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# SOUTH ATLANTIC HARD BOTTOM STUDY

CONTINENTAL SHELF ASSOCIATES, INCORPORATED
TEQUESTA, FLORDIA

JUNE 1979

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# SOUTH ATLANTIC
# HARD BOTTOM STUDY

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Four oil and gas lease blocks in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and subbottom profiler for the purpose of identifying and mapping areas of hard bottom. The primary objective of this study was to determine the efficacy with which standard geophysical equipment and techniques could identify and map hard bottom areas. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs.

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## ABSTRACT

Four oil and gas lease blocks in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and subbottom profiler for the purpose of identifying and mapping areas of hard bottom. The primary objective of this study was to determine the efficacy with which standard geophysical equipment and techniques could identify and map hard bottom areas. In addition, the hard bottom substrate and associated fauna were identified and described from dredge samples and color photographs.

Inspection of geophysically mapped hard bottom areas with an underwater television camera system showed that, through the conservative interpretation of side scan sonar signatures and identification of areas of apparent outcropping of subbottom reflectors or acoustically impenetrable layers by a subbottom profiler, hard bottom areas can be geophysically mapped most successfully. However, the visual inspection was necessary to delineate the discontinuous nature of the emergent hard bottom areas and the types of biological assemblages associated with the mapped areas. A thin veneer of sand that was very difficult to identify from geophysical data and appeared to frequently determine the composition and quantity of the fauna was often observed overlaying the geophysically defined hard bottom.

Bathymetry was generally not adequate for the determination of hard bottom areas except in the cases of the ridges and scarps, a few locations near the shelf-break, and where a depression was associated with a hard bottom area covered with a thin veneer of sand.

Petrographic analyses of 43 rock samples dredged from the hard bottom areas showed that the hard bottom was principally a Recent to Subrecent biostromal reef. Six lithologic types (sandstone, biomicrite, sandy biomicrite, biosparite, biolithite, and algal biolithite) were identified from the dredge samples with no significant variations in their distribution recorded between the four lease blocks.

Four hundred and ninety-nine taxa including 33 fish species were identified from 68 biological dredge samples collected in hard bottom areas. The hard bottom associated fauna was primarily composed of representatives from the following major taxa: Chlorophyta (green algae), Phaeophyta (brown algae), Rhodophyta (red algae), Porifera (sponges), Cnidaria (hydroids, corals, sea anemones, sea feathers, and fans), and Ascidiacea (sea squirts). A number of species of polychaetes, mollusks, crustaceans and echinoderms were also believed to be directly associated with the hard bottom. Faunal assemblages that were identified appeared to be directly correlated with substrate type while water depth seemed to be the second major factor influencing the abundance and distribution of the observed and collected species.

# I. INTRODUCTION

## A. OBJECTIVES

Oil and gas lease tracts are routinely surveyed prior to drilling activities for shallow geologic hazards that include sediment instability, faulting, and shallow gas. These multi-sensor high-resolution engineering surveys are generally performed with a precision depth recorder, side scan sonar, subbottom profiler, and other geophysical equipment including sparkers, boomers, or air guns. The geologic hazards survey records from tracts leased in the Georgia Bight are to be interpreted for the presence of hard (live or hard) bottom areas within 1,820 meters of any proposed oil and gas exploration or production site (USDI, 1978a,b). These live bottom areas have been defined as "those areas which contain biological assemblages consisting of such sessile invertebrates as sea fans, sea whips, hydroids, anemones, ascidians, sponges, bryozoans, or corals living upon and attached to naturally occurring hard or rocky formations with rough, broken, or smooth topography, or whose lithotype favors the accumulation of turtles, fishes, and other fauna" (USDI, 1978a). These areas have been considered to be sufficiently unique and sensitive to require protection from the possible deleterious effects of oil and gas drilling operations. They therefore require identification and characterization prior to drilling activities so that measures may be taken to protect the areas if it is determined that they might be adversely impacted by the proposed activities.

The first known reference to live bottom areas in a scientific publication was made by Struhsaker (1969). He defined the live-bottom habitat as small areas of broken relief in water depths of 18 to 55 meters with a rich assemblage of sessile invertebrate fauna and fishes. This definition is similar to the expanded definition cited in the previous paragraph. In this report the term hard bottom will be used rather than the somewhat ambiguous term live bottom. Hard bottom may either outcrop on the seafloor or be covered by a veneer of sand of variable thickness. Rocky outcrops are probably always covered with epifauna and have an associated fish population (live bottoms) though the quantity and quality may be quite variable. The hard bottoms that are covered by a veneer of sand may also support a variable biomass and number of species depending on the thickness of the sand layer. If the sand layer is too thick the area would not support an attached epifauna (barren sandy bottom), but if the layer is thin, a relatively large number of attached biota and fish may be present (live sandy bottom). The geologic hazards survey records can in reality only be interpreted for hard bottom (either live or barren) with visual or other types of inspections to be made for the determination of whether the hard bottom areas contain faunal assemblages (either live or barren) and the quantity and quality of the assemblages.

The primary objective of this study was to determine if the geologic hazards survey records to be collected in the Georgia Bight will be adequate for defining the locations of hard bottom. This was accomplished by assessing the efficacy with which hard bottom areas in four oil and gas lease tracts located in the Georgia Bight could be identified and mapped utilizing common geophysical equipment and techniques. The study involved the delineation and mapping of hard bottom areas based on side scan sonar, subbottom profiler, and precision fathometer records followed by a television inspection of the mapped areas.

The secondary objectives of the study were to characterize the substrate comprising the hard bottom through petrographic analyses and to identify the hard bottom associated epifauna and demersal fishes. Color photographs were taken and dredge samples collected from the hard bottom areas for this purpose.

## B. DESCRIPTION OF SURVEY AREA

Figure 1 shows the oil and gas lease tracts located on the South Atlantic Outer Continental Shelf in the Southeast Georgia Embayment that were offered for lease by the U.S. Department of the Interior, Bureau of Land Management during Outer Continental Shelf Sale Number 43. The tracts are located approximately 48 to 120 kilometers (26 to 65 nautical miles) offshore from South Carolina, Georgia and north Florida in water depths ranging from approximately 13 to 165 meters. The figure also shows the tracts that were subsequently leased for exploration, development, and production of potential oil and gas resources. Three of the four tracts selected by the Bureau of Land Management for this study were located in the James Island Area (Blocks 198, 380 and 463) and were not leased while the single tract in the Brunswick Area (Block 912) was leased to Getty Oil Company.

The Georgia Bight, a marine extension of the Southeast Georgia Embayment, is bounded to the north by Cape Fear, North Carolina (Cape Fear Arch) and to the south by Cape Canaveral, Florida (part of the Florida Peninsular Arch) and lies between the Coastal Plain to the west and the Florida-Hatteras Slope to the east. The continental shelf break in the Gerogia Bight is often indistinct, but is considered to be between a depth of 50 and 80 meters (Henry and Hoyt, 1968; Macintyre and Milliman, 1970; Uchupi, 1967a). The nearshore waters of the Georgia Bight are greatly influenced by continental drainage (Atkinson et al., 1978) while the offshore waters are dominated by Gulf Stream intrusions and upwellings of cold nutrient-rich waters (O'Malley et al., 1978). The general circulation, though seasonal variations exist, consists of the offshore water moving to the north (Gulf Stream), the nearshore water moving south, and a cross-shelf movement of surface and bottom waters (Bumpus, 1973). The bottom topography of the area is generally smooth with the occurrence of only occasional inner, middle and outer shelf rock outcrops. The surficial sediment in the nearshore zone is mainly composed of fine to medium grain size sands of Holocene age while the middle and outer shelf sediments consist of medium to coarse grain size Pleistocene sand deposits with a higher carbonate content than the nearshore allochthonous sands (Gorsline, 1963; Henry and Hoyt, 1968; Milliman et al., 1968, 1972; Pilkey, 1964; Pilkey and Frankenberg, 1964; Pilkey et al., 1969).

The abundance and distribution of the pelagic biota in the

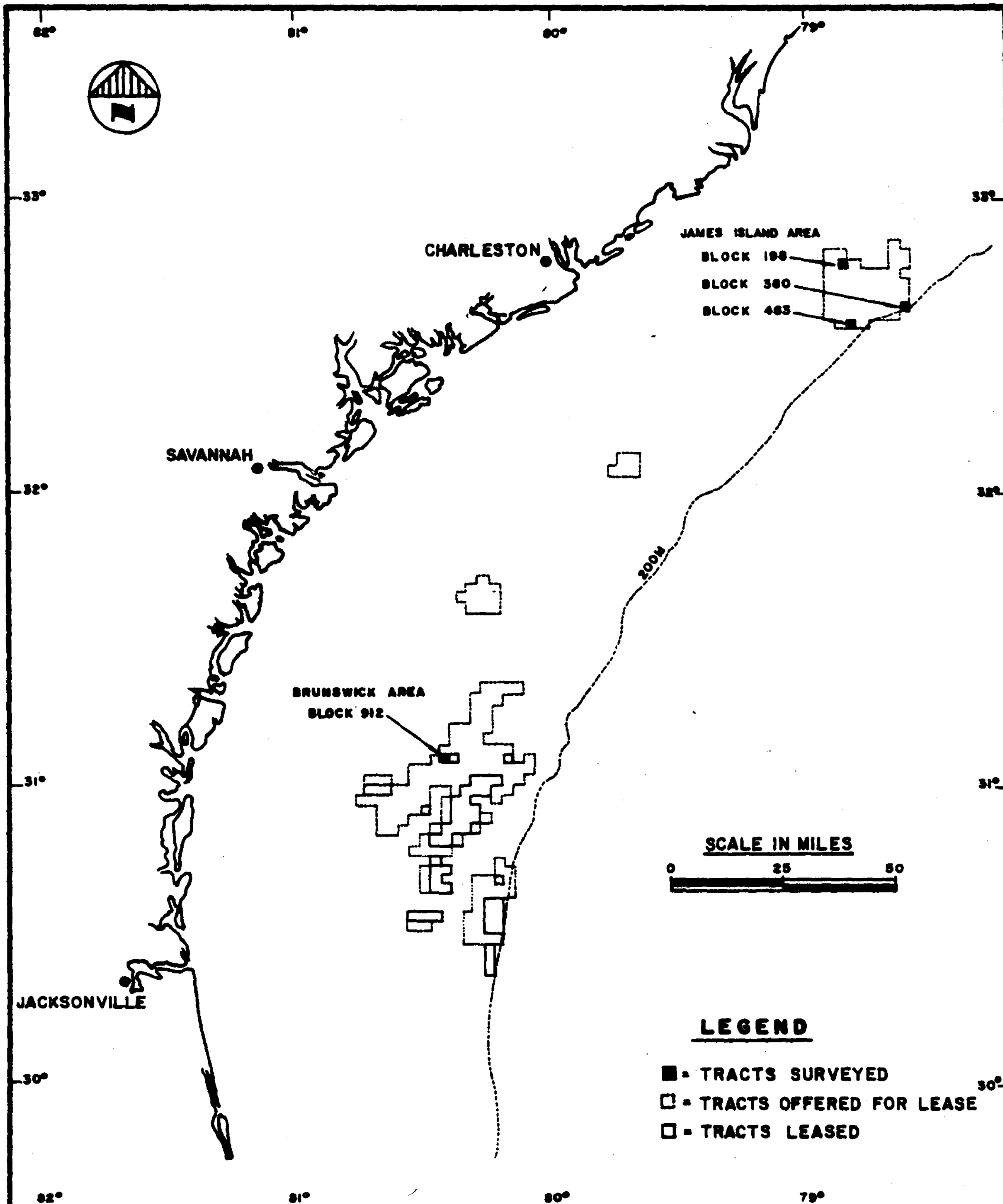



FIGURE: 1 SOUTH ATLANTIC OCS OIL AND GAS LEASE TRACTS

Georgia Bight is primarily water mass dependent. Recognizably different plankton populations occur in the nearshore and shelf-edge zones and contrasting demersal fish assemblages are present in the nearshore, mid-shelf and outer shelf areas (Roberts, 1974; Struhsaker, 1969). Variations in the benthic soft bottom biota also appear to be more depth than latitudinal realted within the Georgia Bight as inner, middle and outer shelf assemblages have been described (Coull, 1978; George and Staiger, 1978; Tenore, 1978). Seasonal ranges in water temperature and perhaps differences in food resources are principal reasons for the relationship with depth rather than any variations in the generally homogeneous substrate. Temporal variations in the spatial distribution of the biota may also be associated with the change in hydrography of the area due to Gulf Stream eddies and meanders and changing freshwater inflows.

## C. PREVIOUS HARD BOTTOM INVESTIGATIONS

### 1. TOPOGRAPHICAL, GEOLOGICAL AND GEOPHYSICAL DATA

There are a number of reports of hard bottoms, live bottoms, patch reefs, black rocks, fishing banks, snapper banks, limestone reefs, and algal reefs occurring on the continental shelf between Cape Hatteras, North Carolina and Cape Canaveral, Florida (USDI, 1978c), but very few of the investigations have included sufficient sampling to characterize the areas which will be termed hard bottoms in this report. The hard bottoms have been described in terms of inner, middle and outer banks (USDI, 1978c), a geographic categorization that will be followed herein. If sufficient information was provided on the location of the hard bottom areas in the reviewed literature then the positions are shown in Figure 2.

#### a) Inner Shelf Locations

The nearshore hard bottoms as shown in Figure 2 are reported to lie between Jacksonville, Florida and Charleston, South Carolina in water depths of approximately 15 to 25 meters (USDI, 1978c). In a study involving an inner shelf hard bottom area, Hunt (1974) investigated an area of approximately 41 square kilometers in about 20 meters of water located 33 kilometers (18 nautical miles) east of Sapelo Island, Georgia. The study site was previously known as "Sapelo Reef", but was re-named "Gray's Reef" by Hunt. The site was studied using a recording fathometer, side scan sonar, subbottom profiler, and underwater television. Samples were collected with dredges and additional samples were collected and observations made during eleven SCUBA dives. The exposed reef areas were described as an interfingering series of northeast-southwest trending ridges and troughs. The rock outcrops, which did not exceed 6.6 meters in relief, had a discontinuous distribution and sand ranging in thickness from a few to 30 or more centimeters covered some of the low relief rock areas. The rock was a moderately to strongly dolomitized, sandy biomicrite and was stratigraphically and lithologically similar to coastal Duplin Marl of Pliocene (?) age.

Milliman et al. (1968) based on quartzose and coquina-lithic

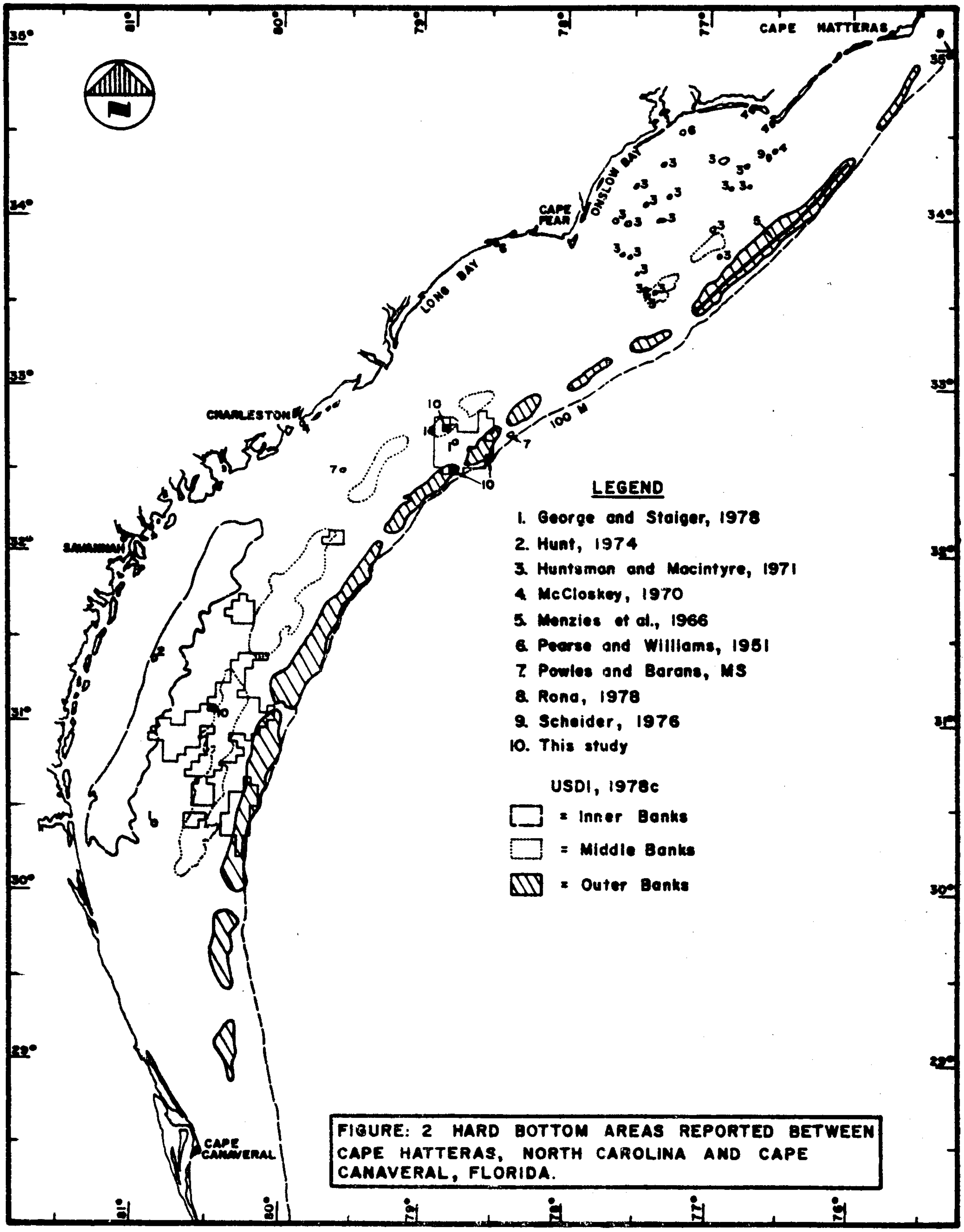



FIGURE: 2 HARD BOTTOM AREAS REPORTED BETWEEN CAPE HATTERAS, NORTH CAROLINA AND CAPE CANAVERAL, FLORIDA.

fragments collected in sediment samples and other previously reported data believed that Raleigh (North Carolina), Onslow (North Carolina) and Long (North Carolina and South Carolina) Bays have one or more semi-continuous bands of coquina limestone Pleistocene outcrops in less than 15 meters of water. Pearse and Williams (1951) collected samples by diving on shallow hard bottom areas (4 to 17 meters) less than 10 nautical miles offshore of New River Inlet (Onslow Bay), North Carolina and Little River (Long Bay), South Carolina. The investigated hard bottom areas ("Black Rocks") were composed of a base of Trent Marl with *Vermicularia spirata* (gastropod) and tubiculous polychaetes forming a reefal cap.

Powles and Barans (manuscript) discussed a hard bottom area in 16 to 24 meters of water off Charleston, South Carolina. The bottom was described as generally being flat sand underlain at varying depths by rock which occasionally protruded as rocky patches or low ledges of up to 30 centimeters relief. The rock was a tightly cemented limestone conglomerate of carbonate shell and quartz-sand material.

Additional references to hard bottom areas in the nearshore zone have been made by (1) Henry and Hoyt (1968) who described lithified to semi-consolidated rocks in 18 meters of water off Georgia ("Gray's Reef"?); (2) McCloskey (1970) who mentioned that conglomerate rock ("coquina") was located in 10 to 18 meters of water off Cape Lookout, North Carolina; (3) Mixon and Pilkey (1976) who reported Pleistocene outcroppings in Onslow Bay, North Carolina; (4) Schneider (1976) who mentioned an outcrop of rock with 5 meters of relief off Cape Lookout, North Carolina in 23 meters of water; (5) Huntsman and McIntyre (1971) who reported the locations of major coral patches in 19 to 40 meters of water in Onslow Bay, North Carolina; and (6) Thompson et al. (1978) who described a well defined system of rocky ledges lying in 20 to 30 meters of water off the east coast of central Florida.

b) <u>Middle Shelf Locations</u>

The middle shelf hard bottom areas as shown in Figure 2 are thought to extend from Jacksonville, Florida into Onslow Bay, North Carolina in depths of 30 to 40 meters (USDI, 1978c). Avent et al. (1977) mentioned rock outcrops with up to 7 meters of relief in 45 to 55 meters of water off the central east coast of Florida. Milliman et al. (1968) described a major outcrop area of phosphatic limestone which they believed extended from off Cape Fear to Cape Lookout (Onslow Bay), North Carolina based on lithoclasts from sediment samples. Macintyre and Pilkey (1969) described rocks dredged from the area as being calcareous quartz sandstone. Mixon and Piley (1976) have reported that the sediment cover over consolidated Miocene sediments in Raleigh (North Carolina) and Long (South Carolina) Bays is relatively thick with few outcrops occurring in contrast to Onslow Bay. Cleary and Pilkey (1968) presented a partial compilation of outcrops in Onslow Bay between depths of 20 and 40 meters, and Roberts and Pierce (1967) assigned the outcrops to the Miocene Yorktown Formation. George and Staiger (1978) stated that hard bottom areas were present off Charleston, South Carolina in 27 meters (Station 2D) and 37 meters (Station 2E) of water and possibly off Jacksonville, Florida in 26 meters of water (Station 6C) based on biota collected in trawls.

Henry and Giles (1978a) examined side scan sonar records, 3.5 kHz seismic profile records, and vibracore logs collected in the Georgia Bight by the U.S. Geological Survey in water depths ranging from 20 meters to beyond the shelf break and described the occurrence of reefs and hard grounds based on the records with particular emphasis placed on the potential oil and gas lease areas. They described and mapped three general hard bottom morphotypes based on interpretations of sonograms and seismic records as well as previously collected television observations. The morphotypes were (1) low-relief hardgrounds, (2) moderate-relief reefs, and (3) shelf-edge reefs. The low-relief hardgrounds were described as having less than 0.5 meters of relief which made them susceptible to covering by a thin veneer of sand. They were generally undetectable on fathometer records and were often difficult to identify from sonograms alone, but when sonograms and 3.5 kHz profiles were examined together the hardgrounds were more discernable.

Features with relief between one-half and two meters or more were termed moderate-relief reefs. They too were said to be difficult to identify on fathometer records alone though they were more easily recognized on sonograms when used in conjunction with 3.5 kHz profiles than the low relief features. The shelf edge reefs were normally identifiable on fathometer, side scan and subbottom records. They reported that the density of hard bottom areas appeared to be the lowest off the central coast of Georgia as compared to northern Florida and South Carolina.

Powles and Barans (manuscript) described a hard bottom area in 29 to 32 meters of water off Charleston, South Carolina. The substrate was composed of sand with rock patches and low relief ledges protruding through the sand. The sampled rock was a limestone conglomerate of carbonate shell and quartz sand.

Henry and Giles (1978b) have run survey lines through the majority of the leased oil and gas tracts using a side scan sonar, subbottom profiler, and television camera to more fully document the extent of the hard bottom within the leased tracts. Submersible observations were also made in certain areas.

Parker (manuscript) used a television camera to view 128 randomly selected stations in water depths ranging from 27 to 183 meters between Cape Hatteras, North Carolina and Cape Canaveral, Florida. Live bottom (hard bottom) based on the observations was estimated to comprise 23.3 percent of the shelf while live bottom with more than one meter of relief was estimated to cover approximately 7.4 percent of the shelf which was in the range (3 to 10 percent) of other estimates mentioned in the paper.

The occurrence of the discontinuous inner and middle shelf hard bottoms appears to be primarily related to acoustically reflective hard layer(s) which outcrop in erosional or non-depositional areas (Henry and Giles, 1978). A greater thickness of surficial sediments probably covers the inner shelf layer, which may be similar in size and lithology to the "Gray's Reef" substrate, resulting in a smaller amount of hard bottom than that in middle shelf areas.

c) Outer Shelf Locations

The outer shelf banks or reefs as shown in Figure 2 are a discontinuous series of ridges and ledges in 50 to 80 meters of water that parallel the shelf break and are found from Cape Hatteras, North Carolina to Cape Canaveral, Florida (USDI, 1978c).

Shelf-edge promininces which vary in morphology, organic composition, distance from shore, and water depth are also found from Cape Canaveral to Key West, Florida in depths from 70 to 110 meters (Avent et al., 1977; Macintyre and Milliman, 1970; Uchupi, 1966, 1969). The shelf-edge features in the Gulf of Mexico have also been described by Bright et al. (1976, 1978a,b), Edwards (1971), Ludwick and Walton (1957), Parker and Curray (1956), Poag and Sweet (1972), Uchupi (1967b), and Uchupi and Emery (1968).

Moe (1963) provided a very general description of shelf-edge reefs from Cape Canaveral to the Florida-Georgia border. Pilkey and Giles (1965) located several shelf-edge (rock?) ledges with reliefs of 5 to 10 meters off Georgia. Menzies et al. (1966) described a discontinuous algal reef approximately 150 kilometers (80 nautical miles) in length that was located in 80 to 110 meters of water and parallel to though slightly seaward of the shelf break off North Carolina. Two distinct types of rock were dredged from the reef: (1) algal rock that included "lithothamnion balls" (coralline algal nodules formed principally by *Lithothamnium*) and consisted of a framework of calcareous algae and lesser amounts of bryozoans and worm tubes, and (2) coquina rock.

Uchupi and Tagg (1966) described a series of terraces at various depths on the shelf between Cape Lookout, North Carolina and Miami, Florida. The terraces, which showed little correlation to the shelf edge, were the result of lowered stands of sea level. Zarudski and Uchupi (1968) in the bathymetric surveys of the shelf edge from Cape Hatteras, North Carolina to Miami, Florida, found a discontinuous series of low relief (less than 10 meters) ridges, perhaps of algal origin. Henry and Hoyt (1968), in 50 to 70 meters of water with the aid of a television, observed lithified to semiconsolidated rocks up to one meter in diameter and encrusted with calcareous growth and partially covered by sand-size material. Rona (1969) using a seismic reflection profiling source described four ridges with relief of up to 10 meters and intervening sediment filled troughs on the outer continental shelf off Cape Hatteras, North Carolina with the seaward ridge being the one described by Menzies et al. (1966).

Macintyre and Milliman (1970) conducted a topographic and lithologic examination of physiographic features that occurred near the shelf break between Cape Hatteras, North Carolina and Fort Lauderdale, Florida. They described troughs, terraces, and poorly defined ridges parallel to the shelf break (50 to 80 meters) at depths of 50 to 150 meters between Cape Hatteras and Cape Fear, North Carolina. The locations are not shown in Figure 2 because of the large number of transects and the lack of precise position information. However, the outer banks shown in Figure 2 indicate the approximate positions of the features described by Macintyre and Milliman (1970). Samples indicated that the rock dredged from the features was composed of highly bored, irregular fragments of algal limestone and sandstone. The shelf-edge topography from Cape Fear, North Carolina to Cape Canaveral, Florida was described as mainly smooth and undulating with a generally indistinct shelf break. Ledges with 6 to 10 meters of relief and rises with less than 5 meters were occasionally noted at depths of 50 to 70 meters while terraces were seen in 70 to 110 meters of water. Dredge samples indicated that the veneer of the rock outcrops along the shelf break were composed of algal limestone, quartz-rich calcarenite, and calcareous quartz sandstone. South of Cape Canaveral the shelf break was reported to be significantly shallower with ridges and ledges continuing.

The shelf-edge features between Cape Hatteras, North Carolina and Cape Canaveral, Florida appear to be primarily algal ridges that were formed by relict calcareous sources deposited during lower stands of sea level and mainly during the Holocene transgression (Menzies et al., 1966; Rona, 1969; Zarudski and Uchupi, 1968). Macintyre and Milliman (1970) believed that the coralline algal limestones and calcareous sandstones which they dredged from certain shelf-edge features generally formed a veneer over buried pre-Holocene Gulf Stream erosional surfaces. They further suggested that the features were not the result of unique constructional processes but were present primarily because they existed in areas of low deposition and were therefore not buried under recent sediments. The structure of many shelf-edge features in southern Florida and the Gulf of Mexico also seems to be related to the Holocene transgression (Bright and Rezek, 1976; Ludwick and Walton, 1957; Macintyre and Milliman, 1970). However, other shelf-edge banks in the Gulf of Mexico have resulted from vertical salt intrusions (Bright and Rezak, 1976).

## 2. BIOLOGY

### a) Benthic Invertebrates

i) Inner Shelf Locations - Pearse and Williams (1951) described the flora and fauna collected from a hard bottom area ("Black Rocks") in 4 to 7 meters of water and less than 18.5 kilometers (10 nautical miles) off New River Inlet, North Carolina and Little River, South Carolina. Over four hundred faunal species were recorded from the hard bottom of which 74 percent were described as southern ranging species as opposed to North and South or North ranging only. The taxa which showed the most predominant southern affinities were sponges, ascidians, bryozoans, decapods, polychaetes, mollusks, amphipods, and echinoderms.

McCloskey (1970) discussed the faunal community associated with the coral *Oculina arbuscula,* which is only known from Cape Hatteras, North Carolina to Charleston, South Carolina in depths of 3 to 25 meters according to McCloskey. Coral heads were collected from three jetty areas (Cape Lookout, Beaufort, and Charleston) and from water depths of 10 to 18 meters off Cape Lookout, North Carolina. *Telesto fruticulosa, Titanideum frauenfeldii* (octocorals), and *Trachygellius cinachyra* (sponge) were also found off Cape Lookout.

Hunt (1974) reported that soft corals, sponges, ascidians, bryozoans, barnacles, and algae were the predominant epifauna on "Gray's Reef" located in 20 meters of water off Sapelo Island, Georgia. Two species of ascidians (*Clavelina picta* and *Amaroucium stellatum*); five species of sponges (*Cinachyra cavernosa, Speciospongia vesparia, Homaxinella rosacea, Ircinia campana,* and *I. fasciculata*); and six species of anthozoans (*Titanideum frauenfeldii, Leptogorgia setacea, L. hebes,* and *Telesto* spp. (3)) were identified. Areas of abundant growth were said to be associated with exposed rock, moderate growth with rock thinly covered by sand, and sparse growth with rock covered by up to 30 centimeters of sand. Gray (unpublished) collected a number of dredge samples from "Gray's Reef", but most of the on-board identifications were never confirmed nor were exact station positions provided.

ii) <u>Middle Shelf Locations</u> - On the rock outcrops of Onslow Bay (Milliman et al., 1968) in 20 to 40 meters of water there exist two species of hermatypic corals (*Solenastrea hyades* and *Siderastrea siderea*). Specimens of *Solenastrea hyades* were reported to be quite healthy despite exposure to water temperatures as low as 10.6°C and probable high turbidity while specimens of *Siderastrea siderea* were generally in poor condition (Macintyre and Pilkey, 1969; Macintyre, 1970). Four species of hermatypic corals have also been reported from Onslow Bay and include *Astrangia astreiformis, Ballanophyllia floridana, Oculina arbuscula,* and *Phyllangia americana* (Macintyre and Pilkey, 1969; Macintyre, 1970). Huntsman and Macintyre (1971) reported that coral heads, sea fans, algae, and sponges characterized the "coral patches".

Schneider (1976) described the benthic flora collected from hard bottom areas of the middle and outer continental shelf principally off Onslow Bay, North Carolina though collections were also made from the shelf between Cape Hatteras, North Carolina and Cape Romain, South Carolina. He identified 150 species and varieties which included 104 species of Rhodophyta (red algae) though coralline algae were not identified. The majority of the algae was believed to have centers of distribution for the western Atlantic in the Caribbean Sea. Sixty-six percent of the offshore species were said to reach their northern limit of distribution in Onslow Bay and 33 percent were said to be found both north and south.

George and Staiger (1978) mentioned that 60 species of invertebrates were collected with an otter trawl from two hard bottom areas off Charleston, South Carolina in 27 and 37 meters of water. Although soft corals, sponges, and ascidians were mentioned in addition to *Oculina* sp. no species list was available at the time of this writing.

Powles and Barans (manuscript) described three hard bottom areas in 16 to 24, 29 to 32 and 32 to 37 meters of water off Charleston, South Carolina. Attached epifauna were observed in the two shallower areas (no visual observations were made in the third area) even when up to eight centimeters of sand covered an underlying rock layer. The epifaunal assemblage in the observed areas was reported to be dominated by sponges and soft corals with algae and hard corals occasionally present. Five species of sponges (*Axinella polycapella,* *Ircinia campanea, I. strobilina, Spheciospongia vesparia,* and *Verongia fistularis*), three octocorals (*Titanideum* sp., *Leptogorgia* sp., *Muricea pendula*), and two scleractinian corals (*Solenastrea hyades(?)* and *Oculina varicosa*) were identified from the two shallower areas.

iii) Outer Shelf Locations - Menzies et al. (1966) collected approximately 170 species of invertebrates (107 species identified) with a small biological trawl in the vicinity of the previously described "algal reef" which is located in 80 to 110 meters of water off Onslow Bay, North Carolina. Three trawl stations were located on the reef, one shoreward of the reef, and one seaward of the reef. Seventy-six percent of the identified fauna were collected from the reef stations with mollusks (45 species) and anthropods (34 species) numerically dominating the samples. Ninety-one percent of the identified taxa were considered to have northern ranges.

Cain (1972) identified 92 species from three stations on the same "algal reef" that Menzies et al. (1966) described. Thirty-seven of the species were not previously known from the reef.

Although Avent et al. (1977) investigated an area slightly south of Cape Canaveral, the described fauna probably extend farther north as Macintyre and Milliman (1970) mentioned that the coral *Oculina* was present on shelf-edge features off north Florida. Avent et al. (1977) described the shelf-edge fauna off Sebastian and St. Lucie Inlets, Florida as being a coral (*Oculina varicosa*) - bivalve (*Barbatia candida*) - echinoderm (*Ophiothrix angulata*) assemblage. Eight taxa of anthozoans, 32 of decapods, 8 of echinoderms, 16 of (living) mollusks, and 26 of bryozoans were identified from dredge samples.

iv) Zoogeography - Johnson (1934) recognized four marine provinces along the Atlantic Coast of North America: (1) Arctic, (2) Boreal (Nova Scotia to Cape Cod, Massachusetts), (3) Trans-atlantic (Cape Cod to Cape Canaveral, Florida), and (4) Caribbean (Cape Canaveral and South). The Transatlantic was later divided into two provinces called the Virginia (Cape Cod to Cape Hatteras, North Carolina) and Carolinian (Cape Hatteras to Cape Canaveral) by Bumpus and Pierce (1955), and Hedgpeth (1953) extended the Carolinian Province into the northern Gulf of Mexico (Tampa Bay, Florida to Brownsville, Texas).

The Carolinian Province has been shown to be bounded to the north (Cape Hatteras) and south (Cape Canaveral or Palm Beach, Florida) by temperature discontinuities (Bumpus and Pierce, 1955; Ekman, 1953; Hall, 1964; Hutchins, 1947).

Cerame-Vivas and Gray (1966) on the basis of 211 species of primarily soft-bottom benthic invertebrates collected from 18 to 183 meters of water off North Carolina divided the fauna into three species assemblages that corresponded to three biogeographic provinces. North of Cape Hatteras was the Virginian Province, south of Cape Hatteras on the middle and inner shelf was the dominant Carolinian Province, while the outer shelf was described as the Tropical Province. A slight seasonal shift in the location of the boundaries between the provinces was noted. Cape Hatteras was proposed as a barrier due to the Gulf Stream bending away from the shelf. Larval distribution and temperature were postulated as the primary factors governing the faunal distribution patterns. Day et al. (1971) studied the soft-bottom infauna at a series of ten stations occupied seasonally on a transect extending from the littoral zone to a depth of 200 meters off Cape Lookout, North Carolina. They were not able to distinguish Carolinian and Caribbean faunal provinces perhaps because they considered only infaunal species whereas Cerame-Vivas and Gray (1966) studied both epifaunal and infaunal species.

Cutler (1975) later suggested that a zoogeographical barrier caused by the effect of water currents on larval distribution existed on the continental slope southeast of Cape Lookout, North Carolina.

Many of the previous studies involving the hard bottom associated invertebrates have reported that the majority of the epifauna is derived from more tropical waters (Pearse and Williams, 1951; Menzies et al., 1966; Schneider, 1976). It has been suggested that the tropical species are introduced by the northern flowing Gulf Stream. Although it appears that a large percent of tropical species can survive as far north and inshore as Onslow Bay, North Carolina with the spatial extent of the assemblages dependent on the availability of a hard substrate, the reproduction of the various tropical species at the northern edge of their range has not been investigated. Thus, the soft bottom shelf fauna from Cape Hatteras to Cape Canaveral appears to be mainly Carolinian while the hard bottom fauna is primarily Tropical.

b) Demersal Fish

Struhsaker (1969) reported the results of a five year study of demersal fish resources on the southeastern United States continental shelf between Cape Hatteras, North Carolina and Jupiter, Florida in which 956 exploratory trawling stations were occupied between depths of 11 and 183 meters. The continental shelf was divided into five regions based on the results of the study: (1) coastal (15 to 18 meters), (2) open shelf (18 to 55 meters), (3) live-bottom, (4) shelf-edge (55 to 110 meters), and (5) lower-shelf (110 to 183 meters). The live-bottom habitat, which was said to consist of outcrops of rock that were heavily encrusted with such sessile invertebrates as sponges and sea fans was found within the open-shelf habitat and seemed to be more numerous off northeast Florida and South Carolina. Moderate to large catches of snappers (*Lutjanus* and *Rhomboplites*), groupers (*Epinephelus* and *Mycteroperca*), and porgies (*Calamus* and *Pagrus*), as well as other subtropical and tropical species of fish, were taken from the live-bottom habitat. The shelf-edge habitat, though sometimes difficult to trawl because of the relief, was found to contain coral, sponge, and other predominately tropical invertebrate animals in addition to large concentrations of snappers, groupers, and porgies in certain localities. The trawl catches in the open-shelf zone were generally poor with the live-bottom and shelf-edge habitats being far more productive.

Huntsman and Macintyre (1971) listed approximately 25 species of "tropical" fishes (see Table 1) that were either collected or

Table 1. Fishes commonly associated with hard bottom habitat areas of the continental shelf of the southeastern United States (After Barans and Burrell, 1976; Huntsman and Macintyre, 1971).

| Taxa | B + B[1] | H + M[2] |
|---|---|---|
| *Abudefduf saxatilis* - sergeant major | X | |
| *Alutera scripta* - scrawled filefish | X | |
| *Calamus leucosteus* - whitebone porgy | | X |
| *Calamus penna* - sheephead porgy | X | |
| *Caranx latus* - horse-eye jack | X | |
| *Caranx ruber* - bar jack | X | |
| *Centropristis striata* - black sea bass | | X |
| *Chaetodipterus faber* - atlantic spadefish | X | |
| *Chaetodon ocellatus* - spotfin butterflyfish | X | |
| *Chaetodon sedentarius* - reef butterflyfish | X | |
| *Chaetodon* sp. - butterflyfish | | X |
| *Chromis enchrysura* - yellowtail reeffish | | X |
| *Doratonotus megalepsis* - dwarf wrasse | X | |
| *Epinephelus drummondhayi* - snowy grouper | | X |
| *Epinephelus niveatus* - gag | | X |
| *Equetus acuminatus* - cubbyu | X | |
| *Equetus lanceolatus* - jackknife fish | X | |
| *Eupomacentrus leucostictus* - beaugregory | X | |
| *Haemulon aurolineatum* - tomtate | X | X |
| *Haemulon plumieri* - white grunt | X | X |
| *Holocanthus ciliaris* - queen angelfish | X | |
| *Holocanthus bermudensis* - blue angelfish | X | X |
| *Holocentrus bullisi* - deepwater squirrelfish | | X |
| *Hypoplectrus unicolor* - butter hamlet | X | |
| *Lachnolaimus maximus* - hogfish | X | |
| *Lagodon rhomboides* - pinfish | | X |
| *Lutjanus campechanus* - red snapper | X | X |
| *Mycteroperca microlepsis* - gag | X | |
| *Mycteroperca phenax* - scamp | X | |
| *Pagrus sedecim* - red porgy | | X |
| *Rhomboplites aurorubens* - vermilion snapper | X | X |
| *Seriola dumerili* - greater amberjack | X | |
| *Sphyraena barracuda* - great barracuda | X | |
| *Thallassoma bifasciatum* - bluehead | X | |
| *Xyrichthys psittacus* - pearly razorfish | X | |

[1] Barans and Burrell, 1976
[2] Huntsman and Macintyre, 1971

sighted by other investigators in the vicinity of hard bottoms ("coral patches") or wrecks in Onslow Bay, North Carolina.

Barans and Burrell (1976) described the results from 380 trawl stations located between Cape Fear, North Carolina and Cape Canaveral, Florida in water depths of 10 to 366 meters. The demersal fish assemblage associated with hard bottoms as based on trawls is shown in Table 1. The catch of these species was very limited compared to the total catch due to the discontinuous distribution of the hard bottom (live bottom) that was reported to be primarily within the 10 to 55 meter depth range. The authors also believed that the hard bottom habitats offered the greatest probability of supporting commercially exploitable groundfish stocks in the area surveyed.

Hunt (1974) included a list of fish species commonly seen in the vicinity of "Gray's Reef". In addition to a number of pelagic species, the black sea bass (*Centropristis striata*), black grouper (*Mycteroperca bonaci*), red snapper (*Lutjanus campechanus*), and porgy (*Calamus* sp.) were reported.

Huntsman (1976) and Huntsman and Dixon (1975) discussed a recreational fishery consisting of approximately 30 headboats that utilized the hard bottom areas off North and South Carolina and caught red porgy (*Pagrus sedecim*), black sea bass (*Centropristis striata*), vermillion snapper (*Rhomboplites aurorubens*), white grunt (*Haemulon plumieri*), and various groupers (*Epinephelus* and *Mycteroperca*). The boats fished both inshore hard bottom areas (27 to 46 meters) and the shelf-edge (46 to 73 meters).

Ulrich et al. (1976) provided preliminary biological and ecocomic information on the hard bottom associated demersal species being caught by commercial roller-rigged trawls and hook-and-line fishermen off South Carolina and adjacent states. Average catch per vessel per day for the trawling operation, which was operating as a demonstration project, was approximately 4,600 kilograms of snapper, grouper, porgy, and sea bass. The average catch of hook-and-line vessels was 1,580 kilograms, mainly of grouper.

Powles and Barans (manuscript) evaluated trapping, trawling (two types of trawls), and underwater television as methods for monitoring the relative abundance of groundfish species of near-shore hard bottom (sponge-coral habitat) areas. The results indicated that future assessment and monitoring of hard bottom areas could best be accomplished through ten-minute trawl tows and short ($\leq$ 6 hour) duration exposure (sets) of baited traps placed on the bottom after reconnaissance with a vertically directed television camera.

# II. SURVEY EQUIPMENT AND METHODOLOGY

## A. FIELD

### 1. EQUIPMENT SPECIFICATIONS

Detailed equipment specifications are provided in Appendix A for each of the major items of equipment utilized during the field survey conducted during the period of September 9 to October 5, 1978.

### 2. NAVIGATION

The navigation and positioning services were provided by Decca Survey Systems, Inc. using two range-range Decca Hi-Fix Chains. A Pawleys Island - Seabrook Island, South Carolina Chain was used for navigation of the vessel, M/V PROFILER, in the James Island Area, and a Fernandina Beach, Florida - Seabrook Island Chain was used for navigation in the Brunswick Area. The shore based antenna stations were established by standard land survey techniques. The Hi-Fix System is capable of providing position to a repeatable accuracy of ± 15 meters under optimal signal conditions, but during periods of signal interference (darkness and electrical storms) repeatable accuracy on the order of ± 35 meters may be a more realistic estimate.

Calibration of the Hi-Fix System was performed using a Decca Trisponder, a line-of-sight micorwave positioning system. Lane counts were acquired, checked, and re-acquired at fixed buoys and tracked on an analog recorder. A closed traverse was made both to and from the survey area and from and to the area's navigational reference buoy once lane counts were acquired to further ensure proper maintenance of the correct lane count needed for documented positional accuracy. The Hi-Fix System was interfaced with a Decca Autocarta which utilized a mini-computer, a key-board/printer with dual magnetic cassette tapes, and a x-y plotter for use in real-time shipborad plotting. The Autocarta also provided course corrections to the helmsman via a left/right and distance-to-line indicator.

Figure 3 shows the geophysical and bathymetric survey grid used for each of the four surveyed oil and gas lease blocks (tracts) with east-west lines spaced at 150 meter intervals and north-south tie lines at 1,000 meter intervals. During surveying, fixes of the ship's position were recorded at 150 meter intervals on both north-south and east-west lines with automatic event marks on the depth recorder, side scan sonar, and subbottom profiler records triggered simultaneously by the navigator. The distances the side scan sonar and subbottom profiler sensors were located behind the onboard Hi-Fix antenna were noted on the applicable record labels. The distance from the stern of the vessel to the positioning system antenna was 21 meters.

During the television/still camera transects navigational fixes

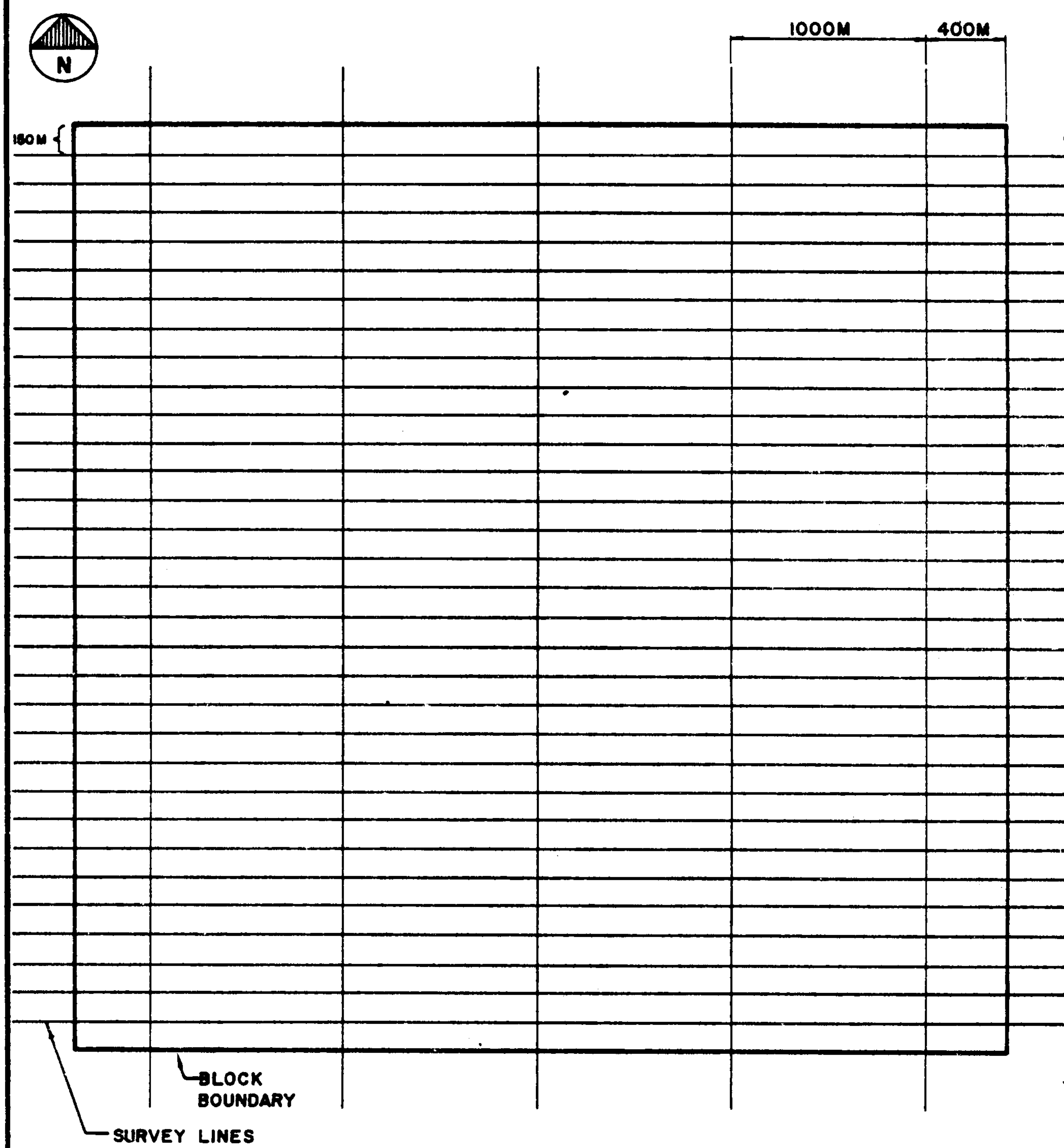



FIGURE: 3 GEOPHYSICAL AND BATHYMETRIC SURVEY GRID were recorded at one minute intervals while the following positions were recorded during dredge sampling: (1) on station, (2) dredge in water, (3) dredge on bottom, (4) beginning of tow, (5) end of tow, and (6) dredge out of water/on deck.

Benchmarks made of 55 gallon drums filled with concrete were placed near the center of each tract and the precise location established with Decca Hi-Fix.

3. BATHYMETRY

A Raytheon DE-731 Recording Fathometer and a Raytheon Model 7210, 40 kHz Hull Mounted Transducer with a beam width of 17 x 25 degrees at -3 db were used for the recording of the majority of the bathymetric data in the four blocks surveyed. A Ross Laboratories Model 5600 Fine Line Recorder, Model 4400 Transceiver, and 100 kHz, 7.5 degree circular beam pattern, hull mounted transducer was run simultaneously with the Raytheon prior to the beginning and end of each survey line and in water depths exceeding approximately 50 meters in James Island Area Block 380 in order to allow for calibration of the Raytheon with the more accurate Ross System. Due to an unexpected interference ("cross-talk") between the operating frequency of the Ross System and the side scan sonar, which resulted in extensive interference on the side scan sonar records, the Ross System could only be operated, without interfering with the sonograms, in water depths exceeding 90 meters. At these depths the side scan sonar transducer was towed a significant distance behind the stern of the vessel eliminating the interference. The velocity of sound used for both instruments was 1,463 meters per second. A lead line check with the Ross System resulted in a variance of 1.40 meters in 33 meters of water with the Ross System recording the shallower value.

4. SIDE SCAN SONAR AND SUBBOTTOM PROFILER

An Edo Western Model 606 Dual Side Scan Sonar System that included a Model 606-602 Tow Body and Tow Cable was used in conjunction with an Edo Western Model 515 Acoustic Subbottom Profiling System that consisted of a Model 515 T Towed Body Transducer and ten kilowatt transceiver to map hard bottom areas in the four surveyed lease blocks. An Edo Western Model 606 Recorder which included receivers and time varied gain circuits was used to record both subbottom profiler and side scan sonar traces side-by-side in phase, and on a single electrostatic dry paper record. Representative examples of subbottom profiler and side scan sonar records along with their interpretations are included in the geological and geophysical observations for each block. The subbottom profiler was operated at a frequency of 7.0 kHz which reduced penetration but allowed for greater resolution of the upper sediment horizons while the side scan sonar functioned at an operating frequency of 100 kHz with a pulse duration of 0.1 milliseconds. The subbottom sensor was towed approximately 4.5 meters behind the stern of the ship at a depth of three meters. The side scan sonar transducer was also towed from the stern, but at distances varying from

10 to 428 meters in order to keep the transducer approximately twenty to twenty-five meters above the bottom regardless of depth. The side scan sonar examined a maximum slant distance (distance from side scan transducer to the target) of 200 meters from both sides of the transducer thereby covering a path 400 meters wide.

The onboard geophysicist interpreted the side scan sonar and subbottom profiler records and prepared a working chart of possible hard bottom areas in each block on navigation post plot maps produced by the Autocarta. The maps were used to decide which areas were to be observed with the television and still camera.

## 5. TELEVISION AND STILL CAMERAS

Remote, real-time video footage of the bottom and associated fauna was recorded using a Hydro Products Model TC-125 Underwater Television Camera, Moder RP-3 Pan and Tilt Unit, Model LT-7 Thallium Iodide Light with a 250 watt thallium idodide lamp, Model SC-303 Television System Control Unit, Elgar Model 121 Power Source (Frequency Stabilizer), and Sony Model AV-3650 Videocorder. The camera employed a f/1.4 lens and all operating functions of the camera were automatic with the exception of the lens focusing which was remotely controlled by a focus control switch. The Control Unit contained the television camera power supply, television monitor, and the lamp power supply in addition to all required operating controls. In addition the video data, audio data including position fixes were placed on Sony High Density one-half inch, sixty-minute videotapes.

Further verification of the substrate and associated fauna was made through still camera photography using a Benthos Model 372 Deep Sea Standard Camera with data chamber, a Model 382 Deep Sea Standard Flash, and Ektachrome ASA 200 35mm color slide film. On each slide, in a data insert, the day, hour, minute, and second that the photograph was taken and two digit identifying number that corresponded to the last two digits of the surveyed block were recorded through the use of the data chamber.

The still camera and strobe were mounted along with the television camera and light on the pan and tilt unit which was bolted to a Continental Shelf Associates' tow sled. The television and still camera system was towed with a wire-out-to-water-depth ratio of approximately 1.5:1 at speeds of one to two knots over the majority of the suspected hard bottom areas as well as the soft bottom areas that were present in between the hard bottom patches. This resulted in not only an inspection of the hard bottom areas identified by geophysical data, but also a visual check of the areas that were believed to be soft bottom. The pan and tilt unit was used when visibility was adequate to inspect a wider area and the tow speed was sufficiently slow to observe and photograph objects of interest that were not in the immediate path of the sled. The still camera shutter was surface activated following the observation of a suitable subject on the television monitor. The image recorded on the film was the same as that seen on the screen of the television monitor at the time of the shutter activation.

### 6. BIOLOGICAL AND ROCK DREDGES

A Kahlsico Triangular Steel Dredge (No. 215WA150) was used to collect biological samples. The rigid steel frame had perforated steel plates (one-half inch mesh) welded on three sides and the bottom. Each side of the dredge measured 60 by 120 centimeters and the height was 86 centimeters.

A Benthos Model 1491 Rock Dredge was used to collect rock samples. The dredge weighed 170 kilograms and had a mouth opening of 41 by 99 centimeters with a 1.2 meter long chain bag.

The positions of the dredge stations were chosen by noting the locations of hard bottom areas during the television and still camera surveys. An attempt was made to collect dredge samples from each of the hard bottom areas observed in a block. A wire-out-to-water-depth ratio of 2.5:1 was normally used. After the first few dredges which were used to establish the quantity of sample collected, an effort was made to tow the dredge approximately 100 meters. Unfortunately, the dredge sometimes hung on the rough bottom preventing a completed tow of 100 meters and occasionally a loss of the sample occurred. Fortunately, no gear loss occurred due to the use of a weak link system with the dredges.

Biological specimens were immediately rough sorted from the sometimes large amounts of sand, shell, and rubble collected in the biological dredge. Biological specimens were placed in rigid plastic containers with identifying labels and preserved in either 10 percent buffered formalin or 70 percent ethyl alcohol depending upon the taxa collected.

All apparent lithic material from either rock or biological dredges was sorted, preserved in buffered formalin, and packaged in similar containers.

## B. LABORATORY

### 1. NAVIGATION

The shotpoint locations, which represent the survey vessel antenna positions at the time of the fixes, were plotted at a scale of 1:10,000 (1 centimeter = 100 meters) and presented as Navigation Base Maps for the four survey blocks. These final navigational maps were used to plot locations of all bathymetric and geophysical survey data following corrections for instrument location relative to the navigational antenna. The locations of the television/still camera transects and locations of the dredge tows were plotted on additional maps utilizing the recorded navigational fix points. No correction was made for the cameras' location relative to the navigational antenna because of the insignificant setback (less than 75 meters maximum) associated with the towing operation.

All Cartesian position information was referenced to the Universal Transverse Mercator Grid, Zone 17, utilizing the Clark (1866) spheriod. All geopraphic positions referenced are given in the North American Datum of 1927 using the same spheriod.

## 2. BATHYMETRIC DATA

The bathymetric records from both the Raytheon and Ross Systems were used in the construction of a bathymetric chart for each of the four surveyed blocks. Water depths were scaled from the records using a seawater sound velocity of 1,463 meters per second which is the rate used by the National Ocean Survey (USDC, 1976).

A correction for variation in tidal height was made by using the predicted tides for Folly Island (outer coast) for the James Island Area and St. Simons Light for the Brunswick Area (USDC, 1977). Pearson (1975) was also consulted for tidal information before making the corrections. Records were obtained for surface water temperatures recorded by the National Oceanic and Atmospheric Administration Data Buoy (Number 40004) which was located in the James Island Area during the time of this survey. In addition, the Miami Satellite Field Services Station of the National Environmental Satellite Services provided analyses of the Gulf Stream position in the survey area during the period of the field effort. Due to a weak thermal gradient and extensive atmospheric moisture during the survey period (Baig, 1978) the analyses were incomplete though it appeared the Gulf Stream generally remained slightly offshore of the survey area. Therefore, no corrections were made to the speed of sound data based on the position of the Gulf Stream. A transducer correction of +3.53 meters was applied to all soundings. The correction resulted from a positive 2.13 meters correction for the transducer depth (vessel draft) and a positive 1.40 meter correction for the Ross System to lead line check. An additional correction was made so that the Raytheon fathometer records would agree with Ross depth checks made at the beginning and end of each line. The correction was generally small, but they did vary from line to line.

The side scan records used to extrapolate between the bathymetric survey lines and bathymetric charts of each survey area were drawn with depth contour intervals of one meter, except in the case of James Island Area Block 380 where a two meter contour interval was used at depths in excess of 60 meters to avoid confusion caused by merging contour lines. All depths were referenced to mean low water which was established by applying the data from the tide tables.

## 3. GEOPHYSICAL DATA

The geophysical data were interpreted and mapped in terms of surficial geology and shallow subsurface information, which included the depth of sediments above strong reflectors (isopachs) and anomalous events within shallow sedimentary sections. The distribution of hard bottom areas was described using both the side scan sonar and subbottom profiler records.

## 4. TELEVISION AND STILL CAMERA OBSERVATIONS

Television videotapes were examined and the substrate types identified. In most cases, organisms could not be specifically identified from the videotapes though a general description of the amount of biomass present in certain areas was made.

All still camera slide film was developed and left in its original roll form (not mounted). Film was viewed using a Dukane Model 27A25 Microreader with a 36 centimeter screen. The data inserts on each frame were compared with shipboard logs for time recorded at each navigation shotpoint for positive position correlation of photographs with navigation fix numbers. Observations regarding substrate type (sand, shell, rock) and abundance of dominant epibenthic organisms and demersal fishes were made along each transect and for each navigational fix. The television and still camera data involving type of substrate and biotic assemblages are depicted on the maps of the lease blocks showing the hard bottom areas identified from the geophysical records.

## 5. PETROGRAPHIC ANALYSES OF DREDGE SAMPLES

Representative pieces of the samples from each station where such material was collected were washed, dried, and examined under a binocular microscope. All samples were then fragmented and Recent (geologic age) encrusting organisms seperated from the substrate material. Fresh unweathered, and where possible, well indurated pieces were selected from each sample and thin-sectioned using standard procedures. Friable specimens required vacuum impregnation with plastic but were otherwise treated in the same way. Under a petrographic microscope using both ordinary and cross polarized light, all thin-sectioned samples were examined, classified, and described. A selection of samples that was representative of all major lithologies present in the samples was dissolved in dilute HCl, washed, and dried. The proportion of non-carbonate material was determined and an examination of the loose sand grains was made for heavy minerals and resistate minerals. The surface textures of the quartz grains were also observed and noted.

## 6. BIOLOGICAL SAMPLES

All biological samlpes were sorted to major taxa, placed in 70 percent ethyl alcohol if they were not originally preserved in it, and identified to the lowest possible taxonomic level in the time frame allowed by the contract. A voucher collection composed of each taxon identified was prepared and deposited in Continental Shelf Associates' laboratory. The discontinuous nature of the visually observed hard bottom and associated fauna as well as difficulties encountered in enumerating individuals of certain major taxa because of fragmentation and colonialism prevented the data from being expressed in a quantitative or even semi-quantitative manner. Due to the qualitative nature of the data no measures of community structure such as diversity or evenness indices were calculated nor were correlations of the faunal distributions with abiotic parameters attempted. Station and species associations were examined using the Jaccard and Czekanowski similarity coefficients with flexible sorting and normal (Q-mode classification with species as attributes) and inverse (R-mode with stations as attributes) cluster analyses (Clifford and Stephenson, 1975).

The data were treated in a binary fashion (presence/absence) because of their qualitative nature. A number of similarity coefficients is available for analyses of biological field data involving collections of species, but the Jaccard and Czekanowski similarity coefficients appear to be the best suited to the binary data generated from this study (Clifford and Stephenson, 1975). When comparing the presence/absence of a species (attribute) between two stations (entities) there are only four possible results: (a) the species is present at both stations, (b) the species is absent at both stations, (c) the species is present at Station One but not Station Two, and (d) the species is present at Station Two but not Station One. Both the Jaccard and Czekanowski coefficients ignore "d" (the previously mentioned possible result) and calculate a similarity coefficient based on the following equations:

Jaccard

$$\frac{a}{a + b + c}$$

Czekanowski

$$\frac{2A}{2A + b + c}$$

These two similarity coefficients, as with other similarity coefficients, are constrained between 0, when entities have no attributes in common, and 1, when entities are identical.

Flexible sorting is a hierarchial fusion strategy that clusters or groups the similarity coefficient values into discrete groups. In this study the coefficient values were sorted in a dissimilarity matrix and the results displayed in dendrogram form. Flexible sorting is considered space-dilating in that it clusters intensely and emphasizes weak boundaries. It becomes more difficult to join elements to the groups as they increase in size, producing discrete groups with a minimum of misclassification (Clifford and Stephenson, 1975).

The computer procedure, which was accomplished on Texas A & M University's Amdahl 470 V-6 Computer, involved the construction of a two dimensional matrix of R rows (species) and C columns (stations) from the data for normal analysis. A value of one was assigned for the presence of a species at a station and zero for absence. The similarity coefficients were computed among stations, sorted (flexible) and clustered in a dissimilarity matrix, and the results displayed in a dendrogram. For inverse analysis the stations were located in R rows and the species in C columns and the above procedure duplicated with the similarity values computed among species.

Numerical classification or cluster analysis, which is a multivariate analytical technique, encompasses a wide variety of techniques for ordering entities into groups on the basis of a certain set of criteria. Numerical classificatory techniques, such as the one outlined in the proceeding paragraphs, have two major advantages over subjective classifications: (1) a much larger data set can be analyzed by a computer than a human, and (2) the methods since they are not subjective can be repeated by any other investigator.

The final result of the previously described procedures, that were used in the numerical classification, was a dendrogram which displayed the grouping of entities (stations or species depending on whether the analysis was normal or inverse) that were based on the matrix resulting from the similarity coefficients. The dendrograms were interpreted with the aid of a two-way coincidence table that was computer constructed by rearranging the stations and species in the order in which they were grouped in the dendrograms. A problem with interpretating the dendrograms is the determination of what level of dissimilarity should be used to define the operational groups within the hierarchy. The groups were selected in this report by studying the dendrogram in consultation with the two-way table. Problems of misclassification of entities were also examined using the two-way table. Particular attention was payed to the cells within the two-way table where groups of species and stations coincided.

# III. RESULTS

All original bathymetric and geophysical records, television videotapes, and still camera color slides accompany this final report to the Bureau of Land Management New Orlans Outer Continental Shelf Office, New Orleans, Louisiana. Although a complete listing of the deliverables, as well as information and instructions for relating each item to a geographic position, is given in "Instructions for Use of Original Data and Oversize Visuals" a summary of the deliverables is presented in Table 2. The television images both observed on the onboard monitor and recorded during the surveys were of less than exceptional quality due to natural turbidity, lack of ambient light as operations were often conducted at night, and a malfunction of the camera's light meter causing a closing-down of the iris beyond the position required for the light conditions encountered.

The following desk-top size visuals (six copies) for each of the four surveyed blocks also accompany this report to the Bureau of Land Management.

- Bathymetric and Geophysical Navigation Map (Navigation Base Map)
- Video and Dredge Navigation Map
- Bathymetric Map
- Surficial Geology Based on Geophysical Data
- Shallow Isopach and Related Subbottom Anomalies (James (Island Area Block 198 and Brunswick Area Block 912 Only)
- Hard Bottom Areas Based on Geophysical Data and Visual Observations
- Benthic Biological Assemblages Visually Observed

## A. JAMES ISLAND AREA, BLOCK 198

### 1. HARD BOTTOM IDENTIFICATION AND MAPPING

#### a) Navigation

Figure 4 shows the bathymetric and geophysical navigation base map of James Island Area Block 198 with latitude and longitude, UTM grid coordinates in feet, and the lease block boundaries indicated. The 31 east-west bathymetric and geophysical lines are consecutively numbered north to south as are the 35 east-west numbered, 150 meter spaced, shot points. The five north-south tie lines are spaced at intervals of 1,000 meters and the 35 north-south numbered shot points are 150 meters apart. Approxi-

Table 2. Summary of original records, videotapes, and photographs delivered to the Bureau of Land Management.

| | James Island Area Block | | | Brunswick Area Block |
|---|---|---|---|---|
| | 198 | 380 | 463 | 912 |
| Bathymetric Records (Kilometers) | 183 | 183+ | 183 | 183 |
| Side Scan Sonar Records (Kilometers) | 183 | 183 | 183 | 183 |
| Subbottom Profiler Records (Kilometers) | 183 | 183 | 183 | 183 |
| Television Videotapes (Hours) | 9 | 7 | 10 | 2 |
| Thirty-five Millimeter Color Slides (Number) | 405 | 930 | 829 | 243 |

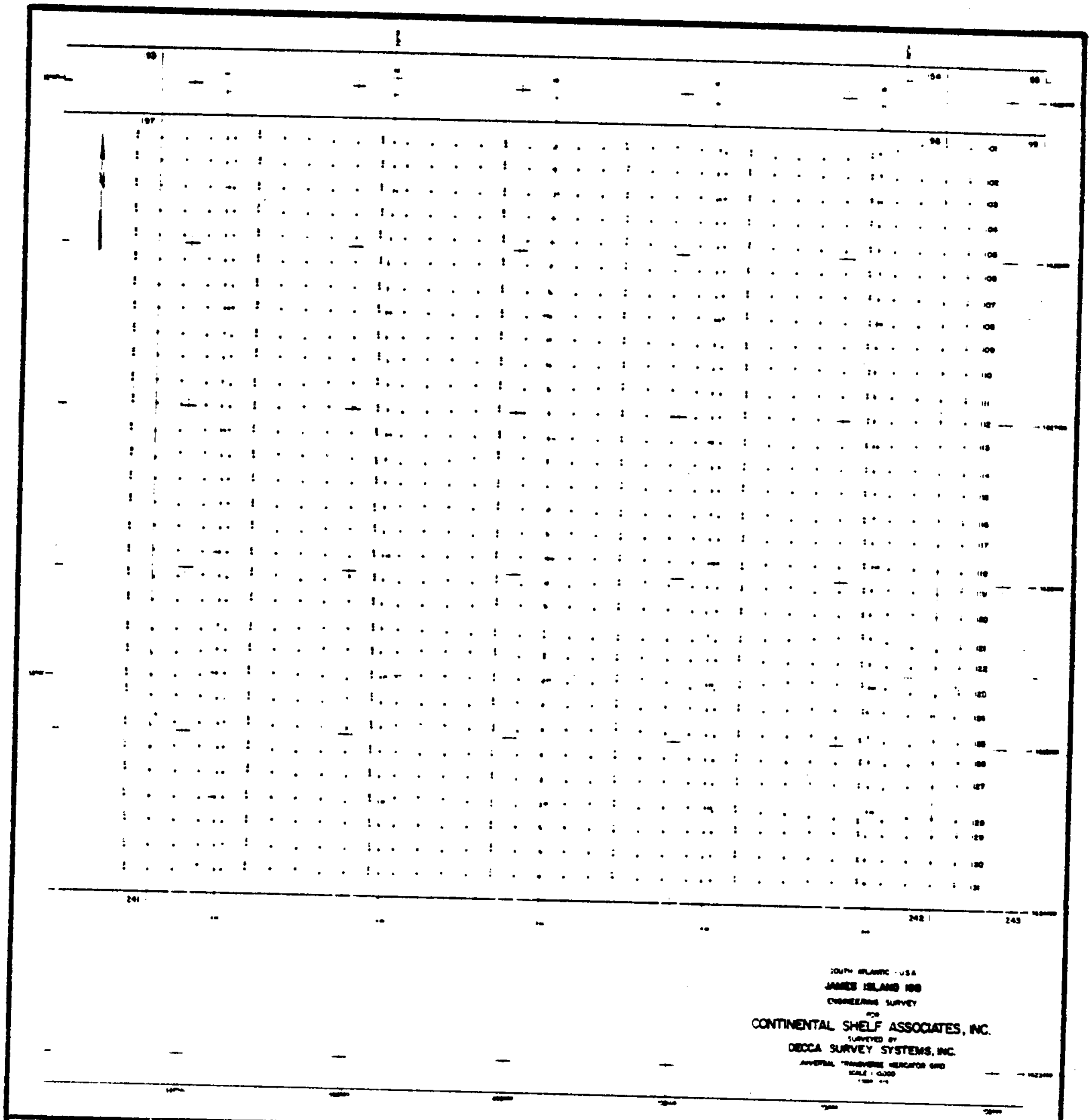



FIGURE: 4 NAVIGATION BASE MAP OF JAMES ISLAND AREA, BLOCK 198

mately 183 kilometers (99 nautical miles) of bathymetric and geophysical data were obtained in the survey of the block.

Figure 5 shows the locations of the 436 one-minute interval position fixes recorded during the towing of the television/still camera sled over suspected emergent hard bottom areas. Breaks or gaps in the survey line are due to recovery of the sled because of mechanical or electrical problems with the television/still camera system and re-deployment at new locations (Fixes 74-75, 235-242), and problems with the recording of the position on the Autocarta at the time of the fix (Fixes 133-137). The locations of the dredge tows are also plotted with the beginning and end of the lines corresponding to the first (on station) and last (dredge out of water) fixes recorded during a dredge tow.

Appendix B lists the observed coordinates, UTM grid coordinates, and latitude and longitude for the benchmark location, deployment and retrieval position fixes of the television/still camera system along the survey line, and the position fixes at the starts and ends of the dredge tows.

b) Bathymetry

Figure 6 shows that the seafloor within James Island Area, Block 198 is relatively flat with only a one to two meter variation in the depth of water. A narrow rise was recorded in the northwest corner of the block; and in the westernmost quarter of the block four high closures with 32 meter contours were mapped. The term high closure is used to denote a high or mounded area on the seafloor encircled by a closed contour at the selected contour interval. A very small, low closed area at the intersection of Lines 1 and 123 was also recorded in the western most quarter of the block with three other low closed areas encountered in the rest of the block.

The side scan sonar record of Line 105R (re-run) showed an indication of the low area central to Shotpoint 22 on Line 106 and seen in Figure 6. Line 1 showed a low area south of Shotpoint 25 while records from Lines 124 and 125 gave an indication of two high areas near Shotpoint 30 in the western quarter of the block. Between Shotpoints 10 and 11 on Lines 108, 109 and 110 a shallow channel was indicated on the sonar records and on Line 116 between Shotpoints 8 and 9 there was an apparent low area. (The latter two features are shown in Figure 8 as side scan sonar anomalies.)

c) Geological and Geophysical Observations

i) Side Scan and Subbottom Data - Figure 7 shows the results of the onboard interpretation of the side scan sonar and subbottom profiler records from James Island Area, Block 198. The map was prepared so that visual observations would be conducted in areas of suspected emergent hard bottom. The laboratory interpretation of the geophysical data is presented in Figures 8 and 9. Figure 8 shows the surficial geology in terms of the distribu-

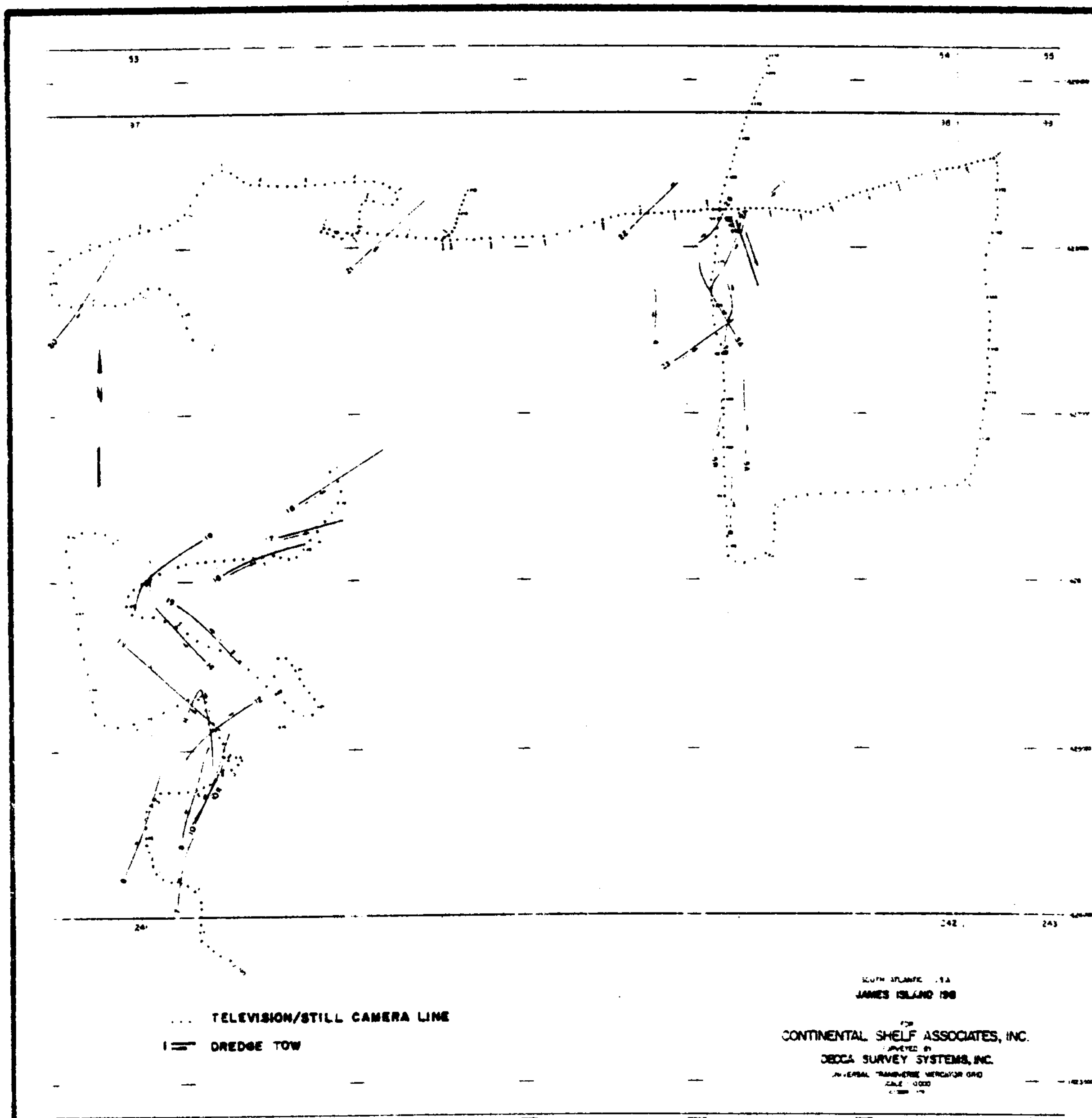



FIGURE: 5 NAVIGATION MAP SHOWING TELEVISION/STILL CAMERA LINES AND DREDGE TOWS CONDUCTED WITHIN JAMES ISLAND AREA, BLOCK 198

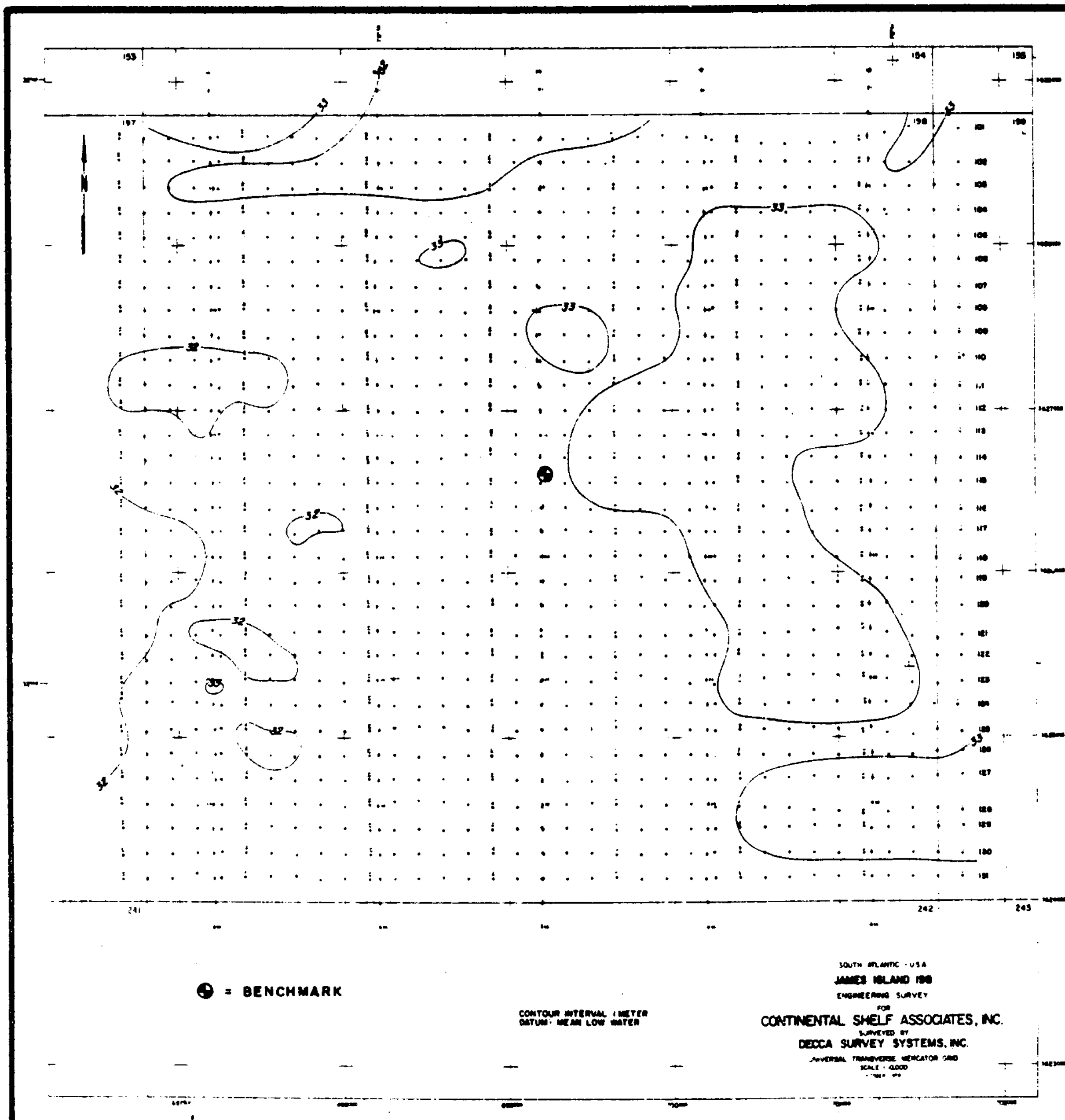
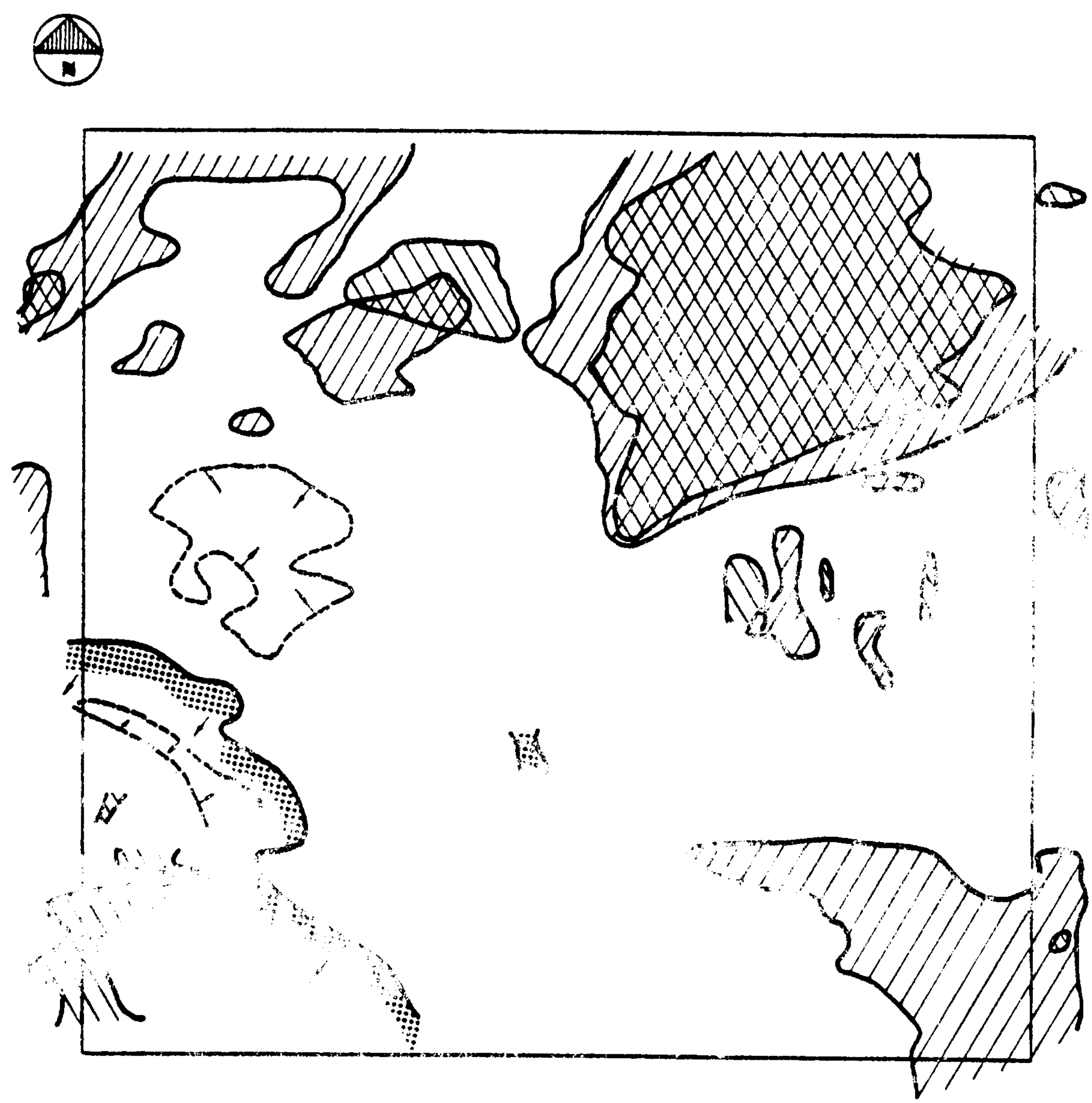



FIGURE: 6 BATHYMETRY OF JAMES ISLAND AREA, BLOCK 198



LEGEND

= HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR

= POSSIBLE HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR

= REFLECTOR OUTCROP AS INDICATED BY SUBBOTTOM PROFILER

= ACOUSTICALLY HARD SEAFLOOR (NO PENETRATION) AS INDICATED BY SUBBOTTOM PROFILER

FIGURE: 7 HARD BOTTOM AREAS BASED ON SHIPBOARD INTERPRETATION OF GEOPHYSICAL DATA COLLECTED WITHIN JAMES ISLAND AREA, BLOCK 198

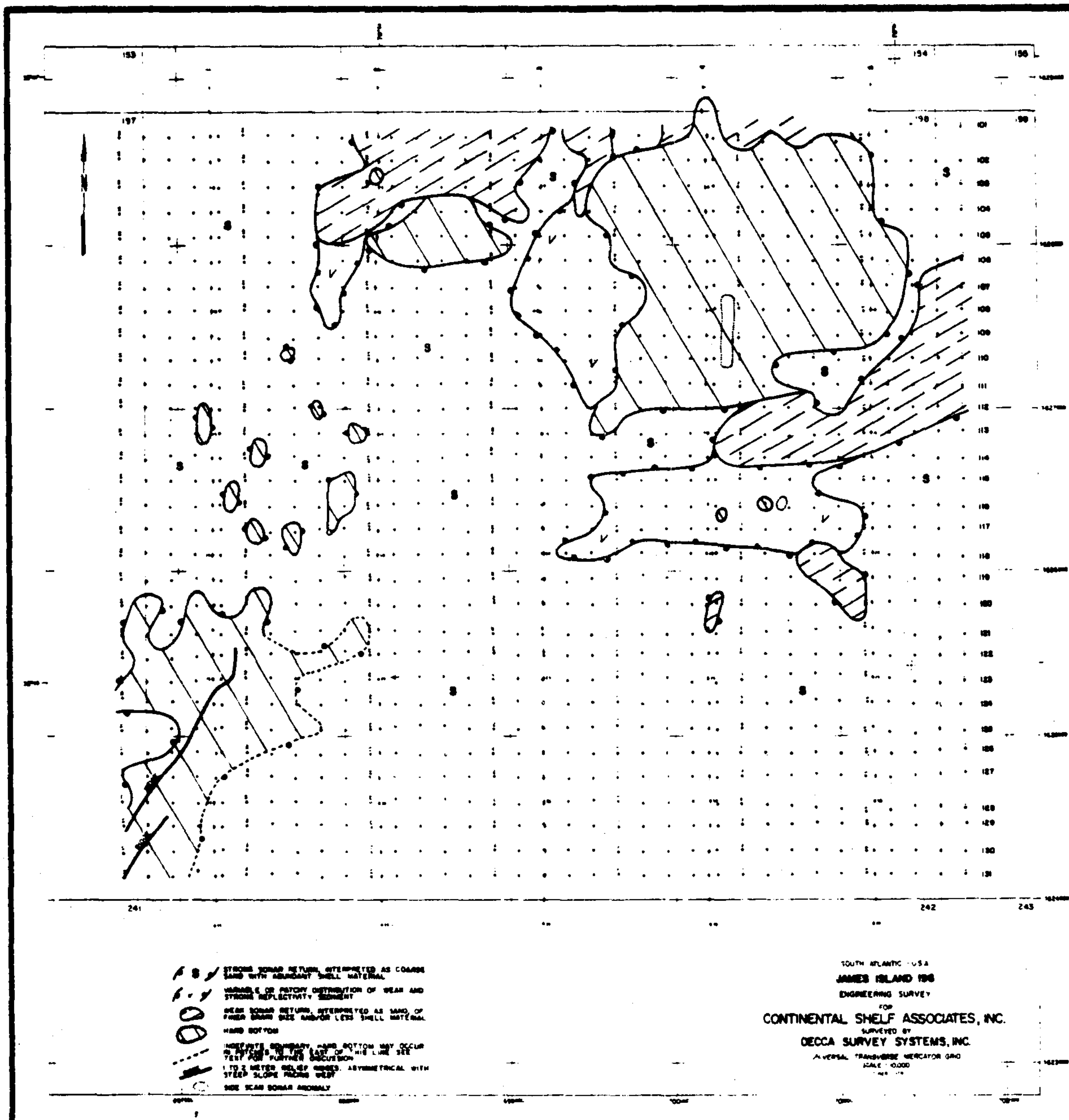



FIGURE: 8 SURFICIAL GEOLOGY OF JAMES ISLAND AREA, BLOCK 198
BASED ON SIDE SCAN SONAR AND SUBBOTTOM PROFILER DATA

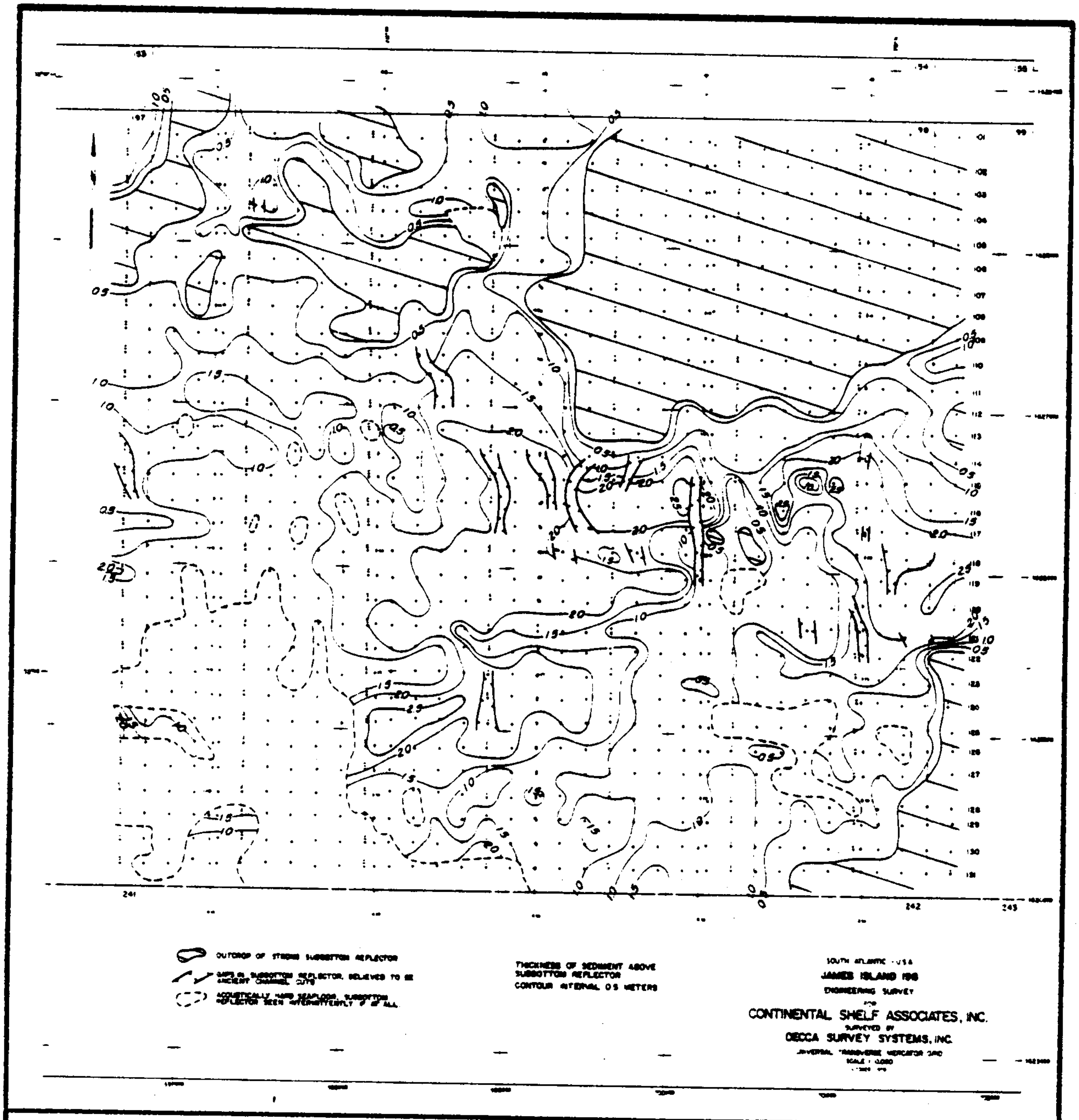



FIGURE: 9 SHALLOW ISOPACH AND RELATED SUBBOTTOM ANOMALIES OF JAMES ISLAND AREA, BLOCK 198 tion of hard bottom areas and sediments, as determined by subtle changes in the side scan sonar records and indications of an outcrop of a subbottom reflector in the subbottom profiler records. Figure 9 presents the shallow sub-surface information which includes an isopach of the sediments above a strong reflector and anomalous events within the shallow sedimentary section. Differences in the boundaries of the mapped areas between Figure 7 and Figures 8 and 9 are a reflection of the limited time and poor conditions available onboard the survey vessel for the interpretation of the geophysical records.

