.3	7	Bare Sand Bottom
1*	30	14278.0	45197.0	5	Sparse Live Bottom
1*	31	14277.6	45197.9	2	Sparse *Caulerpa* beds
1*	32	14277.3	45199.0	5	Sparse Live Bottom
1*	33	14277.0	45200.3	4	Dense Live Bottom
1*	34	14276.7	45201.6	2	*Halophila* and *Caulerpa*
1*	35	14276.2	45203.5	2	*Halophila* and *Caulerpa*
1*	36	14276.0	45203.8	2	*Caulerpa* beds
1*	37	14275.7	45205.5	2	*Halophila* and *Caulerpa*
1*	38	14275.4	45206.3	2	*Halophila* and *Caulerpa*
1*	39	14275.1	45207.5	7	Bare Sand Bottom
1*	40	14274.7	45208.6	7	Bare Sand Bottom
1**	41	14273.3	45206.8	7	Bare Sand Bottom
1**	42	14273.0	45207.3	7	Bare Sand Bottom
1**	43	14272.6	45208.3	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
1**	44	14272.3	45209.1	7	Caulerpa and Udotea
1**	45	14272.0	45209.9	2	Caulerpa Beds
1**	46	14271.7	45210.8	2	Caulerpa Beds
1**	47	14271.5	45211.6	5	Patchy Live Bottom
1**	48	14271.3	45212.4	2 + 5	Sparse Caulerpa and Sargassum with Patchy Live Bottom
1**	49	14271.0	45213.3	7	Bare Sand Bottom
1**	50	14270.7	45214.3	2 + 5	Sparse Algae and Patchy Live Bottom
1**	51	14270.5	45215.0	2 + 5	Sparse Algae and Patchy Live Bottom
1**	52	14270.2	45216.0	4	Dense Live Bottom
1**	53	14270.0	45217.0	7	Bare Sand Bottom
1**	54	14269.7	45217.9	2	Sparse Algae
1**	55	14269.5	45218.7	2	Sparse Caulerpa and Sargassum
1**	56	14269.2	45219.7	2 + 5	Sparse Algae and Patchy Live Bottom
1**	57	14269.1	45220.6	2	Sparse Algae
1**	58	14268.7	45221.4	2	Sparse Algae
1**	59	14268.5	45222.4	2	Sparse Algae
1**	60	14268.2	45223.5	2 + 5	Sparse Algae and Patchy Live Bottom
1**	61	14267.9	45224.6	2 + 5	Sparse Algae and Patchy Live Bottom
1**	62	14267.6	45225.9	2	Caulerpa and Sargassum
1**	63	14267.4	45227.1	2	Caulerpa and Sargassum
1**	64	14267.2	45228.3	2 + 5	Sparse Algae and Patchy Live Bottom
1**	65	14266.9	45229.6	2	Sparse Algae
1**	66	14266.6	45230.9	2	Sparse Algae
1**	67	14266.4	45232.1	2	Caulerpa and Sargassum
1**	68	14266.1	45233.3	2	Sparse Algae
1**	69	14265.8	45234.7	2	Sparse Algae
1**	70	14265.6	45235.4	2	Sparse Algae
1**	71	14265.4	45236.1	2	Sparse Algae
1**	72	14265.1	45237.1	4	Dense Live Bottom
1**	73	14264.7	45238.2	7	Bare Sand
1**	74	14264.4	45239.3	2	Sparse Algae
1**	75	14264.1	45240.4	5	Sparse Live Bottom
1**	76	14263.7	45241.4	1 + 5	Dense Sargassum and Sparse Live Bottom
1**	77	14263.4	45242.5	2	Sparse Caulerpa
1**	78	14263.0	45243.6	2	Sparse Caulerpa

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
1**	79	14262.7	45244.7	2	Sparse Caulerpa
1**	80	14262.4	45245.8	1	Dense Algal Assemblage
1**	81	14262.1	45247.0	2	Sparse Algae
1**	82	14261.7	45248.1	2	Sparse Algae
1**	83	14261.5	45249.2	7	Bare Sand Bottom
1**	84	14260.9	45251.2	7	Bare Sand Bottom
1**	85	14260.8	45251.4	7	Bare Sand Bottom
1**	86	14260.5	45252.5	2	Sparse Algae
1**	87	14260.2	45253.6	1	Dense Sargassum
1**	88	14259.9	45254.7	2	Sparse Algae
1**	89	14259.5	45255.8	2	Sparse Algae
1**	90	14259.2	45257.2	7	Bare Sand Bottom
1**	91	14258.9	45258.1	7	Bare Sand Bottom
1**	92	14258.7	45259.3	2	Sparse Sargassum
1**	93	14258.3	45260.4	4 + 6	Dense Patchy Live Bottom
1**	94	14257.9	45261.5	5 + 6	Sparse Patchy Live Bottom
1**	95	14257.6	45262.7	2	Sparse Algae
1**	96	14257.3	45263.8	2	Sparse Algae
1**	97	14256.9	45265.1	7	Bare Sand Bottom
1**	98	14256.7	45265.8	2	Sparse Algae
1**	99	14256.5	45266.6	7	Bare Sand Bottom
1**	100	14256.2	45267.2	7	Bare Sand Bottom
1**	101	14256.0	45267.6	2	Sparse Algae
1**	102	14255.8	45268.2	2	Sparse Algae
2*	1	14290.5	45285.5	2	Sparse Algae
2*	2	14290.5	45286.2	5	Sparse Live Bottom
2*	3	14290.3	45287.2	2	Sparse Algae
2*	4	14290.0	45288.0	6	Patchy Live Bottom
2*	5	14289.8	45289.0	6	Patchy Live Bottom
2*	6	14289.6	45289.6	4	Dense Live Bottom
2*	7	14289.4	45290.6	4	Dense Live Bottom
2*	8	14289.2	45291.4	5	Sparse Live Bottom
2*	9	14289.0	45292.1	4	Dense Live Bottom
2*	10	14288.8	45293.2	6	Patchy Live Bottom
2*	11	14288.7	45293.7	6	Patchy Live Bottom
2*	12	14288.5	45294.5	3	Patchy Seagrass and Algae
2*	13	14288.4	45295.4	2	Sparse Algae and Seagrass
2*	14	14288.3	45296.2	3	Patchy Algae and Seagrass
2*	15	14288.1	45297.0	5	Sparse Live Bottom
2*	16	14285.6	45301.4	3	Patchy Seagrass and Algae
2*	17	14285.3	45301.9	3	Patchy Seagrass and Algae
2*	18	14285.1	45302.8	3	Patchy Seagrass and Algae
2*	19	14285.1	45303.5	2	Sparse Algae and Seagrass