The most outstanding hard bottom area within James Island Area, Block 198 occurs in the northeast quadrant where an irregular topography exists. The area is composed of platforms flanked by acoustically hard ridges and Figure 10 shows an example of this irregular topography. Letters have been superimposed on the side scan and subbottom records in order to mark identical features of interest. In general the ridges are short and irregular with relief of usually less than one meter. Side scan records showed a "rough" or "rocky" texture scattered throughout the area but mainly corresponding to the tops of platforms and along ridges. After viewing the television videotapes, which showed very little rock exposed on the surface, the signature on the side scan was attributed to various benthic organisms such as sponges and soft corals that were observed protruding through the sediment cover. The macroepibenthic organisms, although too small to be detected individually, as a whole caused stronger acoustic reflections than those generated by the actual seafloor which resulted in a characteristic signature.

In the northeast corner of the block a high amplitude subbottom reflector also crops out on the seafloor as shown in Figure 9. A thin layer of sediment, probably a few centimeters thick, was observed overlying much of the area on the television videotapes. The mapped hard bottom area is diagrammatic in the sense that sediment does exist throughout the area but the numerous patches of hard bottom make the area unique. The area of outcrop encompasses more than just the hard bottom area and outcrops do not always indicate emergent hard bottom. This is related to the nature of the surface as outcropping materials are not always hard. Emergent hard bottom is also not always associated with an outcrop of the subbottom reflector. The remaining hard bottom areas throughout the block are associated with platforms or lens type structures on the seafloor. These features exhibit an acoustically hard and sometimes wholly impenetrable surface. They may often be attributed to isolated patches of sedimentary material not necessarily associated with an outcropping strata. Many of these lenses have a steep westerly dipping slope giving an overall asymmetric profile as shown in Figures 11 and 12.

Figure 11 depicts a portion of a northeast-southwest trending scarp seen in the southwestern corner of the block. This scarp is a portion of an extensive area in the south-southwest portion of Block 198 that contains an acoustically hard seafloor. Relief along the indicated scarp is generally less than

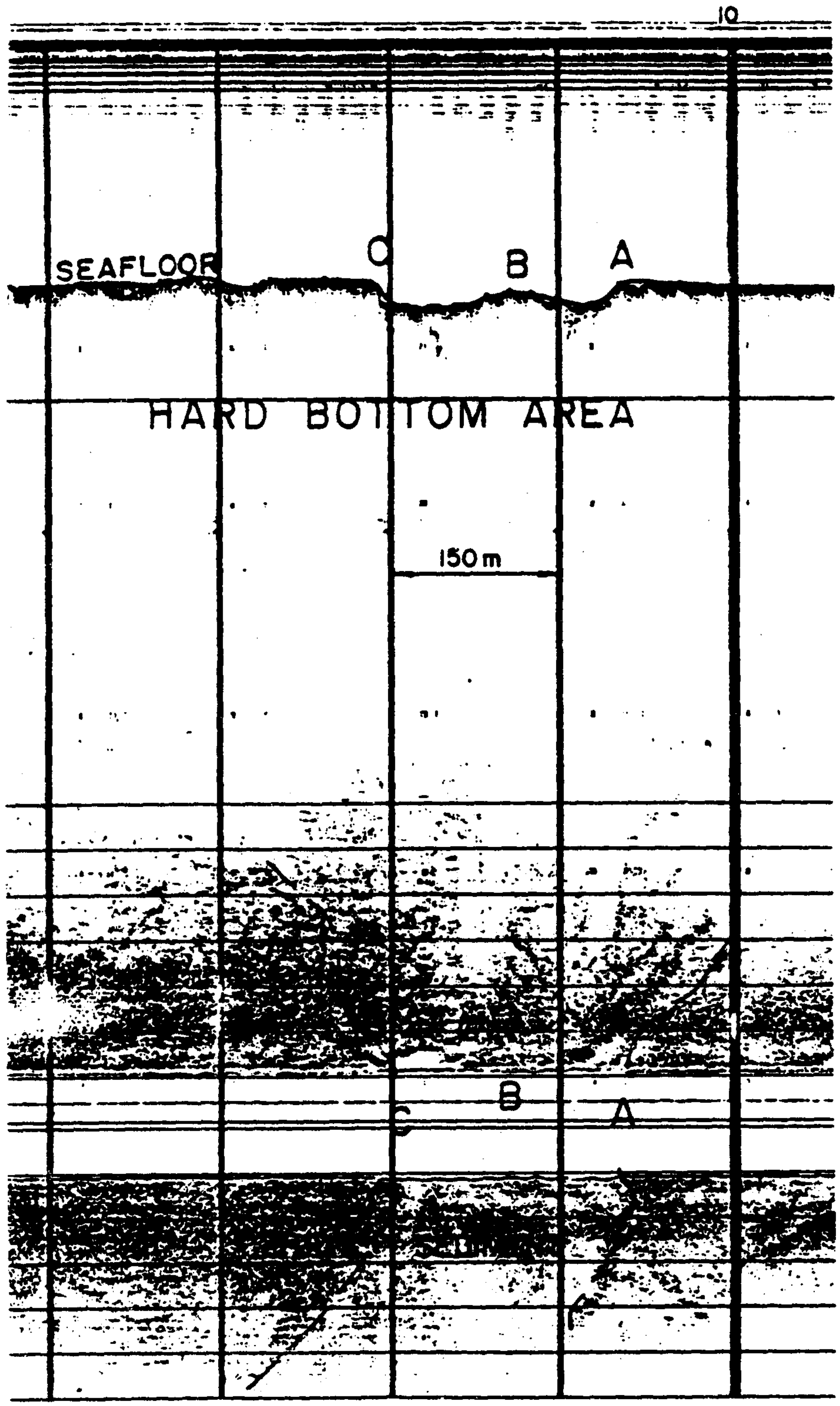



FIGURE: 10 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 104, JAMES ISLAND AREA, BLOCK 198

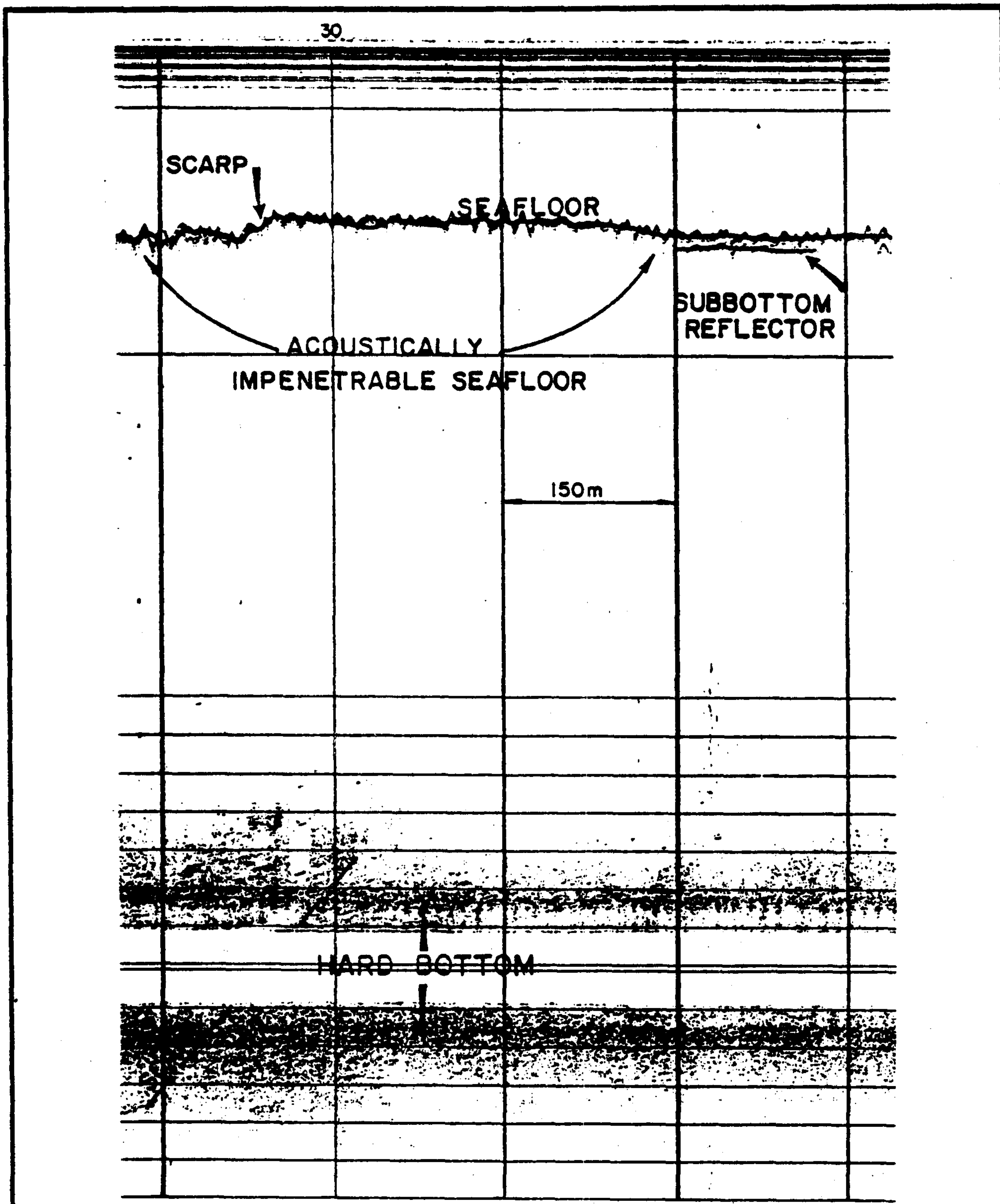



FIGURE: 11 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 122, JAMES ISLAND AREA, BLOCK 198

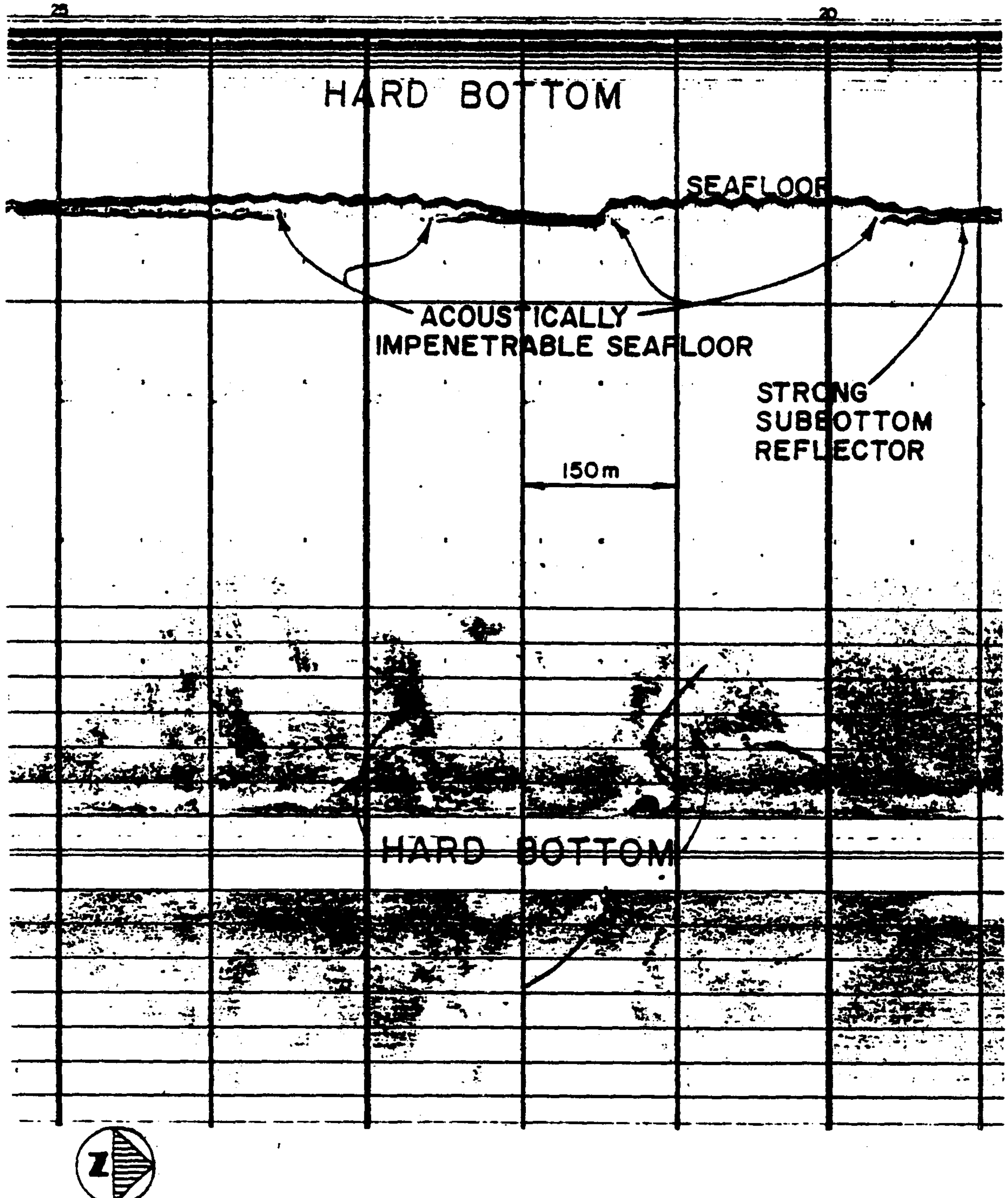



FIGURE: 12 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 105R, JAMES ISLAND AREA, BLOCK 198 one to two meters and was not reflected in the bathymetric data. Figure 9 depicts the boundaries of this area. Hard bottom was strongly evident on the side scan sonar only in the southwest corner (see Figure 8). However, there may be isolated patches of hard bottom throughout the area mapped as acoustically hard in Figure 9.

Figure 12 shows a portion of the hard bottom area located in the extreme north-central portion of the block as seen in Figure 8. In this area two lenses occur with an apparently hard surface. The easternmost lens has an asymmetric profile with the steep slope facing west. The side scan indicated that hard bottom exists over much of this lens and especially along the steep westward face.

Sediment types were delineated acoustically in terms of the strength of the returning sonar signal. Two types were classified: (1) a strong return or uniformly dark shade on the sonogram was interpreted as a coarse sand with a large percentage of shell material and (2) weak return or light colored shades were believed to be sands having a finer grain size and/or less shell material. Figure 8 indicates that the coarser material predominates over much of Block 198 though intrusions of the finer sediments occur in the north and eastern sections. Areas of highly variable or patchy sediment distribution are associated with areas of fine sediment. These variable areas have linear streaks or patches of coarse and fine sediments, which probably indicate the effects of storm currents spreading the finer material over a coarser substrate.

Figure 9 indicates the positions of subbottom features believed to be cut and fill structures. These appear as gaps in the subbottom reflector sometimes with turned down edges. The alignment of these gaps on adjacent lines suggests the remnants of channel cuts formed by rivers or streams that were present on the shelf at times of lower sea level.

ii) Television and Still Camera Observations - Figure 13 shows the hard bottom areas mapped by interpreting the side scan sonar and subbottom profiler data. Areas of emergent hard bottom (rocky) and three sediment types (sand, shell, and rubble/talus) based on television videotapes recorded and still camera photographs taken along the television/still camera survey line are also shown in Figure 13. Generally, emergent hard bottom was only visually observed in the four major areas of hard bottom that were identified and mapped using the geophysical data. An exception occurred in the northwest corner of the block and outside the block boundary (extreme upper-left corner in Figure 13) as emergent hard bottom was visually observed. Although this area was not depicted as hard bottom in Figures 8 and 13 due to a lack of a hard bottom signature on the sonograms, it was identified as an area of a strong subbottom reflector outcrop in Figure 9. Emergent hard bottom was also visually identified approximately 150 meters north of a geophysically identified hard bottom area in the southwest corner of the block. The area in which the emergent hard bottom was observed is shown in Figure 9 as having appr ximately 1.5 meters of sediment above a

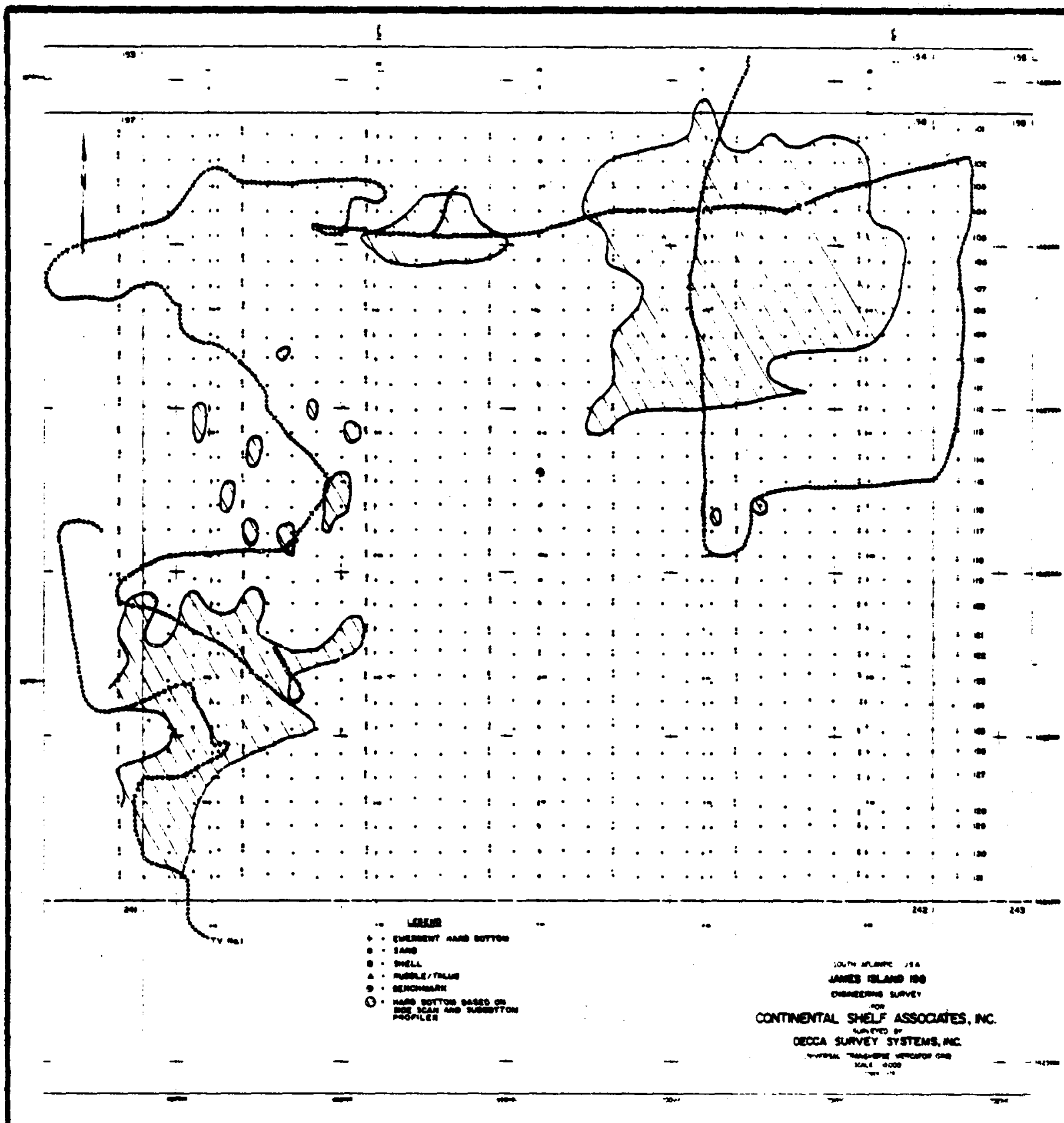



FIGURE: 13 GEOPHYSICALLY DEFINED HARD BOTTOM AREAS WITH SUBSTRATE TYPES BASED ON TELEVISION AND STILL CAMERA OBSERVATIONS IN JAMES ISLAND AREA, BLOCK 198

subbottom reflector. It is possible that because of the discontinuous nature of the emergent hard bottom that a very small outcrop occurred. Comparison between the bathymetry (Figure 6) and the emergent hard bottom areas generally showed no correlation between either enclosed highs or lows and the emergent hard bottom.

The visually observed emergent hard bottom was extremely discontinuous and appeared as flat rocky patches and low ledges with relief generally not exceeding approximately 45 centimeters. The areas of emergent hard bottom were composed of a number of small rock patches and areas of rubble that were separated by sand. The emergent hard bottom areas generally did not exceed 300 meters in length and the individual rock patches varied from perhaps a diameter of five meters to less than one meter. It was more common to observe a cluster of emergent rock patches though isolated outcrops with diameters approaching one meter were sighted. The hard bottom areas mapped using geophysical data were apparently mainly overlain with a veneer of sand and the rock layer was only occasionally exposed. Although approximately 30 percent of the block was described as hard bottom based on geophysical data, visual observations indicated that less than 10 percent of the observed area was emergent hard bottom in the form of rock or rubble/talus. Photograph A (page 45) shows an emergent patch of hard bottom within Block 198 that has a relief of perhaps 30 centimeters and is surrounded by sand.

iii) Petrographic Analyses of Dredge Samples - Sixteen samples were dredged from James Island Area, Block 198 and classified into five major lithologic types as shown in Table 3. A description of each sample is presented in Appendix C.

None of the lithic samples, with the exception of a single block with a diameter of 0.5 meters (Station 17), exceeded ten centimeters in diameter or showed marked fracture surfaces. The rock was weathered in all cases and was covered with a variety of encrusting organisms.

The biosparite category, which comprised 44 percent of the samples by number, included various lithologies. In some cases the thin sections showed a patchy distribution of sparry and micritic matrices and it was difficult to determine the relative ages of each type. In the case of the more porous rocks the sparry calcite appeared to be secondary although in other samples there were mixtures of bioclastic grains that were either unaltered or micritized or replaced by sparry calcite. Micritic pellets were not uncommon and in some cases (Stations 2B and 15) the samples might have been labelled as biopelsparite. Silt and sand size quartz grains were scattered though not uncommon. The sample from Station 2B was analyzed for non-carbonates and a value of 15 percent by weight was recorded.

The term sandy biomicrite was used to identify the four samples in Block 198 that ranged from 10 to 60 percent by grain count of non-carbonate grains. Analysis of the samples from Stations 3B and 14 showed that insoluble residues ranged from 15 to 28 percent by weight. The non-carbonate clastic component was dominated by quartz of generally silt-size angular shaped grains. The carbonate component was dominated by generally coarse bioclastic material of many shapes and sizes. In the cases of coralline algae, serpulid worm, and molluscan

Table 3. Lithologic sample types dredged in James Island Area, Block 198

| Station | Dredge* | Sandstone | Biomicrite | Sandy Biomicrite | Biosparite | Algal Biolithite |
|---|---|---|---|---|---|---|
| 2B | R | - | - | - | X | - |
| 3B | R | - | - | X | - | - |
| 4 | B | - | - | - | X | - |
| 7 | B | X | - | - | - | - |
| 8 | B | - | X | - | - | - |
| 10R | R | - | - | - | - | X |
| 13 | B | - | - | - | X | - |
| 14 | B | - | - | X | - | - |
| 15 | B | - | - | - | X | - |
| 16 | B | - | - | - | X | - |
| 17 | B | - | - | X | - | - |
| 18 | B | - | X | - | - | - |
| 19 | B | - | - | - | X | - |
| 21 | B | - | - | X | - | - |
| 22 | B | - | - | - | X | - |
| 23 | B | - | X | - | - | - |

*B = Biological Dredge
R = Rock Dredge

material the carbonate was frequently unaltered biogenic aragonite or calcite. Other material was typically micritized or as in the sample from Station 17 replaced by sparry calcite in which case there was usually a micritic envelope around the grains. Where porosity was present it seemed to be primary in origin and not noticeably occluded by other than minor fringes of fine drusy calcite. No whisker crystals, meniscus cements or other vadose zone indicators were noted.

Nineteen percent of the samples had only a few scattered non-carbonate grains (less than 10 percent by grain count) that were usually of silt size and those samples were termed biomicrite. Insoluble residues from the three samples ranged from 2 to 10 percent by weight. The main variation in the biomicrite category was in the proportions of micritic ground mass to the larger bioclasts. The larger bioclasts were identified as coralline algal fragments, serpulid worm tubes, molluscan fragments, and occasional pieces of scleractinian corals. Bryozoans and echinoderm debris generally comprised the smaller bioclasts. Numerous small bioclasts including spicular material and foraminifera were observed within the micritic ground mass. In the sample from Station 18 occasional patches of sparry calcite occurred, but they were irregular and random in distribution and did not seem to be replacing earlier clasts. In some instances the larger molluscan and serpulid worm tube fragments contained infillings of micritic material that differed from the other micrite in the sample indicating a certain amount of penecontemporaneous reworking.

A single sample was designated as a sandstone which was defined as having a predominance of quartz grains and being no less than approximately 60 percent non-carbonate by visual grain count. The clastic portion of the sample was composed of poorly sorted medium sand to silt-size quartz grains that were rounded to subangular. The cement was a fine to medium grained sparry calcite.

The "algal biolithite" category was characterized by irregular dusty brown micritic encrusting masses covering various bioclastic and quartz grains. A single sample (Station 10R) of algal biolithite was collected in Block 198. The sample had scattered silt-size quartz grains and the insoluble residue was 16 percent by weight.

## 2. BENTHIC FAUNAL POPULATIONS

A phylogenetic listing of the identified taxa from the dredge samples collected in Block 198 is presented in Appendix D. Appendix E lists the taxa identified from each successful biological dredge tow and a few selected organisms from the rock dredge samples. Biological samples were not collected at Stations 11 and 17 as the samples were lost when the weak-link system tripped. Two hundred and seventy-four taxa exclusive of fishes were identified from the 23 biological and 4 rock dredge samples. Decapods (81 taxa), mollusks (76 taxa), sponges (30 taxa), echinoderms (27 taxa), and anthozoans (18 taxa) dominated the samples as to the numbers of identified taxa. Table 4 lists the dominant species collected in the biological dredge in terms of number of occurrences within the 23 dredges. Twenty-six species were identified from ten or more stations, 59 species at five or more stations, and 146 of the total of 274 taxa occurred at

Table 4. Invertebrate species collected from ten or more of the twenty-three biological dredge stations within James Island Area, Block 198.

| Species | Number of Occurrences |
|---|---|
| *Titanideum frauenfeldii* - anthozoan | 20 |
| *Celleporaria albirostris* - bryozoan | 19 |
| *Molgula* sp. - ascidian | 19 |
| *Chione latilirata* - bivalve | 18 |
| *Telesto sanguinea* - anthozoan | 18 |
| *Polyandrocarpa* sp. - ascidian | 18 |
| *Styela* sp. - ascidian | 17 |
| *Thyroscyphus marginatus* - hydroid | 17 |
| *Gonodactylus bredini* - stomatopod | 17 |
| *Lophogorgia* sp. 2 - anthozoan | 17 |
| *Celleporaria magnifica* - bryozoan | 16 |
| *Arca zebra* - bivalve | 15 |
| *Smittipora levenseni* - bryozoan | 15 |
| *Lophogorgia hebes* - anthozoan | 14 |
| *Hiatella arctica* - bivalve | 14 |
| *Pilumnus sayi* - decapod | 13 |
| *Schizoporella cornuta* - bryozoan | 13 |
| *Pteria colymbus* - bivalve | 13 |
| *Mithrax pleuracanthus* - decapod | 13 |
| *Stylopoma spongites* - bryozoan | 12 |
| *Chama congregata* - bivalve | 11 |
| *Synalpheus* sp. - decapod | 11 |
| *Filograna implexa* - polychaete | 11 |
| *Ophiothrix angulata* - ophiuroid | 11 |
| *Crepidula aculeata* - gastropod | 10 |
| *Diodora* sp. - gastropod | 10 |

two stations or more. Twenty-seven percent (7 species) of the 26 species identified from 10 or more stations were mollusks, 19 percent (5 species) were byrozoans, 15 percent (4 species) were anthozoans, and ascidians (3 species) and decapods (3 species) each contributed 12 percent. It is obvious that a significant portion of the species were not numerically abundant, but that a large number of species were associated with the emergent hard bottom. However, it is difficult to specify the total number of species that were associated exclusively with the hard bottom habitat rather than both the hard bottom and often sandy adjacent substrate as both habitats were sampled during the majority of dredge tows.

The television videotapes and still camera photographs showed that the distribution of attached hard bottom epifauna was not confined to the small amount of emergent hard bottom observed in the lease block. Many species such as *Titanidium frauenfeldii* sp. and *Ircinia* sp. were also observed in a predominantly sand substrate that was apparently underlain by hard bottom as shown in Photograph C (page 46).

Figure 14 shows the spatial distribution of three biological assemblages that were recognized during review of the television videotapes and still camera photographs. The assemblages are based on the largest (megabenthic) and most easily recognizable (identifiable) fauna and correspond directly to substrate differences. The identifications were made using the specimens from the dredge samples as reference.

Assemblage A was associated with a predominately soft bottom composed of sand or sand and shell sediment that was apparently not underlain by a near-surface hard bottom. The asteroids *Luidia* spp. and *Astropecten* spp. as well as the echinoid *Encope michelini* were the only species observed to be consistently associated with the soft bottom although their numbers were very low. A few sea pens (*Virgularia presbytes*) were also seen on the sandy substrate. Photograph B shows the asteroid *Goniaster tessellatus* and the echinoid *Encope michelini*.

Assemblage B was present on the emergent hard bottom and was visually dominated by sponges and gorgonians (particularly *Lophogorgia* spp.).

Assemblage C was observed on a slightly rippled sand bottom that was apparently underlain by a hard substrate which the organisms could use for attachment. Assemblage C was numerically dominated by *Titanideum frauenfeldii* (Photograph C), a few sponges, and occasional colonies of the encrusting polychaete *Filograna implexa*.

Assemblages B and C tended to mix together in areas that were without emergent rock but contained patches of what appeared to be cobbles and shells which provided a suitable substrate for attachment. These areas seemed to contain the largest numbers of species and greatest biomass. Hydroids, bryozoans, and some ascidians were also frequently observed in these areas though they also occasionally appeared on emergent rock.

Clustering analysis using the 61 taxa that were identified from five or more of the 23 stations distinguished three groups of stations using both the Jaccard and Czekanowski coefficients. The purpose of performing the cluster analysis was to examine the exten-

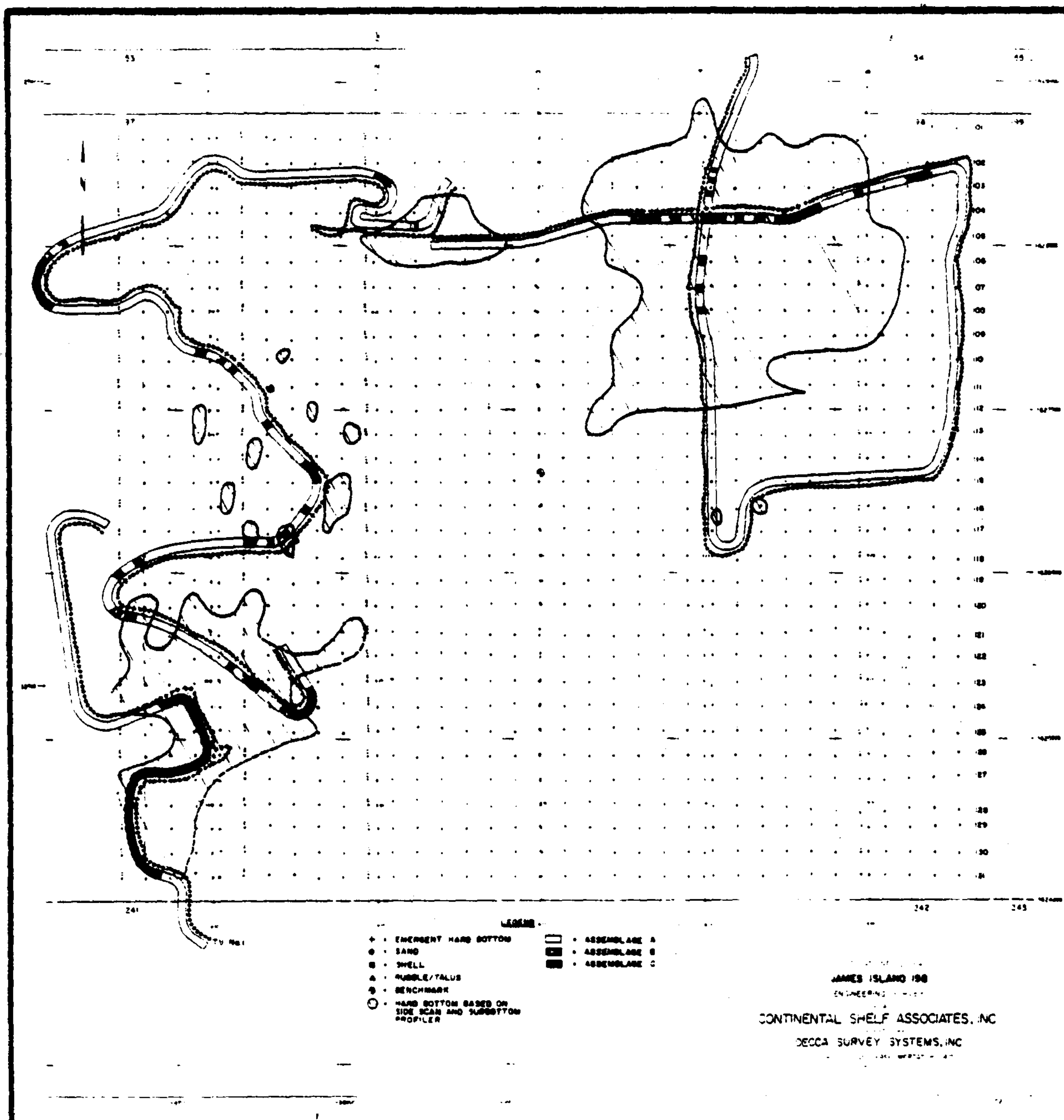
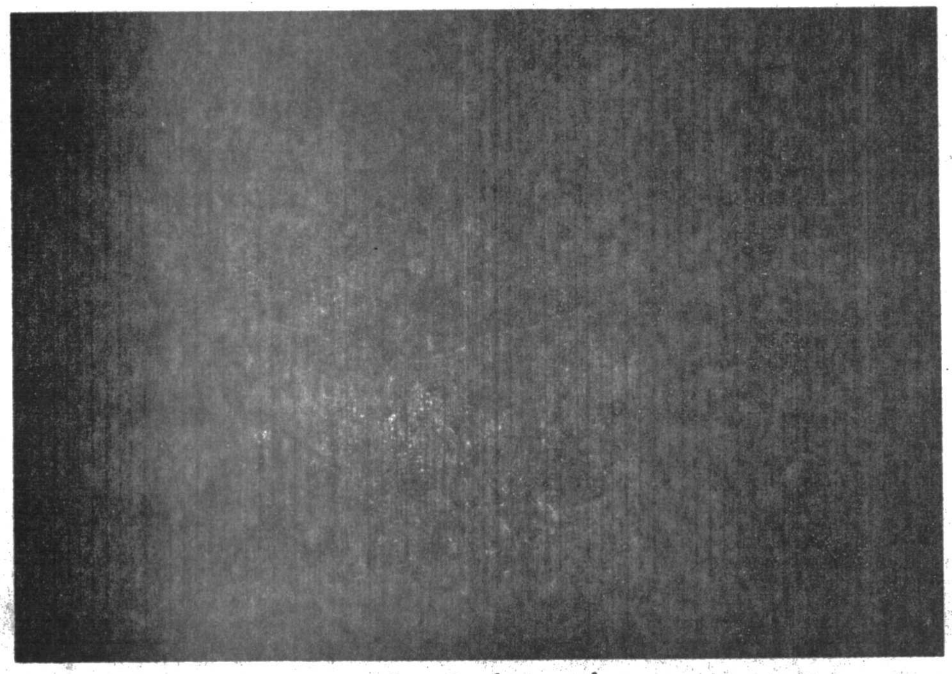
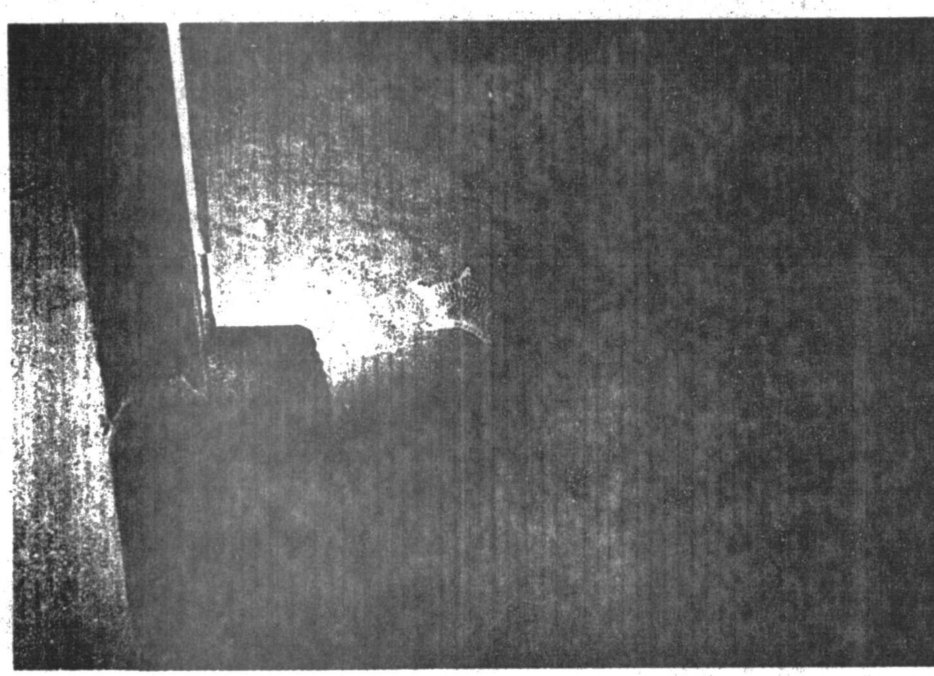



FIGURE: 14 BENTHIC BIOLOGICAL ASSEMBLAGES IDENTIFIED ALONG THE TELEVISION/STILL CAMERA LINE IN JAMES ISLAND AREA, BLOCK 198



Photograph A. The sea fan *Lophogorgia* sp. on an emergent patch of hard bottom within James Island Area, Block 198.



Photograph B. The asteroid *Goniaster tessellatus* and the echinoid *Encope michelini* on a sandy substrate within James Island Area, Block 198.

Photograph C. *Titanideum frauenfeldii* growing on apparently sand covered hard bottom within James Island Area, Block 198.

sive information on species distribution patterns that resulted from the dredge samples in order to determine any significant groupings of stations or species. Stations which were the most similar in terms of species presence/absence appear closest together in the dendrograms and were separated by the least amount of dissimilarity. The same was true for the species dendrograms with the similarity values also based on the presence/absence of species at the sampled stations. If groups of stations or species were separated by large dissimilarity values, the reasons (water depth, substrate type, etc.) for such dissimilar groupings can be investigated. Figure 15 shows the station group dendrogram produced by the Czekanowski similarity coefficient. Examination of the groupings and the two-way table indicated that Group I (Stations 1, 2A, 3A and 4) was composed of stations which had the largest number of the 61 taxa present. Group II (Stations 5A, 5B, 6 and 7) had the fewest number of taxa present while Group III Stations had an intermediate number of taxa. Although the clustering analysis produced realistic groupings for the data, it is believed that there is no real difference between the emergent hard bottom areas within the lease block. The extreme patchy nature of the fauna within the emergent hard bottom areas coupled with the qualitative sampling by the dredge, which has the effect of integrating a number of separate rock and sand patches (Assemblages A, B and C) during a tow, lead to the conclusion that the differences between the dredge samples are probably related to sampling artifacts rather than to real differences in the faunal assemblages.

No distinct species groupings were produced by the clustering analysis using either similarity coefficient as the species chained together (as in Figure 15, Stations 6 through 22) with no differences in their dissimilarity values. Those species having similar numbers of occurrences at the sampled stations appeared closest together in the dendrogram.

## 3. DEMERSAL FISH POPULATIONS

Twenty-two fish species were recorded from James Island Area, Block 198 as shown in Table 5. Eleven of the species were collected by dredging operations and are also listed in Appendices D and E. Schools of cobia (*Rachycentron canadum*), gray snapper (*Lutjanus griscus*), tomtate (*Haemulon aurolineatum*), and amberjack (*Seriola dumerili*) were recorded from television videotapes and still camera photographs. The tomtate and gray snapper schools were observed over emergent hard bottom while the amberjack and cobia were noted over sand and rubble substrates. The large roving amberjack and cobia might be expected to occur independent of bottom cover. Several grouper (*Mycteroperca* sp.) were noted near emergent hard bottom areas in the southwestern section of the lease block. Bank sea bass (*Centropristis ocyurus*) were commonly seen near the bottom swimming among attached organisms. Smaller fish such as the scrawled cowfish (*Acanthostracion quadricornis*) and file fish (*Aluterus* sp. and *Monacanthus* sp.) were observed near apparent sand-covered hard bottom, as indicated by presence of epifauna.

The records from the Raytheon depth recorder showed several

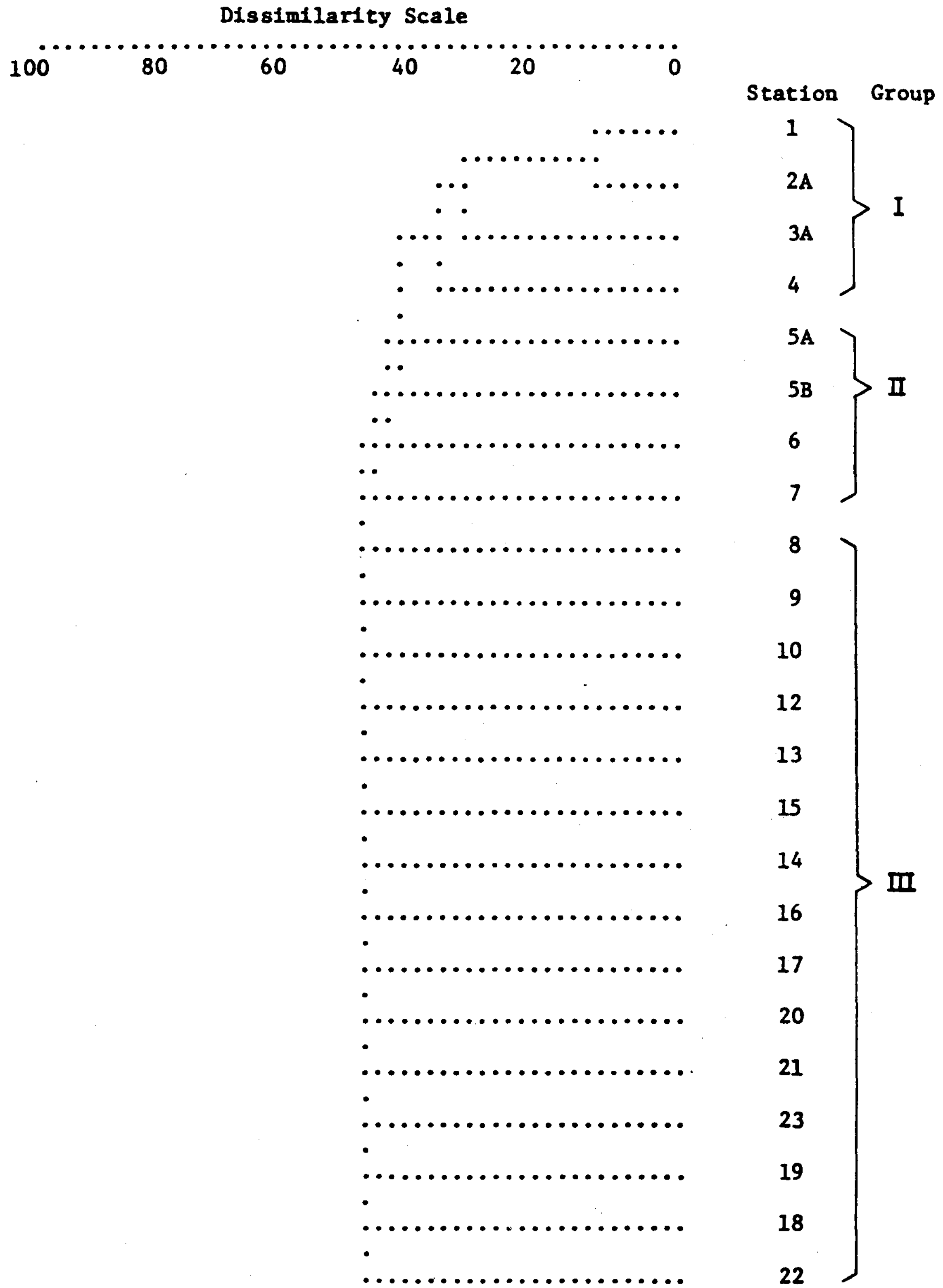



FIGURE: 15 STATION-GROUP DENDROGRAM FOR JAMES ISLAND AREA, BLOCK 198 BASED ON 61 TAXA AND PRODUCED BY THE CZEKANOWSKI SIMILARITY COEFFICIENT AND FLEXIBLE SORTING

Table 5. Species of fish collected or observed in James Island Area, Block 198.

| Species | Habitat* | Dredge Sample | Visually Observed |
|---|---|---|---|
| *Acanthostracion quadricornis* -scrawled cowfish | D | | X |
| *Aluterus* sp. - filefish | D | | X |
| *Blennius marmoreus* - seaweed blenny | D | X | |
| *Bothus* sp. - spottail flounder | D | X | |
| *Centropristis ocyurus* - bank sea bass | D | | X |
| *Centropristis striata* - black sea bass | D | | X |
| *Chriolepis* sp. - goby | D | X | |
| *Echeneis naucrates* - sharksucker | P | | X |
| *Haemulon aurolineatum* - tomtate | D | | X |
| *Halichoeres caudalis* - printed wrasse | D | X | |
| *Lutjanus griseus* - gray snapper | D | | X |
| *Lythrypnus phorellus* - convict goby | D | X | |
| *Monacanthus* sp. - filefish | D | | X |
| *Mycteroperca* sp. - grouper | D | | X |
| *Nicholsina usta* - emerald parrotfish | D | X | |
| *Opichthus* sp. - worm eel | D | X | |
| *Ophidion selensops* - cush eel | D | X | |
| *Pontinus helena* - scorpionfish | D | X | |
| *Rachycentron canadum* - cobia | P | | X |
| *Scorpaena albifimbria* - lesser scorpionfish | D | X | |
| *Seriola dumerili* - greater amberjack | P | | X |
| *Serranus annularis* - orangeback bass | D | X | |

* D = Demersal
P = Pelagic

signatures of fish schools within the block. These may have easily been multiple readings of the same schools and there appeared to be no correlation between positions of the observed fish schools and hard bottom.

B. JAMES ISLAND AREA, BLOCK 380

1. HARD BOTTOM IDENTIFICATION AND MAPPING

a) Navigation

Figure 16 shows the bathymetric and geophysical navigation base map of James Island Area, Block 380. The nomenclature used on the map is identical to that described for the map of James Island Area, Block 198. Figure 17 shows the locations of the five television/still camera survey lines in the lease block with position fixes recorded every minute and 22 dredge tows conducted within the lease block.

Appendix B lists the observed coordinates, UTM grid coordinates, and latitude and longitude for the benchmark location, deployment and retrieval position fixes of the television/still camera system at the starts and ends of the survey lines, and the position fixes at the beginnings and ends of the dredge tows.

b) Bathymetry

The depth of water within Block 380 varies from a minimum of 44 meters to a maximum of 194 meters as shown in Figure 18.

The seafloor dips to the southeast in the western half of the block and almost due east in the eastern half of the block. The rate that the seafloor dips varies from about 2 meters per mile in the vicinity of Shotpoint 28 on Line 112 to a maximum of 112 meters per mile in the southeastern quarter of the block.

There is a high closed area near the intersection of Lines 2 and 104 which appears to be on the crest of a ridge running east-west along Lines 104 and 105 from Shotpoints 20 to 35. To the south there are two low closed areas, one near the intersection of Lines 2 and 111, and the other central to Shotpoint 24 on Line 115. Farther south there is a southeasterly trending ridge with its axis extending from Shotpoint 23 on Line 118 to Shotpoint 19 on Line 126. There is a pinnacle between Shotpoints 12 and 13 on Line 125 to the east of the southeast end of the ridge. To the southeast of the ridge there is a closed high area central to Shotpoint 14 on Lines 130 and 131. On Line 4 between Shotpoints 23 and 25 there are two high areas and in the immediate vicinity of that area there is a small high between Shotpoints 12 and 13 on Line 122.

On Line 5 from Shotpoints 17 to 24 and from Shotpoints 30 to 33 the seafloor is very rough with a small high closed area between Shotpoints 32 and 33. These irregularities are generally due to the large sand waves in the area (see Figure 20).

Side scan sonar information (Line 125 between Shotpoints 13 and 14) confirmed the pinnacle located between Shotpoints 12 and 13

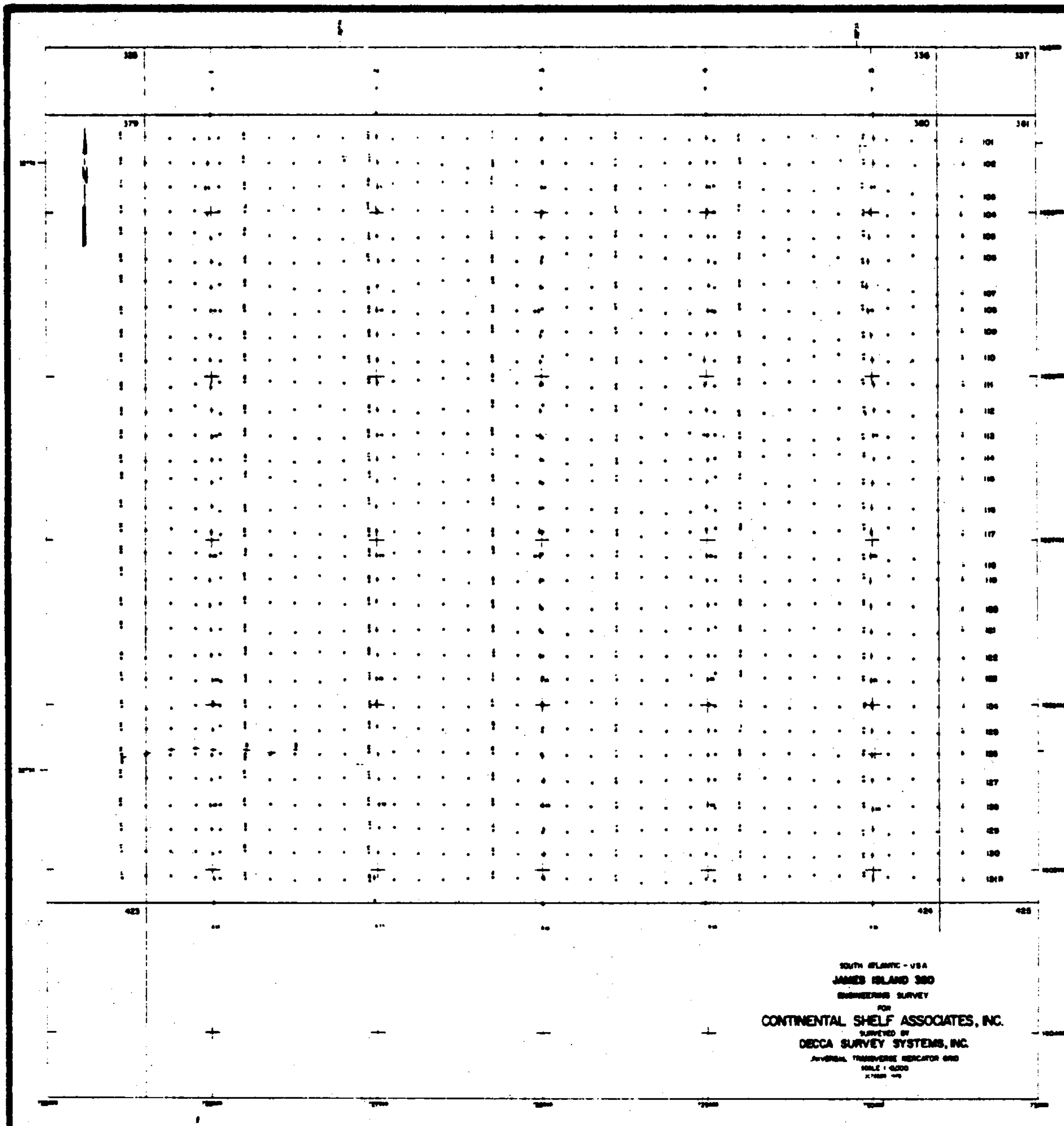



FIGURE: 16 NAVIGATION BASE MAP OF JAMES ISLAND AREA, BLOCK 380

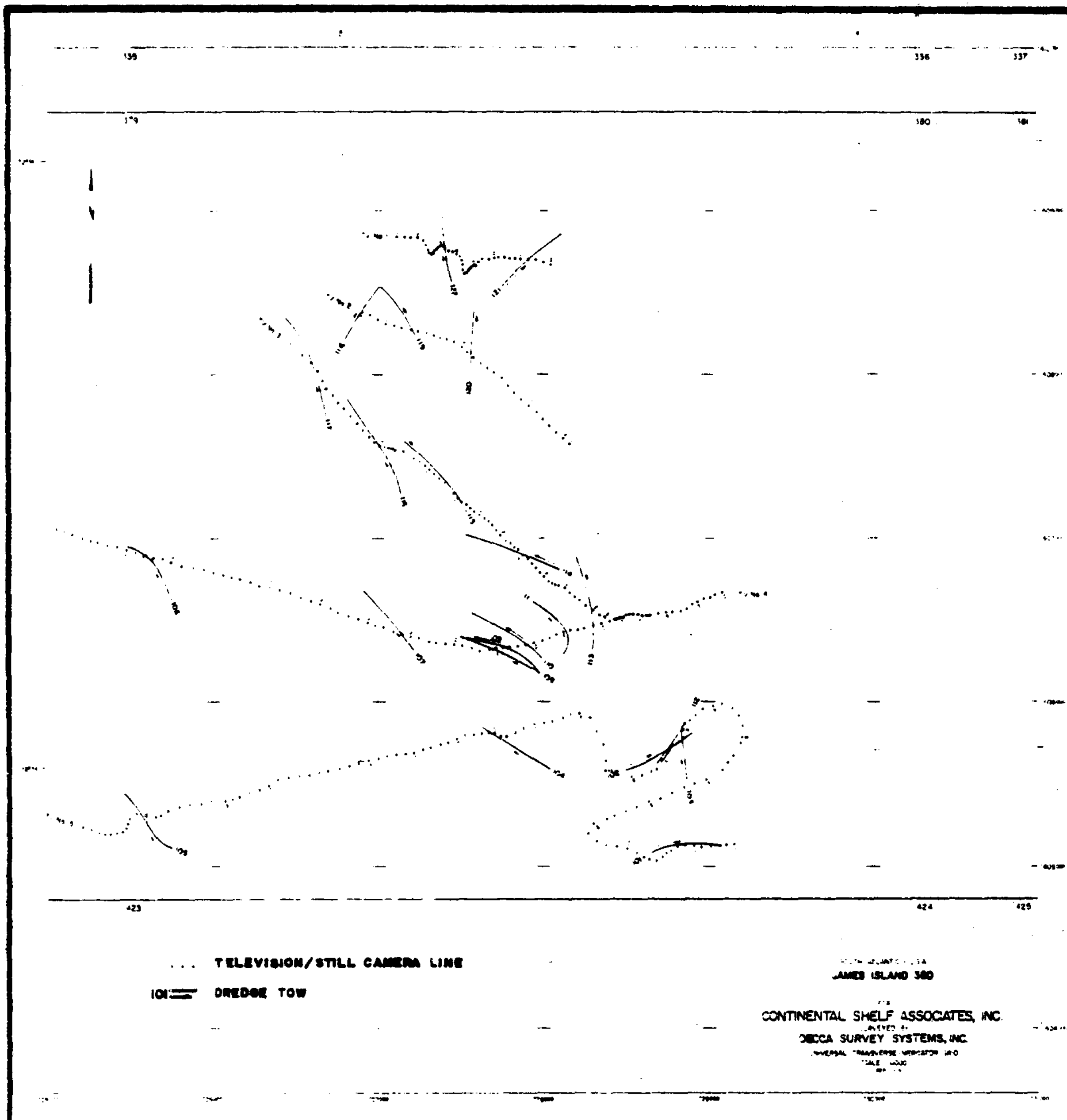



FIGURE 17 NAVIGATION MAP SHOWING TELEVISION/STILL CAMERA LINES AND DREDGE TOWS CONDUCTED WITHIN JAMES ISLAND AREA, BLOCK 380

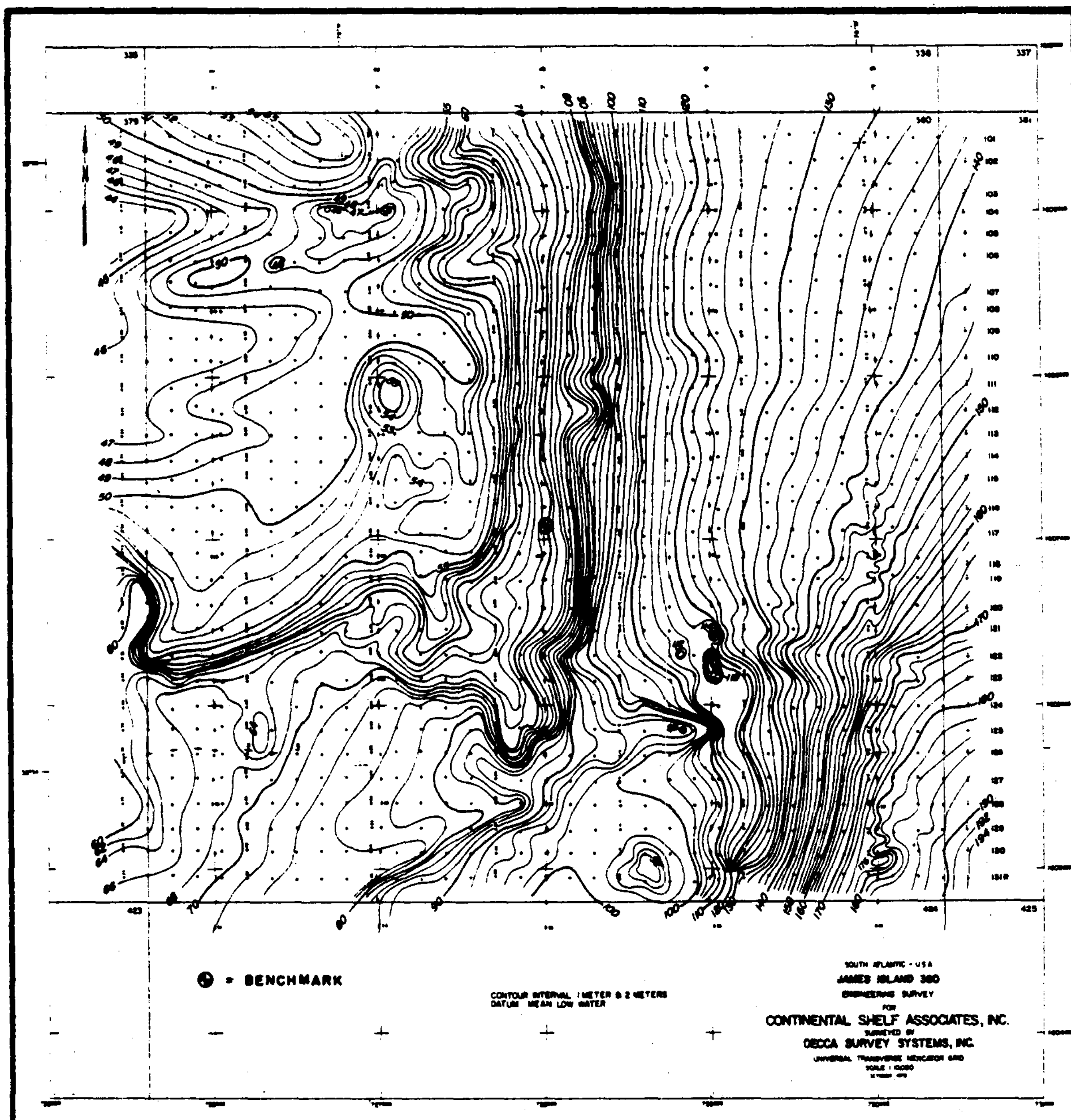



FIGURE: 18 ,BATHYMETRY OF JAMES ISLAND AREA, BLOCK 380 on Line 125 and the sonograms (Line 129 between Shotpoints 13 and 15) also indicated the closed high area central to Shotpoint 14 on Line 130. The side scan records also showed the sand waves scattered throughout the eastern half of the block.

c) Geological and Geophysical Observations

i) Side Scan and Subbottom Data - Figure 19 shows the results of the onboard interpretation of the side scan sonar and subbottom profiler records from James Island Area, Block 380. The map was prepared so that visual observations would be conducted in areas of suspected emergent hard bottom. The laboratory interpretation of the geophysical data is presented in Figure 20 which depicts the surficial geology in terms of the distribution of hard bottom areas and sediments. A shallow isopach and related subbottom anomalies map was not drawn for Block 380 because of a lack of penetration by the subbottom profiler's 7 kHz pulse. Coarse, hard packed sands which have a high acoustic attenuation, especially at the high frequency employed, caused the lack of penetration.

Figure 20 shows that hard bottom areas dominate the western half of the lease block landward of the continental shelf break which trends roughly north-south down the center of Block 380. The majority of the hard bottom area exhibits very little relief as only a few small ridges exist within a rugged plain composed of visually observed coarse sandy sediments and numerous rocks and boulders. A seafloor rise which is broken by a series of platforms and ridges up to several meters in relief occurs within 1.0 to 1.5 kilometers to the west of the shelf break in the northern and southern sections of the block as shown in Figure 18, illustrated in Figure 21, and previously described.

The rise generally has the most pronounced areas of hard bottom within the block. Figure 20 indicates that a gap exists between the two areas of irregular topography as the rugged plain extends to the shelf break.

The north-south trending shelf break abruptly curves to the southwest in the southern portion of the lease block (see Figures 18 and 20) and the break becomes more subdued in slope and appearance. At this location the shelf break grades into a gently trough of primarily coarse sand with scattered occurrences of hard bottom. On the north side, the seafloor rises 10 to 15 meters up to the rugged plain in a relatively short distance, with sometimes a sharp 5 meter break present as shown in Figure 22. The areas surrounding the trough appear to have hard bottom while no hard bottom exists within the trough or basin-like structure itself. The structure is not a true basin, however, as the slope continues to dip toward the southeast. A few subbottom profiler records indicated foreset-like bedding within the trough sediments (Figure 22), suggesting rapid sedimentation rates.

The upper continental slope seaward of the hard bottom area that forms the shelf break is composed of coarse, highly reflective material which was observed to represent talus from the hard bottom ridge. The slope grades into a seafloor composed of materials with low reflective properties that dominate the eastern portion of

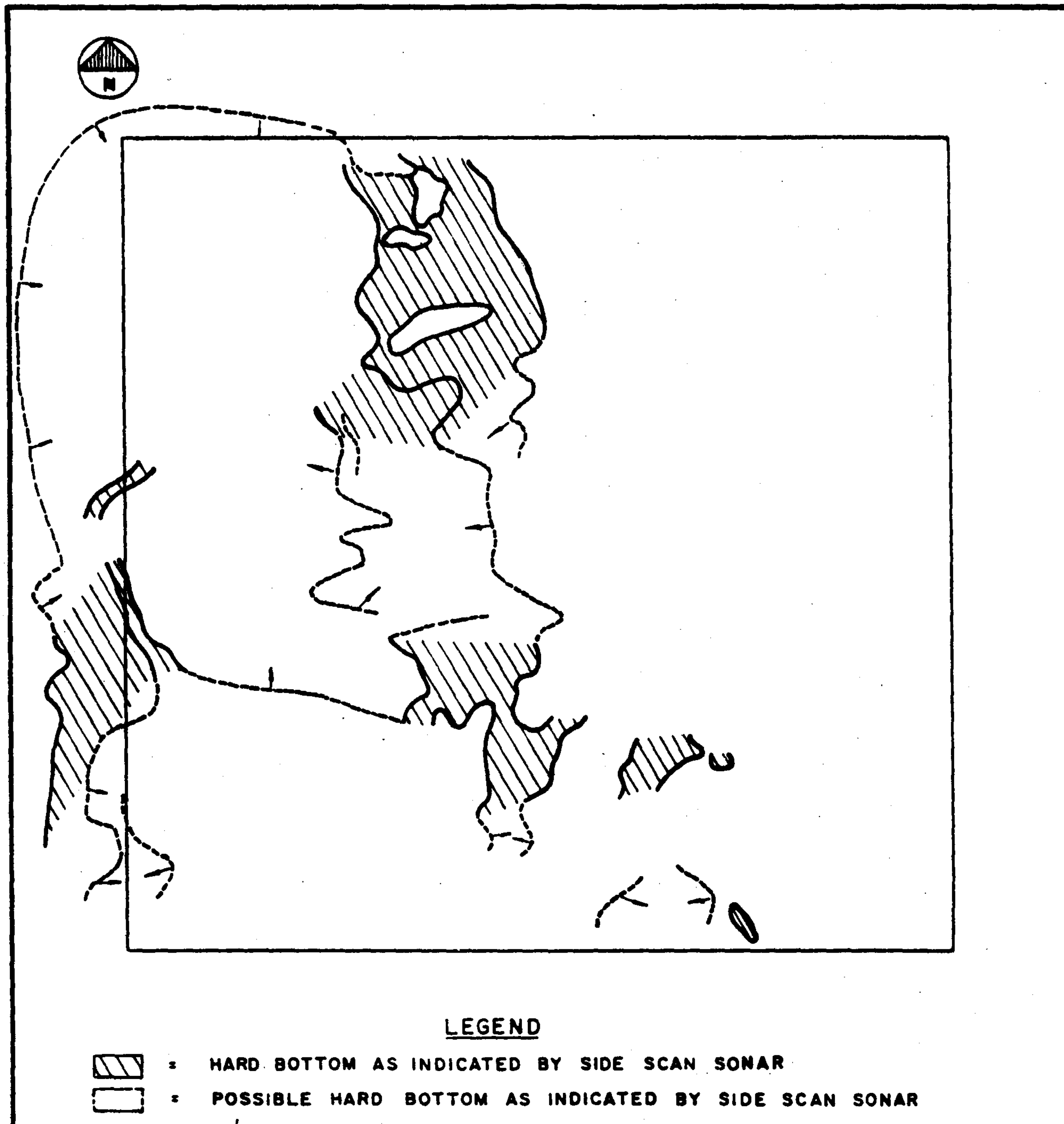



FIGURE: 19 HARD BOTTOM AREAS BASED ON SHIPBOARD INTERPRETATION OF GEOPHYSICAL DATA COLLECTED WITHIN JAMES ISLAND AREA, BLOCK 380

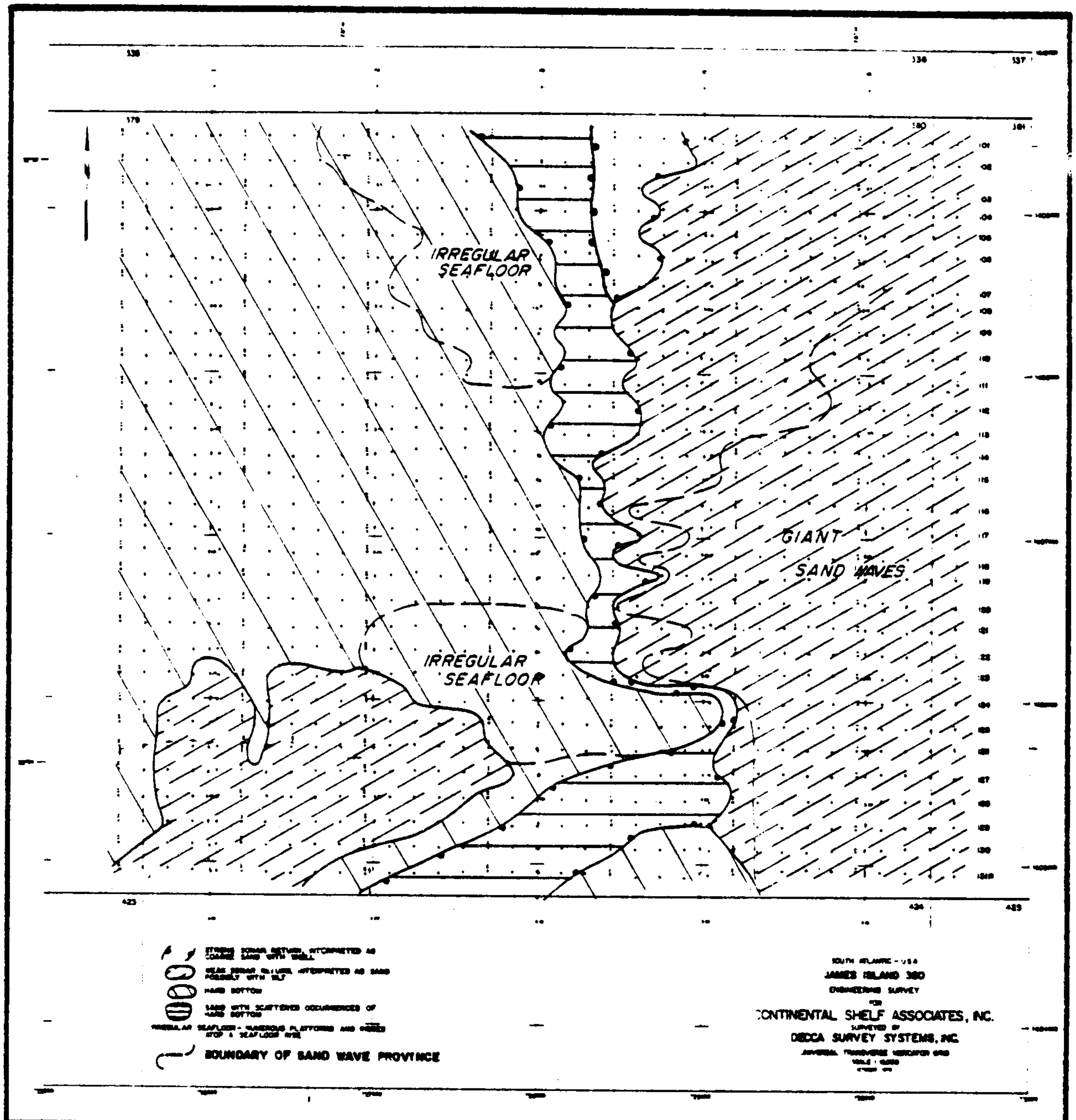



FIGURE: 20 SURFICIAL GEOLOGY OF JAMES ISLAND AREA, BLOCK 380 BASED ON SIDE SCAN SONAR AND SUBBOTTOM PROFILER DATA

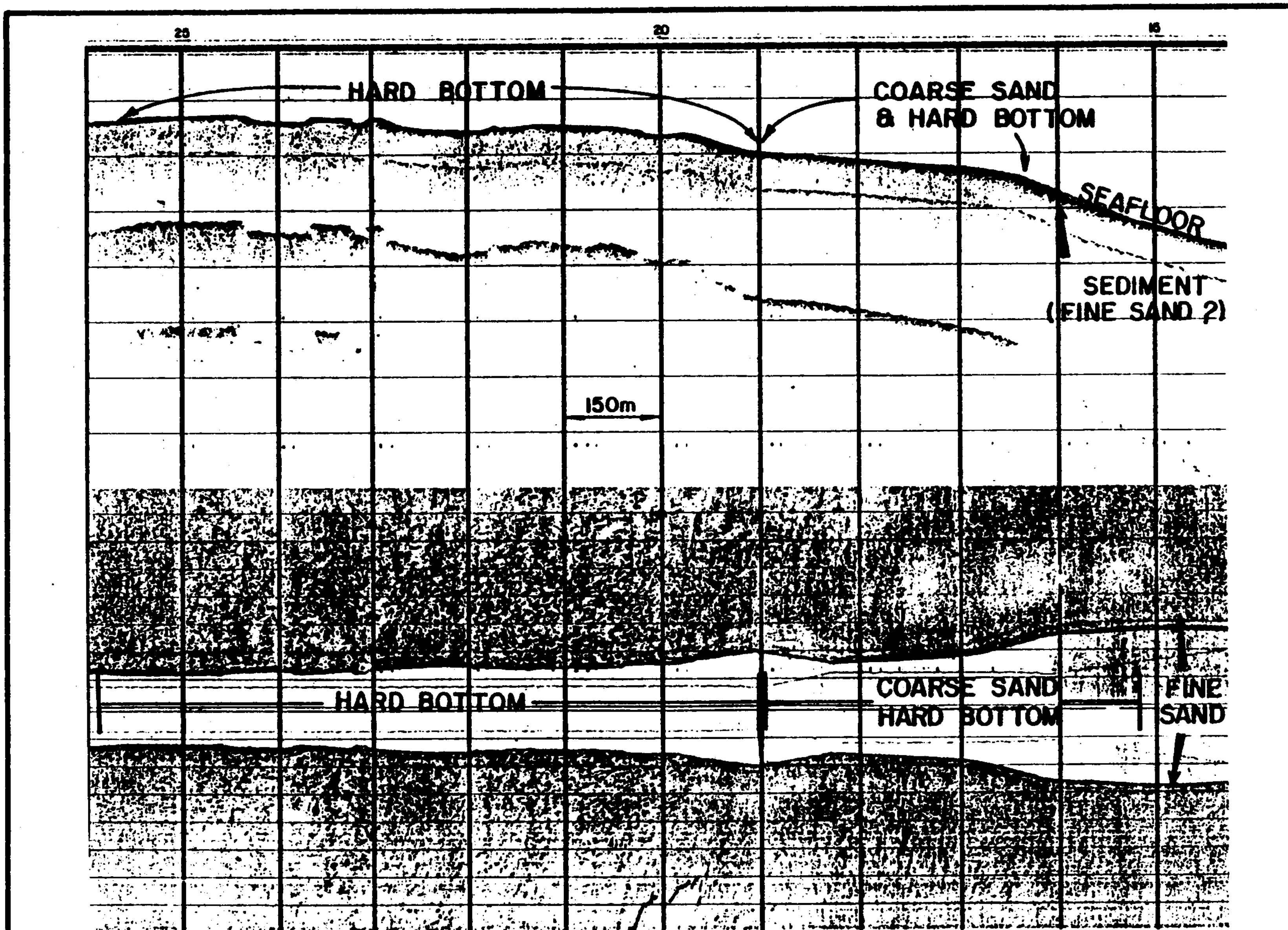



FIGURE: 21 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 103, JAMES ISLAND AREA, BLOCK 380

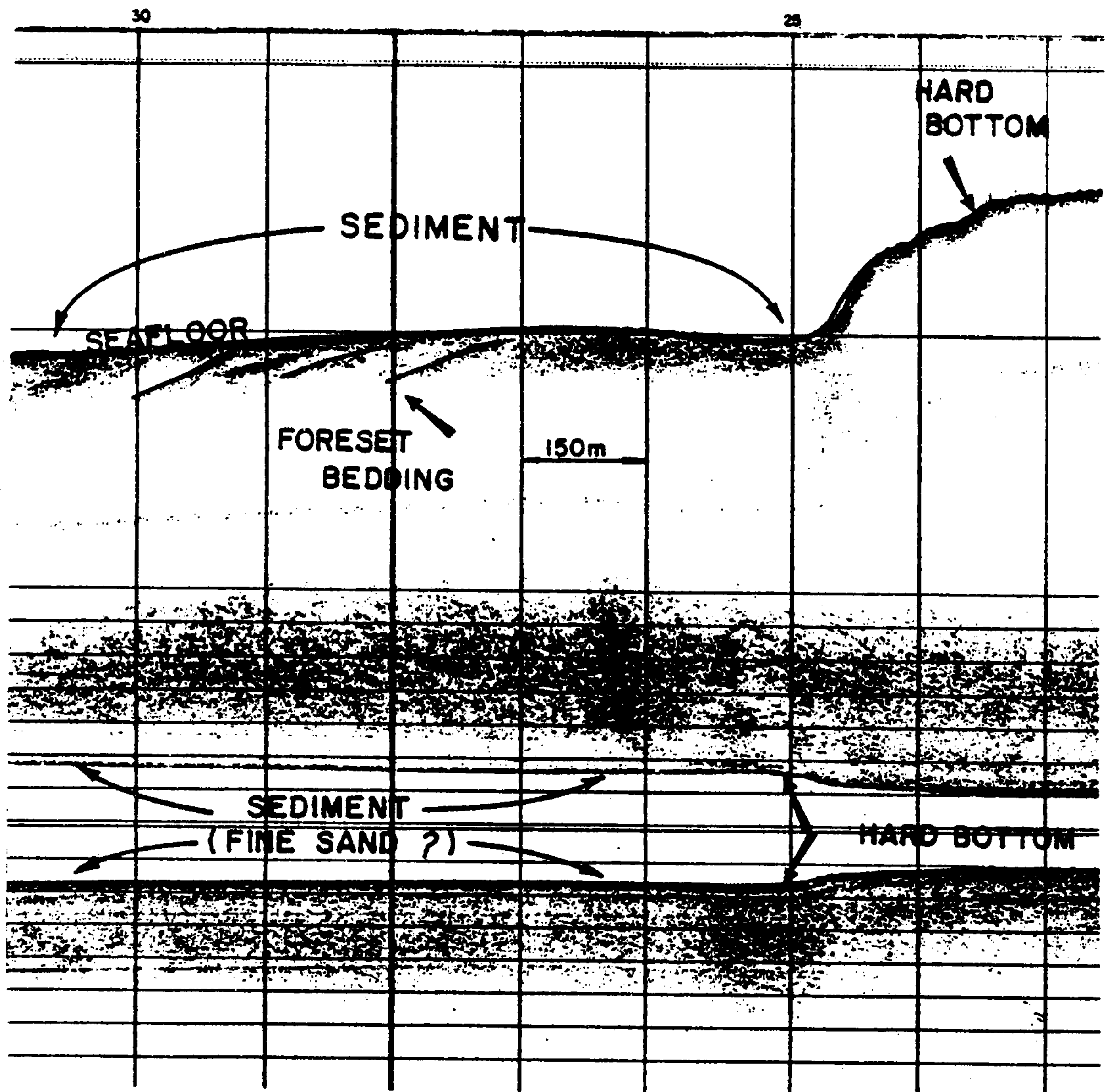



FIGURE: 22 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE I, JAMES ISLAND AREA, BLOCK 380 the lease block and appeared to be fine sand with perhaps some silt and clay.

A large portion of the slope below the talus zone is built into large sand waves as illustrated in Figure 23. The wavelengths from crest to crest ranged from 50 to 200 meters while heights are from 1 to 10 meters. These features are not depicted in Figure 18 due to their transient nature and small horizontal scale. The trend of these sand waves is roughly parallel to the regional bathymetric contours suggesting the action of strong bottom currents.

ii) Television and Still Camera Observations - Figure 24 shows the geographic extent of the hard bottom that was mapped by interpreting the side scan sonar and subbottom profiler data. Areas of emergent hard bottom, rubble/talus, and sand (including broken shell) as observed from videotapes and photographs are also depicted in Figure 24. Emergent hard bottom was visually observed only in the geophysically defined hard bottom areas. However, Television/Still Camera Survey Lines 4 and 5 in Figure 24 show that the emergent hard bottom is somewhat discontinuous in the geophysically defined hard bottom areas as patches of rubble/talus and sand often divide the areas of the emergent hard bottom.

The emergent hard bottom generally showed a relief of less than 15 to 20 centimeters though certain areas did show rock ledges with relief of greater than a meter (Television Line 5, Fix 76). Small patches of coarse grained sand were present in the majority of the hard bottom in many areas. A dense epifaunal cover often interfered with the visual recognition of exposed rock and in most cases it was assumed that the epifauna were attached to a hard substrate. Bare rock in the form of small ledges was observed most frequently at the shelf break on all television lines and the emergent hard bottom areas on Television Lines 4 and 5. Photograph D (page 67) shows the attached epifauna on the extremely low relief hard substrate with interfingering patches of sand. Photograph E (page 67) is an example of the rubble/talus substrate.

iii) Petrographic Analyses of Dredge Samples - Thirteen samples were dredged from James Island Area, Block 380 and identified as belonging to five major lithologic types as shown in Table 6. A description of each sample is presented in Appendix C. None of the lithic samples exceeded 10 to 15 centimeters in diameter or showed marked fracture surfaces. The rock was weathered in all cases and was covered with a variety of encrusting organisms.

The algal biolithites composed 38 percent of the samples collected in the lease block and as in Block 198 were characterized by irregular dusty brown micrite encrusting masses covering various bioclastic and quartz grains. The general matrix of the rocks was biomicrite with micritic bioclasts. Small dolomite rhombs were noted in the samples from Stations 108 and 110. Scattered sand and silt size quartz grains were often in patches and clumps surrounded by micritic envelopes which suggests some intermixture of interclasts from various sources prior to the algal encrustation. Insoluble residues of the sample from Station 108 were 12 percent by weight.