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
2*	20	14284.9	45304.2	5	Sparse Live Bottom
2*	21	14284.9	45305.0	7	Bare Sand Bottom
2*	22	14284.7	45306.0	7	Bare Sand Bottom
2*	23	14284.4	45307.5	2	Sparse Algae and Seagrass
2*	24	14284.3	45308.2	2	Sparse Algae and Seagrass
2*	25	14284.1	45309.2	6 + 2	Patchy Live Bottom with Sparse Seagrass
2*	26	14284.0	45309.7	2	Sparse Seagrass and Algae
2*	27	14283.8	45310.4	5	Sparse Live Bottom
2*	28	14283.5	45311.4	6	Patchy Live Bottom
2*	29	14383.3	45312.1	2	Sparse Seagrass and Algae
2*	30	14383.2	45312.9	2	Sparse Seagrass and Algae
2*	31	14283.0	45313.7	7	Bare Sand Bottom
2*	32	14282.7	45314.5	2	Sparse Seagrass and Algae
2*	33	14282.7	45315.4	3 + 6	Patchy Seagrass and Live Bottom
2*	34	14282.5	45316.0	7	Bare Sand Bottom
2*	35	14282.4	45316.9	2 + 6	Sparse Algae and Patchy Live Bottom
2*	36	14282.1	45317.7	-	--
2*	37	14280.8	45321.7	5	Sparse Live Bottom
2*	38	14280.6	45322.8	5	Sparse Live Bottom
2*	39	14280.5	45323.4	3	Patchy Seagrass and Algae
2*	40	14280.3	45324.1	3	Patchy Seagrass and Algae
2*	41	14280.1	45324.6	3	Patchy Seagrass and Algae
2*	42	14280.0	45325.5	1	Dense Halophila and Algae
2*	43	14279.9	45325.9	3	Patchy Seagrass and Algae
2*	44	14279.7	45326.3	3	Patchy Seagrass and Algae
2*	45	14279.5	45327.0	7	Bare Sand Bottom
2*	46	14279.4	45327.6	6	Patchy Live Bottom
2*	47	14279.2	45328.0	3	Patchy Seagrass and Algae
2*	48	14279.0	45328.5	3	Patchy Seagrass and Algae
2*	49	14278.8	45329.0	6	Patchy Live Bottom
2*	50	14278.7	45329.5	7	Bare Sand Bottom
2*	51	14278.5	45330.0	7	Bare Sand Bottom
2*	52			3	Patchy Seagrass and Algae
2*	53	14278.4	45330.6	2	Sparse Seagrass and Algae
2*	54	14278.2	45331.0	2 + 6	Sparse Seagrass and Patchy Live Bottom
2*	55	14278.0	45331.6	2	Sparse Algae
2*	56	14277.8	45332.0	5	Sparse Live Bottom
3*	1	14331.2	45327.3	4	Dense Live Bottom
3*	2	14330.9	45327.8	4	Dense Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
3*	3	14330.7	45328.7	2	Sparse Halophila
3*	4	14330.5	45329.6	2	Halophila and Caulerpa
3*	5	14330.3	45330.4	7	Bare Sand Bottom
3*	6	14330.0	45331.2	2	Sparse Halophila and Algae
3*	7	14329.9	45332.0	5	Sparse Live Bottom
3*	8	14329.6	45332.7	7	Bare Sand Bottom
3*	9	14329.4	45333.5	7	Bare Sand Bottom
3*	10	14329.2	45334.3	2	Sparse Halophila
3*	11	14329.0	45335.1	7	Bare Sand Bottom
3*	12	14328.8	45335.9	7	Bare Sand Bottom
3*	13	14328.7	45336.7	5	Sparse Live Bottom
3*	14	14328.4	45337.5	7	Bare Sand Bottom
3*	15	14328.3	45338.3	7	Bare Sand Bottom
3*	16	14328.0	45339.1	2	Sparse Halophila
3*	17	14327.8	45339.9	2	Sparse Halophila
3*	18	14327.6	45340.7	3	Patchy Halodule and Halophila
3*	19	14327.5	45341.5	2	Sparse Halodule and Halophila
3*	20	14327.2	45342.5	7	Bare Sand Bottom
3*	21	14327.0	45343.2	7	Bare Sand Bottom
3*	22	14326.8	45344.1	5	Sparse Live Bottom
3*	23	14326.6	45334.9	7	Bare Sand Bottom
3*	24	14326.3	45345.7	7	Bare Sand Bottom
3*	25	14326.2	45346.5	7	Bare Sand Bottom
3*	26	14325.9	45347.4	7	Bare Sand Bottom
3*	27	14324.4	45348.6	4	Dense Live Bottom
3*	28	14324.1	45349.7	4	Dense Live Bottom
3*	29	14323.7	45350.7	4	Dense Live Bottom
3*	30	14323.5	45351.8	3	Patchy Halophila and Caulerpa
3*	31	14323.3	45352.9	7	Bare Sand Bottom
3*	32	14323.0	45353.8	7	Bare Sand Bottom
3*	33	14322.9	45354.7	2	Sparse Seagrass and Algae
3*	34	14322.6	45355.5	3	Patchy Halophila and Caulerpa
3*	35			3	Patchy Halophila engelmanni and Algae
3*	36	14322.5	45356.4	3 + 6	Patchy Seagrass and Live Bottom
3*	37			3 + 6	Patchy Seagrass and Live Bottom
3*	38	14322.3	45357.3	3 + 6	Patchy Seagrass and Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
3*	39	14322.1	45358.4	3 + 6	Patchy Seagrass and Live Bottom
3*	40	14321.9	45359.2	6	Patchy Live Bottom
3*	41	14321.6	45360.0	6	Patchy Live Bottom
3*	42	14321.4	45361.1	3 + 6	Patchy Seagrass and Live Bottom
3*	43	14321.2	45361.9	3 + 6	Patchy Seagrass and Live Bottom
3*	44	14321.0	45362.5	7	Bare Sand Bottom
3*	45	14320.8	45363.7	3	Patchy Caulerpa Beds
3*	46	14320.6	45364.3	7	Bare Sand Bottom
3*	47	14320.3	45365.3	-	--
3*	48	14318.4	45366.4	7	Bare Sand Bottom
3*	49	14318.1	45367.0	6	Patchy Live Bottom
3*	50	14317.9	45367.8	7	Bare Sand Bottom
3*	51	14317.7	45368.5	7	Bare Sand Bottom
3*	52	14317.5	45369.6	3 + 6	Patchy Seagrass and Live Bottom
3*	53	14317.2	45370.4	7	Bare Sand Bottom
3*	54	14317.1	45371.3	6	Patchy Live Bottom
3*	55	14316.8	45372.3	5	Sparse Live Bottom
3*	56	14316.6	45373.4	2 + 5	Sparse Algae and Live Bottom
3*	57	14316.3	45374.2	5	Sparse Live Bottom
3*	58	14316.1	45375.1	5	Sparse Live Bottom
3*	59	14315.9	45376.1	5	Sparse Live Bottom
3*	60	14315.7	45376.8	6	Patchy Live Bottom
3*	61	14315.5	45377.7	6	Patchy Live Bottom
3*	62	14315.2	45378.7	5	Sparse Live Bottom
3*	63	14315.0	45379.5	6	Patchy Live Bottom
3*	64	14314.9	45380.3	5	Sparse Live Bottom
3*	65	14314.6	45381.2	7	Bare Sand Bottom
3*	66	14314.4	45382.1	2 + 5	Sparse Seagrass and Live Bottom
4*	1	14356.4	45765.6	7	Bare Sand Bottom
4*	2	14356.2	45767.2	7	Bare Sand Bottom
4*	3	14356.1	45768.2	3	Patchy Halophila Beds
4*	4	14356.0	45769.1	1	Dense Halophila Beds
4*	5	14355.9	45770.0	2	Sparse Halophila Beds
4*	6	14355.7	45771.0	3	Patchy Halophila Beds
4*	7	14355.7	45771.9	7	Bare Sand Bottom
4*	8	14355.6	45772.8	7	Bare Sand Bottom
4*	9	14355.5	45773.2	7	Bare Sand Bottom
4*	10	14355.4	45774.7	7	Bare Sand Bottom
4*	11	14355.4	45776.0	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
4*	12	14355.3	45776.9	7	Bare Sand Bottom
4*	13	14355.3	45777.8	7	Bare Sand Bottom
4*	14	14355.2	45778.7	7	Bare Sand Bottom
4*	15	14355.1	45779.5	7	Bare Sand Bottom
4*	16	14355.1	45779.9	7	Bare Sand Bottom
4*	17	14355.0	45781.7	7	Bare Sand Bottom
4*	18	14354.9	45782.3	3	Patchy Halophila
4*	19	14354.9	45782.9	7	Bare Sand Bottom
4*	20	14354.9	45784.0	3	Patchy Halophila
4*	21	14354.8	45784.0	3	Patchy Halophila
4*	22	14354.8	45785.8	7	Bare Sand Bottom
4*	23	14354.8	45786.8	7	Bare Sand Bottom
4*	24	14354.1	45789.0	7	Bare Sand Bottom
4*	25	14354.0	45789.9	7	Bare Sand Bottom
4*	26	14354.0	45791.7	7	Bare Sand Bottom
4*	27	14353.9	45793.0	3	Patchy Halophila
4*	28	14354.0	45793.6	3	Patchy Halophila
4*	29	14353.9	45794.7	7	Bare Sand Bottom
4*	30	14353.9	45795.7	7	Bare Sand Bottom
4*	31	14353.9	45796.7	7	Bare Sand Bottom
4*	32	14353.8	45797.6	7	Bare Sand Bottom
4*	33	14353.7	45798.8	2	Sparse Halophila
4*	34	14353.6	45799.6	1	Dense Halophila
4*	35	14353.6	45800.8	7	Bare Sand Bottom
4*	36	14353.4	45801.5	2	Sparse Halophila
4*	37	14353.3	45802.4	7	Bare Sand Bottom
4*	38	14353.1	45803.3	7	Bare Sand Bottom
4*	39	14353.0	45804.1	2	Sparse Halophila
4*	40	14352.9	45805.2	2	Sparse Halophila
4*	41	14352.8	45806.1	7	Bare Sand Bottom
4*	42	14352.8	45807.0	2	Sparse Halophila
4*	43	14352.7	45808.0	2	Sparse Halophila
4*	44	14352.6	45809.0	2	Sparse Halophila
4*	45	14352.5	45810.0	2	Sparse Halophila
4*	46	14352.4	45810.9	7	Bare Sand Bottom
4*	47	14352.0	45813.6	2	Sparse Halophila engelmanni
4*	48	14351.9	45814.4	2	Sparse Halophila
4*	49	14351.8	45815.1	7	Bare Sand Bottom
4*	50	14351.8	45816.1	7	Bare Sand Bottom
4*	51	14351.8	45817.0	1	Dense Halophila Beds
4*	52	14351.6	45818.0	6	Patchy Live Bottom
4*	53	14351.6	45819.1	1	Dense Halophila Beds
4*	54	14351.3	45819.9	7	Bare Sand Bottom
4*	55	14351.3	45821.0	2	Sparse Halophila
4*	56	14351.2	45821.8	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
4*	57	14351.1	45822.8	7	Bare Sand Bottom
4*	58	14351.0	45823.8	2	Sparse Halophila
4*	59	14350.9	45824.6	7	Bare Sand Bottom
4*	60	14350.9	45825.6	7	Bare Sand Bottom
4*	61	14350.8	45826.6	2	Sparse Halophila
4*	62	14350.8	45827.7	2	Sparse Algae
4*	63	14350.6	45828.6	7	Bare Sand Bottom
4*	64	14350.2	45832.0	7	Bare Sand Bottom
4*	65	14350.1	45833.1	7	Bare Sand Bottom
4*	66	14350.0	45834.1	7	Bare Sand Bottom
4*	67	14350.0	45835.1	2	Sparse Halophila
4*	68	14349.9	45836.1	1	Dense Halophila
4*	69	14349.8	45837.1	2	Sparse Halophila
4*	70	14349.8	45838.0	7	Bare Sand Bottom
4*	71	14349.7	45839.0	1	Dense Halophila
4*	72	14349.6	45840.0	7	Bare Sand Bottom
4*	73	14349.5	45841.1	2	Sparse Halophila
4*	74	14349.4	45842.0	7	Bare Sand Bottom
4*	75	14349.3	45843.0	3	Patchy Halophila
4*	76	14349.2	45843.9	2	Sparse Halophila
4*	77	14349.2	45844.9	-	--
4*	78	14349.2	45846.0	2	Patchy Halophila
4*	79	14349.0	45847.1	2	Patchy Halophila
4*	80	14348.8	45850.6	6	Patchy Live Bottom
4*	81	14348.8	45851.6	-	--
4*	82	14348.6	45852.2	1	Dense Halophila
4*	83	14348.6	45853.3	-	--
4*	84	14348.5	45854.1	1	Dense Halophila
4*	85	14348.5	45854.7	6	Patchy Live Bottom
4*	86	14348.4	45855.4	6	Patchy Live Bottom
4*	87	14348.4	45856.4	7	Bare Sand Bottom
4*	88	14348.4	45857.0	2	Sparse Halophila
4*	89	14348.3	45857.5	7	Bare Sand Bottom
4*	90	14348.3	45858.3	2	Sparse Halophila
4*	91	14348.3	45859.0	2	Sparse Halophila
4*	92	14348.2	45859.6	2 + 5	Sparse Halophila and Live Bottom
4*	93	14348.2	45860.1	6	Patchy Live Bottom
4*	94	14347.9	45862.7	2	Sparse Halophila
4*	95	14347.9	45863.1	5	Sparse Live Bottom
4*	96	14347.8	45863.7	5	Sparse Live Bottom
4*	97	14347.8	45864.5	2 + 5	Sparse Halophila and Live Bottom
4*	98	14347.7	45865.1	5	Sparse Live Bottom
4*	99	14347.7	45865.8	5	Sparse Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
4*	100	14347.7	45866.2	5	Sparse Live Bottom
4*	101			2	Sparse Halophila
4*	102	14347.3	45868.7	7	Bare Sand Bottom
4*	103	14347.3	45869.3	2	Sparse Halophila
4*	104	14347.2	45870.1	2	Sparse Halophila
4*	105	14347.2	45871.2	3	Patchy Halophila
4*	106	14347.2	45871.6	2	Sparse Halophila
4*	107	14347.2	45872.6	2	Sparse Halophila engelmanni Beds
4*	108	14347.2	45873.3	2	Sparse Halophila
4*	109	14347.0	45874.1	1	Dense Halophila
4*	110	14347.0	45874.7	5	Sparse Live Bottom
4*	111	14346.9	45875.5	5	Sparse Live Bottom
4*	112	14346.8	45876.0	2	Sparse Halophila
4**	113	14346.7	45876.6	1	Dense Halophila engelmanni
4**	114	14346.7	45877.9	7	Bare Sand Bottom
4**	115	14346.5	45879.1	6	Patchy Live Bottom
4**	116	14346.4	45880.3	4	Dense Live Bottom
4**	117	14346.2	45881.4	1	Dense Halophila
4**	118	14346.2	45882.6	3	Patchy Halophila
4**	119	14346.1	45883.8	7	Bare Sand Bottom
4**	120	14345.9	45884.9	6	Patchy Live Bottom
4**	121	14345.8	45886.2	6	Patchy Live Bottom
4**	122	14345.7	45887.4	6	Patchy Live Bottom
4**	123	14345.6	45888.5	2	Sparse Sargassum
4**	124	14345.5	45889.9	4	Dense Live Bottom
4**	125	14345.4	45891.0	4	Dense Live Bottom
4**	126	14345.3	45892.4	7	Bare Sand Bottom
4**	127	14345.1	45893.4	4	Dense Live Bottom
4**	128	14345.0	45894.5	7	Bare Sand Bottom
4**	129	14344.9	45895.7	5	Sparse Live Bottom
4**	130	14344.7	45896.9	7	Bare Sand Bottom
4**	131	14344.6	45898.1	2	Sparse Halophila
4**	132	14344.5	45899.3	2	Sparse Halophila
4**	133	14344.4	45900.5	2	Sparse Halophila
4**	134	14344.3	45901.6	2	Sparse Halophila
4**	135	14344.2	45902.8	5	Sparse Live Bottom
4**	136	14344.1	45904.0	7	Bare Sand Bottom
4**	137	14343.9	45905.6	5	Sparse Live Bottom
4**	138	14343.8	45906.4	5	Sparse Live Bottom
4**	139	14343.7	45907.5	4	Dense Live Bottom
4**	140	14343.6	45908.7	6	Patchy Live Bottom
4**	141	14343.6	45909.9	6	Patchy Live Bottom
4**	142	14343.4	45911.0	5	Sparse Live Bottom
4**	143	14343.3	45912.3	2	Sparse Halophila