Twenty-three percent of the samples collected in Block 380 were

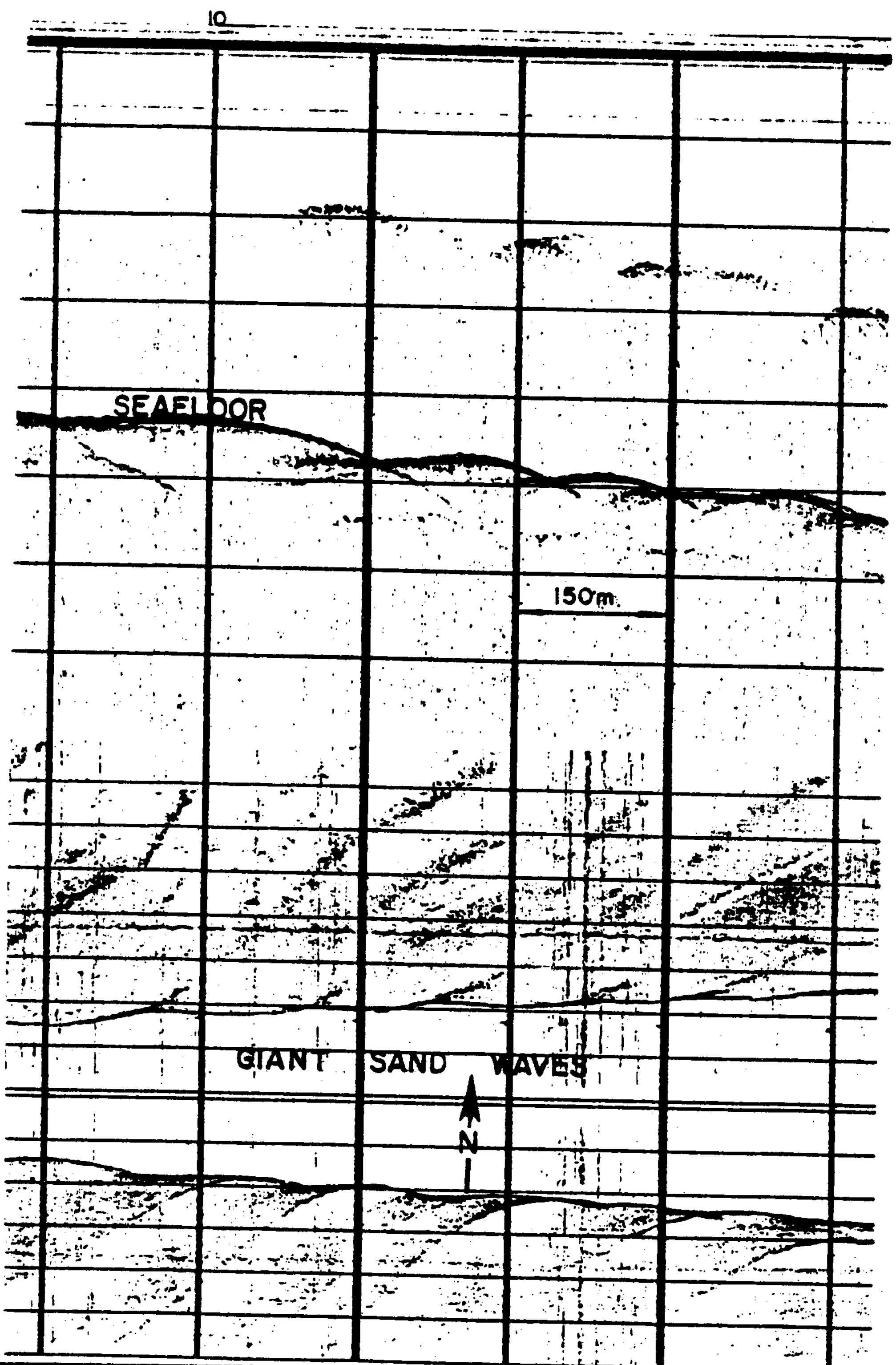



FIGURE: 23 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 120, JAMES ISLAND AREA, BLOCK 380

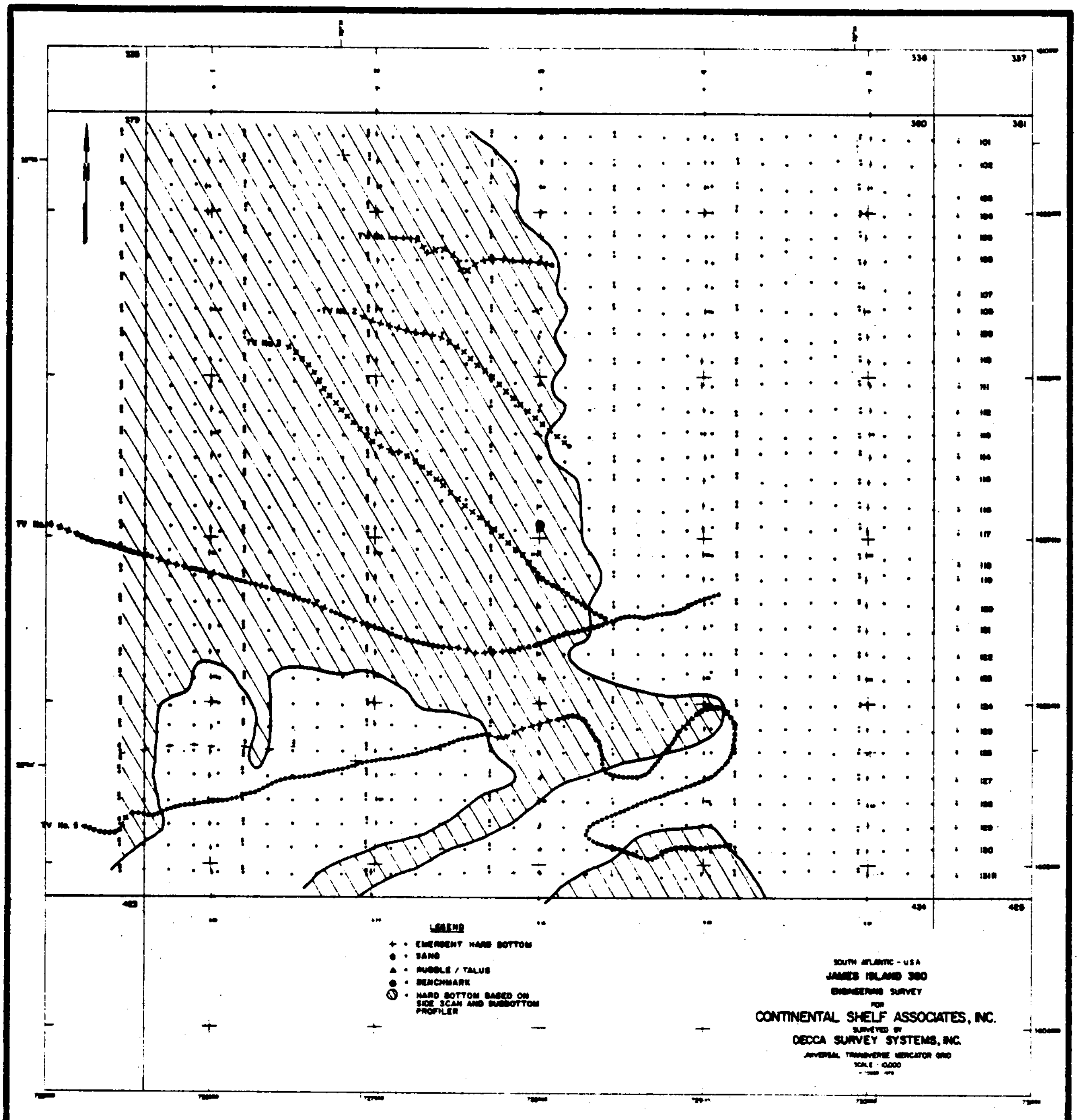



FIGURE: 24 GEOPHYSICALLY DEFINED HARD BOTTOM AREAS WITH SUBSTRATE TYPES BASED ON TELEVISION AND STILL CAMERA OBSERVATIONS IN JAMES ISLAND AREA, BLOCK 380

Table 6. Lithologic sample types dredged in James Island Area, Block 380.

| Station | Dredge* | Water Depth (m) | Sandstone | Biomicrite | Sandy Biomicrite | Biolithite | Algal Biolithite |
|---|---|---|---|---|---|---|---|
| 101 | B | 95-100 | X | - | - | - | X |
| 102 | B | 95-98 | - | - | - | - | - |
| 104 | B | 72-79 | - | - | - | - | X |
| 105 | B | 60-61 | - | - | - | - | X |
| 106 | B | 48-51 | - | X | - | - | - |
| 108 | B | 57-62 | - | - | - | - | X |
| 110 | B | 62-64 | - | - | - | - | X |
| 111 | B | 79-82 | - | X | - | - | - |
| 113 | B | 96-98 | - | - | X | - | - |
| 117 | B | 47-49 | - | - | - | X | - |
| 120 | B | 53-55 | - | - | X | - | - |
| 121 | B | 64-69 | - | X | - | - | - |
| 122 | B | 49-54 | X | - | - | - | - |

*B = Biological Dredge

biomicrites. Insoluble residues of 8 and 4 percent by weight were determined for samples from Stations 106 and 111. Pelecypod, serpulid worm tube and red algal fragments were the most frequently encountered large bioclasts. The smaller bioclasts were similar to those described for Block 198. Pellets or pelletoid grains were present in patches, particularly in the sample from Station 111 which may more properly be classified as a biopelmicrite.

Two samples of sandy biomicrite were identified from Block 380. Insoluble residues were 39 percent by weight in the sample from Station 113. The samples were composed of medium to coarse grained quartz sand mixed with unaltered and micritized bioclasts in micrite ground mass. The sample from Station 113 had little porosity while the sample from Station 120 had scattered patchy porosity.

Two sandstone samples were identified from the material collected in Block 380. The sample from Station 102 was composed of a large grained quartz sand with rounded bioclasts and occasional micritic pellets cemented by micritic calcite. The sample from Station 122 was of medium grained sand, pellets, and micritized bioclasts in a fine grained sparry calcite matrix.

The single biolithite was mainly an unaltered serpulid worm colony with occasional sand size quartz grains and less frequent microcline grains and pellets trapped inside. The voids in the colony were lined with minor amounts of acicular calcite.

## 2. BENTHIC FAUNAL POPULATIONS

Appendix E lists the taxa identified from each of the 20 successful biological dredge tows and a few selected taxa from the single rock dredge sample collected in Block 380 while Appendix D gives a phylogenetic listing of the identified taxa. Two hundred and fourteen taxa exclusive of fishes were identified from the dredge samples. Decapods (52 taxa), mollusks (43 taxa), sponges (29 taxa), echinoderms (28 taxa), anthozoans (25 taxa), and bryozoans (13 taxa) dominated the samples as to the numbers of identified taxa. Table 7 lists the dominant species collected in the biological dredges in terms of number of occurrences within the 20 dredges. Eighteen species were identified from ten or more stations, 63 species at five or more stations, and 140 of the total of 214 taxa occurred at two stations or more. Both anthozoans and echinoderms had four species represented in the eighteen species that occurred at ten or more stations, while decapods had three species, and bryozoans and polychaetes two species each.

Figure 25 shows the approximate distributions of five biological assemblages that were recognized during review of the television videotapes and still camera photographs. The assemblages seem to be substrate and depth dependent and are based on the largest and most easily recognizable fauna. The identifications were made using the specimens from the dredge samples as reference.

Assemblage D was dominated both in terms of numbers and biomass by the colonial epibenthic polychaeta *Phyllochaetopterus socialis*. The red algae *Peysonnelia rubra* which was observed among the chitonous polychaete tubes was also very abundant. A number of anthozoans (Anthothelidae sp., *Ellisella* sp., and *Telesto sanguinea*), echinoderms (*Astropyga magnifica* and *Lytechinus variegatus*), and sponges

Table 7. Invertebrate species collected from ten or more of the twenty biological dredge stations within James Island Area, Block 380.

| Species | Number of Occurrences |
|---|---|
| *Comactinia* sp - crinoid | 18 |
| Anthothelidae sp. - anthozoan | 15 |
| *Ophiothrix angulata* - echinoderm | 15 |
| *Micropanope sculptipes* - decapod | 14 |
| *Phyllochaetopterus socialis* - polychaete | 14 |
| *Arca zebra* - bivalve | 13 |
| *Ellisella* sp. - anthozoan | 13 |
| *Filograna implexa* - polychaete | 13 |
| *Palicus* sp. - decapod | 13 |
| *Eucidaris tribuloides* - echinoderm | 12 |
| *Peyssonnelia rubra* - algae | 12 |
| *Asteroporpa annulata* - echinoderm | 11 |
| *Telesto sanguinea* - anthozoan | 11 |
| *Cladocora arbuscula* - anthozoan | 11 |
| *Hippopetraliella bisinuata* - bryozoan | 10 |
| *Stylocidaris affinis* - echinoderm | 10 |
| *Smittipora levenseni* - bryozoan | 10 |
| *Podochela gracilipes* - decapod | 10 |

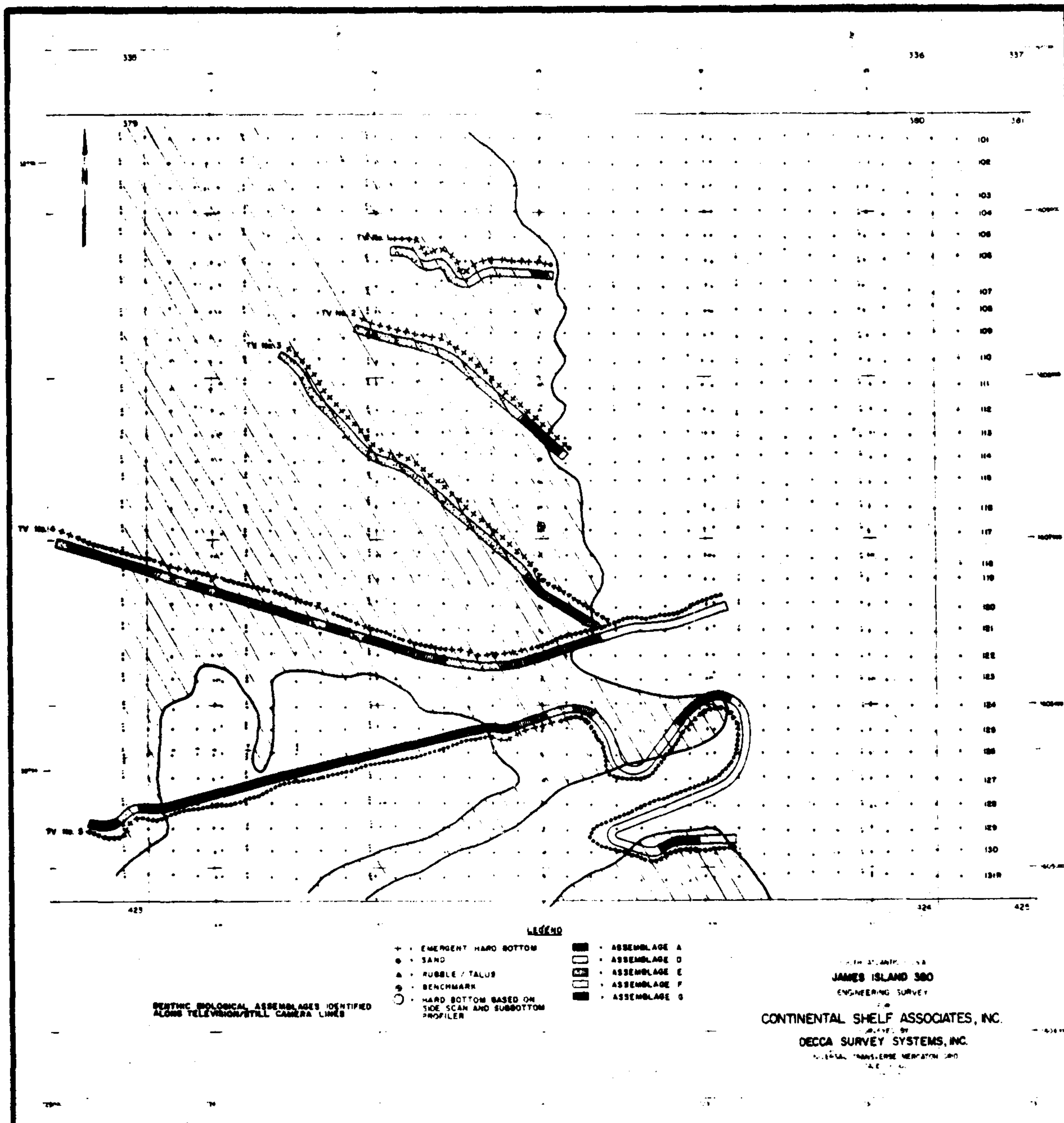
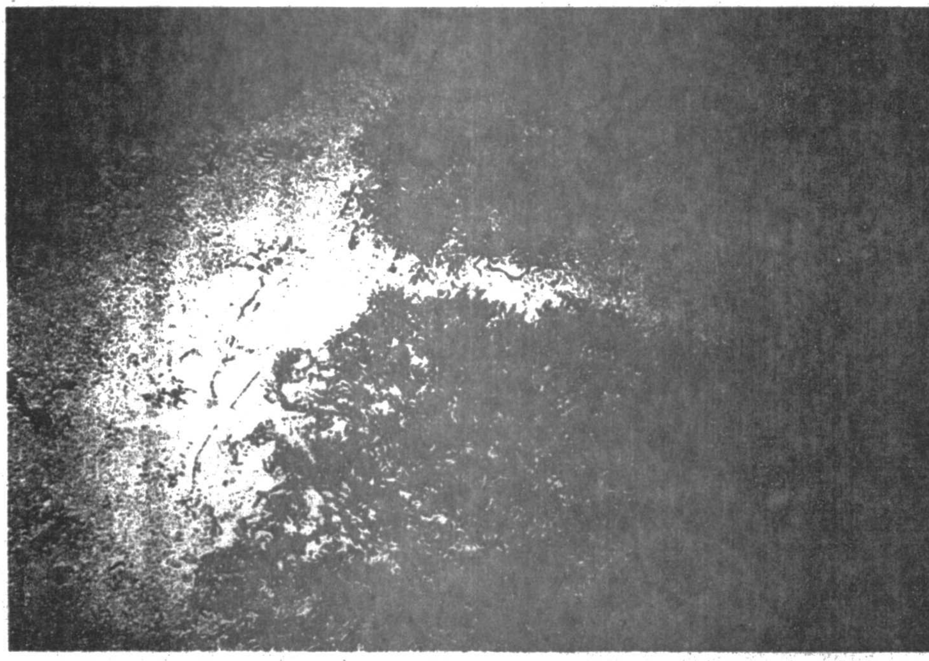



FIGURE: 25 BENTHIC BIOLOGICAL ASSEMBLAGES IDENTIFIED ALONG TELEVISION /STILL CAMERA LINES IN JAMES ISLAND AREA, BLOCK 380 were also frequently observed among the polychaete tubes. The colonial polychaete *Filograna implexa* was occasionally identified. As Photograph D shows, the polychaete *Phyllochaetopterus socialis* was often bordered by coarse sand and the sand was often observed between the individual chitinous tubes. Assemblage D was primarily observed in water depths shallower than 65 meters along Television Lines 1, 2 and 3 with scattered occurrences on Lines 4 and 5. Low relief rock which was apparently frequently covered with a thin veneer of sand appeared to be the most common habitat for *P. socialis* although the polychaete was also observed on rubble/talus and rock outcrops which had reliefs of up to one meter.

Assemblage E was differentiated from D by a reduced quantity of *P. socialis* and associated species and a large number of crinoids (*Comactinia* sp.) as shown in Photograph E. Sponges and coralline algae were also present on the rubble/talus and rock ledges at the shelf break where Assemblage E was predominately observed. The assemblage seemed to be present in depths of 65 to 85 meters though exceptions did exist particularly along Television Line 4 where the number of crinoids was reduced and sponges and the algae *Peyssonnelia rubra* appeared to be more numerous. The crinoid appeared to be more commonly associated with the rubble/talus substrate than the rock ledges though this might have been a function of depth rather than substrate. At depths exceeding approximately 85 meters the rubble/talus areas were rarely observed and sand with what appeared to be extensive populations of sabellid polychaetes were seen. This assemblage (Assemblage F) was not sampled because it occurred on a soft bottom. A soft sand bottom with little epifauna other than the sea pen (*Virgularia presbytes*) at Fixes 14 to 22 was observed on Television Line 5, Fixes 14 to 50 (Assemblage A).

Assemblage G was confined to Television Line 5 (Fixes 74-78, 108-112) in depths of approximately 92 to 105 meters. The assemblage, which had a lower biomass than Assemblages D or E, was dominated by Gorgonacea sp. 2 as shown in Photograph F. Crinoids and a few other unidentified gorgonians were also observed clinging to the emergent hard bottom.

Clustering analysis using the 63 taxa that were identified from five or more of the 20 stations distinguished two groups of stations using both the Jaccard and Czekanowski coefficients. Figure 26 shows the station-group dendrogram produced by the Czekanowski coefficient. Examination of the groupings and a two-way table of stations and species indicated that Group I (Stations 101, 102, 104, 105 and 112) was composed of stations which had the fewest number of the 63 taxa present. All five stations of Group I were from Television Line 5. The dredge tows at Stations 104 and 112 were relatively short (41 and 35 meters) because the dredge hung on the rough bottom and this probably accounted for the small number of species collected. Station 105 had a larger number of identified taxa than the other Group I Stations and a fewer number than the remaining Group II Stations. It therefore may be more correct to consider that station separately from both groups. Although the dendrogram indicated that Stations 106, 107 and 108 should be differentiated from Group II, the two-way table showed this to be a rather arbitrary grouping. The qualitative samples collected by the dredge were not sufficient to adequately differentiate Assemblage D from E though Assemblage G (Group I) was



**Photograph D.** A polychaete (*Phyllochaetopterus socialis*)/ algae (*Peyssonnelia rubra*) assemblage (Assemblage D) within James Island Area, Block 380. The asteroid *Narcissia trigonaria* and the scorpionfish *Scorpaena* sp. are also visible members of this assemblage.

**Photograph E.** Crinoids (*Comactinia* sp.) and a gorgonacephalan basketstar on rubble/talus substrate within James Island Area, Block 380.

Photograph F. Hard bottom dominated by Gorgonacea sp. 2 at approximately 100 meters depth within James Island Area, Block 380.

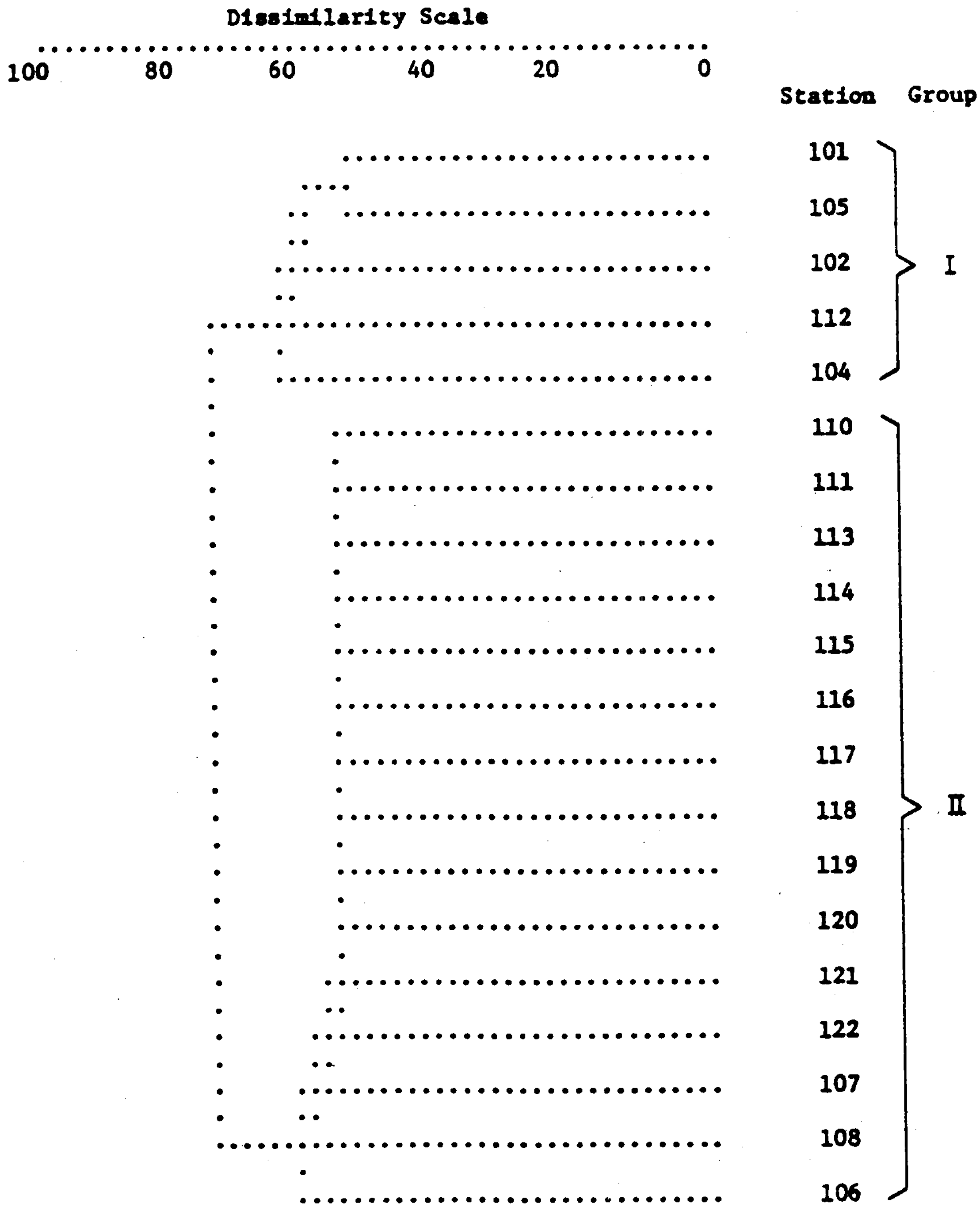



FIGURE: 26 STATION-GROUP DENDROGRAM FOR JAMES ISLAND AREA, BLOCK 380 BASED ON 63 TAXA AND PRODUCED BY THE CZEKANOWSKI SIMILARITY COEFFICIENT AND FLEXIBLE SORTING

indicated because of the absence of a number of taxa. Assemblages D and E were based on changes in the numerical dominance of a few species which presence/absence data could not detect. Assemblage G was differentiated because of the numerical dominance of Gorgonacea sp. 2 and the absence of a larger number of species. Clustering analysis was able to detect the absence of species in Assemblage G.

No distinct species groupings were produced by the clustering analysis by either similarity coefficients as the species chained together (as in Figures 26, Stations 110 through 120) with no differences in their dissimilarity values. Those species having similar numbers of occurrences at the sampled stations appeared closest together in the dendrogram.

### 3. DEMERSAL FISH POPULATIONS

Twenty-four (24) species of fish were identified from James Island Area, Block 380 as shown in Table 8. Eleven species were collected from dredge samples and are also listed in Appendices D and E while sixteen were identified from still photographs. Only three species collected by the dredging operation were identified from underwater photographs. The majority of the species collected by dredging were smaller benthic forms which apparently utilized the bottom for protection. Photographically identified fishes were most often larger specimens capable of avoiding the dredge. The majority of visually identified fishes were observed near emergent hard bottom. Among these were individual sea bass (*Centropristis* sp.), bigeye (*Priacanthus arenatus*), and scorpionfish (*Scorpaena* sp.). Bigeye in particular were found at locations where protective crevices existed. Small patches of rock on otherwise open sand bottom were often surrounded by several (4-6) yellowtail reeffish (*Chromis enchyrsurus*) and one or two bigeye. Several species of fish that are characteristically associated with warm waters were seen near emergent hard bottom areas. These included blue angelfish (*Holacanthus bermudensis*), squirrelfish (*Holocentrus* sp.), twospot cardinal fish (*Apogon pseudomaculatus*), bank butterflyfish (*Chaetodon aya*), reef butterflyfish (*Chaetodon sedentarius*), and spotted moray eel (*Gymnothorax moringa*).

Amberjack (a school of 6 to 8), flounder, and tattler were fishes observed over sand bottom areas. The records from the Raytheon depth recorder showed scattered fish signatures near the bottom in the shallow portion of Block 380. The records from the Ross depth recorder showed no fish signatures though this was more likely due to a lack of sensitivity in the recorder than an absence of fish.

## C. JAMES ISLAND AREA, BLOCK 463

### 1. HARD BOTTOM IDENTIFICATION AND MAPPING

#### a) Navigation

Figure 27 shows the bathymetric and geophysical navigation base

Table 8. Species of fish collected or observed in James Island Area, Block 380.

| Species | Habitat* | Dredge Sample | Visually Observed |
|---|---|---|---|
| *Antennarius* sp. - frogfish | D | X | |
| *Apogon pseudomaculatus* - twospot cardinalfish | D | | X |
| *Centropristis ocyurus* - bank sea bass | D | | X |
| *Centropristis striata* - black sea bass | D | | X |
| *Chaetodon aya* - bank butterflyfish | D | | X |
| *Chaetodon sedentarius* - reef butterflyfish | D | | X |
| *Chromis enchrysurus* - yellowtail reeffish | D | X | X |
| *Emblemaria atlantica* - deepwater blenny | D | X | |
| *Gymnothorax moringa* - spotted moray eel | D | | X |
| *Haemulon aurolineatum* - tomtate | D | | X |
| *Halichoeres* sp. - wrasse | D | X | |
| *Holocanthus bermudensis* - blue angelfish | D | | X |
| *Holanthius martiniensis* ** | D | X | |
| *Holocentrus* sp. - squirrelfish | D | | X |
| *Mycteroperca* sp. - grouper | D | | X |
| *Plectranthias garrupellus*** | D | X | |
| *Pontinus* sp. - scorpionfish | D | X | |
| *Priacanthus arenatus* - bigeye | D | | X |
| *Scorpaena dispar* - hunchback scorpionfish | D | X | |
| *Scorpaena* sp. - scorpionfish | D | X | X |
| *Seriola dumerili* - greater amberjack | P | | X |
| *Serranus phoebe* - tattler | D | X | X |
| *Synacium* sp. - flounder | D | | X |
| *Synodus synodus* - red lizardfish | D | X | |

* D = Demersal
  P = Pelagic
** new continental record

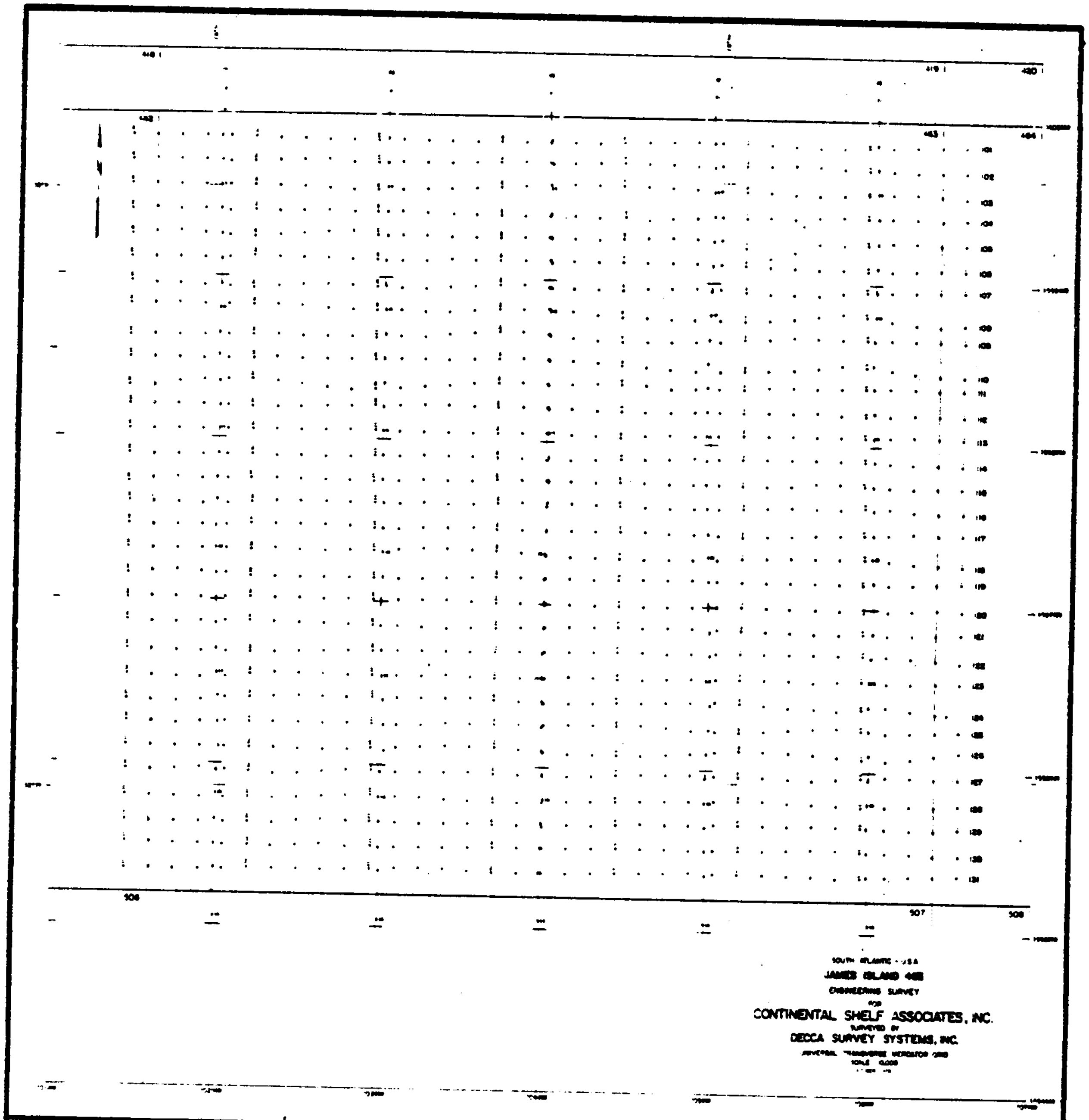



FIGURE: 27 NAVIGATION BASE MAP OF JAMES ISLAND AREA, BLOCK 463

map of James Island Area, Block 463. The nomenclature used on the map is identical to that previously described for the navigation base map of Block 198. Figure 28 shows the locations of the five television/still camera survey lines (numbered 2 through 6) in the lease block with position fixes recorded every minute and the 25 dredge tows conducted within the lease block.

Appendix B lists the observed coordinates, UTM grid coordinates, latitude and longitude for the benchmark location, deployment and retrieval position fixes of the television/still camera system at the starts and ends of the survey lines, and the position fixes at the beginnings and ends of the dredge tows.

b) Bathymetry

The depth of water within Block 463 varies from a minimum of 44 meters to a maximum of 78 meters as shown in Figure 29. The seafloor dips to the southeast, but not at a uniform rate since there are several anomalous areas in the lease block. There was an elongated high closure (elevation) observed between Lines 114 and 115 at Shotpoints 31 to 34 and a small, low closed area (depression) between Lines 116 and 117 at Shotpoint 33. A northeasterly-trending trough has its axis on a line extending from Shotpoint 22 on Line 2 to Shotpoint 21 on Line 115. There is a low area on Lines 103 and 104 extending from Shotpoint 9 to Shotpoint 19. An easterly deepening trough has its axis extending from Shotpoint 13 on Line 108 through Shotpoint 11 on Line 5 and then through the east line of the block. A southwesterly deepening ridge has its axis on a line lying between Shotpoint 10 on Line 115 and Shotpoint 26 on Line 2. There are small pinnacles associated with this ridge between Shotpoints 28 and 29 on Line 3. There is a very steep southeasterly dip between Shotpoints 27 and 29 on Line 5 that continues southwesterly. This same condition exists on Line 4 near Shotpoint 26.

The sonar records indicated on Line 123 between Shotpoints 15 and 18 numerous small anomalies. These areas continue in a southerly direction to Line 127 and are shown in Figure 31 as an area of irregular terrain. The sonograms also showed small pinnacles on Line 118 between Shotpoints 7 and 10.

c) Geological and Geophysical Observations

i) Side Scan and Subbottom Data - Figure 30 shows the results of the onboard interpretation of the side scan sonar and subbottom profiler records from James Island Area, Block 463. The map was prepared so that visual observations would be conducted in areas of suspected emergent hard bottom. The laboratory interpretation of the geophysical data is presented in Figures 31 and 32 which depict the surficial geology within Block 463. A shallow isopach and related subbottom anomalies map was not drawn for Block 463 because of the thickness of the overlying sediments and a lack of penetration by the subbottom profiler. The lack of penetration was caused by the high seismic attentuation of the overlying sediments. Figure 31 presents the distribution of hard bottom and sediments while Figure 32 outlines the areas of outcrop of a strong subbottom reflector. The two maps indicate a direct correlation between hard

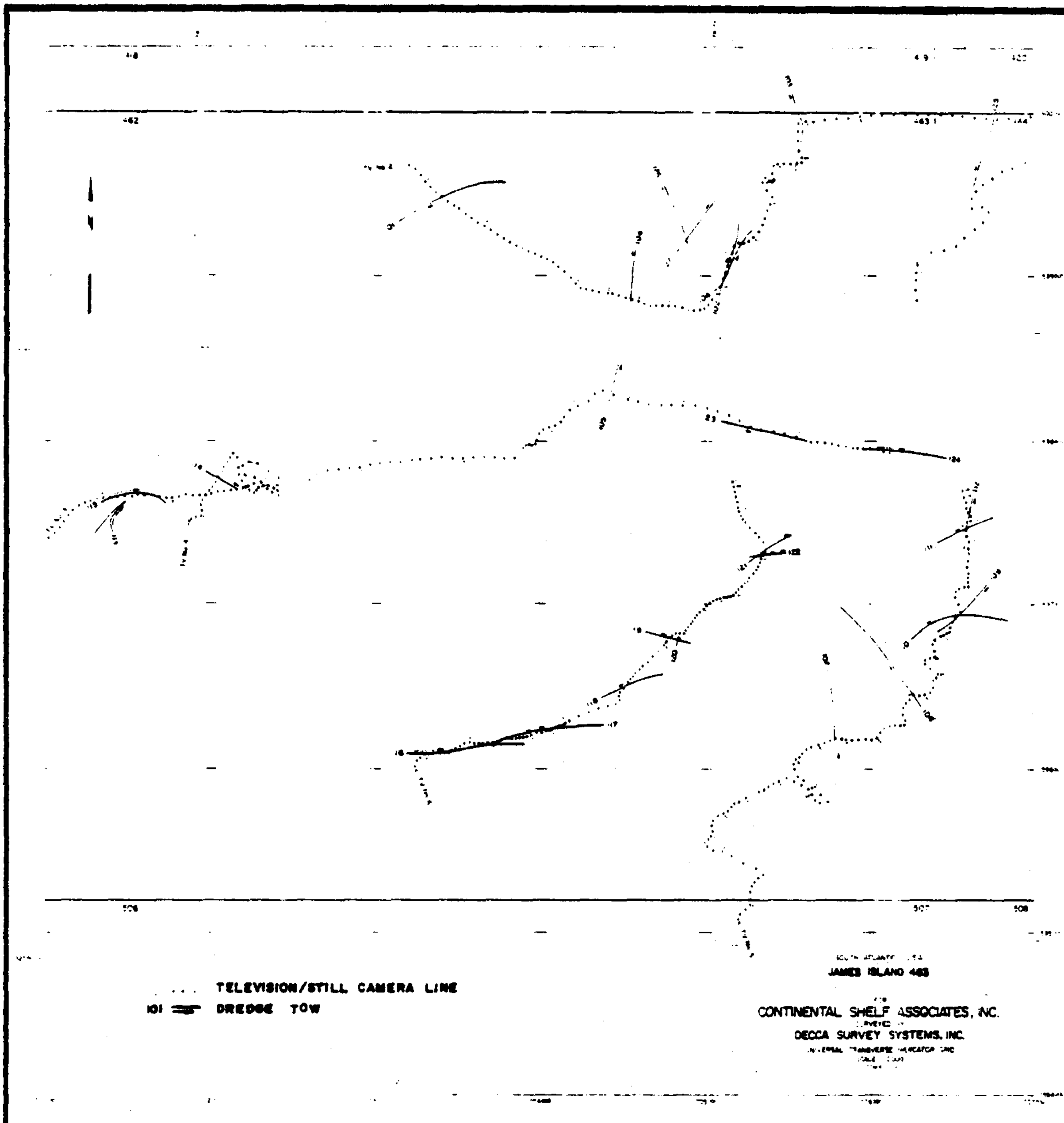



FIGURE: 28 NAVIGATION MAP SHOWING TELEVISION/STILL CAMERA LINES AND DREDGE TOWS CONDUCTED WITHIN JAMES ISLAND AREA, BLOCK 463

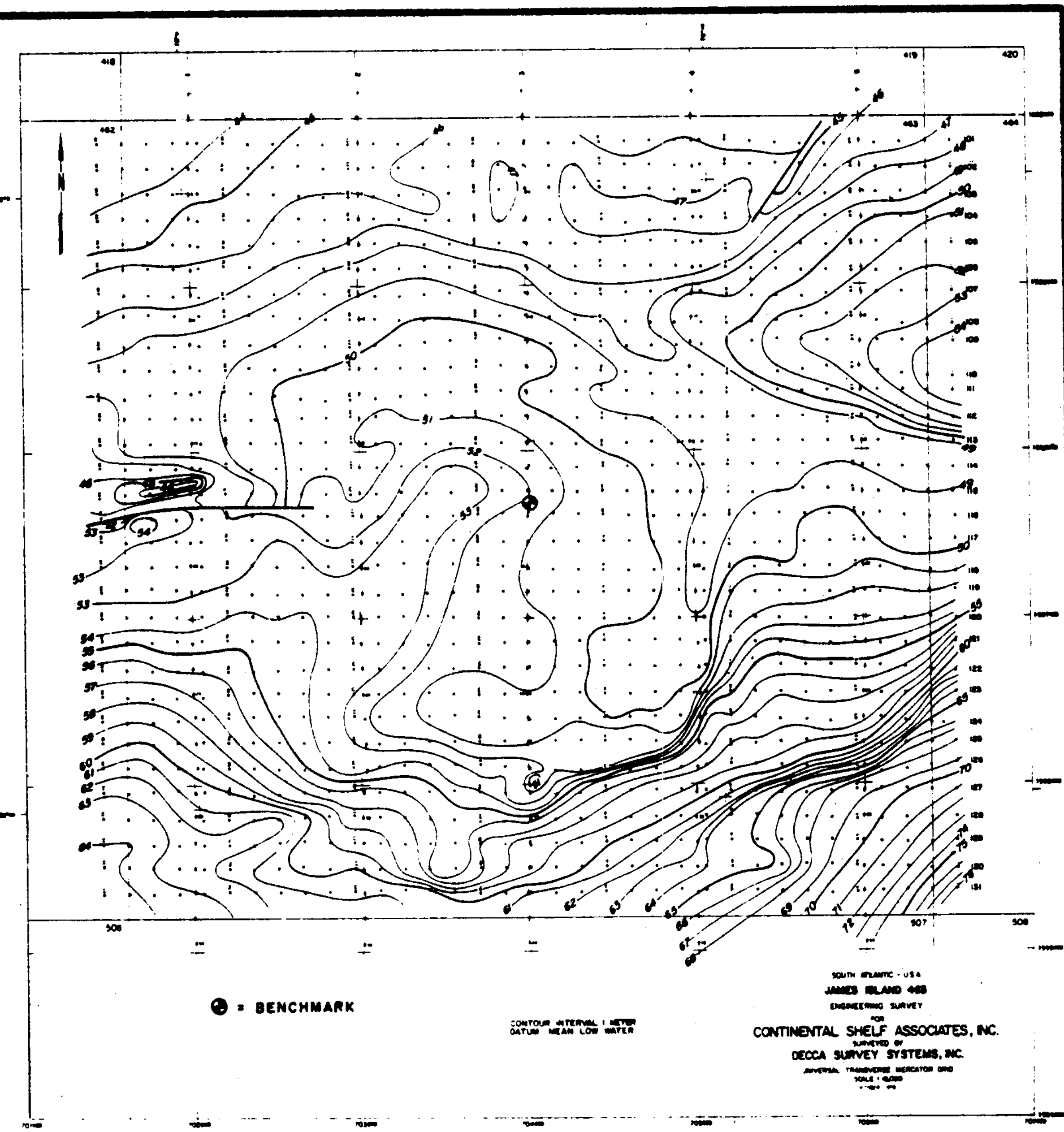
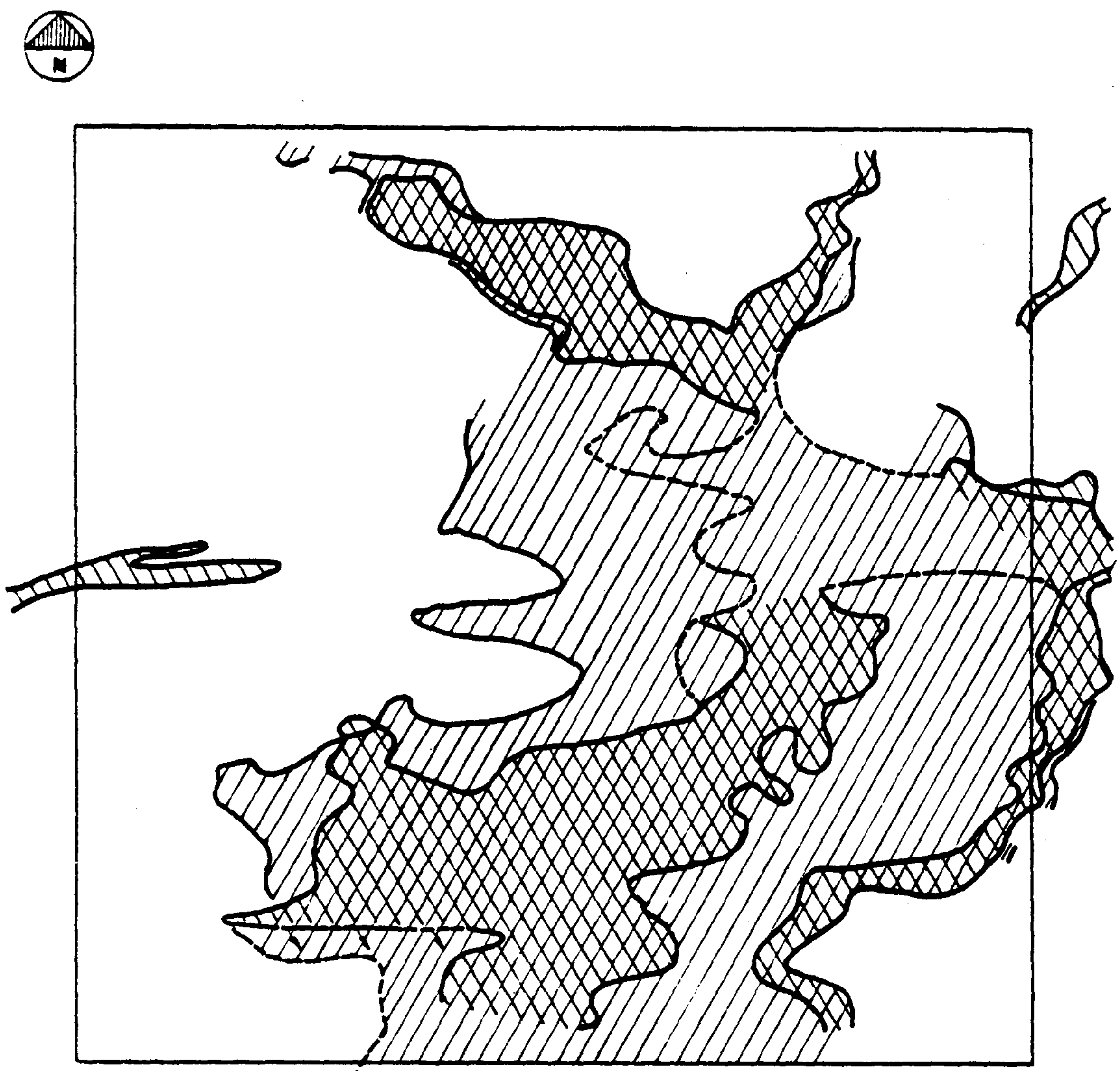



FIGURE: 39 BATHYMETRY OF JAMES ISLAND AREA, BLOCK 463



LEGEND

= HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR

= POSSIBLE HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR

= REFLECTOR OUTCROP AS INDICATED BY SUBBOTTOM PROFILER

FIGURE: 30 HARD BOTTOM AREAS BASED ON SHIPBOARD INTERPRETATION OF GEOPHYSICAL DATA COLLECTED WITHIN JAMES ISLAND AREA, BLOCK 463

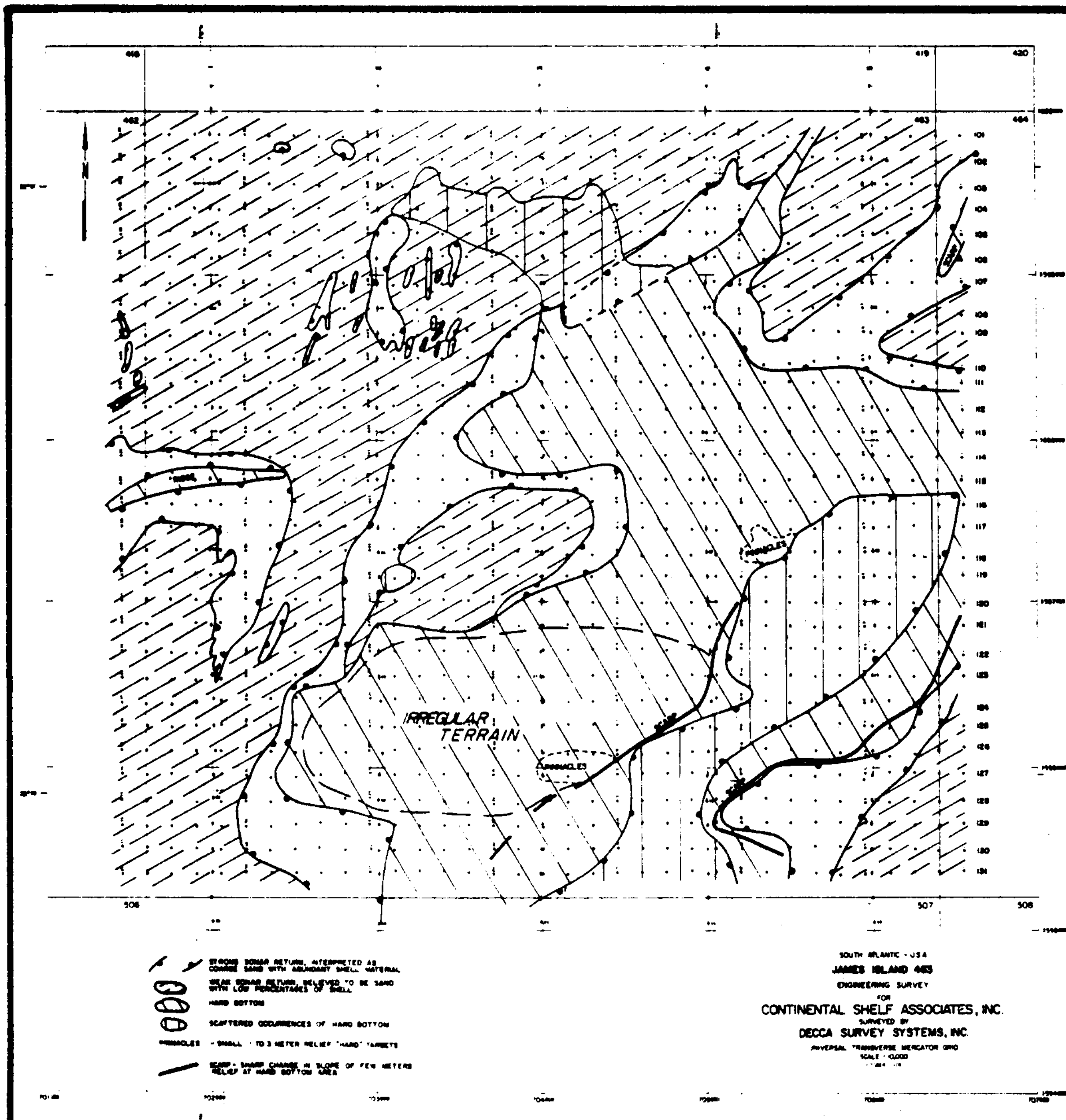



**FIGURE: 31 SURFICIAL GEOLOGY OF JAMES ISLAND AREA, BLOCK 463 BASED ON SIDE SCAN SONAR AND SUBBOTTOM PROFILER DATA (PART I)**

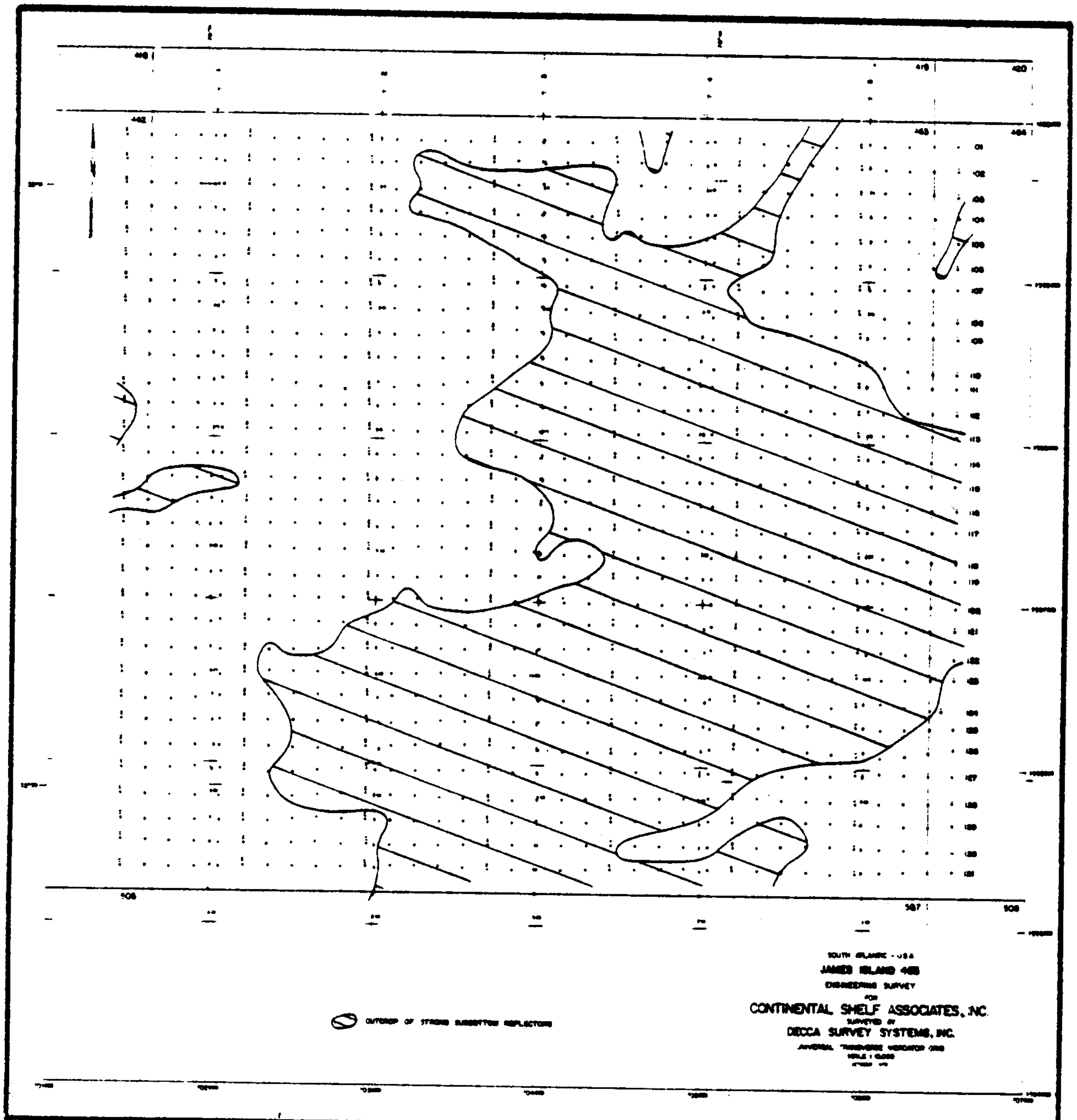



FIGURE: 32 SURFICIAL GEOLOGY OF JAMES ISLAND AREA, BLOCK 463 BASED ON SIDE SCAN SONAR AND SUBBOTTOM PROFILER DATA (PART II) bottom and the outcrop of the reflector, though a few exceptions exist. The exceptions are on the borders of the hard bottom area in the northern half of the block where it appears that the sediment has encroached on the area covering the outcrop with a thin veneer of sediment.

The most pronounced hard bottom areas occur as a series of scarps located mainly in the eastern half of the block. Figure 33 illustrates the northern-most extension of the main hard bottom area. As shown in the figure, the northeast-southwest trending scarp, which has an overall relief of approximately four meters, exhibits an asymmetrical profile with the steepest slopes facing west. The scarp loses its relief to the south and blends into a larger area of hard bottom. The hard bottom becomes very extensive throughout the eastern half of the block and is evident as a slightly irregular seafloor which becomes a seafloor rise to the south. Just south of Line 118 this rise has a sharp eastern face which extends almost the rest of the way through the block. A slight trough composed of a thin veneer of coarse sand and shell with occasional hard bottom development occurs eastward of this ridge. The trough's eastern edge is bounded by another scarp and associated hard bottom. The trend of these features is roughly northeast-southwest.

The hard bottom areas excluding the scarps appear on side scan records as rugged and broken terrain (protruding through a veneer of coarse sediment). This is especially true in the southern area. Pinnacle-like structures are evident throughout much of the area mapped as "irregular terrain" on Figure 31, but are usually less than one meter in height. Two areas of structures up to three meters in height (see Figure 34) are plotted in Figure 31 as "pinnacles".

The hard bottom area is surrounded by coarse (highly reflective) sediment over most of the lease block that is believed to be sand with a high percentage of shell material. To the west and north are extensive areas of sediment with lower acoustic reflectivity which was interpreted as a fine sand with little shell material, and possibly containing some silt/clay fraction. This fine sediment blankets an outcrop area in the extreme north-central portion of the block. The thickness of the sediment is estimated to be only a few centimeters and occasional patches of hard bottom are apparent.

The highest relief feature within Block 463 is a scarp located in the west-central portion of the block that trends approximately east-west. Figure 35 depicts the south face of this scarp which has a relief of approximately eight meters. A secondary ridge with five meters of relief is present to the north of the south face of the scarp. A veneer of coarse sediment surrounds the feature and is probably composed of debris from the scarp.

ii) Television and Still Camera Observations - Figure 36 shows the geographic extent of the hard bottom that was mapped by interpreting the side scan sonar and subbottom profiler data. Areas of emergent hard bottom, rubble/talus, and sand as observed from videotapes and photographs are also depicted in Figure 36. Emergent hard bottom was visually observed only in the geophysically defined hard bottom areas or immediately contiguous areas. However, sand and rubble/talus were also observed over a large area of the geo-

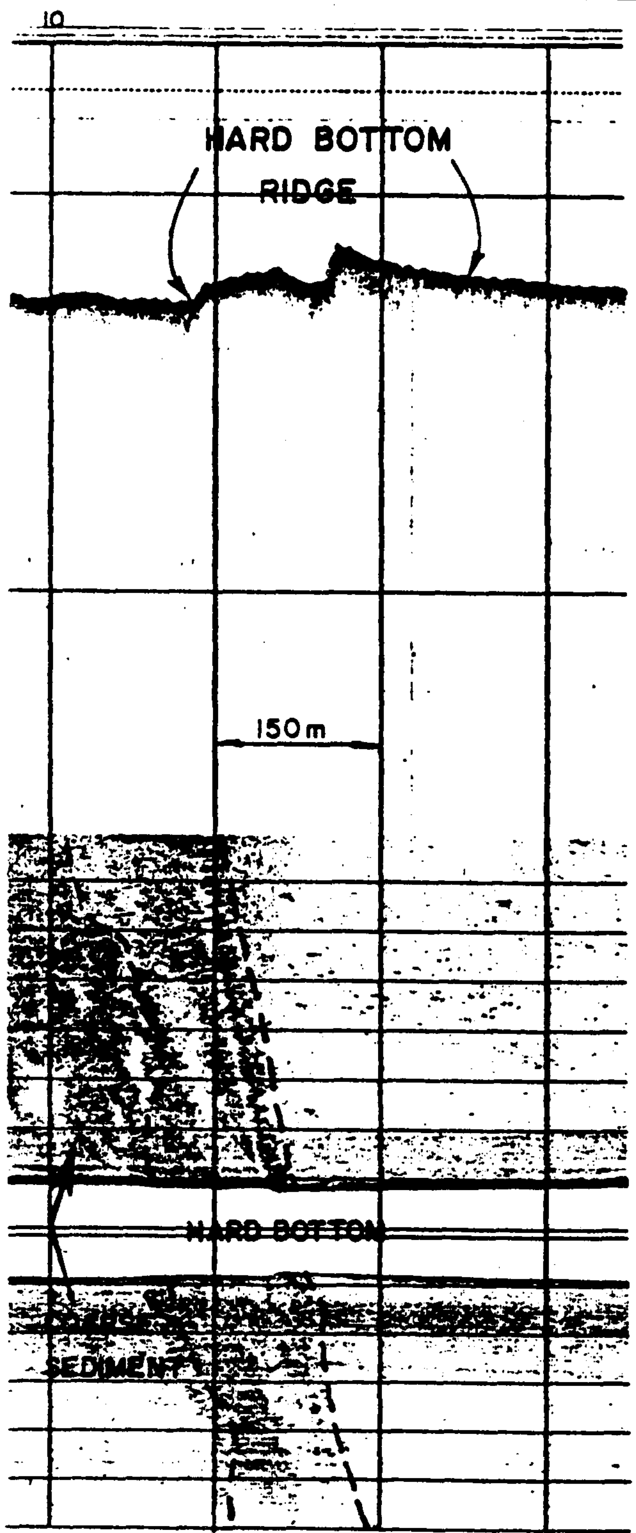



FIGURE: 33 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 103, JAMES ISLAND AREA, BLOCK 463

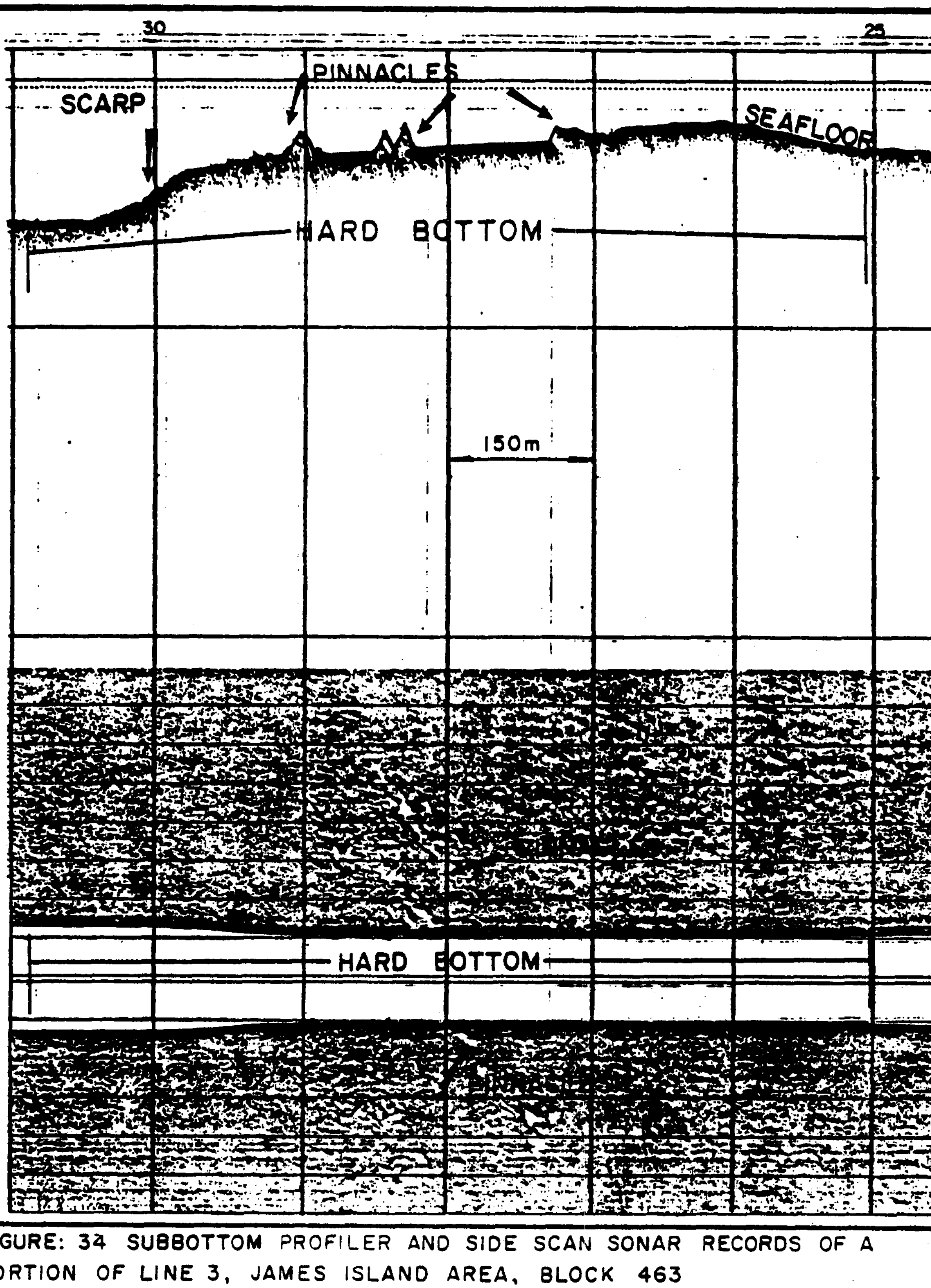



FIGURE: 34 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 3, JAMES ISLAND AREA, BLOCK 463

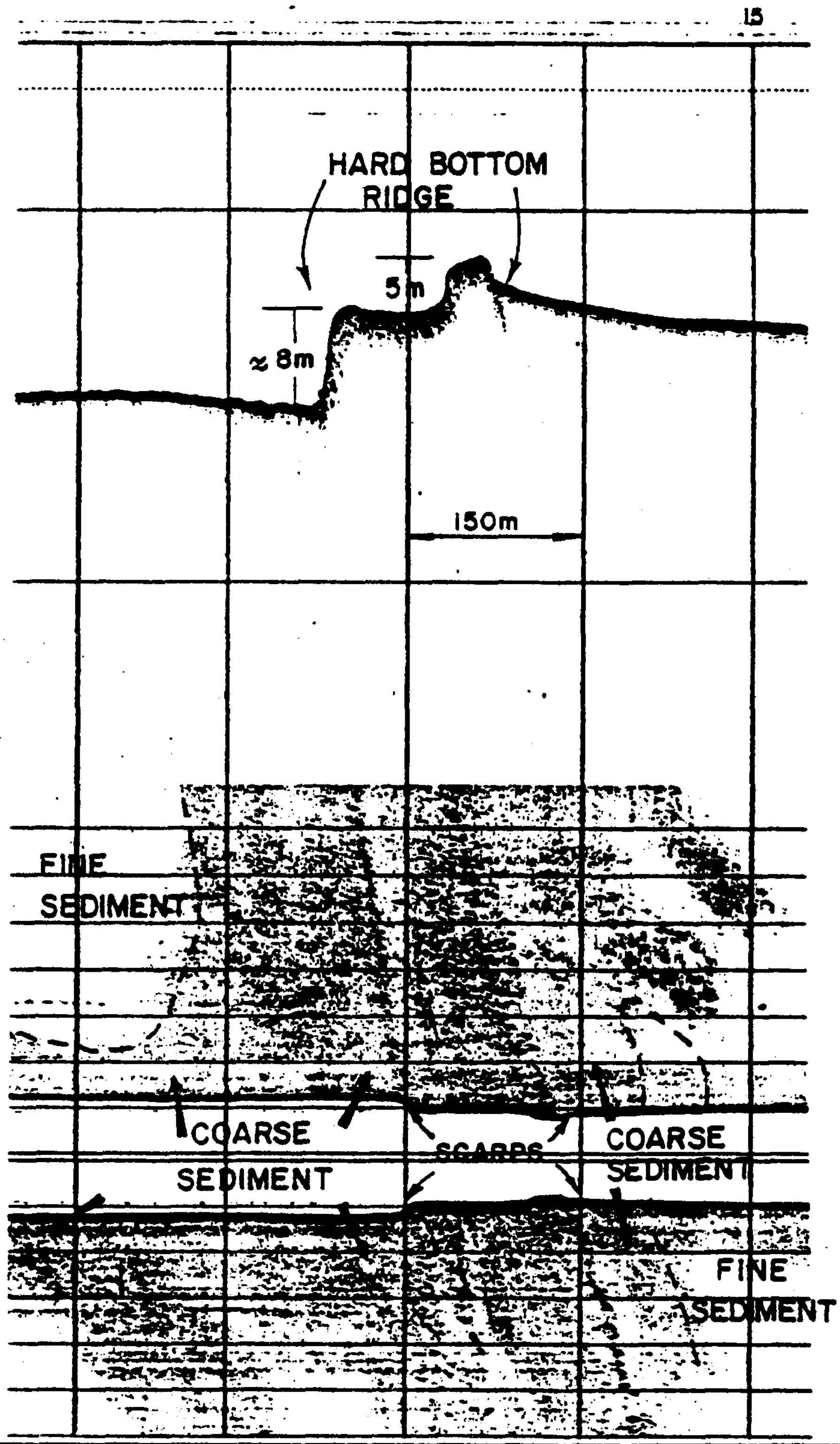



FIGURE: 35 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 1, JAMES ISLAND AREA, BLOCK 463

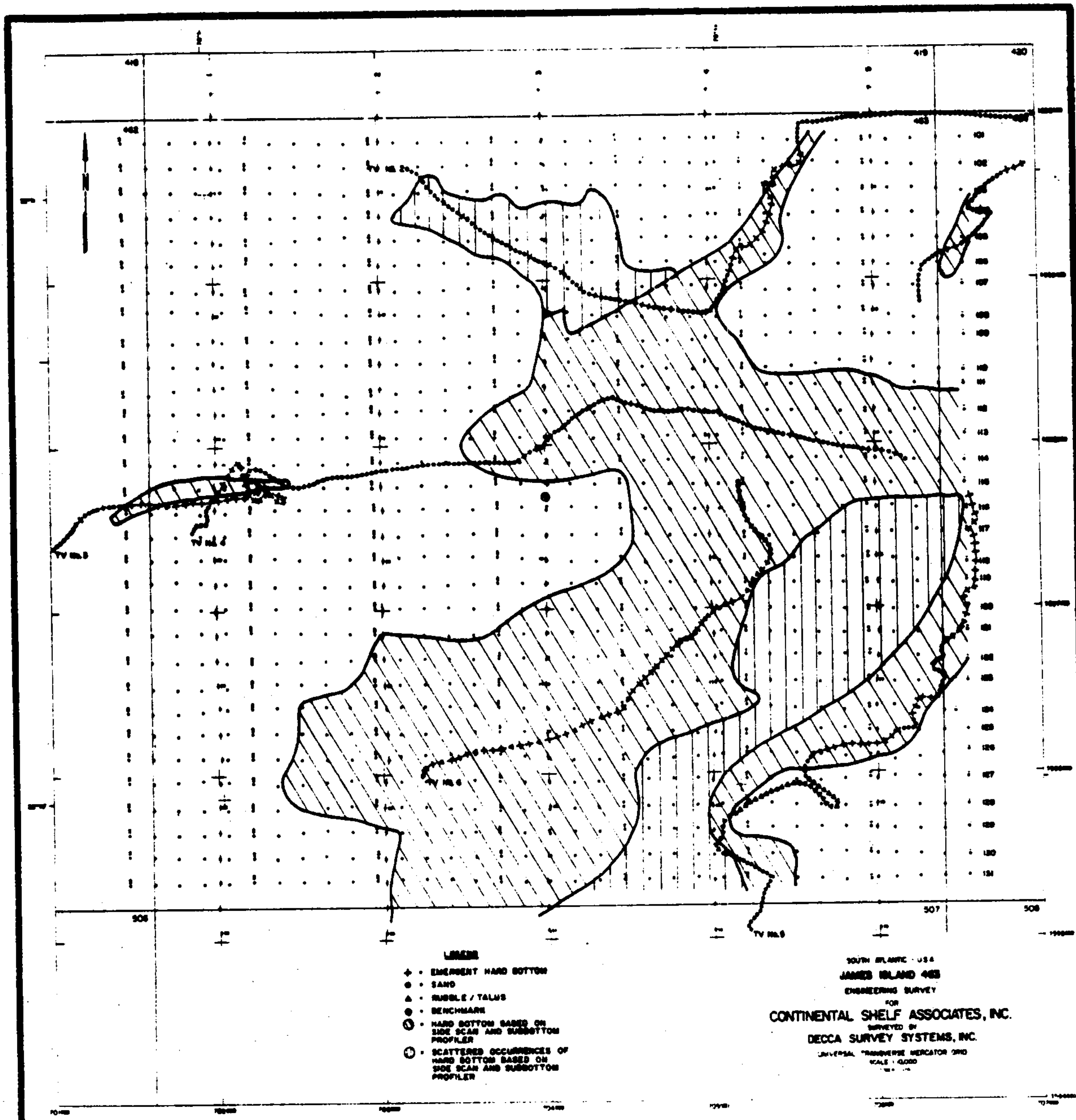



FIGURE: 36 GEOPHYSICALLY DEFINED HARD BOTTOM AREAS WITH SUBSTRATE TYPES BASED ON TELEVISION AND STILL CAMERA OBSERVATIONS IN JAMES ISLAND AREA, BLOCK 463

physically defined hard bottom.

Scattered small outcrops typically one to three meters in diameter and with less than 0.5 meters of relief were observed emerging from the sand substrate along Television Line 2 from Fixes 2 to 60 (see Photograph M, page 92 ). From Fixes 60 to 88 along Television Line 2, emergent rock of less than one meter relief dominated with occasional sand patches noted. Emergent hard bottom was also noted on the previously described scarp located between Fixes 113 to 130 on Television Line 2. The ridge which was crossed by Television Lines 3 and 4 was predominantly rock. The relief on the top of the ridge was less than 0.5 meters and the hard bottom was covered with sand in many areas. The area bordering the southern face of the ridge had outcrops of up to one meter. Small scattered low relief outcrops were also observed on Television Line 4, Fixes 65 to 115. Television Lines 5 and 6 had more rubble/talus areas as shown in Photograph J (page 90 ) than the other lines. The emergent hard bottom areas along the lines were of low relief (Photograph N, page 92 ) or often covered with a veneer of sand (see Photographs H and J, pages 89 and 90 ).

iii) Petrographic Analyses of Dredge Samples - Thirteen samples were dredged from James Island Area, Block 463 and classified into five major lithologic types as shown in Table 9. A description of each sample is presented in Appendix C. None of the lithic samples exceeded 10 to 15 centimeters in diameter or showed marked fracture surfaces. The rock was weathered in all cases and was covered with a variety of encrusting organisms.

The sandstones comprised 46 percent of the samples collected in the lease block. The clastic components of the sandstones were dominated by subrounded to subangular quartz ranging from medium sand to silt size with the finer size ranges being more angular. The majority of the grains were monocrystalline while microscopic vacuoles, usually in strings, were the most common inclusions in the quartz. A noticeable feature was a relatively low percentage of grains showing strain shadows. Plagioclase feldspar followed by microcline were second in importance to quartz but the feldspars contributed only a few scattered grains to only the finer fractions. In most samples a variable portion of carbonate grains that were recognized as bioclasts, though often micritized, was found with the quartz grains. The most common taxonomically identifiable fragments were pieces of red algae that were usually rounded or subrounded followed by fragments of serpulid worm tubes and mollusks that were platy or irregular in shape. Occasional bryozoan or echinoderm debris was also recognizable. The cementing material or matrix was most typically micritic calcite that was often quite dark in color. Where there were larger particles the matrix was observed to be a fine grained biomicrite with, for the most part, unidentifiable bioclastic material with occasional foraminifera. In the few cases where the cement was fine to medium grained sparry calcite (Stations 102 and 106) the carbonate clasts were rare.

The biomicrite and sandy biomicrite samples were similar to those previously described for Blocks 198 and 380. Bioclasts ranged from medium to small in size with some pellets that were often encrusted with micritic envelopes. Under Folk's (1962) classification

Table 9. Lithologic sample types dredged in James Island Area, Block 463.

| Station | Dredge* | Water Depth (m) | Sandstone | Biomicrite | Sandy Biomicrite | Biolithite | Algal Biolithite |
|---|---|---|---|---|---|---|---|
| 101 | B | 46 | X | - | - | - | - |
| 102 | B | 47-50 | X | - | - | - | - |
| 103 | B | 46 | - | - | X | - | - |
| 104 | B | 46-49 | X | - | - | - | - |
| 105 | B | 47 | X | - | - | - | - |
| 106 | B | 47-48 | X | - | - | - | - |
| 107 | B | 57-58 | - | X | - | - | X |
| 109 | B | 57-59 | - | - | X | - | - |
| 112 | B | 49-52 | - | - | X | - | - |
| 116 | B | 50-51 | - | - | - | X | - |
| 117 | B | 50-51 | - | - | - | - | X |
| 118 | B | 49 | - | - | - | X | - |
| 120 | B | 49 | - | - | - | X | - |
| 121 | B | 51 | - | - | X | - | - |
| 123 | B | 48 | - | X | - | - | - |
| 124 | B | 50 | X | - | - | - | - |

* B = Biological

fossiliferous micrite, sparse biomicrite, and packed biomicrite were represented in the samples from the James Island Area.

Two of the three biolithite samples were serpulid worm colonies and the third appeared to possibly be composed of scleractinian coral fragments. At least two types of wall structure were present with one consisting of dark concentric calcite laminae and the other with a more fibrous structure. The voids in the colonies were usually open although they were sometimes lined with micritic material.

The algal biolithite samples were characterized by micritic encrusting masses. The sample from Station 117 was composed of algal encrusted pelecypod valves which were partially open or filled by micrite or silty micrite.

## 2. BENTHIC FAUNAL POPULATIONS

Appendix E lists the taxa identified from each of the twenty successful biological dredge tows and a few selected taxa from the three rock dredge samples collected in Block 463 while Appendix D gives a phylogenetic listing of the identified taxa. Two hundred and fifty-seven taxa exclusive of fishes were identified from the dredge samples. Decapods (64 taxa), mollusks (63 taxa), sponges (31 taxa), echinoderms (25 taxa), and anthozoans (23 taxa) dominated the samples as to the numbers of identified taxa. Table 10 lists the dominant species collected in the biological dredge in terms of number of occurrences within the 20 dredges. Twenty-three species were identified from ten or more stations, 81 species at five or more stations, and 159 of the total of 257 taxa occurred at two stations or more. Six species of decapods, five species of anthozoans, and three bryozoan species were the major taxa that dominated Table 10.

Figure 37 shows the approximate distribution of four biological assemblages that were recognized during review of the television videotapes and still camera photographs. The assemblages appear to be substrate dependent and are based on the largest and most easily recognizable fauna. The identifications were made using the specimens from the dredge samples as reference.

Assemblage D, as in Block 380, was dominated in terms of numbers and biomass by the epibenthic colonial polychaete *Phyllochaetopterus socialis*. The red algae *Peyssonnelia rubra*, sponges, anthozoans (*Telesto sanguinea*, *Lophogorgia* sp., *Ellisella* sp., and anthothelidae sp.), and the polychaete *Filograna implexa* were also frequently observed. As shown in Photographs G, H and I this assemblage generally occurred on low relief hard bottom with numerous patches of sand in close proximity. Slight increases in relief seemed to result in an increased number of species as shown in Photograph G.

Assemblage H was observed primarily on the rubble/talus areas of Television Lines 5 and 6. The assemblage was characterized by a lack of *Phyllochaetopterus socialis* and consequently a reduced biomass. Apparently the substrate was not suitably stable for most attached organisms as only coralline algae and *Peyssonnelia rubra* were consistently present (see Photograph J). Photograph K shows that certain patches of emergent hard bottom were also very sparsely populated with epifauna.

**Table 10.** Invertebrate species collected from ten or more of the twenty biological dredge stations within James Island Area, Block 463.

| Species | Number of Occurrences |
|---|---|
| *Telesto sanguinea* - anthozoan | 18 |
| *Celleporaria albirostris* - bryozoan | 18 |
| *Titanideum frauenfeldi* - anthozoan | 18 |
| *Parthenope fraterculus* - decapod | 17 |
| *Ophiothrix angulata* - echinoderm | 15 |
| *Lophogorgia* sp. 2 - anthozoan | 15 |
| *Filograna implexa* - polychaete | 15 |
| *Phyllochaetopterus socialis* - polychaete | 13 |
| *Smittipora levenseni* - bryozoan | 13 |
| *Hippopetraliella bisinuata* - bryozoan | 13 |
| *Ellisella* sp. - anthozoan | 12 |
| *Gonodactylus bredini* - stomatopod | 11 |
| *Asteroporpa annulata* - echinoderm | 11 |
| Anthothelidae sp. - anthozoan | 11 |
| *Calappa* sp. - decapod | 11 |
| *Laevicardium pictum* - bivalve | 11 |
| *Carpoporus papulosus* - decapod | 11 |
| *Symethis* sp. - decapod | 11 |
| *Arca zebra* - bivalve | 11 |
| *Peyssonnelia rubra* - algae | 10 |
| *Podochela* sp. - decapod | 10 |
| *Lytocarpus clarkei* - hydrozoan | 10 |
| *Stenocionops* sp. - decapod | 10 |

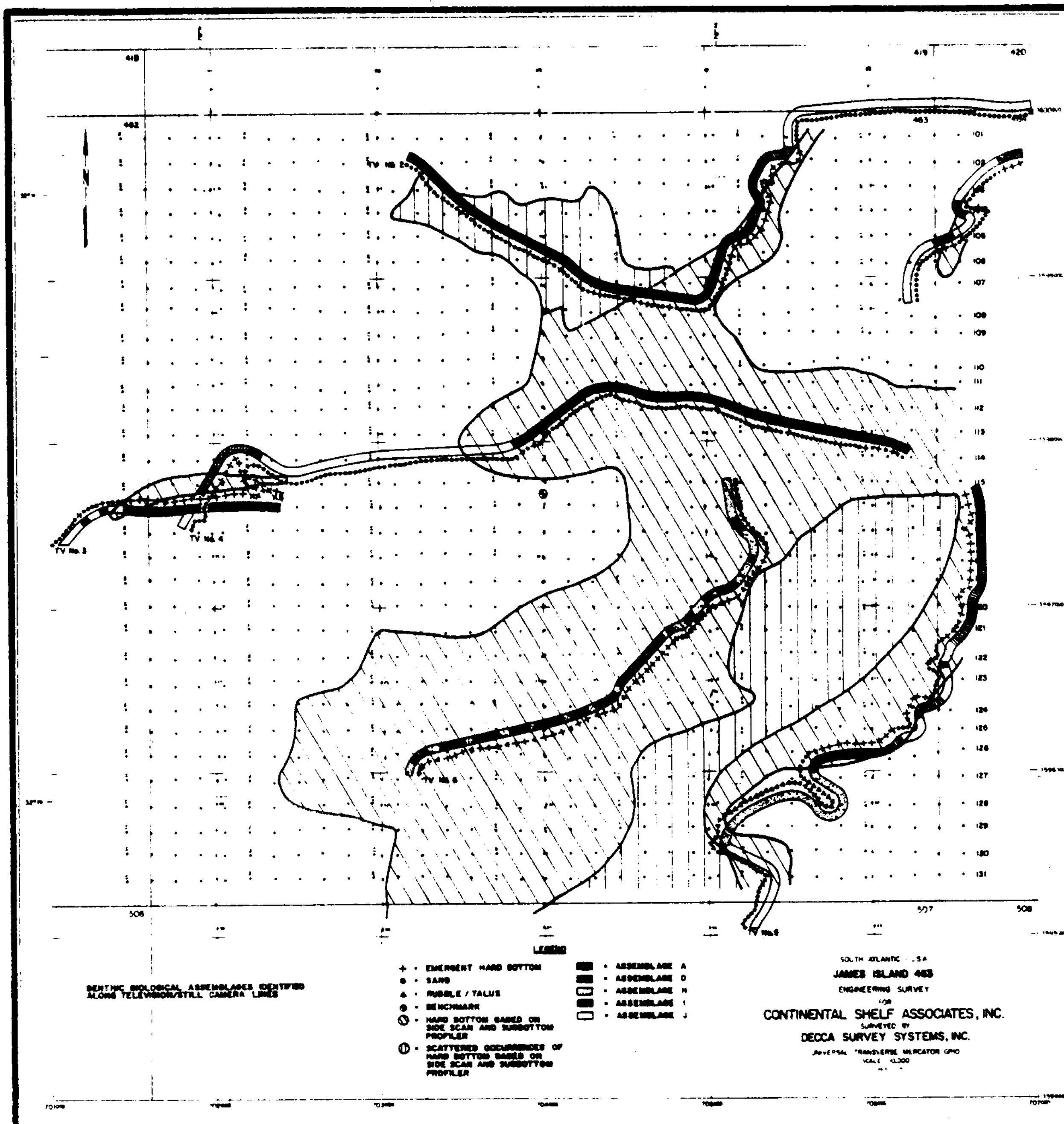
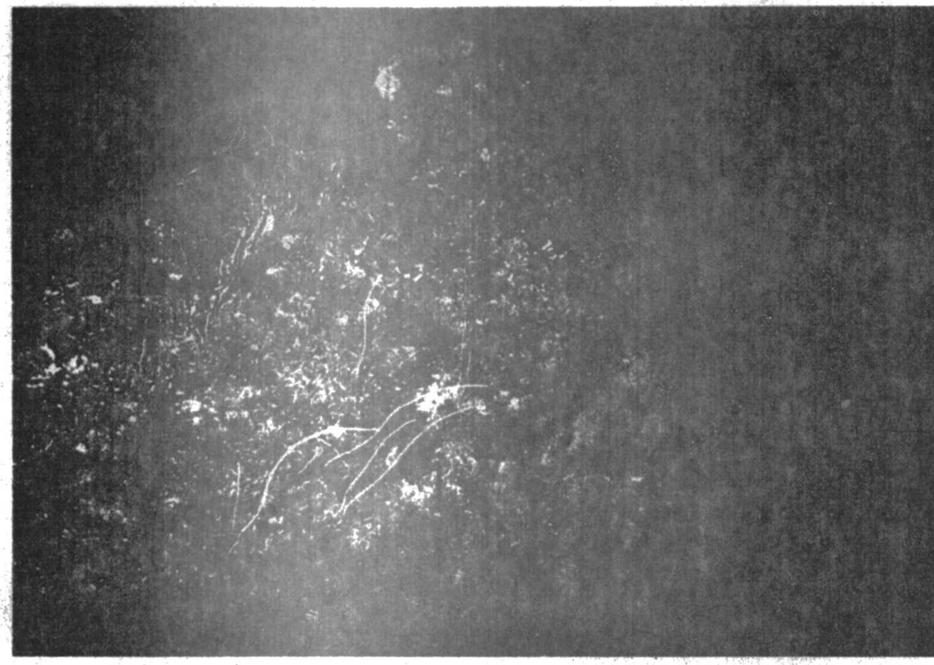
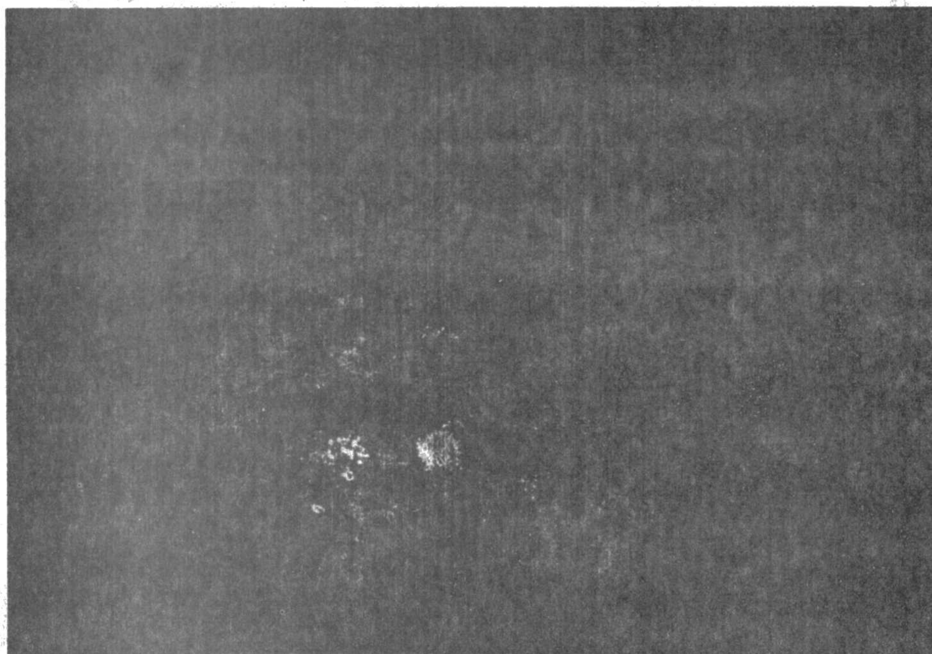



FIGURE 37 BENTHIC BIOLOGICAL ASSEMBLAGES IDENTIFIED ALONG TELEVISION/STILL CAMERA LINES IN JAMES ISLAND AREA, BLOCK 463



**Photograph G.** The colonial polychaete (*Phyllochaetopterus socialis*), sponges, and anthozoans (*Lophogorgia* sp. 1 and 2) covering hard bottom within James Island Area, Block 463.

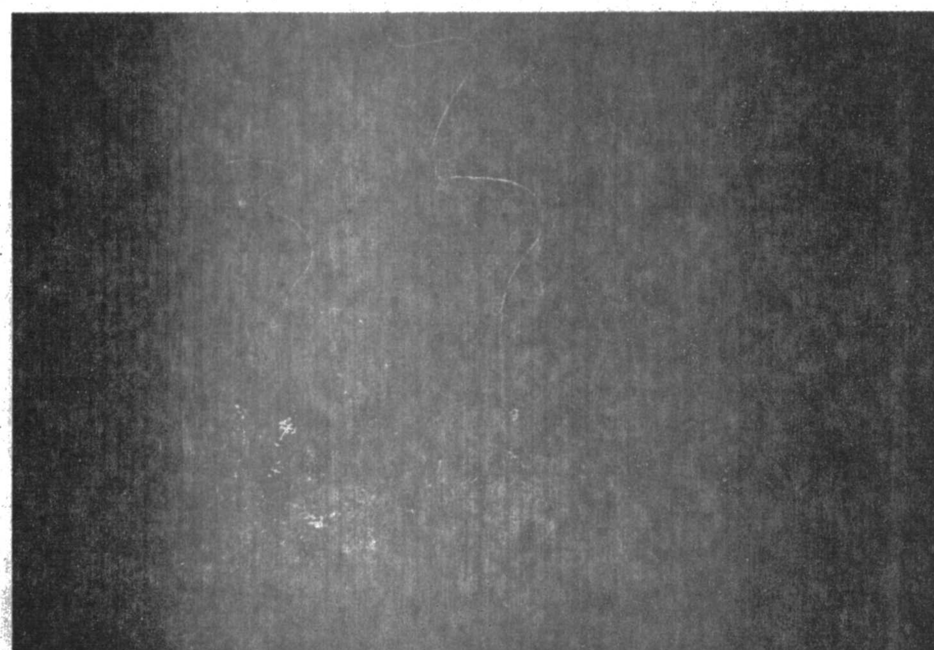
**Photograph H.** Colonies of the epibenthic polychaete (*Filograna implexa*) on partially sand covered low relief hard bottom within James Island Area, Block 463.