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
4**	144	14343.3	45913.5	5	Sparse Live Bottom
4**	145	14343.1	45914.7	-	--
4**	146	14343.0	45915.8	5	Sparse Live Bottom
4**	147	14342.9	45917.1	2	Sparse Sargassum
4**	148	14342.8	45918.2	2	Sparse Halophila
4**	149	14342.7	45919.5	5	Sparse Live Bottom
4**	150	14342.7	45920.6	5	Sparse Live Bottom
4**	151	14342.6	45921.8	2	Sparse Caulerpa and Sargassum
4**	152	14342.5	45922.9	2	Sparse Caulerpa and Sargassum
4**	153	14342.4	45924.1	5	Sparse Live Bottom
4**	154	14342.3	45925.2	7	Bare Sand Bottom
4**	155	14342.2	45926.4	5	Sparse Live Bottom
4**	156	14342.1	45927.5	5	Sparse Live Bottom
4**	157	14342.0	45928.8	2	Sparse Caulerpa and Sargassum
4**	158	14341.8	45929.8	7	Bare Sand Bottom
4**	159	14341.7	45931.1	7	Bare Sand Bottom
4**	160	14341.5	45932.1	7	Bare Sand Bottom
4**	161	14341.3	45933.2	7	Bare Sand Bottom
4**	162	14341.1	45934.4	7	Bare Sand Bottom
4**	163	14341.0	45935.5	2	Sparse Halophila
4**	164	14340.9	45936.8	2 + 5	Sparse Seagrass and Live Bottom
4**	165	14340.7	45937.9	5	Sparse Live Bottom
4**	166	14340.5	45939.0	2	Sparse Halophila
4**	167	14340.4	45940.1	5	Sparse Live Bottom
4**	168	14340.2	45941.4	5	Sparse Live Bottom
4**	169	14340.1	45942.4	2	Sparse Sargassum
4**	170	14339.8	45943.8	5	Sparse Live Bottom
4**	171	14339.7	45944.7	5	Sparse Live Bottom
4**	172	14339.6	45945.8	5	Sparse Live Bottom
4**	173	14339.4	45946.9	5	Sparse Live Bottom
4**	174	14339.2	45948.1	5	Sparse Live Bottom
4**	175	14339.0	45949.1	7	Bare Sand Bottom
4**	176	14338.9	45950.1	5	Sparse Live Bottom
4**	177	14338.7	45950.9	5	Sparse Live Bottom
4**	178	14338.6	45951.7	4	Dense Live Bottom
4**	179	14338.5	45952.5	4	Dense Live Bottom
4**	180	14338.4	45953.3	5	Sparse Live Bottom
5*	1	14408.3	45886.2	6	Patchy Live Bottom
5*	2	14408.1	45886.7	3	Patchy Halophila

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
5*	3	14408.1	45887.5	3	Patchy Halophila and Caulerpa
5*	4	14407.9	45888.4	5	Sparse Live Bottom
5*	5	14407.7	45889.4	6	Patchy Live Bottom
5*	6	14407.6	45890.1	2	Sparse Halophila engelmanni
5*	7	14407.3	45890.9	2	Sparse Caulerpa and Halophila
5*	8	14407.1	45891.7	3	Patchy Halophila and Caulerpa
5*	9	14406.9	45892.4	2	Sparse Halophila and Caulerpa
5*	10	14406.7	45893.3	5	Sparse Live Bottom
5*	11	14406.5	45893.8	4	Dense Live Bottom
5*	12	14406.2	45894.5	6	Patchy Live Bottom
5*	13	14406.1	45895.4	6	Patchy Live Bottom
5*	14	14405.9	45896.2	2	Sparse Halophila
5*	15	14405.6	45896.9	2	Sparse Halophila and Caulerpa
5*	16	14405.4	45897.6	2	Sparse Halophila
5*	17	14405.2	45898.2	2	Sparse Halophila
5*	18	14405.0	45899.1	3	Patchy Halophila
5*	19	14404.7	45900.0	7	Bare Sand Bottom
5*	20	14404.6	45900.6	7	Bare Sand Bottom
5*	21	14404.6	45905.2	3	Patchy Halophila engelmanni
5*	22	14404.3	45905.8	3	Patchy Halophila engelmanni
5*	23	14404.1	45906.4	3	Patchy Halophila
5*	24	14403.9	45907.0	6	Patchy Live Bottom
5*	25	14403.7	45907.6	6	Patchy Live Bottom
5*	26	14403.5	45908.2	5	Sparse Live Bottom
5*	27	14403.3	45908.9	2	Sparse Halophila and Caulerpa
5*	28	14402.9	45909.5	2	Sparse Halophila and Caulerpa
5*	29	14402.7	45910.0	3 + 6	Patchy Seagrass and Live Bottom
5*	30	14402.6	45910.5	3 + 6	Patchy Seagrass and Live Bottom
5*	31	14402.3	45910.9	6	Patchy Live Bottom
5*	32	14402.0	45911.5	6	Patchy Live Bottom
5*	33	14401.9	45912.0	3	Patchy Halophila and Caulerpa
5*	34	14401.6	45912.4	1	Dense Halophila and Caulerpa
5*	35	14401.3	45913.0	1	Dense Halophila and Caulerpa

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
5*	36	14401.2	45913.4	5	Sparse Live Bottom
5*	37	14401.0	45913.7	6	Patchy Live Bottom
5*	38	14400.7	45914.3	6	Patchy Live Bottom
5*	39	14400.5	45914.6	1	Dense Halophila
5*	40	14400.3	45915.3	3 + 6	Patchy Seagrass and Live Bottom
5*	41	14400.2	45918.6	7	Bare Sand Bottom
5*	42	14400.0	45919.1	3 + 6	Patchy Seagrass and Live Bottom
5*	43	14399.8	45919.7	3 + 6	Patchy Seagrass and Live Bottom
5*	44	14399.6	45920.2	3 + 6	Patchy Seagrass and Live Bottom
5*	45	14399.3	45920.7	6	Patchy Live Bottom
5*	46	14399.0	45921.2	-	--
5*	47	14398.9	45921.8	2	Sparse Halophila engelmanni
5*	48	14398.6	45922.3	1	Dense Halophila engelmanni
5*	49	14398.4	45922.8	3	Patchy Halophila and Caulerpa
5*	50	14398.2	45923.4	4	Dense Live Bottom
5*	51	14398.0	45924.0	4	Dense Live Bottom
5*	52	14397.8	45924.4	7	Bare Sand Bottom
5*	53	14397.6	45925.0	5	Sparse Live Bottom
5*	54	14397.4	45925.5	6	Patchy Live Bottom
5*	55	14397.2	45926.0	5	Sparse Live Bottom
5*	56	14397.0	45926.7	6	Patchy Live Bottom
5*	57	14396.8	45927.3	1	Dense Halophila engelmanni
6*	1	14440.2	46060.3	5	Sparse Live Bottom
6*	2	14440.2	46061.1	5	Sparse Live Bottom
6*	3	14440.1	46061.9	2	Sparse Halophila engelmanni
6*	4	14439.9	46062.9	2	Sparse Halophila engelmanni and Caulerpa
6*	5	14439.9	46063.9	2	Sparse Halophila engelmanni and Caulerpa
6*	6	14439.7	46064.7	7	Bare Sand Bottom
6*	7	14439.7	46065.8	7	Bare Sand Bottom
6*	8	14439.6	46066.6	5	Sparse Live Bottom
6*	9	14439.5	46067.6	5	Sparse Live Bottom
6*	10	14439.4	46068.5	5	Sparse Live Bottom
6*	11	14439.2	46069.2	7	Bare Sand Bottom
6*	12	14439.1	46070.1	2	Sparse Halophila
6*	13	14439.0	46071.0	5	Sparse Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
6*	14	14438.8	46071.7	7	Bare Sand Bottom
6*	15	14438.6	46072.5	2	Sparse Halophila, Sargassum, and Caulerpa
6*	16	14438.5	46073.4	7	Bare Sand Bottom
6*	17	14438.3	46074.2	7	Bare Sand Bottom
6*	18	14438.2	46075.0	7	Bare Sand Bottom
6*	19	14438.8	46079.2	3	Patchy Halophila
6*	20	14438.6	46080.0	2	Sparse Sargassum
6*	21	14438.5	46080.7	2	Sparse Caulerpa
6*	22	14438.4	46081.5	2	Sparse Halophila, Caulerpa, and Sargassum
6*	23	14438.2	46082.3	2 + 5	Sparse Seagrass and Live Bottom
6*	24	14438.2	46082.9	2	Sparse Caulerpa
6*	25	14437.7	46083.6	7	Bare Sand Bottom
6*	26	14437.6	46084.2	5	Sparse Live Bottom
6*	27	14437.4	46084.7	5	Sparse Live Bottom
6*	28	14437.1	46085.6	5	Sparse Live Bottom
6*	29	14436.9	46086.1	2	Sparse Seagrass and Algae
6*	30	14436.8	46086.4	2	Sparse Caulerpa
6*	31	14436.4	46087.5	7	Bare Sand Bottom
6*	32	14436.3	46088.1	2	Sparse Halophila
6*	33	14436.2	46088.7	1	Dense Halophila
6*	34	14436.0	46089.5	7	Bare Sand Bottom
6*	35	14435.6	46090.3	7	Bare Sand Bottom
6*	36	14436.2	46093.9	1	Dense Halophila engelmanni
6*	37	14436.1	46094.4	1 + 6	Seagrass and Patchy Live Bottom
6*	38	14436.0	46095.0	5	Sparse Live Bottom
6*	39	14435.7	46095.7	7	Bare Sand Bottom
6*	40	14435.6	46096.4	3 + 6	Patchy Sargassum and Live Bottom
6*	41	14435.3	46097.0	6	Patchy Live Bottom
6*	42	14435.1	46097.9	7	Bare Sand Bottom
6*	43	14434.8	46098.7	7	Bare Sand Bottom
6*	44	14434.5	46099.4	6	Patchy Live Bottom
6*	45	14434.3	46100.0	4	Dense Live Bottom
6*	46	14434.2	46100.4	1	Dense Halophila engelmanni
6*	47	14434.0	46101.1	5	Sparse Live Bottom
6*	48	14433.8	46101.6	5	Sparse Live Bottom
6*	49	14433.6	46102.6	6	Patchy Live Bottom
6*	50	14433.3	46103.3	6	Patchy Live Bottom
6*	51	14433.0	46103.9	5	Sparse Live Bottom
6*	52	14432.8	46104.6	7	Bare Sand Bottom
6*	53	14432.5	46105.3	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
6*	54	14432.2	46106.1	5	Sparse Live Bottom
6*	55	14432.0	46106.7	6	Patchy Live Bottom
6*	56	14431.8	46107.5	1	Dense Halophila
6*	57	14432.0	46110.7	5	Sparse Live Bottom
6*	58	14431.8	46111.2	5	Sparse Live Bottom
6*	59	14431.5	46112.0	5	Sparse Live Bottom
6*	60	14431.2	46112.4	3	Patchy Halophila dicipiens and Halophila engelmanni
6*	61	14430.9	46113.0	1	Dense Halophila dicipiens and Halophila engelmanni
6*	62	14430.6	46113.4	1	Dense Halophila dicipiens and Halophila engelmanni
6*	63	14430.3	46113.9	5 + 6	Sparse Patchy Live Bottom
6*	64	14430.0	46114.4	2	Sparse Halophila engelmanni
6*	65	14429.6	46114.9	3	Patchy Halophila dicipiens
6*	66	14429.3	46115.4	3	Patchy Halophila engelmanni
6*	67	14429.1	46115.9	2	Sparse Halophila dicipiens
6*	68	14428.7	46116.3	1	Dense Halophila
6*	69	14428.4	46116.8	7	Bare Sand Bottom
6*	70	14428.1	46117.3	7	Bare Sand Bottom
6*	71	14427.7	46117.8	2	Sparse Halophila engelmanni
6*	72	14427.4	46118.1	2	Sparse Halophila engelmanni
6*	73	14427.4	46120.3	3 + 6	Patchy Seagrass and Live Bottom
6*	74	14427.2	46120.8	5	Sparse Live Bottom
6*	75	14426.9	46121.2	5	Sparse Live Bottom
6*	76	14426.6	46121.5	7	Bare Sand Bottom
6*	77	14426.3	46121.5	5	Sparse Live Bottom
6*	78	14426.0	46122.1	7	Bare Sand Bottom
6*	79	14425.7	46122.3	7	Bare Sand Bottom
6*	80	14425.4	46122.7	5	Sparse Live Bottom
6*	81	14425.1	46122.9	5	Sparse Live Bottom
6*	82	14424.7	46123.1	5	Sparse Live Bottom
6*	83	14424.4	46123.5	2	Sparse Halophila
6*	84	14424.1	46123.7	7	Bare Sand Bottom
6*	85	14423.7	46124.1	5	Sparse Live Bottom
7*	1	14429.4	46268.4	2	Sparse Halophila
7*	2	14429.0	46268.0	6	Patchy Live Bottom
7*	3	14428.6	46267.5	6	Patchy Live Bottom
7*	4	14428.1	46267.0	2	Sparse Halophila engelmanni
7*	5	14427.8	46266.3	-	--