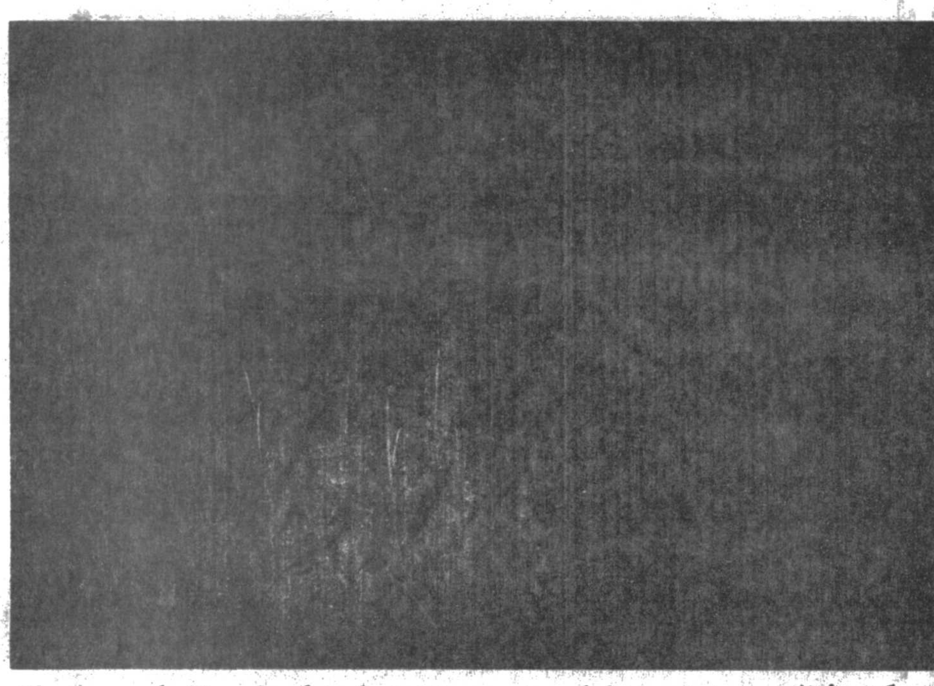
Photograph I. Typical low relief hard bottom supporting Biological Assemblage D within James Island Area, Block 463.

Photograph J. A school of Greater Amberjack (*Seriola dumerili*) above a rubble/talus substrate within James Island Area, Block 463.

Photograph K. A Bigeye (*Priacanthus arenatus*) and several Yellowtail Reeffish (*Chromis enchrysurus*) clustered near a small area of emergent hard bottom within James Island Area, Block 463.



Photograph L. Biological Assemblage I within James Island Area, Block 463 including the spiral sea whip *Cirrhipathes* sp.



Photograph M. Sand substrate covered by sea pens (*Virgularia presbytes*) within James Island Area, Block 463.

Photograph N. Yellowtail Reeffish (*Chromis enchrysurus*) near a small (0.5 m diameter) rock outcrop within James Island Area, Block 463.

Assemblage I was primarily associated with the ridges and scarps within the lease block. The assemblage was dominated by sponges, anthozoans (including a spiral sea whip that was not collected but identified as *Cirrhipathes* sp.), hydroids, and *Filograna implexa* (polychaete). Photograph L is an example of Assemblage I.

Assemblage A was observed on a sand substrate over large portions of the lease block. Sea pens (*Virgularia presbytes*) often covered large areas of the sand as shown in Photograph M. Small outcrops of rock similar to that shown in Photograph N were observed along Television Lines 2 (Fixes 2 and 26 and 29 to 48) and 4 (Fixes 65 to 83). The outcrops were apparently covered with sand particularly along Television Line 2 as *Lophogorgia* sp. 2 was occasionally observed emerging from a sand bottom. The small outcrops often supported a number of the species observed in Assemblages D and I though *Phyllochaetopterus socialis* was excluded.

Assemblage J was characterized by a lack of observed epifauna on a soft sandy substrate.

Clustering analysis was performed on the 81 taxa that were identified from five or more of the 20 dredge stations. The clustering orderings of stations in the dendrograms produced by the Jaccard and Czekanowski coefficients were quite different from each other because there were no obvious (real) differences between the presence or absence of the 81 taxa at the 20 dredge stations. Figure 38 shows the results of the clustering using the Czekanowski coefficient. No effort was made to divide the dendrogram groups because of their lack of significance. The inability of the clustering analysis to detect differences in the stations is again due to the use of qualitative data and the integrating of a number of both sand and rock patches by the dredge within a given tow.

As in Blocks 198 and 380 no distinct species groupings were produced by the clustering analysis as the species chained together with those having similar numbers of occurrences appearing closest together in the dendrogram.

## 3. DEMERSAL FISH POPULATIONS

Twenty-nine species of fish were identified from James Island Block 463 as shown in Table 11. Of these thirteen were identified only from dredge samples (listed in Appendices D and E) and 18 were identified from still photography. Two species were identified from both photographs and collected specimens. Most of the visually identified species within Block 463 were smaller forms observed as individuals or pairs near hard bottom areas. Several species were observed that are characteristic of warm waters such as bank butterflyfish (*Chaetodon aya*), bigeye (*Priacanthus arenatus*), reef butterflyfish (*Chaetodon sedentarius*), adult and juvenile blue angelfish (*Holocanthus bermudensis*), twospot cardinalfish (*Apogon pseudomaculatus*), spotfin hogfish (*Bodianus pulchellus*), spotfin butterflyfish (*Chaetodon ocellatus*), and yellowtail reeffish (*Chromis enchryurus*).

The most commonly seen fishes in the surveyed areas were yellow-tailed reeffish, bigeye, tattler (*Serranus phoebe*), and scorpion-fishes (*Scorpaena* sp.). Tattler were seen over all substrate types. Scorpionfish most often were observed on emergent hard bottom areas

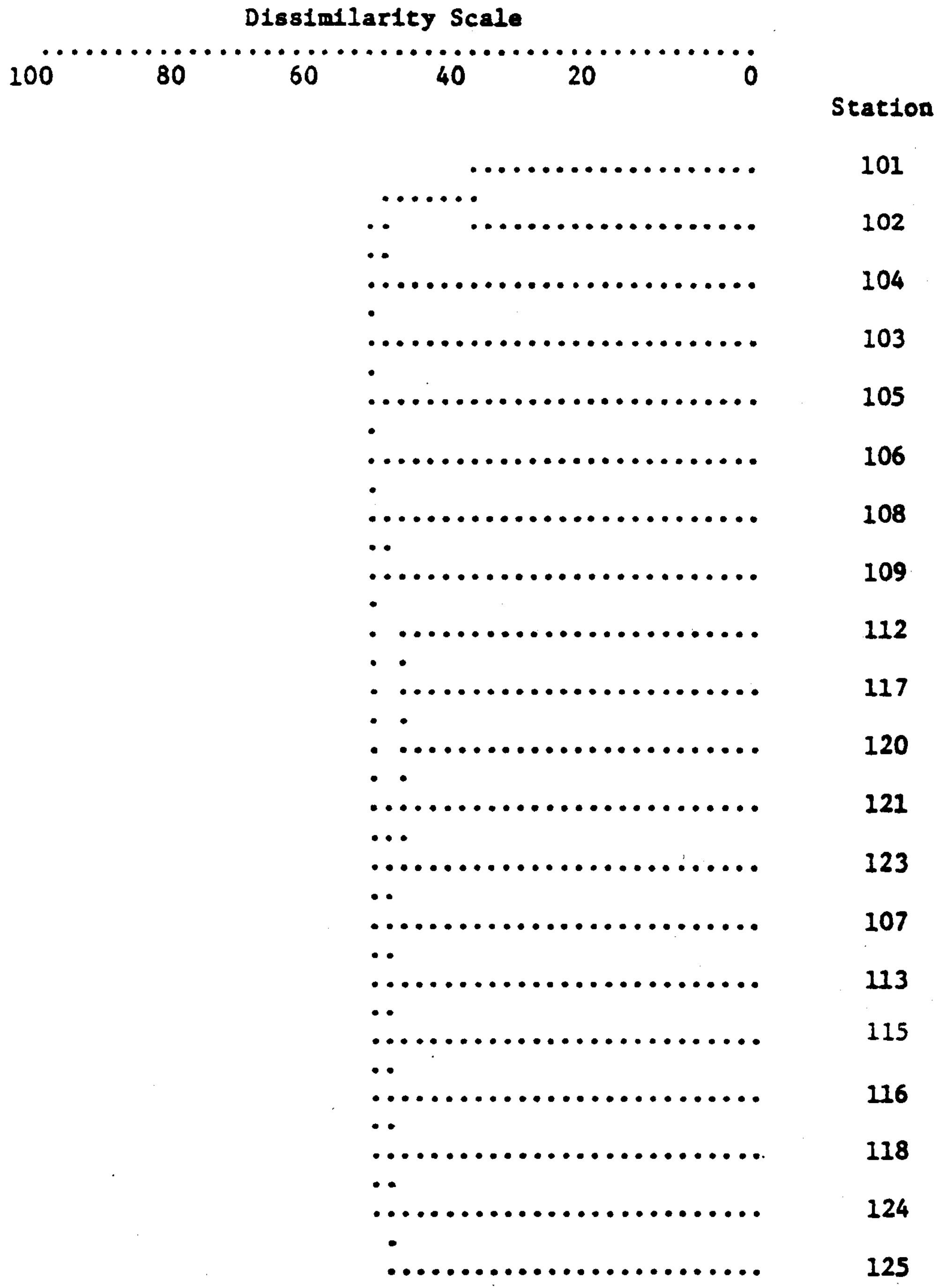



FIGURE: 38 STATION-GROUP DENDROGRAM FOR JAMES ISLAND AREA, BLOCK 463 BASED ON 81 TAXA AND PRODUCED BY THE CZEKANOWSKI SIMILARITY COEFFICIENT AND FLEXIBLE SORTING

Table 11. Species of fish collected or observed in James Island Area, Block 463.

| Species | Habitat* | Dredge Sample | Visually Observed |
|---|---|---|---|
| *Anarchias yoshiae*-pygmy moray | D | X | |
| *Apogon pseudomaculatus* - twospot cardinalfish | D | | X |
| *Bodianus pulchellus* - spotfin hogfish | D | | X |
| *Calamus bajonado* - jolthead porgy | D | | X |
| *Centropristis ocyurus*-bank sea bass | D | | X |
| *Centropristis striata* - black sea bass | D | | X |
| *Chaetodon aya* - bank butterflyfish | D | | X |
| *Chaetodon ocellatus* - spotfin butterflyfish | D | | X |
| *Chaetodon sedentarius* - reef butterflyfish | D | | X |
| *Chriolepis* sp. - goby | D | X | |
| *Chromis enchrysurus* -yellowtail reeffish | D | X | X |
| *Equetus lanceolatus* - jackknife fish | D | | X |
| *Gillellus* sp. - stargazer | D | X | |
| *Haemulon aurolineatum* - tomtate | D | | X |
| *Halichoeres* sp. - wrasse | D | X | |
| *Hemiteronotus* sp. - razorfish | D | X | |
| *Hippocampus erectus* - lined seahorse | D | X | |
| *Holocanthus bermudensis* - blue angelfish | D | | X |
| *Mycteroperca* sp. - grouper | D | | X |
| *Ophidion holbrooki* - bank cush eel | D | X | |
| *Plectranthias garrupellus* | D | X | |
| *Priacanthus arenatus* - bigeye | D | | X |
| *Rypticus bistrispinus* - soapfish | D | X | |
| *Scorpaena dispar* - hunchback scorpionfish | D | X | |
| *Scorpaena* sp. - scorpionfish | D | | X |
| *Selar crumenophthalmus* - bigeye scad | P | | X |
| *Seriola dumerili* - greater amberjack | P | | X |
| *Serranus phoebe* - tattler | D | X | X |
| *Syngnathus elucens* - shortfin pipefish | D | X | |

* D = Demersal
P = Pelagic

which supported abundant epifaunal communities. Bigeye and yellowtail reeffish were observed most frequently near rock outcrops which offered protective crevices, though yellowtail reeffish were also common near heavy concentrations of epifauna. In addition, a school of several thousand bigeye scad (*Selar crumenophthalmus*) was observed near hard substrate in the eastern sections of Block 463 (Television Lines 3 and 4). Other species of fish observed included small groups (6-8) of jackknife fish (*Equetus lanceolatus*) and individual grouper (*Mycteroperca* sp.). Grouper appeared to be abundant near the emergent hard bottom areas in the eastern portion of the lease block and were not observed over soft bottom areas. The records from the Raytheon depth recorder showed evidence of fish schools over hard bottom areas in the southeast quadrant of the block. Schools (6-8) of amberjack (*Seriola dumerili*) were sighted over sand bottom on Television Lines 2 and 6. Both sightings were in the deeper water in the eastern areas of the lease block.

## D. BRUNSWICK AREA, BLOCK 912

### 1. HARD BOTTOM IDENTIFICATION AND MAPPING

#### a) Navigation

Figure 39 shows the bathymetric and geophysical navigation base map of Brunswick Area, Block 912. The nomenclature used on the map is identical to that previously described for the navigation base map of James Island Area, Block 198. Figure 40 shows the locations of the single television/still camera survey line with position fixes recorded every minute and the locations of the six dredge tows conducted within the lease block.

Appendix B lists the observed coordinates, UTM grid coordinates, and latitude and longitude for the benchmark location, deployment and retrieval position fixes of the television/still camera system at the start and end of the survey lines, and the position fixes at the beginnings and ends of the dredge tows.

#### b) Bathymetry

The depth of water within Block 912 varies from a minimum of 29 meters to a maximum of 35 meters as shown in Figure 41.

The seafloor generally dips in a southeasterly direction though the direction of dip is not uniform since there are numerous rises trending in a northeasterly direction. A small rise trends northeasterly with its axis crossing Line 2 at Shotpoint 10, while to the east of this rise the north half of the block is low with troughs and closed low areas trending to the northeast. A northeasterly trending high has its axis extending from Shotpoint 27 on Line 1 to Shotpoint 20 on Line 4. Southeast of this rise there is an elongated trough area within a 31 meter contour. A ridge is located in the south central part of the block within a 30 meter contour, the highest portion being within a 29 meter closure. A large trough covers most of the southeast corner of the block. In the trough there are two low closed areas with small closures slightly deeper than 34 meters.

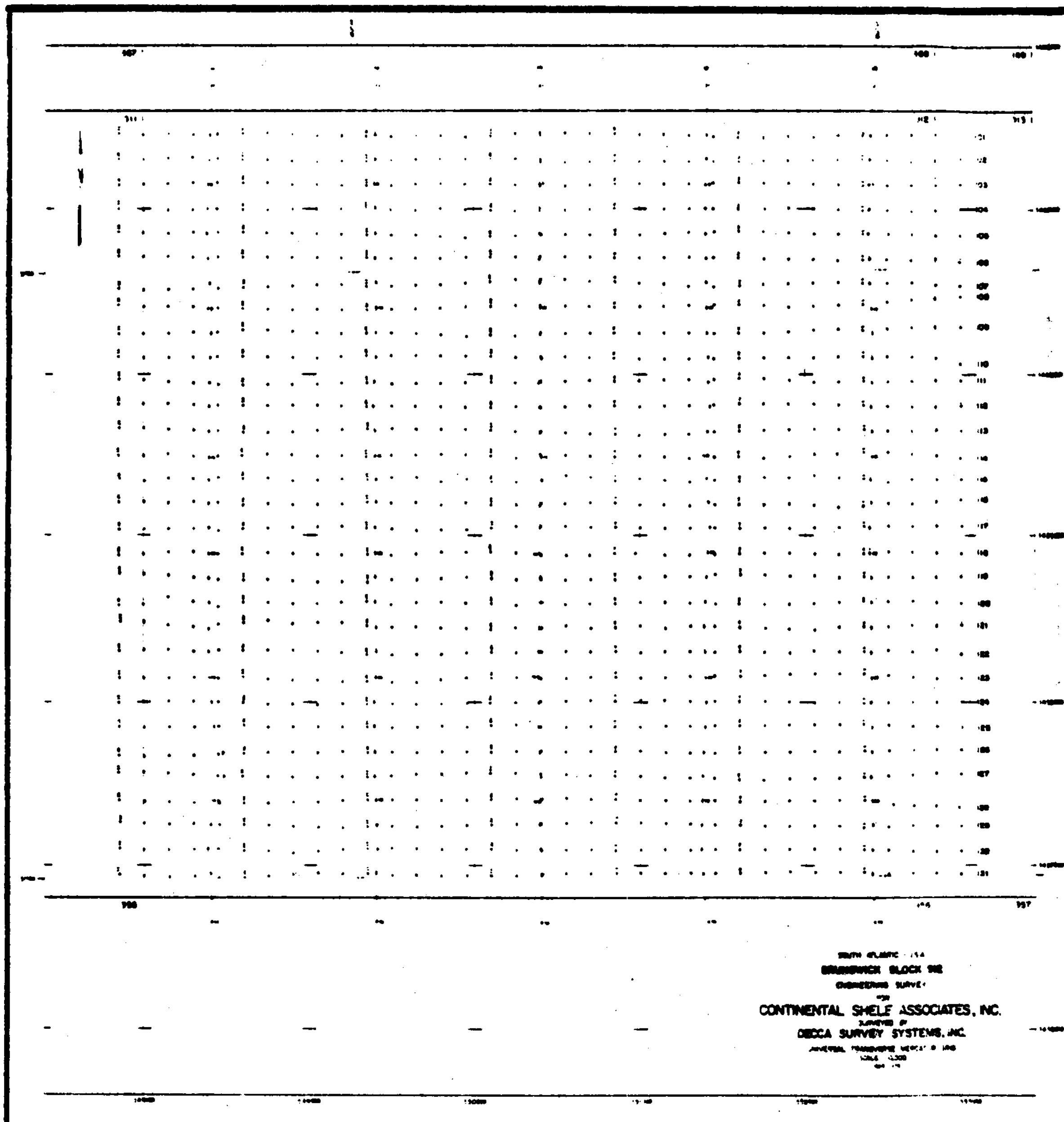



FIGURE: 39 NAVIGATION BASE MAP OF BRUNSWICK AREA, BLOCK 912

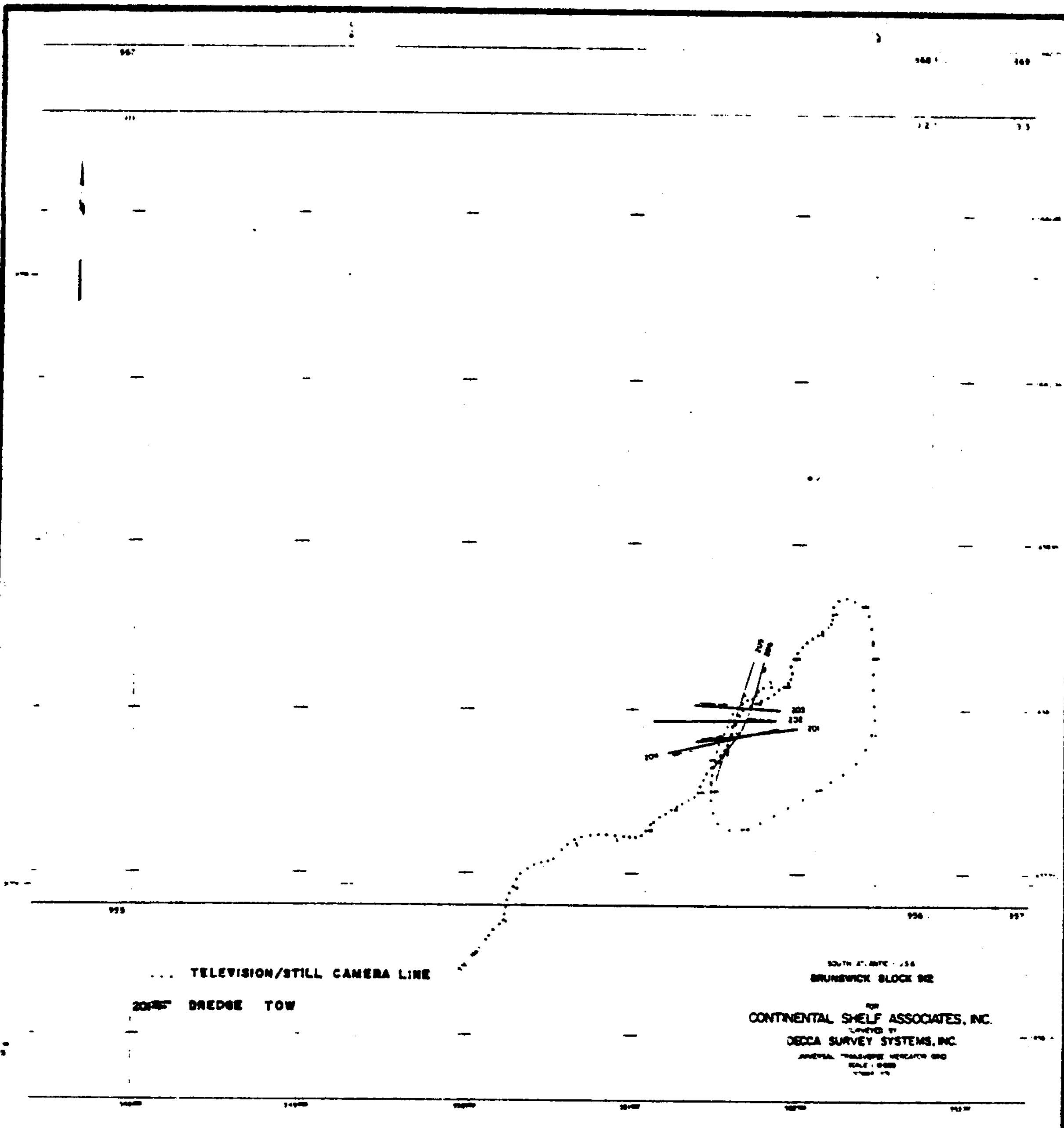



FIGURE: 40 NAVIGATION MAP SHOWING TELEVISION / STILL CAMERA LINES AND DREDGE TOWS CONDUCTED WITHIN BRUNSWICK AREA, BLOCK 912

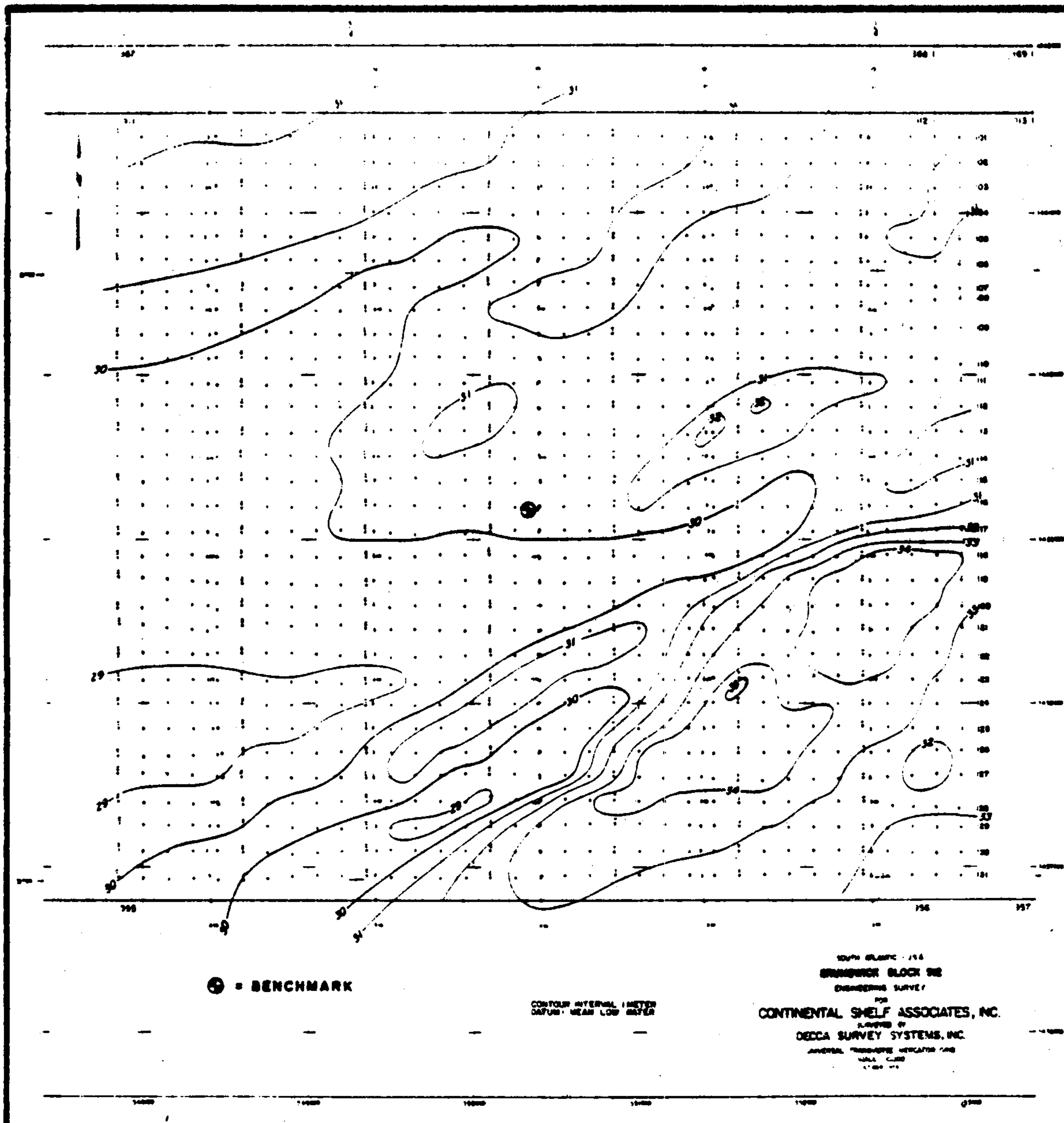



FIGURE: 41 BATHYMETRY OF BRUNSWICK AREA, BLOCK 912

On the side scan sonar records from Lines 123 and 124 at Shotpoint 10 there was evidence of a low area within this trough. The sonograms also showed a small closed high area along the east line of the block between Shotpoints 2 and 3 on Lines 126 and 127.

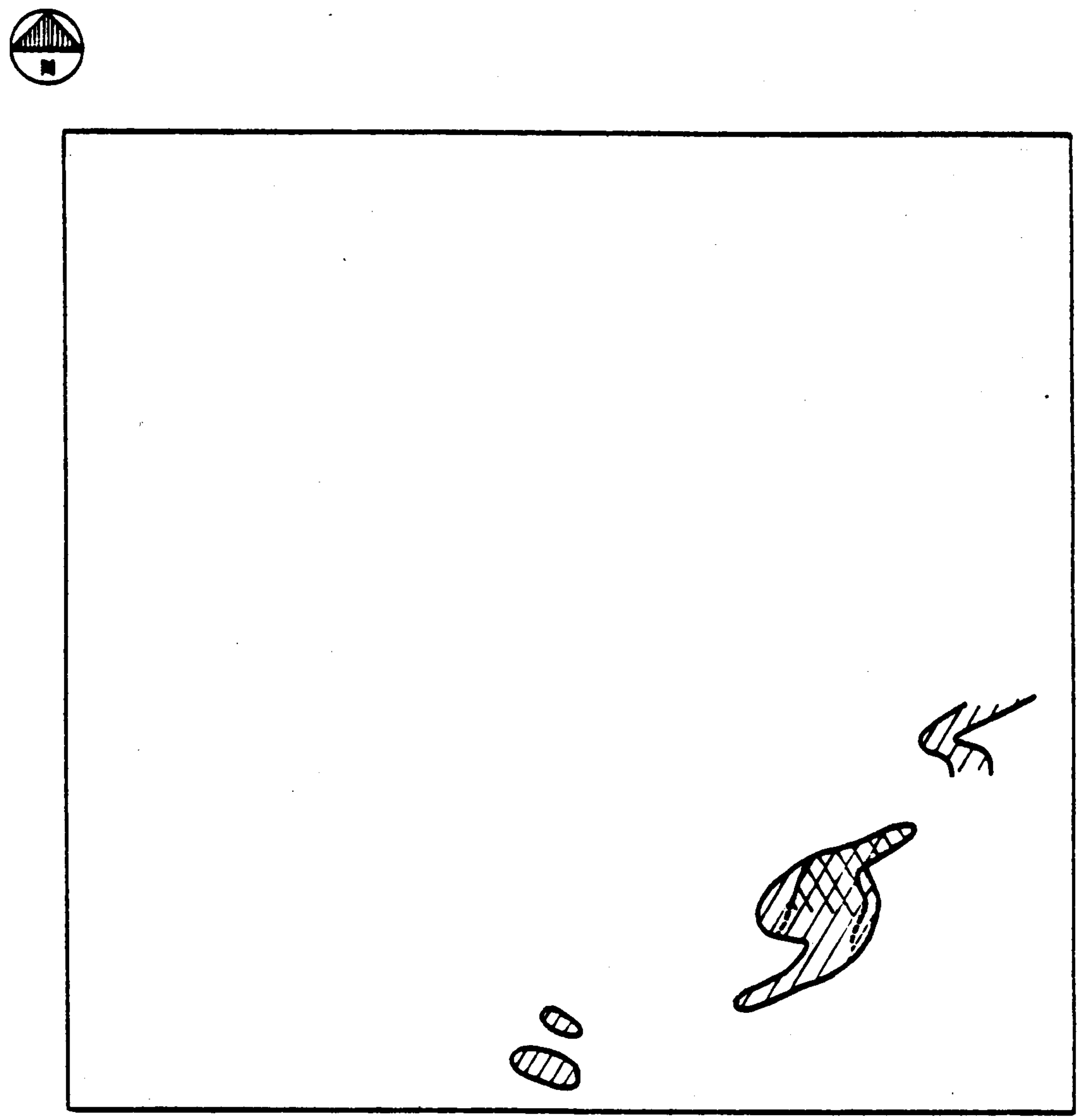
c) Geological and Geophysical Observations

i) Side Scan and Subbottom Data - Figure 42 shows the results of the onboard interpretation of the side scan sonar and subbottom profiler records from Brunswick Area, Block 912. The map was prepared so that visual observations would be conducted in areas of suspected emergent hard bottom. The laboratory interpretation of the geophysical data is presented in Figures 43 and 44.

As can be seen in Figure 43 the lease block was relatively uneventful in terms of hard bottom. One major area in the southeast corner exhibits hard bottom characteristics. It corresponds to an outcrop of a strong subbottom reflector illustrated in Figure 45. The hard bottom area occurs in a topographic low which trends roughly northeast-southwest. Sediment thicknesses increase rapidly to the northwest forming a large wedge and also seaward, but not as rapidly as to the northwest (see Figure 44). The hard bottom developed in this trough is of low relief and very sparse. Comparison between Figures 43 and 44 indicates that emergent hard bottom is not present at every occurrence of the outcrop of the subbottom reflector. The outcrop areas with no emergent hard bottom are covered by a coarse sand or gravel and sometimes appear as coarse patches within a finer sediment matrix.

The remainder of the seafloor in Block 912 is composed of sediments of three textural types (classified acoustically). Overall, only one type is mapped over a large area and is consistently uniform throughout. The boundaries between differing types are usually gradational and some areas consist of a patchy distribution with roughly linear streaks of two or more sediment types.

Figure 44 indicates a variety of subbottom structures. A thick sequence of channel fill sediments is located mainly in the northwest half of the block. Individual channel cuts are sometimes evident and are depicted on Figure 44. These sediments are generally acoustically more transparent than the accumulation of sands throughout the rest of the block. Distinct layering can be observed eight to ten meters below the seafloor. Figure 46 illustrates channel fill sediments present in the northwest corner of Block 912. Within these sediments are a number of anomalies that may be the result of biogenic gas accumulations. Wipe out zones or acoustic voids occur when gas is concentrated sufficiently to act as a barrier to sound propagation. Also present are disrupted or distorted bedding that may be due to gas migration. A few water column anomalies were observed throughout the block. Most have been attributed to schools of fish. However, several such anomalies have been labelled as possible gas seeps, because of their juxtaposition relative to subbottom gas accumulations which may have vents to the seafloor. One such example is illustrated in Figure 46. One possible gas seep appears on the side scan sonar records on Line 110 at Shotpoint 2. All gas accumulations observed are believed to be of biogenic origin from soft, muddy high organic



LEGEND

- = HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR
- = POSSIBLE HARD BOTTOM AS INDICATED BY SIDE SCAN SONAR
- = REFLECTOR OUTCROP AS INDICATED BY SUBBOTTOM PROFILER

FIGURE: 42 HARD BOTTOM AREAS BASED ON SHIPBOARD INTERPRETATION OF GEOPHYSICAL DATA COLLECTED WITHIN BRUNSWICK AREA, BLOCK 912

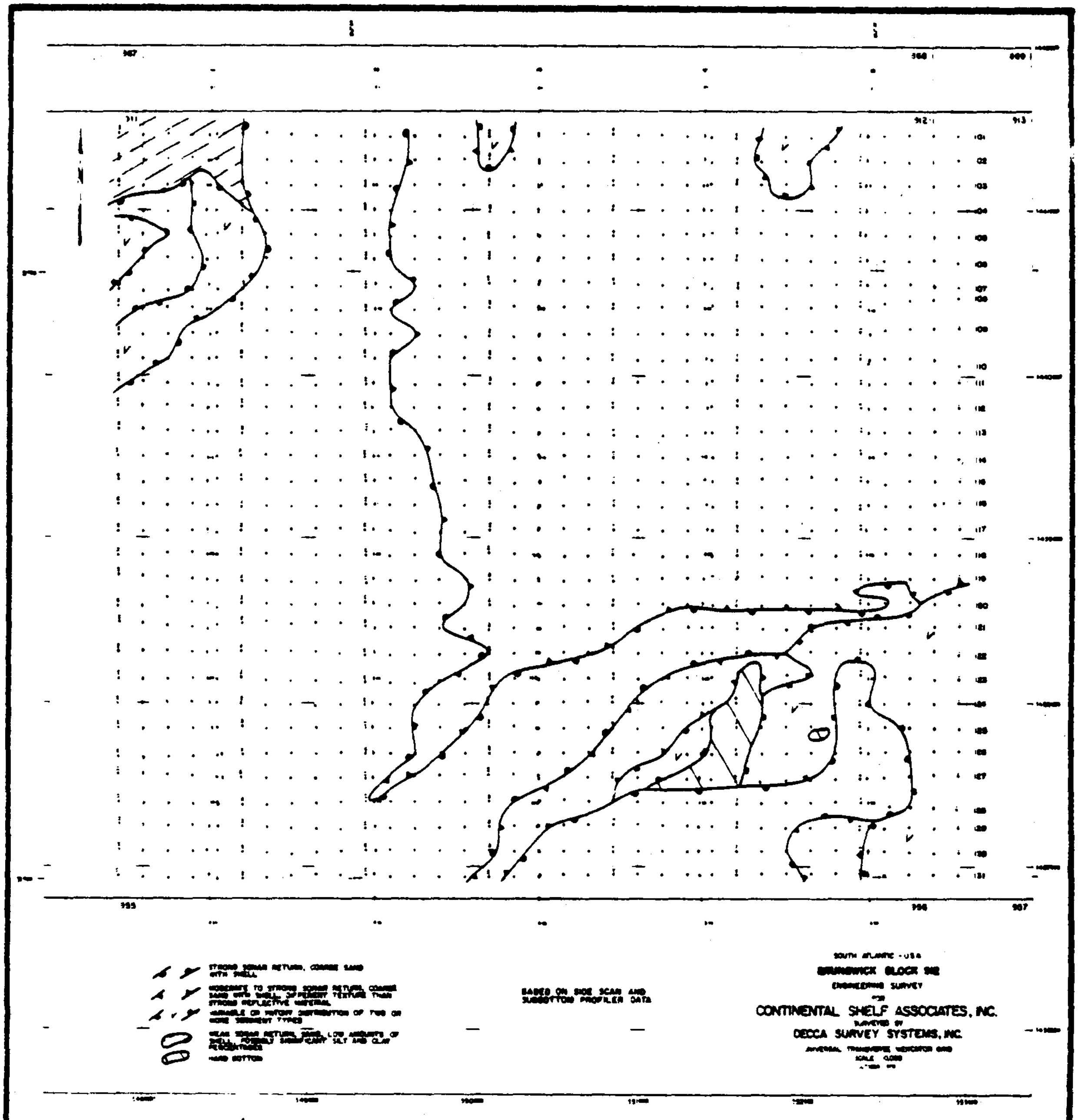



FIGURE: 43 SURFICIAL GEOLOGY OF BRUNSWICK AREA, BLOCK 912 BASED ON SIDE SCAN SONAR AND SUBBOTTOM PROFILER DATA

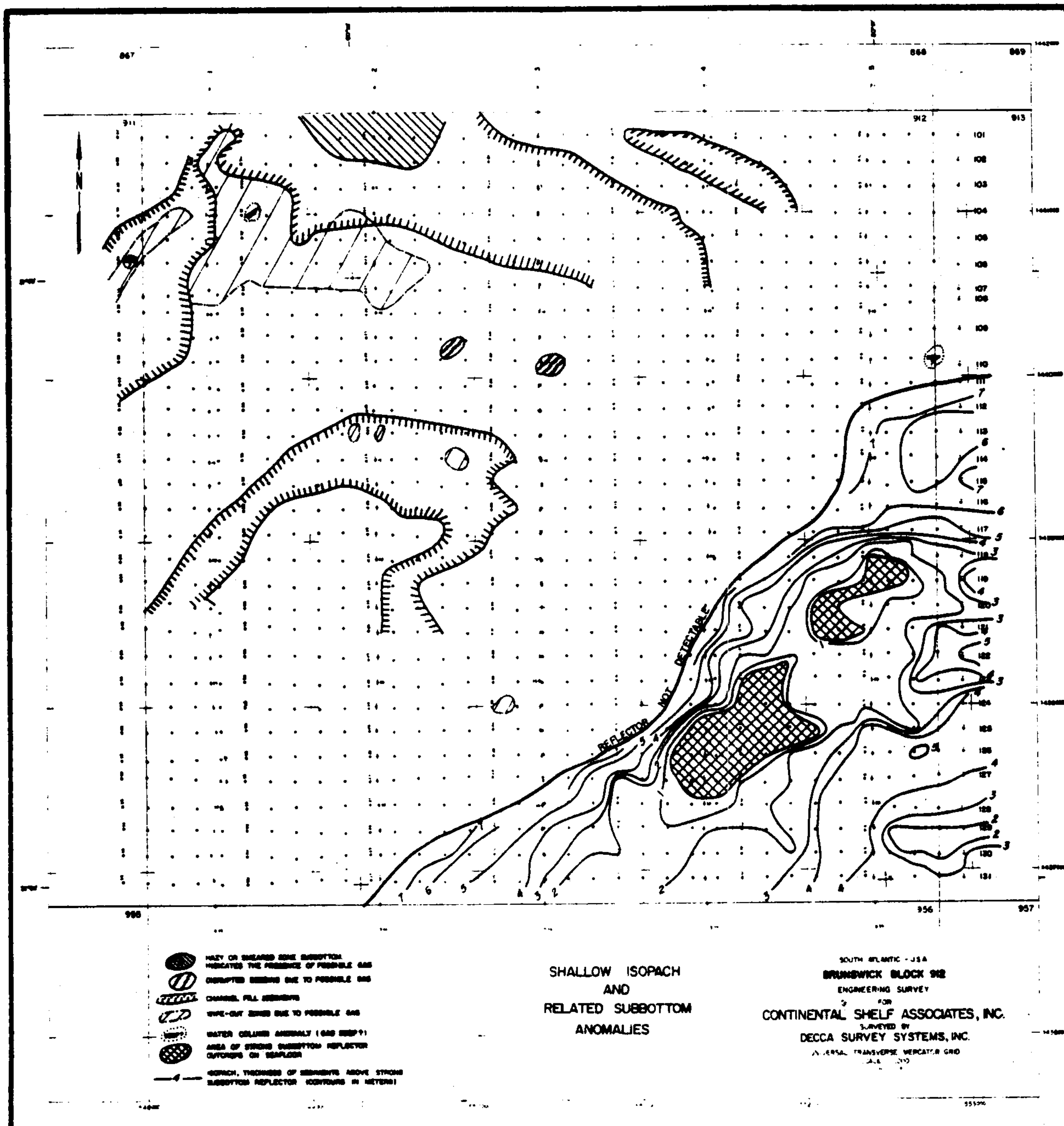



FIGURE: 44 SHALLOW ISOPACH AND RELATED SUBBOTTOM ANOMALIES OF BRUNSWICK AREA, BLOCK 912

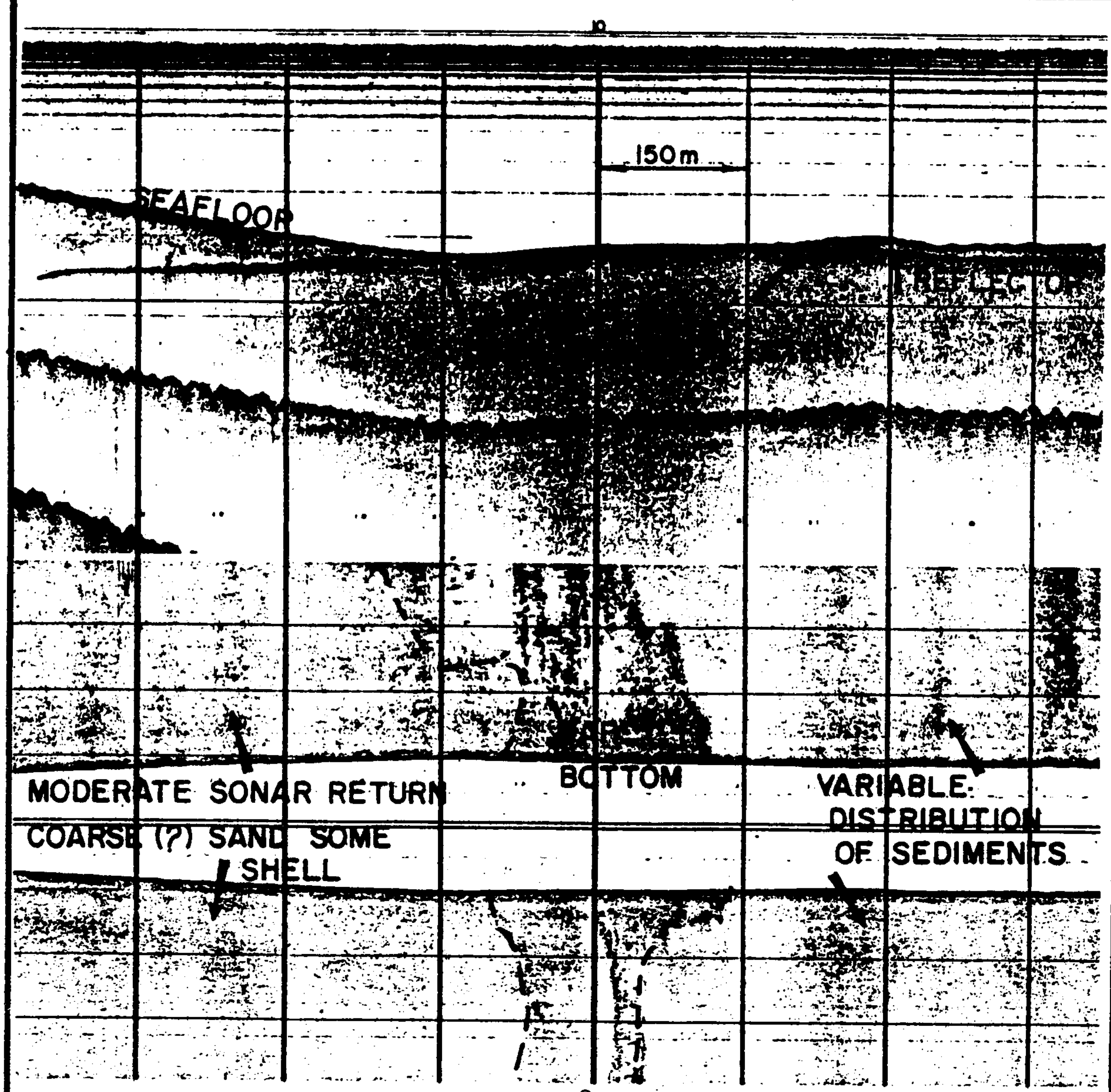



FIGURE: 45 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 124, BRUNSWICK AREA, BLOCK 912

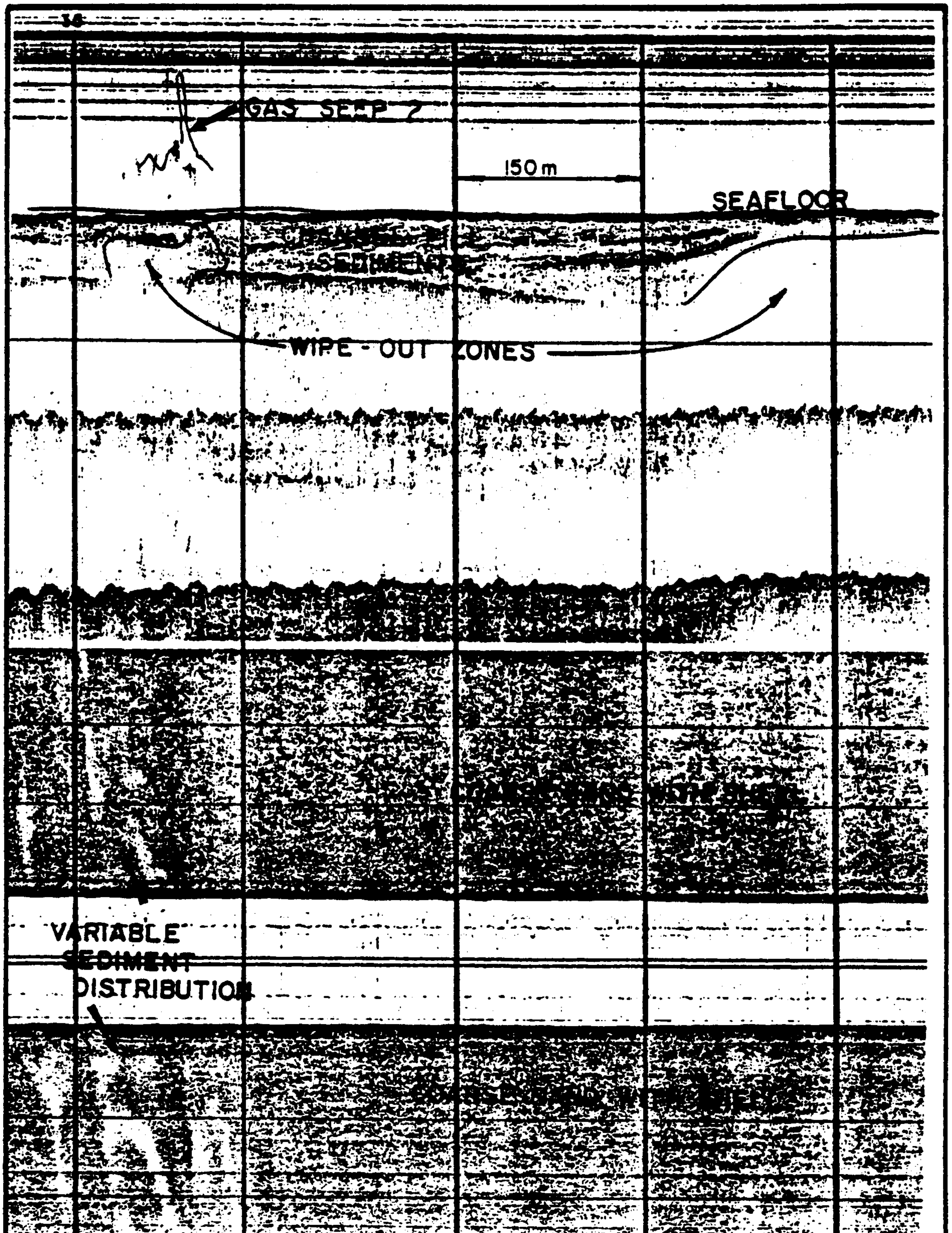



FIGURE: 46 SUBBOTTOM PROFILER AND SIDE SCAN SONAR RECORDS OF A PORTION OF LINE 106, BRUNSWICK AREA, BLOCK 912 content layers within the channel fill deposits. There is no evidence on the subbottom profiler records to suggest a deep seated migration.

ii) Television and Still Camera Observations - Figure 47 shows the area of hard bottom that was mapped by interpreting the side scan sonar and subbottom profiler data. A single occurrence of emergent hard bottom in the form of a small ledge with less than 0.5 meters of relief was observed from the videotapes and photographs and is depicted in Figure 47 just south of the larger geophysically defined hard bottom area. Areas of broken shell and medium to coarse size sand were observed from Fixes 1 to 36 (see Photograph O, page 110). Within the geophysically defined hard bottom area an area of broken shell extended from Fixes 36 to 42 and 107 to 110. Attached epifauna (anthozoans and sponges) were observed emerging from the rippled sand from Fixes 44 to 48 and 111 to 118 indicating that a hard bottom was located only a few centimeters below the sand. The sand within this area and the remainder of the observed area appeared to be of a finer grain size than that seen with the broken shell (see Photograph P, page 110).

iii) Petrographic Analyses of Dredge Samples - A single well weathered sample approximately eight centimeters in diameter was obtained with a biological dredge from Brunswick Area, Block 912. The sample was classified as a sandy biomicrite and was composed of poorly sorted medium sand to silt-size particles with scattered sand-size bioclasts in micrite matrix. No porosity was detected but scattered patches of fine sparry calcite were observed.

## 2. BENTHIC FAUNAL POPULATIONS

Appendix E lists the taxa identified from each of the five successful biological dredge tows made on Block 912 while Appendix D gives a phylogenetic listing of the identified taxa. Seventy-one taxa exclusive of fishes were identified from the dredge samples. Decapods (25 taxa), mollusks (19 taxa), echinoderms (7 taxa), sponges (6 taxa), and anthozoans (6 taxa) dominated the samples as to the numbers of identified taxa. Table 12 lists the dominant species collected in the dredges in terms of number of occurrences within the five dredges. Five of the fourteen species collected at three or more stations were decapods.

Figure 48 shows the approximate distribution of two biological assemblages that were recognized during review of the television videotapes and still camera photographs. The identifications of the fauna were made using the specimens from the dredge samples as reference.

Assemblage K, which occurred primarily on the finer grained sand bottom, was visually dominated by asteroids (*Luidia* spp.) and occasional crabs (*Portunus gibbesii*). In the areas dominated by broken shell (Photograph O) hydroids and octopods were noted.

Assemblage C was apparently attached to a hard bottom that was covered by a thin veneer of sand. Large sponges (*Ircinia campana* and *Anthosigmella varians*), the polychaete *Filograna implexa* which

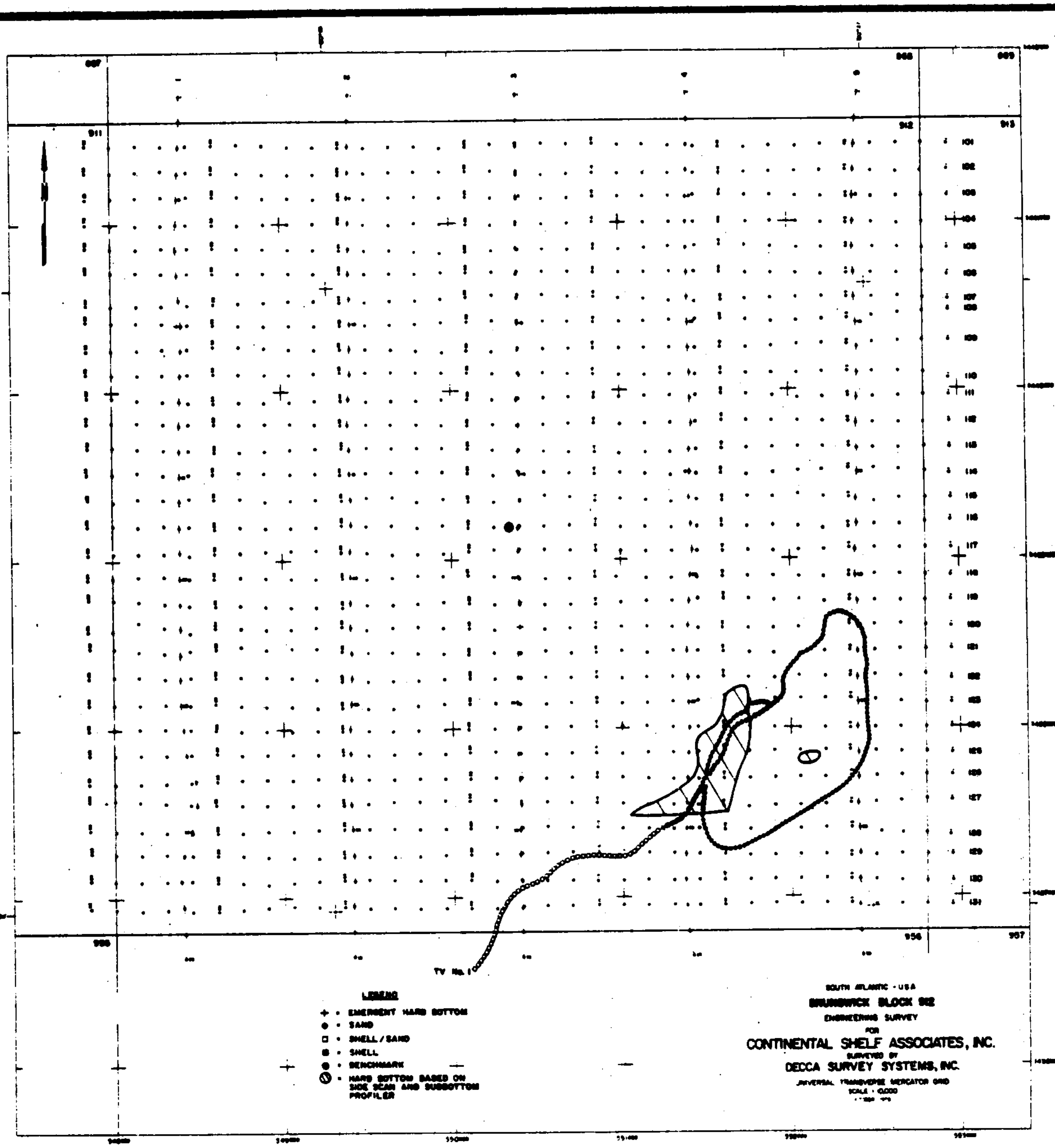



FIGURE: 47 GEOPHYSICALLY DEFINED HARD BOTTOM AREAS WITH SUBSTRATE TYPES BASED ON TELEVISION AND STILL CAMERA OBSERVATIONS IN BRUNSWICK AREA, BLOCK 912

Table 12. Invertebrate species collected from three or more of the five biological dredge stations within Brunswick Area, Block 912.

| Species | Number of Occurrences |
|---|---|
| *Titanideum frauenfeldii* - anthozoan | 5 |
| *Filograna implexa* - polychaete | 4 |
| *Arcinella cornuta* - bivalve | 4 |
| *Pilumnus sayi* - decapod | 4 |
| *Porifera* sp. 2 - sponge | 3 |
| *Chione latilirata* - bivalve | 3 |
| *Thyroscyphus marginatus* - hydrozoan | 3 |
| *Telesto sanguinea* - anthozoan | 3 |
| *Pseudomedaeus agassizii* - decapod | 3 |
| *Smittipora levenseni* - bryozoan | 3 |
| *Pylopagurus* sp. - decapod | 3 |
| *Parthenope granulata* - decapod | 3 |
| *Iliacantha intermedia* - decapod | 3 |

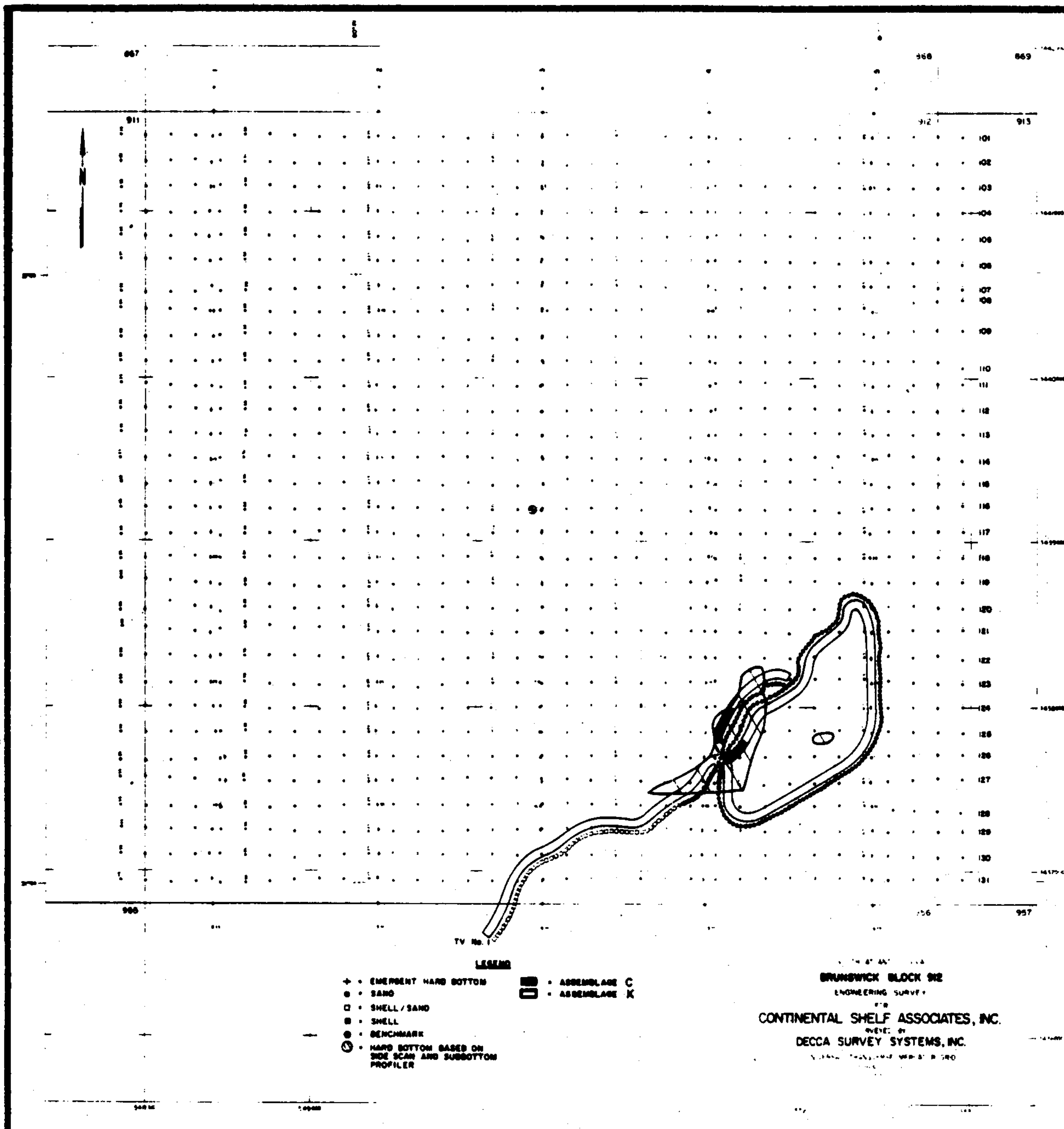
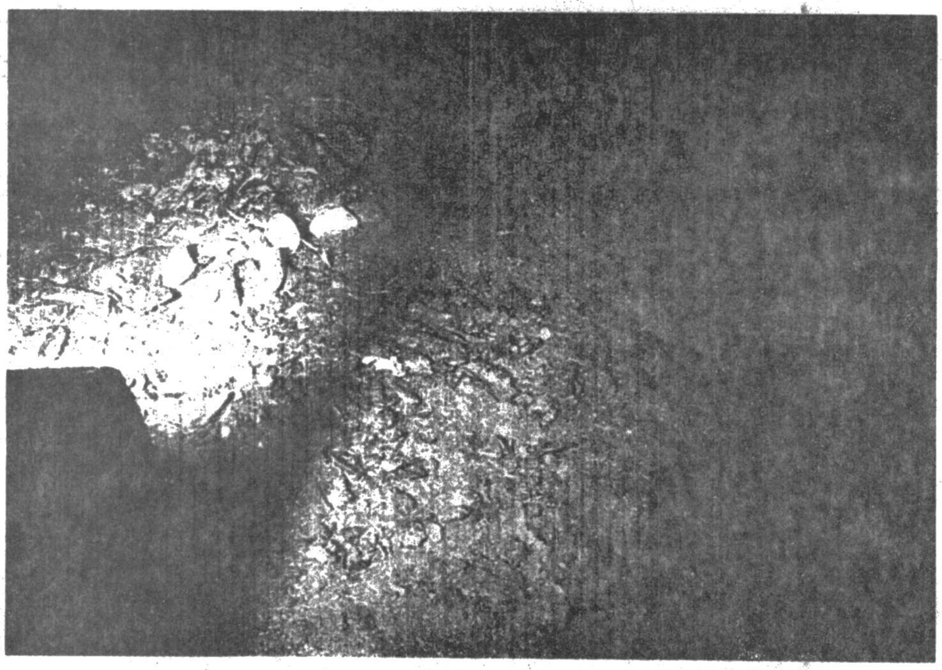
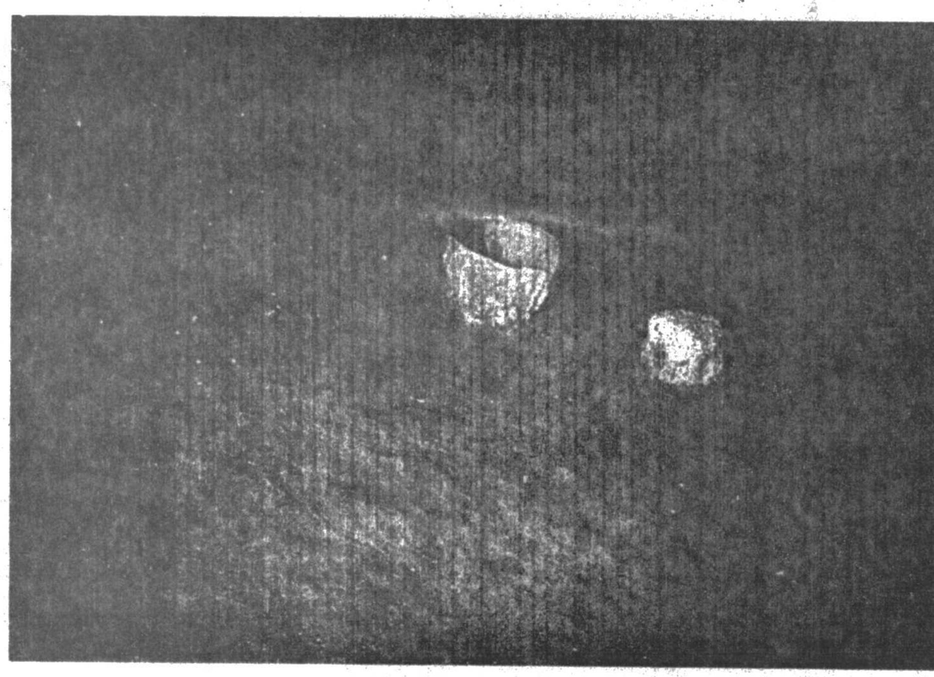



FIGURE: 48 BENTHIC BIOLOGICAL ASSEMBLAGES IDENTIFIED ALONG THE TELEVISION/STILL CAMERA LINE IN BRUNSWICK AREA, BLOCK 912



Photograph O. Shell/sand substrate within Brunswick Area, Block 912. (Note octopus within shell mound at upper left of photograph.)



Photograph P. Sponges (*Ircinia campana* and *Anthosigmella varians*) and a hydroid (*Thyroscyphus marginatus*) on apparent sand covered hard bottom within Brunswick Area, Block 912.

supported hydroids (*Thyroscyphus marginatus*), the anthozoan *Titanidium frauenfeldii*, and an unidentifiable white octocoral were the visually dominant fauna of the assemblage. As Photograph P shows, the fauna were very sparse in the area of their occurrence with only isolated clumps of epifauna observed.

Clustering analysis using the collected taxa showed that the five stations were divisible into two groups as shown in Figure 49. Group I Stations (201 and 203) had fewer species present than Group II. However, this grouping of stations did not represent a real difference in the areas and faunal assemblages sampled as it was a sampling artifact based on the patchiness of the faunal distribution.

As in the other lease blocks surveyed, no distinct species groupings were produced by the clustering analysis as the species chained together with those having similar numbers of occurrences appearing closest together in the dendrogram.

## 3. DEMERSAL FISH POPULATIONS

Nine species of fish were visually observed within Brunswick Area, Block 912 as shown in Table 13. A total of four species was collected with the dredge (listed in Appendices D and E) of which one was different from those photographically identified making a total of ten species. Channel flounder (*Synacium micrurum*), razor fish (*Hemipteronotus* sp.), and sea robins (*Prionotus roseus*) were observed on shell/sand sediments. Sea basses (*Centropristis* sp.) and gray snapper (*Lutjanus griseus*) were observed near the small ledge which was the only observed emergent hard bottom in the lease block. Queen triggerfish (*Balistes vetula*), striped burrfish (*Chilomycterus schoepfi*), and jack-knife fish (*Equetus lanceolatus*) were observed over areas of scattered attached epifauna.

The records from the Raytheon depth recorder showed little evidence of fish schools within the lease block. This was not surprising due to the lack of emergent hard bottom within Block 912.

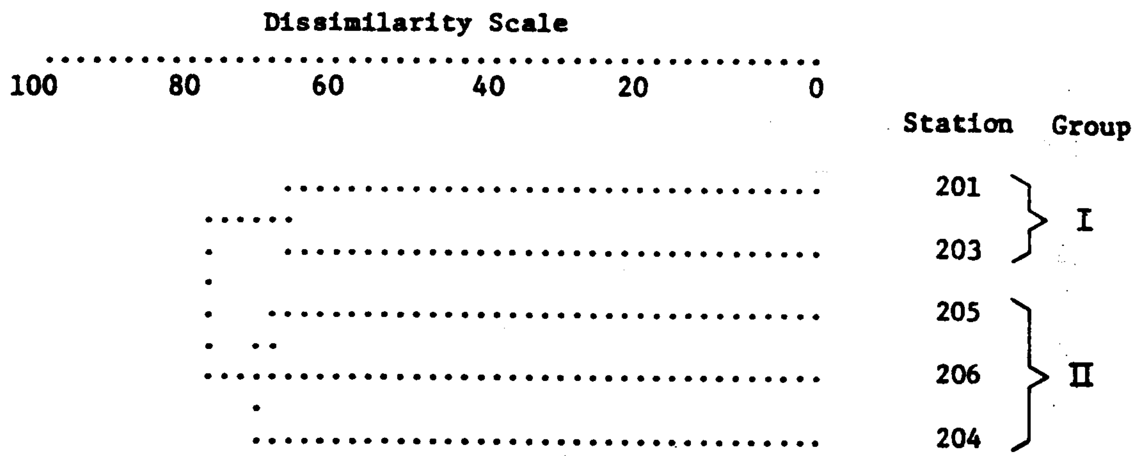



FIGURE: 49 STATION-GROUP DENDROGRAM FOR BRUNSWICK AREA, BLOCK 912 BASED ON 76 TAXA AND PRODUCED BY THE CZEKANOWSKI SIMILARITY COEFFICIENT AND FLEXIBLE SORTING

Table 13. Species of fish collected or observed in Brunswick Area, Block 912.

| Species | Habitat* | Dredge Sample | Visually Observed |
|---|---|---|---|
| *Balistes vetula* - queen triggerfish | D | | X |
| *Centropristis ocyurus* - bank sea bass | D | | X |
| *Centropristis striata* - black sea bass | D | X | X |
| *Chilomycterus schoepfi* - striped burrfish | D | | X |
| *Equetus lanceolatus* - jackknife fish | D | | X |
| *Hemipteronotus* sp. - razorfish | D | | X |
| *Lutjanus griseus*-gray snapper | D | | X |
| *Prionotus roseus* - sea robin | D | X | X |
| *Scorpaena* sp. - scorpionfish | D | X | X |
| *Synacium micrurum* - channel flounder | D | X | |

* D = Demersal
P = Pelagic

# IV. DISCUSSION

## A. HARD BOTTOM IDENTIFICATION AND MAPPING

The conservative interpretation of signatures on the sonograms as hard bottom coupled with the delineation of subbottom reflector outcrops and areas of little or no penetration by the subbottom profiler led to the identification and mapping of extensive areas of hard bottom. The emergent low relief hard bottom was so discontinuous that geophysical mapping of each patch was not feasible, and in some cases was impossible, which led to the outlining of large areas. In addition, since sediment thicknesses of less than a meter were often undetectable, it became difficult to differentiate very thin veneers of coarse material from lithified material. Direct visual observation with the television and still cameras showed that large areas of geophysically identified low relief hard bottom were not exposed but were covered with a thin veneer of sand. Although the survey grid and geophysical methods used in this survey were very similar to those used during typical multi-sensor, high resolution engineering surveys for geological hazards, no additional instruments that are typically used on shallow hazard surveys such as an air gun or sparker were used.

The side scan sonar provides the primary hard bottom mapping information in this type of survey. It is important for the side scan to be tuned properly and the records to be as noise-free as possible to allow for maximum utilization of the sonograms. Excessive sea state conditions can cause erratic tilting of the towed side scan fish thus distorting the printed record. Specific limits are difficult to set on the sea conditions in which the side scan sonar may be operated without distortion. The limits are dependent on many factors such as cable length, size and stability of the survey vessel, directions of the seas relative to the ship's course, and the experience and ability of the side scan sonar operator. Additional inaccuracies in the mapping of hard bottom areas may occur if the interpreter is not experienced with false traces caused by water column anomalies, the recorded shading of various substrate types, and the acoustic shadows (signatures) caused by topographic targets.

The subbottom profiler was an essential tool for hard bottom mapping as it allowed the interpreter to visualize the seafloor in three dimensions. One difficulty encountered with the subbottom profiler was the limited extent of penetration into the seafloor. The difficulty was caused by the presence in the survey area, and probably the whole lease area, of hard packed sands. The use of an air gun or "boomer" system of low power and tuned to a high band of frequencies could help to define the depth and extent of subbottom horizons with its greater capability for penetration. This system, however, would not yield the resolution of a subbottom profiler, and therefore, is recommended only as an additional survey tool and not as a replacement for the subbottom profiler. Also, the boomer may add additional noise to the side scan sonar records that could interfere with and hinder the detection of subtle changes in surficial geology. The gain of additional information would have to be weighed against this possible interference.

The quality of subbottom data is affected by excessive sea-state conditions which can cause cavitation at the subbottom fish causing poor quality records. Subbottom profiler records may also be of a poor quality in rough sea conditions if a hull mounted transducer is used due to the pounding action of the hull and the roll and pitch of the vessel.

The interpretation of the side scan sonar records generally showed excellent correlation with the television and still camera observations in the surveyed areas. This survey demonstrated the importance of visually observing the geophysically detected hard bottom areas to ascertain the amount of emergent hard bottom and to identify the types of biological assemblages that were present. The types of fauna and their biomass appeared to be directly related to the thickness of the sand cover which was generally not definable from the geophysical records.

The quality of the visual records is also subject to the same controlling limitations of sea-state and operator experience and ability as effects the collection of geophysical data. Additionally, high turbidity in the water close to the bottom will also affect the quality of the visual data. However, only extreme conditions will prevent the collection of the data since only one meter visibility is required as a bare minimum to be able to verify the substrate and biological assemblage types.

The bathymetric data generally showed little correlation with emergent hard bottom other than in the cases of obvious ridges and scarps and an area in Brunswick Area, Block 912 where a depression was directly related to a hard bottom location.

The biological dredge served as a useful tool to sample the hard bottom since it was able to sample large surface areas and all substrate types. The dredge samples provided the physical specimens needed for positive species identification of the biota recorded with the television and still cameras. However, dredging across high profile and on rough (rock) substrate may lead to possible damage or loss of samples or equipment unless the operator is experienced at dredging over rough terrain.

The use of grabs or box core type samples for collecting representative samples of biological communities may be questionable both due to the highly variable (i.e., patchy) nature of substrate types and associated biota and the inability of these sampler's to obtain samples on hard substrate. Such patchiness would require a large number of samples before the biologist could be assured of adequate species representation of the sampled assemblage.

Biological sampling should be used only to provide additional specific data involving the species comprising a biological assemblage. Visual observation techniques should still be required to establish substrate type/biotal assemblage relationships.

## B. GEOLOGICAL INTERPRETATION OF EMERGENT HARD BOTTOM

It appears that the emergent portions of the geophysically defined hard bottom areas are primarily Recent to Subrecent biostromal reef that is discontinuously covered by sands. The subbottom reflector may also represent the same biostromal reef though this has not been completely documented. The reef is composed of a mixture of encrusting organisms, bioclastic calcarenites, and cemented quartz sand. The sandstone often occurs in irregular lenses and frequently with a nodular relationship to sandy biomicritic, biomicritic and biolithic rocks. The sandstone probably represents sand that at one time filtered into various interstices, holes, and hollows in existing reef areas. In some cases the sandstone pre-dates the adjacent carbonates and represents clasts incorporated into the reef by encrusting organisms.

Whether any of the calcarenitic lithologies formed as beach rock is not certain but it seems unlikely. None of the typical features either in gross lithology or petrography seem to be present. It is believed that in the predominantly carbonate rocks the sand and silt-size carbonate clasts are derived from mechanical and biomechanical breakdown of the substrate reef and lithified by submarine cementing processes as no evidence of vadose cements was seen.

It appears that reef building activities by a considerable variety of organisms including serpulid worms, bryozoans, and lime-secreting algae have been going on fairly continuously following the post-Wisconsin sea level rise. Destruction of the reef probably occurs intermittently as it is smothered by shifting sediment at which time boring and burrowing organisms, whose destructive activities are probably effectively balanced during periods of healthy reef activity, greatly speed up the breakdown of the reef. It is probable that some submarine weathering, both chemical and mechanical (storm wave effects), is also occurring. The consequences of this breakdown are seen in the rubble of scattered clasts of all sizes from gravel to large blocks often lying near ledges from which they have recently become detached. This crumbling of the reef is to some extent balanced since the larger blocks themselves may become suitable substrates for succeeding generations of encrusting organisms so that in time they are re-incorporated into the reef again.

There is little evidence for extensive dolomitization of the reefoid material and alizarin red stain showed only scattered dolomite crystals. It thus differed from the substrate reported from "Gray's Reef" by Hunt (1974). Hunt suggested a correlation between the "Gray's Reef" substrate and the Duplin Marl of coastal Georgia and elsewhere. In the present case the evidence thus far collected would seem to indicate a younger (Recent to Subrecent) age. However, there is no reason to suppose that we are not dealing with the same diachronous lithosome since, in the relatively short time span since the end of Wisconsin time, sea bottom conditions along this entire stretch of the eastern seaboard have probably remained essentially the same.

Existing data indicate that any large scale deposition or removal of surficial sands from the observed emergent hard bottom areas could only occur during major storm conditions. Near-bottom current speeds on the outer continental shelf of the Georgia Embayment generally do not exceed 15 centimeters/second and bottom photographs of a particular site on the continental shelf studied by the U.S. Geological Survey showed minor changes in erosion and deposition of small bedforms but no mass movement of sediment (Butman, 1978; Lee, 1978). Biological observations showed individual sponges (*Ircinia* spp. and *Anthosigmella varians*) with diameters of 30 to 45 centimeters protruding through sand lenses only a few centimeters thick. It is estimated that a period of several years would be required for such sponges to attain a diameter of five to ten centimeters and perhaps avoid burial, though data on sponge growth is extremely limited. Based on the size of the sponges observed in Brunswick Area, Block 912, it is possible that the depression where the semi-emergent hard bottom area was discovered in the block was originally created during the last major storm in the area which is believed to have occurred during 1964 (Hurricane Dora). However, sand has apparently been gradually deposited in the depression at a rate that is slow enough to avoid smothering of the sponges.

## C. BENTHIC INVERTEBRATE ASSEMBLAGES

Table 14 lists the 38 species of the 499 identified taxa that were found in at least 25 percent of the 68 dredge samples collected during this survey. Decapods (7 species), anthozoans (6 species), bivalves (6 species), bryozoans (5 species), and echinoderms (5 species) composed 76 percent of the 38 species. Eight species were recorded from 50 percent or more of the dredges and 144 species from at least ten percent of the dredges.

Table 15 lists the eleven biological assemblages, their characteristic species, and the corresponding substrate types identified from the television/still camera observations conducted within the four surveyed blocks.

The polychaete *Phyllochaetopterus socialis* may be the most important species in James Island Area, Blocks 380 and 463. It appears to have the highest biomass in addition to creating a substrate for other fauna. The species has been reported from the continental shelf of the United States on only a single known previous occasion (Day, 1973) when it was collected off North Carolina. The polychaete was not observed or collected in the shallower water blocks of James Island Area, Block 198, and Brunswick Area, Block 912 where the observed epifaunal biomass was greatly reduced in comparison to the other two areas.

Brunswick Area, Block 912 appeared to have the lowest numerical abundance and biomass of attached epifauna of the four surveyed areas. Block 912 also had the lowest number of identified taxa of the four blocks (71 taxa). The visual observations indicated that these statistics were not simply a function of the few number of dredge samples, but were probably due to the small area of hard bottom and high degree of sand cover.

Although James Island Area, Block 198 was located in the shallowest water and had the least amount of emergent hard bottom of the blocks surveyed in the James Island Area, it had the largest number of identified taxa (274) as compared to Blocks 380 (214) and 463 (257). Assemblage C was identified in Blocks 198 and 912 as the individuals in both faunal groups were emerging from a sand substrate though they were apparently attached to a hard substrate below. Similar species were encountered in the two assemblages

Table 14. Species collected from twenty-five percent or more of the sixty-eight biological dredges collected in hard bottom areas.

| Species | Number of Dredges | Percent of Total Dredges |
|---|---|---|
| *Telesto sanguinea* - anthozoan | 50 | 74 |
| *Titanideum frauenfeldii* - anthozoan | 44 | 65 |
| *Celleporaria albirostris* - bryozoan | 43 | 63 |
| *Filograna implexa* - polychaete | 43 | 63 |
| *Arca zebra* - bivalve | 41 | 60 |
| *Smittipora levenseni* - bryozoan | 41 | 60 |
| *Ophiothrix angulata* - echinoderm | 41 | 60 |
| *Gonodactylus bredini* - stomatopod | 38 | 56 |
| *Lophogorgia* sp. 2 - anthozoan | 33 | 49 |
| *Hippopetraliella bisinuata* - bryozoan | 31 | 46 |
| *Parthenope fraterculus* - decapod | 29 | 43 |
| *Phyllochaetopterus socialis* - polychaete | 27 | 40 |
| *Ellisella* sp. - anthozoan | 26 | 38 |
| Anthothelidae sp. - anthozoan | 26 | 38 |
| *Chione latilirata* - bivalve | 25 | 37 |
| *Pteria colymbus* - bivalve | 24 | 35 |
| *Celleporaria magnifica* - bryozoan | 24 | 35 |
| *Asteroporpa annulata* - echinoderm | 23 | 34 |
| *Peyssonnelia rubra* - algae | 23 | 34 |
| *Stylopoma spongites* - bryozoan | 22 | 32 |
| *Thyroscyphus marginatus* - hydroid | 22 | 32 |
| *Polyandrocarpa* sp. - ascidian | 22 | 32 |
| *Palicus* sp. - decapod | 22 | 32 |
| *Molgula* sp. - ascidian | 21 | 31 |
| *Laevicardium pictum* - bivalve | 21 | 31 |
| *Stenorhynchus* sp. - decapod | 20 | 29 |
| *Cladocora arbuscula* - anthozoan | 20 | 29 |
| *Eucidaris tribuloides* - echinoderm | 20 | 29 |
| *Comactinia* sp. - echinoderm | 20 | 29 |
| *Ophioderma brevispinum* - echinoderm | 19 | 28 |
| *Synalpheus* sp. - decapod | 19 | 28 |
| *Hiatella arctica* - bivalve | 18 | 26 |
| *Nidalia occidentalis* - anthozoa | 18 | 26 |
| *Chama congregata* - bivalve | 18 | 26 |
| *Styela* sp. - ascidian | 17 | 25 |
| *Pilumnus sayi* - decapod | 17 | 25 |
| *Ascidia* sp. - ascidian | 17 | 25 |
| *Portunus ordwayi* - decapod | 17 | 25 |

**Table 15. Benthic biological assemblages, characteristic species, and corresponding substrate types identified from television/still camera observations in James Island Area Blocks 198, 380 and 463 and Brunswick Area Block 912.**

| Assemblage | Characteristic Taxa | Block | Substrate Type |
|---|---|---|---|
| A | *Virgularia presbytes* (sea pen)<br>*Luidia* spp. (asteroid)<br>*Encope michelini* (echinoid) | 198, 380, 463 | Sand and sandy shell |
| B | Sponges<br>Gorgonaceans (particularly *Lophogorgia* spp.) | 198 | Emergent hard bottom (low relief) |
| C | *Titanideum frauenfeldii* (anthozoan)<br>*Filograna implexa* (polychaete)<br>Sponges | 198, 912 | Sand covered hard bottom |
| D | *Phyllochaetopterus socialis* (polychaete)<br>*Peyssonnelia rubra* (algae)<br>Anthothelidae sp. (anthozoan)<br>*Ellisella* sp. (anthozoan)<br>*Telesto sanguinea* (anthozoan)<br>*Filograna implexa*<br>Sponges | 380, 463 | Emergent hard bottom (low relief) |
| E | *Comactinia* sp. (crinoid)<br>*Peyssonnelia rubra*<br>Coralline algae<br>Sponges | 380 | Rubble/talus and emergent hard bottom (high relief) |
| F | Sabellid polychaetes | 380 | Coarse sand |
| G | *Gorgonacea* sp. 2 | 380 | Emergent hard bottom (high relief) |
| H | Coralline algae<br>*Peyssonnelia rubra* | 463 | Rubble/talus |

Table 15. (cont.)

| Assemblage | Characteristic Taxa | Block | Substrate Type |
|---|---|---|---|
| I | *Cirrhipathes* sp. (anthozoan)<br>*Filograna implexa*<br>Hydroids<br>Sponges | 463 | Emergent hard bottom (high relief) |
| J | No biota observed | 463 | Sand |
| K | *Luidia* spp.<br>*Portunus gibbesii* (decapod)<br>Hydroids<br>Octopods | 912 | Sand/shell |

though their observed numerical abundances differed. The visual observations in Block 198 showed that an increased species richness and biomass appears to be associated with emergent hard bottom.

The visual dominance of *Phyllochaetopterus socialis* in Blocks 380 and 463 separated Assemblage D from all others. Four additional assemblages in Block 380, two of which were associated with emergent hard bottom, appeared to be depth related. Larger portions of the observed area of Block 463 were dominated by the sea pen, *Virgularia presbytes*, (Assemblage A) than in Blocks 198 and 380. The rubble/talus areas in Blocks 380 and 463 appeared to support a much lower biomass and faunal abundance than the emergent rock slabs and ledges, but higher than the sand bottom areas.

A series of clustering analyses was made on the presence/absence data from the four blocks using the Jaccard and Czekanowski similarity coefficients. The following three sets of data were used: (1) the 65 most frequently occurring taxa from the 28 stations of Blocks 198 and 912, (2) the 94 most frequently occurring taxa from the 40 stations of Blocks 380 and 463, and (3) the 99 most frequently occurring taxa from the total of 68 stations. The station dendrogram (Figure 50) produced using the Czekanowski coefficient for the 99 most frequently occurring taxa from the total of 68 stations differentiated four groups. Examination of the groups and a two-way table of stations and species indicated that Group I (Block 198 stations) appears to have a slightly different group of taxa present than Group II (Block 380 stations and eight stations from Block 463) and Group IV (eight stations from Block 463). Group III was composed of the Block 912 stations and four stations from Block 463 that were improperly classified. Though a certain amount of misclassification of stations occurred in the dendrogram the two-way table did show that the five stations in Block 912 were somewhat different than the other 63 stations. As expected, the Block 380 and 463 stations appeared to be the most similar though little difference in the presence/absence of species between Blocks 198, 380 and 463 could be detected in the two-way table.

The other clustering analyses provided little information in addition to that already provided by the individual block clustering analyses and the clustering analysis just discussed which compared all the stations. The water depth of the stations in Blocks 198 and 912 ranged from 30 to 35 meters and from 45 to 102 meters in Blocks 380 and 463. Although one might expect to discern a minimum of two different biological assemblages due to water depth, the confounding parameter involving the quality of the emergent hard bottom (amount of sand cover and relief) complicates the analysis of the factors controlling the distribution of the taxa.

No distinct species groupings were produced by the clustering analysis using either similarity coefficient as the species chained together with those having similar numbers of occurrences appearing closest together in the dendrogram.

The following major taxa are believed to be associated primarily with the hard bottom areas based on the species sampled as opposed to the more dominant soft, sandy bottom of the Georgia Bight continental shelf: (1) Porifera (sponges), (2) Hydrozoa (hydroids), (3) Anthozoa (corals, sea anemones, sea feathers, and fans) excluding

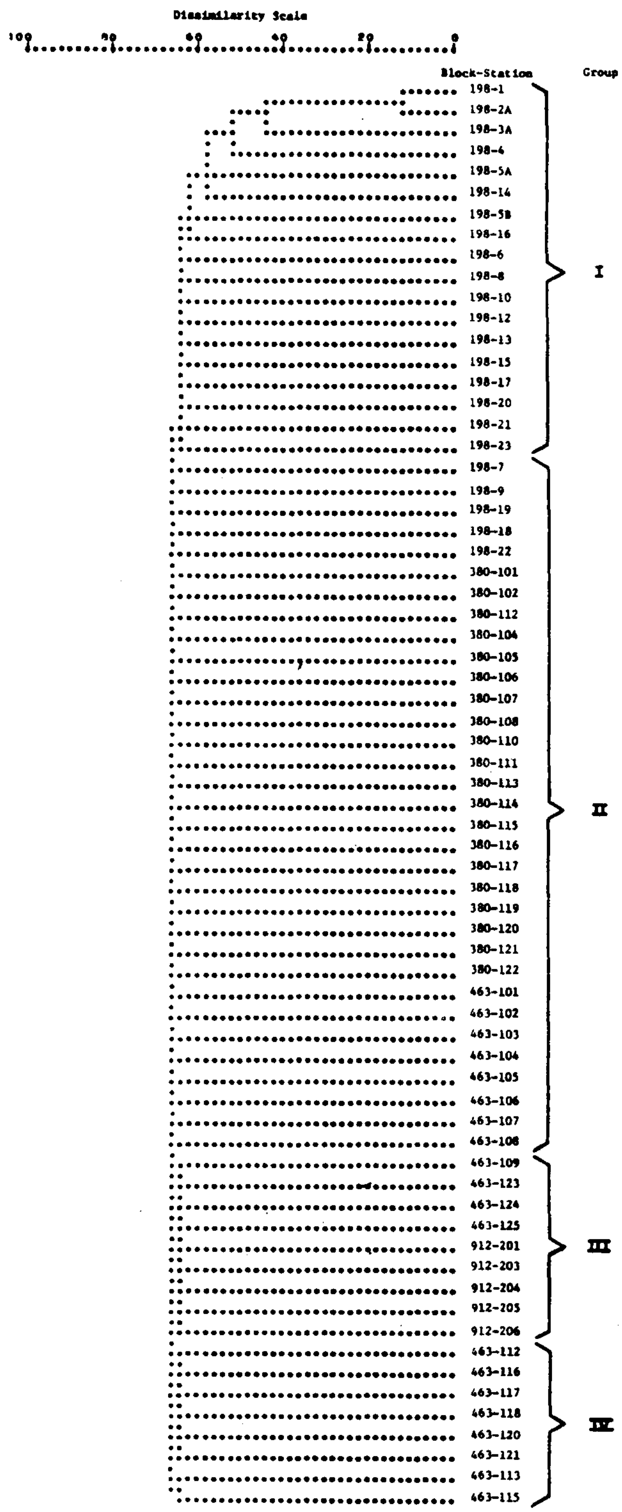



FIGURE: 50 STATION-GROUP DENDROGRAM FOR THE FOUR AREAS SURVEYED BASED ON 99 TAXA AND PRODUCED BY THE CZEKANOWSKI SIMILARITY COEFFICIENT AND FLEXIBLE SORTING

*Renilla reniformis and Virgularia presbytes,* (4) Cirripedia (barnacles), (5) Bryozoa (moss animals), (6) Ascidiacea (sea squirts), and (7) Chlorophyta (green algae), Phaeophyta (brown algae) and Rhodophyta(red algae). Certain species of polychaetes, mollusks, crustaceans and echinoderms as shown in Appendix D are also believed to be almost exclusively associated with hard bottom substrates. A more complete list of exclusive hard bottom species is difficult to construct due to the close spatial proximity between sand and rock in most areas and the historical occurrence of some species in more than one habitat.

The zoogeographical affinities of the hard bottom associated taxa seem to be primarily tropical (Caribbean/West Indian) based on discussions of the various major taxonomic groups by different authors (Abbott, 1974; Bayer, 1961; Cairns, 1978; Giammona, 1978; Meyer et al., 1978; Widenmayer, 1977). A species-by-species discussion of zoogeographical considerations is beyond the scope of this report.

Comparisons between the fauna collected in this study and that collected by Avent et al. (1977) off the east coast of central Florida and Menzies et al. (1966) and Cain (1972) off the coast of North Carolina on shelf edge reefs reveal a large number of species in common. Three of eight cnidarian species, 13 of 32 decapod, seven of 8 echinoderm, 15 of 45 gastropod, 11 of 26 bivalve and one of 26 bryozoan species were found in common with the samples collected by Menzies et al. (1966) at their reef stations. Ten of the 19 species designated by Menzies et al. as characteristic of the reef stations were also collected during this study. Twenty-eight of the 85 taxa identified by Cain (1972) to species level and reported were dredged from the areas surveyed during this study. It is believed that because of the qualitative nature of these data sets and the variable amount of effort spent in the collection and taxonomic identification phases of the three studies, the only general conclusion that can be made is that certain portions of the fauna are similar.

## D. FUTURE CONSIDERATIONS

### 1. ENVIRONMENTAL STIPULATIONS CONCERNING GEORGIA EMBAYMENT HARD BOTTOM AREAS

The hard bottom areas within the Georgia Embayment are a valuable resource as both a recreational and commercial snapper/grouper fishery of North and South Carolina, Georgia, and north Florida (Cupka et al., 1977; Huntsman, 1976; Huntsman and Dixon, 1976; Ulrich et al., 1976; Wolff, 1979). However, South Carolina and north Florida fishermen seem to be utilizing the hard bottoms to a greater extent than Georgia fishermen (Smith and Rivers, 1977).

The hard bottom areas surveyed had extremely limited amounts of hermatypic coral in contrast to the Florida Middle Ground (Grimm and Hopkins, 1977) and the Gulf of Mexico Flower Garden Banks (Bright and Pequegnat, 1974; Bright et al., 1976). However, the faunal assemblages were as extensive and rich (species richness) in the James Island Area as those reported by Ludwick and Walton (1957) and

Woodward-Clyde (1979) for the outer shelf areas off the central and northern west coast of Florida and the South Texas Banks (Antipatharian Zone) reported by Bright et al. (1978b). A number of the same octocorals have been identified from all three areas.

The total area of hard bottom in the Georgia Embayment is not known with any degree of accuracy. However, this lack of knowledge does not change the fact that these areas and associated fauna are probably as sensitive, unique, and important as hard bottom areas and associated fauna in the eastern and northwestern Gulf of Mexico.

According to McCarthy (1978) the current regulations involving the identification and mapping of suspected hard bottom areas using geophysical data collected during shallow geological hazard surveys followed by visual inspection of any suspected areas within 1,820 meters of a proposed drillsite appear to be sufficient to insure identification and characterization of the hard bottom areas and associated fauna.

The question remains as to what are the most effective methods for protecting the areas from the impact of oil and gas drilling operations. The Federal Register stipulations relevant to the lease blocks considered have stated:

"If it is determined that live bottom (hard bottom) areas might be adversely impacted by the proposed activities, then the Supervisor will require the lessee to undertake any measure deemed economically, environmentally and technically feasible to protect live bottom areas. These measures may include, but are not limited to the following:

(a) The relocation of operations to avoid live bottom areas.

(b) The shunting of all drilling fluids and cuttings in such a manner as to avoid live bottom areas.

(c) The transportation of drilling fluids and cuttings to approved disposal sites.

(d) The monitoring of live bottom areas to assess the adequacy of any mitigation measures taken and the impact of lessee initiated activities (USDI, 1978a).

The general low relief of the hard bottom in the Georgia Embayment, except possibly near the shelf-edge, is unlike the Gulf of Mexico topographic highs (banks). The discharge of drilling fluids and cuttings through a downpipe terminating near the bottom (shunting) would tend to concentrate the discharges near the hard bottom areas rather than isolating the discharges form the sensitive areas as is apparently the case with shunting near the Texas topographic highs. Near-surface discharges would allow for maximum dilution and dispersion of the discharges. The distance from hard bottom areas beyond which discharges can be safely made without possibly damaging the area is difficult to state without a greater knowledge of the components of the discharges, the oceanographic conditions at the time of the discharges, and a knowledge of the effects of the discharges on the biota.

## 2. RECOMMENDATIONS FOR FUTURE RESEARCH

The current regulations that require interpretation of the shallow geologic hazards data for hard bottom and subsequent visual inspection and perhaps sampling of the suspected areas will serve to define the hard bottom areas and lead to a general description of the associated communities within tracts leased for oil and gas exploration. A mapping survey presently being conducted by the U.S. Geological Survey and primarily concentrated in the leased tracts will provide additional information on the percentage of hard bottom areas located on the continental shelf in the Georgia Embayment. Additional studies of the hard bottom associated ichthyofauna are presently being made by the National Marine Fisheries Service or through their funding of other research groups.

In the event that environmental monitoring programs are required during drilling operations that are conducted near (distance presently unspecified) hard bottom areas then information on the dispersion and dilution of the discharges and the area affected during particular oceanographic conditions should be collected. The monitoring programs should also supply data on the detectable effects of the operations on the fauna associated with the hard bottom.

There is insufficient available knowledge describing the exposure times and concentration levels at which drilling fluids may damage the hard bottom fauna. This lack of data coupled with a minimal understanding of the ecological dynamics of the hard bottom faunal assemblages makes the restrictions on discharges as specific distances from the hard bottom areas virtually arbitrary. Laboratory studies (bioassay) involving representatives of the hard bottom faunal assemblages and long-term field studies involving temporal variations in ecological conditions and subsequent changes in the structure of the faunal assemblages of specific hard bottom areas is needed. Information on the temporal stability of the hard bottom areas and fauna is also needed to assess the significance of the possible short or long term effects of drilling operations on the hard bottom fauna.

Whether the economic expenditures required to obtain these needed data can be justified against the economic cost of not acquiring the information is beyond the scope of this report.

## V. SUMMARY AND CONCLUSIONS

Four oil and gas lease tracts in the Georgia Embayment were surveyed with a precision depth recorder, side scan sonar, and subbottom profiler for the purpose of identifying and mapping areas of hard bottom. Multi-sensor high resolution engineering surveys using similar equipment are routinely conducted prior to drilling activities in order to identify shallow geologic hazards including sediment instability, faulting, and shallow gas. The primary objective of this study was to determine the efficacy with which the standard geophysical equipment and techniques normally used could identify and map hard bottom areas. An underwater television system was used to inspect the geophysically mapped hard bottom areas to determine the relationship of emergent hard bottom to geophysically mapped hard bottoms and benthic faunal biomass. The secondary objectives of this study were to characterize the substrate comprising the hard bottom using petrographic analyses and to identify the hard bottom associated epifauna and demersal fishes. Color photographs were taken and dredge samples collected for this purpose.

The results showed that through the conservative interpretation of side scan sonar signatures and identification of areas of apparent outcropping of subbottom reflectors or acoustically impenetrable layers by the subbottom profiler, that hard bottom areas can be identified and mapped most successfully. However, visual inspection was necessary to delineate the discontinuous nature of the emergent hard bottom areas and the types of biological assemblages associated with the mapped areas. A thin veneer of sand that was very difficult to identify from geophysical data was often observed overlying the geophysically defined hard bottom. Attached epifauna were frequently observed protruding from the sand which in those areas was probably less than six centimeters in thickness. The thickness of the sand veneer frequently appeared to determine the composition and quantity of the epifauna, with a depauperate fauna present in areas having apparently the thickest veneer of sand. Visual observations also showed that the geophysically defined hard bottom areas were very often a mosaic of low relief rock ledges and slabs (less than one meter), areas of rubble/talus, and patches of sand with the pattern of the mosaic being extremely variable. Areas of higher relief hard bottom in the form of ridges and scarps were occasionally identified.

Bathymetry was generally not adequate for the determination of hard bottom areas except in the cases of the ridges and scarps and in one instance (Brunswick Area, Block 912) where a depression was associated with a hard bottom area covered with a thin veneer of sand.

Petrographic analyses of 43 rock samples dredged from the hard bottom areas showed that the hard bottom was principally a Recent to Subrecent biostromal reef. Six lithologic types were identified (sandstone, biomicrite, sandy biomicrite, biosparite, biolithite, and algal biolithite) from the dredge samples with no significant variations in their distributions recorded between the four lease blocks.

Four hundred and ninety-nine taxa including 33 fishes were identified from 68 biological dredge samples collected in hard bottom areas. The hard bottom associated fauna was primarily composed of representatives from the following major taxa: Chlorophyta (green algae), Phaeophyta (brown algae), Rhodophyta (red algae), Porifera (sponges), Cnidaria (hydroids, corals, sea anemones, sea feathers, and fans) and Ascidiacea (sea squirts). A number of species of polychaetes, mollusks, crustaceans and echinoderms were also believed to be directly associated with the hard bottom. Biological assemblages were identified from the dredge samples through computer-aided clustering analyses. The faunal assemblages identified from the visual data were believed to more accurately represent the faunal associations. This was due to the qualitative nature of the dredge data and the habitat (rock/sand) integrating effect of the dredge. Although some coherence of identified assemblages was noted between the four study areas, the composition of the assemblages and their areal extent were often quite variable. The faunal assemblages appeared to be directly correlated to substrate type with water depth seeming to be the second major factor influencing the abundance and distribution of the observed and collected species.

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## VII. ACKNOWLEDGEMENTS

As prime contractor Continental Shelf Associates, Inc. was responsible for project management, logistics, field data collection with the exception of the navigation and geophysical elements, data management, analysis of television/still camera data and dredge samples, and the writing of the report. Decca Survey Systems, Inc. provided navigation and was responsible for geophysical data collection, interpretation and reporting.

Individuals responsible for these work elements plus consultants that provided geological, geophysical, taxonomic and numerical analysis expertise are listed in the following table.

Table 16. Principal Contributors to the South Atlantic Hard Bottom Study.

| Affiliation | Contributors | Project Work Element |
|---|---|---|
| Continental Shelf Associates, Inc. | Robert C. Stevens, Jr. | Project Manager |
| | Dennis J. Adamek | Data Manager |
| | David A. Gettleson, Ph.D. | Chief Scientist |
| | Frederick B. Ayer II | Field Operations Leader |
| | Russell E. Putt, Jr. | Television/Still Camera Interpretation |
| Decca Survey Systems, Inc. | Thomas E. Neurauter | Geophysical Collection and Interpretation |
| | John W. Antoine | Geophysical Interpretation |
| Florida Atlantic University | Roy R. Lemon, Ph.D. | Petrographic Analyses |
| Skidaway Institute of Oceanography | Vernon J. Henry, Jr., Ph.D. | Geophysical/Geological |
| South Carolina Marine Resources Research Institute | Dale R. Calder, Ph.D. | Hydroid Taxonomy |
| U.S. Bureau of Land Management | Richard E. Defenbaugh, Ph.D. | Hydroid Taxonomy |
| Texas A & M University | Arthur J. Leuterman, Ph.D. | Bryozoan Taxonomy |
| | Robert J. Case | Numerical Analyses |
| Independent Taxonomic Consultants | Steven O. Blair | Algae |
| | Stephen D. Cairns | Scleractinia |
| | R. Grant Gilmore | Osteichthyes |
| | Margaret O. Hall | Algae |
| | Paul M. Mikkelsen | Mollusca |
| | Paula S. Mikkelsen | Mollusca |
| | John E. Miller | Echinodermata |
| | David H. Mook | Ascidiacea, Cirripedia |
| | Thomas H. Perkins | Polychaeta |
| | John K. Reed | Porifera, Anthozoa |
| | Kim A. Wilson | Crustacea |

# VIII. APPENDICES

# APPENDIX A

## Equipment Specifications

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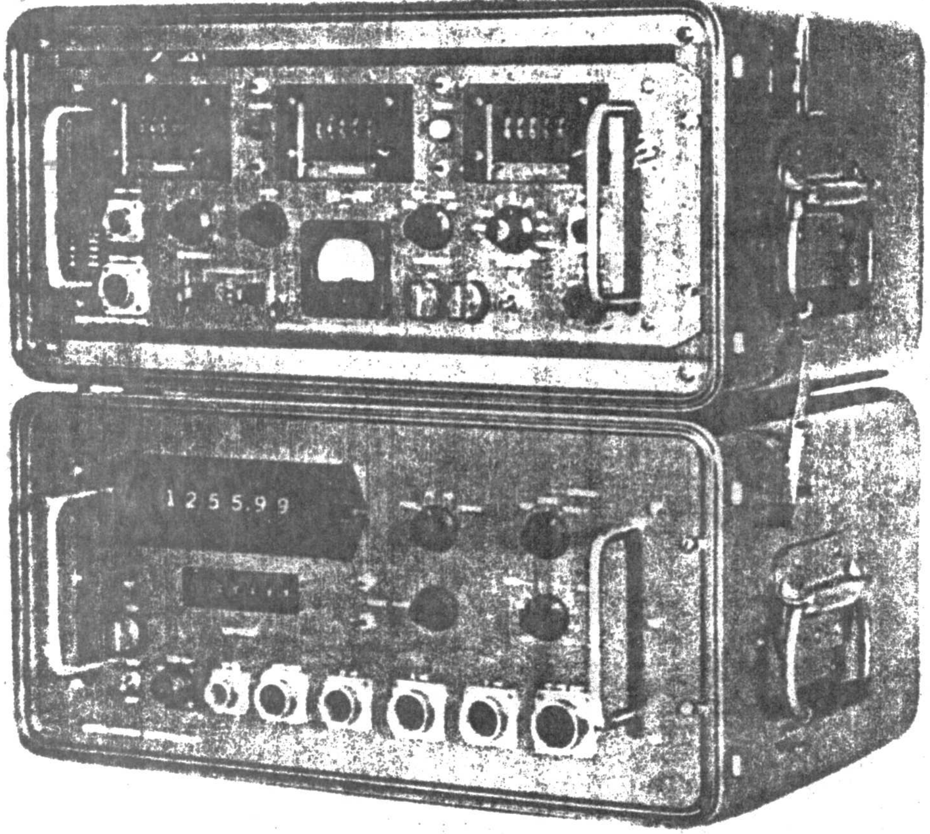
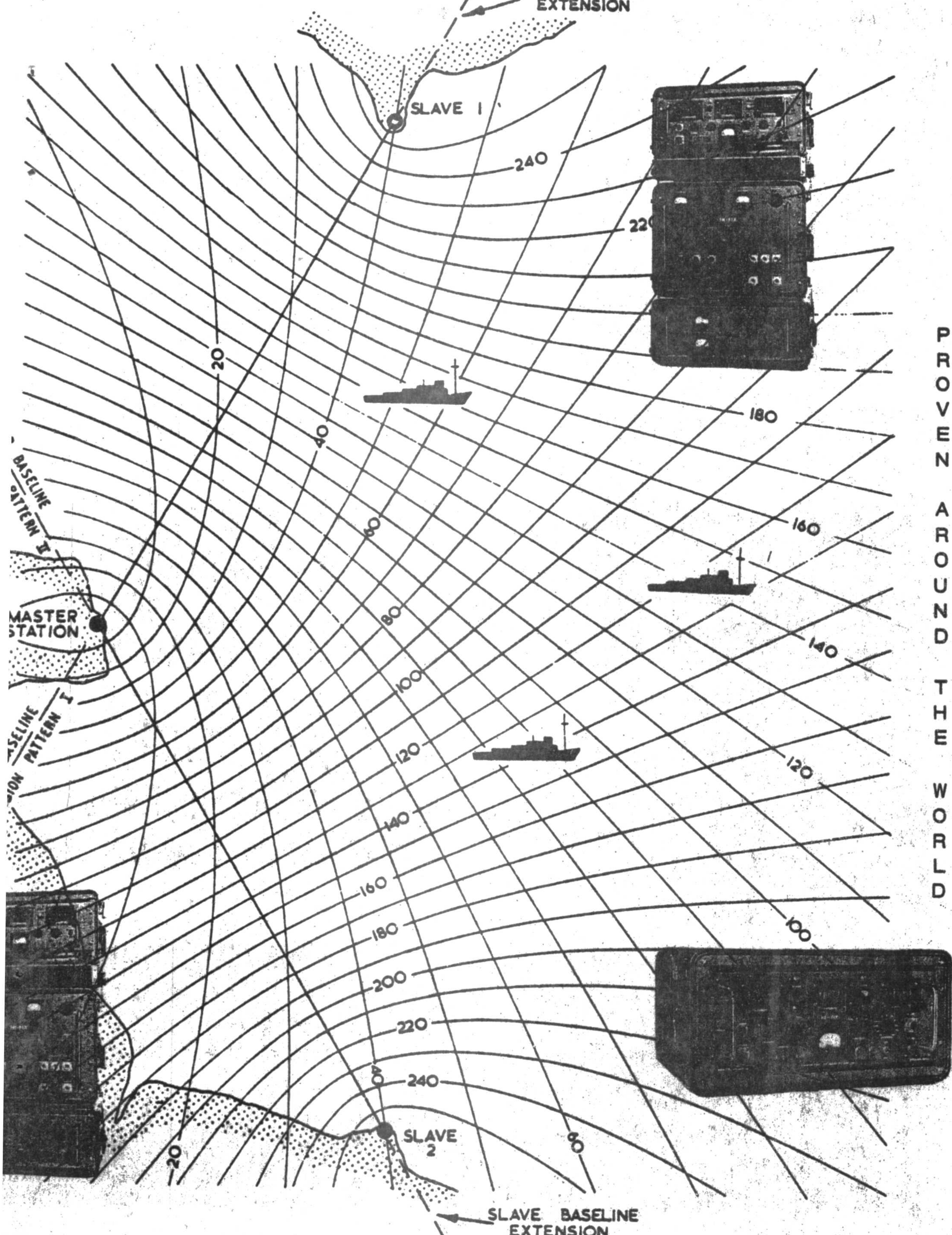


HI-FIX Chain Stations are designed for unattended operation. All units are easily handled by one man and are mounted in rugged field cases measuring 20 / 14 / 10 inches. Units are designed for stacking during operations.
All Transmitters, Slave and Shipboard Receivers are interchangeable for flexibility and economy. Numerous optional display services are available.

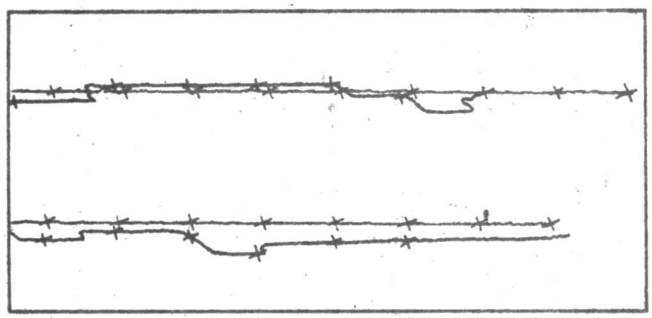
| | |
|---|---|
| Operating Frequency ($f_o$) | selected frequency within 1600-2000 KC Band. |
| Control Frequency | $F_o$-60 Cycles |
| Receiver Band Width | ± 100 Cycles |
| Radiated Signal | ICW Time Multiplex between Master and Slaves |
| Radiated Power | 10W or 40W |
| Working Range | 50-100 Miles Temperate Lats.<br>25- 50 Miles Tropical Lats. } 10 W Radiated Power |
| | 100-200 Miles Temperate Lats.<br>50-100 Miles Tropical Lats. } 40 W Radiated Power |
| ACCURACY: | |
| Hyperbolic Mode | .015 Lane |
| Range-Range Mode | .015 Lane |
| POWER: | |
| Hi-FIX Master or Slave | 6a @ 24 V.D.C. |
| Shipboard Receiver | 4a @ 24 V.D.C. |

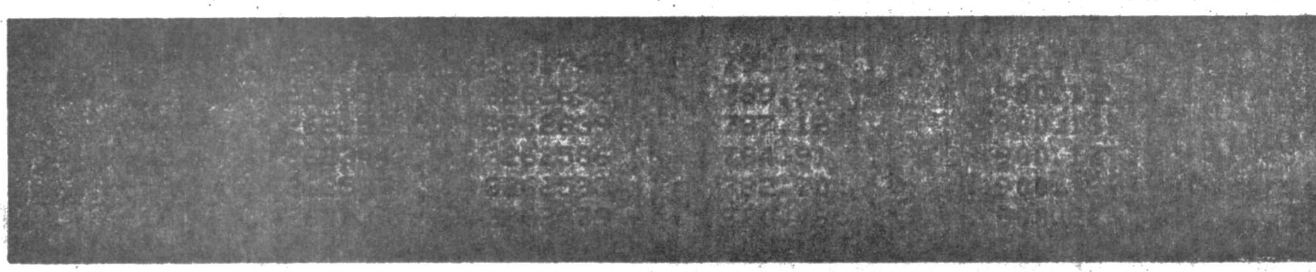

SLAVE BASELINE EXTENSION
SLAVE 1
240
220
20
40
60
80
100
120
140
160
180
200
220
240
180
160
140
120
100
MASTER STATION
BASELINE
PATTERN II
PATTERN I
SLAVE 2
SLAVE BASELINE EXTENSION
PROVEN AROUND THE WORLD

# AUTOCARTA

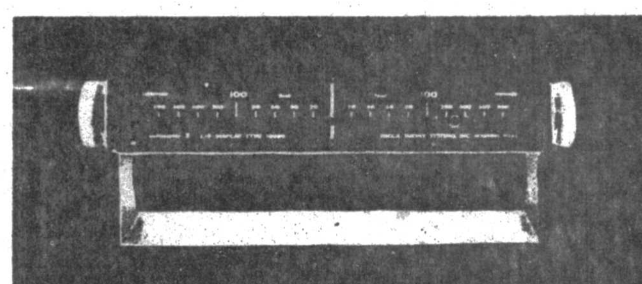
## FOR SEISMIC SURVEYS AND OFFSHORE ENGINEERING

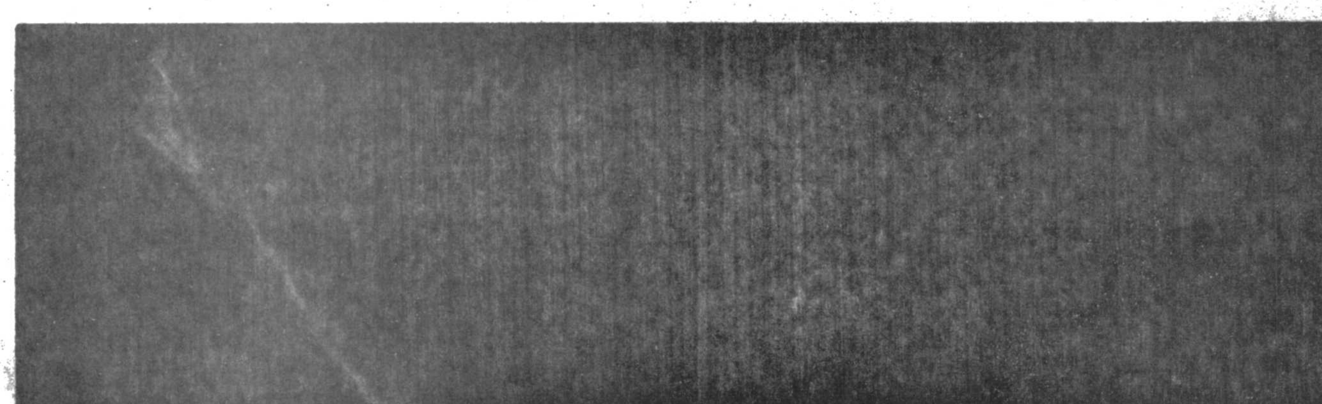
When programmed for seismic applications the operator first specifies the **Preplot** operation, and then defines line and fix point data. The precise grid and pattern co-ordinates of each fix point are then listed, and simultaneously the required track with each fix point annotated is recorded on the plotter.





At the commencement of the survey the **Postplot** operation is specified. Pattern corrections and real time are input together with line and fix point data as before. Guidance information is then presented to the helmsman on the left right display, and the actual track recorded on the plotter. At each fix point – determined automatically from Autocarta, or manually – a contact closure is available for marking the seismic instruments. Also the track made good is annotated and a listing made comprising actual pattern and grid co-ordinates together with depth and real time.





# AUTOCARTA

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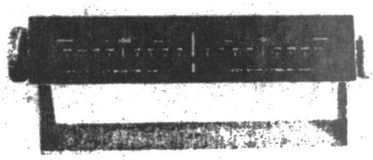
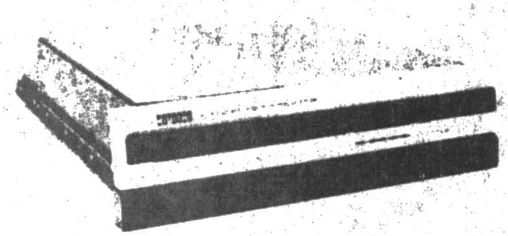
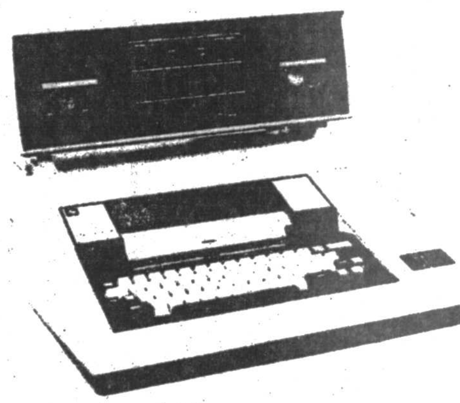
## SYSTEM HARDWARE



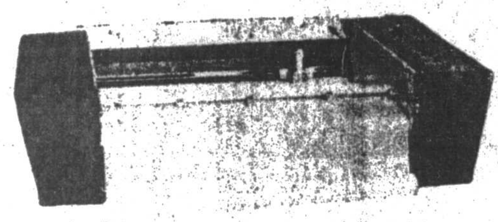
10409 Left/Right Display



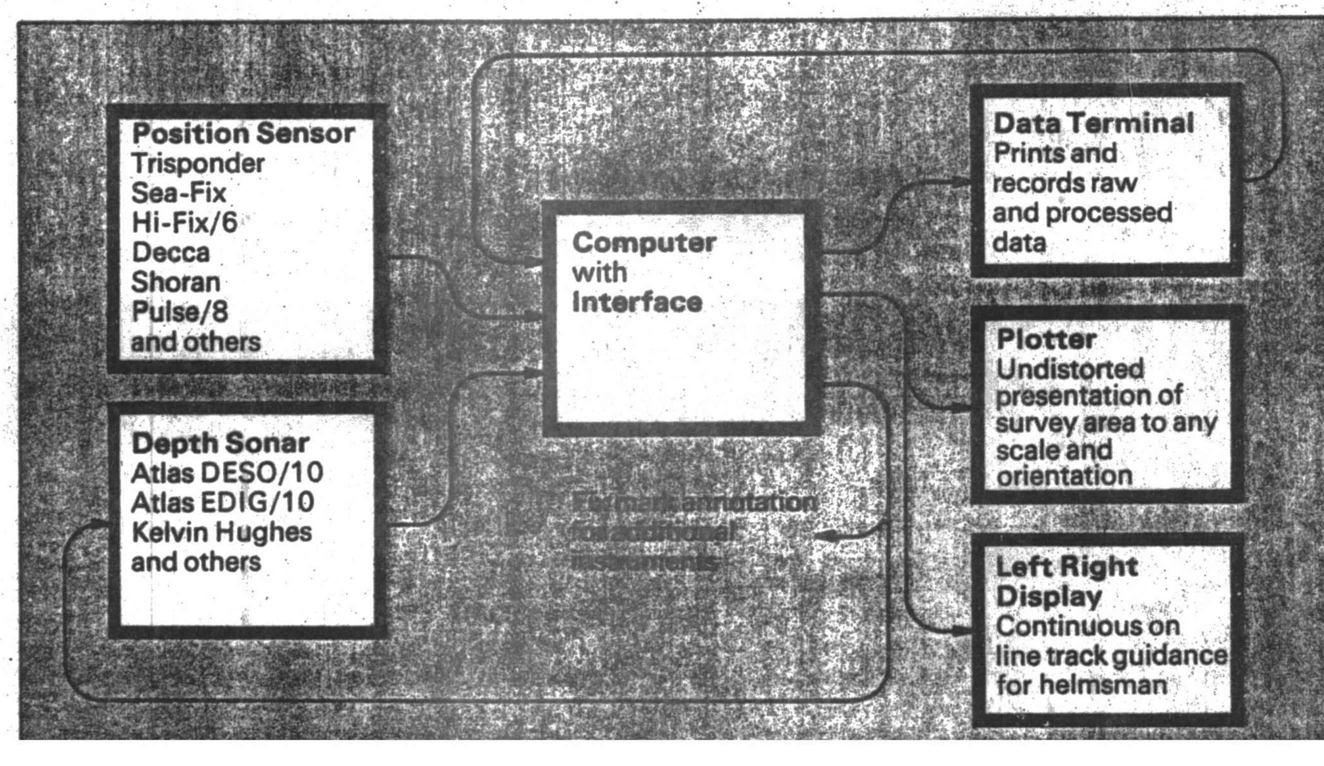
PDP 11/05 or Micro 1 Computer



733 ASR Data Terminal



DP3 Plotter



# AUTOCARTA

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| | | | | |
|---|---|---|---|---|
| 115/230V AC 325W | 65lbs (29.5Kg) | 5.25in (16.0cm) | 19.0in (48.2cm) | 20.0in (50.8cm) |
| 115/230V AC 200W | 50lbs (22.6Kg) | 14.6in (37.0cm) | 21.2in (53.8cm) | 19.5in (49.5cm) |
| 115/230V AC 125W | 80lbs (36.2Kg) | 10in (25.4cm) | 36in (91.4cm) | 18in (46.2cm) |
| Supplied by computer | 6lbs (2.7Kg) | 6.6in (16.9cm) | 10.0in (25.4cm | 9.0in (22.9cm) |
| Supplied by computer | Integral with computer | | | |

| | | | | |
|---|---|---|---|---|
| 115/230V AC 125W | 50lbs (22.6Kg) | 9.5in (24.1cm) | 14.0in (35.5cm) | 19.75in (50.2cm) |
| 115/230V AC 170W | 53lbs (24.0Kg) | 9.8in (25.0cm) | 39.5in (100.2cm) | 14.7in (37.4cm) |
| 115/230V AC 350W | 50lbs (22.6Kg) | 10.5in (26.7cm) | 19.0in [illegible] | 15.0in [illegible] |

# DECCA SURVEY TRISPONDER®

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## FUNCTION

Decca Survey Trisponder is a short range microwave aid for the accurate position fixing of sea going vessels and aircraft. It may be used in any application where precise control is required, and its many operational advantages render it a particularly effective system.
Equipment is lightweight, portable and easily deployed. After initial calibration, no preliminary setting up is required and the clearly readable position fix is unambiguous. Modern electronic design techniques allow for extended periods of operation without routine support, and also ensure that down time during servicing is significantly reduced.

## STANDARD TRISPONDER

- **Range Accuracy ± 3 metres**
- **Range to 80Km**
- **Range Resolution ± 1 metre**
- **4 Remote Capability (2 Interrogated)**
- **BCD Output of Two Ranges**
- **Radar Interference Suppression**
- **AGC Facility**
- **Option:**
  - 3 User Operation – Time Shared

## EQUIPMENT OUTLINE

The minimum equipment requirement to provide position fixing consists of three stations, and is known as the 'Basic System'. One station installed on the user vehicle is termed the Mobile, and the remaining two at fixed locations are called Remotes. Pulsed transmissions in the X band and digital measuring techniques are employed in a range/range configuration to give the position of the Mobile with respect to the Remotes. Three small Transmitter/Receiver (T/R) Units, and a Distance Measuring Unit (DMU) for control and display purposes at the Mobile Station are the only items of equipment required. Primary power is at 24 volts DC.

Decca Survey Trisponder is available as Standard, Multi Channel or Short Range systems, and considerable variation within each system type is also possible. Equipment can be provided to a client's specification which presents range measurements in feet or metres, has radar interference suppression fitted and has a multi user time share option available. Systems are now provided with the Automatic Gain Control (AGC) option fitted. This recently developed improvement contributes greatly to overall range stability and hence accuracy by maintaining constant input signal levels which minimises the need for field calibration.

# BASIC SYSTEM EQUIPMENT

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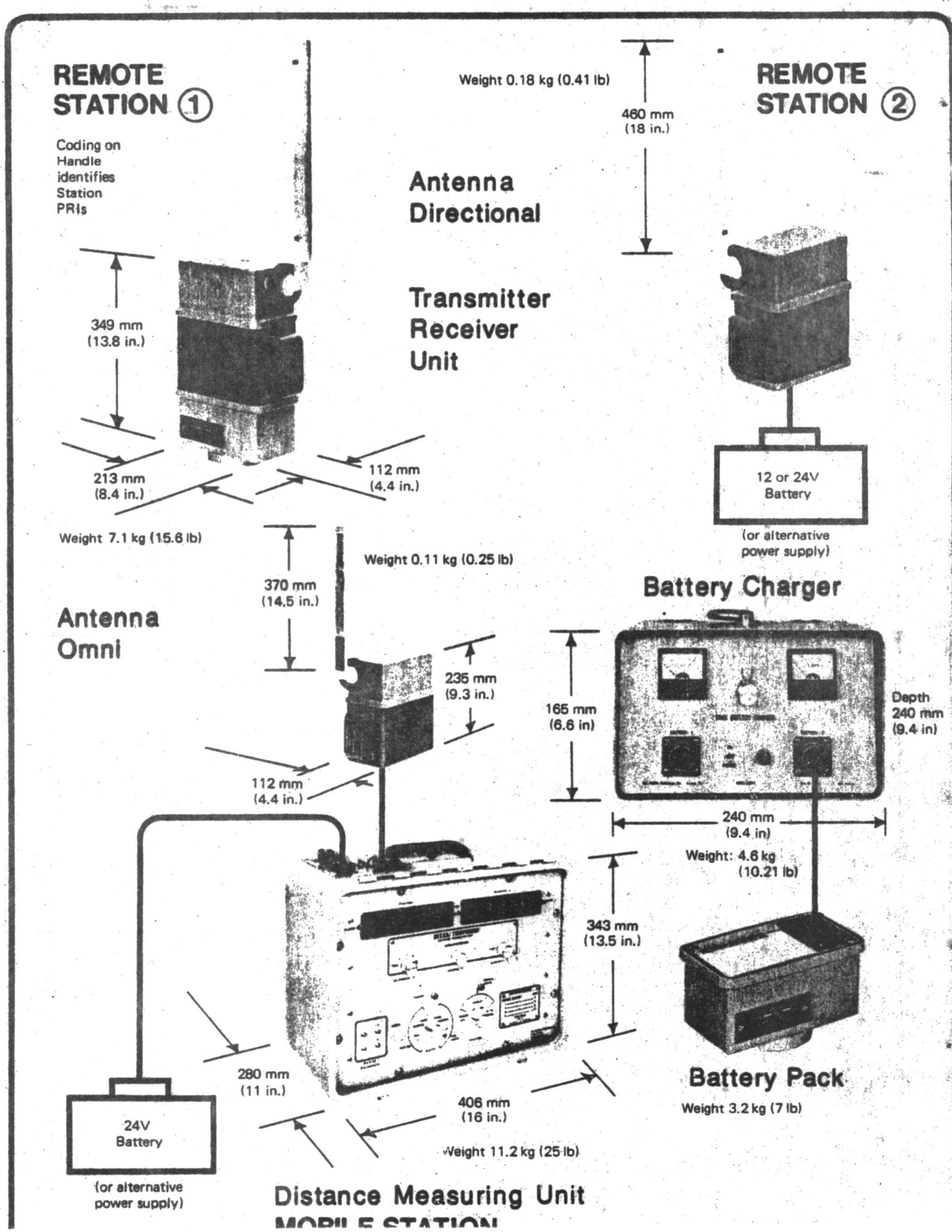
Detail shown is for Short Range Trisponder



**LICENCING DATA**

System parameters within the shaded areas should be furnished to the UK. Authority when application for a licence is made. Similar requisites may be required for licencing purposes, in other countries and the appropriate authority should be consulted.

**SYSTEM AND UNIT VARIANTS**

Systems are available with distance measurements expressed in metres or feet, indicated by a first suffix letter M or F respectively.

Systems are available with or without an AGC option, indicated by a second suffix letter C or A respectively.

Example: A short range system giving distance measurements in metres and fitted with an AGC option is identified as type 202A-MS10-MC.

**FREQUENCIES**

Tuning range 9300–9600 MHz. Units are normally supplied adjusted to transmit on the frequencies shown.

Within the USA systems are supplied adjusted to transmit on 9360 MHz (Mobile) and 9480 MHz (Remotes).

**PULSE REPETITION INTERVALS (PRIs)**

System PRIs are expressed in μS and identified by code letters or numbers. When numbers are used, a small plate on the DMU indicates the PRI group to which it is set, and on the carrying handle of T/R units a two-figure ident indicates the MSDs of the individual PRI set.

**ANTENNA SYSTEMS**

Types shown are those normally supplied.

Variants for more specialised applications are available on request.

| | | | DECCA SURVEY TRISPONDER | | |
|---|---|---|---|---|---|
| | | | STANDARD (4 REMOTES) | MULTI CHANNEL (8 REMOTES) | SHORT RANGE (4 REMOTES) |
| SYSTEM AND UNIT VARIANTS | SYSTEM TYPE | | 202A–MS06 | 202A–MS08 | 202A–MS10 |
| | DISTANCE MEASURING UNIT TYPE | | 202–R03 | 202–R02 | 202–R04 |
| | TRANSMITTER RECEIVER UNIT TYPE | | 21701 | 21701 | Mobile 26101–M<br>Remote 26101–R |
| | SYSTEM SERIES TYPE | | 217 | 217 | 261 |
| FREQUENCIES | MOBILE STATION | | 9480MHz | 9480MHz | 9480MHz |
| | REMOTE STATION | | 9325MHz | 9325MHz | 9325MHz |
| | TRANSMITTER POWER | | 1KW (+60dbm) | 1KW (+60 dbm) | 10 Watts (+40dbm) |
| | PULSE WIDTH | | 0.5μsec±0.1 | 0.5μsec±0.1 | 0.5μsec±0.1. |
| | INTERMEDIATE FREQUENCY | | 60MHz | 60MHz | 60MHz |
| | I.F. BANDWITH | | 12MHz | 12MHz | 12MHz |
| | RECEIVER SENSITIVTY | | −74db | −74db | −74db |
| PULSE REPETITION INTERVALS (PRIs) | | | NUMBER CODES 1–4 | NUMBER CODES 1–8 | NUMBER CODES 1–4 |
| | | | ANY PAIR IN RANGE 624 μsec TO 994 μsec | ANY GROUP IN RANGE 624 μsec TO 984 μsec | ANY PAIR IN RANGE 124 μsec TO 284 μsec |
| ANTENNA SYSTEMS | OMNI ANTENNA TYPE 21249 | GAIN | 7db NOMINAL | 7db NOMINAL | 7db NOMINAL |
| | | HORIZONTAL BEAMWIDTH | 360° | 360° | 360° |
| | | VERTICAL BEAMWIDTH | 30° | 30° | 30° |
| | DIRECTIONAL ANTENNA TYPE 21248 | GAIN | 16 db | 16 db | 16 db |
| | | HORIZONTAL BEAMWIDTH | 87.5° | 87.5° | 87.5° |
| | | VERTICAL BEAMWIDTH | 5° | 5° | 5° |
| | OR 21278 | GAIN | 16 db | 16 db | 16 db |
| | | HORIZONTAL BEAMWIDTH | 180° | 180° | 180° |
| | | VERTICAL BEAMWIDTH | 5° | 5° | 5° |
| POLARIZATION | | | HORIZONTAL | HORIZONTAL | HORIZONTAL |
| OTHER MAJOR FEATURES | RADAR INTERFERENCE SUPPRESSION FITTED | | YES | YES | YES |
| | MULTI USER TIME SHARE OPTION AVAILABLE | | YES | YES | YES |
| POWER SUPPLY REQUIREMENTS | MOBILE | VOLTAGE | 23–32 V d.c. | 23–32 V d.c. | 23–32 V d.c. |
| | | CURRENT CONSUMPTION MIN | 2.4A | 2.4A | AVERAGE 2.5A |
| | | CURRENT CONSUMPTION MAX | 5.0A | 5.0A | |
| | REMOTES | VOLTAGE | 23–32 V d.c. | 23–32 V d.c. | 11.5–30 V d.c. |
| | | CURRENT CONSUMPTION MIN | 0.8A | 0.8A | AVERAGE 0.5A |
| | | CURRENT CONSUMPTION MAX | 3.5A | 3.5A | |

**For further information please contact:**

The Decca Survey Group policy is one of continuous product development to take advantage of technological advances that will benefit the customer. The Group therefore reserves the right to alter without prior warning any of the information in this publication.

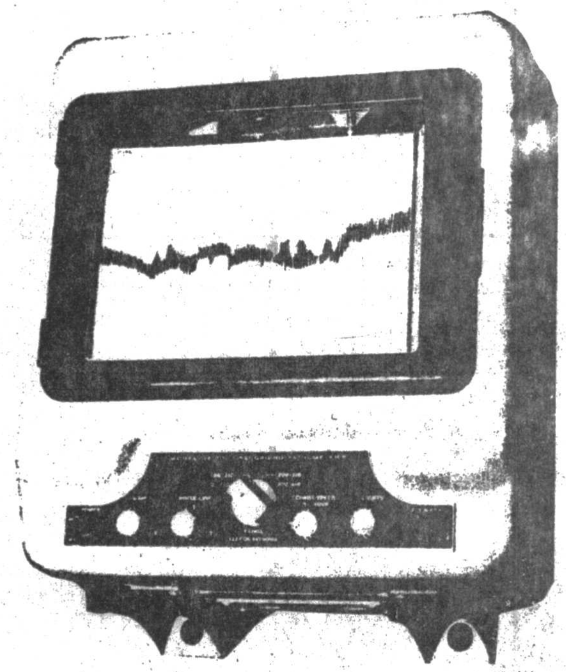
Front covers produced from a portion of BA chart No. 26 with the sanction of the Controller, HM Stationery Office and of the Hydrographer of the Navy.

Designed and produced by the Technical Information Department Decca Survey Limited Brixham, in conjunction with Dasprint Limited London SW18

**Decca Survey Limited**
Survey House, Kingston Road,
Leatherhead, Surrey, England.
Telephone: Leatherhead 76971
Cables: DECSURVEY LEATHERHEAD
Telex: 928437

# RAYTHEON MARINE

## DE-731 RECORDER FATHOMETER® DEPTH SOUNDER



The DE-731 is a ruggedly built feet and fathom recording Fathometer depth sounder. It is a fully solid-state and weatherproof unit that delivers powerful performance and offers a number of desirable features that include "Whiteline" operation.

Heavy duty construction and advanced electronics insure maximum reliability with a minimum of power consumption. For easy serviceability most circuitry is mounted on plug-in printed circuit boards.

Precise recordings to depths of 410 feet or 410 fathoms are presented through four overlapping phases in feet and fathoms, selectable by a front panel switch. The functions of adjustable chart lights and fix marker are also controlled on the front panel.

A built-in phase indicator marks the lower portion of the chart paper, noting permanently the feet phase in use. A hinged front window panel enables easy access to chart paper for manual notations.

The DE-731 offers easy-to-read 7" chart paper, and a chart speed that is continuously variable between 4" and 40" per hour. A hinged front cover and a sliding recording mechanism simplify chart paper replacement.

### Features

- White-Line Operation
- Eight Depth Ranges
- Magnetic Keying
- Phase-Indicator
- "Zero" Adjustment: Electronic Adjustment by Control Knob −5′ to +60′ Adjustment
- Depths to 410 feet or 410 fathoms
- Choice of Transducers

# DE-731 RECORDER FATHOMETER® DEPTH SOUNDER

## ›ecifications

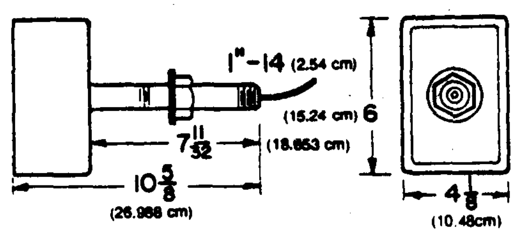
| | | |
|---|---|---|
| ıges: | Phase 1 | 0-110 feet or fathoms |
| | Phase 2 | 100-210 feet or fathoms |
| | Phase 3 | 200-310 feet or fathoms |
| | Phase 4 | 300-410 feet or fathoms |
| tages: | 115VAC 50/60 cycle or 32VDC Basic | |
| | 220/240VAC — Internal Adjustment | |
| | 12VDC or 24VDC — Accessory Adaptors | |
| wer Requirements: | 12VDC input | 3.0 amps |
| | 24VDC input | 1.45 amps |
| | 32VDC input | 1.20 amps |
| | 117/220VAC input 40 watts | |

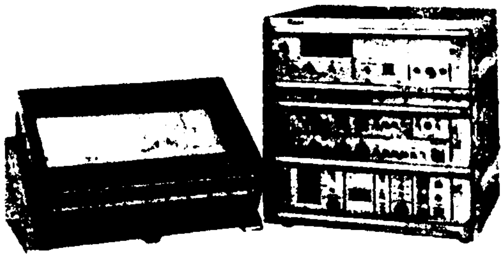
| | |
|---|---|
| Accuracy: | ± 1% (can be adjusted by internal control) |
| Frequency: | 40 kHz |
| Chart Speed: | Continuously adjustable 4" to 40" per hour |
| Chart Paper: | 60' (18.3m) long, 7" (17.8cm) wide |
| Dimensions: | 19" (48.3cm) H, 15½" (39.4cm) W, 8½" (21.6cm) D |
| Weight: | 40 lbs.(18.1kg) approx. |

## ransducers

**odel 7193**— Thru-hull design. Naval bronze. Urethane window.

equency .......................................... 40 KHz
›urce Level db re 1 μbar/volt .................. 64 typical
›ceive Sensitivity db re 1 volt/μbar ........... −79 typical
›am Width at −3 db .................... 17° x 25° typical
ıilt-in Transformer ................................ No
ıpedance .......................... 200 ohms typical
ılse Power ................................ 700 watts
'eight ............................ 13 lbs. with cable
able .................. 2 conductor shielded, 20 AWG, neoprene jacket. 30' long. (Belden 8412)
onnector ............................ None supplied





ROSS LABORATORIES

Precision Survey Fine Line Recorder

Specifications

Model 5600 Fine Line Recorder
Model 4400 Transceiver
Model 1000 Power Converter
100 kHz - 7.5° Circular Beam Pattern Transducer

Ranges: Phase 1 - 0-50 meters
Phase 2 - 50-100 meters
Phase 3 - 100-150 meters
Phase 4 - 150-200 meters

Accuracy: Typical - 0.5%
Guaranteed - 1.0%

The Ross precision survey recorders are designed to fill the requirements of precision survey required for marine chart production, harbor surveys, channel maintenance, before and after dredging surveys, etc.

Features of these systems are;

Digital thumbwheel controls for setting Draft, Tide, Blanking and Calibrate functions.

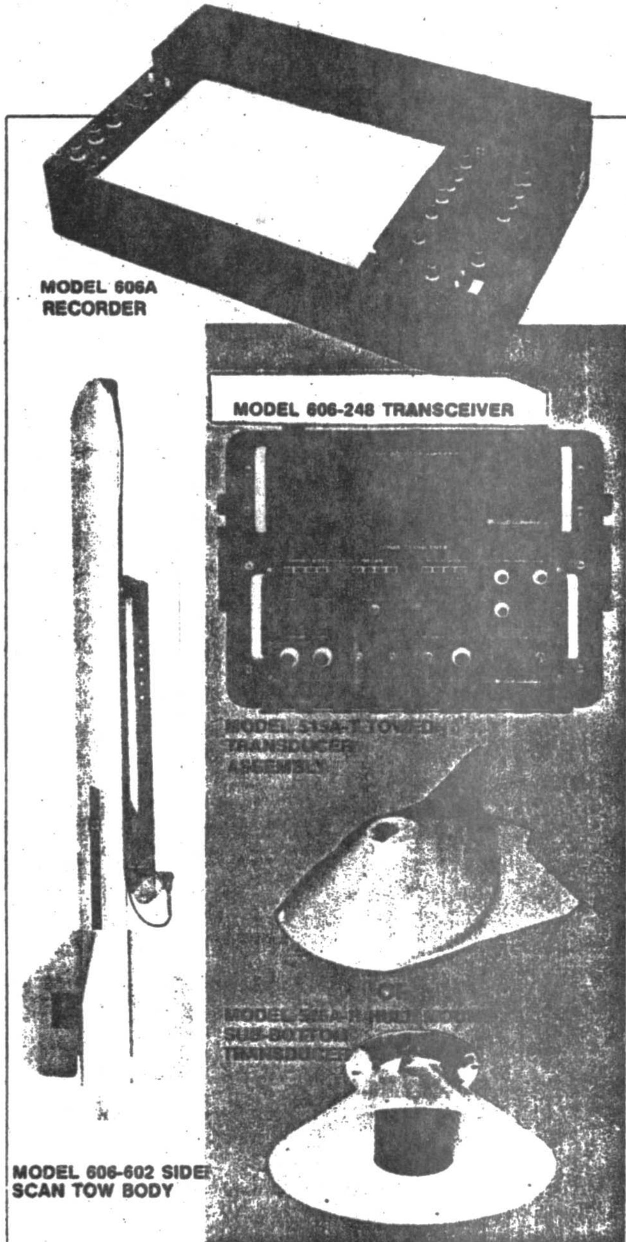
Precision crystal oscillator, with frequency synthesizer, for correction of record and/or digitized depths to compensate for variations in sound velocity (Bar Check).

The design and performance of these models are compatible and complete so that they may be integrated with components of an Automated Hydrographic Survey System.

The high resolution, sharp bottom detail of the Ross Fine Line recorders.

An electronic Zero offset for setting Draft.

A variable frequency, 60 c/s power supply, which may be adjusted, by bar check, to compensate for varying sound velocity.




# INTEGRATED SIDE SCAN AND SUB-BOTTOM/ BATHYMETRIC SYSTEMS

The dual side scan and sub-bottom capability of the Model 606A Recorder permits integration of the 606 Side Scan and 515A or other Sub-Bottom profiling systems. The 606A recorder connects to the existing 515A system through the Model 515A-248 sub-bottom transceiver. A connector on the recorder provides a key pulse to the Sub-Bottom Transceiver and interfaces with the receiver output. The "Aux" channel controls on the recorder select the recorder range and controls the received signal level for the sub-bottom data.

## MODEL 606-248 TRANSCEIVER

### Receiver Section

| | |
|---|---|
| **Frequency** | Choice of 3 standard frequencies: 1.5, 2.5, 3.5, 5.0, 7.0, 8.5 and 12.0 kHz |
| **Bandwidth** | Dependent upon frequency used Selected to pass 1½ cycle pulse |
| **Gain (With 500 ohm load)** | 106 db maximum |
| **Gain Control** | Time Varied Gain (TVG) with front panel control, AGC – Fast, AGC – Slow |
| **TVG Dynamic Range** | 0 – 35 DB |
| **TVG Start Delay** | 0.001 to 1.5 seconds (coarse and fine controls) |
| **TVG Rise Time** | 200 to 35,000 db/second |
| **Input Circuit Protection** | Diode |
| **Minimum Detectable Signal** | 0.5 uVrms |
| **AGC Dynamic Range** | 60 db |

### Transmitter Section

| | |
|---|---|
| **Power Output** | 10,000 or 2,000 watts (HIGH-LOW front panel selection with continuously variable control in each range) |
| **Frequency** | 3.5-7.0 kHz |
| **Maximum Duty Cycle** | 8% for 2,000 watts; 1% for 10,000 watts |
| **Standard Pulse Widths** | 0.2, 1.0, and 4.0 ms. (Front panel selectable) |
| **Keying** | Selectable for contact closure, +2V gate signal, also manual |
| **Protective Circuits** | Output short circuit, overvoltage, pulse-width overload |

### Power Requirements

| | |
|---|---|
| **Primary Voltage** | 115V ± 10% |
| **Primary Line Frequency** | 50 – 65 Hz |
| **Power** | 300 watts (max.) |

### Construction

| | |
|---|---|
| **Design Guide** | MIL-E 16400 |
| **External Connection** | MS3102A connectors rear of chassis |
| **Size** | 48¼cm (19") x 35½cm (14") x 37½cm (14¾") deep (including connectors) |
| **Weight** | 45.5 kg (100 pounds) |

# Performance characteristics

## MODEL 606A RECORDER

| | |
|---|---|
| **Range Scales** | 50, 100, 200, 400 meters |
| **Paper Width** | 49cm (19") wide, 60m (200') long |
| **Paper Type** | Dry electrosensitive |
| **Operating Mode** | |
| **Side Scan Only** | 23.3cm (9⅛") side (center out display) |
| **Programmed** | 23.5 cm (9¼") aux. input display 11.6 cm (4½") side scan display (center out display) |
| **Auxiliary Input** | |
| **Range Scales** | 50, 100, 200, 400 meters (independent of side scan range scales) |
| **Input Level** | 100 mv – 10 volts peak |
| **Input Impedance** | 10K minimum |
| **Frequency Response** | 1kHz – 100kHz (DC-100kHz optional) |
| **Key Pulse Out** | TTL compatible (2 loads) 0.1 ms nominal |
| **Recorder Resolution** | 100 line pairs inch |
| **Position Accuracy** | ± 0.13mm (.005") |
| **Stylus Jitter** | ± 0.06mm (.0025") maximum |
| **Scale Lines** | 25 meter intervals |
| **Event Mark** | Manual or external 5 volt pulse (delayed maximum of one sweep) |

## MECHANICAL CHARACTERISTICS

| | |
|---|---|
| **Size** | 79cm (31") wide, 19.4cm (7⅝") high 51cm (20") deep |
| **Weight** | 43kg (95 lbs) |

## ENVIRONMENTAL CHARACTERISTICS

| | |
|---|---|
| **Temperature** | |
| **Operating** | 10°C to +40°C |
| **Storage** | -25°C to +65°C |
| **Humidity** | 90% |
| **Shock and Vibration** | To meet normal shipboard requirements |

## SIDE SCAN CHARACTERISTICS

| | |
|---|---|
| **Electronics** | |
| **Operating Frequency** | 100kHz |
| **Pulse Length** | 100 usec |
| **Output Power** | 1500 watts nominal |
| **Gain Control** | Separate initial and final gain controls |
| **TVG** | Manual or bottom-lock |
| **TVG** | 70dB |
| **TVG Delay** | 2-100 ms |
| **Maximum voltage transmitted down cable** | 60 volts |

## MODEL 606-602 TOW BODY

| | |
|---|---|
| **Maximum Tow Speed** | 15 knots |
| **Depth Rating** | 2000 feet |
| **Weight (including transducers)** | 75 pounds |
| **Transducers** | |
| **Vertical Beam** | |
| **Width at half power points** | ±25° |
| **Back response** | The back response has been reduced by a factor of 25 dB (300 to 1) below the main lobe. |
| **Source Level** | 117dB at 1200 watts of total input power into two transducers. |
| **Note:** | the 117dB source level is present for the complete 100 usec pulse. A rapidly decaying shock excited transmitter is not used. |
| **Horizontal Beam** | |
| **Width at half power points** | ±1° |
| **Side lobes** | All side lobes present will be reduced by a factor of 20 dB (100 to 1) below the main lobes. |

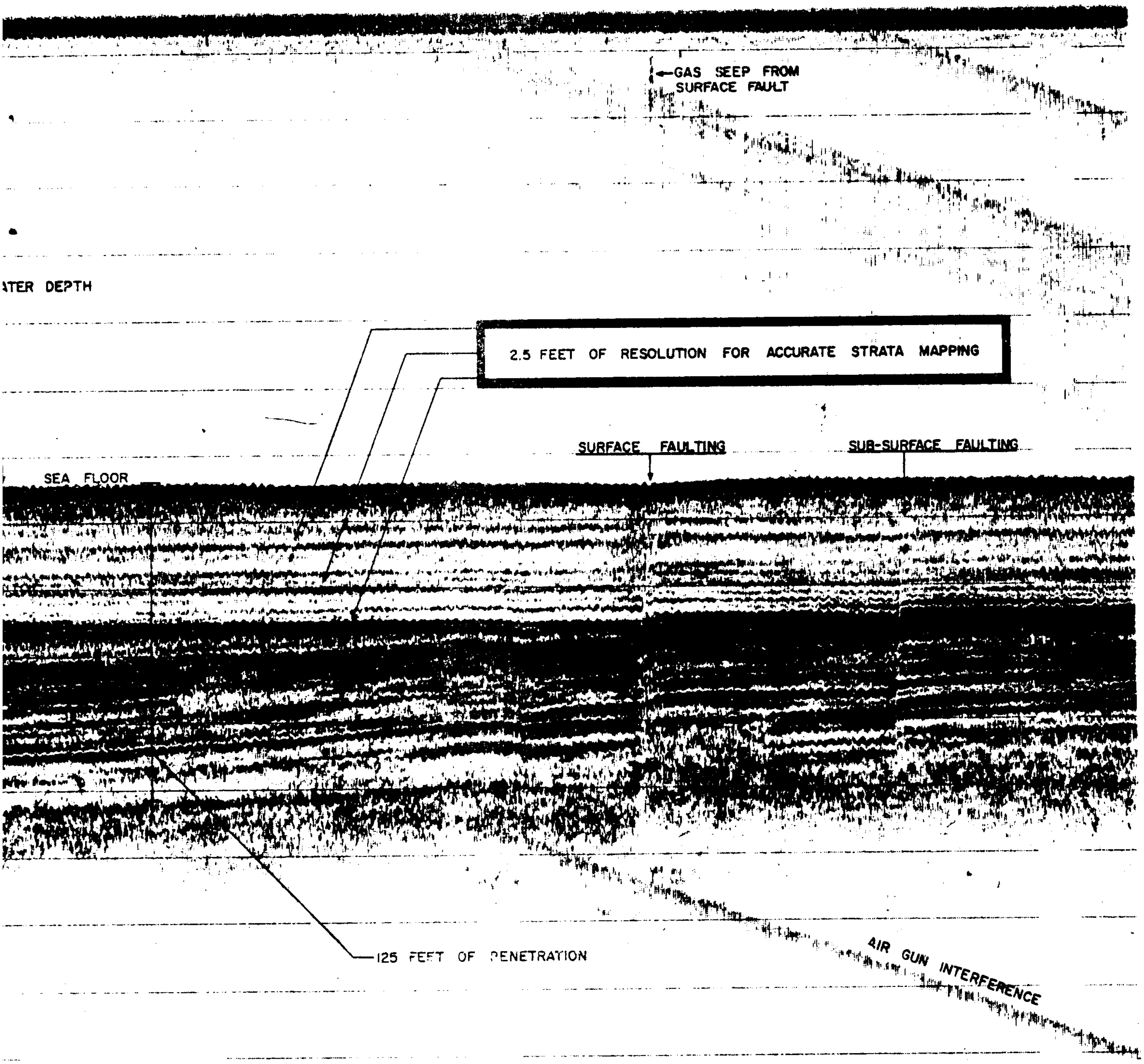
## TOW CABLE

| | | |
|---|---|---|
| **Construction** | Flexible lightweight<br>Separately shielded signal leads | Double armored steel<br>Separately shielded signal leads |
| **Diameter** | 1.37 cm (0.54") | 1.37 cm (0.54") |
| **Standard Length** | 150 meters (other lengths available) | 500 meters (other lengths available) |
| **Breaking Strength** | 900kg (2000 lbs.) | 4550kg (10,000 lbs.) |

## OPTIONS

| | |
|---|---|
| **Digital Output** | |
| **Resolution** | 15 binary levels |
| **Format** | Compatible with most digital recorders |

**Self tuning Receiver**
**Tow Vehicle Depressor**
**Power Converters**
**Non-Linear Recorder Sweep**




**The complete recording this portion was extricated from is provided in the back pocket of this brochure as insert No. 12 and a similar recording is provided as insert No. 14. Full size recordings of both insert No. 12 and No. 14 may be obtained by contacting Edo Western Corporation.**

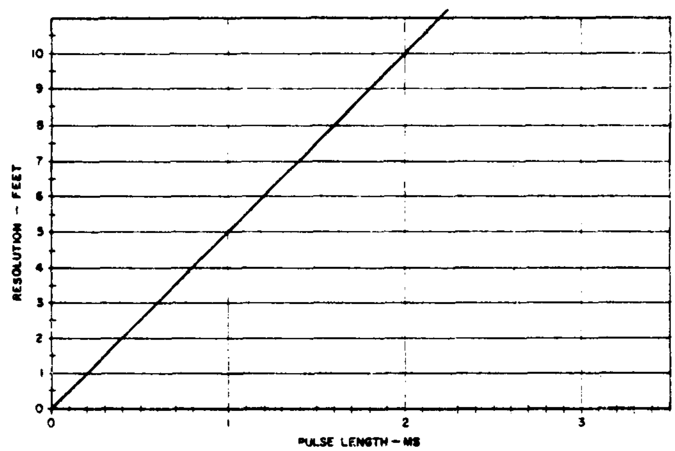
# MODEL 515 SUB-BOTTOM PROFILING SYSTEM

# FACTORS AFFECTING SUB-BOTTOM RESOLUTION

Numerous acoustic systems have been developed for the purpose of obtaining continuous seismic reflection profiles of sedimentary deposits. The majority of these sources have used high level transient type sound sources such as electric arcs, pneumatic sources, or mechanical shock sources using large metal diaphragms. All of these have the common characteristics of generating a multiple frequency pulse characterized by a transient "bubble". This type of signal provides relatively deep penetration from the low frequency portions of the frequency spectrum, but has limited resolution due to the bandwidth and length of the outgoing pulse. The transient "bubble" (or cavitation pulse) also results in the masking of the first 50 to 200 feet of sedimentary reflections. Transient source systems are also characterized by multiple reflections from the sub-bottom reflectors which result in a record with several parallel lines for each sub-bottom reflection.

The solution for the problems and limitations of the "shock pulse" sound sources has been the development of a system which generates an extremely short pulse of a single frequency, and this is a salient characteristic of the Model 515 System. To obtain maximum resolution from a sub-bottom profiling system, two major factors must be considered – pulse length and beam width. The pulse length is of prime importance because the system cannot resolve layers or objects with separations less than the transmitted pulse length times the sound velocity. The graph provided following shows the relationship between pulse length and system resolution.

The effect of transmitted beam width on resolution is also extremely important. The beam width and related directional characteristics must be carefully considered relative to resolution limitations directly related to the ensonified area and overall system performance, and relationship to signal-to-noise ratios. The volume and direction of energy wave in the ensonified area is also critical because the resultant record is the sum of all reflections within both the transmitting and receiving beam widths. This means that for wide beam systems, detail layering may be completely lost in the final record. As an example, as the beam width is doubled, four times the area is ensonified, thereby resulting in the displayed data being the sum of all the targets in the larger area.

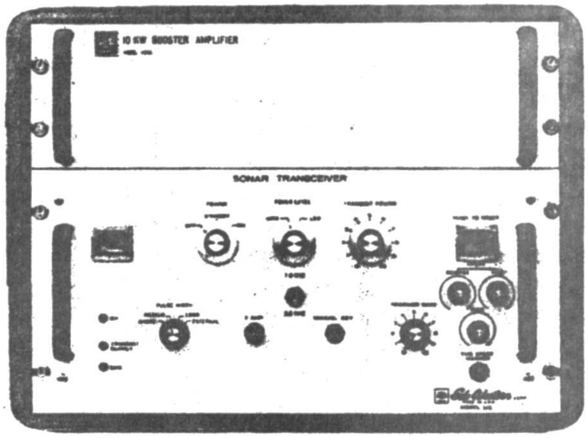



The directional characteristics must also be carefully selected to provide maximum signal-to-noise ratio. The narrow beam transducer improves the signal-to-noise ratio by increasing the output source level and providing isolation from unwanted noise. A value of 20° to 45° appears to be the optimum compromise between resolution, transducer size, and operating under normal conditions of pitch and roll.

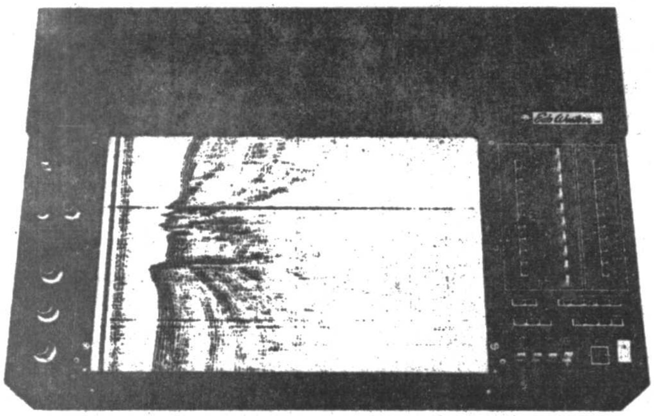
The back pocket of this brochure contains copies of a number of actual full scale recordings. Some of these recordings were taken with the Model 415 System, predecessor to the Model 515 System. They were taken under varying conditions in the locations shown on the legends. These records are indicative of the type of performance that may be expected through use of the Model 515 Sub-Bottom Profiling System.

Some very informative articles regarding sub-bottom profiling have been written, two of which we have reproduced for the purposes of supplementing the information provided in this brochure. An article prepared by T. C. Moore, Jr. and L. D. Kulm under the auspices of the University of Oregon is included in the back of this brochure as Insert #5. The information therein was derived from tests conducted using Edo Western Corporation's sub-bottom profiling equipment. Another excellent article entitled "High Resolution Seismic Profiles and Gravity Cores of Sediments in Southern Lake Michigan" has been prepared under the auspices of the University of Wisconsin. The length of this article precludes it as an insert herein, but a copy will be sent upon special request to the Publications Department of Edo Western Corporation.

# BASIC COMPONENTS OF THE MODEL 515 SYSTEM

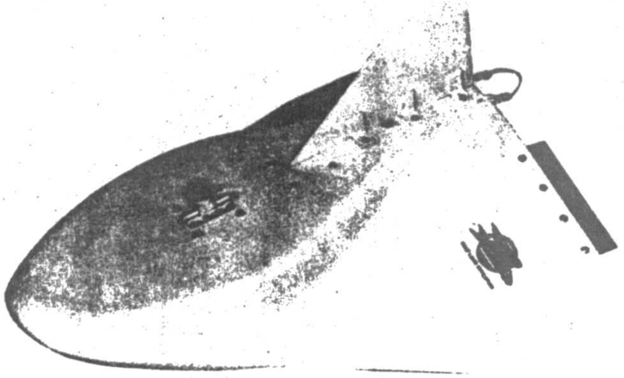



10 KW TRANSCEIVER



DRY PAPER RECORDER (PBSR)

**Choice of Transducers**



TOWED BODY TRANSDUCER
515T (7.0-3.5kHz)

HULL-MOUNTED TRANSDUCER
515H (7.0-3.5kHz)

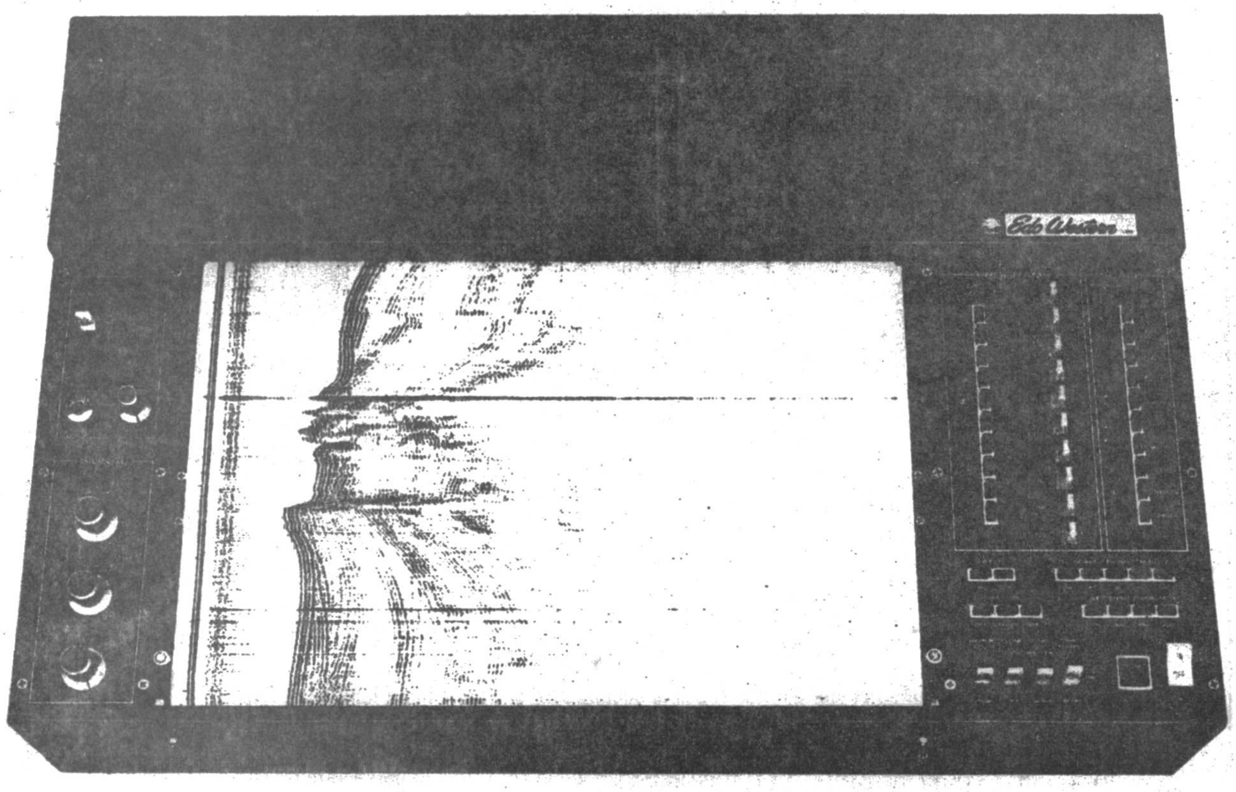
## SIGNIFICANT FEATURES OF THE MODEL 515 SYSTEM

This versatile, high resolution sub-bottom profiling system offers many unique features such as:

- Single pulse, full power acoustic output
- Unique, narrow beam transducer system generates single cycle acoustic pulse without ringing to provide maximum resolution
- High power transmitter resulting in up to 400' of penetration
- Dual frequency systems permitting front panel selection of optimum operating frequency
- Towed or hull-mounted transducer configuration
- Resolution to 30 inches with adjustable TVG for optimum resolution
- Proprietary signal processing, including Time Varied Gain (TVG) and Manual Gain Control providing an overall dynamic range of 106 db
- Full 19-inch record on wide, dynamic range dry recording paper
- Complete field support

# PRECISION BATHYMETRIC/SEISMIC RECORDER (PBSR)

Edo Western's Precision Bathymetric/Seismic Recorder (PBSR) sets a new standard for precision and versatility in sonar recorders. Designed for table top operation, the PBSR provides 10 ranges—from 300 feet to 24,000 feet (125 ms–10 seconds). It is also equipped for manual programming which allows the operator to transmit, gate or receive on any multiple interval of the base range up to 10 cycles. This feature makes it possible to follow a given echo on an expanded scale while rejecting intermediate ranges that are not of interest. Scale lines on all ranges are generated by an independent precision clock electronic timing system, thereby providing a self-checking feature for stylus drive and the scale line generator; hence, fluctuations in supply power frequency do not affect recorder accuracy in the same manner as on recorders with pre-marked paper or timing belt synchronized line generators. As used in the Model 515 System, the PBSR not only provides reliable, wide dynamic, permanent, dry-paper charts, but it also makes available a valuable tool for other requirements. The PBSR is designed to permit synchronization of the recorder to an external synchronizing signal in the Start/Stop mode, or operation of one or more recorders slaved to a master unit. These features permit a wide variety of applications such as simultaneous recordings from transponders and bottom soundings, and playback of data recorded on magnetic tapes. The PBSR's extreme versatility also allows interface with many other equipments, thereby making it available for use in numerous applications with other systems.



## SIGNIFICANT FEATURES

- Dry, high resolution recording paper
- Wide sweep range in all modes
- Can be driven from an external source in Start/Stop mode
- Ten sweep ranges in Continuous Mode
- Synchronizing control for simultaneous operation of two or more recorders or magnetic tape playback
- Automatic full scale check at selectable intervals of 15, 30, or 60 minutes
- All solid state electronics
- Long life stylus
- Accessibility of electronics from front for ease of maintenance
- No gear changes or clutches
- Variable programming for optimum recording
- Uniform 75, 100, 150, or 200 line per inch recording density at all depth ranges
- Time calibration mark OFF, ON, RESET (10 minute intervals)
- Rapid paper advance control

# RECORDER PERFORMANCE CHARACTERISTICS

## Electrical

| | |
|---|---|
| **Resolution** | 100 line pairs/inch minimum |
| **Positional Accuracy** | ±.005" (.13 mm) Continuous Mode |
| **Stylus Jitter** | ±.0025" (.06 mm) maximum, Continuous Mode |
| **Dynamic Range** | 23 db from white to full black on 1 sec. sweep (10 shades of gray) |
| **Frequency Response** | DC to 100 kHz |
| **Signal Input** | 1.0 Vrms for full black at ⅛ second sweep |
| **Signal Input Impedance** | 10 K ohms |
| **Output Key Pulse** | DC pulse, 1 K ohm output impedance, adjustable 0 to +2.5 VDC |
| **Power In** | 115 Vrms ±10%, 50 - 65 Hz, 250 watts |
| **Modes** | Continuous Bathymetric<br>Programmed Bathymetric (10 cycle programmer)<br>Stop/Start Seismic - Non-synchronous (1 second thru 10 second sweeps) |
| **Controls** | POWER (On/Off)<br>THRESHOLD<br>CONTRAST<br>GAIN<br>SCALE LINES (10, Off, 20)<br>SCALE LINE Event Marker<br>SCALE LINE Intensity<br>SWEEP (Continuous, Start/Stop)<br>KEYING (Off, Center, Edge)<br>FULL SCALE KEYING MINUTES (On, Off, 15, 30, 60)<br>LINE DENSITY PER INCH (75, 100, 150, 200)<br>PROGRAM - Length (1 to 10)<br>Cycle - Transmit, Gate, Receive (1 to 10)<br>SCALE - Sweep Speeds (⅛, ¼, ½, 1, 2, 2.5, 4, 5, 8 and 10 seconds)<br>Ranges (300, 600, 1200, 2400, 4800, 6000, 9600, 12000, 19200 and 24000 feet)<br>PAPER ADVANCE<br>ILLUMINATION (On/Off)<br>SYNC (Master/Slave)<br>TIME MARK - Off, On, Reset (10 minute intervals) |

## Environmental

| | |
|---|---|
| **Temperature** | Operating - 10°C to 40°C<br>Storage - -25°C to +65°C |
| **Humidity** | 90% |
| **Shock and Vibration** | To meet normal shipboard requirements |

## Mechanical

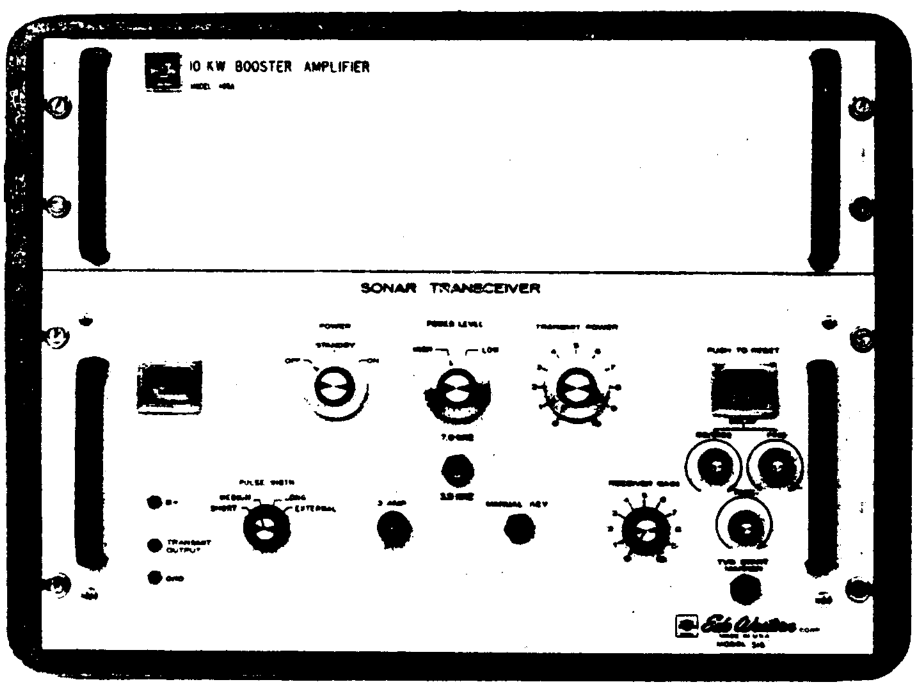
| | |
|---|---|
| **Paper (Electrosensitive)** | 19" (49 cm) wide, 200' (60 m) long |
| **Size** | 31" (79 cm) wide, 7⅝" (19.4 cm) high, 20" (51 cm) deep |
| **Weight** | 95 pounds |

# SOLID STATE SONAR TRANSCEIVER

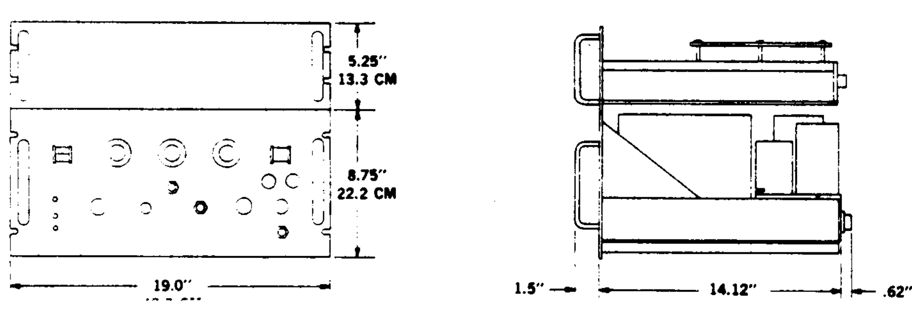
Edo Western's Transceiver, as used in the Model 515 Sub-bottom Profiling System, is an all solid-state, 10,000 watt transceiver with adjustable output power and pulse length, and includes a unique receiving system which allows the operator to select the optimum receiver system for his operation. One receiver (TVG) is designed specifically for sub-bottom profiling purposes. This receiver employs a low noise receiver providing time variable gain (TVG) with adjustable delay and rise. This feature allows amplification of the weak echoes from deep layers without losing details of the near surface layers due to receiver saturation as shown on Insert No. 1, in the back of this brochure. Figure C of Insert No. 1 shows an unprocessed record of a sub-bottom profile utilizing a standard transceiver and a precision recorder. Figure D shows an unprocessed record of a sub-bottom profile utilizing a Model 515 Transceiver and a PBSR. Figure D demonstrates the improved resolution and penetration obtained after being processed by the Model 515 System.

The second receiver (AGC) has been used extensively for years as the heart of the bathymetric systems. Now it has been included as a standard feature of the Model 515 System because of its unique capability of locating pipelines. This capability is demonstrated quite vividly by Insert No. 15. Most survey operations currently are requested to supply both high resolution sub-bottom data and pipeline data, and the Model 515 Transceiver is the only available transceiver having this dual purpose capability.

The choice of operating frequency is a trade-off between resolution and penetration. In soft silt conditions, a single cycle of 6 to 8 kHz provides penetration in excess of 100 feet with resolution of approximately 1 foot. In harder bottom conditions, or for greater penetration, 3.5 kHz is a better choice to meet most bottom conditions. Edo Western offers a standard choice of two operating frequencies for the Model 515 System - 7.0 kHz and 3.5 kHz in a dual frequency system (7.0 and 3.5 kHz) configuration. This dual frequency system permits the operator to select the frequency best for a particular area. The capability of front panel selected frequency change can double the usefulness of the penetration system, and will provide useful, high resolution data in almost all sedimentary bottoms.




## TRANSCEIVER INSTALLATION DATA



# SONAR TRANSCEIVER
# PERFORMANCE CHARACTERISTICS

## Receiver Section

| | |
|---|---|
| **Input Impedance** | 1800 ohms |
| **Frequency** | 3.5/7.0 kHz |
| **Bandwidth** | Dependent upon frequency used |
| **Output Impedance** | Less than 50 ohms |
| **Maximum Output Voltage** | 2 Vrms |
| **Gain (With 500 ohm load)** | 106 db maximum |
| **Gain Control** | Time Varied Gain (TVG) with front panel control |
| **TVG Dynamic Range** | 0 – 35 DB |
| **TVG Start Delay** | 0.001 to 1.5 seconds (coarse and fine controls) |
| **TVG Rise Time** | 200 to 35,000 db/second |
| **Input Circuit Protection** | Diode |
| **Minimum Detectable Signal** | 0.5 uVrms |
| **AGC Dynamic Range** | 60 db |

## Transmitter Section

| | |
|---|---|
| **Power Output** | 10,000 or 2,000 watts (HIGH – LOW front panel selection with continuously variable control in each range) |
| **Output Impedance** | 10, 25, and 50 ohms to 10KW or 50, 100, 140, 175 or 200 ohms to 2KW |
| **Frequency** | 3.5-7.0 kHz |
| **Maximum Duty Cycle** | 8% for 2,000 watts; 1% for 10,000 watts |
| **Standard Pulse Widths** | 0.2, 1.0, and 4.0 ms. (Front panel selectable) |
| **Keying** | Selectable for contact closure, +2V gate signal, also manual |
| **Protective Circuits** | Output short circuit, overvoltage, pulse-width overload |

## Power Requirements

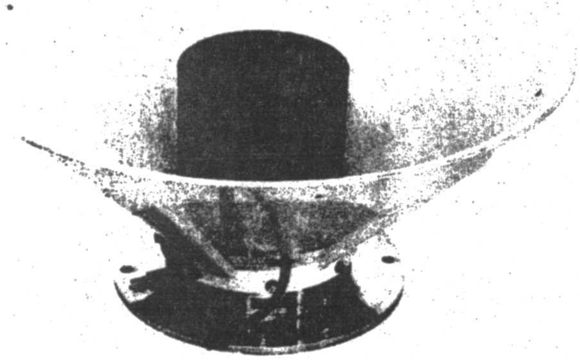
| | |
|---|---|
| **Primary Voltage** | 115V ±10% |
| **Primary Line Frequency** | 50 – 65 Hz |
| **Power** | 300 watts (max.) |

## Construction

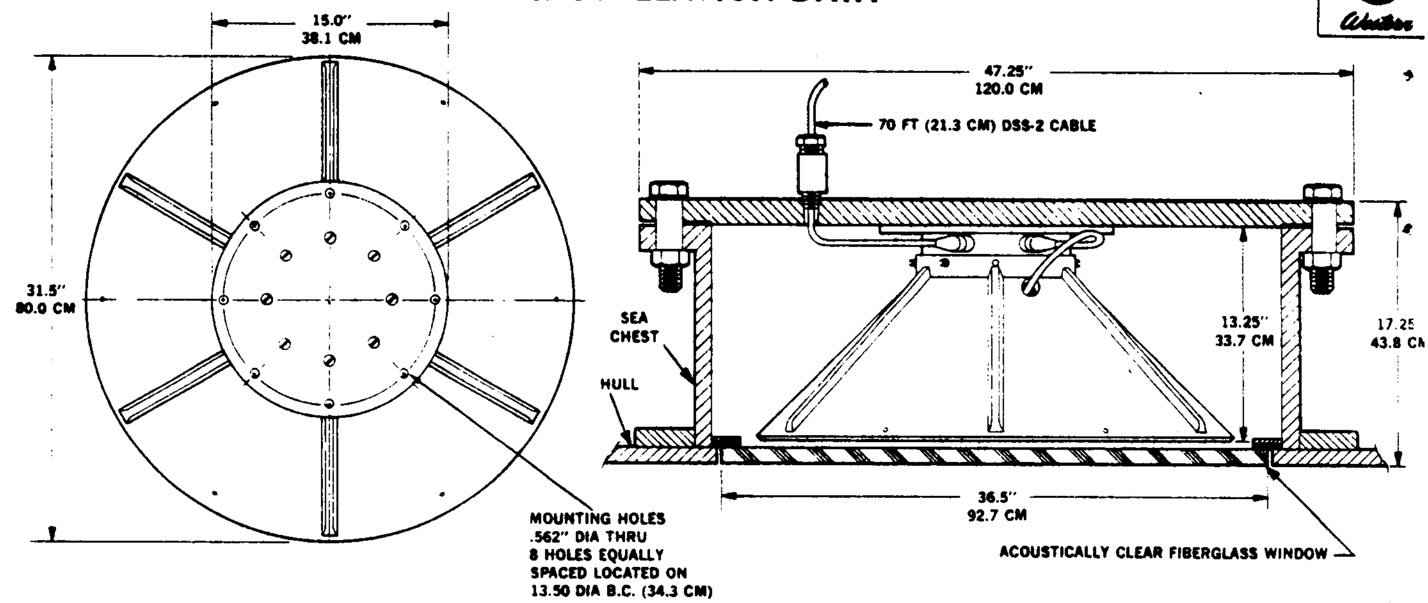
| | |
|---|---|
| **Design Guide** | MIL-E-16400 |
| **External Connection** | MS3102A connectors rear of chassis |
| **Size** | 19" wide x 14 " high x 14¾" deep (including connectors) |
| **Weight** | 100 pounds |
| **Cables Power** | 6 ft. length |
| **Signal (Transceiver/Recorder)** | 9 ft. length |

# MODEL 515 TRANSDUCER

The Model 515 Transducer was designed specifically for high resolution survey work where very short energy pulses are required. The fast rise time, short ring time, and mechanical Q of approximately 1 are the salient characteristics of this transducer. The Model 515 Transducer operating frequency ranges from 3.5 kHz to 7.0 kHz, and provides a minimum efficiency of 35%. A transducer may be installed as a permanent hull-mount configuration, or it may be towed in a hydrodynamically stabilized body. The towed configuration is for a semi-permanent installation, but similar installations are possible where short term applications are required. A photo of the hull-mount transducer is shown here, along with installation data and performance parameters.