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7*	6	14427.4	46265.5	1 + 6	Dense Sargassum and Patchy Live Bottom
7*	7	14427.1	46265.0	5	Sparse Live Bottom
7*	8	14426.7	46264.7	4	Dense Live Bottom
7*	9	14426.3	46263.9	6	Patchy Live Bottom
7*	10	14426.0	46263.3	1 + 6	Dense Sargassum and Patchy Live Bottom
7*	11	14425.6	46262.6	7	Bare Sand Bottom
7*	12	14425.2	46261.9	3	Patchy Sargassum and Algae
7*	13	14424.9	46261.4	2	Sparse Halophila
7*	14	14424.6	46260.8	2	Sparse Halophila
7*	15	14424.2	46260.1	7	Bare Sand Bottom
7*	16	14423.9	46259.5	-	--
7*	17	14423.5	46258.8	-	--
7*	18	14423.0	46260.1	3	Patchy Algae
7*	19	14422.8	46259.6	5	Sparse Live Bottom
7*	20	14422.5	46258.8	3	Patchy Algae
7*	21	14422.2	46258.1	3	Patchy Halophila
7*	22	14421.9	46257.2	6	Patchy Live Bottom
7*	23	14421.7	46256.2	6	Patchy Live Bottom
7*	24	14421.3	46255.5	7	Bare Sand Bottom
7*	25	14420.9	46254.6	3 + 6	Patchy Seagrass and Live Bottom
7*	26	14420.5	46253.7	3 + 6	Patchy Seagrass and Live Bottom
7*	27	14420.1	46252.9	6	Patchy Live Bottom
7*	28	14419.8	46252.0	3	Patchy Seagrass Beds
7*	29	14419.4	46251.1	3	Patchy Seagrass Beds
7*	30	14419.0	46250.2	2	Sparse Seagrass
7*	31	14418.6	46249.5	4	Dense Live Bottom
7*	32	14418.2	46248.8	4	Dense Live Bottom
7*	33	14417.8	46248.0	6	Patchy Live Bottom
7*	34	14417.6	46249.3	6	Patchy Live Bottom
7*	35	14417.2	46248.4	1	Dense Halophila Beds
7*	36	14416.8	46247.6	3	Patchy Halophila Beds
7*	37	14416.4	46246.5	7	Bare Sand Bottom
7*	38	14416.0	46245.8	7	Bare Sand Bottom
7*	39	14415.6	46245.0	7	Bare Sand Bottom
7*	40	14415.2	46244.4	6	Patchy Live Bottom
7*	41	14414.8	46243.6	6	Patchy Live Bottom
7*	42	14414.4	46243.0	7	Bare Sand Bottom
7*	43	14414.1	46242.3	7	Bare Sand Bottom
7*	44	14413.7	46241.6	7	Bare Sand Bottom
7*	45	14413.3	46241.0	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7*	46	14412.9	46240.1	7	Bare Sand Bottom
7*	47	14412.5	46239.3	7	Bare Sand Bottom
7*	48	14412.1	46238.4	7	Bare Sand Bottom
7*	49	14411.8	46237.7	7	Bare Sand Bottom
7*	50	14411.4	46237.1	7	Bare Sand Bottom
7*	51	14411.1	46236.3	7	Bare Sand Bottom
7*	52	14411.3	46238.8	7	Bare Sand Bottom
7*	53	14411.1	46238.5	7	Bare Sand Bottom
7*	54	14410.8	46237.8	7	Bare Sand Bottom
7*	55	14410.4	46236.9	7	Bare Sand Bottom
7*	56	14410.1	46236.0	7	Bare Sand Bottom
7*	57	14409.7	46235.0	7	Bare Sand Bottom
7*	58	14409.3	46234.1	3	Patchy Seagrass and Algae
7*	59	14408.9	46233.2	7	Bare Sand Bottom
7*	60	14408.5	46232.2	7	Bare Sand Bottom
7*	61	14408.1	46231.3	7	Bare Sand Bottom
7*	62	14407.7	46230.5	7	Bare Sand Bottom
7*	63	14407.4	46229.7	7	Bare Sand Bottom
7*	64	14407.0	46228.9	7	Bare Sand Bottom
7*	65	14406.5	46228.3	7	Bare Sand Bottom
7*	66	14406.2	46227.6	5	Sparse Live Bottom
7*	67	14405.8	46226.8	5	Sparse Live Bottom
7*	68	14405.4	46226.2	5	Sparse Live Bottom
7*	69	14405.0	46225.3	7	Bare Sand Bottom
7*	70	14404.6	46224.5	2	Sparse Halophila
7**	71	14405.3	46230.8	7	Bare Sand Bottom
7**	72	14405.1	46230.4	7	Bare Sand Bottom
7**	73	14404.7	46230.1	2	Sparse Seagrass and Algae
7**	74	14404.4	46229.8	2	Sparse Seagrass and Algae
7**	75	14404.1	46229.3	2	Sparse Seagrass and Algae
7**	76	14403.8	46229.1	6	Patchy Live Bottom
7**	77	14403.6	46228.6	6	Patchy Live Bottom
7**	78	14403.4	46228.4	4	Dense Live Bottom
7**	79	14403.1	46228.0	4	Dense Live Bottom
7**	80	14402.8	46227.6	6	Patchy Live Bottom
7**	81	14402.6	46227.3	4	Dense Live Bottom
7**	82	14402.3	46226.7	4	Dense Live Bottom
7**	83	14402.0	46226.3	7	Bare Sand Bottom
7**	84	14401.7	46225.9	6	Patchy Live Bottom
7**	85	14401.5	46225.7	7	Bare Sand Bottom
7**	86	14401.3	46225.4	6	Patchy Live Bottom
7**	87	14401.0	46224.9	2	Sparse Seagrass and Algae
7**	88	14400.8	46224.6	3	Patchy Seagrass and Algae
7**	89	14400.5	46224.2	3	Patchy Seagrass and Algae

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7**	90	14400.3	46224.0	3 + 6	Patchy Seagrass and Live Bottom
7**	91	14400.0	46223.6	6	Patchy Live Bottom
7**	92	14399.7	46223.0	7	Bare Sand Bottom
7**	93	14399.5	46222.7	5	Sparse Live Bottom
7**	94	14399.3	46222.2	6	Patchy Live Bottom
7**	95	14399.0	46221.7	2	Sparse Algal Assemblage
7**	96	14398.9	46221.2	6	Patchy Live Bottom
7**	97	14398.5	46220.9	6	Patchy Live Bottom
7**	98	14398.4	46220.5	6	Patchy Live Bottom
7**	99	14398.1	46220.0	3	Patchy Seagrass and Algae
7**	100	14397.8	46219.5	3 + 6	Patchy Seagrass and Live Bottom
7**	101	14397.6	46219.0	3 + 6	Patchy Seagrass and Live Bottom
7**	102	14397.3	46218.7	3 + 6	Patchy Seagrass and Live Bottom
7**	103	14397.1	46218.1	3 + 6	Patchy Seagrass and Live Bottom
7**	104	14396.9	46217.7	1	Dense Halophila
7**	105	14396.6	46217.6	2	Sparse Seagrass and Algae
7**	106	14396.3	46217.1	2	Sparse Halophila
7**	107	14396.1	46216.7	6	Patchy Live Bottom
7**	108	14395.8	46216.2	6	Patchy Live Bottom
7**	109	14395.6	46215.9	1	Dense Halophila
7**	110	14395.4	46215.5	7	Bare Sand Bottom
7**	111	14395.1	46214.9	7	Bare Sand Bottom
7**	112	14394.9	46214.5	6	Patchy Live Bottom
7**	113	14394.7	46213.9	7	Bare Sand Bottom
7**	114	14394.5	46213.5	1	Dense Halophila
7**	115	14394.3	46213.0	5	Sparse Live Bottom
7**	116	14394.0	46212.5	6	Patchy Live Bottom
7**	117	14393.8	46212.2	3 + 6	Patchy Halophila and Live Bottom
7**	118	14393.5	46211.8	3 + 6	Patchy Halophila and Live Bottom
7**	119	14393.3	46211.3	6	Patchy Live Bottom
7**	120	14393.0	46210.9	3 + 6	Patchy Halophila and Live Bottom
7**	121	14392.8	46210.5	4	Dense Live Bottom
7**	122	14392.7	46210.0	4	Dense Live Bottom
7**	123	14392.4	46209.7	4	Dense Live Bottom
7**	124	14392.2	46209.1	-	--
7**	125	14391.9	46208.7	6	Patchy Live Bottom
7**	126	14391.7	46208.2	4	Dense Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7**	127	14391.5	46207.7	7	Bare Sand Bottom
7**	128	14391.2	46207.4	2	Sparse Halophila
7**	129	14391.0	46206.9	7	Bare Sand Bottom
7**	130	14390.7	46206.5	-	--
7**	131	14390.3	46206.0	6	Patchy Live Bottom
7**	132	14389.9	46205.0	6	Patchy Live Bottom
7**	133	14389.5	46204.2	6	Patchy Live Bottom
7**	134	14389.1	46203.1	7	Bare Sand Bottom
7**	135	14388.7	46202.2	7	Bare Sand Bottom
7**	136	14388.3	46201.3	7	Bare Sand Bottom
7**	137	14388.0	46200.4	5	Sparse Live Bottom
7**	138	14387.6	46199.6	-	--
7**	139	14387.2	46198.9	-	--
7**	140	14386.9	46198.1	6	--
7**	141	14386.5	46197.5	-	--
7**	142	14386.3	46196.9	-	--
7**	143	14385.8	46196.1	-	--
7**	144	14385.5	46195.4	6	Patchy Live Bottom
7**	145	14385.2	46194.8	6	Patchy Live Bottom
7**	146	14384.9	46194.1	7	Bare Sand Bottom
7**	147	14384.6	46193.4	7	Bare Sand Bottom
7**	148	14384.2	46192.6	7	Bare Sand Bottom
7**	149	14384.0	46192.0	7	Bare Sand Bottom
7**	150	14383.6	46191.3	7	Bare Sand Bottom
7**	151	14383.3	46190.7	7	Bare Sand Bottom
7**	152	14383.0	46190.1	7	Bare Sand Bottom
7**	153	14382.6	46189.4	7	Bare Sand Bottom
7**	154	14382.4	46188.6	7	Bare Sand Bottom
7**	155	14382.0	46188.0	7	Bare Sand Bottom
7**	156	14381.7	46187.3	7	Bare Sand Bottom
7**	157	14381.4	46186.6	-	--
7**	158	14381.0	46186.0	2	Sparse Sargassum and Caulerpa
7**	159	14380.8	46185.2	4	Dense Live Bottom
7**	160	14380.4	46184.6	7	Bare Sand Bottom
7**	161	14380.2	46183.6	2	Sparse Halophila and Algae
7**	162	14380.0	46182.9	2	Sparse Halophila and Algae
7**	163	14379.6	46182.3	7	Bare Sand Bottom
7**	164	14379.3	46181.5	5	Sparse Live Bottom
7**	165	14379.0	46180.8	5	Sparse Live Bottom
7**	166	14378.7	46179.8	5	Sparse Live Bottom
7**	167	14378.4	46179.0	5	Sparse Live Bottom
7**	168	14378.1	46178.1	5	Sparse Live Bottom
7**	169	14377.8	46177.4	2	Sparse Seagrass and Algae
7**	170	14377.4	46176.7	4	Dense Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7**	171	14377.1	46176.1	2 + 5	Sparse Seagrass and Live Bottom
7**	172	14376.7	46175.4	5	Sparse Live Bottom
7**	173	14376.4	46174.7	4	Dense Live Bottom
7**	174	14376.1	46173.9	4	Dense Live Bottom
7**	175	14375.8	46173.1	4	Dense Live Bottom
7**	176	14375.5	46172.3	2 + 5	Sparse Seagrass and Live Bottom
7**	177	14375.1	46171.7	2 + 5	Sparse Seagrass and Live Bottom
7**	178	14374.8	46171.7	2 + 5	Sparse Seagrass and Live Bottom
7**	179	14374.5	46170.0	5	Sparse Live Bottom
7**	180	14374.2	46169.5	4	Dense Live Bottom
7**	181	14373.8	46168.8	5	Sparse Live Bottom
7**	182	14373.5	46168.1	5	Sparse Live Bottom
7**	183	14373.1	46167.3	2 + 5	Sparse Seagrass and Live Bottom
7**	184	14372.8	46166.7	2 + 5	Sparse Seagrass and Live Bottom
7**	185	14372.3	46166.0	5	Sparse Live Bottom
7**	186	14372.0	46165.6	5	Sparse Live Bottom
7**	187	14371.7	46164.8	2 + 5	Sparse Seagrass and Live Bottom
7**	188	14371.6	46164.5	2 + 5	Sparse Seagrass and Live Bottom
7**	189	14371.3	46164.0	2 + 5	Sparse Seagrass and Live Bottom
7**	190	14370.8	46162.5	2 + 5	Sparse Seagrass and Live Bottom
7**	191	14370.3	46161.5	5	Sparse Live Bottom
7**	192	14370.0	46160.8	2 + 5	Sparse Seagrass and Live Bottom
7**	193	14369.8	46160.2	5	Sparse Live Bottom
7**	194	14369.3	46159.3	5	Sparse Live Bottom
7**	195	14369.0	46158.7	7	Bare Sand Bottom
7**	196	14368.6	46157.8	5	Sparse Live Bottom
7**	197	14368.2	46157.1	5	Sparse Live Bottom
7**	198	14368.0	46156.7	6	Patchy Live Bottom
7**	199	14367.8	46156.4	4	Dense Live Bottom
7**	200	14367.4	46155.8	7	Bare Sand Bottom
7**	201	14367.0	46155.0	5	Sparse Live Bottom
7**	202	14366.3	46154.7	5	Sparse Live Bottom
7**	203	14365.9	46152.9	5	Sparse Live Bottom
7**	204	14365.5	46152.3	5	Sparse Live Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
7**	205	14365.2	46151.5	5	Sparse Live Bottom
7**	206	14364.7	46150.9	5	Sparse Live Bottom
7**	207	14364.3	46150.1	5	Sparse Live Bottom
7**	208	14364.0	46149.5	7	Bare Sand Bottom
7**	209	14363.6	46148.7	2	Sparse Seagrass and Algae
7**	210	14363.2	46148.1	2 + 6	Sparse Seagrass and Patchy Live Bottom
7**	211	14362.8	46147.4	7	Bare Sand Bottom
7**	212	14362.5	46146.6	5	Sparse Live Bottom
7**	213	14362.1	46145.9	5	Sparse Live Bottom
7**	214	14361.7	46145.0	5	Sparse Live Bottom
7**	215	14361.4	46144.3	2	Sparse Seagrass and Algae
7**	216	14361.0	46143.7	2	Sparse Seagrass and Algae
7**	217	14360.6	46143.1	2	Sparse Seagrass and Algae
7**	218	14360.1	46142.4	5	Sparse Live Bottom
7**	219	14359.7	46141.7	5	Sparse Live Bottom
7**	220	14359.4	46140.9	2	Sparse Seagrass and Algae
7**	221	14358.9	46140.1	5	Sparse Live Bottom
7**	222	14358.5	46139.3	2 + 5	Sparse Seagrass and Live Bottom
7**	223	14358.2	46138.6	2 + 5	Sparse Seagrass and Live Bottom
7**	224	14357.8	46138.0	5	Sparse Live Bottom
7**	225	14357.3	46137.5	5	Sparse Live Bottom
7**	226	14356.9	46136.8	5	Sparse Live Bottom
7**	227	14356.5	46136.1	2 + 5	Sparse Seagrass and Live Bottom
7**	228	14356.1	46135.7	2 + 5	Sparse Seagrass and Live Bottom
7**	229	14355.6	46134.9	2	Sparse Seagrass and Algae
7**	230	14355.3	46134.2	7	Bare Sand Bottom
7**	231	14354.8	46133.5	7	Bare Sand Bottom
7**	232	14354.4	46132.7	7	Bare Sand Bottom
7**	233	14354.0	46132.0	7	Bare Sand Bottom
8*	1	14439.9	45869.2	7	Bare Sand Bottom
8*	2	14439.8	45868.0	7	Bare Sand Bottom
8*	3	14439.7	45867.2	7	Bare Sand Bottom
8*	4	14439.6	45866.4	5	Sparse Live Bottom
8*	5	14439.4	45865.5	7	Sparse Live Bottom
8*	6	14439.3	45864.7	7	Sparse Live Bottom
8*	7	14439.2	45864.0	2	Sparse Sargassum
8*	8	14439.1	45863.1	7	Bare Sand Bottom
8*	9	14439.0	45862.2	6	Patchy Live Bottom
8*	10	14438.8	45861.5	7	Bare Sand Bottom
8*	11	14438.7	45860.7	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
8*	12	14438.5	45859.7	7	Bare Sand Bottom
8*	13	14438.4	45859.0	7	Bare Sand Bottom
8*	14	14438.2	45858.2	7	Bare Sand Bottom
8*	15	14438.2	45857.5	7	Bare Sand Bottom
8*	16	14438.0	45856.6	6	Patchy Live Bottom
8*	17	14438.0	45856.0	7	Bare Sand Bottom
8*	18	14437.8	45855.0	7	Bare Sand Bottom
8*	19	14437.7	45854.1	7	Bare Sand Bottom
8*	20	14437.7	45853.2	7	Bare Sand Bottom
8*	21	14437.5	45852.4	7	Bare Sand Bottom
8*	22	14437.7	45854.6	7	Bare Sand Bottom
8*	23	14437.5	45854.4	6	Patchy Live Bottom
8*	24	14437.4	45853.7	7	Bare Sand Bottom
8*	25	14437.3	45852.8	6	Patchy Live Bottom
8*	26	14437.1	45851.9	6	Patchy Live Bottom
8*	27	14437.0	45851.1	6	Patchy Live Bottom
8*	28	14437.0	45850.2	6	Patchy Live Bottom
8*	29	14436.8	45849.4	6	Patchy Live Bottom
8*	30	14436.8	45848.3	6	Patchy Live Bottom
8*	31	14436.6	45847.7	7	Bare Sand Bottom
8*	32	14436.6	45846.9	7	Bare Sand Bottom
8*	33	14436.5	45846.0	7	Bare Sand Bottom
8*	34	14436.4	45845.1	2	Sparse Halodule wrightii
8*	35	14436.3	45844.3	2 + 5	Sparse Seagrass and Live Bottom
8*	36	14436.2	45843.6	4	Dense Live Bottom
8*	37	14436.2	45842.7	5	Sparse Live Bottom
8*	38	14436.1	45841.9	6	Patchy Live Bottom
8*	39	14436.0	45841.0	7	Bare Sand Bottom
8*	40	14435.9	45840.2	3	Patchy Seagrass and Algae
8*	41	14435.8	45839.5	7	Bare Sand Bottom
8*	42	14435.7	45838.6	6	Patchy Live Bottom
8*	43	14477.8	45835.7	2 + 5	Sparse Seagrass and Live Bottom
8*	44	14435.6	45837.1	6	Patchy Live Bottom
8*	45	14435.6	45836.2	7	Bare Sand Bottom
8*	46	14435.5	45835.5	5	Sparse Live Bottom
9*	1	14393.1	45744.3	5	Sparse Live Bottom
9*	2	14393.0	45744.9	5	Sparse Live Bottom
9*	3	14392.7	45745.5	5	Sparse Live Bottom
9*	4	14392.6	45746.0	7	Bare Sand Bottom
9*	5	14392.4	45746.9	7	Bare Sand Bottom
9*	6	14392.1	45747.4	7	Bare Sand Bottom