# INSTALLATION DATA




A note of caution is warranted at this point concerning the installation of the hull-mount transducers. The location of any acoustic transducer is extremely critical in that it must be located at a suitable point on the hull which is free of turbulence, low wash, aeration, etc. Ideally, a hull-mount transducer should be located in an acoustic dome which is hydrodynamically designed to minimize flow noise and turbulence. However, many survey vessels cannot tolerate the increased draft of the dome and must chance a flush mount installation on the hull as shown in the installation drawing. In this type of installation, the location on the hull is critical due to the tendency of air bubbles to sweep down along the hull from the low wash. If possible, it is a good idea to make this type of installation in the forward one-third of the hull.

## TRANSDUCER PERFORMANCE CHARACTERISTICS

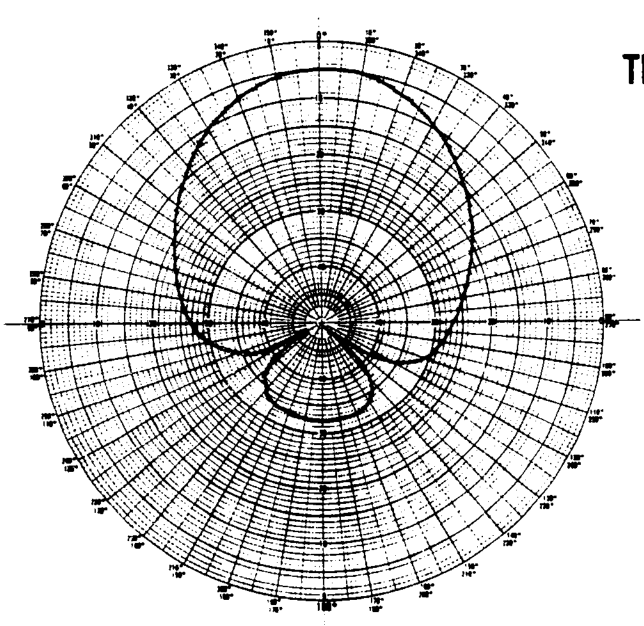
| | Model 515T Towed Transducer | | Hull Mounted Transducer | |
|---|---|---|---|---|
| **Operating Frequency** | 3.5-7.0 kHz | | 3.5-7.0 kHz | |
| **Transmitted Pulse Length** | .2 milliseconds min. | | .2 milliseconds min. | |
| **Power Input at 10% Duty Cycle** | 10 KW max.* | | 10 KW max.* | |
| **Rise Time** | 200 microseconds max. (to full power) | | 200 microseconds max. (to full power) | |
| **Efficiency** | 35% | | 35% | |
| **Acoustic Source Level** | | | | |
| **3.5 kHz** | 111 db//1 ubar* | | 111 db//1 ubar* | |
| **7.0 kHz** | 115 db//1 ubar* | | 116 db//1 ubar* | |
| **Impedance** | 50 ohms nominal | | 50 ohms nominal | |
| **Directivity Pattern** | 3.5 kHz | 7.0 kHz | 3.5 kHz | 7.0 kHz |
| **Beam Width** | 45° | 27° | 40° | 20° |
| **Side Lobes** | -40 db | -15 db | -25 db | -15 db |
| **Back Response** | -25 db | -30 db | -35 db | -35 db |
| **Operating Depth** | 500 feet maximum | | 100 feet maximum | |
| **Weight in Air** | 150 lbs. Towed Vehicle | | Approx. 105 lbs. | |
| **Cable Type** | Armored Tow Cable | | DSS-2 | |
| **Cable Length** | 100 feet (25 feet faired) | | 70 feet | |

*Source level stated is for nominal depth of 25 feet and may vary due to cavitational characteristics of the particular water conditions.

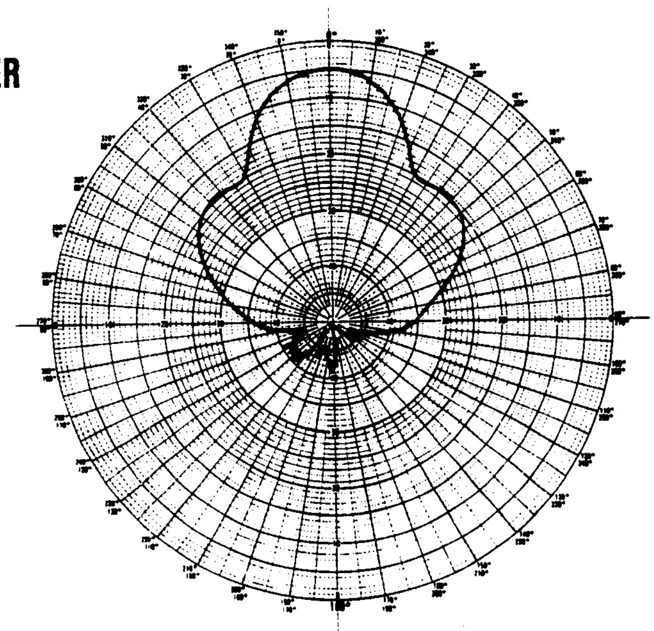
# TRANSDUCER DIRECTIVITY PATTERNS

Transducer directivity patterns for the hull mounted and the towed versions are provided below. A unique design characteristic has been incorporated to produce a narrow beam in as small a size as possible for the towed version. This feature minimizes the two vehicle size and weight. Comparable systems require towed transducers approximately twice as large to produce a similar beam pattern.

## TOWED TRANSDUCER

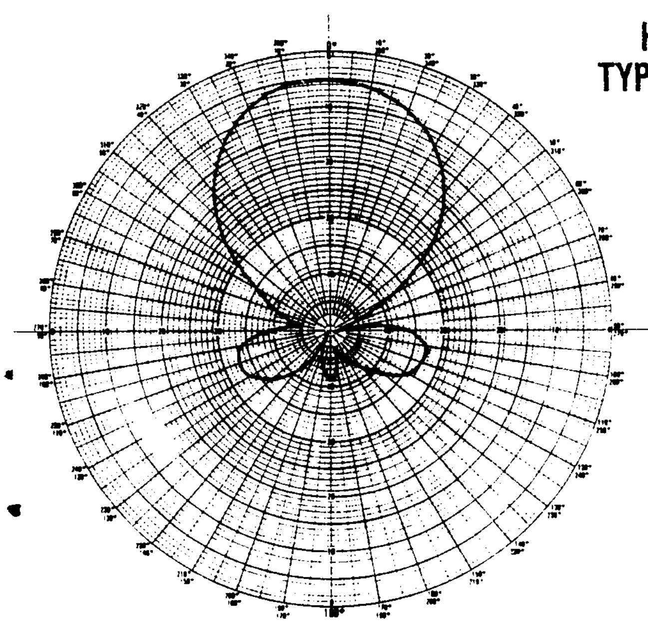


Typical Beam Pattern
Taken at 3.5 kHz

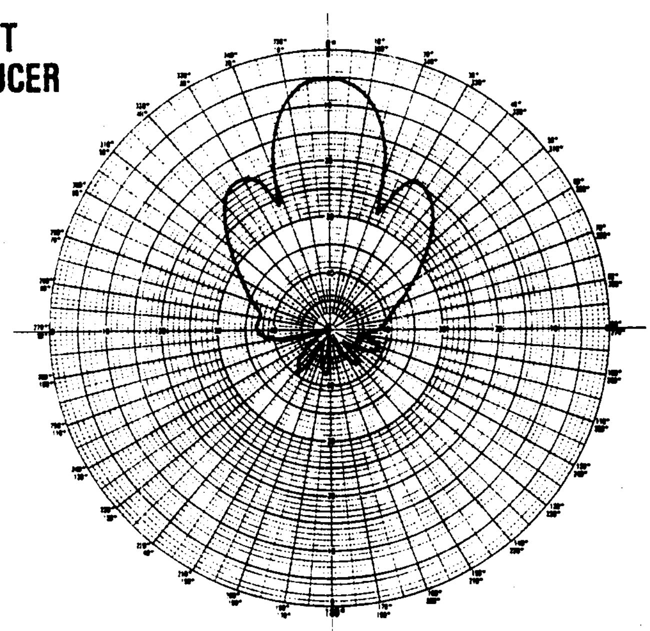


Typical Beam Pattern
Taken at 7.0 kHz

## HULL-MOUNT TYPE TRANSDUCER



Typical Beam Pattern
Taken at 3.5 kHz

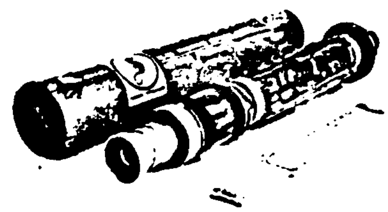


Typical Beam Pattern
Taken at 7.0 kHz

# TC-125 Miniature Underwater Television Camera



1



**Features TC-125 Camera:**

**Truly engineered for the environment by people with over 12 years' experience in supplying underwater television equipment**

**Completely self-contained in a miniature underwater housing**

**Dynamic range greater than 10,000:1**

**Numerous options to the basic TC-125 will optimize it for virtually any underwater or environmental application**

**Easy maintenance — only three plug-in electronic circuit boards**

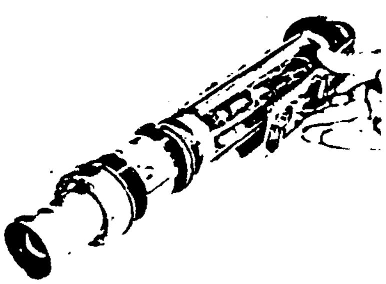
**A safe 12 VDC operates the camera**

**Remote focus control**

Hydro Products' TC-125 Television Camera represents twelve years of experience supplying underwater television equipment. As in all Hydro cameras, the self-contained design is optimized to perform underwater viewing tasks from optics to electronic circuitry to pressure housing. Each component has been maximized for the highest reliability and ease of operation.

The TC-125 is totally self-contained including target control, video and sweep circuits, and remote optical focus all powered by a safe, low DC voltage. Nothing complicated, only five conductors control the camera including focus from 3 inches to infinity.

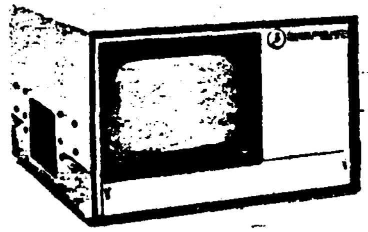
From the surface, the TC-125 is simple to control. Power switch, focus control, and standard monitor controls are all that are required. The system is easier to operate than your home television set giving the operator the maximum performance possible in the harsh underwater environment.



The Model TC-125 is designed utilizing highly reliable integrated circuits. This miniaturization of the circuits has resulted in an easily maintained camera constructed with only three major plug-in circuit boards.

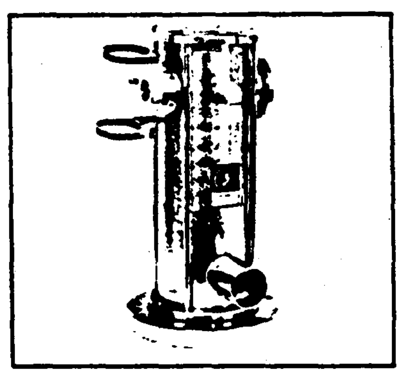
TC-125 options:
The TC-125 was not just designed to a set of specifications. It is the result of years of field experience, resulting in a camera that has eliminated every normal viewing problem encountered. The modular aspect of the TC-125 provides available options to optimize virtually every underwater application.

The Pan and Tilt, Camera, and Light shown above were recently recovered after 6 years on the bottom of the ocean at a depth of 1800 ft. off the Bahama Islands. All three units were still operating perfectly when recovered.

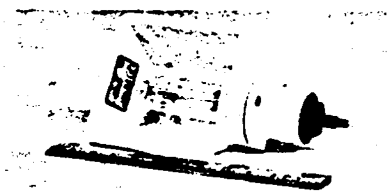


The SC-303 System Control Unit is a rugged, splashproof module ideally suited for shipboard or offshore drilling rig applications. The unit contains a nine-inch transistorized monitor, a low voltage constant current television camera power supply and a lamp ballast power supply to operate any of Hydro Products' 250-watt mercury vapor or thallium iodide lights.

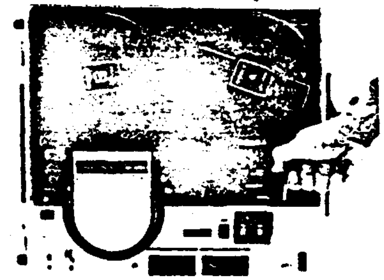
The SC-303 can also include optional push-button pan and tilt controls or a diver communications module as described in the UDATS Diver Inspection System on Page 4.



Hydro Products' RP-3 Pan and Tilt mechanism is a rugged, precision, remote-controlled manipulator for directing a Hydro Products' television or photographic camera to any desired orientation at any depth. The pan and tilt develops a minimum of 18 foot-pounds of torque to accommodate heavy, unbalanced loads in strong currents. All exterior parts are nickel-chrome plated marine brass or stainless steel to provide maximum resistance to the corrosive effects of salt water. The RP-3 can provide remote panning control up to 350° and remote tilting control up to 190°.

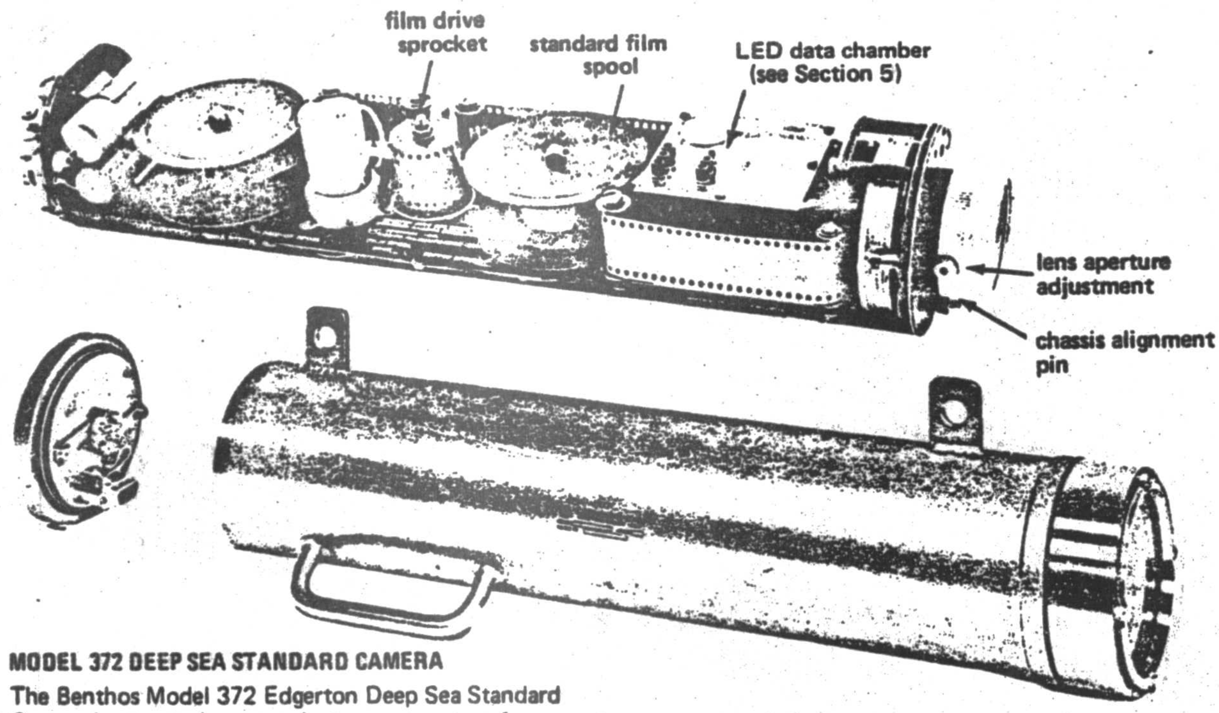


The L-7 Series are Hydro Products' standard line of moderate and deep ocean lights. The same housing can be used with many different light elements, allowing the same housing and reflector to be used as an LQ-7 quartz iodide 500-watt, L-7 mercury vapor 250-watt, or LT-7 thallium iodide 250-watt light. The lights have been designed to operate to depths of 4,570m (15,000 ft.). L-7 Series lamps are available for depths to 12,000 m (40,000 ft.).



The AV-3650 is a compact, portable EIAJ Type 1 video tape recorder with capstan servo electronic editing, a feature ordinarily found only in larger, more expensive machines. It provides one hour of audio and monochrome video recording and playback on ½-inch tape and offers automatic control of both audio and video levels for exceptional ease of recording. Playback can be performed in the normal, slow-motion, or stop action modes.

# 3 EDGERTON DEEP SEA 35 MM




## MODEL 372 DEEP SEA STANDARD CAMERA

The Benthos Model 372 Edgerton Deep Sea Standard Camera is a general purpose instrument proven for use in a variety of deep ocean applications. The camera takes 800 or more exposures per loading. A data chamber with a light emitting diode digital display, furnishing date, time (hours, minutes, seconds) and run number information on each photo frame, is available as an option.

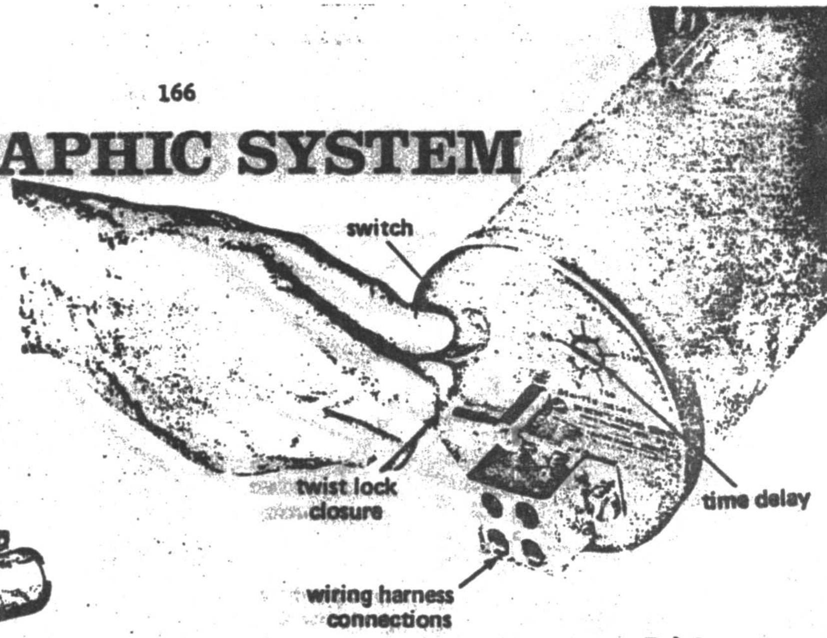
When used with a Benthos Model 382 Edgerton Deep Sea Standard Flash, the camera becomes a pre-programmed, automatic system. The camera can also be used with the Benthos Model 383 Hi-Intensity Flash (see Section 4) and companion power packs for applications where greater camera-to-subject distances require more light. Stereo photographs can be obtained by spacing two Model 372's with their axes parallel. Precision orientation of the camera chassis in its housing maintains proper alignment for stereo photography.

### Specifications – Model 372 Camera

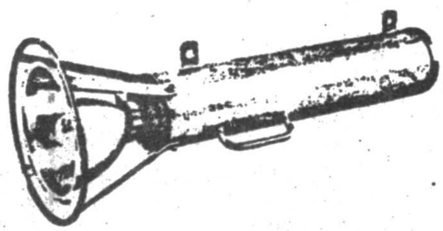
| | |
|---|---|
| Number of exposures per loading using standard film | 800 |
| Number of exposures per loading using thin base film | 1600 |
| Film length using standard film: | 30.5 meters (100 feet) min. |
| Film length using thin base film: | 61 meters (200 feet) min. |
| Spool type: | Standard Kodak No. 10 |
| Spool diameter: | 9.3 cm (3.6 inches) |
| Dimensions: | |
| Length: | 64.3 cm (24.4 inches) |
| Diameter: | 12.5 cm (4.9 inches) |
| Weight in air: | 21 kg (46 pounds) |
| Weight in water: | 16 kg (35 pounds) |
| Shutter speed: | Controllable from 1/50th to 2/5th second from Model 382 Flash or external programmer |
| Power required: | 28 ±5 VDC at 1 amp peak, supplied from external source or Model 382 Flash |
| Data chambers available: | Optical, digital or remote (see Section 5) |

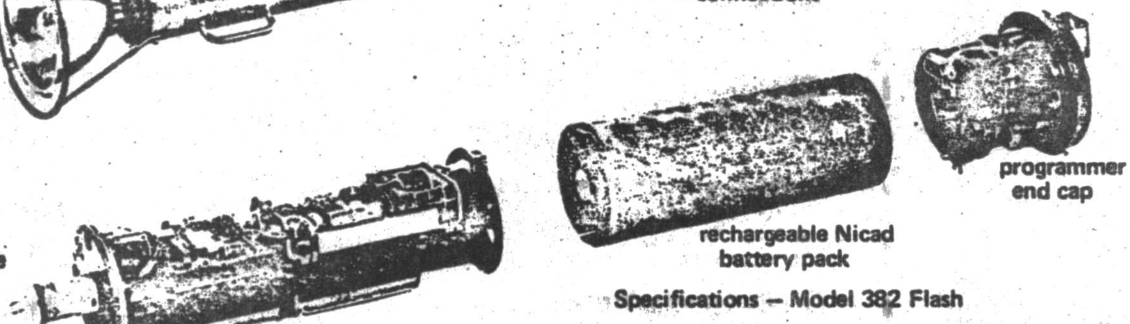
BENTHOS, Inc.

# PHOTOGRAPHIC SYSTEM




**up to 1600 exposures per loading**






## MODEL 382 DEEP SEA STANDARD FLASH

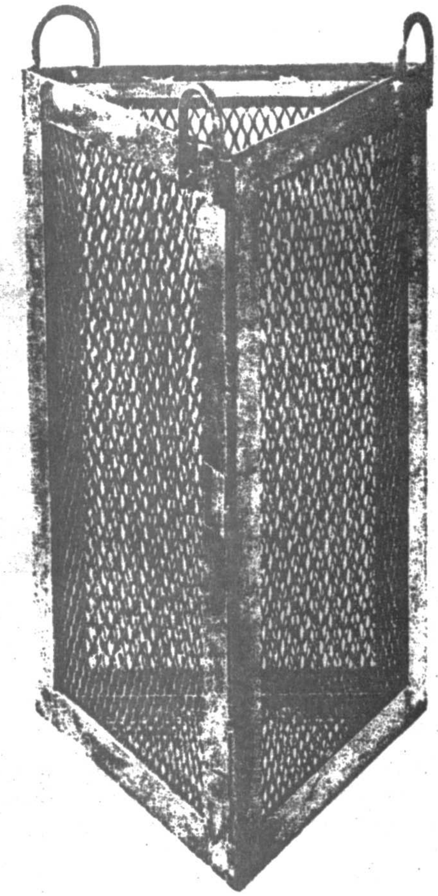
The self-contained, 100-watt-second Flash is designed as a companion unit to the Model 372 Camera or for use with other Benthos cameras. It contains a solid state electronic camera programmer that puts out electrical impulses at preset intervals causing the camera to take pictures and advance its film. Adjustment of the interval between exposures and for the shutter speed are provided on the internal printed circuit board. The flash also features an externally adjustable electronic timer to delay the start of picture taking while the camera system is being lowered to the desired depth. A switch control on the outside of the rear end cap can be turned to three positions to start the delay, restart the delay or to turn the system on immediately for test. The flash contains a rechargeable nickel-cadmium battery pack which supplies power for both the flash and camera.

*Intervals to 32 hours are available using the Benthos 380-30 low power programmer option. Contact Benthos for application details.

**Specifications – Model 382 Flash**

| | |
|---|---|
| Power source: | Benthos Model 389 Battery Pack mounted in Flash housing. 28 VDC Nicad rechargeable type rated at 4 ampere-hours |
| Flash tube input energy: | 100 watt-seconds |
| Number of flashes: | Over 3200 with charged battery |
| Flash duration: | Approximately 1 ms |
| Dimensions: | |
| Overall length: | 90.5 cm (35.6 inches) |
| Housing diam. | 21 cm (8.2 inches) |
| Weight in air: | 31 kg (69 pounds) |
| Weight in water: | 23 kg (50 pounds) |
| Turn-on delay setting: | 0 to 200 minutes |
| Camera exposure duration adjustment: | 40 to 400 ms |
| Exposure interval adjustment: | 3 sec to 2 minutes between* photos or manual |

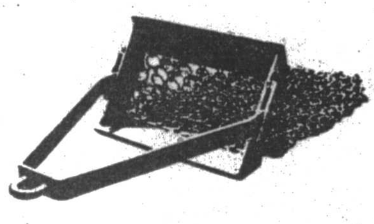
BENTHOS, Inc.
NORTH FALMOUTH, MASS.

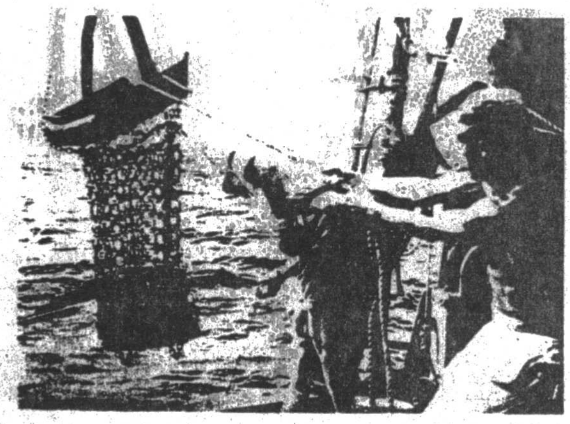


NO. 215WA150 TRIANGULAR STEEL DREDGE
Printed in U.S.A.

**No. 215WA150 KAHLSICO TRIANGULAR STEEL DREDGE** is designed for heavy-duty use. The rigid ¼" (6 mm) thick steel frame has perforated steel plates welded on three sides and the bottom. The plates have ½" (12 mm) holes to trap small stones, rocks, coral, etc. as it is dragged along the ocean bottom. Its large size assures collection of a large mass of material. The entire assembly is galvanized to prevent corrosion. The illustration shows the dredge with its 3 heavy eye-rings for wire or chain attachment. This dredge can be towed regardless of which side rests on the sea bed. Each side measures 24"x48" (60 cm x 120 cm); the total weight is approx. 100 lbs (45 kg).

# ROCK DREDGE, TYPE 149





The BENTHOS Type 149 Rock Dredge is an exceedingly rugged device used for collection of large samples of rock from the ocean bottom. It is equipped with an articulated bail which allows proper attack angle on the bottom with either side of the dredge mouth. The heavily weighted cutting edges cause positive plowing action during the tow for dislodging and collection of partially embedded samples. Collected material is retained in a heavy, three foot long, galvanized chain bag. An improved design of the chain bag links prevents tearout even under the most severe conditions. This device is normally used with BENTHOS Type 143 Weak Links attached both to the bail and to the rear of the chain bag via a safety cable to enable freeing of the dredge in the event of snagging on the bottom. (See Data Sheet #1-03-681.) The dredge has a mouth opening of 23" by 10" and weighs approximately 100 kgs. (220 lbs.). The BENTHOS Type 148 Rock Dredge is adapted from a design by Andy Nalwalk of the Woods Hole Oceanographic Institution.

# APPENDIX B

## Navigational Positions of Benchmarks, Geophysical/Bathymetric and Television/ Still Camera Lines, and Dredge Tows

The point numbers, observed coordinates, UTM grid coordinates "in feet", and the geographic coordinates (latitude and longitude) for all data and sample collection operations are presented. The first three digits of the point number are line numbers. The last digit of the point numbers listed for the geophysical and bathymetric (seismic) lines refers to either start of line (shot point 1) in which case the number is 1 or end of line (shot point 35) in which case the number is 2. Only the first and last points in each line are listed.

The point numbers for television and still camera lines (TV) in James Island Area, Block 198 and Brunswick Area, Block 912 refer to selected fix marks along the lines which may be located on the appropriate figures in the text. The two-digit point numbers listed for James Island Area, Blocks 380 and 463 reference both the line number, which is the first digit, and the start (first fix mark) or end (last fix mark) of line fix marks which are listed as either 1 (start) or 2 (end).

The last digit of the dredge tow (dredge) point numbers refers to the first (on station) and last (dredge out of water) fix marks recorded during a dredge tow. The first fix mark is designated with a 1 and the last fix mark with a 2. In James Island Area, Block 198 different stations were assigned similar station numbers but with different fix marks. Therefore, higher numbers were used to designate first and last fix marks, i.e., 3 and 4, 5 and 6. Any confusion is eliminated by listing the station number in addition to the point numbers for those stations with redundant station numbers.

TABLE OF CONTENTS

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON — HI FIX EAST COAST -.00 -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 SEISMIC — OSSI REF NO. 933 — COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 1261 | 956.13 | 1460.53 | 701740.8 | 3624916.5 | 32 44 43.21 | 78 50 48.26 |
| 1262 | 936.62 | 1401.26 | 696640.4 | 3624893.4 | 32 44 45.76 | 78 54 04.13 |
| 1251 | 954.71 | 1460.61 | 701735.3 | 3625039.4 | 32 44 47.21 | 78 50 48.68 |
| 1252 | 936.83 | 1401.42 | 696635.5 | 3625047.6 | 32 44 50.80 | 78 54 04.51 |
| 1241 | 952.85 | 1460.61 | 701709.0 | 3625197.4 | 32 44 52.35 | 78 50 49.56 |
| 1242 | 934.60 | 1401.67 | 696639.5 | 3625245.3 | 32 44 57.21 | 78 54 04.19 |
| 1231 | 951.34 | 1461.19 | 701734.7 | 3625341.8 | 32 44 57.02 | 78 50 48.47 |
| 1232 | 933.48 | 1402.04 | 696637.4 | 3625343.3 | 32 45 00.39 | 78 54 04.21 |
| 1221 | 949.58 | 1461.51 | 701735.5 | 3625500.2 | 32 45 02.16 | 78 50 48.31 |
| 1222 | 931.82 | 1402.34 | 696637.4 | 3625489.7 | 32 45 05.14 | 78 54 04.10 |
| 1211 | 948.24 | 1461.76 | 701736.4 | 3625621.0 | 32 45 06.08 | 78 50 48.18 |
| 1212 | 930.25 | 1402.60 | 696635.4 | 3625627.5 | 32 45 09.62 | 78 54 04.07 |
| 1201 | 946.20 | 1462.14 | 701737.7 | 3625804.8 | 32 45 12.04 | 78 50 47.99 |
| 1202 | 928.20 | 1402.99 | 696636.6 | 3625808.6 | 32 45 15.49 | 78 54 03.89 |
| 1191 | 944.35 | 1462.49 | 701739.0 | 3625971.6 | 32 45 17.46 | 78 50 47.81 |
| 1192 | 926.46 | 1403.33 | 696638.2 | 3625962.5 | 32 45 20.49 | 78 54 03.71 |
| 1181 | 943.03 | 1462.66 | 701733.3 | 3626088.3 | 32 45 21.25 | 78 50 47.94 |
| 1182 | 924.82 | 1403.62 | 696637.0 | 3626106.8 | 32 45 25.17 | 78 54 03.64 |
| 1171 | 941.12 | 1463.07 | 701738.2 | 3626261.8 | 32 45 26.88 | 78 50 47.61 |
| 1172 | 923.22 | 1403.93 | 696637.9 | 3626248.2 | 32 45 29.76 | 78 54 03.50 |
| 1271 | 957.77 | 1460.13 | 701739.1 | 3624766.0 | 32 44 38.33 | 78 50 48.75 |
| 1272 | 940.10 | 1400.88 | 696638.5 | 3624760.3 | 32 44 41.47 | 78 54 04.61 |
| 1281 | 960.13 | 1459.71 | 701737.5 | 3624553.6 | 32 44 31.44 | 78 50 48.97 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.00 -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 SEISMIC DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1282 | 941.93 | 1400.51 | 696634.2 | 3624597.9 | 32 44 36.20 | 78 54 04.90 |
| 1291 | 961.25 | 1459.57 | 701741.2 | 3624456.2 | 32 44 28.28 | 78 50 48.91 |
| 1292 | 945.65 | 1400.27 | 696638.6 | 3624449.4 | 32 44 31.38 | 78 54 04.84 |
| 1301 | 963.09 | 1459.20 | 701736.5 | 3624287.7 | 32 44 22.81 | 78 50 49.22 |
| 1302 | 945.48 | 1399.94 | 696637.5 | 3624286.1 | 32 44 26.08 | 78 54 05.01 |
| 1311 | 964.64 | 1458.96 | 701737.9 | 3624149.1 | 32 44 16.31 | 78 50 49.27 |
| 1312 | 947.13 | 1399.67 | 696638.4 | 3624141.1 | 32 44 21.38 | 78 54 05.09 |
| 51 | 909.18 | 1462.62 | 701196.3 | 3628946.6 | 32 46 54.36 | 78 51 06.33 |
| 52 | 965.93 | 1451.93 | 701181.2 | 3623846.9 | 32 44 08.87 | 78 51 10.88 |
| 41 | 505.29 | 1450.91 | 700182.7 | 3628944.0 | 32 46 54.94 | 78 51 45.27 |
| 42 | 962.37 | 1440.42 | 700192.2 | 3623843.6 | 32 44 09.41 | 78 51 48.86 |
| 31 | 901.56 | 1439.51 | 699194.4 | 3628946.0 | 32 46 55.72 | 78 52 23.23 |
| 32 | 958.77 | 1426.71 | 699184.3 | 3623849.4 | 32 44 10.26 | 78 52 27.55 |
| 21 | 898.06 | 1428.11 | 698207.3 | 3628943.9 | 32 46 56.23 | 78 53 01.16 |
| 22 | 955.48 | 1417.22 | 698196.7 | 3623845.6 | 32 44 10.78 | 78 53 05.48 |
| 11 | 894.51 | 1416.34 | 697186.6 | 3628946.4 | 32 46 56.97 | 78 53 40.37 |
| 12 | 952.20 | 1405.50 | 697188.4 | 3623846.6 | 32 44 11.46 | 78 53 44.19 |
| 1011 | 914.44 | 1468.24 | 701738.1 | 3628665.9 | 32 46 44.90 | 78 50 45.74 |
| 1012 | 896.45 | 1409.22 | 696637.7 | 3628612.7 | 32 46 46.50 | 78 54 01.71 |
| 1021 | 916.75 | 1467.78 | 701738.9 | 3628457.7 | 32 46 38.14 | 78 50 45.87 |
| 1022 | 897.51 | 1408.93 | 696638.7 | 3628483.9 | 32 46 42.32 | 78 54 01.77 |
| 1031 | 918.24 | 1467.45 | 701736.5 | 3628322.4 | 32 46 33.75 | 78 50 46.07 |
| 1032 | 899.80 | 1408.53 | 696637.8 | 3628316.5 | 32 46 36.88 | 78 54 01.93 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON  HI FIX EAST COAST  -.00  -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 19? SEISMIC  DSSI REF NO. 933  COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
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| 1041 | 919.95 | 1467.13 | 701738.3 | 3628168.8 | 32 46 28.76 | 78 50 46.12 |
| 1042 | 901.61 | 1408.16 | 696639.5 | 3628157.0 | 32 46 31.71 | 78 54 01.96 |
| 1051 | 921.70 | 1466.75 | 701735.8 | 3628010.0 | 32 46 23.61 | 78 50 46.34 |
| 1052 | 903.28 | 1407.82 | 696637.8 | 3628008.9 | 32 46 26.90 | 78 54 02.16 |
| 1061 | 923.23 | 1466.47 | 701739.2 | 3627864.3 | 32 46 18.88 | 78 50 46.32 |
| 1062 | 904.96 | 1407.51 | 696640.2 | 3627861.1 | 32 46 22.10 | 78 54 02.18 |
| 1071 | 925.17 | 1466.99 | 701737.8 | 3627697.8 | 32 46 13.48 | 78 50 46.51 |
| 1072 | 906.68 | 1407.12 | 696636.6 | 3627708.1 | 32 46 17.14 | 78 54 02.44 |
| 1081 | 926.60 | 1465.82 | 701738.5 | 3627569.2 | 32 46 09.30 | 78 50 46.58 |
| 1082 | 908.34 | 1406.82 | 696639.1 | 3627562.2 | 32 46 12.40 | 78 54 02.45 |
| 1091 | 928.21 | 1465.48 | 701736.3 | 3627423.3 | 32 46 04.57 | 78 50 46.78 |
| 1092 | 909.96 | 1406.47 | 696636.0 | 3627418.4 | 32 46 07.74 | 78 54 02.65 |
| 1101 | 929.94 | 1465.18 | 701739.0 | 3627268.4 | 32 45 59.54 | 78 50 46.79 |
| 1102 | 911.65 | 1406.17 | 696639.5 | 3627269.9 | 32 46 02.92 | 78 54 02.66 |
| 1111 | 931.82 | 1464.79 | 701736.6 | 3627098.2 | 32 45 54.02 | 78 50 47.02 |
| 1112 | 913.38 | 1405.79 | 696636.1 | 3627116.2 | 32 45 57.93 | 78 54 02.91 |
| 1121 | 933.55 | 1464.52 | 701738.3 | 3626961.1 | 32 45 49.57 | 78 50 47.06 |
| 1122 | 914.88 | 1405.54 | 696639.5 | 3626984.7 | 32 45 53.66 | 78 54 02.88 |
| 1131 | 934.78 | 1464.22 | 701735.9 | 3626831.5 | 32 45 45.36 | 78 50 47.26 |
| 1132 | 916.62 | 1405.12 | 696635.7 | 3626812.4 | 32 45 48.07 | 78 54 03.15 |
| 1141 | 936.79 | 1463.87 | 701737.9 | 3626652.2 | 32 45 39.54 | 78 50 47.32 |
| 1142 | 916.56 | 1404.94 | 696640.1 | 3626660.1 | 32 45 43.13 | 78 54 03.10 |
| 1151 | 938.28 | 1463.58 | 701737.1 | 3626516.9 | 32 45 35.15 | 78 50 47.46 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.00  -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN  81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 19B SEISMIC                    DSSI REF NO.   933          COMPUTED 04 JAN 79   AT  13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1152 | 920.23 | 1404.49 | 696637.5 | 3626512.0 | 32 45 38.32 | 78 54 03.31 |
| 1161 | 939.70 | 1463.42 | 701746.6 | 3626385.3 | 32 45 30.88 | 78 50 47.19 |
| 1162 | 921.40 | 1404.41 | 696649.1 | 3626412.0 | 32 45 35.07 | 78 54 02.94 |

72 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.00 -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 TV DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1 | 953.06 | 1405.36 | 697188.6 | 3623770.8 | 32 44 09.00 | 78 53 44.24 |
| 74 | 923.16 | 1403.10 | 696568.8 | 3626234.1 | 32 45 29.35 | 78 54 06.17 |
| 75 | 938.75 | 1412.17 | 697546.7 | 3625136.1 | 32 44 53.08 | 78 53 29.45 |
| 133 | 922.68 | 1418.93 | 697859.0 | 3626650.6 | 32 45 42.03 | 78 53 16.29 |
| 136 | 911.94 | 1412.56 | 697167.6 | 3627397.0 | 32 46 06.70 | 78 53 42.28 |
| 204 | 906.68 | 1424.30 | 698041.3 | 3628125.9 | 32 46 29.79 | 78 53 08.16 |
| 207 | 907.12 | 1422.94 | 697937.6 | 3628054.9 | 32 46 27.55 | 78 53 12.20 |
| 235 | 906.65 | 1432.13 | 698679.2 | 3628327.9 | 32 46 35.93 | 78 52 43.50 |
| 236 | 902.38 | 1434.67 | 698814.6 | 3628751.7 | 32 46 49.60 | 78 52 37.97 |
| 240 | 902.38 | 1454.16 | 700396.8 | 3629278.6 | 32 47 05.66 | 78 51 36.79 |
| 241 | 903.02 | 1454.29 | 700418.2 | 3629228.5 | 32 47 04.02 | 78 51 36.00 |
| 437 | 907.94 | 1430.48 | 698566.1 | 3628177.2 | 32 46 31.12 | 78 52 47.96 |

12 POINTS COMPUTED ON THIS LINE

BENCHMARK

928.99 1434.34 699215.8 3626507.7 32 45 36.52 78 52 24.30

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON          HI FIX EAST COAST    .00  -.00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN  81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 DREDGE & TRAWL          DSSI REF NO.   933          COMPUTED 04 JAN 79   AT  13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE | |
|---|---|---|---|---|---|---|---|
| 11 | 913.65 | 1453.46 | 700518.5 | 3628362.3 | 32 46 35.85 | 78 51 32.82 | |
| 12 | 913.58 | 1452.47 | 700446.9 | 3628290.2 | 32 46 33.55 | 78 51 35.63 | |
| 21 | 914.70 | 1450.35 | 700293.1 | 3628137.5 | 32 46 28.70 | 78 51 41.65 | Station 2A |
| 22 | 918.79 | 1447.33 | 700113.9 | 3627710.8 | 32 46 14.97 | 78 51 48.87 | |
| 23 | 914.37 | 1450.38 | 700290.2 | 3628166.1 | 32 46 29.63 | 78 51 41.74 | Station 2AR |
| 24 | 919.52 | 1451.10 | 700431.9 | 3627752.4 | 32 46 16.11 | 78 51 36.62 | |
| 25 | 912.73 | 1449.72 | 700209.8 | 3628286.0 | 32 46 33.57 | 78 51 44.74 | Station 2B |
| 26 | 914.42 | 1447.64 | 700084.8 | 3628092.4 | 32 46 27.37 | 78 51 49.69 | |
| 31 | 922.20 | 1448.53 | 700265.8 | 3627456.3 | 32 46 06.61 | 78 51 43.23 | Station 3A |
| 32 | 916.45 | 1446.93 | 700043.8 | 3627896.9 | 32 46 21.05 | 78 51 51.42 | |
| 33 | 922.28 | 1447.68 | 700198.0 | 3627426.4 | 32 46 05.68 | 78 51 45.86 | Station 3B |
| 34 | 918.37 | 1448.63 | 700212.8 | 3627781.6 | 32 46 17.20 | 78 51 45.01 | |
| 41 | 920.28 | 1442.84 | 699772.5 | 3627464.5 | 32 46 07.20 | 78 52 02.17 | |
| 42 | 916.33 | 1443.39 | 699754.0 | 3627811.5 | 32 46 18.47 | 78 52 02.61 | |
| 51 | 930.49 | 1447.56 | 700316.2 | 3626730.9 | 32 45 43.04 | 78 51 41.86 | Station 5A |
| 52 | 925.20 | 1448.47 | 700308.2 | 3627201.8 | 32 45 58.32 | 78 51 41.80 | |
| 53 | 929.54 | 1445.42 | 700127.4 | 3626753.4 | 32 45 43.89 | 78 51 49.09 | Station 5B |
| 54 | 926.12 | 1446.60 | 700170.4 | 3627073.6 | 32 45 54.25 | 78 51 47.19 | |
| 61 | 934.88 | 1445.62 | 700225.0 | 3626308.1 | 32 45 29.37 | 78 51 45.69 | |
| 62 | 930.59 | 1446.55 | 700235.5 | 3626695.2 | 32 45 41.93 | 78 51 44.99 | |

20 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON — HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 DREDGE < TRAWL — DSSI REF NO. 933 — COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE | |
|---|---|---|---|---|---|---|---|
| 71 | 949.28 | 1403.38 | 696943.5 | 3624071.0 | 32 44 18.91 | 78 53 53.43 | |
| 72 | 944.86 | 1405.32 | 697041.4 | 3624486.3 | 32 44 32.32 | 78 53 49.55 | |
| 81 | 946.21 | 1400.24 | 696642.2 | 3624258.4 | 32 44 25.18 | 78 54 04.85 | |
| 82 | 940.08 | 1403.79 | 696847.1 | 3624855.2 | 32 44 44.42 | 78 53 56.53 | |
| 91 | 945.00 | 1404.50 | 696975.7 | 3624457.3 | 32 44 31.42 | 78 53 51.89 | |
| 92 | 939.05 | 1407.43 | 697131.4 | 3625026.0 | 32 44 49.79 | 78 53 45.48 | |
| 101 | 944.02 | 1405.66 | 697057.2 | 3624566.6 | 32 44 34.91 | 78 53 48.68 | Station 10 |
| 102 | 938.62 | 1408.99 | 697253.3 | 3625098.6 | 32 44 52.06 | 78 53 40.74 | |
| 103 | 943.97 | 1405.51 | 697044.2 | 3624567.3 | 32 44 34.55 | 78 53 49.18 | Station 10R |
| 104 | 941.04 | 1407.98 | 697205.3 | 3624871.3 | 32 44 44.71 | 78 53 42.76 | |
| 111 | 940.46 | 1407.43 | 697151.8 | 3624907.3 | 32 44 45.91 | 78 53 44.79 | |
| 112 | 936.16 | 1406.61 | 697021.8 | 3625250.1 | 32 44 57.12 | 78 53 49.52 | |
| 121 | 937.00 | 1411.00 | 697394.7 | 3625282.3 | 32 44 57.92 | 78 53 35.18 | |
| 122 | 939.44 | 1405.76 | 696999.6 | 3624954.4 | 32 44 47.54 | 78 53 50.69 | |
| 131 | 938.16 | 1408.41 | 697198.9 | 3625123.8 | 32 44 52.91 | 78 53 42.81 | |
| 132 | 930.82 | 1403.09 | 696653.5 | 3625617.6 | 32 45 09.28 | 78 54 03.38 | |
| 151 | 934.19 | 1410.56 | 697318.8 | 3625508.7 | 32 45 05.32 | 78 53 37.92 | |
| 152 | 929.02 | 1407.04 | 696950.9 | 3625860.2 | 32 45 16.97 | 78 53 51.78 | |
| 141 | 933.30 | 1408.31 | 697119.2 | 3625530.2 | 32 45 06.15 | 78 53 45.56 | |
| 142 | 928.77 | 1405.58 | 696827.2 | 3625847.2 | 32 45 16.62 | 78 53 56.53 | |
| 161 | 927.83 | 1410.63 | 697227.4 | 3626044.5 | 32 45 22.77 | 78 53 41.01 | |
| 162 | 927.44 | 1416.56 | 697707.6 | 3626219.2 | 32 45 28.13 | 78 53 22.44 | |
| 172 | 926.17 | 1419.24 | 697907.6 | 3626391.2 | 32 45 33.58 | 78 53 14.63 | |
| 171 | 926.48 | 1414.93 | 697559.0 | 3626261.0 | 32 45 29.58 | 78 53 28.12 | |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 198 DREDGE < TRAWL DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 181 | 924.62 | 1416.67 | 697673.3 | 3626458.8 | 32 45 35.93 | 78 53 23.57 |
| 182 | 922.69 | 1423.21 | 698178.5 | 3626781.5 | 32 45 46.07 | 78 53 03.92 |
| 191 | 928.46 | 1404.13 | 696703.5 | 3625839.7 | 32 45 16.46 | 78 54 01.29 |
| 192 | 925.15 | 1409.64 | 697105.0 | 3626247.9 | 32 45 29.45 | 78 53 45.56 |
| 201 | 908.49 | 1402.32 | 696241.5 | 3627471.5 | 32 46 09.71 | 78 54 17.79 |
| 202 | 903.82 | 1407.54 | 696592.7 | 3627983.5 | 32 46 26.11 | 78 54 03.92 |
| 211 | 909.49 | 1423.87 | 698021.4 | 3627905.6 | 32 46 22.65 | 78 53 09.09 |
| 212 | 906.77 | 1429.42 | 698429.3 | 3628274.0 | 32 46 34.34 | 78 52 53.14 |
| 221 | 913.65 | 1443.65 | 699642.2 | 3628163.7 | 32 46 28.03 | 78 52 06.68 |
| 222 | 911.07 | 1446.95 | 699926.7 | 3628375.3 | 32 46 36.66 | 78 51 55.55 |
| 231 | 922.80 | 1444.34 | 699903.8 | 3627318.1 | 32 46 02.36 | 78 51 57.24 |
| 232 | 920.67 | 1448.59 | 700218.8 | 3627595.5 | 32 46 11.16 | 78 51 44.93 |

36 POINTS COMPUTED ON THIS LINE

ILLEGAL CHARACTERS IN INPUT

I/O CALLED AT SEQUENCE NUMBER 01346 OF 'MAIN'

FORTRAN LIBRARY LEVEL: 11.1C

ABOVE MESSAGES RESULTED FROM FOLLOWING CARD:
JAMES ISLAND 198 DREDGE < TRAWL 0.00 <.10

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON    HI FIX EAST COAST  -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 3D0 SEISMIC    DSSI REF NO. 933    COMPUTED 04 JAN 79  AT  13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 11 | 1236.50 | 1727.99 | 726006.4 | 3609748.7 | 32 36 14.09 | 78 35 30.11 |
| 12 | 1289.47 | 1726.93 | 726002.0 | 3604643.0 | 32 33 28.42 | 78 35 34.70 |
| 21 | 1242.16 | 1739.71 | 727002.3 | 3609752.1 | 32 36 13.46 | 78 34 51.93 |
| 22 | 1294.83 | 1738.62 | 726994.9 | 3604651.1 | 32 33 27.95 | 78 34 56.66 |
| 31 | 1247.97 | 1751.43 | 727998.4 | 3609749.2 | 32 36 12.63 | 78 34 13.75 |
| 32 | 1300.46 | 1750.44 | 727998.9 | 3604645.2 | 32 33 27.02 | 78 34 18.20 |
| 41 | 1253.61 | 1763.16 | 728995.2 | 3609751.8 | 32 36 11.98 | 78 33 35.54 |
| 42 | 1306.17 | 1762.45 | 729017.3 | 3604651.4 | 32 33 26.47 | 78 33 39.18 |
| 51 | 1259.87 | 1775.06 | 730006.6 | 3609749.5 | 32 36 11.15 | 78 32 56.77 |
| 52 | 1311.78 | 1773.92 | 729993.2 | 3604649.8 | 32 33 25.69 | 78 33 01.79 |
| 1011 | 1266.34 | 1781.36 | 730552.2 | 3609430.9 | 32 36 00.40 | 78 32 36.14 |
| 1012 | 1236.42 | 1721.34 | 725451.1 | 3609453.1 | 32 36 04.90 | 78 35 51.65 |
| 1021 | 1267.86 | 1781.44 | 730563.3 | 3609291.1 | 32 35 55.86 | 78 32 35.84 |
| 1022 | 1237.98 | 1721.30 | 725452.5 | 3609303.1 | 32 36 00.03 | 78 35 51.73 |
| 1031 | 1269.76 | 1781.18 | 730547.0 | 3609093.6 | 32 35 49.46 | 78 32 36.64 |
| 1032 | 1239.45 | 1721.20 | 725448.4 | 3609158.9 | 32 35 55.36 | 78 35 52.01 |
| 1041 | 1270.90 | 1781.19 | 730551.0 | 3608983.3 | 32 35 45.88 | 78 32 36.58 |
| 1042 | 1241.07 | 1721.17 | 725450.5 | 3609003.7 | 32 35 50.32 | 78 35 52.06 |
| 1311 | 1312.05 | 1780.51 | 730552.8 | 3604940.2 | 32 33 34.69 | 78 32 40.09 |
| 1312 | 1283.29 | 1720.45 | 725451.5 | 3604948.6 | 32 33 38.74 | 78 35 55.53 |
| 1301 | 1310.30 | 1780.47 | 730549.1 | 3605109.2 | 32 33 40.18 | 78 32 40.09 |
| 1302 | 1281.55 | 1720.42 | 725448.7 | 3605113.5 | 32 33 44.09 | 78 35 55.50 |
| 1291 | 1308.95 | 1780.49 | 730550.4 | 3605242.0 | 32 33 44.48 | 78 32 39.92 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 386 SEISMIC                    CSSI REF NO. 933          COMPUTED 04 JAN 79   AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 1292 | 1280.16 | 1720.45 | 725450.8 | 3605247.6 | 32 33 48.44 | 78 35 55.30 |
| 1261 | 1307.43 | 1780.47 | 730548.1 | 3605389.4 | 32 33 49.27 | 78 32 39.88 |
| 1282 | 1278.58 | 1720.42 | 725447.7 | 3605397.2 | 32 33 53.30 | 78 35 55.29 |
| 1271 | 1305.52 | 1780.51 | 730550.8 | 3605538.8 | 32 33 54.11 | 78 32 39.64 |
| 1272 | 1276.80 | 1720.46 | 725450.2 | 3605566.9 | 32 33 58.87 | 78 35 55.05 |
| 1261 | 1304.19 | 1780.49 | 730548.1 | 3605706.6 | 32 33 59.56 | 78 32 39.60 |
| 1262 | 1275.41 | 1720.42 | 725446.0 | 3605699.8 | 32 34 03.12 | 78 35 55.10 |
| 1251 | 1302.84 | 1780.53 | 730550.6 | 3605840.3 | 32 34 03.90 | 78 32 39.38 |
| 1252 | 1274.07 | 1720.48 | 725450.0 | 3605849.4 | 32 34 07.97 | 78 35 54.81 |
| 1241 | 1301.27 | 1760.52 | 730548.6 | 3605993.0 | 32 34 08.85 | 78 32 39.33 |
| 1242 | 1272.45 | 1720.49 | 725449.8 | 3605985.4 | 32 34 12.38 | 78 35 54.70 |
| 1231 | 1299.63 | 1780.56 | 730550.5 | 3606154.9 | 32 34 14.11 | 78 32 39.11 |
| 1232 | 1270.69 | 1720.52 | 725450.8 | 3606154.6 | 32 34 17.87 | 78 35 54.52 |
| 1221 | 1296.30 | 1780.56 | 730549.3 | 3606284.6 | 32 34 18.32 | 78 32 39.04 |
| 1222 | 1269.37 | 1720.50 | 725447.8 | 3606279.6 | 32 34 21.93 | 78 35 54.52 |
| 1211 | 1296.59 | 1780.59 | 730550.0 | 3606452.8 | 32 34 23.77 | 78 32 38.86 |
| 1212 | 1267.46 | 1720.59 | 725453.3 | 3606465.7 | 32 34 27.97 | 78 35 54.15 |
| 1201 | 1295.28 | 1760.58 | 730547.6 | 3606580.1 | 32 34 27.90 | 78 32 38.84 |
| 1202 | 1265.98 | 1720.56 | 725449.1 | 3606605.5 | 32 34 32.51 | 78 35 54.19 |
| 1191 | 1293.48 | 1780.64 | 730550.5 | 3606758.5 | 32 34 33.69 | 78 32 38.58 |
| 1192 | 1264.12 | 1720.62 | 725451.8 | 3606785.5 | 32 34 38.34 | 78 35 53.93 |
| 1181 | 1292.62 | 1780.64 | 730549.3 | 3606842.3 | 32 34 36.41 | 78 32 38.55 |
| 1182 | 1262.71 | 1720.59 | 725447.3 | 3606918.5 | 32 34 42.66 | 78 35 53.99 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 369 SEISMIC                DSSI REF NO. 933          COMPUTED 04 JAN 79   AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 1171 | 1290.67 | 1780.69 | 730550.8 | 3607034.7 | 32 34 42.65 | 78 32 38.32 |
| 1172 | 1261.32 | 1720.67 | 725452.0 | 3607054.5 | 32 34 47.07 | 78 35 53.69 |
| 1161 | 1289.18 | 1780.69 | 730548.5 | 3607179.9 | 32 34 47.36 | 78 32 38.28 |
| 1162 | 1259.75 | 1720.67 | 725449.5 | 3607204.1 | 32 34 51.93 | 78 35 53.66 |
| 1151 | 1287.23 | 1780.75 | 730550.3 | 3607372.8 | 32 34 53.62 | 78 32 38.04 |
| 1152 | 1258.02 | 1720.72 | 725450.9 | 3607371.1 | 32 34 57.35 | 78 35 53.46 |
| 1141 | 1285.66 | 1780.74 | 730547.1 | 3607505.7 | 32 34 57.94 | 78 32 38.04 |
| 1142 | 1256.81 | 1720.70 | 725447.1 | 3607485.4 | 32 35 01.06 | 78 35 53.51 |
| 1131 | 1284.45 | 1780.76 | 730547.9 | 3607644.9 | 32 35 02.45 | 78 32 37.89 |
| 1132 | 1255.18 | 1720.73 | 725446.6 | 3607641.9 | 32 35 06.14 | 78 35 53.39 |
| 1121 | 1282.95 | 1780.85 | 730550.9 | 3607794.4 | 32 35 07.30 | 78 32 37.64 |
| 1122 | 1253.82 | 1720.81 | 725450.7 | 3607775.0 | 32 35 10.45 | 78 35 53.12 |
| 1111 | 1281.41 | 1780.86 | 730548.6 | 3607944.8 | 32 35 12.18 | 78 32 37.60 |
| 1112 | 1252.21 | 1720.83 | 725449.1 | 3607929.1 | 32 35 15.45 | 78 35 53.05 |
| 1101 | 1279.80 | 1780.93 | 730551.1 | 3608104.9 | 32 35 17.36 | 78 32 37.36 |
| 1192 | 1250.47 | 1720.90 | 725451.2 | 3608097.8 | 32 35 20.93 | 78 35 52.82 |
| 1091 | 1276.10 | 1780.95 | 730549.0 | 3608271.3 | 32 35 22.78 | 78 32 37.29 |
| 1092 | 1248.66 | 1720.91 | 725448.5 | 3608249.5 | 32 35 25.85 | 78 35 52.79 |
| 1061 | 1276.79 | 1781.02 | 730551.8 | 3608402.2 | 32 35 27.02 | 78 32 37.07 |
| 1062 | 1247.44 | 1720.98 | 725451.0 | 3608389.6 | 32 35 30.39 | 78 35 52.57 |
| 1071 | 1275.72 | 1781.00 | 730547.6 | 3608505.2 | 32 35 30.37 | 78 32 37.14 |
| 1072 | 1245.42 | 1721.01 | 725448.6 | 3608563.0 | 32 35 36.67 | 78 35 52.50 |
| 1261 | 1273.55 | 1781.10 | 730550.5 | 3608723.1 | 32 35 37.44 | 78 32 36.84 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON    HI FIX EAST COAST  -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 380 SEISMIC    DSSI REF NO. 933    COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1062 | 1244.12 | 1721.08 | 725451.2 | 3608709.2 | 32 35 40.78 | 78 35 52.29 |
| 1051 | 1272.19 | 1781.13 | 730549.5 | 3608854.9 | 32 35 41.71 | 78 32 36.76 |
| 1052 | 1242.42 | 1721.09 | 725447.5 | 3608671.8 | 32 35 46.04 | 78 35 52.29 |

74 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 382 TV OSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 11 | 1252.24 | 1740.81 | 727124.0 | 3608839.3 | 32 35 43.75 | 78 34 48.06 |
| 12 | 1259.39 | 1751.72 | 728655.7 | 3608665.8 | 32 35 37.44 | 78 34 12.50 |
| 21 | 1255.75 | 1738.23 | 726916.8 | 3608383.5 | 32 35 29.12 | 78 34 56.40 |
| 22 | 1271.20 | 1752.73 | 728166.3 | 3607576.9 | 32 35 02.02 | 78 34 09.22 |
| 31 | 1255.32 | 1732.98 | 726475.5 | 3608163.0 | 32 35 22.94 | 78 35 13.49 |
| 32 | 1287.31 | 1755.01 | 728376.4 | 3606516.2 | 32 34 27.45 | 78 34 02.10 |
| 41 | 1258.64 | 1715.10 | 724978.7 | 3607062.7 | 32 34 47.68 | 78 36 11.82 |
| 42 | 1285.83 | 1763.45 | 729091.4 | 3606671.6 | 32 34 31.96 | 78 33 34.56 |
| 51 | 1276.86 | 1717.60 | 725208.7 | 3605246.7 | 32 33 48.59 | 78 36 04.58 |
| 52 | 1301.94 | 1764.14 | 729162.0 | 3605142.4 | 32 33 42.29 | 78 33 33.20 |

10 POINTS COMPUTED ON THIS LINE

**BENCHMARK**

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1275.36 | 1750.71 | 728003.4 | 3607081.3 | 32 34 46.07 | 78 34 15.90 |

FOOTNOTE:
Starting and ending points of individual TV lines have suffixes of 1 and 2 respectively

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND [illegible] DREDGE < TRAWL DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1011 | [illegible].79 | [illegible].37 | 728663.6 | 3605084.8 | 32 33 40.79 | 78 33 52.35 |
| 1012 | 1301.49 | 1772.97 | 729062.6 | 3605130.9 | 32 33 41.99 | 78 33 37.02 |
| 1021 | 1293.[illegible] | 17[illegible] | 728511.[illegible] | 3605[illegible]91.5 | 32 33 57.35 | 78 33 57.74 |
| 1022 | 1293.66 | 1761.[illegible] | 728904.7 | 3605810.0 | 32 34 04.14 | 78 33 42.47 |
| 1031 | 1298.6[illegible] | 17[illegible].85 | 728879.5 | 3605495.6 | 32 33 53.96 | 78 33 43.72 |
| 1032 | 1[illegible]1.20 | 17[illegible]0.23 | 728825.1 | 3605999.0 | 32 34 10.33 | 78 33 45.36 |
| 1041 | 1290.91 | 1751.01 | 728544.8 | 3605595.8 | 32 33 57.83 | 78 34 15.61 |
| 1042 | 1286.00 | 1746.16 | 727631.2 | 3605845.1 | 32 34 06.23 | 78 34 31.24 |
| 1051 | 1283.13 | 1723.[illegible] | 725747.6 | 3605117.6 | 32 33 44.01 | 78 35 44.04 |
| 1052 | 1278.15 | 1720.66 | 725467.9 | 3605448.8 | 32 33 54.96 | 78 35 54.48 |
| 1061 | 1267.36 | 1724.66 | 725746.1 | 3606629.7 | 32 34 33.07 | 78 35 42.79 |
| 1062 | 1262.55 | 1721.08 | 725488.3 | 3606955.6 | 32 34 43.64 | 78 35 52.39 |
| 1071 | 1278.21 | 1741.04 | 727191.6 | 3606359.2 | 32 34 23.23 | 78 34 47.63 |
| 1072 | 1273.[illegible] | 1737.82 | 726914.2 | 3606678.3 | 32 34 33.79 | 78 34 57.99 |
| 1081 | 1284.62 | 1750.[illegible] | 727983.5 | 3606171.6 | 32 34 16.56 | 78 34 17.46 |
| 1082 | 1279.62 | 1744.77 | 727508.0 | 3606395.2 | 32 34 24.17 | 78 34 35.48 |
| 1091 | 1284.47 | 1750.[illegible] | 727978.3 | 3606183.3 | 32 34 16.94 | 78 34 17.64 |
| 1092 | 1279.86 | 1745.66 | 727532.8 | 3606385.5 | 32 34 23.83 | 78 34 34.54 |
| 1101 | 1283.68 | 1750.49 | 727995.2 | 3606269.2 | 32 34 19.72 | 78 34 16.92 |
| 1102 | 1278.[illegible] | 1745.49 | 727567.5 | 3606542.9 | 32 34 28.92 | 78 34 33.07 |
| 1111 | 1279.8[illegible] | 1749.[illegible] | 727940.3 | 3606613.3 | 32 34 30.92 | 78 34 18.72 |
| 1112 | 1284.10 | 1751.92 | 728116.4 | 3606295.3 | 32 34 20.47 | 78 34 12.25 |
| 1121 | 129[illegible].97 | 175[illegible] | 728721.3 | 3605672.0 | 32 33 59.80 | 78 33 49.62 |

184

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 390 DREDGE & TRAWL          CSSI REF NO.  933          COMPUTED 04 JAN 79   AT  13:58:33

| POINT | OBSERVED | | GRID COORDINATES | | GEOGRAPHIC COORDINATES | |
|---|---|---|---|---|---|---|
| NUMBER | COORDINATES | | X OR E | Y OR N | LATITUDE | LONGITUDE |
| 1122 | 1257.76 | 1760.68 | 728864.4 | 3605869.2 | 32 34 06.09 | 78 33 43.97 |
| 1131 | 1278.50 | 1752.59 | 728200.8 | 3606885.5 | 32 34 35.56 | 78 34 08.53 |
| 1132 | 1274.96 | 1754.03 | 728295.5 | 3606310.9 | 32 34 20.85 | 78 34 05.38 |
| 1141 | 1275.68 | 1751.75 | 728095.7 | 3606810.1 | 32 34 37.19 | 78 34 12.60 |
| 1142 | 1273.25 | 1745.19 | 727535.3 | 3607027.2 | 32 34 44.65 | 78 34 33.98 |
| 1151 | 1271.77 | 1745.19 | 727533.0 | 3607169.5 | 32 34 49.27 | 78 34 33.84 |
| 1152 | 1265.24 | 1740.95 | 727165.1 | 3607600.1 | 32 35 03.51 | 78 34 47.57 |
| 1161 | 1266.35 | 1740.51 | 727133.6 | 3607281.4 | 32 34 53.20 | 78 34 49.05 |
| 1162 | 1259.66 | 1736.49 | 726779.9 | 3607908.0 | 32 35 13.79 | 78 35 02.06 |
| 1171 | 1260.96 | 1735.38 | 726688.9 | 3607753.7 | 32 35 08.85 | 78 35 05.69 |
| 1172 | 1253.42 | 1732.65 | 726443.5 | 3608349.4 | 32 35 28.36 | 78 35 14.57 |
| 1181 | 1256.93 | 1736.86 | 726804.6 | 3608207.3 | 32 35 23.48 | 78 35 00.85 |
| 1182 | 1254.78 | 1739.59 | 727028.4 | 3608539.4 | 32 35 34.09 | 78 34 51.99 |
| 1191 | 1259.09 | 1741.96 | 727237.2 | 3608236.6 | 32 35 24.11 | 78 34 44.25 |
| 1192 | 1254.75 | 1739.46 | 727017.4 | 3608536.2 | 32 35 34.00 | 78 34 52.41 |
| 1201 | 1263.52 | 1745.71 | 727561.5 | 3607986.3 | 32 35 15.75 | 78 34 32.04 |
| 1202 | 1259.60 | 1746.18 | 727592.2 | 3608384.6 | 32 35 28.66 | 78 34 30.52 |
| 1211 | 1259.04 | 1748.19 | 727759.2 | 3608532.6 | 32 35 33.34 | 78 34 23.98 |
| 1212 | 1257.85 | 1752.58 | 728123.6 | 3608856.6 | 32 35 43.58 | 78 34 09.73 |
| 1221 | 1256.65 | 1744.56 | 727449.8 | 3608572.6 | 32 35 34.86 | 78 34 35.81 |
| 1222 | 1252.56 | 1744.27 | 727414.3 | 3608970.3 | 32 35 47.79 | 78 34 36.82 |

44 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON          HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN  81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 SEISMIC          DSSI REF NO.   933          COMPUTED 04 JAN 79   AT  13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1011 | 1254.77 | 1498.96 | 706548.3 | 3599850.0 | 32 31 06.54 | 78 48 03.89 |
| 1012 | 1238.52 | 1438.96 | 701447.2 | 3599852.0 | 32 31 09.98 | 78 51 19.27 |
| 1021 | 1256.58 | 1499.08 | 706550.5 | 3599690.0 | 32 31 01.35 | 78 48 03.93 |
| 1022 | 1240.26 | 1439.08 | 701451.3 | 3599700.6 | 32 31 05.06 | 78 51 19.23 |
| 1031 | 1258.37 | 1499.13 | 706548.3 | 3599530.4 | 32 30 56.17 | 78 48 04.14 |
| 1032 | 1241.84 | 1439.10 | 701447.1 | 3599561.0 | 32 31 00.54 | 78 51 19.50 |
| 1051 | 1261.61 | 1499.31 | 706551.6 | 3599243.8 | 32 30 46.86 | 78 48 04.24 |
| 1052 | 1245.46 | 1439.31 | 701451.2 | 3599244.8 | 32 30 50.27 | 78 51 19.59 |
| 1061 | 1263.31 | 1499.33 | 706546.6 | 3599091.4 | 32 30 41.92 | 78 48 04.56 |
| 1062 | 1246.98 | 1439.36 | 701449.3 | 3599111.2 | 32 30 45.54 | 78 51 19.76 |
| 1071 | 1264.80 | 1499.47 | 706552.6 | 3598961.0 | 32 30 37.69 | 78 48 04.43 |
| 1072 | 1248.64 | 1439.46 | 701451.1 | 3598966.2 | 32 30 41.23 | 78 51 19.81 |
| 1081 | 1267.08 | 1499.52 | 706547.5 | 3598757.1 | 32 30 31.07 | 78 48 04.79 |
| 1092 | 1252.48 | 1439.66 | 701451.7 | 3598630.0 | 32 30 30.32 | 78 51 20.84 |
| 1101 | 1270.08 | 1499.71 | 706548.2 | 3598437.9 | 32 30 20.72 | 78 48 05.01 |
| 1102 | 1253.98 | 1439.68 | 701446.7 | 3598497.3 | 32 30 26.02 | 78 51 20.34 |
| 1111 | 1271.67 | 1499.79 | 706550.7 | 3598350.5 | 32 30 17.89 | 78 48 04.98 |
| 1112 | 1256.01 | 1439.83 | 701450.3 | 3598320.4 | 32 30 20.27 | 78 51 20.34 |
| 1121 | 1273.49 | 1499.87 | 706549.2 | 3598189.0 | 32 30 12.64 | 78 48 05.17 |
| 1122 | 1257.35 | 1439.87 | 701447.4 | 3598202.4 | 32 30 16.44 | 78 51 20.54 |
| 1131 | 1275.08 | 1499.99 | 706552.2 | 3598048.9 | 32 30 08.09 | 78 48 05.17 |
| 1132 | 1259.12 | 1440.02 | 701451.8 | 3598048.5 | 32 30 11.45 | 78 51 20.49 |
| 1141 | 1276.93 | 1500.04 | 706547.7 | 3597886.2 | 32 30 02.81 | 78 48 05.46 |
| 1082 | 1250.26 | 1439.51 | 701449.0 | 3598824.0 | 32 30 36.62 | 78 51 20.0 |
| 1091 | 1268.32 | 1499.66 | 706554.2 | 3598649.1 | 32 30 27.56 | 78 48 04.61 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 SEISMIC                    DSSI REF NO.   933          COMPUTED 04 JAN 79   AT  13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1142 | 1260.62 | 1440.07 | 701447.8 | 3597898.6 | 32 30 06.58 | 78 51 20.76 |
| 1151 | 1278.52 | 1500.16 | 706550.2 | 3597743.3 | 32 29 58.17 | 78 48 05.48 |
| 1152 | 1262.79 | 1440.22 | 701450.8 | 3597726.9 | 32 30 01.01 | 78 51 20.77 |
| 1161 | 1280.28 | 1500.25 | 706549.1 | 3597587.0 | 32 29 53.10 | 78 48 05.65 |
| 1162 | 1264.29 | 1440.29 | 701449.1 | 3597595.1 | 32 29 56.74 | 78 51 20.94 |
| 1171 | 1281.74 | 1500.35 | 706550.3 | 3597457.9 | 32 29 48.91 | 78 48 05.70 |
| 1172 | 1265.86 | 1440.40 | 701450.4 | 3597458.0 | 32 29 52.28 | 78 51 21.00 |
| 1181 | 1283.85 | 1500.46 | 706548.8 | 3597270.4 | 32 29 42.83 | 78 48 05.91 |
| 1182 | 1267.50 | 1440.47 | 701447.6 | 3597313.8 | 32 29 47.61 | 78 51 21.21 |
| 1191 | 1285.15 | 1500.56 | 706550.5 | 3597155.8 | 32 29 39.10 | 78 48 05.93 |
| 1192 | 1269.26 | 1440.63 | 701451.8 | 3597160.8 | 32 29 42.64 | 78 51 21.17 |
| 1201 | 1287.01 | 1500.66 | 706549.1 | 3596990.5 | 32 29 33.74 | 78 48 06.12 |
| 1202 | 1271.03 | 1440.71 | 701448.9 | 3597005.2 | 32 29 37.59 | 78 51 21.40 |
| 1211 | 1288.58 | 1500.79 | 706551.6 | 3596852.2 | 32 29 29.25 | 78 48 06.13 |
| 1212 | 1272.57 | 1440.84 | 701451.4 | 3596871.0 | 32 29 33.23 | 78 51 21.41 |
| 1221 | 1290.56 | 1500.88 | 706548.2 | 3596675.8 | 32 29 23.53 | 78 48 06.40 |
| 1222 | 1274.51 | 1440.92 | 701447.1 | 3596700.2 | 32 29 27.69 | 78 51 21.71 |
| 1231 | 1291.99 | 1501.01 | 706551.2 | 3596550.0 | 32 29 19.44 | 78 48 06.39 |
| 1232 | 1276.36 | 1441.09 | 701450.8 | 3596539.3 | 32 29 22.47 | 78 51 21.69 |
| 1241 | 1293.85 | 1500.22 | 706471.7 | 3596361.8 | 32 29 13.39 | 78 48 09.58 |
| 1242 | 1278.05 | 1441.18 | 701448.4 | 3596390.8 | 32 29 17.65 | 78 51 21.89 |
| 1251 | 1295.31 | 1501.23 | 706550.7 | 3596255.8 | 32 29 09.90 | 78 48 06.64 |
| 1252 | 1279.59 | 1441.31 | 701450.2 | 3596256.6 | 32 29 13.29 | 78 51 21.93 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON          HI FIX EAST COAST   -.40  -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 SEISMIC          DSSI REF NO. 933          COMPUTED 04 JAN 79   AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1261 | 1256.76 | 1501.29 | 706547.1 | 3596126.4 | 32 29 05.70 | 78 48 06.86 |
| 1262 | 1261.28 | 1441.41 | 701448.3 | 3596108.3 | 32 29 06.48 | 78 51 22.11 |
| 1271 | 1298.62 | 1501.46 | 706550.4 | 3595962.6 | 32 29 00.38 | 78 48 06.88 |
| 1272 | 1282.96 | 1441.57 | 701451.5 | 3595962.1 | 32 29 03.74 | 78 51 22.10 |
| 1281 | 1300.49 | 1501.57 | 706548.1 | 3595796.4 | 32 28 54.99 | 78 48 07.10 |
| 1282 | 1284.80 | 1441.65 | 701446.6 | 3595800.0 | 32 28 58.48 | 78 51 22.42 |
| 1292 | 1286.59 | 1441.84 | 701451.3 | 3595644.6 | 32 28 53.43 | 78 51 22.36 |
| 1291 | 1302.08 | 1501.72 | 706551.0 | 3595656.5 | 32 28 50.45 | 78 48 07.10 |
| 1301 | 1303.99 | 1501.85 | 706549.9 | 3595487.2 | 32 28 44.55 | 78 48 07.28 |
| 1302 | 1288.07 | 1441.93 | 701449.2 | 3595514.7 | 32 28 49.22 | 78 51 22.54 |
| 1311 | 1305.40 | 1501.99 | 706552.7 | 3595363.2 | 32 28 40.93 | 78 48 07.27 |
| 1312 | 1290.03 | 1442.11 | 701451.5 | 3595343.9 | 32 28 43.67 | 78 51 22.58 |
| 51 | 1249.52 | 1492.42 | 706002.0 | 3600150.2 | 32 31 16.65 | 78 48 24.58 |
| 52 | 1307.15 | 1495.83 | 706004.7 | 3595051.4 | 32 28 31.18 | 78 48 28.49 |
| 41 | 1246.20 | 1480.67 | 705003.4 | 3600148.4 | 32 31 17.25 | 78 49 02.83 |
| 42 | 1303.95 | 1484.02 | 704998.5 | 3595048.2 | 32 28 31.74 | 78 49 07.02 |
| 31 | 1242.67 | 1466.75 | 703990.5 | 3600152.4 | 32 31 18.06 | 78 49 41.62 |
| 32 | 1300.78 | 1472.17 | 703989.4 | 3595052.1 | 32 28 32.53 | 78 49 45.64 |
| 21 | 1239.83 | 1457.21 | 703009.7 | 3600149.0 | 32 31 18.59 | 78 50 19.19 |
| 22 | 1297.92 | 1469.64 | 703006.6 | 3595044.4 | 32 28 32.93 | 78 50 23.27 |
| 11 | 1236.74 | 1445.39 | 702005.3 | 3600152.6 | 32 31 19.37 | 78 50 57.66 |
| 12 | 1294.89 | 1448.80 | 701996.8 | 3595053.9 | 32 28 33.90 | 78 51 01.85 |
| 1041 | 1259.46 | 1498.97 | 706530.5 | 3599428.2 | 32 30 52.86 | 78 48 04.91 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 SEISMIC DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1042 | 1243.72 | 1439.25 | 701452.5 | 3599397.7 | 32 30 55.23 | 78 51 19.41 |

70 POINTS COMPUTED ON THIS LINE

70 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES HI FIX EAST COAST
419 POINTS

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON — HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 TV — DSSI REF NO. 933 — COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 21 | 1245.86 | 1459.76 | 703207.8 | 3599672.2 | 32 31 02.99 | 78 50 11.98 |
| 22 | 1265.06 | 1496.43 | 706289.4 | 3598856.7 | 32 30 34.48 | 78 48 14.59 |
| 31 | 1265.23 | 1435.39 | 701021.1 | 3597406.8 | 32 29 50.90 | 78 51 37.48 |
| 32 | 1265.08 | 1449.80 | 702266.1 | 3597733.6 | 32 30 00.69 | 78 50 49.55 |
| 41 | 1266.73 | 1445.27 | 701866.4 | 3597486.6 | 32 29 52.94 | 78 51 05.04 |
| 42 | 1275.81 | 1495.90 | 706195.2 | 3597877.6 | 32 30 02.77 | 78 48 18.97 |
| 51 | 1304.48 | 1486.43 | 705204.6 | 3595058.8 | 32 28 31.95 | 78 48 59.12 |
| 52 | 1279.15 | 1500.32 | 706560.9 | 3597690.6 | 32 29 56.45 | 78 48 05.12 |
| 61 | 1287.83 | 1462.63 | 703246.8 | 3595992.7 | 32 29 03.55 | 78 50 13.34 |
| 62 | 1273.52 | 1483.84 | 705162.1 | 3597743.9 | 32 29 59.12 | 78 48 58.64 |

10 POINTS COMPUTED ON THIS LINE

<u>BENCHMARK</u>

| | | | | | |
|---|---|---|---|---|---|
| 1270.95 | 1470.22 | 704000.1 | 3597679.8 | 32 29 57.81 | 78 49 43.19 |

190

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 DREDGE DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1011 | 1249.52 | 1459.21 | 703146.6 | 3599333.5 | 32 30 52.04 | 78 50 14.58 |
| 1012 | 1248.83 | 1466.65 | 703789.3 | 3599570.6 | 32 30 59.31 | 78 49 49.78 |
| 1021 | 1260.68 | 1482.27 | 705087.2 | 3598892.3 | 32 30 36.44 | 78 49 00.60 |
| 1022 | 1256.01 | 1483.40 | 705203.2 | 3599338.8 | 32 30 50.85 | 78 48 55.81 |
| 1031 | 1253.63 | 1487.34 | 705551.2 | 3599651.5 | 32 31 00.76 | 78 48 42.24 |
| 1032 | 1248.14 | 1486.71 | 705515.9 | 3600127.3 | 32 31 16.23 | 78 48 43.22 |
| 1041 | 1260.27 | 1481.92 | 705058.8 | 3598920.3 | 32 30 37.36 | 78 49 01.67 |
| 1042 | 1256.94 | 1484.37 | 705283.2 | 3599279.9 | 32 30 46.88 | 78 48 52.80 |
| 1051 | 1266.65 | 1474.56 | 704395.8 | 3598168.6 | 32 30 13.41 | 78 49 27.65 |
| 1052 | 1263.39 | 1475.35 | 704478.9 | 3598479.5 | 32 30 23.44 | 78 49 24.22 |
| 1061 | 1260.77 | 1475.91 | 704547.3 | 3598730.0 | 32 30 31.53 | 78 49 21.41 |
| 1062 | 1255.93 | 1476.17 | 704581.1 | 3599166.9 | 32 30 45.68 | 78 49 19.77 |
| 1071 | 1296.68 | 1492.66 | 705796.7 | 3595897.3 | 32 28 58.77 | 78 48 35.79 |
| 1072 | 1288.76 | 1491.53 | 705747.7 | 3596600.9 | 32 29 21.63 | 78 48 37.11 |
| 1081 | 1293.18 | 1498.42 | 706319.5 | 3596370.3 | 32 29 13.96 | 78 48 15.40 |
| 1082 | 1264.66 | 1492.10 | 705820.4 | 3596984.4 | 32 29 34.03 | 78 48 34.03 |
| 1091 | 1288.42 | 1499.25 | 706419.0 | 3596827.1 | 32 29 28.52 | 78 48 11.23 |
| 1092 | 1286.61 | 1502.14 | 706679.5 | 3597064.8 | 32 29 36.07 | 78 48 01.07 |
| 1101 | 1288.38 | 1497.31 | 706251.1 | 3596781.1 | 32 29 27.14 | 78 48 17.70 |
| 1102 | 1289.10 | 1504.22 | 706846.0 | 3596894.0 | 32 29 30.41 | 78 47 54.83 |
| 1111 | 1282.19 | 1498.75 | 706409.5 | 3597376.1 | 32 29 46.35 | 78 48 11.16 |
| 1112 | 1281.55 | 1502.70 | 706754.7 | 3597536.0 | 32 29 51.31 | 78 47 57.82 |
| 1121 | 1283.45 | 1500.72 | 706573.4 | 3597313.2 | 32 29 44.20 | 78 48 04.93 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 4&5 DREDGE DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1122 | 1279.87 | 1501.19 | 706632.5 | 3597648.3 | 32 29 55.03 | 78 48 02.41 |
| 1131 | 1265.91 | 1439.53 | 701409.5 | 3597443.5 | 32 29 51.84 | 78 51 22.57 |
| 1132 | 1265.78 | 1438.52 | 701268.4 | 3597424.7 | 32 29 51.31 | 78 51 27.22 |
| 1141 | 1263.36 | 1446.78 | 701979.6 | 3597810.8 | 32 30 03.39 | 78 51 00.46 |
| 1142 | 1265.07 | 1448.56 | 702159.1 | 3597706.9 | 32 29 59.90 | 78 50 53.66 |
| 1151 | 1263.66 | 1439.21 | 701359.1 | 3597627.8 | 32 29 57.85 | 78 51 24.36 |
| 1152 | 1264.65 | 1443.53 | 701725.9 | 3597615.7 | 32 29 57.22 | 78 51 10.32 |
| 1161 | 1266.51 | 1461.91 | 703192.6 | 3596694.4 | 32 29 06.69 | 78 50 15.34 |
| 1162 | 1268.04 | 1470.19 | 703901.3 | 3596148.7 | 32 29 08.18 | 78 49 48.16 |
| 1171 | 1287.42 | 1468.22 | 703734.2 | 3596156.3 | 32 29 08.60 | 78 49 54.55 |
| 1172 | 1288.00 | 1474.67 | 704290.1 | 3596258.0 | 32 29 11.47 | 78 49 33.19 |
| 1181 | 1286.25 | 1475.55 | 704376.9 | 3596435.9 | 32 29 17.19 | 78 49 29.73 |
| 1182 | 1285.82 | 1479.68 | 704737.5 | 3596573.7 | 32 29 21.42 | 78 49 15.81 |
| 1191 | 1282.75 | 1478.58 | 704659.9 | 3596822.7 | 32 29 29.56 | 78 49 18.59 |
| 1192 | 1284.25 | 1481.47 | 704901.7 | 3596758.2 | 32 29 27.30 | 78 49 09.38 |
| 1201 | 1284.22 | 1480.45 | 704813.5 | 3596736.1 | 32 29 26.64 | 78 49 12.78 |
| 1202 | 1283.77 | 1480.70 | 704837.7 | 3596782.5 | 32 29 28.13 | 78 49 11.81 |
| 1211 | 1279.78 | 1485.34 | 705261.5 | 3597254.7 | 32 29 43.17 | 78 48 55.21 |
| 1212 | 1278.71 | 1486.27 | 705520.7 | 3597423.7 | 32 29 48.49 | 78 48 45.16 |
| 1221 | 1279.41 | 1485.39 | 705267.8 | 3597289.2 | 32 29 44.29 | 78 48 54.95 |
| 1222 | 1279.64 | 1487.93 | 705485.4 | 3597313.6 | 32 29 44.94 | 78 48 46.60 |
| 1231 | 1269.43 | 1482.78 | 705092.3 | 3598120.5 | 32 30 11.39 | 78 49 01.01 |
| 1232 | 1272.46 | 1489.62 | 705616.8 | 3598004.2 | 32 30 07.26 | 78 48 41.02 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.40 -.30

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

JAMES ISLAND 463 DREDGE DSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:58:33

| POINT | OBSERVED | | GRID COORDINATES | | GEOGRAPHIC COORDINATES | |
|---|---|---|---|---|---|---|
| NUMBER | COORDINATES | | X OR E | Y OR N | LATITUDE | LONGITUDE |
| 1241 | 1274.16 | 1493.81 | 705953.4 | 3597952.3 | 32 30 05.35 | 78 48 28.17 |
| 1242 | 1276.48 | 1499.08 | 706466.6 | 3597899.2 | 32 30 03.29 | 78 48 08.55 |
| 1251 | 1258.53 | 1500.64 | 706624.6 | 3599503.9 | 32 30 55.26 | 78 48 01.24 |
| 1252 | 1254.02 | 1501.40 | 706758.9 | 3599981.3 | 32 31 10.66 | 78 47 55.72 |
| 1261 | 1257.78 | 1486.16 | 704917.3 | 3599099.6 | 32 30 43.28 | 78 49 06.95 |
| 1262 | 1251.81 | 1477.86 | 704742.4 | 3599576.9 | 32 30 58.88 | 78 49 13.28 |
| 1271 | 1257.30 | 1478.96 | 704815.9 | 3599112.9 | 32 30 43.78 | 78 49 10.82 |
| 1272 | 1254.26 | 1481.72 | 705965.3 | 3599453.5 | 32 30 54.66 | 78 49 01.00 |

54 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.10   .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN  81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 SEISMIC                    DSSI REF NO.   933        COMPUTED 04 JAN 79   AT  13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1011 | 1233.36 | 1948.63 | 552952.8 | 3441451.9 | 31 06 26.60 | 80 26 40.97 |
| 1012 | 1179.44 | 1959.05 | 547851.0 | 3441460.1 | 31 06 27.66 | 80 29 53.56 |
| 1021 | 1232.58 | 1950.38 | 552948.9 | 3441302.1 | 31 06 21.74 | 80 26 41.15 |
| 1022 | 1178.59 | 1960.87 | 547849.1 | 3441303.1 | 31 06 22.56 | 80 29 53.66 |
| 1031 | 1231.85 | 1952.17 | 552953.6 | 3441147.4 | 31 06 16.71 | 80 26 41.00 |
| 1032 | 1177.79 | 1962.70 | 547852.7 | 3441144.2 | 31 06 17.40 | 80 29 53.55 |
| 1041 | 1231.06 | 1953.91 | 552949.8 | 3440998.4 | 31 06 11.87 | 80 26 41.17 |
| 1042 | 1176.99 | 1964.40 | 547845.9 | 3440997.8 | 31 06 12.64 | 80 29 53.68 |
| 1051 | 1230.26 | 1955.78 | 552950.4 | 3440837.5 | 31 06 06.65 | 80 26 41.18 |
| 1052 | 1176.29 | 1966.02 | 547853.6 | 3440857.0 | 31 06 08.07 | 80 29 53.57 |
| 1061 | 1229.45 | 1957.61 | 552948.1 | 3440680.5 | 31 06 01.55 | 80 26 41.30 |
| 1062 | 1175.50 | 1967.69 | 547849.9 | 3440713.4 | 31 06 03.40 | 80 29 53.73 |
| 1071 | 1228.74 | 1959.32 | 552950.4 | 3440533.1 | 31 05 56.76 | 80 26 41.23 |
| 1072 | 1174.49 | 1969.55 | 547850.9 | 3440517.8 | 31 05 57.05 | 80 29 53.73 |
| 1081 | 1228.39 | 1960.09 | 552948.4 | 3440467.2 | 31 05 54.62 | 80 26 41.33 |
| 1082 | 1173.93 | 1971.10 | 547846.4 | 3440419.3 | 31 05 53.85 | 80 29 53.91 |
| 1091 | 1227.51 | 1962.20 | 552950.5 | 3440285.5 | 31 05 48.71 | 80 26 41.28 |
| 1092 | 1173.06 | 1973.14 | 547851.2 | 3440242.0 | 31 05 48.09 | 80 29 53.76 |
| 1101 | 1226.39 | 1964.82 | 552949.9 | 3440060.3 | 31 05 41.40 | 80 26 41.35 |
| 1102 | 1172.32 | 1974.73 | 547848.2 | 3440105.2 | 31 05 43.65 | 80 29 53.90 |
| 1111 | 1225.94 | 1965.95 | 552952.8 | 3439962.7 | 31 05 38.23 | 80 26 41.25 |
| 1112 | 1171.67 | 1976.28 | 547852.5 | 3439970.4 | 31 05 39.27 | 80 29 53.76 |
| 1121 | 1225.14 | 1967.77 | 552949.8 | 3439806.7 | 31 05 33.16 | 80 26 41.40 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.10   .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 SEISMIC                    DSSI REF NO.   933          COMPUTED 04 JAN 79   AT   13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1122 | 1170.81 | 1978.10 | 547847.3 | 3439814.1 | 31 05 34.19 | 80 29 53.98 |
| 1131 | 1224.41 | 1969.51 | 552950.1 | 3439657.1 | 31 05 28.30 | 80 26 41.41 |
| 1132 | 1170.12 | 1979.74 | 547851.2 | 3439671.6 | 31 05 29.56 | 80 29 53.86 |
| 1141 | 1223.60 | 1971.40 | 552948.6 | 3439494.8 | 31 05 23.03 | 80 26 41.50 |
| 1142 | 1169.25 | 1981.67 | 547849.5 | 3439505.1 | 31 05 24.16 | 80 29 53.95 |
| 1151 | 1222.55 | 1973.06 | 552953.2 | 3439351.4 | 31 05 18.37 | 80 26 41.35 |
| 1152 | 1166.53 | 1983.33 | 547850.8 | 3439361.5 | 31 05 19.49 | 80 29 53.93 |
| 1161 | 1222.26 | 1974.63 | 552949.8 | 3439217.0 | 31 05 14.01 | 80 26 41.51 |
| 1162 | 1167.71 | 1985.12 | 547847.4 | 3439207.4 | 31 05 14.49 | 80 29 54.08 |
| 1171 | 1221.52 | 1976.47 | 552952.5 | 3439058.4 | 31 05 08.85 | 80 26 41.43 |
| 1172 | 1166.59 | 1987.06 | 547851.6 | 3439039.9 | 31 05 09.01 | 80 29 53.95 |
| 1181 | 1220.71 | 1978.33 | 552948.8 | 3438899.1 | 31 05 03.68 | 80 26 41.60 |
| 1182 | 1166.14 | 1988.76 | 547849.9 | 3438892.4 | 31 05 04.25 | 80 29 54.04 |
| 1191 | 1220.04 | 1980.01 | 552951.4 | 3438754.2 | 31 04 58.98 | 80 26 41.53 |
| 1192 | 1165.60 | 1990.08 | 547853.5 | 3438777.7 | 31 05 00.53 | 80 29 53.92 |
| 1201 | 1219.26 | 1981.86 | 552949.8 | 3438595.5 | 31 04 53.82 | 80 26 41.62 |
| 1202 | 1164.57 | 1992.32 | 547847.7 | 3438585.2 | 31 04 54.27 | 80 29 54.18 |
| 1211 | 1218.66 | 1983.37 | 552952.0 | 3438465.3 | 31 04 49.59 | 80 26 41.57 |
| 1212 | 1164.19 | 1993.44 | 547858.6 | 3438486.4 | 31 04 51.06 | 80 29 53.78 |
| 1221 | 1217.79 | 1985.44 | 552950.0 | 3438287.7 | 31 04 43.82 | 80 26 41.67 |
| 1222 | 1163.19 | 1995.54 | 547849.1 | 3438306.7 | 31 04 45.23 | 80 29 54.17 |
| 1231 | 1217.10 | 1987.13 | 552950.2 | 3438142.5 | 31 04 39.10 | 80 26 41.70 |
| 1232 | 1162.44 | 1997.[illegible] | 547853.5 | 3438146.9 | 31 04 40.04 | 80 29 54.03 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON                    HI FIX EAST COAST   -.10   .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 SEISMIC                    DSSI REF NO. 933          COMPUTED 04 JAN 79   AT 13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | Y OR N | GEOGRAPHIC COORDINATES LATITUDE | LONGITUDE |
|---|---|---|---|---|---|---|
| 1241 | 1216.34 | 1988.98 | 552949.7 | 3437983.5 | 31 04 33.94 | 80 26 41.75 |
| 1242 | 1161.62 | 1999.13 | 547846.5 | 3437997.1 | 31 04 35.17 | 80 29 54.32 |
| 1251 | 1215.71 | 1990.56 | 552951.7 | 3437845.7 | 31 04 29.46 | 80 26 41.69 |
| 1252 | 1169.95 | 2000.84 | 547852.9 | 3437848.1 | 31 04 30.33 | 80 29 54.11 |
| 1261 | 1215.08 | 1992.11 | 552950.8 | 3437714.3 | 31 04 25.20 | 80 26 41.75 |
| 1262 | 1160.11 | 2002.75 | 547850.4 | 3437683.6 | 31 04 24.99 | 80 29 54.23 |
| 1271 | 1214.35 | 1993.86 | 552948.6 | 3437564.3 | 31 04 20.32 | 80 26 41.66 |
| 1272 | 1159.55 | 2004.02 | 547848.4 | 3437574.3 | 31 04 21.44 | 80 29 54.32 |
| 1281 | 1213.18 | 1996.31 | 552930.5 | 3437356.6 | 31 04 13.58 | 80 26 42.59 |
| 1282 | 1158.72 | 2006.02 | 547850.3 | 3437401.2 | 31 04 15.81 | 80 29 54.28 |
| 1291 | 1212.67 | 1997.59 | 552950.8 | 3437243.4 | 31 04 09.90 | 80 26 41.84 |
| 1292 | 1158.07 | 2007.60 | 547852.2 | 3437264.3 | 31 04 11.37 | 80 29 54.23 |
| 1301 | 1212.14 | 1999.39 | 552949.9 | 3437088.9 | 31 04 04.88 | 80 26 41.91 |
| 1302 | 1157.26 | 2009.45 | 547849.2 | 3437105.1 | 31 04 06.20 | 80 29 54.37 |
| 1311 | 1211.49 | 2001.04 | 552950.7 | 3436946.9 | 31 04 00.27 | 80 26 41.90 |
| 1312 | 1156.49 | 2011.31 | 547850.4 | 3436944.2 | 31 04 00.97 | 80 29 54.35 |
| 11 | 1186.89 | 1954.45 | 548413.1 | 3441749.9 | 31 06 36.99 | 80 29 32.29 |
| 12 | 1161.02 | 2013.54 | 548405.2 | 3436648.3 | 31 03 51.28 | 80 29 33.47 |
| 21 | 1197.45 | 1952.26 | 549414.7 | 3441751.5 | 31 06 36.89 | 80 28 54.48 |
| 22 | 1171.84 | 2011.37 | 549407.9 | 3436653.5 | 31 03 51.29 | 80 28 55.63 |
| 31 | 1207.86 | 1950.21 | 550403.8 | 3441749.3 | 31 06 36.67 | 80 28 17.14 |
| 32 | 1182.59 | 2009.38 | 550406.4 | 3436649.7 | 31 03 51.02 | 80 28 17.96 |
| 41 | 1218.54 | 1948.15 | 551410.7 | 3441750.7 | 31 06 36.56 | 80 27 39.13 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON — HI FIX EAST COAST -.10 .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 SEISMIC — DSSI REF NO. 933 — COMPUTED 04 JAN 79 AT 13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 42 | 1193.49 | 2007.37 | 551414.3 | 3436651.8 | 31 03 50.93 | 80 27 39.93 |
| 51 | 1229.26 | 1946.18 | 552422.5 | 3441749.5 | 31 06 36.36 | 80 27 00.94 |
| 52 | 1204.30 | 2005.50 | 552414.4 | 3436649.0 | 31 03 50.68 | 80 27 02.19 |

72 POINTS COMPUTED ON THIS LINE

72 POINTS COMPUTED ON THIS LINE

CONTINENTAL SHELF ASSOCIATES — HI FIX EAST COAST
88 POINTS

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON  HI FIX EAST COAST  -.10  .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 TV  DSSI REF NO. 933  COMPUTED 04 JAN 79  AT 13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 1 | 1179.19 | 2010.65 | 550117.3 | 3436590.4 | 31 03 49.14 | 80 28 28.88 |
| 59 | 1201.22 | 1993.02 | 551603.2 | 3437855.2 | 31 04 25.99 | 80 27 32.58 |
| 120 | 1203.15 | 1990.55 | 551694.7 | 3438052.5 | 31 04 36.38 | 80 27 29.09 |
| 125 | 1205.12 | 1989.30 | 551840.6 | 3438135.8 | 31 04 39.07 | 80 27 23.57 |

4 POINTS COMPUTED ON THIS LINE

BENCHMARK

| | | | | | | |
|---|---|---|---|---|---|---|
| | 1194.33 | 1979.94 | 550351.0 | 3439195.9 | 31 05 13.74 | 80 28 19.60 |

CONTINENTAL SHELF ASSOCIATES

DECCA SURVEY SYSTEMS, INC., HOUSTON HI FIX EAST COAST -.10 .00

UNIVERSAL TRANSVERSE MERCATOR PROJECTION, CENTRAL MERIDIAN 81 DEGREES W, COORDINATES IN METERS

BRUNSWICK 912 DREDGE AND TRAWL CSSI REF NO. 933 COMPUTED 04 JAN 79 AT 13:54:55

| POINT NUMBER | OBSERVED COORDINATES | | GRID COORDINATES X OR E | GRID COORDINATES Y OR N | GEOGRAPHIC COORDINATES LATITUDE | GEOGRAPHIC COORDINATES LONGITUDE |
|---|---|---|---|---|---|---|
| 2011 | 1198.62 | 1995.96 | 551381.1 | 3437811.4 | 31 04 28.60 | 80 27 40.97 |
| 2012 | 1205.60 | 1991.96 | 551994.4 | 3437890.2 | 31 04 31.06 | 80 27 17.81 |
| 2021 | 1204.47 | 1991.57 | 551869.3 | 3437935.8 | 31 04 32.56 | 80 27 22.53 |
| 2022 | 1196.46 | 1993.06 | 551126.6 | 3437931.9 | 31 04 32.55 | 80 27 50.55 |
| 2031 | 1199.55 | 1991.46 | 551370.8 | 3438028.4 | 31 04 35.65 | 80 27 41.32 |
| 2032 | 1204.96 | 1990.82 | 551887.4 | 3437997.3 | 31 04 34.56 | 80 27 21.83 |
| 2041 | 1204.31 | 1992.17 | 551877.9 | 3437882.7 | 31 04 30.84 | 80 27 22.21 |
| 2042 | 1196.48 | 1995.11 | 551213.8 | 3437740.6 | 31 04 26.33 | 80 27 47.30 |
| 2051 | 1198.83 | 1996.47 | 551505.0 | 3437575.0 | 31 04 20.91 | 80 27 36.34 |
| 2052 | 1204.68 | 1987.71 | 551730.3 | 3438291.0 | 31 04 44.12 | 80 27 27.70 |
| 2061 | 1199.17 | 1995.44 | 551497.4 | 3437664.6 | 31 04 23.81 | 80 27 36.61 |
| 2062 | 1205.31 | 1987.69 | 551792.8 | 3438282.3 | 31 04 43.83 | 80 27 25.35 |

12 POINTS COMPUTED ON THIS LINE

# APPENDIX C

## Petrographic Analyses Sample Descriptions

The samples collected during this study and petrographically analyzed are described in this appendix. The first of the two station numbers listed for the samples in this appendix is the same station number shown on the 1:10,000 maps, and also given as part of the number code in the tables of Appendix B. The second station number (in parentheses) was assigned when selecting the stations for dredging and appears on the label in the sample container with the identified material.