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
9*	7	14392.0	45747.9	7	Bare Sand Bottom
9*	8	14391.6	45748.8	7	Bare Sand Bottom
9*	9	14391.5	45749.6	7	Bare Sand Bottom
9*	10	14391.2	45750.3	7	Bare Sand Bottom
9*	11	14391.0	45751.1	6	Patchy Live Bottom
9*	12	14390.8	45752.1	7	Bare Sand Bottom
9*	13	14390.6	45752.9	5	Sparse Live Bottom
9*	14	14390.3	45753.6	5	Sparse Live Bottom
9*	15	14390.2	45754.2	5	Sparse Live Bottom
9*	16	14390.0	45755.2	7	Bare Sand Bottom
9*	17	14389.7	45755.8	5	Bare Sand Bottom
9*	18	14389.4	45756.7	7	Bare Sand Bottom
9*	19	14389.3	45757.5	7	Bare Sand Bottom
9*	20	14389.6	45759.8	7	Bare Sand Bottom
9*	21	14389.8	45760.9	7	Bare Sand Bottom
9*	22	14389.7	45761.7	5	Sparse Live Bottom
9*	23	14389.5	45762.6	-	--
9*	24	14389.3	45763.2	5	Sparse Live Bottom
9*	25	14389.0	45764.0	3	Patchy Halophila
9*	26	14388.8	45765.1	7	Bare Sand Bottom
9*	27	14388.6	45766.2	3	Patchy Halophila
9*	28	14388.3	45767.2	3	Patchy Halophila
9*	29	14388.1	45768.3	1	Dense Halophila
9*	30	14387.9	45769.4	7	Bare Sand Bottom
9*	31	14387.8	45770.3	7	Bare Sand Bottom
9*	32	14387.5	45771.2	7	Bare Sand Bottom
9*	33	14387.1	45771.9	7	Bare Sand Bottom
9*	34	14386.9	45772.8	7	Bare Sand Bottom
9*	35	14386.6	45773.5	7	Bare Sand Bottom
9*	36	14386.3	45774.1	7	Bare Sand Bottom
9*	37	14386.0	45774.7	7	Bare Sand Bottom
9*	38	14385.7	45775.3	5	Sparse Live Bottom
9*	39	14386.1	45778.1	1	Dense Halophila
9*	40	14385.9	45779.1	1	Dense Halophila
9*	41	14385.6	45779.7	3	Patchy Halophila
9*	42	14385.4	45780.5	7	Bare Sand Bottom
9*	43	14385.0	45782.1	5	Sparse Live Bottom
9*	44	14384.7	45782.8	1	Dense Halophila
9*	45	14384.5	45783.5	3	Patchy Halophila
9*	46	14384.3	45784.3	3	Patchy Halophila
9*	47	14384.1	45784.9	3 + 4	Patchy Halophila and Dense Live Bottom
9*	48	14384.0	45785.7	1	Dense Halophila
9*	49	14383.7	45786.6	4	Dense Live Bottom
9*	50	14383.4	45787.3	3	Patchy Halophila

APPENDIX B. (CONTINUED).

Transect	Fix No.	Loran-C Time Delays		Habitat Code	Description
9*	51	14383.3	45787.8	6	Patchy Live Bottom
9*	52	14383.9	45790.7	7	Bare Sand Bottom
9*	53	14383.9	45791.6	7	Bare Sand Bottom
9*	54	14383.6	45792.4	3	Patchy Halophila
9*	55	14383.4	45793.2	7	Bare Sand Bottom
9*	56	14383.1	45793.8	3	Patchy Halophila
9*	57	14382.9	45794.5	3	Patchy Halophila
9*	58	14382.7	45795.3	7	Bare Sand Bottom
9*	59	14382.5	45796.2	7	Bare Sand Bottom
9*	60	14382.2	45797.3	7	Bare Sand Bottom
9*	61	14381.9	45798.1	7	Bare Sand Bottom
9*	62	14381.3	45798.8	3	Patchy Halophila
9*	63	14381.2	45800.3	3	Patchy Halophila
9*	64	14380.8	45801.1	3	Patchy Halophila
9*	65	14380.7	45801.9	3	Patchy Halophila
9*	66			3	Patchy Halophila

*Diver
**TV

Habitat Codes:
1 = Dense Seagrass and Algae
2 = Sparse Seagrass and Algae
3 = Patchy Seagrass and Algae
4 = Dense Live Bottom
5 = Sparse Live Bottom
6 = Patchy Live Bottom
7 = Bare Sand Bottom
8 = Bare Mud Bottom.

APPENDIX C

LOCATION, HABITAT CLASSIFICATION, NUMERICALLY DOMINANT PLANT SPECIES, AND MEAN BLADE DENSITIES AT THE 50 SIGNATURE CONTROL STATIONS SAMPLED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984)

APPENDIX C. LOCATION, HABITAT CLASSIFICATION, NUMERICALLY DOMINANT PLANT SPECIES, AND MEAN BLADE DENSITIES AT THE 50 SIGNATURE CONTROL STATIONS SAMPLED DURING CRUISE 1 (OCTOBER TO NOVEMBER 1984).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
1	28°43.32'	83°10.46'	12	Patchy Live Bottom	6	132	Halophila decipiens Caulerpa sertularioides
2	28°44.19'	83°12.92'	13	Sparse Seagrass and Algae	3	900	H. decipiens H. engelmanni C. prolifera
3	28°47.59'	83°21.07'	17	Sparse Seagrass and Algae	2	374	C. mexicana C. prolifera H. engelmanni H. decipiens
4	28°48.88'	83°24.16'	18	Sparse Seagrass and Algae	2	738	H. decipiens H. engelmanni C. prolifera C. lanuginosa
5	28°25.56'	83°21.15'	21	Patchy Live Bottom	6	390	H. decipiens C. sertularioides
6	28°26.96'	83°12.01'	15	Sparse Live Bottom	5	774	H. decipiens C. sertularioides C. mexicana

APPENDIX C. (CONTINUED).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
7	28°26.84'	83°09.36'	13	Sparse Seagrass and Algae	2	485	H. decipiens C. sertularioides
8	28°26.86'	83°07.08'	13	Dense Live Bottom	4	-	--
9	28°26.52'	83°03.79'	11	Dense Seagrass and Algae	1	2,300	H. decipiens C. prolifera C. sertularioides
10	28°28.08'	83°01.38'	10	Bare Sand Bottom	7	-	--
11	28°28.82'	82°59.92'	8	Sparse Live Bottom	5	-	C. sertularioides
12	28°29.39'	82°58.24'	7	Sparse Live Bottom	5	-	C. sertularioides
13	28°29.70'	82°57.24'	6	Dense Seagrass	1	1,705	Halodule wrightii
14	28°27.96'	82°51.99'	3	Dense Seagrass	1	249	Thalassia testudinum
15	28°27.62'	82°51.06'	4	Dense Seagrass	1	309	T. testudinum
16	28°26.96'	82°48.37'	3	Dense Seagrass	1	215	T. testudinum
17	28°46.06'	82°55.95'	5	Sparse Seagrass	2	102	T. testudinum

APPENDIX C. (CONTINUED).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
18	28°47.96'	82°56.25'	6	Bare Sand Bottom	7	-	--
19	28°49.93'	82°56.49'	6	Sparse Live Bottom	5	-	--
20	28°51.92'	82°56.79'	5	Sparse Live Bottom	5	-	--
21	28°54.90'	83°09.11'	9	Bare Sand Bottom	7	-	--
22	28°54.96'	83°11.34'	9	Bare Sand Bottom	7	-	--
23	28°54.98'	83°13.52'	12	Bare Sand Bottom	7	-	--
24	28°55.06'	83°15.47'	12	Bare Sand Bottom	7	-	--
25	28°54.12'	83°30.88'	20	Sparse Seagrass	2	1,463	H. decipiens H. engelmanni
26	28°58.26'	83°29.65'	17	Sparse Seagrass	2	842	H. engelmanni
27	29°06.19'	83°28.02'	12	Bare Sand Bottom	7	-	--
28	29°12.37'	83°15.27'	5	Bare Sand Bottom	8	-	--
29	29°16.42'	83°18.02'	5	Patchy Seagrass	3	2,026	T. testudinum H. wrightii

APPENDIX C. (CONTINUED).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
30	29°17.27'	83°19.24'	5	Bare Mud Bottom	8	-	--
31	29°18.01'	83°20.01'	5	Bare Sand Bottom	7	-	--
32	29°24.97'	83°21.72'	3	Bare Sand Bottom	7	-	--
33	29°07.90'	83°33.56'	15	Bare Sand Bottom	7	-	--
34	29°09.31'	83°38.87'	15	Sparse Seagrass	2	2,657	H. engelmanni
35	29°10.50'	83°42.91'	17	Sparse Seagrass	2	1,033	H. engelmanni
36	29°11.39'	83°46.14'	19	Sparse Seagrass	2	1,033	H. engelmanni
37	29°12.29'	83°48.98'	23	Sparse Seagrass and Algae	2	596	H. decipiens C. sertularioides Udotea sp.
38	29°12.97'	83° 51.45'	23	Sparse Seagrass and Algae	2	1,893	H. decipiens H. engelmanni C. lanuginosa C. sertularioides
39	29°15.68'	83° 56.65'	23	Dense Live Bottom	4	-	--

APPENDIX C. (CONTINUED).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
40	29°22.39'	83°53.35'	21	Patchy Live Bottom and Algae	6	-	C. mexicana
41	29°27.26'	83°50.94'	17	Sparse Seagrass and Algae	2	973	H. decipiens H. engelmanni C. prolifera Udotea sp. C. sertularioides
42	29°28.46'	83°50.38'	16	Sparse Seagrass and Algae	2	497	H. decipiens C. sertularioides C. mexicana
43	29°31.29'	83°48.97'	17	Sparse Live Bottom and Seagrass	5	167	H. decipiens Udotea sp. Halimeda sp.
44	29°33.97'	83°47.66'	15	Sparse Seagrass and Algae	2	846	H. engelmanni C. sertularioides Udotea sp.
45	29°37.67'	83°45.81'	14	Sparse Seagrass and Algae	2	497	H. engelmanni C. sertularioides C. prolifera

APPENDIX C. (CONCLUDED).

Station	Latitude	Longitude	Depth (m)	Habitat Description	Habitat Code*	Mean Seagrass and Algal Blade Densities (No. Blades m^{-2})	Numerically Dominant Plant Species**
46	29°57.76'	84°00.78'	5	Sparse Seagrass	2	41	T. testudinum
47	29°59.32'	84°02.42'	5	Patchy Live Bottom and Seagrass	3 + 6	48	T. testudinum
48	29°59.78'	84°02.71'	5	Bare Mud Bottom	8	-	--
49	30°01.46'	84°04.08'	5	Patchy Live Bottom	6	-	--
50	30°00.97'	84°05.26'	5	Sparse Seagrass	2	74	T. testudinum H. wrightii

*Habitat Codes:
1 = Dense Seagrass and Algae
2 = Sparse Seagrass and Algae
3 = Patchy Seagrass and Algae
4 = Dense Live Bottom
5 = Sparse Live Bottom
6 = Patchy Live Bottom
7 = Bare Sand Bottom
8 = Bare Mud Bottom.

**Species are arranged by order of numerical abundance within stations.

APPENDIX D

COMPARISON OF MEAN LEAF DENSITIES AT SIGNATURE CONTROL STATIONS SAMPLED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER) AND CRUISE 2 (19-27 FEBRUARY 1985)

APPENDIX D. COMPARISON OF MEAN LEAF DENSITIES AT SIGNATURE CONTROL STATIONS SAMPLED DURING CRUISE 1 (24 OCTOBER TO 1 NOVEMBER 1984) AND CRUISE 2 (19-27 FEBRUARY 1985).

	Cruise 1			Cruise 2		
Station	Sampling Date	No. Blades m^{-2}	Numerically Dominant Plant Species	Sampling Date	No. Blades m^{-2}	Numerically Dominant Plant Species
1	28 Oct 1984	132	Halophila decipiens Caulerpa sertularioides	21 Feb 1985	137	C. prolifera
2	28 Oct 1984	900	H. decipiens H. engelmanni C. prolifera	26 Feb 1985	0	--
5	28 Oct 1984	390	C. sertularioides H. decipiens	20 Feb 1985	124	C. sertularioides C. prolifera H. engelmanni
6	28 Oct 1984	774	H. decipiens C. sertularioides C. mexicana	26 Feb 1985	221	C. prolifera C. mexicana C. sertularioides H. engelmanni
9	29 Oct 1984	2,300	H. decipiens C. prolifera C. sertularioides	20 Feb 1985	67	C. sertularioides C. prolifera C. mexicana H. engelmanni
9	--	-	--	26 Feb 1985	67	C. sertularioides

APPENDIX D. (CONCLUDED).

	Cruise 1			Cruise 2		
Station	Sampling Date	No. Blades m^{-2}	Numerically Dominant Plant Species	Sampling Date	No. Blades m^{-2}	Numerically Dominant Plant Species
13	29 Oct 1984	1,705	*H. wrightii*	26 Feb 1985	100	*Halodule wrightii* *H. engelmanni*
14	29 Oct 1984	249	*Thalassia testudinum*	26 Feb 1985	126	*T. testudinum*
15	29 Oct 1984	309	*T. testudinum*	26 Feb 1985	126	*T. testudinum*
26	31 Oct 1984	842	*H. engelmanni*	26 Feb 1985	937	*H. engelmanni*
34	31 Oct 1984	2,657	*H. engelmanni*	22 Feb 1985	804	*H. engelmanni*
45	1 Nov 1984	497	*H. engelmanni* *C. sertularioides* *C. prolifera*	23 Feb 1985	571	*H. engelmanni* *C. prolifera*

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.