JAMES ISLAND AREA, BLOCK 198

| Station | |
|---|---|
| 2B(2Ab) | Biosparite, partially biopelsparite. Mixture of fine bioclasts and pellets. The small bioclasts include foraminifera and spicules. Scattered medium sand-size rounded quartz grains also silt-size angular to subangular grains. Intergranular porosity, pore spaces with fine grained acicular calcite. 15.96% non-carbonate. |
| 3B(3Aa) | Sandy biomicrite. Angular bioclastic material, in micritic matrix. Angular silt-size quartz grains with rare microcline grains. Dense texture poor porosity but with small particles of sparry calcite. 27.96% non-carbonate. |
| 4(4Aa) | Biosparite. Fine grained bioclasts and micritic pellets in fine sparry calcite. Some patchy porosity lined with acicular calcite. Rare angular silt-size quartz grains. |
| 7(7Aa) | Sandstone. Poorly sorted medium sand to silt-size quartz grains, rounded to sub-angular with sand-size irregular bioclasts. Some micritic intraclasts. In sparry clacite cement. |
| 8(8Aa) | Biomicrite. Scattered large irregular bioclasts mixed with small bioclast grains. Occasional silt-size quartz grains. Micritic groundmass dense with only minor porosity. Non-carbonates 5.5%. |
| 10R(10Aa) | Algal biolithite. Irregular encrusting dark micritic overgrowths on bioclasts. Scattered silt-size quartz grains. Non-carbonates 16.06% |
| 13(12Aa) | Biosparite. Sandy/silts angular to sub-angular quartz grains with micritic particles. Scattered Foraminifera. |
| 14(14Aa) | Sandy biomicrite. Non-carbonate 15.28%. |
| 15(13Aa) | Biosparite and biopelsparite with pellets of micrite, small bioclasts with micritic envelopes. Some quartz silt grains. |

| | |
|---|---|
| 16(15Aa) | Biosparite. With micritic particles and some micritic envelopes on bioclasts. Scattered silt-size quartz. |
| 17(16Aa) | Sandy biomicrite. Mixed silt-size quartz and bioclasts, rare microcline. Some replacement of bioclasts by sparry calcite. Moderate porosity, minor occlusion by sparry calcite. Rare microcline grains. |
| 18(21Aa) | Biomicrite. Large irregular bioclasts with interval voids partially or wholly filled with sparry calcite or micritic mud. Some veins of sparry calcite cutting all other components. Abundant small bioclasts, pellets and silt-size quartz in micritic ground mass. Rare foraminifera. Non-carbonate 9.62%. |
| 19(20Aa) | Biosparite and biopelsparite with patches of micritic or micritized intraclasts. Some pellets. Scattered quartz sand and silt grains. Rare foraminifera. |
| 21(18Aa) | Sandy biomicrite. Poorly sorted sand grains with some bioclasts in micritic ground mass. With scattered calcite intraclasts. |
| 22(22Aa) | Biosparite and biopelsparite. Porous texture with fine grained sparry and acicular calcite. Bioclasts partially micritized. Rare foraminifera and silt-size quartz grains. |
| 23(19Aa) | Biomicrite. Scattered coarse bioclasts. Rare silt-size quartz grains occasional foraminifera. 1.84% non-carbonates. |

JAMES ISLAND AREA, BLOCK 380

| Station | |
|---|---|
| 101(1Aa) | Algal biolithite. Dark, dense micritic envelopes encrusting quartz, sand and silt grains and silty intraclasts. Some drusy calcite lining intergranular porosity. |
| 102(2Aa) | Sandstone. Maximum grained, well sorted quartz sand, rounded to subrounded mixed with rounded bioclasts and occasional micritic pellets. Rare foraminifera. Porous, minor linings of acicular calcite. 57.79% non-carbonate. |
| 104(4Aa) | Algal biolithite. Similar to Station 101 with patches of quartz silt and micritized bioclasts. |
| 105(5Aa) | Algal biolithite and biomicrite. Algal encrusting micritized grains and unaltered bioclasts. |
| 106(6Aa) | Biomicrite. Large irregular bioclasts of pelecypod and serpulid worm tube fragments in micritic and fine biomicritic ground mass with small rounded bioclasts, partially micritized and pellets. Some medium to fine sand-size quartz grains. Scattered foraminifera. Non-carbonates 8.11%. |
| 109(8Aa) | Algal biolithite. Encrusted large irregular bioclasts with scattered quartz sand grains. Micritic matrix with scattered dolomite rhombs. Non-carbonates 12.45%. |
| 110(9Aa) | Algal biolithite. Similar to Station 109 but quartz grains fine sand to silt size. Larger bioclasts with micritic fillings, rare dolomite rhombs. |
| 111(10Aa) | Biomicrite and biopelmicrite. Fine grained with few recognizable bioclasts. Irregular voids due to secondary solution? Some pellets with acicular calcite overgrowths. Scattered silt-size quartz grains. Non-carbonates 3.74%. |
| 113(11Aa) | Sandy biomicrite. Medium to coarse, moderately shorted quartz sand, rounded to subrounded, about one-third grains being polycrystalline. Mixed with coarse subrounded unaltered bioclasts.. In micritic ground mass, little porosity. Non-carbonares 38.90%. |

117(15Aa) Biolithite. Mainly unaltered serpulid worm colony, minor acicular calcite line openings. Occasional set-size quartz grains and rare microcline grains trapped inside. Also rare pellets.

120(18Aa) Sandy biomicrite. Medium grained mixture of quartz grains and largely micritized bioclasts with occasional pellets. Red algal fragments unaltered. Quartz sand moderately well sorted, subrounded to subangular, mainly monocrystalline grains. Rare plagioclase grains. In micrite ground mass. Scattered patchy porosity.

121(19Aa) Biomicrite to biolithe. Fragments of red algae, pelecypod and serpulid worm colony. Partially micritized large open voids. Occasional patches of quartz silt. Rare foraminifera and pellets.

122(20Aa) Sandstone. Medium grained sand, sub-angular, well sorted in fine grained sparry calcite matrix. Porous, porosity partially occluded by calcite. Scattered pellets or micritized bioclasts. Rare plagioclase grains.

JAMES ISLAND AREA, BLOCK 463

| Station | |
|---|---|
| 101(1Aa) | Sandstone. Fine to medium sand, rounded to sub-rounded poorly sorted, majority of grains monocrystalline. Bubble inclusions. Rare microcline and plagioclase. Ocassional sand-size bioclasts. In micrite ground mass. Non-carbonate 55.21%. |
| 102(2Aa) | Sandstone. Fine sand, angular to sub-angular grains. Scattered plagioclase and microcline. Mixed and sandsize bioclasts largely micritized. Micritic cement but small patches of fine sparry calcite. Porous. Non-carbonate 40.27%. |
| 103(3Aa) | Sandy/Silty biomicrite. Dominantly small bioclast and pellets. Abundant silt-size quartz grains. Non-carbonate 53.45%. |
| 104(4Aa) | Sandstone. Similar to Station 102 some increase in number of microcline grains. |
| 105(5Aa) | Sandstone. Similar to Station 102. Poorly sorted, coarser sand grains rounded. Silt particles angular. |
| 106(6Aa) | Sandstone. Angular to sub-angular quartz grains rare chert and microcline. Pellets and/or bioclasts micritized. Some micritic cement, but mainly fine sparry calcite. No unaltered bioclasts. Non-carbonates 41.43%. |
| 107(7Aa) | Algal biolithite and biomicrite. Irregular, often delicate bioclasts encrusted with micritic envelopes. Occasional pellets. Scattered sub-rounded fine sand-size quartz grains. |
| 109(9Aa) | Sandy biomicrite and biomicrite. Irregular small to medium irregular bioclasts partially micritized. Open inter-granular porosity. Some pellets with micritic envelopes. Scattered silt grains. |
| 112(10Ab) | Sandy biomicrite. Similar to Station 101. Non-carbonate 25.32%. |
| 116(14Aa) | Biolithite. Serpulid worm colony. Patchy infillings of biomicrite. |

| | |
|---|---|
| 117(15Aa) | Algal biolithite. Algal encrusting of pelecypod valves which are partially open or filled by micrite or silty micrite. |
| 118(16Aa) | Biolithite. Possibly scleractinian coral fragments. |
| 120(18Aa) | Biolithite. Serpulid worm colony, unaltered. Voids filled with micrite and silty micrite. |
| 121(19Aa) | Sandy biomicrite. Sand-size bioclasts mixed with rounded quartz grains. Porous. Beginnings of fine grained drusy calcite growth in voids. Some pellets. Rare microcline grains. Non-carbonates 25.63%. |
| 123(20Aa) | Biomicrite. Mixed bioclasts and some silt-size quartz grains in micritic ground mass. |
| 124(21Aa) | Sandstone. Similar to Station 101. |

BRUNSWICK AREA, BLOCK 912

| Station | |
|---|---|
| 201(1Aa) | Sandy biomicrite. Poorly sorted medium sand to silt. Scattered sand-size bioclasts. Micrite matrix. No porosity but scattered patches of fine sparry calcite. Rare foraminifera. |

# APPENDIX D

## Phylogenetic Listing of Identified Taxa Collected in Dredges

This appendix lists divisions, phyla, classes, and orders in phylogenetic sequence while families, genera, and species are alphabetically listed in order to simplify reference for the nonspecialist. The following typing sequence was used in the arrangement of the groups:

Division
Phylum
  Class - Subclass
    Order - Suborder
            - Section
      Family
        Genus, Species

Generic level identifications of the Polychaeta, Mollusca, Crustacea, and Echinodermata that are preceded by an asterisk are considered to be associated almost exclusively with hard bottom. All the identified species of the Chlorophyta, Phaeophyta, Rhodophyta, Porifera, Cnidaria (excluding *Renilla reniformis* and *Virgularia presbytes*), Bryozoa and Ascidiacea are believed to be exclusively associated with a hard bottom habitat.

Phylogenetic Listing of Identified Taxa Collected in Dredges

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Chlorophyta | | | | |
| Chlorophyceae | | | | |
| Siphonales | | | | |
| Codiaceae | | | | |
| *Codium taylori* | X | | | |
| Siphonocladales | | | | |
| Boodleacea | | | | |
| *Struvea ramosa* | | | X | |
| Phaeophyta | | | | |
| Phaeophyceae | | | | |
| Dictyotales | | | | |
| Dictyotaceae | | | | |
| *Dictyopteris hoytii* | X | | X | |
| *Dictyopteris justii* | | | X | |
| *Spatoglossum schroederi* | | | X | |
| Fucales | | | | |
| Sargesacea | | | | |
| *Sargassum filipendula* | X | | | |
| *Sargassum pteroplueron* | X | | | |
| Rhodophyta | | | | |
| Rhodophyceae | | | | |
| Cryptonemiales | | | | |
| Corallinaceae | | | | |
| Corallinaceae sp. 1 | X | X | | |
| Corallinaceae sp. 2 | | X | X | |
| Squamariaceae | | | | |
| *Peyssonnelia rubra* | | X | X | |
| Gigartinales | | | | |
| Gracilariaceae | | | | |
| *Gracilaria mammillaris* | | X | X | |
| Rhodymeniales | | | | |
| Rhodymeniaceae | | | X | |
| *Fauchea hassleri* | | | X | |
| *Leptofauchea rhodymenoides* | | X | X | |
| *Leptofauchea* sp. | X | | | |
| *Rhodymenia occidentalis* | | X | X | |
| *Rhodymenia pseudopalmata* | | X | X | |
| *Rhodymenia* sp. | X | | | |
| Ceramiales | | | | |
| Delesseriaceae | | | | |
| *Cryptopleura* sp. | | | X | |
| *Membranoptera* sp. | | X | X | |
| Porifera | | | | |
| Porifera sp. 1 | X | | | |
| Porifera sp. 2 | X | | | X |
| Porifera sp. 3 | X | | | |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Porifera sp. 4 | X | | | |
| Porifera sp. 5 | X | | | |
| Porifera sp. 6 | | X | X | |
| Porifera sp. 7 | | | X | |
| Porifera sp. 8 | | | X | |
| Porifera sp. 9 | | X | | |
| Porifera spp. | X | | | |
| Calcarea | | | | |
| Calcarea sp. 1 | X | | X | X |
| Calcarea sp. 2 | X | X | X | X |
| Calcarea sp. 3 | X | | | |
| Demospongia | | | | |
| Tetractinellida sp. | | X | X | |
| Keratosa | | | | |
| Keratosa sp. 1 | | X | X | |
| Keratosa sp. 2 | X | | X | |
| Keratosa sp. 3 | X | | | |
| Spongiidae | | | | |
| *Ircinia campana* | X | | X | |
| *Ircinia felix* | X | | | |
| *Ircinia* sp. | X | X | X | X |
| Haplosclerida | | | | |
| Haliclonidae | | | | |
| *Callyspongia fallax* | | X | | |
| *Haliclona compressa* | X | | | |
| *Spinosella* sp. | | | X | |
| Poecilosclerida | | | | |
| *Endectyon tenax* | X | | X | |
| Agelasidae | | | | |
| *Agelas* sp. | | X | | |
| Microcionidae | | | | |
| *Dictyociona adioristica* | | X | X | |
| *Thalysias juniperina* | X | | | |
| Axinellida | | | | |
| Axinellidae | | | | |
| Axinellidae sp. | | X | X | |
| Desmoxyidae | | | | |
| *Higginsia strigilata* | X | X | X | |
| Hadromerida | | | | |
| Hadromerida sp. 1 | X | | | |
| Hadromerida sp. 2 | X | | X | |
| Hadromerida sp. 3 | | | X | |
| Hadromerida sp. 4 | | X | | |
| *Placospongia melobesioides* | | | X | |
| Spirastrellidae | | | | |
| *Anthosigmella varians* | | | | X |
| Spirastrellidae sp. 1 | X | | | |
| Spirastrellidae sp. 2 | X | X | X | |
| Choristida | | | | |
| Choristida sp. 1 | X | | X | X |
| Choristida sp. 2 | X | | | |
| Choristida sp. 3 | | X | | |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Chondrillidae | | | | |
| *Chondrilla nucula* | | | X | |
| Craniellidae | | | | |
| *Cinachyra alloclada* | X | X | X | |
| Geodiidae | | | | |
| *Erylus trisphaera* | | X | X | |
| *Geodia* sp. | X | X | X | |
| Monaxonida | | | | |
| Monaxonida sp. 1 | X | | | |
| Monaxonida sp. 2 | X | | X | |
| Monaxonida sp. 3 | X | | X | |
| Monaxonida sp. 4 | | X | X | |
| Monaxonida sp. 5 | | | X | |
| Monaxonida sp. 6 | | | X | |
| Monaxonida sp. 7 | | | X | |
| Monaxonida sp. 8 | | X | X | |
| Monaxonida sp. 9 | | | X | |
| Monaxonida sp. 10 | | X | | |
| Monaxonida sp. 11 | | X | | |
| Monaxonida sp. 12 | | X | | |
| Monaxonida sp. 13 | | X | | |
| Monaxonida sp. 14 | | X | | |
| Monaxonida sp. 15 | | X | | |
| Monaxonida sp. 16 | | X | | |
| Monaxonida sp. 17 | | X | | |
| Monaxonida sp. 18 | | X | | |
| Monaxonida sp. 19 | | X | | |
| Monaxonida sp. 20 | | X | | |
| Monaxonida spp. | X | | | |
| Cnidaria | | | | |
| Scyphozoa | | | | |
| Stauromedusae | | | | |
| *Stephanoscyphus corniformis* | | | X | |
| Hydrozoa | | | | |
| Thecata | | | | |
| Lafoeidae | | | | |
| *Cryptolaria pectinata* | X | X | X | |
| *Lafoea* sp. | X | X | X | |
| Plumularidae | | | | |
| *Lytocarpus clarkei* | X | X | X | |
| *Monostaechas quadridens* | X | | X | |
| *Nemertesia simplex* | | X | X | |
| Sertularidae | | | | |
| *Dynamena dalmasi* | X | X | X | |
| *Dynamena quadridentata* | | | X | |
| *Sertularella* cf. *distans* | X | | X | |
| *Thryoscyphus marginatus* | X | | X | X |

| Species | James Island | | | Brunswick |
|---|---|---|---|---|
| | 198 | 380 | 463 | 912 |
| Anthozoa | | | | |
| Stolonifera | | | | |
| Stolonifera sp. | | X | | |
| Telestacea | | | | |
| Telestidae | | | | |
| *Telesto riisei* | | X | | X |
| *Telesto sanguinea* | X | X | X | X |
| Alcyonacea | | | | |
| Nephtheidae | | | | |
| *Neospongodes agassizii* | | X | X | |
| Nidaliidae | | | | |
| *Nidalia occidentalis* | X | X | X | |
| Gorgonacea | | | | |
| Gorgonacea sp. 1 | X | | | |
| Gorgonacea sp. 2 | X | | | |
| Gorgonacea sp. 3 | X | | | |
| Gorgonacea sp. 4 | | X | X | |
| Gorgonacea sp. 5 | | X | | |
| Anthothelidae | | | | |
| Anthothelidae sp. | | X | X | |
| *Diodogorgia nodulifera* | | X | X | |
| *Titanideum frauenfeldii* | X | X | X | X |
| Ellisellidae | | | | |
| *Ellisella* sp. | | X | X | X |
| Gorgoniidae | | | | |
| *Lophogorgia hebes* | X | | X | X |
| *Lophogorgia* sp. 1 | X | X | | |
| *Lophogorgia* sp. 2 | X | X | X | |
| *Lophogorgia* sp. 3 | | | X | |
| *Lophogorgia* sp. 4 | | | X | |
| Paramuriceidae | | | | |
| Paramuriceidae sp. | | | X | |
| Plexauridae | | | | |
| *Muricea pendula* | X | | X | |
| *Muricea* sp. | | | X | |
| Pennatulacea | | | | |
| Virgulariidae | | | | |
| *Virgularia presbytes* | | X | X | |
| Renillidae | | | | |
| *Renilla reniformis* | X | | | X |
| Actiniaria | | | | |
| Actiniaria sp. | X | X | | |
| Scleractinia | | | | |
| Caryophylliidae | | | | |
| *Asterosmilia prolifera* | | X | | |
| *Paracyathus pulchellus* | X | X | | |
| *Polymyces fragilis* forma *tulipa* | | X | | |
| *Rhizosmilia maculata* | | | X | |
| Dendrophylliidae | | | | |
| *Balanophyllia floridana* | | X | X | |

| Species | James Island | | | Brunswick |
|---|---|---|---|---|
| | 198 | 380 | 463 | 912 |
| **Faviidae** | | | | |
| _Cladocora arbuscula_ | | X | X | |
| _Cladocora debilis_ | | X | X | |
| _Solenastrea hyades_ | X | | | |
| **Oculinidae** | | | | |
| _Oculina varicosa_ | X | X | X | |
| **Pocilloporidae** | | | | |
| _Madracis asperula_ | | X | | |
| **Rhizangiidae** | | | | |
| _Astrangia danae_ | | X | | |
| _Astrangia solitaria_ | | | X | |
| _Phyllangia americana_ | X | | X | |
| **Antipatharia** | | | | |
| **Anthipathidae** | | | | |
| _Antipathes rhipidion_ | | X | X | |
| **Annelida** | | | | |
| **Polychaeta** | | | | |
| Polychaeta spp. | X | X | X | X |
| **Sabellida** | | | | |
| **Serpulidae** | | | | |
| *_Filograna implexa_ | X | X | X | X |
| **Spionida** | | | | |
| **Chaetopteridae** | | | | |
| *_Phyllochaetopterus socialis_ | | X | X | |
| **Mollusca** | | | | |
| **Gastropoda - Prosobranchia** | | | | |
| **Archaeogastropoda** | | | | |
| **Fissurellidae** | | | | |
| *_Diodora_ sp. | X | | | X |
| **Trochidae** | | | | |
| *_Calliostoma_ cf. _euphytum_ | X | | | |
| *_Calliostoma pulchrum_ | X | | | |
| **Turbinidae** | | | | |
| *_Turbo castanea_ | | X | | |
| **Mesogastropoda** | | | | |
| **Cassidae** | | | | |
| _Phalium granulatum_ | | X | | |
| **Architectonidae** | | | | |
| _Architectonica nobilis_ | | | X | |
| **Cerithiidae** | | | | |
| _Cerithium eburneum_ | X | | | |
| **Crepidulidae** | | | | |
| *_Crepidula aculeata_ | X | | | |
| *_Crepidula fornicata_ | X | | X | |
| *_Crepidula plana_ | X | | | |
| *_Crucibulum auricula_ | X | | X | X |
| **Cymatiidae** | | | | |
| _Cymatium pileare_ | X | X | X | |
| _Distorsio constricta macgintyi_ | | X | X | |

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|---|---|---|---|---|
| Cypraeidae | | | | |
| **Cypraea cinerea* | | X | | |
| **Cypraea spurca acicularis* | X | X | X | |
| Epitoniidae | | | | |
| *Cirsotrema dalli* | | | X | |
| Eratoidae | | | | |
| *Trivia pediculus* | | | | X |
| Naticidae | | | | |
| *Natica canrena* | X | | X | |
| *Natica floridana* | | X | | |
| *Natica* sp. | | | X | |
| *Polinices lacteus* | X | | X | |
| Ovulidae | | | | |
| **Cymphoma signatum* | | | | X |
| **Simnia acicularis* | X | | | |
| Siliquariidae | | | | |
| **Siliquaria squamata* | X | | | |
| Turritellidae | | | | |
| *Turritella acropora* | X | | | |
| *Turritella exoleta* | | | X | |
| **Vermicularia* cf. *fargoi* | | | X | |
| **Vermicularia knorri* | | | X | |
| **Vermicularia spirata* | X | | | |
| **Vermicularia* sp. | | X | | X |
| Neogastropoda | | | | |
| Buccinidae | | | | |
| **Cantharus multangulus* | X | | X | |
| **Pisania tincta* | X | | | |
| Columbellidae | | | | |
| **Anachis lafresnayi* | X | | | |
| **Anachis* sp. | | | X | |
| **Columbellidae* sp. | | X | | |
| Conidae | | | | |
| *Conus daucus* | | X | | |
| *Conus delesserti* | X | | | |
| **Conus floridanus floridensis* | X | | | |
| Fasciolariidae | | | | |
| *Fasciolaria lilum hunteria* | X | | X | |
| *Fasciolaria tulipa* | | | X | |
| **Pleuroplaca gigantea* | X | | | |
| Fusinidae | | | | |
| **Fusinus eucosmius* | | | X | |
| Marginellidae | | | | |
| *Marginella bella* | X | | | |
| *Marginella roscida* | X | X | X | |
| Melongenidae | | | | |
| *Busycon spiratum pyruloides* | X | | | |

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|---|---|---|---|---|
| Muricidae | | | | |
| *_Chicoreus florifer_ | | X | X | |
| *_Murex cabritii_ | X | | | |
| *_Murex recurvirostris_ | | | X | |
| *_Murex recurvirostris rubidus_ | X | | X | |
| *_Murexiella levicula_ | X | | | |
| *_Phyllonotus pomum_ | | | X | |
| Nassariidae | | | | |
| _Ilyanassa obsoleta_ | X | | | |
| _Nassarius albus_ | X | | | |
| Olividae | | | | |
| _Oliva sayana_ | X | | X | X |
| _Oliva_ sp. | | | X | |
| Terebridae | | | | |
| _Terebra dislocata_ | | | | X |
| Volutidae | | | | |
| _Scaphella junonia_ | X | | | |
| Gastropoda - Opisthobranchia | | | | |
| Cephalaspidea | | | | |
| Bullidae | | | | |
| _Bulla_ cf. _solida_ | X | X | | |
| Notasidea | | | | |
| Pleurobranchidae | | | | |
| Pleurobranchidae sp. | | X | | |
| Polyplacophora | | | | |
| Neoloricata | | | | |
| Acanthochitonidae | | | | |
| *Acanthochitonidae sp. | X | | X | |
| Bivalvia | | | | |
| Arcoida | | | | |
| Arcidae | | | | |
| *_Anadara floridana_ | X | | | |
| *_Anadara notabilis_ | X | X | X | X |
| *_Anadara_ sp. | X | X | | |
| *_Arca imbricata_ | X | | | |
| *_Arca zebra_ | X | X | X | X |
| *_Acropsis adamsi_ | | | X | |
| *_Barbatia candida_ | | X | X | |
| Glycmerididae | | | | |
| _Glycymeris americana_ | X | | X | |
| Hiatellidae | | | | |
| *_Hiatella arctica_ | X | X | | X |
| Lyonsiidae | | | | |
| *_Lyonsia beana_ | X | | X | |
| Mytiloida | | | | |
| Mytilidae | | | | |
| _Amygdalum papyrium_ | X | | | |
| *_Lithophaga_ sp. | X | | X | |
| *_Modiolus modiolus squamosus_ | X | | | |
| *_Musculus lateralis_ | X | | | |

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|---|---|---|---|---|
| Pinnidae | | | | |
| *Atrina* sp. | | | X | |
| *Pinna carnea* | X | X | | |
| Pterioida | | | | |
| Anomidae | | | | |
| **Pododesmus rudis* | X | | X | |
| Limidae | | | | |
| *Lima pellucida* | | X | X | |
| Malleidae | | | | |
| **Malleus candeanus* | | X | | |
| Pectinidae | | | | |
| *Aequipecten muscosus* | X | X | X | X |
| *Argopecten gibbus* | | | X | |
| *Chlamys benedicti* | | X | X | |
| *Chlamys* sp. | | X | | |
| *Lyropecten nodosus* | X | | X | |
| *Pecten raveneli* | X | X | X | |
| *Pecten ziczac* | | X | | |
| Plicatulidae | | | | |
| **Plicatula gibbosa* | X | X | | |
| Pteriidae | | | | |
| **Pinctada imbricata* | | | | X |
| **Pteria colymbus* | X | X | X | |
| Spondylidae | | | | |
| **Spondylus americanus* | | X | X | |
| Ostreina | | | | |
| Gryphaeidae | | | | |
| **Pycnodonte hyotis* | X | X | | |
| Ostreidae | | | | |
| **Ostrea permollis* | | | X | |
| Veneroida | | | | |
| Cardiidae | | | | |
| *Americardia media* | X | | X | |
| *Laevicardium pictum* | X | X | X | X |
| *Laevicardium* sp. | X | | | |
| *Nemocardium tinctum* | | | X | |
| *Papyridea soleniformis* | | X | X | |
| Carditidae | | | | |
| *Glans dominguensis* | | | X | |
| *Pleuromeris tridentata* | X | | | |
| Chamidae | | | | |
| **Arcinella cornuta* | X | | | |
| **Chama congregata* | X | | X | X |
| **Chama* cf. *lactuca* | | X | | |
| **Chama macerophylla* | X | | X | |
| **Chama* sp. | | X | | X |
| **Pseudochama radians* | X | X | X | |
| Crassatellidae | | | | |
| *Eucrassatella speciosa* | X | | | X |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Semelidae | | | | |
| *Semele purpurascens* | X | X | X | |
| Veneridae | | | | |
| *Callista eucymata* | X | X | X | |
| *Chione grus* | X | X | | |
| *Chione latilirata* | X | | X | X |
| *Chione* sp. | X | | | |
| *Macrocallista maculata* | X | | X | X |
| *Pitar fulminatus* | | | X | |
| Myoida | | | | |
| Corbulidae | | | | |
| *Corbula dietziana* | | X | X | |
| Gastrochaenidae | | | | |
| **Gastrochaena hians* | X | | X | |
| Cephalopoda | | | | |
| Octopoda | | | | |
| Octopodidae | | | | |
| **Octopus* sp. | X | X | | |
| Arthropoda | | | | |
| Pycnogonida | | | | |
| Pycnogonida spp. | X | X | X | X |
| Crustacea - Cirripedia | | | | |
| Thoraciea | | | | |
| Balanidae | | | | |
| **Acasta* sp. | | X | | |
| **Balanus trigonus* | X | X | X | |
| Lepadidae | | | | |
| **Lepas* sp. | | | X | |
| Crustacea - Malacostraca | | | | |
| Stomatopoda | | | | |
| Gonodactylidae | | | | |
| *Gonodactylidae sp. | X | | | |
| **Gonodactylus bredini* | X | X | X | |
| Squillidae | | | | |
| *Meiosquilla* sp. | X | | | |
| Decapoda - Penaeidea | | | | |
| Penaeidae | | | | |
| *Metapenaeopsis* sp. | X | X | X | X |
| Penaeidae sp. | | | X | |
| *Sicyonia* sp. | X | | X | |
| *Solenocera* sp. | X | | | |
| *Trachypenaeus* sp. | | | | X |
| Decapoda - Caridea | | | | |
| Alpheidae | | | | |
| *Alpheidae sp. | X | | | |
| **Alpheus* sp. | X | X | X | |
| **Synalpheus townsendi* | X | | | |
| **Synalpheus* sp. | X | X | X | X |

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|---|---|---|---|---|
| Hippolytidae | | | | |
| Hippolytidae sp. | X | | | |
| *Latreutes parvulus* | | X | X | |
| *Latreutes* sp. | | | X | |
| Palaemonidae | | | | |
| *Palaemonidae sp. | X | X | X | |
| **Periclimenes* sp. | X | X | | |
| **Typton* cf. *distinctus* | X | | | |
| **Typton* sp. | X | | | |
| Processidae | | | | |
| *Processa* sp. | X | X | X | |
| Processidae sp. | | X | | |
| Decapoda - Stenopodidea | | | | |
| Stenopodidae | | | | |
| *Stenopus* sp. | | | X | |
| Decapoda - Macrura | | | | |
| Callianassidae | | | | |
| Callianassidae sp. | | X | X | |
| Scyllaridae | | | | |
| *Scyllarus chacei* | X | | X | |
| *Scyllarus depressus* | X | X | X | |
| Decapoda - Anomura | | | | |
| Diogenidae | | | | |
| *Dardanus* sp. | | X | | |
| Diogenidae sp. | X | X | | |
| *Petrochirus* sp. | X | | X | X |
| Galatheidae | | | | |
| **Galathea rostrata* | X | X | X | X |
| **Galathea* sp. | | | X | |
| **Munida* sp. | X | X | X | |
| *Paguridae | | | | |
| Paguridae sp. | X | X | X | X |
| *Pagurus* sp. | X | X | | X |
| *Pylopagurus* sp. | X | X | X | X |
| Porcellanidae | | | | |
| **Megalobrachium soriatum* | X | | | X |
| **Pachycheles rugimanus* | X | | | |
| **Pachycheles* sp. | X | | | |
| *Porcellana* sp. | | | X | X |
| Decapoda - Brachyura | | | | |
| Calappidae | | | | |
| *Calappa angusta* | | X | | |
| *Calappa gallus* | X | | | |
| *Calappa* sp. | | | X | |
| *Cyclones bairdii* | X | | X | X |
| **Osachila semilevis* | | X | X | |
| **Osachila* sp. | X | | X | |
| Dorippidae | | | | |
| *Ethusa mascarone americana* | X | X | | |
| *Ethusa* sp. | | | X | |

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|---|---|---|---|---|
| **Dromiidae** | | | | |
| *Dromidia antillensis* | | X | X | |
| *Dromidia* sp. | | | X | |
| **Hypoconcha arcuata* | X | | | |
| **Hypoconcha sabulosa* | X | | | X |
| **Hypoconcha spinossisimus* | X | | | |
| **Hypoconcha* sp. | X | | X | |
| **Grapsidae** | | | | |
| *Euchirograpsus americanus* | | X | | |
| *Euchirograpsus* sp. | | | X | |
| **Leucosiidae** | | | | |
| *Callidactylus asper* | X | X | X | X |
| *Callidactylus* sp. | | | X | |
| *Ebalia* sp. | | | X | |
| *Iliacantha intermedia* | X | | X | X |
| *Speloecophorus nodosus* | X | | | |
| * **Majidae** | | | | |
| *Arachnopsis* sp. | | X | | |
| **Collodes trispinosum* | | | | X |
| **Collodes* sp. | | X | X | |
| *Macrocoeloma camptocerum* | X | | | |
| *Macrocoeloma eutheca* | | | X | |
| *Macrocoeloma septemspinossum* | X | X | | |
| **Macrocoeloma trispinosum* | X | | | |
| *Macrocoeloma* sp. | | X | X | |
| Majidae sp. | X | | X | |
| *Metaporhaphis* sp. | | | X | X |
| *Microphrys* sp. | X | | | |
| *Mithrax acuticornis* | X | X | | |
| *Mithrax cornutus* | | X | | |
| *Mithrax forceps* | X | | | |
| *Mithrax pleuracanthus* | X | | X | X |
| *Mithrax* sp. | X | | X | |
| *Nibilia* sp. | | X | | |
| *Pitho* sp. | X | | | |
| *Podochela gracilipes* | X | X | | |
| *Podochela riisei* | X | | | |
| *Podochela sidneyi* | X | | | |
| *Podochela* sp. | X | | X | |
| **Stenocionops furcata* | X | X | X | |
| **Stenocionops furcata coelata* | X | | | |
| **Stenocionops furcata furcata* | X | | | |
| **Stenocionops* sp. | X | | X | |
| **Stenorhynchus seticornis* | X | | | |
| **Stenorhynchus* sp. | X | X | X | X |
| **Palicidae** | | | | |
| *Palicus alternatus* | X | | | |
| *Palicus* sp. | X | X | X | |
| **Parthenopidae** | | | | |
| *Heterocrypta* sp. | | X | X | |

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|---|---|---|---|---|
| **Parthenope fraterculus* | X | X | X | |
| *Parthenope granulata* | | | | X |
| *Parthenope serrata* | X | | | |
| *Parthenope* sp. | X | | X | |
| *Solenolambrus* sp. | | | X | X |
| Pinnotheridae | | | | |
| *Parapinnixa* sp. | X | | | |
| *Pinnotheres* sp. | X | | | |
| Portunidae | | | | |
| *Ovalipes ocellatus* | X | | | |
| Portunidae sp. | X | | | |
| *Portunus gibbesii* | X | | | X |
| *Portunus ordwayi* | X | X | X | |
| *Portunus spinicarpus* | X | | X | |
| *Portunus* sp. | X | X | X | |
| Raninidae | | | | |
| *Ranilia* sp. | | | X | |
| *Symethis variolosa* | X | X | | |
| *Symethis* sp. | | | X | |
| Xanthidae | | | | |
| *Actaea rufopunctata* | | X | | |
| *Actaea* sp. | | | X | |
| *Carpoporus papulosus* | | X | X | |
| **Glyptoxanthus erosus* | X | X | | |
| *Glyptoxanthus* sp. | X | | | |
| *Leptodius* sp. | | | X | |
| *Melybia* sp. | X | X | | |
| **Micropanope lobifrans* | | X | | |
| **Micropanope sculptipes* | X | X | | |
| *Micropanope* sp. | | X | | |
| *Pilumnus sayi* | X | | | X |
| *Pilumnus* sp. | X | X | X | X |
| *Platyactaea setigera* | X | X | X | |
| **Pseudomedaeus agassizii* | X | | | X |
| **Pseudomedaeus distinctus* | | X | X | |
| *Pseudomedaeus* sp. | X | X | X | X |
| Xanthidae sp. | X | X | X | |
| Sipuncula | | | | |
| Sipuncula sp. | X | | | |
| Bryozoa | | | | |
| Stenolaemata | | | | |
| Cyclostomata | | | | |
| Crissidae | | | | |
| *Crisia eburnea* | X | X | X | |
| Gymnolaemata | | | | |
| Ctenostomata | | | | |
| Vesiculariidae | | | | |
| *Amathia convolata* | | X | X | |
| Cheilostomata - Malacostega | | | | |
| Cupuladriidae | | | | |
| *Cupuladria biporosa* | X | | | |

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|---|---|---|---|---|
| Cheilostomata - Coilostega | | | | |
| Onychocellidae | | | | |
| *Smittipora levenseni* | X | X | X | X |
| Cheilostomata - Cellularina | | | | |
| Bugulidae | | | | |
| *Halophila johnstoniae* | | X | X | |
| Farciminariidae | | | | |
| *Nellia oculata* | X | X | X | |
| Celleporidae | | | | |
| *Buskea dichotoma* | X | | | |
| *Celleporaria albirostris* | X | X | X | X |
| *Celleporaria magnifica* | X | X | X | |
| Cheiloporinidae | | | | |
| *Tetraplaria* sp. | | X | | |
| Schizoporellidae | | | | |
| *Stylopoma spongites* | X | X | X | |
| *Schizoporella cornuta* | X | | X | |
| Stomachetosellidae | | | | |
| *Cigclisula serrulata* | | X | X | |
| Petraliellidae | | | | |
| *Hippopetraliella bisinuata* | X | X | X | X |
| Umbonulidae | | | | |
| *Hippopleurifera mucronata* | X | X | X | X |
| Echinodermata | | | | |
| Crinoidea | | | | |
| Articulata | | | | |
| Comasteridae | | | | |
| **Comactinia echinoptera* | X | | | |
| **Comactinia* sp. | | X | X | |
| Holothuroidea | | | | |
| Dendrochirotida | | | | |
| Cucumariidae | | | | |
| *Thyone* sp. | | | X | |
| *Thyonella pervicax* | | | | X |
| Phyllophoridae | | | | |
| *Phyllophorus occidentalis* | | X | | |
| *Stolus micropunctatus* | | X | | |
| Psolidae | | | | |
| **Psolus tuberculosus* | | X | X | |
| Echinoidea | | | | |
| Cidaroida | | | | |
| Cidaridae | | | | |
| **Eucidaris tribuloides* | | X | X | |
| **Stylocidaris affinis* | | X | X | |
| Diadematoida | | | | |
| Diadematidae | | | | |
| **Astropyga magnifica* | | X | | |
| Arbacioida | | | | |
| Arbaciidae | | | | |
| **Arbacia punctulata* | X | X | X | |
| Temnopleuroida | | | | |
| Temnopleuridae | | | | |
| **Genocidaris maculata* | | X | X | |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Toxopneustidae | | | | |
| *Lytechinus variegatus* | X | X | | |
| **Pseudoboletica maculata* | X | | | |
| Clypeasteroida | | | | |
| Clypeasteridae | | | | |
| *Clypeaster subdepressus* | X | | | |
| *Clypeaster* sp. | | X | | |
| Mellitidae | | | | |
| *Encope michelini* | X | | | |
| *Leodia sexiesperforata* | X | | | |
| Cassiduloida | | | | |
| Echinolampadidae | | | | |
| *Echinolampus depressa* | | X | X | |
| Spatangoida | | | | |
| Brissidae | | | | |
| *Agassizia excentrica* | | X | | |
| Brissidae sp. | | | X | |
| *Brissopsis sp.* | X | | | |
| *Meoma ventricosa* | | X | | |
| Stelleroidea - Asteroidea | | | | |
| Platyasterida | | | | |
| Luidiidae | | | | |
| *Luidia alternata* | X | | | X |
| *Luidia clathrata* | X | | | X |
| *Luidia sagamina* | | | X | |
| Paxillosida | | | | |
| Astropectinidae | | | | |
| *Astropecten articulatus* | X | | X | X |
| *Astropecten comptus* | X | | | |
| *Astropecten duplicatus* | X | | X | X |
| *Astropecten* sp. | | | | X |
| Valvatida | | | | |
| Goniasteridae | | | | |
| *Goniaster tessellatus* | X | | X | |
| *Mediaster bairdii* | | | X | |
| Ophidasteridae | | | | |
| *Chaetaster nodosus* | | X | X | |
| *Linkia nodosa* | | X | | |
| **Narcissia trigonaria* | | X | X | |
| Spinulosida | | | | |
| Echinasteridae | | | | |
| *Othilia modesta* | X | | | |
| *Othilia serpentaria* | X | | | |
| *Othilia* sp. | | | X | |
| Stelleroidea - Ophiuroidea | | | | |
| Ophiuroida | | | | |
| Amphiuridae | | | | |
| Amphiuridae sp. | X | | | |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| *Ophiostigma isacanthum* | X | | | |
| *Ophiophragmus septus* | X | | | |
| Ophiactidae | | | | |
| **Ophiactis* sp. | X | | | |
| Ophiodermatidae | | | | |
| **Ophioderma appressum* | | X | X | |
| **Ophioderma brevispinum* | X | X | X | |
| **Ophioderma* sp. | | X | | |
| Ophiolepididae | | | | |
| *Ophiolepis elegans* | X | X | | X |
| Ophionereididae | | | | |
| **Ophionereis reticulata* | X | | | |
| Ophiothrichidae | | | | |
| **Ophiothrix angulata* | X | X | X | |
| **Ophiothrix suensonii* | | X | | |
| Phrynophiurida | | | | |
| Euryalidae | | | | |
| **Euryal* sp. | X | | | |
| Gorgonocephalidae | | | | |
| **Astroporpa annulata* | X | X | X | |
| **Astroporpa caecilia* | | X | | |
| **Astrocyclus* sp. | | X | X | |
| **Astrophyton muricatum* | X | X | X | |
| *Gorgoncephalidae sp. | | X | | |
| Ophiomyxidae | | | | |
| **Ophiomyxa flaccida* | | | X | |
| Chordata - Urochordata | | | | |
| Ascidiacea | | | | |
| Enterogona | | | | |
| Didemnidae | | | | |
| Didemnidae sp. | | | X | |
| *Didemnum candidum* | X | X | X | X |
| *Diplosoma fragile* | X | | | |
| *Diplosoma macdonaldi* | X | | X | |
| *Trididemnum* sp. | | | X | |
| Polycitoridae | | | | |
| *Clavelina gigantea* | X | X | | |
| *Eudistoma* sp. | X | | X | |
| Symoicidae | | | | |
| Symoicidae sp. | | | X | |
| Phlebobranchia | | | | |
| Ascidiidae | | | | |
| *Ascidia* sp. | X | X | X | |
| Ascidiidae sp. | | | X | |
| Pleurogona | | | | |
| Molgulidae | | | | |
| *Molgula* sp. | X | | X | |
| Polyclinidae | | | | |
| *Aplidium* sp. | X | | | |

| Species | James Island 198 | 380 | 463 | Brunswick 912 |
|---|---|---|---|---|
| Pyuridae | | | | |
| *Pyura* sp. | | X | | |
| Styelidae | | | | |
| *Polyandrocarpa* sp. | X | X | X | |
| *Styela* sp. | X | | | |
| Chordata - Acrania | | | | |
| Amphioxi | | | | |
| Amphioxiformes | | | | |
| Brachiostomidae | | | | |
| *Brachiostoma virginiae* | X | | X | |
| Chordata - Cranista | | | | |
| Osteichthyes | | | | |
| Anguilliformes | | | | |
| Muraenidae | | | | |
| *Anarchias yoshiae* | | | X | |
| Ophichthidae | | | | |
| *Ophichthus* sp. | X | | | |
| Myctophiformes | | | | |
| Synodontidae | | | | |
| *Synodus synodus* | | X | | |
| Lophiiformes | | | | |
| Antennariidae | | | | |
| *Antennarius* sp. | | X | | |
| Gadiformes | | | | |
| Ophidiidae | | | | |
| *Ophidion holbrooki* | | | X | |
| *Ophidion selenops* | X | | | |
| Gasterosteiformes | | | | |
| Syngnathidae | | | | |
| *Hippocampus erectus* | | | X | |
| *Syngnathus elucens* | | | X | |
| Perciformes | | | | |
| Blenniidae | | | | |
| *Blennius marmoreus* | X | | | |
| Clinidae | | | | |
| *Emblemaria atlantica* | | X | | |
| Dactyloscopidae | | | | |
| *Gillellus* sp. | | | X | |
| Gobiidae | | | | |
| *Chriolepis* sp. | X | | X | |
| *Lythrypnus phorellus* | X | | | |
| Grammistidae | | | | |
| *Rypticus bistrispinus* | | | X | |
| Labridae | | | | |
| *Halichoeres caudalis* | X | | | |
| *Halichoeres radiatus* | | | X | |
| *Halichoeres* sp. | | X | X | |
| *Hemipteronotus* sp. | | | X | |

| Species | James Island 198 | James Island 380 | James Island 463 | Brunswick 912 |
|---|---|---|---|---|
| Pomacentridae | | | | |
| *Chromis enchrysurus* | | X | X | |
| Scaridae | | | | |
| *Nicholsina usta* | X | | | |
| Scorpaenidae | | | | |
| *Pontinus helena* (?) | X | | | |
| *Pontinus* sp. | | X | | |
| *Scorpaena albifimbria* | X | | | |
| *Scorpaena dispar* | | X | X | |
| *Scorpaena* sp. | | X | | X |
| Serranidae | | | | |
| *Centropristis striata* | | | | X |
| *Holanthius martiniensis* | | X | | |
| *Plectranthias garrupellus* | | X | X | |
| *Serranus annularis* | X | | | |
| *Serranus phoebe* | | X | X | |
| Triglidae | | | | |
| *Prionotus roseus* | | | | X |
| Pleuronectiformes | | | | |
| Bothidae | | | | |
| *Bothus* sp. | X | | | |
| *Syacium micrurum* | | | | X |

# APPENDIX E

## Taxa Identified from Dredge Station Samples

This appendix lists the date of collection, water depth, distance for which the dredge was estimated to be on the bottom during the tow, identified taxa and number of individuals for each sample collected. The first station number is the Decca Hi-Fix station number that was used for positioning while the second station number (in parentheses) was assigned when selecting the stations for dredging and appears on the labels in the sample containers with the identified material. In order to visually determine locations of the dredge stations within the appropriate block refer to the following figures using the Decca Hi-Fix station number: (1) Block 198 - Figure 5, (2) Block 380 - Figure 17, (3) Block 463 - Figure 28, and (4) Block 912 - Figure 40. The asterisk in the number of individuals column means that the number of individuals could not be determined due to fragmentation or because the species was colonial.

The following table of contents lists the stations by lease block and the page number on which a station may be located.

## TABLE OF CONTENTS

James Island Area, Block 198

TABLE OF CONTENTS (cont.)

James Island Area, Block 198 (cont.)



James Island Area, Block 380

TABLE OF CONTENTS (cont.)

TABLE OF CONTENTS (cont.)

James Island Block 198
Biological Dredge - Station 1 (1-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 34.0 meters
Length of Tow: 70 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Cinachyra alloclada* | * |
| *Endectyon tenax* (?) | * |
| Hadromerida sp. 1 | * |
| *Haliclona compressa* | * |
| *Higginsia strigilata* (?) | * |
| *Ircinia felix* | * |
| Kertosa sp. 3 | * |
| Monaxonida sp. 1 | * |
| Porifera sp. 2 | * |
| Porifera spp. | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| *Dynamena dalmasi* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Oculina varicosa* | * |
| *Solenastrea hyades* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 27 |
| Gastropoda | |
| *Anachis lafresnayi* | 1 |
| *Cantharus multangulus* | 2 |
| *Crepidula aculeata* | 8 |
| *Crepidula fornicata* | 1 |
| *Crucibulum auricula* | 1 |
| *Diodora* sp. | 3 |
| *Fasciolaria lilium hunteria* | 1 |
| *Murexiella levicula* | 3 |
| *Nassarius albus* | 1 |
| *Natica canrena* | 1 |
| *Oliva sayana* | 5 |
| *Polinices lacteus* | 2 |
| *Vermicularia spirata* | 2 |

| Species | Number of Individuals |
|---|---|
| **Bivalvia** | |
| *Aequipecten muscosus* | 1 |
| *Americardia pictum* | 2 |
| *Anadara floridana* | 2 |
| *Arca zebra* | 34 |
| *Arcinella cornuta* | 1 |
| *Chama congregata* | 25 |
| *Chama macerophylla* | 9 |
| *Chione latilirata* | 18 |
| *Eucrassatella speciosa* | 5 |
| *Glycymeris americana* | 3 |
| *Hiatella arctica* | 10 |
| *Laevicardium pictum* | 2 |
| *Lyonsia beana* | 2 |
| *Lyropecten nodosus* | 1 |
| *Macrocallista maculata* | 1 |
| *Modiolus modiolus squamosus* | 3 |
| *Plicatula gibbosa* | 3 |
| *Pteria colymbus* | 59 |
| **Cirripedia** | |
| *Balanus trigonus* | 74 |
| **Stomatopoda** | |
| *Gonodactylus bredini* | 1 |
| **Decapoda** | |
| *Galathea rostrata* | 3 |
| **Hippolytidae** sp. | 1 |
| *Macrocoeloma trispinosum* | 1 |
| **Majidae** sp. | 1 |
| *Mithrax pleuracanthus* | 5 |
| *Pachycheles rugimanus* | 1 |
| **Paguridae** sp. | 5 |
| *Pilumnus sayi* | 3 |
| *Pilumnus* sp. | 3 |
| *Pitho* sp. | 3 |
| *Pseudomedaeus agassizii* | 3 |
| *Speloeophorus rodosus* | 1 |
| *Stenocionops furcata coelata* | 3 |
| *Stenocionops* sp. | 3 |
| *Stenorhynchus* sp. | 1 |
| *Synalpheus* sp. | 1 |
| **Xanthidae** sp. | 3 |
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Nellia oculata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| *Tetraplaria* sp. | * |

| Species | Number of Individuals |
|---|---|
| Ophiuroidea | |
| Amphiuridae (juveniles) | 4 |
| *Ophiactis* sp. | 2 |
| *Ophiostigma isacanthum* | 4 |
| *Ophiothrix angulata* | 5 |
| Echinoidea | |
| *Arbacia punctulata* (juvenile) | 1 |
| *Clypeaster subdepressus* (juvenile) | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 2A (2-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 33.0 meters
Length of Tow: 543 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Rhodymenia* sp. | * |
| Porifera | |
| *Cinachyra alloclada* | * |
| *Haliclona compressa* | * |
| *Higginsia strigilata* | * |
| *Ircinia felix* | * |
| *Porifera* sp. 1 | * |
| *Porifera* sp. 2 | * |
| *Thalysias juniperina* | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| *Monostaechas quadridens* | * |
| *Sertularella* cf. *distans* | * |
| Anthozoa | |
| Gorgonacea sp. 2 | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. | * |
| *Nidalia occidentalis* | * |
| *Paracyathus pulchellus* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 4 |
| Gastropoda | |
| *Calliostoma* cf. *euphytum* | 1 |
| *Cantharus multangulus* | 5 |
| *Conus delesserti* | 1 |
| *Conus floridanus floridensis* | 1 |
| *Crepidula aculeata* | 1 |
| *Cymatium pileare* | 2 |
| *Marginella bella* | 1 |
| *Murexiella levicula* | 1 |
| *Oliva saguana* | 1 |
| *Pisania tincta* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Anadara* sp. | 6 |
| *Arca zebra* | 13 |
| *Arcinella cornuta* | 1 |
| *Chama congregata* | 27 |
| *Chama macerophylla* | 13 |

| Species | Number of Individuals |
|---|---|
| **Bivalvia (cont.)** | |
| *Chione grus* | 1 |
| *Chione latilirata* | 12 |
| *Eucrassatella speciosa* | 1 |
| *Hiatella arctica* | 1 |
| *Ilyanassa absoleta* | 1 |
| *Laevicardium pictum* | 1 |
| *Macrocallista maculata* | 1 |
| *Modiolus modiolus squamosus* | 3 |
| *Plicatula gibbosa* | 22 |
| *Pteria colymbus* | 31 |
| *Pycnodonte hyotis* | 3 |
| **Cephalopoda** | |
| *Octopus* sp. | 1 |
| **Pycnogonida** | |
| Pycnogonida sp. | 1 |
| **Cirripedia** | |
| *Balanus trigonus* | 52 |
| **Stomatopoda** | |
| *Gonodactylus bredini* | 4 |
| **Decapoda** | |
| *Galathea rostrata* | 7 |
| *Macrocoeloma trispinosum* | 1 |
| *Megalobrachium soriatum* | 2 |
| *Metapenaeopsis* sp. | 1 |
| *Mithrax pleuracanthus* | 9 |
| *Pachycheles rugimanus* | 11 |
| Paguridae sp. | 3 |
| *Pilumnus sayi* | 2 |
| *Pilumnus* sp. | 1 |
| *Portunus* sp. | 1 |
| *Pseudomedaeus agassizii* | 6 |
| *Stenocionops* sp. | 3 |
| *Stenorynchus seticornis* | 1 |
| *Stenorynchus* sp. | 1 |
| *Synalpheus* sp. | 1 |
| Xanthidae sp. | 7 |
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Cupuladria biporosa* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| **Asteroidea** | |
| *Astropecten duplicatus* | 1 |
| *Goniaster tessellatus* | 1 |
| **Ophiuroidea** | |
| *Asteroppra annulata* | 1 |

| Species | Number of Individuals |
|---|---|
| Ophiuroidea (cont.) | |
| *Euryale* sp. | 1 |
| *Ophiophragmus septus* | 1 |
| *Ophiostigma isacanthum* | 2 |
| *Ophiothrix angulata* | 7 |
| Echinoidea | |
| *Arbacia punctulata* | |
| *Leodia sexiesperforata* | |
| *Lytechinus variegatus* | |
| Crinoidea | |
| *Comactinia echinoptera* | 4 |
| Ascidiacea | |
| *Clavelina gigantea* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Bothus* sp. | * |

James Island Block 198
Rock Dredge - Station 2AR (2-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 33.0 meters
Length of Tow: 249 meters

| Species | Number of Individuals |
|---|---|
| Ascidiacea | |
| *Diplosoma fragile* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |

James Island Block 198
Rock Dredge - Station 2B (2-A-b)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 32.5 meters
Length of Tow: 196 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Endectyon tenax (?)* | * |
| *Geodia* sp. | * |
| *Ircinia felix* | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Titanideum frauenfeldii* | * |
| Bivalvia | |
| *Arca zebra* | 3 |
| *Hiatella arctica* | 1 |
| *Modiolus modiolus squamosus* | 2 |
| *Pteria colymbus* | 6 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Hippopetraliella bisinuata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Echinoidea | |
| *Encope michelini* | 1 |

James Island Block 198
Biological Dredge - Station 3A (3-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 34.0 meters
Length of Tow: 241 meters

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| *Codium taylori* | * |
| Porifera | |
| *Cinachyra alloclada* | * |
| *Endectyon tenax (?)* | * |
| *Geodia* sp. | * |
| *Haliclona compressa* | * |
| *Higginsia strigilata* | * |
| *Ircinia campana* | * |
| *Ircinia felix* | * |
| Kertosa sp. 3 | * |
| Porifera sp. 2 | * |
| Porifera sp. 3 | * |
| Porifera spp. | * |
| Spirastrellidae sp. 2 | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| *Lafoea* sp. | * |
| *Lytocarpus clarkei* | * |
| *Monostaechas quadridens* | * |
| *Sertularella* cf. *distans* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia* sp. | * |
| *Muricea pendula* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Gastropoda | |
| *Cymatium pileare* | 1 |
| *Diodora* sp. | 1 |
| *Oliva sayana* | 1 |
| *Siliquaria squamata* | 1 |
| Bivalvia | |
| *Arca zebra* | 6 |
| *Chama congregata* | 2 |
| *Chione latilirata* | 2 |
| *Hiatella arctica* | 2 |
| *Lyonsia beana* | 1 |
| *Lyropecten nodosus* | 1 |
| *Modiolus modiolus squamosus* | 1 |
| *Pteria colymbus* | 1 |

| Species | Number of Individuals |
|---|---|
| Stomatopoda | |
| *Gonodactylus bredini* | 7 |
| Decapoda | |
| Alpheidae sp. | 1 |
| *Galathea rostrata* | 8 |
| *Hypoconcha sabulosa* | 1 |
| *Metapenaeopsis* sp. | 1 |
| *Mithrax pleuracanthus* | 7 |
| *Mithrax* sp. | 1 |
| *Parthenope serrata* | 2 |
| *Parthenope* sp. | 2 |
| *Pilumnus sayi* | 1 |
| *Pilumnus* sp. | 1 |
| *Pitho* sp. | 1 |
| Portunidae sp. | 1 |
| *Portunus* sp. | 1 |
| *Pseudomedaeus agassizii* | 2 |
| *Sicyonia* sp. | 1 |
| *Stenocionops furcata coelata* | 2 |
| *Stenorynchus* sp. | 2 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Astropecten articulatus* | 1 |
| Ophiuroidea | |
| *Ophiactis* sp. | 1 |
| *Ophiostigma isacanthum* | 2 |
| *Ophiothrix angulata* | 6 |
| Echinoidea | |
| *Leodia sexiesperforata* | 1 |
| Ascidiacea | |
| *Diplosoma fragile* | * |
| *Eudistoma* sp. | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Rock Dredge - Station 3B (3-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.5 - 34.0 meters
Length of Tow: 212 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Lophogorgia hebes* | * |
| Decapoda | |
| *Pachycheles rugimanus* | 1 |
| Bryozoa | |
| *Celleporaria magnifica* | * |
| *Nellia oculata* | * |
| *Stylopoma spongites* | * |
| Ascidiacea | |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 4 (4-A-a)

Date of Collection: September 17, 1978
Water Depth: 32.0 - 32.5 meters
Length of Tow: 209 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Geodia* sp. | * |
| *Haliclona compressa (?)* | * |
| *Keratosa* sp. 2 | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Balanophyllia floridana* | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Muricea pendula* | * |
| *Phyllangia americana* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 9 |
| Gastropoda | |
| *Crepidula aculeata* | 4 |
| *Diodora* sp. | 5 |
| *Marginella roscida* | 1 |
| *Murex cabritii* | 1 |
| *Oliva sayana* | 1 |
| *Vermicularia spirata* | 1 |
| Bivalvia | |
| *Anadara floridana* | 1 |
| *Arca zebra* | 14 |
| *Chama congregata* | 7 |
| *Chione latilirata* | 12 |
| *Hiatella arctica* | 5 |
| *Lyropecten nodosus* | 1 |
| *Macrocallista maculata* | 1 |
| *Modiolus modiolus squamosus* | 5 |
| *Ostrea permollis* | 19 |
| *Pteria colymbus* | 11 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| Alpheidae sp. | 1 |
| *Galathea rostrata* | 3 |
| *Hypoconcha sabulosa* | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Macrocoeloma camptocerum* | 1 |
| *Munida* sp. | 3 |
| *Pachycheles rugimanus* | 1 |
| Paguridae sp. | 1 |
| *Pilumnus sayi* | 1 |
| *Pilumnus* sp. | 3 |
| *Podochela riisei* | 1 |
| *Portunus ordwayi* | 6 |
| *Synalpheus* sp. | 5 |
| Xanthidae sp. | 2 |
| Bryozoa | |
| *Schizoporella cornuta* | * |
| *Stylopoma spongites* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Smittipora levenseni* | * |
| *Buskea dichotoma* | * |
| Asteroidea | |
| *Luidia alternata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 5A (5-A-a)

Date of Collection: September 17, 1978
Water Depth: 33.0 - 33.5 meters
Length of Tow: 253 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Lophogorgia* sp. 2 | * |
| Bivalvia | |
| *Arcinella cornuta* | 1 |
| *Chione latilirata* | 1 |
| Decapoda | |
| Diogenidae sp. | 1 |
| *Ovalipes ocellatus* | 1 |
| *Parthenope* sp. | 3 |
| *Podochela sidneyi* | 1 |
| *Scyllarus chacei* | 1 |
| Bryozoa | |
| *Crisia eburnea* | * |
| Asteroidea | |
| *Astropecten comptus* | 1 |
| *Luidia clathrata* | 1 |
| Ophiuroidea | |
| *Ophiolepis elegans* | 7 |
| Echinoidea | |
| *Leodia sexiesperforata* | 1 |
| Osteichthyes | |
| Ophichthidae sp. | 1 |

James Island Block 198
Biological Dredge - Station 5B (5-A-b)

Date of Collection: September 17, 1978
Water Depth: 32.5 meters
Length of Tow: 241 meters

| Species | Number of Individuals |
|---|---|
| Gastropoda | |
| *Oliva sayana* | 1 |
| Bivalvia | |
| *Chione latilirata* | 4 |
| Decapoda | |
| Paguridae sp. | 1 |
| *Portunus gibbesii* | 1 |
| *Scyllarus chacei* | 2 |
| *Sicyonia* sp. | 2 |
| *Solenocera* sp. | 1 |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| *Luidia alternata* | 1 |
| Ophiuroidea | |
| *Ophiolepis elegans* | 5 |

James Island Block 198
Biological Dredge - Station 6 (6-A-a)

Date of Collection: September 17, 1978
Water Depth: 34.0 meters
Length of Tow: 113 meters

| Species | Number of Individuals |
|---|---|
| Gastropoda | |
| *Fasciolaria lilum hunteria* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 1 |
| *Chione* sp. | 1 |
| Decapoda | |
| *Cycloes bairdii* | 1 |
| *Ethusa mascarone americana* | 1 |
| *Pylopagurus* sp. | 2 |
| Asteroidea | |
| *Ludia alternata* | 1 |
| Ophiuroidea | |
| *Ophiolepis elegans* | 2 |
| Cephalochordata | |
| *Brachiostoma virginiae* | 1 |

James Island Block 198
Biological Dredge - Station 7 (7-A-a)

Date of Collection: September 28, 1978
Water Depth: 32.0 meters
Length of Tow: 109 meters

| Species | Number of Individuals |
|---|---|
| Phaeophyta | |
| *Dictyopteris hoytii* | * |
| Porifera | |
| Choristida sp. 1 | * |
| Choristida sp. 2 | * |
| *Geodia* sp. | * |
| Spirastrellidae sp. | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaete spp. | 7 |
| Gastropoda | |
| *Calliostoma pulchrum* | 4 |
| *Diodora* sp. | 1 |
| *Vermicularia spirata* | 2 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 4 |
| *Arcinella cornuta* | 1 |
| *Chama congregata* | 2 |
| *Hiatella arctica* | 8 |
| *Laevicardium pictum* | 1 |
| *Pteria colymbus* | 12 |
| Cirripedia | |
| *Balanas trigonus* | 30 |
| Stomatopoda | |
| *Gonodactylus bredini* | 6 |
| Decapoda | |
| Diogenidae sp. | 1 |
| Majidae sp. | 1 |
| *Mithrax pleuracanthus* | 1 |
| *Mithrax* sp. | 1 |
| Paguridae sp. | 2 |
| *Parapinnixa* sp. | 1 |
| *Pilumnus sayi* | 1 |
| *Pilumnus* sp. | 7 |
| *Synalpheus* sp. | 7 |
| Xanthidae sp. | 2 |

| Species | Number of Individuals |
|---|---|
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleurifera mucronata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| **Ophiuroidea** | |
| *Astrophyton muricatum* | 1 |
| **Ascidiacea** | |
| *Aplidium* sp. | * |
| *Ascidia* sp.(?) | * |
| *Didemnum candidum* | * |
| *Diplosoma fragile* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 8 (8-A-a)

Date of Collection: September 28, 1978
Water Depth: 32.5 meters
Length of Tow: 119 meters

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| *Codium taylori* | * |
| Porifera | |
| *Endectyon tenax (?)* | * |
| Monaxonida sp. 2 | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Muricea pendula* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 3 |
| Gastropoda | |
| *Crepidula aculeata* | 4 |
| *Polinices lacteus* | 1 |
| Bivalvia | |
| *Arca zebra* | 3 |
| *Chama macerophylla* | 1 |
| *Chione latilirata* | 2 |
| *Hiatella arctica* | 13 |
| *Laevicardium* sp. | 1 |
| *Lyonsia beana* | 1 |
| *Musculus lateralis* | 12 |
| *Pteria columbus* | |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Callidactylus asper* | 1 |
| *Galathea rostrata* | 5 |
| *Macrocoeloma camptocerum* | 1 |
| *Microphrys* sp. | 1 |
| *Mithrax pleuracanthus* | 2 |
| *Pachycheles rugimanus* | 1 |
| *Pachycheles* sp. | 1 |
| Paguridae sp. | 3 |
| Palaemonidae sp. | 2 |
| *Pilumnus sayi* | 3 |
| *Portunus ordwayi* | |
| *Pylopagurus* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Stenocionops furcata coelata* | 1 |
| *Stenorynchus* sp. | 1 |
| *Synalpheus* sp. | 4 |
| *Typton* sp. | 1 |
| Bryozoa | |
| *Schizoporella cornuta* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Smittipora levenseni* | * |
| *Hippopetraliella bisinuata* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Astropecten* cf. *articulatus* | 1 |
| *Goniaster tessellatus* | 2 |
| Echinoidea | |
| *Lytechinus variegatus* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 9 (9-A-a)

Date of Collection: September 28, 1978
Water Depth: 32.0 meters
Length of Tow: 123 meters

| Species | Number of Individuals |
|---|---|
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 8 |
| Gastropoda | |
| *Calliostoma pulchrum* | 2 |
| Bivalvia | |
| *Chama congregata* | 2 |
| *Chione latilirata* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| Diogenidae sp. | 1 |
| *Metapenaeopsis* sp. | 1 |
| Paguridae sp. | 1 |
| *Synalpheus* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Hippopleurifera* sp. | * |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| Osteichthes | |
| *Pontinus helena* (?) | 1 |

James Island Block 198
Biological Dredge - Station 10 (10-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.5 meters
Length of Tow: 99 meters

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| *Codium taylori* | * |
| Phaeophyta | |
| *Dictyopteris hoytii* | * |
| *Sargassum filipendula* | * |
| Porifera | |
| Calcarea sp. 2 | * |
| *Cinachyra alloclada* | * |
| *Endectyon tenax (?)* | * |
| *Ircinia campana* | * |
| Spirastrellidae sp. 1 | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Phyllangia americana* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 49 |
| Gastropoda | |
| *Crepidula aculeata* | 8 |
| *Diodora* sp. | 3 |
| *Pisania tincta* | 2 |
| *Vermicularia spirata* | 1 |
| Bivalvia | |
| *Arca zebra* | 14 |
| *Chama macerophylla* | 2 |
| *Chione latilirata* | 3 |
| *Hiatella arctica* | 3 |
| *Laevicardium pictum* | 1 |
| *Lyropecten nodosus* | 1 |
| *Pteria colymbus* | 2 |
| Cephalopoda | |
| *Octopus* sp. | 1 |
| Cirripedia | |
| *Balanus trigonus* | 88 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |

| Species | Number of Individuals |
|---|---|
| Decapoda | |
| *Galathea rostrata* | 2 |
| *Glyptoxanthus* sp. | 1 |
| *Mithrax pleuracanthus* | 5 |
| *Mithrax* sp. | 1 |
| *Pachycheles rugimanus* | 2 |
| Paguridae sp. | 3 |
| *Parthenope* sp. | 1 |
| *Petrochirus* sp. | 1 |
| *Pilumnus sayi* | 2 |
| *Pilumnus* sp. | 5 |
| *Podochela* sp. | 1 |
| *Pseudomedaeus agassizii* | 4 |
| *Stenocionops furcata furcata* | 1 |
| *Synalpheus townsendii* | 6 |
| *Synalpheus* sp. | 1 |
| Bryozoa | |
| *Schizoporella cornuta* | * |
| *Stylopoma spongites* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Nellia oculata* | * |
| *Hippopetraliella bisinuata* | * |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| *Goniaster tessellatus* | 1 |
| Ophiuroidea | |
| *Astrophyton muricatum* | 2 |
| Ascidiacea | |
| *Aplidium* sp. | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Rock Dredge - 10R (10-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.5 meters
Lenth of Tow: 91 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Lophogorgia* sp. 2 | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta sp. | 1 |
| Bivalvia | |
| *Arca zebra* | 7 |
| *Pododesmus rudis* | 1 |
| *Pteria colymbus* | 14 |
| Bryozoa | |
| *Celleporaria magnifica* | * |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 12 (11-A -b)

Date of Collection: September 28, 1978
Water Depth: 32.0 meters
Length of Tow: 30 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Ircinia* sp. | * |
| Porifera sp. 2 | * |
| Porifera sp. 4 | * |
| Porifera sp. 5 | * |
| Spirastrellidae sp. 1 | * |
| Hydrozoa | |
| *Monostaechas quadridens* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| Gorgonacea sp. 3 | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Phyllangia americana* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 40 |
| Gastropoda | |
| *Crepidula aculeata* | 2 |
| *Simnia acicularis* | 1 |
| Bivalvia | |
| *Aequipecten muscosus* | 1 |
| *Amyagdalum papyrium* | 1 |
| *Arca imbricata* | 1 |
| *Arca zebra* | 5 |
| *Modiolus modiolus squamosus* | 1 |
| *Pteria colymbus* | 40 |
| Pycnogonida | |
| Pycnogonida sp. | 1 |
| Cirripedia | |
| *Balanus trigonus* | * |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| *Glyptoxanthus erosus* | 1 |
| *Megalobrachium soriatum* | 1 |
| *Mithrax forceps* | 1 |
| *Mithrax pleurocanthus* | 3 |
| *Pachycheles rugimanus* | 9 |
| *Palicus alternatus* | 1 |
| *Palicus* sp. | 1 |
| *Pilumnus sayi* | 3 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Pilumnus* sp. | 1 |
| *Pinnotheres* sp. | 1 |
| *Pseudomedaeus agassizii* | 1 |
| *Synalpheus* sp. | 5 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 3 |
| Ascidiacea | |
| *Diplosoma fragile* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Lythrypnus phorellus* | 1 |

James Island Block 198
Biological Dredge - Station 13 (12-A-a)

Date of Collection: September 28, 1978
Water Depth: 33.0 meters
Length of Tow: 128 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 1 |
| Gastropoda | |
| *Diodora* sp. | 1 |
| *Murex recurvirostris rubidus* | 1 |
| Bivalvia | |
| *Aequipecten muscosus* | 1 |
| *Americardia media* | 1 |
| *Anadara notabilis* | 1 |
| *Chione latilirata* | 4 |
| *Gastrochaena hians* | 1 |
| *Hiatella arctica* | 1 |
| *Pleuromeris tridentata* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Metapenaeopsis* sp. | 1 |
| Paguridae sp. | 4 |
| *Parthenope fraterculus* | 1 |
| *Petrochirus* sp. | 1 |
| *Portunus ordwayi* | 3 |
| *Pylopagurus* sp. | 1 |
| Xanthidae sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Schizoporella cornuta* | * |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| Ophiuroidea | |
| *Ophiothrix angulata* | 2 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |

James Island Block 198
Biological Dredge - Station 14 (14-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.0 meters
Length of Tow: 143.0 meters

| Species | Number of Individuals |
|---|---|
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| Actiniaria sp. | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 25 |
| Gastropoda | |
| *Diodora* sp. | 1 |
| *Fasciolarium lilium hunteria* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Anadara notabilis* | 1 |
| *Chama congregata* | 1 |
| *Chione latilirata* | 1 |
| *Hiatella arctica* | 12 |
| *Modiolus modiolus squamosus* | 1 |
| *Plicatula gibbosa* | 1 |
| Cirripedia | |
| *Balanus trigonus* | 21 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |
| *Meiosquilla* sp. | 1 |
| Decapoda | |
| *Hypoconcha arcuata* | 1 |
| *Metapenaeopsis* sp. | 1 |
| *Mithrax pleuracanthus* | 4 |
| *Pachycheles rugimanus* | 3 |
| Paguridae sp. | 1 |
| *Pilumnus sayi* | 1 |
| *Pilumnus* sp. | 1 |
| *Pinnotheres* sp. | 1 |
| *Portunus ordwayi* | 1 |
| *Pylopagurus* sp. | 1 |
| *Stenocionope furcata coelata* | 1 |
| *Stenorhyncus* sp. | 2 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Buskea dichotoma* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Hippopetraliella bisinuata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Ophiothrix angulata* | 2 |
| Echinoidea | |
| *Arbacia punctulata* | 1 |
| Ascidiacea | |
| *Aplidium* sp. | * |
| *Didemnum candidum* | * |
| *Diplosoma fragile* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteicthyes | |
| *Blennius marmoreus* | 1 |

James Island Block 198
Biological Dredge - Station 15 (13-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.5 meters
Length of Tow: 132 meters

| Species | Number of Individuals |
|---|---|
| Phaeophyta | |
| *Sargassum pteroplueron* | * |
| Porifera | |
| Choristida sp. 1 | * |
| *Haliclona compressa* | * |
| Porifera sp. 2 | * |
| Hydrozoa | |
| *Sertularella* cf. *distans* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | |
| Polychaeta spp. | 18 |
| Gastropoda | |
| *Crepidula aculeata* | 1 |
| *Crucibulum auricula* | 1 |
| *Fasciolaria lilium hunteria* | 1 |
| *Murex recurvirostris rubidus* | 1 |
| *Pleuroploca gigantea* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 10 |
| *Chione latilirata* | 3 |
| *Gastrochaena hians* | 1 |
| *Lyonsia beana* | 1 |
| *Lyropecten nodosus* | 1 |
| *Pecten raveneli* | 1 |
| *Pteria colymbus* | 3 |
| Cirripedia | |
| *Balanus trigonus* | 6 |
| Stomatopoda | |
| *Gonodactylus bredini* | 4 |
| Decapoda | |
| *Hypoconcha acurata* | 1 |
| *Mithrax pleuracanthus* | 3 |
| *Pachycheles rugimanus* | 5 |
| Paguridae sp. | 1 |
| Palaemonidae sp. | 5 |
| *Pilumnus sayi* | 1 |
| *Stenocionops furcata furcata* | 2 |
| *Synalpheus* sp. | |

| Species | Number of Individuals |
|---|---|
| Sipuncula | |
| Sipuncula sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Goniaster tessellatus* | 1 |
| Echinoidea | |
| *Clypeaster subdepressus* | 1 |
| *Lytechinus variegatus* | 2 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Halichoeres caudalis* | 1 |

James Island Block 198
Biological Dredge - Station 16 (15-A-a)

Date of Collection: September 28, 1978
Water Depth: 32.0 meters
Length of Tow: 133 meters

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| Chlorophyta sp. | * |
| *Codium taylori* | * |
| Rhodophyta | |
| *Leptofauchea* sp. | * |
| Porifera | |
| *Cinachyra alloclada* | * |
| Monaxonida sp. 3 | * |
| Porifera sp. 2 | * |
| Hydrozoa | |
| *Monostaechas quadridens* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Gastropoda | |
| *Bulla* cf. *solida* | 1 |
| *Cerithium* cf. *eburneum* | 1 |
| *Cypraea spurca acicularis* | 2 |
| *Diodora* sp. | 1 |
| Bivalvia | |
| *Arca zebra* | 5 |
| *Chama congregata* | 4 |
| *Chione grus* | 1 |
| *Laevicardium pictum* | 2 |
| *Lyonsia beana* | 1 |
| *Plicatula gibbosa* | 1 |
| *Pinna carnea* | 1 |
| *Pteria colymbus* | 2 |
| *Semele purpurascens* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 4 |
| Gonodactylidae sp. | 1 |
| Decapoda | |
| Diogenidae sp. | 1 |
| *Melybia* sp. | 8 |
| *Micropanope sculptipes* | 6 |

| Species | Number of Individuals |
| --- | --- |
| Decapoda (cont.) | |
| *Mithrax acuticornis* | 2 |
| *Mithrax pleuracanthus* | 1 |
| Paguridae sp. | 2 |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 1 |
| *Periclimenes* sp. | 1 |
| *Pilumnus sayi* | 3 |
| *Platyactaea setigera* | 3 |
| *Podochela gracilipes* | 2 |
| *Processa* sp. | 1 |
| *Pseudomedaeus* sp. | 1 |
| *Stenocionops furcata* | 1 |
| *Stenocionops furcata furcata* | 1 |
| *Symethis variolosa* | 1 |
| *Synalpheus townsendi* | 2 |
| *Synalpheus* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 1 |
| *Ophiomyxa flaccida* | 1 |
| Echinoidea | |
| *Arbacia punctulata* | 2 |
| *Brissopsis* sp. | 1 |
| *Genocidaris maculata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Nicholsina usta* | 1 |
| *Scorpaena albifimbria* | 1 |
| *Serranus annularis* | 1 |

James Island Block 198
Biological Dredge - Station 17 (16-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.0 meters
Length of Tow: 14 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Hadromerida sp. 2 | * |
| *Haliclona compressa* | * |
| Monaxonida sp. 2 | * |
| Monaxonida sp. 3 | * |
| Monaxonida sp. | * |
| Porifera sp. | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 6 |
| Gastropoda | 1 |
| *Crepidula plana* | 1 |
| *Scaphella junonia* | 1 |
| Bivalvia | |
| *Chama congregata* | 1 |
| *Chione latilirata* | 1 |
| *Hiatella arctica* | 1 |
| *Pseudochama radians* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Mithrax pleuracanthus* | 1 |
| *Petrochirus* sp. | 1 |
| *Stenocionops* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Chriolepis* sp. | 1 |

James Island Block 198
Biological Dredge - Station 18 (21-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.5 - 32.0 meters
Length of Tow: 119 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Porifera sp. 2 | * |
| Hydrozoa | |
| *Lytocarpus clarkei* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 11 |
| Gastropoda | |
| *Busycon spiratum pyruloides* | 1 |
| *Callistoma pulchrum* | 1 |
| *Turritella acropora* | 3 |
| Bivalvia | |
| *Americardia media* | 2 |
| *Chione latilirata* | 2 |
| *Hiatella arctica* | 1 |
| *Laevicardium pictum* | 1 |
| *Pecten raveneli* | 1 |
| Decapoda | |
| *Calappa gallus* | 1 |
| *Pagurus* sp. | 1 |
| *Pilumnus sayi* | 1 |
| *Portunus ordwayi* | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| Asteroidea | |
| *Luidia alternata* | 1 |
| Ophiuroidea | |
| Amphiuridae sp. | 1 |
| *Opionereis recticulata* | |
| Echinoidea | |
| *Lytechinus variegatus* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 19 (20-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.0 meters
Length of Tow: 120 meters

| Species | Number of Individuals |
|---|---|
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 1 | * |
| *Lophogorgia* sp. 2 | * |
| *Solenastrea hyades* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Gastropoda | |
| *Crepidula aculeata* | 10 |
| *Diodora* sp. | 1 |
| *Polinices lacteus* | 1 |
| Polyplacophora | |
| Acanthochitonidae sp. | 1 |
| Bivalvia | |
| *Arca zebra* | 19 |
| *Chama congregata* | 1 |
| *Chama macerophylla* | 4 |
| *Chione latilirata* | 6 |
| *Modiolus modiolus squamosus* | 6 |
| *Plicatula gibbosa* | 1 |
| *Pseudochama radians* | 1 |
| *Pteria colymbus* | 4 |
| Stomatopoda | |
| *Gonodactylus bredini* | 4 |
| Decapoda | |
| *Alpheus* sp. | 2 |
| *Ethusa mascarone americana* | 1 |
| *Galathea rostrata* | 1 |
| *Hypoconcha sabulosa* | 1 |
| *Mithrax pleuracanthus* | 5 |
| *Osachila* sp. | 1 |
| *Pinnotheres* sp. | 1 |
| *Pitho* sp. | 1 |
| *Portunus ordwayi* | 1 |
| *Synalpheus* sp. | 3 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Smittipora levenseni* | * |

| Species | Number of Individuals |
|---|---|
| **Asteroidea** | |
| *Astropecten articulatus* | 1 |
| *Luidia alternata* | 1 |
| *Othilia modesta* | 1 |
| *Othilia serpentaria* | 6 |
| **Ophiuroidea** | 1 |
| *Ophiothrix angulata* | |
| **Echinoidea** | |
| *Arbacia punctulata* | 6 |
| *Leodia sexiesperforata* | 1 |
| *Lytechinus variegatus* | 3 |
| **Ascidiacea** | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

James Island Block 198
Biological Dredge - Station 20 (17-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.0 meters
Length of Tow: 149 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | |
| Hydrozoa | |
| *Lytocarpus clarkei* | * |
| *Monostaechas quadridens* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Gastropoda | |
| *Crepidula aculeata* | 1 |
| *Crepidula plana* | 1 |
| *Murexiella levicula* | 1 |
| Bivalvia | |
| *Arca zebra* | 13 |
| *Chione latilirata* | 6 |
| *Hiatella arctica* | 2 |
| *Lyropecten nodosus* | 1 |
| *Macrocallista maculata* | 1 |
| *Pecten raveneli* | 1 |
| Decapoda | |
| Diogenidae sp. | 1 |
| *Hypoconcha sabulosa* | 1 |
| *Hypoconcha spinossisimus* | 1 |
| *Hypoconcha* sp. | 1 |
| Paguridae sp. | 2 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Luidia alternata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |

## James Island Block 198
## Biological Dredge - Station 21 (18-A-a)

Date of Collection: September 28, 1978
Water Depth: 31.0 meters
Length of Tow: 115 meters

| Species | Number of Individuals |
|---|---|
| Hydrozoa | |
| Hydrozoa sp. | * |
| Anthozoa | |
| *Renilla reniformis* | * |
| *Titanideum frauenfeldii* | * |
| Bivalvia | |
| *Chione latilirata* | 1 |
| Decapoda | |
| *Iliacantha intermedia* | 2 |
| *Metapenaeopsis* sp. | 1 |
| *Palicis* sp. | 1 |
| *Portunis ordwayi* | 1 |
| *Portunis spinicarpus* | 1 |
| Asteroidea | |
| *Ophiolepis elegans* | 1 |
| Echinoidea | |
| *Leodia sexiesperforata* | 35 |
| Ascidiacea | |
| *Diplosoma fragile* (?) | * |
| Osteichthyes | |
| *Ophidion selenops* | 1 |

James Island Block 198
Biological Dredge - Station 22 (22-A-a)

Date of Collection: September 28, 1978
Water Depth: 32.0 - 33.0 meters
Length of Tow: 110 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Calcarea sp. 1 | * |
| Calcarea sp. 2 | * |
| *Geodia* sp. | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| *Lafoea* sp. | * |
| *Lytocarpus clarkei* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| Gorgonacea sp. 1 | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 8 |
| Gastropoda | |
| *Marginella roscida* | 1 |
| Bivalvia | |
| *Americardia media* | 3 |
| *Arca zebra* | 2 |
| *Chione latilirata* | 2 |
| *Chione* sp. | 2 |
| *Hiatella arctica* | 6 |
| *Lyonsia beana* | 1 |
| *Modiolus modiolus squamosus* | 1 |
| *Pecten raveneli* | 1 |
| *Pteria colymbus* | 4 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| *Ethusa mascarone americana* | 1 |
| *Macrocoeloma camptocerum* | 1 |
| *Macrocoeloma septemspinossum* | 2 |
| *Mithrax pleuracanthus* | 1 |
| Paguridae sp. | 3 |
| *Parthenope fraterculus* | 1 |
| *Pilumnus sayi* | 1 |
| *Pilumnus* sp. | 1 |
| *Portunus ordwayi* | 3 |
| *Stenorhynchus* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Luidia alternata* | 1 |
| Ascidiacea | |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteicthyes | |
| *Blennius marmoreus* | 1 |

**James Island Block 198**
**Biological Dredge - Station 23 (19-A-a)**

Date of Collection: September 29, 1978
Water Depth: 32.0 - 33.0 meters
Length of Tow: 65 meters

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| *Codium taylori* | * |
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| Porifera | |
| Calcarea sp. 3 | * |
| Choristida sp. 2 | * |
| *Geodia* sp. | * |
| *Ircinia* sp. | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. | * |
| *Solenastrea hyadas* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 13 |
| Gastropoda | |
| *Crepidula aculeata* | 4 |
| *Diodora* sp. | 1 |
| *Pisania tincta* | 1 |
| Bivalvia | |
| *Arca imbricata* | 1 |
| *Arca zebra* | 1 |
| *Chama congregata* | 8 |
| *Chama macerophylla* | 1 |
| *Chione grus* | 2 |
| *Hiatella arctica* | 14 |
| *Lithophaga* sp. | 1 |
| *Modiolus modiolus squamosus* | 1 |
| *Pteria colymbus* | 35 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| Alpheidae sp. | 1 |
| Paguridae sp. | 3 |
| *Pylopagurus* sp. | 2 |
| *Stenocionops* sp. | 1 |
| *Typton* cf. *distinctus* | 1 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Hippopetraliella bisinuata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |
| Ascidiacea | |
| *Diplosoma macdonaldi* | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |
| *Styela* sp. | * |
| Osteichthyes | |
| *Lythrypnus phorellus* | 1 |

## James Island Block 380
## Biological Dredge - Station 101 (1-A-a)

Date of Collection: October 1, 1978
Water Depth: 95.0 - 100.0 meters
Length of Tow: 181 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | * |
| Corallinaceae sp. 1 | * |
| Corallinaceae sp. 2 | |
| Porifera | |
| Tetractinellida sp. | * |
| Anthozoa | |
| *Lophogorgia* sp. 1 | * |
| Stolonifera sp. | * |
| Polychaeta | |
| Polychaeta spp. | 2 |
| Gastropoda | |
| *Chicoreus florifer* | 1 |
| Bivalvia | |
| *Barbatia candida* | 2 |
| *Chama* cf. *lactuca* | 2 |
| *Corbula dietziana* | 1 |
| *Plicatula gibbosa* | 5 |
| *Pteria colymbus* | 4 |
| Decapoda | |
| *Alpheus* sp. | 3 |
| *Calappa angusta* | 1 |
| *Dardanus* sp. | 1 |
| Diogenidae sp. | 1 |
| *Micropanope sculptipes* | 5 |
| *Micropanope* sp. | 1 |
| *Nanoplax* sp. | 1 |
| *Osachila semilevis* | 1 |
| *Pagurus* sp. | 1 |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 2 |
| *Podochela gracilipes* | 1 |
| *Stenorynchus* sp. | 1 |
| Xanthidae sp. | 1 |
| Bryozoa | |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Smittipora levensenі* | * |
| *Tetraplaria* sp. | * |

| Species | Number of Individuals |
|---|---|
| Ophiuroidea | |
| *Asteroporpa annulata* | 28 |
| *Astrocyclus caecilia* | 4 |
| *Ophiomyxa flaccida* | 1 |
| *Ophiothrix angulata* | 2 |
| Echinoidea | |
| *Echinolampus depressa* | 1 |
| *Stylocidaris affinis* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 1 |
| Osteicthyes | |
| *Scorpaena dispar* | 1 |

James Island Block 380
Biological Dredge - Station 102 (2-A-a)

Date of Collection: October 1, 1978
Water Depth: 95.0-98.0 meters
Length of Tow: 84 meters

| Species | Number of Individuals |
|---|---|
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| Gorgonacea sp. 2 | * |
| Gorgonacea sp. | * |
| *Neospongodes agassizii* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| Polychaeta spp. | 25 |
| Bivalvia | |
| *Pycnodonte hyotis* | 5 |
| Cirripedia | |
| *Balanus trigonus* | 51 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| *Euchirograpsus americanus* | 1 |
| *Micropanope sculptipes* | 2 |
| Paguridae sp. | 3 |
| *Pagurus* sp. | 2 |
| Xanthidae sp. | 2 |
| Bryozoa | |
| *Crisia eburnea* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Astrocyclus* sp. | 1 |
| *Ophioderma appressum* | 1 |
| *Ophiothrix angulata* | 2 |
| Crinoidea | |
| *Comactinia* sp. | 1 |

James Island Block 380
Biological Dredge - Station 104 (4-A-a)

Date of Collection: October 1, 1978
Water Depth: 72.0 - 79.0 meters
Length of Tow: 41 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Callyspongia fallax* | * |
| Monaxonida sp. 14 | * |
| Porifera sp. 6 | * |
| Porifera sp. | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora debilis* | * |
| *Diodogorgia nodulifera* | * |
| Gorgonacea sp. 5 | * |
| *Neospongodes agassizii* | * |
| *Paracyathus pulchellus* | * |
| Paramuriceidae sp. | * |
| Polychaeta | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 7 |
| Bivalvia | |
| *Arca zebra* | 16 |
| *Barbatia candida* | 4 |
| *Chama* sp. | 3 |
| *Plicatula gibbosa* | 15 |
| Cirripedia | |
| *Balanus trigonus* | 1 |
| Decapoda | |
| Nibilia sp. | 1 |
| *Podochela gracilipes* | 1 |
| Bryozoa | |
| *Cupuladria biporosa* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 5 |
| Echinoidea | |
| *Echinolampus depressa* | 1 |
| *Genocidaris maculata* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 2 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Scorpaena dispar* | 2 |
| *Scorpaena* sp. | 1 |

James Island Block 380
Biological Dredge - Station 105 (5-A-a)

Date of Collection: October 1, 1978
Water Depth: 60.0-61.0 meters
Length of Tow: 129 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. | 1 |
| Porifera | |
| Axinellidae sp. | * |
| Choristida sp. 3 | * |
| Keratosa sp. | * |
| Monaxonida sp. 15 | * |
| Monaxonida sp. | * |
| Porifera sp. 6 | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| *Nemertesia simplex* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Astrangia danae* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Nidalia occidentalis* | * |
| *Oculina* cf. *varicosa* | * |
| *Paracyathus pulchellus* | * |
| *Telesto sanguinea* | * |
| *Virgularia presbytes* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 2 |
| Gastropoda | |
| *Conus daucus* | 1 |
| Bivalvia | |
| *Aequipecten muscosus* | 1 |
| *Arca zebra* | 3 |
| *Barbatia candida* | 1 |
| *Callista eucymata* | 1 |
| *Chama* sp. | 1 |
| *Pecten raveneli* | 2 |
| *Pteria colymbus* | 1 |
| *Spondylus americanus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 8 |
| Decapoda | |
| *Calappa angusta* | 2 |
| *Carpoporus papulosus* | 2 |
| *Ethusa mascarone americana* | 1 |
| *Galathea rostrata* | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Metapaenopsis* sp. | 2 |
| *Micropanope sculptipes* | 8 |
| *Micropanope* sp. | 2 |
| *Mithrax cornutus* | 5 |
| *Munida* sp. | 5 |
| *Pagurus* sp. | 2 |
| *Palicus* sp. | 2 |
| *Parthenope fraterculus* | 11 |
| *Podochela gracilipes* | 12 |
| *Portunus ordwayii* | 1 |
| *Pylopagurus* sp. | 1 |
| *Stenocionops furcata* | 4 |
| *Stenorynchus* sp. | 2 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Crisia eburnea* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleurifera muronata* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Narcissia trigonaria* | 3 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 1 |
| *Ophioderma brevispinum* | 3 |
| *Ophiolepis elegans* | 1 |
| *Ophiothrix angulata* | 8 |
| Echinoidea | |
| *Agassizia excentrica* | 1 |
| *Eucidaris tribuloides* | 8 |
| Crinoidea | |
| *Comactinia* sp. | 2 |
| Ascidiacea | |
| *Didemnum candidum* | * |
| Pyuridae sp. | * |
| Osteicthyes | |
| *Serranus phoebe* | 1 |

James Island Block 380
Biological Dredge - Station 106 (6-A-a)

Date of Collection: October 1, 1978
Water Depth: 48.0 - 51.0 meters
Length of Tow: 109 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Gracilaria mammillaris* | * |
| *Leptofauchea rhodymenoides* | * |
| *Membranopteria* sp. | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia occidentalis* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| Porifera sp. | * |
| Anthozoa | |
| *Antipathes rhipidion* | * |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| *Lophogorgia* sp. 1 | * |
| *Madracis asperula* | * |
| *Telesto riisei* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | 2 |
| Polychaeta spp. | * |
| Gastropoda | |
| *Cypraea cinerea* | 1 |
| *Cypraea spurca acicularis* | 4 |
| *Distorsio constricta macgintyi* | 1 |
| *Marginella roscida* | 2 |
| *Natica floridana* | 1 |
| *Phalium granulatum* | 1 |
| Bivalvia | |
| *Arca zebra* | 6 |
| *Argopecten gibbus* | 1 |
| *Chalyms* sp. | 1 |
| *Laevicardium pictum* | 2 |
| *Pecten raveneli* | 3 |
| *Pecten ziczac* | 1 |
| *Spondylus americanus* | 1 |
| Cirripedia | |
| *Lepas* sp. | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |

| Species | Number of Individuals |
| --- | --- |
| Decapoda | |
| *Actaea rufopunctata* | 1 |
| *Calappa angusta* | 1 |
| *Carpoporus papulosus* | 1 |
| *Hyponconcha spinosissina* | 1 |
| *Macrocoeloma* sp. | 1 |
| *Melybia* sp. | 1 |
| *Metapenaeopsis* sp. | 1 |
| *Micropanope sculptipes* | 5 |
| *Mithrax acuticornis* | 6 |
| *Mithrax cornutus* | 1 |
| *Munida* sp. | 1 |
| *Pagurus* sp. | 1 |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 5 |
| *Podochela gracilipes* | 3 |
| *Portunus ordwayi* | 1 |
| Processidae sp. | 1 |
| *Pseudomedaeus* sp. | 1 |
| *Pylopagurus* sp. | 1 |
| *Stenocionops furcata* | 11 |
| *Stenorynchus* sp. | 5 |
| *Symethis variolosa* | 2 |
| Bryozoa | |
| *Amathia convulata* | * |
| Asteroidea | |
| *Goniaster tessellatus* | 1 |
| Ophiuroidea | |
| *Astrophyton muricatum* | 1 |
| *Ophioderma brevispinum* | 3 |
| *Ophiomyxa flaccida* | 1 |
| *Ophiothrix angulata* | 20 |
| Echinoidea | |
| *Arbacia punctulata* | 4 |
| *Astropyga magnifica* | 1 |
| *Clypeaster* sp. | 1 |
| *Echinolampas depressa* | 2 |
| *Eucidaris tribuloides* | 6 |
| *Meoma ventricosa* | 1 |
| *Stylocidaris affinis* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 1 |
| Osteicthyes | |
| *Chromis enchrysurus* | 1 |
| *Emblemari atlantica* | 1 |
| *Scorpaena dispar* | 1 |
| *Serranus phoebe* | 1 |

**James Island Block 380**
**Biological Dredge- Station 107 (7-A-a)**

Date of Collection: October 1, 1978
Water Depth: 60.0 - 63.0 meters
Length of Tow: 118 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | 1 |
| Porifera | |
| Axinellidae sp. | * |
| Calcarea sp. 2 | * |
| *Dictyociona adioristica* | * |
| Porifera sp. 6 | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Neospongodes agassizii* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 1 |
| Gastropoda | |
| *Turbo castanea* | 1 |
| Bivalvia | |
| *Spondylus americanus* | 1 |
| Decapoda | |
| *Dromidia antillensis* | 1 |
| *Heterocrypta* sp. | 1 |
| *Micropanope sculptipes* | 5 |
| *Micropanope* sp. | 1 |
| *Mithrax acuticornis* | 1 |
| *Pagurus* sp. | 1 |
| *Palicus* sp. | 2 |
| *Parthenope fraterculus* | 2 |
| *Podochela gracilipes* | 3 |
| *Pseudomedaeus distinctus* | 1 |
| *Symethis variolosa* | 1 |
| Bryozoa | |
| *Cigclisula serrulata* | * |
| Asteroidea | |
| *Chaetaster nodosus* | 2 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 8 |
| *Ophioderma brevispinum* | 1 |
| *Ophiothrix angulata* | 4 |

| Species | Number of Individuals |
|---|---|
| Echinoidea | |
| *Eucidaris tribuloides* | 1 |
| *Stylocidaris affinis* | 8 |
| Crinoidea | |
| *Comactinia* sp. | 3 |

James Island Block 380
Biological Dredge - Station 108 (8-A-a)

Date of Collection: October 1, 1978
Water Depth: 57.0 - 62.0 meters
Length of Tow: 133 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| *Callyspongia fallax* | * |
| *Cinachyra alloclada* | * |
| *Dictyociona adioristica* | * |
| Hadromerida sp. 4 | * |
| *Ircinia* sp. | * |
| Monaxonida sp. 4 | * |
| Monaxonida sp. 10 | * |
| Monaxonida sp. 11 | * |
| Monaxonida sp. 12 | * |
| Monaxonida sp. 13 | * |
| Monaxonida sp. 19 | * |
| Monaxonida sp. 20 | * |
| Porifera sp. 6 | * |
| Porifera sp. | * |
| Tetractinellida sp. | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| *Lytocarpus clarkei* | * |
| *Monostaechas quadridens* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| Gorgonacea sp. 5 | * |
| *Madracis asperula* | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| *Telesto riisei* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 20 |

| Species | Number of Individuals |
|---|---|
| **Bivalvia** | |
| *Arca zebra* | 19 |
| *Chlamys benedicti* | 1 |
| *Chlamys* sp. | 7 |
| *Hiatella arctica* | 2 |
| *Malleus candeanus* | 4 |
| *Plicatula gibbosa* | 5 |
| *Pteria colymbus* | 3 |
| **Cirripedia** | |
| *Balanus* sp. | 8 |
| *Acasta* sp. | 2 |
| **Decapoda** | |
| *Dromidia antillensis* | 1 |
| *Galathea rostrata* | 1 |
| *Mithrax cornutus* | 2 |
| *Osachila semilevis* | 1 |
| Palaemonidae sp. | 1 |
| *Palicus* sp. | 3 |
| *Periclimenes* sp. | 2 |
| *Pilumnus* sp. | 1 |
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Crisia eburnea* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| **Asteroidea** | |
| *Narcissia trigonaria* | 2 |
| **Ophiuroidea** | |
| *Asteroporpa annulata* | 15 |
| *Ophioderma brevispinum* | 1 |
| *Ophioderma* sp. | 2 |
| *Ophiomyxa flaccida* | 2 |
| *Ophiothrix angulata* | 10 |
| **Echinoidea** | |
| *Eucidaris tibuloides* | 2 |
| *Stylocidaris affinis* | 8 |
| **Ascidiacea** | |
| *Ascidia* sp. | * |
| *Cavelina gigantea* | * |
| **Osteicthyes** | |
| *Chromis enchrysurus* | * |
| *Holanthias martiniensis* | * |

James Island Block 380
Rock Dredge - Station 109 (8-A-a)

Date of Collection: October 2, 1978
Water Depth: 60.0 - 62.0 meters
Length of Tow: 125 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| Porifera | |
| *Callyspongia fallax* | * |
| Keratosa sp. 1 | * |
| Monaxonida sp. 11 | * |
| Monaxonida sp. 12 | * |
| Monaxonida sp. 19 | * |
| Monaxonida sp. 20 | * |
| Spirastrellidae sp. 2 | * |
| *Unimia* sp. | * |
| Anthozoa | |
| Actiniaria sp. | * |
| Gorgonacea sp. 5 | * |
| Gastropoda | |
| *Vermicularia* sp. | 4 |
| Bivalvia | |
| *Arca zebra* | 8 |
| *Barbatia candida* | 7 |
| *Chama sp.* | 1 |
| *Hiatella arctica* | 1 |
| *Pinna carnea* | 1 |
| *Spondylus americanus* | 2 |
| Decapoda | |
| *Micropanope sculptipes* | 14 |
| *Parthenope fraterculus* | 2 |
| *Pseudomedaeus* sp. | 4 |
| *Synalpheus* sp. | 3 |
| Asteroidea | |
| *Narcissia trigonaria* | 2 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 6 |
| Echinoidea | |
| *Arbacia punctulata* | 1 |
| Holothuroidea | |
| *Stolus micropuntaties* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 22 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteichthyes | |
| *Scorpaena dispar* | 1 |

James Island Block 380
Biological Dredge - Station 110 (9-A-a)

Date of Collection: October 2, 1978
Water Depth: 62.0 - 64.0 meters
Length of Tow: 87 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Peysonnelia rubra* | * |
| Porifera | |
| Calcarea sp. 2 | * |
| *Callyspongia fallax* | * |
| *Chondrilla nucula* | * |
| *Dictyociona adioristica* | * |
| *Higginsia strigilata* | * |
| Monaxonida sp. 15 | * |
| Monaxonida sp. 18 | * |
| Monaxonida sp. | * |
| Porifera sp. 6 | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 5 | * |
| *Lophogorgia* sp. 1 | * |
| *Madracis asperula* | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | * |
| Bivalvia | |
| *Arca zebra* | 7 |
| *Callista eucymata* | 1 |
| *Malleus candeanus* | 3 |
| *Plicatula gibbosa* | 3 |
| *Pteria colymbus* | 1 |
| *Pycnodonte hyotis* | 8 |
| *Spondylus americanus* | 2 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |

| Species | Number of Individuals |
|---|---|
| Decapoda | |
| *Collodes* sp. | 1 |
| *Galathea rostrata* | 1 |
| *Macrocoeloma septemspinosum* | 2 |
| *Metapenaeopsis* sp. | 2 |
| *Micropanope sculptipes* | 1 |
| *Mithrax acuticornis* | 5 |
| *Palicus* sp. | 3 |
| *Parthenope fraterculus* | 4 |
| *Scyllarus depressum* | 1 |
| *Stenorynchus furcata* | 3 |
| *Stenorynchus* sp. | 1 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Ciqclisula serrulata* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Chaetaster nodosus* | 1 |
| *Marcissia trigonaria* | 5 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 34 |
| *Astrocyclus* sp. | 5 |
| *Ophiomyxa flaccida* | 2 |
| *Ophiothrix angulata* | 3 |
| Echinoidea | |
| *Arbacia punctulata* | 2 |
| *Eucidaris tribuloides* | 2 |
| *Lytechinus variegatus* | 2 |
| *Stylocidaris affinis* | 16 |
| Crinoidea | |
| *Comactinia* sp. | 7 |
| Ascidiacea | |
| *Ascidia* sp. | * |

James Island Block 380
Biological Dredge - Station 111 (10-A-a)

Date of Collection: October 2, 1978
Water Depth: 79.0 - 82.0 meters
Length of Tow: 86 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Callyspongia fallax* | * |
| Choristida sp. | * |
| *Dictyociona adioristica* | * |
| *Geodia* sp. | * |
| Monaxonida sp. 3 | * |
| Monaxonida sp. 5 | * |
| Monaxonida sp. 14 | * |
| Monaxonida sp. 15 | * |
| Monaxonida sp. 18 | * |
| Porifera sp. | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| *Antipathes rhipidion* | * |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| Gorgonacea sp. 5 | * |
| *Lophogorgia* sp.1 | * |
| *Lophogorgia* sp. | * |
| *Madracis asperula* | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 16 |
| Gastropoda | |
| *Chicoreus florifer* | 2 |
| Bivalvia | |
| *Arca zebra* | 22 |
| *Barbatia candida* | 17 |
| *Hiatella arctica* | 1 |
| *Malleus candeanus* | 1 |
| *Plicatula gibbosa* | 15 |
| *Pteria colymbus* | 3 |
| Decapoda | |
| *Euchirograpsus americanus* | 1 |
| *Metapenaeopsis* sp. | 1 |
| *Micropanope sculptipes* | 3 |
| *Mithrax acuticornis* | 3 |
| *Palicus* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda ( cont.) | |
| *Pagurus* sp. | 1 |
| *Parthenope fraterculus* | 1 |
| *Pseudomedaeus distinctus* | 3 |
| *Scyllarus depressus* | 1 |
| *Stenocionops furcata* | 1 |
| Bryozoa | |
| *Amathia convulata* | * |
| Bryozoa sp. | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Disporella* cf. *fimbriata* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| Asteroidea | |
| *Narcissia trigonaria* | 1 |
| Ophiuroidea | |
| *Astrocyclus* sp. | 2 |
| *Asterophyton muricatum* | 1 |
| *Asteroporpa annulata* | 17 |
| *Ophiothrix angulata* | 2 |
| Echinoidea | |
| *Eucidaris tribuloides* | 1 |
| *Stylocidaris affinis* | 5 |
| Crinoidea | |
| *Comactinia* sp. | 8 |
| Osteicthyes | |
| *Antennarius* sp. | 1 |
| *Plectranthias garrupellus* | 1 |
| *Scorpaena dispar* | 1 |

James Island Block 380
Biological Dredge - Station 112 (3-A-b)

Date of Collection: October 2, 1978
Water Depth: 97 - 102 meters
Length of Tow: 35 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Oculina varicosa* | * |
| *Paracyathus pulchellus* | * |
| Polychaeta | |
| Polychaeta spp. | 3 |
| Bivalvia | |
| *Barbatia candida* | 4 |
| *Lima pellucida* | 1 |
| *Plicatula gibbosa* | 6 |
| Cephalopoda | |
| *Octopus* sp. | 2 |
| Decapoda | |
| *Nibilia* sp. | 1 |
| Paguridae sp. | 1 |
| Bryozoa | |
| *Nellia oculata* | * |
| *Hippopetraliella bisinuata* | * |
| Crinoidea | |
| *Comactinia* sp. | 1 |

James Island Block 380
Biological Dredge - Station 113 (11-A-a)

Date of Collection: October 2, 1978
Water Depth: 96.0 - 98.0 meters
Length of Tow: 78 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Geodia* sp. | * |
| *Higginsia strigilata* | * |
| Monaxonida sp. 5 | * |
| Monaxonida sp. 16 | * |
| Porifera sp. 9 | * |
| Anthozoa | |
| Actiniaria sp. | * |
| *Lophogorgia* sp. 1 | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| *Paracyathus pulchellus* | * |
| *Polymyces fragilis* forma *tulipa* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 35 |
| Bivalvia | |
| *Barbatia candida* | 5 |
| *Chama* sp. | 1 |
| *Plicatula gibbosa* | 27 |
| *Pteria colymbus* | 3 |
| *Pycnodonte hyotis* | 39 |
| Cirripedia | |
| *Balanus trigonus* | 5 |
| Decapoda | |
| *Dardanus* sp. | 1 |
| *Euchirograpsus americanus* | 1 |
| *Micropanope sculptipes* | 4 |
| *Osachila semilevis* | 1 |
| *Pagurus* sp. | 2 |
| *Parthenope fraterculus* | 1 |
| *Podochela gracilipes* | 1 |
| *Scyllarus depressus* | 1 |
| *Synalpheus* sp. | 1 |
| Bryozoa | |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 11 |
| *Asterocyclus caecilia* | 1 |

| Species | Number of Individuals |
|---|---|
| Echinoidea | |
| *Stylocidaris affinis* | 3 |
| Holothuroidea | |
| *Psolus tuberculosus* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 2 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Pontinus* sp. | 1 |

James Island Block 380
Biological Dredge - Station 114 (12-A-a)

Date of Collection: October 2, 1978
Water Depth: 60.0 - 64.0 meters
Length of Tow: 138 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Axinellidae sp. | * |
| *Callyspongia fallax* | * |
| *Cinachyra alloclada* | * |
| Porifera sp. | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| *Lafoea* sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 5 | * |
| *Lophogorgia* sp. 1 | * |
| *Madracis asperula* | * |
| *Neospongodes agassizii* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 13 |
| Gastropoda | |
| *Chicoreus florifer* | 2 |
| Bivalvia | |
| *Arca zebra* | 6 |
| *Barbatia candida* | 2 |
| *Chlamys benedicti* | 1 |
| *Chlamys* sp. | 1 |
| *Plicatula gibbosa* | 6 |
| *Pteria colymbus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Arachnopsis* sp. | 1 |
| *Carpoporus papulosus* | 2 |
| *Metapenaeopsis* sp. | 2 |
| *Micropanope sculptipes* | 3 |
| *Micropanope* sp. | 1 |
| *Osachila* sp. | 1 |
| *Pagurus* sp. | 3 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 6 |
| *Podochela gracilipes* | 6 |
| *Podochela* sp. | 1 |
| *Pseudomedaeus* sp. | 1 |
| *Scyllarus depressus* | 1 |
| Bryozoa | |
| *Cigclisula serrulata* | * |
| *Hippopetraliella bisinuata* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Narcissia trigonaria* | 2 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 2 |
| *Astrocyclus* sp. | 2 |
| *Ophiothrix angulata* | 1 |
| Echinoidea | |
| *Stylocidaris affinis* | 3 |
| Holothuroidea | |
| *Psolus tuberculosus* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 3 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Chromis enchrysurus* | 1 |

James Island Block 380
Biological Dredge - Station 115 (13-A-a)

Date of Collection: October 2, 1978
Water Depth: 52.0 - 53.0 meters
Length of Tow: 89 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Choristida sp. 3 | * |
| Monaxonida sp. | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Madracis asperula* | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 10 |
| Bivalvia | |
| *Arca zebra* | 1 |
| *Chama* sp. | 1 |
| *Lima pellucida* | 2 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Callidactylus asper* | * |
| *Melybia* sp. | * |
| *Metapenaeopsis* sp. | * |
| *Micropanope sculptipes* | * |
| *Mithrax acuticornis* | * |
| *Osachila semilevis* | * |
| *Symethis variolosa* | * |
| Bryozoa | |
| Bryozoa sp. | * |
| *Halophila johnstoniae* | * |
| Asteroidea | |
| *Linkia nodosa* | 1 |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 1 |
| *Ophiomyxa flaccida* | 3 |
| *Ophiothrix angulata* | 7 |

| Species | Number of Individuals |
|---|---|
| Echinoidea | |
| *Arbacia punctulata* | 32 |
| *Astropyga magnifica* | 4 |
| *Eucidaris tribuloides* | 4 |
| *Stylocidaris affinis* | 2 |
| Crinoidea | |
| *Comactinia* sp. | 4 |

James Island Block 380
Biological Dredge - Station 116 (14-A-a)

Date of Collection: October 2, 1978
Water Depth: 53.0 meters
Length of Tow: 96 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 2 | * |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Choristida sp. 3 | * |
| *Dictyociona adioristica* | * |
| *Ircinia* sp. | * |
| Monaxonida sp. 13 | * |
| Porifera sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| Gorgonacea sp. 5 | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Gastropoda | |
| *Chicoreus florifer* | 1 |
| Columbellidae sp. | 2 |
| *Vermicularia* sp. | 3 |
| Bivalvia | |
| *Anadara notabilis* | 1 |
| *Arca zebra* | 1 |
| *Callista eucymata* | 1 |
| *Chlamys* sp. | 2 |
| *Lima pellucida* | 1 |
| *Semele purpurascens* | 2 |
| *Spondylus americanus* | 1 |
| Decapoda | |
| *Macrocoeloma* sp. | 1 |
| *Melybia* sp. | 2 |
| *Micropanope lobifrans* | 2 |
| *Micropanope sculptipes* | 4 |
| *Mithrax acuticornis* | 4 |
| *Munida* sp. | 1 |
| *Palicus* sp. | 5 |
| *Parthenope fraterculus* | 1 |
| *Podochela gracilipes* | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Processa* sp. | 1 |
| *Stenocionops furcata* | 3 |
| *Stenorynchus* sp. | 2 |
| *Symethis variolosa* | 2 |
| Bryozoa | |
| *Cigclisula serrulata* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 1 |
| *Ophioderma* sp. | 1 |
| *Ophiomyxa flaccida* | 1 |
| *Ophiothrix angulata* | 3 |
| Echinoidea | |
| *Astropyga magnifica* | 5 |
| *Eucidaris tribuloides* | 1 |
| *Pseudoboletia maculata* | 1 |
| *Stylocidaris affinis* | 9 |
| Crinoidea | |
| *Comactinia* sp. | 1 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Anarchias yoshiae* | 2 |
| *Scorpaena* sp. | 1 |
| *Synodus synodus* | 2 |

James Island Block 380
Biological Dredge - Station 117 (15-A-a)

Date of Collection: October 2, 1978
Water Depth: 47.0 - 49.0 meters
Lenght of Tow: 109 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| *Higginsia strigilata* | * |
| *Ircinia* sp. | * |
| Monaxonida sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 6 |
| Gastropoda | |
| *Cymatium pileare* | 1 |
| Bivalvia | |
| *Anardara notabilis* | 1 |
| *Arca zebra* | 3 |
| *Chione grus* | 1 |
| *Laevicardium pictum* | 1 |
| *Papyridea soleniformis* | 2 |
| Decapoda | |
| *Euchirograpsus americanus* | 1 |
| *Latreutes parvulus* | 1 |
| *Metapenaeopsis* sp. | 2 |
| *Micropanope* sp. | 4 |
| *Munida* sp. | 1 |
| *Portunus ordwayi* | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Crisia eburnea* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| Gorgonocephalidae sp. | 1 |
| *Ophiothrix angulata* | 2 |
| Echinoidea | |
| *Arbacia punctulata* | 22 |
| *Astropyga magnifica* | 2 |
| *Clypeaster* sp. | 1 |
| *Eucidaris tribuloides* | 2 |

| Species | Number of Individuals |
|---|---|
| Ascidiacea | |
| *Didemnum candidum* | * |

James Island Block 380
Biological Dredge - Station 118 (16-A-a)

Date of Collection: October 2, 1978
Water Depth: 50.0 meters
Length of Tow: 83 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| Corallinaceae sp. 2 | * |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| Porifera | * |
| Calcarea sp. 2 | * |
| *Dictyociona adioristica* | * |
| Monaxonida sp. | * |
| Porifera sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 4 |
| Gastropoda | |
| *Bulla* cf. *solida* | 1 |
| Pleurobranchidae sp. | 3 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 3 |
| *Callista eucymata* | 3 |
| *Pseudochama radians* | 1 |
| *Spondylus americanus* | 1 |
| Decapoda | |
| *Actaea rufopunctata* | 2 |
| *Melybia* sp. | 4 |
| *Micropanope sculptipes* | 3 |
| *Mithrax cornutus* | 1 |
| *Palicus* sp. | 5 |
| *Platyactaea setigera* | 4 |
| *Portunus ordwayi* | 1 |
| *Stenocionops furcata* | 1 |
| *Stenorynchus* sp. | 1 |
| *Symethis variolosa* | 1 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Cigclisula serrulata* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |
| Echinoidea | |
| *Arbacia punctulata* | 1 |
| *Astropyga magnifica* | 1 |
| *Eucidaris tribuloides* | 10 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Scorpaena* sp. | 1 |

## James Island Block 380
## Biological Dredge - Station 119 (17-A-a)

Date of Collection: October 2, 1978
Water Depth: 50.0 meters
Length of Tow: 103 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Calcarea sp. 2 | * |
| *Ircinia* sp. | * |
| Monaxonida sp. 13 | * |
| Hydrozoa | |
| *Lytocarpus clarkei* | * |
| *Nemertesia simplex* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| Gorgonacea sp. 4 | * |
| *Lophogorgia* sp. 1 | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 3 |
| Bivalvia | |
| *Arca zebra* | 4 |
| *Pteria colymbus* | 1 |
| *Spondylus americanus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| *Melybia* sp. | 2 |
| *Metapenaeopsis* sp. | 1 |
| *Micropanope sculptipes* | 1 |
| *Mithrax acuticornis* | 1 |
| *Osachila semilevis* | 1 |
| *Palicus* sp. | 1 |
| *Podochela gracilipes* | 6 |
| *Stenocionops furcata* | 1 |
| *Stenorynchus* sp. | 2 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Celleporaria albirostris* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 5 |
| *Astrocyclus* sp. | 2 |
| *Ophioderma brevispinum* | 4 |
| *Ophiothrix angulata* | 5 |
| *Ophiothrix suensonii* | 1 |
| Echinoidea | |
| *Astropyga magnifica* | 6 |
| *Eucidaris tribuloides* | 20 |
| Ascidiacea | |
| *Clavelina gigastea* | * |

James Island Block 380
Biological Dredge - Station 120 (18-A-a)

Date of Collection: October 2, 1978
Water Depth: 53.0 - 55.0 meters
Length of Tow: 107 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Calcarea sp. 2 | * |
| Monaxonida sp. 10 | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 7 |
| Bivalvia | |
| *Arca zebra* | 8 |
| *Barbatia candida* | 1 |
| *Chlamys* sp. | 5 |
| *Malleus candeanus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 4 |
| Decapoda | |
| *Actaea rufopunctata* | 1 |
| *Alpheus* sp. | 1 |
| *Melybia* sp. | 1 |
| *Munida* sp. | 1 |
| Paguridae sp. | 1 |
| *Pagurus* sp. | 1 |
| *Palicus* sp. | 1 |
| *Polochela gracilipes* | 1 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Cigclisula serrulata* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Smittipora levenseni* | * |

| Species | Number of Individuals |
|---|---|
| Asteroidea | |
| *Chaetaster nodosus* | 1 |
| *Narcissia trigonaria* | 1 |
| Ophiuroidea | |
| *Astrophyton muricatum* | 1 |
| *Ophioderma brevispinum* | 1 |
| *Ophiothrix angulata* | 7 |
| Echinoidea | |
| *Arbacia punctulata* | 15 |
| *Astropyga magnifica* | 2 |
| *Eucidaris tribuloides* | 2 |
| *Pseudoboletia maculata* | 2 |
| Holothuroidea | |
| *Phyllophorus occidentalis* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 4 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| *Clavelina gigastea* | * |
| *Polyandrocarpa* sp. | * |
| Osteicthyes | |
| *Chromis enchrysurus* | 1 |
| *Halichoeres* sp. | 2 |
| *Scorpaena dispar* | 3 |

James Island Block 380
Biological Dredge - Station 121 (19-A-a)

Date of Collection: October 2, 1978
Water Depth: 64.0 - 69.0 meters
Length of Tow: 110 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| Corallinaceae sp. 2 | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| *Agelas* sp. | * |
| Calcarea sp. 2 | * |
| *Callyspongia fallax* | * |
| *Erylus trisphaera* | * |
| *Ircinia* sp. | * |
| Monaxonida sp. 5 | * |
| Monaxonida sp. 15 | * |
| Monaxonida sp. 17 | * |
| Monaxonida sp. | * |
| Anthozoa | |
| *Asterosmilia prolifera* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 5 | * |
| *Lophogorgia* sp. 1 | * |
| *Neospongodes agassizii* | * |
| Polychaeta | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 15 |
| Gastropoda | |
| *Vermicularia* sp. | 6 |
| Bivalvia | |
| *Arca zebra* | 14 |
| *Barbatia candida* | 24 |
| *Chlamys* sp. | 6 |
| *Hiatella arctica* | 4 |
| *Malleus candeanus* | 4 |
| *Plicatula gibbosa* | 3 |
| *Pteria colymbus* | 2 |
| Cirripedia | |
| *Balanus trigonus* | 2 |
| Decapoda | |
| Callianassidae | 1 |
| *Munida* sp. | 1 |
| Palaemonidae sp. | 1 |
| *Palicus* sp. | 1 |
| *Portunus* sp. | 1 |
| *Pseudomedaeus* sp. | 1 |
| *Stenorynchus* sp. | 1 |
| *Symethis variolosa* | 1 |

| Species | Number of Individuals |
|---|---|
| **Bryozoa** | |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| **Asteroidea** | |
| *Narcissia trigonaria* | 1 |
| **Ophiuroidea** | |
| *Asteroporpa annulata* | 8 |
| *Astrocycles* sp. | 2 |
| *Astrophyton muricatum* | 1 |
| Ophiactidae sp. | 1 |
| **Echinoidea** | |
| *Arbacia punctulata* | 3 |
| **Holothuroidea** | |
| *Phyllophorus occidentalis* | 1 |
| **Crinoidea** | |
| *Comactinia* sp. | 9 |
| **Osteicthyes** | |
| *Chromis enchrysurus* | 1 |

James Island Block 380
Biological Dredge - Station 122 (20-A-a)

Date of Collection: October 2, 1978
Water Depth: 49.0 - 54.0 meters
Length of Tow: 93 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Monaxonida sp. | * |
| Porifera sp. 6 | * |
| Tetractinellida sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| Gorgonacea sp. 5 | * |
| *Madracis asperula* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Bivalvia | |
| *Malleus candeanus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Glyptoxanthus erosus* | 1 |
| *Melybia* sp. | 5 |
| *Micropanope sculptipes* | 5 |
| *Micropanope* sp. | 2 |
| *Mithrax acuticornis* | 3 |
| *Mithrax cornutus* | 1 |
| *Pagurus* sp. | 1 |
| *Platyactaea setigera* | 1 |
| *Symethis variolosa* | 2 |
| Bryozoa | |
| *Cigclisula serrutata* | * |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 1 |
| *Ophiothrix angulata* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 3 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| *Clavelina gigantea* | * |
| *Polyandrocarpa* sp. | * |
| Osteicthyes | |
| *Halichoeres* sp. | 1 |

James Island Block 463
Biological Dredge - Station 101 (1-A-a)

Date of Collection: September 24, 1978
Water Depth: 46.0 meters
Length of Tow: 102 meters

| Species | Number of Individuals |
|---|---|
| Phaeophyta | |
| *Dictyopteris justii* | * |
| Porifera | |
| *Endectyon tenax* | * |
| *Geodia* sp. | * |
| *Ircinia campana* | * |
| Porifera sp. 7 | * |
| Spirastrellidae sp. 2 | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| Anthozoa | |
| *Diodogorgia nodulifera* | * |
| Gorgonacea sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Virgularia presbytes* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Gastropoda | |
| *Cantharus multangulus* | 1 |
| *Crucibulum auricula* | 1 |
| *Phyllonotus pomum* | 1 |
| *Polinices lacteus* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Chione latilirata* | 4 |
| *Chama congregata* | 2 |
| *Laevicardium pictum* | 1 |
| *Pseudochama radians* | 1 |
| Decapoda | |
| *Cycloes bairdii* | 1 |
| Diogenidae sp. | 3 |
| *Galathea* sp. | 1 |
| *Mithrax pleuracanthus* | 1 |
| Paguridae sp. | 6 |
| *Parthenope fraterculus* | 1 |
| *Pilumnus* sp. | 1 |
| *Porcellana* sp. | 1 |
| *Pylopagurus* sp. | 2 |
| *Stenocionops* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| **Ophiuroidea** | |
| *Asteroporpa annulata* | 1 |
| *Ophioderma appressum* | 1 |
| *Ophiothrix angulata* | 1 |

James Island Block 463
Biological Dredge - Station 102 (2-A-a)

Date of Collection: September 24, 1978
Water Depth: 47.0 - 49.5 meters
Length of Tow: 78 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Hadromerida sp. 2 | * |
| Spirastrellidae sp. 2 | * |
| Anthozoa | |
| *Lophogorgia* sp. 2 | * |
| *Virgularia presbytes* | * |
| *Telesto sanguinea* | * |
| *Telesto* sp. | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 5 |
| Gastropoda | |
| *Chicoreus florifer* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Amygdalum papyrium* | 1 |
| *Arca zebra* | 1 |
| *Chama congregata* | 1 |
| *Corbula dietziana* | 1 |
| *Laevicardium pictum* | 3 |
| Stomatopoda | |
| *Gonodactylus bredini* | 2 |
| Decapoda | |
| *Calappa* sp. | 4 |
| *Callidactylus* sp. | 1 |
| *Cycloes bairdii* | 1 |
| Diogenidae sp. | 2 |
| *Galathea* sp. | 1 |
| Goneplacidae sp. | 1 |
| *Micropanope* sp. | 1 |
| Paguridae sp. | 4 |
| *Parthenope fraterculus* | 4 |
| *Pilumnus* sp. | 1 |
| *Podochela* sp. | 8 |
| *Pseudomedaeus* sp. | 5 |
| *Pylopagurus* sp. | 1 |
| *Scyllarus chacei* | 2 |
| *Solenolambrus* sp. | 4 |
| *Synalpheus* sp. | 2 |

| Species | Number of Individuals |
|---|---|
| **Bryozoa** | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| **Ophiuroidea** | |
| *Ophiothrix angulata* | 6 |
| **Ascidiacea** | |
| *Ascidia* sp. | * |
| Ascidiidae sp. | * |
| **Osteicthyes** | |
| *Hemipteronotus* sp. | 1 |

James Island Block 463
Biological Dredge - Station 103 (3-A-a)

Date of Collection: September 24, 1978
Water Depth: 45.5 meters
Length of Tow: 105 meters

| Species | Number of Individuals |
| --- | --- |
| Chlorophyta | |
| *Struvea ramosa* | * |
| Phaeophyta | |
| *Spatoglossum schroederi* | * |
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| Porifera | |
| Calcarea sp. 1 | * |
| Choristida sp. 1 | * |
| *Cinachyra alloclada* | * |
| *Endectyon tenax* | * |
| *Geodia* sp. | * |
| *Ircinia* sp. | * |
| Keratosa sp. 1 | * |
| Monaxonida sp. 6 | * |
| Monaxonida sp. | * |
| *Spinosella* sp. | * |
| Spirastrellidae sp. 2 | * |
| Tetractinellida sp. | * |
| Scyphozoa | |
| *Stephanoscyphus corniformis* | * |
| Hydrozoa | |
| *Cryptolaria pectinata* | * |
| *Lafoea* sp. | * |
| *Lytocarpus clarkei* | * |
| *Sertularella* cf. *distans* | * |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Diodgorgia nodulifera* | * |
| *Muricea pendula* | * |
| *Virgularia presbytes* | * |
| *Phyllangia americana* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 7 |
| Gastropoda | |
| *Cypraea spurca acicularis* | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 1 |
| *Chama congregata* | 1 |
| *Chione latilirata* | 2 |
| *Pseudochama radians* | 1 |
| *Pycnodonte hyotis* | 1 |

| Species | Number of Individuals |
| --- | --- |
| Cephalopoda | |
| *Octopus* sp. | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Calappa* sp. | 8 |
| *Callidactylus asper* | 3 |
| *Carpoporus papulosus* | 1 |
| *Galathea* sp. | 1 |
| *Mithrax pleuracanthus* | 4 |
| *Osachila semilevis* | 1 |
| *Parthenope fraterculus* | 3 |
| *Pilumnus* sp. | 3 |
| *Portunus ordwayi* | 1 |
| *Portunus spinicarpus* | 2 |
| *Portunus* sp. | 1 |
| *Psuedomedaeus* sp. | 1 |
| *Pylopagurus* sp. | 1 |
| *Stenocionops* sp. | 3 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifaca* | * |
| *Hippopetraliella bisinuata* | * |
| *Schizoporella cornuta* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Astropecten articulatus* | 3 |
| Ophiuroidea | |
| *Ophiothrix angulata* | 2 |
| Echinoidea | |
| *Eucidaris tribuloides* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 1 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| *Eudistoma* sp. | * |
| Synocidae sp. | * |
| Osteicthyes | |
| *Chromis enchrysurus* | 1 |
| *Rypticus bistrispinus* | 1 |

James Island Block 463
Biological Dredge - Station 104 (4-A-a)

Date of Collection: September 24, 1978
Water Depth: 46.0 - 49.0 meters
Length of Tow: 136 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Endectyon tenax* | * |
| Monaxonida sp. 5 | * |
| Hydrozoa | |
| *Lytocarpus clarkei* | * |
| *Nemestesia simplex* | * |
| Anthozoa | |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Lophogorgia hebes* | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 8 |
| Gastropoda | |
| *Architectonica nobilis* | 1 |
| *Chicoreus florifer* | 2 |
| *Oliva sayana* | 4 |
| *Vermicularia knorri* | 4 |
| Bivalvia | |
| *Anadara notabilis* | 1 |
| *Chama congregata* | 1 |
| *Chlamys benedicti* | 1 |
| *Corbula dietziana* | 1 |
| *Laevicardium pictum* | 1 |
| *Pododesmus rudis* | 1 |
| Decapoda | |
| *Alpheus* sp. | 1 |
| *Calappa* sp. | 8 |
| *Callidactylus asper* | 1 |
| *Carpoporus papulosus* | 3 |
| *Collodes* sp. | 2 |
| *Ethusa* sp. | 1 |
| *Macrocoeloma* sp. | 1 |
| Paguridae sp. | 3 |
| *Parthenope fraterculus* | 2 |
| *Parthenope* sp. | 1 |
| *Pylopagurus* sp. | 1 |
| *Solenolambrus* sp. | 3 |

| Species | Number of Individuals |
| --- | --- |
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Halophila johnstoniae* | * |
| *Smittipora levenseni* | * |
| **Ophiuroidea** | |
| *Asteroporpa annulata* | 1 |
| *Ophiothrix angulata* | 1 |

James Island Block 463
Biological Dredge - Station 105 (5-A-a)

Date of Collection: September 24, 1978
Water Depth: 47.0 meters
Length of Tow: 82.0 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Cinachyra alloclada* | * |
| *Endectyon tenax* | * |
| *Geodia* sp. | * |
| Porifera sp. 8 | * |
| Spirastrellidae sp. 2 | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| *Nemestesia simplex* | * |
| Anthozoa | |
| Balanophyllia floridana | * |
| *Lophogorgia* sp. | * |
| *Telesto sanuinea* | * |
| *Titanideum frauenfeldii* | * |
| *Virgularia presbytes* | * |
| Polychaeta | |
| Polychaeta spp. | 37 |
| Gastropoda | |
| *Cymatium pileare* | 1 |
| *Fasciolaria lilium hunteria* | 1 |
| Bivalvia | |
| *Anadara notabilis* | 1 |
| *Americardia media* | 1 |
| *Arca zebra* | 5 |
| *Argopecten gibbus* | 1 |
| *Chama congregata* | 3 |
| *Chama macerophylla* | 1 |
| *Chione latilirata* | 2 |
| *Corbula dietziana* | 2 |
| *Laevicardium pictum* | 6 |
| *Papyridea soleniformis* | 1 |
| *Pododesmus rudis* | 1 |
| *Pteria colymbus* | 1 |
| Decapoda | |
| *Calappa* sp. | 6 |
| *Carpoporus papulosus* | 1 |
| Diogenidae sp. | 2 |
| Paguridae sp. | 9 |
| *Parthenope fraterculus* | 2 |
| *Podochela* sp. | 4 |
| *Pseudomedaeus* sp. | 1 |
| *Scyllarus chacei* | 1 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Crisia eburnea* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleurifera mucronta* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 2 |
| *Ophiothrix angulata* | 3 |
| Ascidiacea | |
| *Eudistoma* sp. | * |

James Island Block 463
Biological Dredge - Station 106 (6-A-a)

Date of Collection: September 24, 1978
Water Depth: 47.0 - 47.5 meters
Length of Tow: 96 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Membranoptera* sp. | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| *Cinachyra alloclada* | * |
| *Ircinia campana* | * |
| *Ircinia* sp. | * |
| Keratosa sp. | * |
| Monaxonida sp. 2 | * |
| Monaxonida sp. 3 | * |
| Porifera sp. | * |
| Spirastrellidae sp. 2 | * |
| Anthozoa | |
| *Antipathes rhipidion* | * |
| Anthothelidae sp. | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| *Virgularia presbytes* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 26 |
| Gastropoda | |
| *Cypraea spurca acicularis* | 2 |
| *Turritella exoleta* | 7 |
| Bivalvia | |
| *Anadara notabilis* | 2 |
| *Arca zebra* | 1 |
| *Chama macerophylla* | 1 |
| *Chlamys benedicti* | 2 |
| *Laevicardium pictum* | 2 |
| *Lyonsia beana* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |
| Decapoda | |
| *Alpheus* sp. | 2 |
| *Calappa* sp. | 5 |
| *Carpoporus papulosus* | 1 |

| Species | Number of Individuals |
|---|---|
| **Decapoda** (cont.) | |
| **Diogenidae** sp. | 1 |
| *Galathea* sp. | 1 |
| *Leptodius* sp. | 1 |
| *Micropanope* sp. | 2 |
| *Mithrax* sp. | 6 |
| **Paguridae** sp. | 5 |
| *Parthenope fraterculus* | 11 |
| *Pilumnus* sp. | 1 |
| *Podochela* sp. | 1 |
| *Portunus ordwayi* | 1 |
| *Pseudomedaeus* sp. | 1 |
| *Pylopagurus* sp. | 3 |
| *Ranilia* sp. | 1 |
| *Solenolambrus* sp. | 1 |
| *Stencionops* sp. | 3 |
| *Symethis* sp. | 11 |
| **Bryozoa** | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleurifera mucronata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| **Ophiuroidea** | |
| *Ophioderma appressum* | 1 |
| *Ophioderma brevispinum* | 2 |
| *Ophiomyxa flaccida* | 1 |
| *Ophiothrix angulata* | 6 |
| **Echinoidea** | |
| *Eucidaris tribuloides* | 2 |
| **Ascidiacea** | |
| *Ascidia* sp. | * |
| *Eudistoma* sp. | * |
| **Didemnidae** sp. | * |

James Island Block 463
Biological Dredge - Station 107 (7-A-a)

Date of Collection: September 24, 1978
Water Depth: 56.5 - 57.5 meters
Length of Tow: 113 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Calcarea sp. 2 | * |
| *Dictyociona adioristica* | * |
| Hadromerida sp. 3 | * |
| Monaxonida sp. 3 | * |
| Monaxonida sp. 5 | * |
| Monaxonida sp. 6 | * |
| Monaxonida sp. | * |
| *Placospongia melobesioides* | * |
| Porifera sp. | * |
| Spirastrellidae sp. 2 | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Cladocora debilis* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Lophogorgia* sp. 3 | * |
| *Neospongodes agassizi* | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 3 |
| Gastropoda | |
| *Anachis* sp. | 1 |
| *Fasciolaria tulipa* | 1 |
| *Natica* sp. | 1 |
| *Vermicularis knorri* | 1 |
| Decapoda | |
| *Collodes* sp. | 1 |
| *Euchirograpsus* sp. | 1 |
| *Galathea* sp. | 4 |
| *Latreutes* sp. | 1 |
| *Metapenaeopsis* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| **Decapoda (cont.)** | |
| *Metaporhaphis* sp. | 1 |
| *Micropanope* sp. | 8 |
| *Mithrax* sp. | 4 |
| *Osachila semilevis* | 2 |
| Paguridae sp. | 4 |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 2 |
| *Pseudomedaeus* sp. | 5 |
| *Pylopagurus* sp. | 1 |
| *Stenocionops* sp. | 1 |
| *Stenorynchus* sp. | 2 |
| *Symethis* sp. | 3 |
| *Synalpheus* sp. | 3 |
| **Bryozoa** | |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| **Asteroidea** | |
| *Luidia sagamina* | 1 |
| **Ophiuroidea** | |
| *Astrophyton muricatum* | 1 |
| *Ophioderma brevispinum* | 1 |
| *Ophithrix angulata* | 3 |
| **Echinoidea** | |
| *Eucidaris tribuloides* | 2 |
| **Ascidiacea** | |
| *Ascidia sp.* | * |
| **Osteicthyes** | |
| *Chromis enchrysurus* | 1 |
| *Scorpaena dispar* | 2 |

James Island Block 463
Biological Dredge - Station 108 (8-A-a)

Date of Collection: September 24, 1978
Water Depth: 54.5 - 55.5 meters
Length of Tow: 181 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 1 | * |
| *Leptofauchea rhodymenaides* | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Axinellidae sp. | * |
| *Endectyon tenax* | * |
| *Higginsia strigilata* | * |
| Keratosa sp. 2 | * |
| Monaxonida sp. 5 | * |
| Monaxonida sp. 9 | * |
| Hydrozoa | |
| *Dynamena dalmasi* | * |
| *Lytocarpus clarkei* | * |
| *Monostaechas quadridens* | * |
| *Nemestesia simplex* | * |
| Anthozoa | |
| *Antipathes rhipidion* | * |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 53 |
| Gastropoda | |
| *Natica canrena* | 1 |
| Bivalvia | |
| *Anadara notabilis* | 1 |
| *Arca zebra* | 1 |
| *Arcopsis adamsi* | 1 |
| *Argopecten gibbus* | 1 |
| *Atrina* sp. | 1 |
| *Barbatia candida* | 5 |
| *Chlamys benedicti* | 8 |
| *Laevicardium pictum* | 2 |
| *Lima pellucida* | 1 |

| Species | Number of Individuals |
|---|---|
| Bivalvia (cont.) | |
| *Nemocardium tinctum* | 1 |
| Ostreidae sp. | 1 |
| *Pitar fulminatus* | 1 |
| *Semele purpurascens* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Aetaea* sp. | 1 |
| *Alpheus* sp. | 1 |
| *Calappa* sp. | 2 |
| *Carpoporus papulosus* | 2 |
| Diogenidae sp. | 2 |
| *Galathea* sp. | 4 |
| *Macrocoeloma* sp. | 2 |
| Majidae sp. | 1 |
| *Metapenaeopsis* sp. | 3 |
| *Micropanope* sp. | 8 |
| Paguridae sp. | 9 |
| Palaemonidae sp. | 2 |
| *Palicus* sp. | 2 |
| *Parthenope fraterculus* | 11 |
| *Podochela* sp. | 6 |
| *Processa* sp. | 3 |
| *Pseudomedaeus* sp. | 7 |
| *Stenocionops* sp. | 1 |
| *Stenorynchus* sp. | 2 |
| *Symethis* sp. | 2 |
| *Synalpheus* sp. | 12 |
| Xanthidae sp. | 7 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Crisia eburnea* | * |
| *Halophila johnstoniae* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Goniaster tessellatus* | 1 |
| *Narcissia trigonaria* | 3 |
| *Chaetaster nodosus* | 1 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 7 |
| *Ophioderma appressum* | 1 |
| *Ophioderma brevispinum* | 2 |
| *Ophiothrix angulata* | 8 |

| Species | Number of Individuals |
|---|---|
| Holothuroidea | |
| *Psolus tuberculosus* | 1 |
| Crinoidea | |
| *Comactinia* sp. | 2 |
| Osteicthyes | |
| *Chriolepis* sp. | 1 |

James Island Block 463
Biological Dredge - Station 109 (9-A-a)

Date of Collection: September 24, 1978
Water Depth: 57.0 - 59.0 meters
Length of Tow: 138 meters

| Species | Number of Individuals |
|---|---|
| **Rhodophyta** | |
| *Peyssonnelia rubra* | * |
| **Porifera** | |
| Calcarea sp. | * |
| *Higginsia strigilata* | * |
| Porifera sp. 6 | * |
| **Hydrozoa** | |
| *Dynamena dalmasi* | * |
| *Lytocarpus clarkei* | * |
| *Nemestesia simplex* | * |
| **Anthozoa** | |
| *Antipathes rhipidion* | * |
| *Balanophyllia floridana* | |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Muricea* sp. | * |
| *Neospongodes agassizii* | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| **Polychaeta** | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 7 |
| **Gastropoda** | |
| *Cypraea spurca acicularis* | 2 |
| *Fusinus eucosmius* | 1 |
| *Turritella exoleta* | 3 |
| **Bivalvia** | |
| *Anadara notabilis* | 1 |
| *Arca zebra* | 1 |
| *Barbatia candida* | 2 |
| *Chlamys benedicti* | 2 |
| *Glans dominguensis* | 1 |
| *Papyridea soleniformis* | 1 |
| *Pecten raveneli* | 2 |
| **Stomatopoda** | |
| *Gonodactylus bredini* | 5 |

| Species | Number of Individuals |
|---|---|
| Decapoda | |
| *Alpheus* sp. | 1 |
| *Calappa* sp. | 5 |
| *Carpoporus papulosus* | 5 |
| *Galathea* sp. | 1 |
| *Leptodius* sp. | 4 |
| *Macrococloma* sp. | 1 |
| *Micropanope* sp. | 1 |
| *Mithrax* sp. | 11 |
| *Osachila semilevis* | 1 |
| Paguridae sp. | 13 |
| *Parthenope fraterculus* | 8 |
| Penaeidae sp. | 1 |
| *Podochela* sp. | 4 |
| *Pylopagurus* sp. | 2 |
| *Scyllarus depressus* | 1 |
| *Stenocionops* sp. | 2 |
| *Stenorynchus* sp. | 1 |
| *Symethis* sp. | 4 |
| *Synalpheus* sp. | 1 |
| Xanthidae sp. | 6 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleuifera mucronata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Asteroidea | |
| *Goniaster tessellatus* | 2 |
| *Othilia* sp. | 1 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 12 |
| *Astrocyclus* sp. | 1 |
| *Ophioderma brevispinum* | 2 |
| *Ophiothrix angulata* | 13 |
| Echinoidea | |
| Brissidae sp. | 1 |
| *Echinolampas depressa* | 2 |
| *Eucidaris tribuloides* | 2 |
| *Gonocidaris maculata* | 2 |
| *Stylocidaris affinis* | 2 |
| Crinoidea | |
| *Comactinia* sp. | 2 |
| Ascidiacea | |
| *Didemnidae* sp. | * |
| *Eudistoma* sp. | * |
| Osteicthyes | |
| *Gillellus* sp. | 1 |

James Island Block 463
Rock Dredge - Station 110 (9-A-a)

Date of Collection: September 24, 1978
Water Depth: 62.0 meters
Length of Tow: 119 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Higginsia strigilata* | * |
| Anthozoa | |
| *Ellisella* sp. | * |
| Asteroidea | |
| *Narcissia trigonaria* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |

James Island Block 463
Biological Dredge - Station 112 (10-A-b)

Date of Collection: September 24, 1978
Water Depth: 49.0 - 52.0 meters
Length of Tow: -

| Species | Number of Individuals |
|---|---|
| Chlorophyta | |
| *Struvea ramosa* | * |
| Rhodophyta | |
| *Gracilaria mammillaris* | * |
| *Leptofauchea rhodymenoides* | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| *Ircinia* sp. | * |
| Monaxonida sp. 7 | * |
| Porifera sp. 6 | * |
| Porifera sp. | * |
| Spirastrellidae sp. 2 | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Antipathes rhipidion* | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 10 |
| Gastropoda | |
| *Chicoreus florifer* | 1 |
| *Cypraea spurca acicularis* | 2 |
| *Turritella exoleta* | 1 |
| *Vermicularis* cf. *fargoi* | 1 |
| Bivalvia | |
| *Chlamys benedicti* | 2 |
| *Corbula dietziana* | 1 |
| *Lyropecten nodosus* | 1 |
| *Spondylus americanus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda | |
| *Collodes* sp. | 1 |
| Diogenidae sp. | 2 |
| *Dromidia antillensis* | 1 |
| *Galathea rostrata* | 1 |
| *Macrocoeloma eutheca* | 1 |
| *Macrocoeloma* sp. | 1 |
| *Micropanope* sp. | 3 |
| *Mithrax* sp. | 7 |
| Paguridae sp. | 5 |
| *Palicus* sp. | 4 |
| *Parthenope* sp. | 1 |
| *Pilumnus* sp. | 1 |
| *Portunus ordwayi* | 4 |
| *Pseudomedaeus distinctus* | 3 |
| *Scyllarus chacei* | 1 |
| *Stenocionops furcata* | 1 |
| *Stenorynchus* sp. | 1 |
| *Symethis* sp. | 4 |
| Xanthidae sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Hippopetraliella bisinuata* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 3 |
| *Astrocyclus* sp. | 1 |
| *Ophioderma brevispinum* | 4 |
| *Ophiomyxa flaccida* | 2 |
| *Ophiothrix angulata* | 5 |
| Echinoidea | |
| *Arbacia punctulata* | 1 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Osteicthyes | |
| *Gillellus* sp. | 1 |
| *Scorpaena dispar* | 3 |
| *Serranus annularis* | 1 |
| *Serranus phoebe* | 1 |

James Island Block 463
Biological Dredge - Station 113 (11-A-a)

Date of Collection: September 25, 1978
Water Depth: 50.0 - 54.0 meters
Length of Tow: 129 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Cinachyra alloclada* | * |
| *Dictyociona adioristica* | * |
| Monaxonida sp. | * |
| Porifera sp. | * |
| Anthozoa | |
| *Astrangia danae* | * |
| *Astrangia solitaria* | * |
| *Balanophyllia floridana* | * |
| *Ellisella* sp. | * |
| *Oculina varicosa* | * |
| *Phyllangia americana* | * |
| *Rhizosmilia maculata* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 6 |
| Gastropoda | |
| *Fasciolaria lilium hunteria* | 1 |
| *Oliva* sp. | 4 |
| *Phyllonotus pomum* | 1 |
| *Turritella exoleta* | 4 |
| Bivalvia | |
| *Anadara notabilis* | 2 |
| *Acropsis adamsi* | 1 |
| Decapoda | |
| *Cycloes bairdii* | 1 |
| Diogenidae sp. | 2 |
| *Echirograpsus* sp. | 1 |
| Paguridae sp. | 4 |
| *Parthenope fraterculus* | 1 |
| *Pylopagurus* sp. | 2 |
| *Ranilia* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Hippopleurifera mucronata* | * |
| *Stylopoma spongites* | * |

James Island Block 463
Biological Dredge - Station 115 (13-A-a)

Date of Collection: September 25, 1978
Water Depth: 45.0 - 47.0 meters
Length of Tow: 59 meters

| Species | Number of Individuals |
|---|---|
| Phaeophyta | |
| *Spatoglossum schroederi* | * |
| Rhodophyta | |
| *Cryptopleura* sp. | * |
| *Gracilaria* | * |
| *Rhodymenia pseudopalmata* | * |
| Hydrozoa | |
| *Lytocarpus clarkei* | * |
| *Nemertesia simplex* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Telesto sanguinea* | * |
| *Virgularia presbytes* | * |
| Polychaeta | |
| Polychaeta spp. | 4 |
| Gastropoda | |
| *Murex recurvirostris* | 1 |
| Bivalvia | |
| *Chione latilirata* | 2 |
| *Glycymeris americana* | 1 |
| *Laevicardium pictum* | 2 |
| *Pecten raveneli* | 2 |
| *Pitar fulminatus* | 1 |
| *Semele purpurascens* | 1 |
| Decapoda | |
| *Carpoporus papulosus* | 1 |
| *Cycloes bairdii* | 1 |
| Goneplacidae sp. | 1 |
| *Metaporhaphis* sp. | 1 |
| *Micropanope* sp. | 1 |
| Paguridae sp. | 1 |
| *Palicus* sp. | 1 |
| *Ranilia* sp. | 1 |
| Bryozoa | |
| *Hippopetraliella bisinuata* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| *Ophiothrix angulata* | 1 |
| Ascidiacea | |
| *Didemnum candidum* | * |
| *Eudistoma* sp. | * |
| *Molgula* sp. | * |
| *Polyandrocarpa* sp. | * |

James Island Block 463
Biological Dredge - Station 116 (14-A-a)

Date of Collection: September 25, 1978
Water Depth: 50.0 - 51.0 meters
Length of Tow: -

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| Corallinaceae sp. 2 | * |
| *Leptofauchea rhodymenoides* | * |
| *Peyssonnelia rubra* | * |
| Porifera | |
| *Higginsia strigilata* | * |
| Monaxonida sp. 2 | * |
| Porifera sp. 6 | * |
| Hydrozoa | |
| *Lafoea* sp. | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Diodogorgia nodulifera* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 8 |
| Gastropoda | |
| *Cypraea spurca acicularis* | 1 |
| *Marginella roscida* | 1 |
| Polyplacophora sp. | 1 |
| Acanthochitonidae sp. | 1 |
| Bivalvia | |
| *Arca zebra* | 3 |
| *Chlamys benedicti* | 1 |
| *Laevicardium pictum* | 1 |
| *Pecten raveneli* | 1 |
| *Semele purpurascens* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 13 |
| Decapoda | |
| Callianassidae sp. | 2 |
| *Carpoporus papulosa* | 2 |
| *Euchirograpsus* sp. | 1 |
| *Micropanope* sp. | 1 |
| *Mithrax* sp. | 4 |
| Paguridae sp. | 1 |
| *Parthenope fraterculus* | 6 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| *Portunus ordwayi* | 1 |
| *Stenocionops* sp. | 2 |
| *Symethis* sp. | 2 |
| Bryozoa | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Cigclisula serrulata* | * |
| *Halophila johnsontiae* | * |
| *Hippopetraliella bisinuata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 3 |
| *Ophiomyxa flaccida* | 1 |
| *Ophiothrix angulata* | 1 |
| Echinoidea | |
| *Stylocidaris affinis* | 1 |
| Holothuroidea | |
| *Thyone* sp. | 1 |
| Cephalochordata | |
| *Branchiostoma virginiae* | 2 |
| Osteicthyes | |
| *Anarchias yoshiae* | 2 |

James Island Block 463
Biological Dredge - Station 117 (15-A-a)

Date of Collection: September 25, 1978
Water Depth: 50.0 - 51.0 meters
Length of Tow: 137 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia occidentalis* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| Axinellidae sp. | * |
| *Chondrilla nucula* | * |
| *Cinachyra alloclada* | * |
| *Dictyociona adioristica* | * |
| *Higginisia strigilata* | * |
| *Ircinia* sp. | * |
| Porifera sp. 6 | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| *Lytocarpus clarkei* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 13 |
| Gastropoda | |
| *Cypraea spurca acicularis* | 1 |
| *Chicoreus florifer* | 1 |
| *Fusinus eucosmius* | 1 |
| *Oliva sayana* | 2 |
| *Vermicularia* cf. *fargoi* | 1 |
| *Vermicularia spirata* | 1 |
| Bivalvia | |
| *Aequipecten muscosus* | 1 |
| *Arca zebra* | 11 |
| *Argopecten gibbus* | 1 |
| *Chlamys benedicti* | 5 |
| *Laevicardium pictum* | 1 |
| *Pecten raveneli* | 2 |

| Species | Number of Individuals |
|---|---|
| Cirripedia | |
| *Balanus trigonus* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 4 |
| Decapoda | |
| *Calappa* sp. | 3 |
| *Carpoporus papulosus* | 3 |
| *Dromidia* sp. | 1 |
| *Hypoconcha* sp. | 1 |
| *Macrocoeloma* sp. | 1 |
| *Micropanope* sp. | 6 |
| *Mithrax* sp. | 6 |
| *Munida* sp. | 1 |
| *Osachila semilevis* | 1 |
| Paguridae sp. | 2 |
| *Parthenope fraterculus* | 6 |
| *Portunus ordwayi* | 1 |
| *Pseudomedaeus distinctus* | 4 |
| *Scyllarus chacei* | 2 |
| *Scyllarus depressus* | 1 |
| *Sicyonia* sp. | 1 |
| *Stenocionops* sp. | 2 |
| *Stenorynchus* sp. | 1 |
| *Symethis* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Hippopleurifera mucronata* | * |
| *Smittipora levenseni* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 16 |
| *Ophioderma brevispinum* | 1 |
| *Ophiomyxa flaccida* | 2 |
| *Ophiothrix angulata* | 5 |
| Echinoidea | |
| *Echinolampas depressa* | 2 |
| *Eucidaris tribuloides* | 3 |
| *Stylocidaris affinis* | 1 |
| Ascidiacea | |
| Didemnidae sp. | * |
| *Trididemnum* sp. | * |
| Osteicthyes | |
| *Anarchias yoshiae* | 2 |
| *Scorpaena dispar* | 1 |
| *Syngnathus elucens* | 1 |

James Island Block 463
Biological Dredge - Station 118 (16-A-a)

Date of Collection: September 25, 1978
Water Depth: 49.0 meters
Length of Tow: 93 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| Porifera | |
| Axinellidae sp. | * |
| *Cinachyra alloclada* | * |
| *Erylus trisphaera* | * |
| Monaxonida sp. 6 | * |
| Porifera sp. 8 | * |
| Porifera sp. | * |
| Anthozoa | |
| *Antipathes rhipidion* | * |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Diodogorgia nodulifera* | * |
| Lophogorgia sp. 2 | * |
| Lophogorgia sp. | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 5 |
| Gastropoda | |
| *Cypraea spurca acicularis* | 1 |
| *Distorsio constricta macgintyi* | 1 |
| *Marginella roscida* | 1 |
| Bivalvia | |
| *Argopecten gibbus* | 1 |
| *Chlamys benedicti* | 1 |
| *Pteria colymbus* | 2 |
| *Semele purpurascens* | 1 |
| Stomatopoda | |
| *Gonodoctylus bredini* | 5 |
| Decapoda | |
| *Calappa* sp. | 1 |
| *Callidactylus asper* | 1 |
| *Carpoporus papulosus* | 5 |
| *Macrocoeloma* sp. | 1 |
| *Mithrax* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| Decapoda (cont.) | |
| Paguridae sp. | 2 |
| *Palicus* sp. | 2 |
| *Parthenope fraterculus* | 11 |
| *Podochela* sp. | 4 |
| *Pseudomedaeus* sp. | 1 |
| *Scyllarus depressus* | 1 |
| *Stenocionops* sp. | 1 |
| *Stenopus* sp. | 1 |
| *Stenorynchus* sp. | 1 |
| *Symethis* sp. | 3 |
| Bryozoa | |
| Bryozoa sp. | * |
| *Celleporaria albirostris* | * |
| *Hippopetraliella bisinuata* | * |
| *Hippopleurifera mucronata* | * |
| *Nellia oculata* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Mediaster bairdii* | 1 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 8 |
| *Ophioderma brevispinum* | 3 |
| *Ophiomyxa flaccida* | 2 |
| *Ophiothrix angulata* | 4 |
| Echinoidea | |
| *Echinolampas depressa* | 1 |
| *Eucidaris tribuloides* | 3 |
| *Stylocidaris affinis* | 1 |
| Ascidiacea | |
| *Ascidia* sp. | * |
| Didemnidae sp. | * |
| Osteicthyes | |
| *Hippocampus erectus* | 1 |

# James Island Block 463
## Biological Dredge - Station 120 (18-A-a)

Date of Collection: September 25, 1978
Water Depth: 49.0 meters
Length of Tow: -

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| *Higginsia strigilata* | * |
| Monaxonida sp. 7 | * |
| Monaxonida sp. 8 | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| *Lytocarpus clarkei* | * |
| *Nemestesia simplex* | * |
| Anthozoa | |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 27 |
| Gastropoda | |
| *Chicoreus florifer* | 2 |
| *Cirsotrema dalli* | 1 |
| *Marginella roscida* | 1 |
| *Natica canrena* | 1 |
| Bivalvia | |
| *Anadara notabilis* | 1 |
| *Arca zebra* | 1 |
| *Argopecten gibbus* | 1 |
| *Corbula dietziana* | 1 |
| *Gastrochaena hians* | 1 |
| *Pecten raveneli* | 2 |
| Cirripedia | |
| *Lepas* sp. | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 8 |

| Species | Number of Individuals |
|---|---|
| Decapoda | |
| *Calappa* sp. | 4 |
| *Carpoporus papulosus* | 4 |
| *Galathea* sp. | 1 |
| *Hypoconcha* sp. | 1 |
| *Mithrax* sp. | 5 |
| Paguridae sp. | 2 |
| *Parthenope fraterculus* | 9 |
| *Podochela* sp. | 2 |
| *Scyllarus chacei* | 1 |
| *Solenolambrus* sp. | 2 |
| *Stenorynchus* sp. | 1 |
| *Symethis* sp. | 1 |
| *Synalpheus* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Hippopetralliella bisinuata* | * |
| *Hippopleuifera mucronata* | * |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Mediaster bairdii* | 1 |
| Ophiuroidea | |
| *Asteroporpa annulata* | 7 |
| *Ophiomyxa flaccida* | 3 |
| Echinoidea | |
| *Echinolampas depressa* | 3 |
| Ascidiacea | |
| Didemnidae sp. | * |

# James Island Block 463
## Biological Dredge - Station 121 (19-A-a)

Date of Collection: September 26, 1978
Water Depth: 51.0 meters
Length of Tow: 153 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Leptofauchea rhodymenoides* | * |
| *Peyssonnelia rubra* | * |
| *Rhodymenia pseudopalmata* | * |
| Porifera | |
| Monaxonida sp. | * |
| Porifera sp. 6 | * |
| Porifera sp. | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| *Lytocarpus clarkei* | * |
| *Monostaechas quadridens* | * |
| *Nemertesia simplex* | * |
| Anthozoa | |
| Anthothelidae sp. | * |
| *Antipathes rhipidion* | * |
| *Balanophyllia floridana* | * |
| *Cladocora arbuscula* | * |
| *Ellisella* sp. | * |
| Gorgonacea sp. 4 | * |
| *Lophogorgia* sp. | * |
| *Nidalia occidentalis* | * |
| *Paracyathus pulchellus* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 12 |
| Gastropoda | |
| *Crepidula fornicata* | 1 |
| Bivalvia | |
| *Barbatia candida* | 2 |
| *Semele purpurascens* | 1 |
| *Spondylus americanus* | 1 |
| Cirripedia | |
| *Balanus trigonus* | 10 |
| Stomatopoda | |
| *Gonodactylus bredini* | 3 |
| Decapoda | |
| Paguridae sp. | 2 |
| *Parthenope fraterculus* | 1 |
| *Symethis* sp. | 1 |

| Species | Number of Individuals |
|---|---|
| **Bryozoa** | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Halophila johnstoniae* | * |
| *Hippopetralliella bisinuata* | * |
| *Smittipora levenseni* | * |
| *Stylopoma spongites* | * |
| **Asteroidea** | |
| *Narcissia trigonaria* | 1 |
| **Ophiuroidea** | |
| *Asteroporpa annulata* | 1 |
| *Ophiomyxa flaccida* | 4 |
| **Ascidiacea** | |
| *Ascidia* sp. | * |
| *Didemnum candidum* | * |
| *Eudistoma* sp. | * |
| Didemnidae sp. | * |
| Synocidae sp. | * |

James Island Block 463
Rock Dredge - Station 122 (19-A-a)

Date of Collection: September 26, 1978
Depth of Water: 51.0 meters
Length of Tow: 23 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Porifera sp. 6 | * |
| Anthozoa | |
| *Lophogorgia* sp. 1 | * |

James Island Block 463
Biological Dredge - Station 123 (20-A-a)

Date of Collection: September 26, 1978
Water Depth: 48.0 meters
Length of Tow: 95 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| Axinellidae sp. | * |
| Monaxonida sp. 4 | * |
| Hydrozoa | |
| *Dynamena quadridentata* | * |
| *Lytocarpus clarkei* | * |
| *Phyroscyphus marginatus* | * |
| Anthozoa | |
| *Balanophyllia floridana* | * |
| *Diodogorgia nodulifera* | * |
| *Lophogorgia* sp. 2 | * |
| *Lophogorgia* sp. 3 | * |
| *Virgularia presbytes* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| *Phyllochaetopterus socialis* | * |
| Gastropoda | |
| *Oliva* sp. | 1 |
| Cephalopoda | |
| *Octopus* sp. | 1 |
| Bivalvia | |
| *Americardia media* | 1 |
| *Arca zebra* | 2 |
| *Argopecten gibbus* | 1 |
| *Chama congregata* | 1 |
| *Laevicardium pictum* | 1 |
| Decapoda | |
| *Calappa* sp. | 3 |
| *Collodes* sp. | 4 |
| *Ethusa* sp. | 1 |
| *Hypoconcha* sp. | 2 |
| *Macrocoeloma* sp. | 1 |
| *Osachila* sp. | 1 |
| Paguridae sp. | 5 |
| *Parthenope fraterculus* | 7 |
| *Podochela* sp. | 1 |
| *Portunus ordwayi* | 1 |
| *Pylopagurus* sp. | 2 |
| *Stenocionops* sp. | 2 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Amathia convulata* | * |
| *Celleporaria albirostris* | * |
| *Celleporaria magnifica* | * |
| *Halophila johnstoniae* | * |
| *Hippopetraliella bisinuata* | * |
| *Nellia oculata* | * |
| Asteroidea | |
| *Othilia modesta* | 1 |
| Ophiuroidea | |
| *Ophioderma brevispinum* | 1 |
| Echinoidea | |
| *Echinolampas depressa* | 1 |
| *Eucidaris tribuloides* | 5 |
| *Stylocidaris affinis* | 1 |
| Ascidiacea | |
| *Eudistoma* sp. | * |
| *Polyandrocarpa* sp. | * |
| Osteicthyes | |
| *Gillelus* sp. | 2 |

James Island Block 463
Biological Dredge - Station 124 (21-A-a)

Date of Collection: September 26, 1978
Water Depth: 50.0 meters
Length of Tow: 288 meters

| Species | Number of Individuals |
|---|---|
| **Rhodophyta** | |
| *Fauchea hassleri* | * |
| **Porifera** | |
| *Higginsia strigilata* | * |
| **Hydrozoa** | |
| *Dynamena dalmasi* | * |
| *Dynamena quadridentata* | * |
| **Anthozoa** | |
| Anthothelidae sp. | * |
| *Balanophyllia floridana* | * |
| *Cladocora debilis* | * |
| *Ellisella* sp. | * |
| *Lophogorgia* sp. 2 | * |
| *Nidalia occidentalis* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| *Virgularia presbytes* | * |
| **Polychaeta** | |
| *Phyllochaetopterus socialis* | * |
| Polychaeta spp. | 16 |
| **Gastropoda** | |
| *Crucibulum auricula* | 1 |
| *Murex recurvirostris rubidus* | 2 |
| **Bivalvia** | |
| *Arca zebra* | 1 |
| *Anadara notabilis* | 1 |
| *Argopecten gibbus* | 1 |
| *Callista eucymata* | 1 |
| *Laevicardium pictum* | 1 |
| **Decapoda** | |
| *Callidactylus asper* | 1 |
| *Dromidia* sp. | 1 |
| *Ebalia* sp. | 1 |
| *Ethusa* sp. | 1 |
| *Heterocrypta* sp. | 1 |
| *Hypoconcha* sp. | 1 |
| *Osachila semilevis* | 2 |
| Paguridae sp. | 4 |
| *Palicus* sp. | 1 |
| *Parthenope fraterculus* | 8 |
| *Podochela* sp. | 4 |
| *Pseudomedaeus* sp. | 1 |
| *Pylopagurus* sp. | 2 |
| *Ranilia* sp. | 1 |
| *Solenolambrus* sp. | 5 |

| Species | Number of Individuals |
|---|---|
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Nellia oculata* | * |
| Ophiuroidea | |
| *Asteroporpa annulata* | 1 |
| *Ophiothrix angulata* | 4 |
| Echinoidea | |
| *Ecuidaris tribuloides* | 2 |
| Osteicthyes | |
| *Chromis enchrysurus* | 1 |
| *Gillellus* sp. | 1 |
| *Hippocampus erectus* | 2 |
| *Ophidion holbrooki* | 1 |
| *Syngnathus elucens* | 1 |

Brunswick Block 912
Biological Dredge - Station 204 (4-A-a)

Date of Collection: October 4, 1978
Water Depth: 36.5 meters
Length of Tow: 247 meters

| Species | Number of Individuals |
|---|---|
| Anthozoa | |
| *Lophogorgia hebes* | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 32 |
| Bivalvia | |
| *Arcinella cornuta* | 1 |
| *Chione latilirata* | 1 |
| *Macrocallista maculata* | 1 |
| Decapoda | |
| *Callidactylus asper* | 1 |
| *Cycloes bairdii* | 1 |
| *Galathea rostrata* | 1 |
| *Hypoconcha sabulosa* | 1 |
| *Iliacantha intermedia* | 2 |
| *Metapenaeopsis* sp. | 2 |
| *Parthenope granulata* | 4 |
| *Pilumnus sayi* | 5 |
| *Porcellana* sp. | 1 |
| *Portunus gibbesii* | 1 |
| *Pylopagurus* sp. | 1 |
| *Synalpheus* sp. | 4 |
| Asteroidea | |
| *Astropecten duplicatus* | 1 |
| Osteicthyes | |
| *Synacium micrurum* | 1 |

Brunswick Block 912
Biological Dredge - Station 205 (5-A-a)

Date of Collection: October 4, 1978
Water Depth: 36.5 meters
Length of Tow: 194 meters

| Species | Number of Individuals |
|---|---|
| Porifera | |
| *Anthosigmella varians* | * |
| Calcarea sp. 1 | * |
| Calcarea sp. 2 | * |
| *Ircinia* sp. | * |
| Porifera sp. 2 | * |
| Hydrozoa | |
| *Thyroscyphus marginatus* | * |
| Anthozoa | |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| Polychaeta | |
| Polychaeta spp. | 26 |
| Gastropoda | |
| *Cyphoma signatum* | 1 |
| *Oliva sayana* | 3 |
| *Vermicularia* sp. | 2 |
| Bivalvia | |
| *Aequipecten muscosus* | 1 |
| *Arcinella cornuta* | 5 |
| *Chama* sp. | 4 |
| *Chione latilirata* | 3 |
| *Laevicardium pictum* | 2 |
| *Pinctada imbricata* | 1 |
| Stomatopoda | |
| *Gonodactylus bredini* | 1 |
| Decapoda | |
| *Callidactylus asper* | 1 |
| *Collodes trispinosum* | 1 |
| *Cycloes bairdii* | 1 |
| *Hypoconcha sabulosa* | 1 |
| *Iliacantha intermedia* | 2 |
| *Petrochirus* sp. | 1 |
| *Pilumnus sayi* | 3 |
| *Pylopagurus* sp. | 1 |
| *Solenolambrus* sp. | 1 |
| Bryozoa | |
| *Celleporaria albirostris* | * |
| *Smittipora levenseni* | * |
| *Hippopetraliella bisinuata* | * |
| Asteroidea | |
| *Astropecten articulatus* | 1 |
| Osteicthyes | |
| *Centropristis striata* | 1 |
| *Prionotus roseus* | 1 |

Brunswick Block 912
Biological Dredge - Station 206 (6-A-a)

Date of Collection: October 4, 1978
Water Depth: 36.5 meters
Length of Tow: 257 meters

| Species | Number of Individuals |
|---|---|
| Rhodophyta | |
| *Peyssonnelia rubra* | * |
| Porifera | |
| Choristida sp. 1 | * |
| *Ircinia* sp. | * |
| Anthozoa | |
| *Ellisella* sp. | * |
| *Telesto sanguinea* | * |
| *Titanideum frauenfeldii* | * |
| *Renilla reniformis* | * |
| Polychaeta | |
| *Filograna implexa* | * |
| Polychaeta spp. | 27 |
| Gastropoda | |
| *Crucibulum auricula* | 1 |
| *Diodora* sp. | 1 |
| *Vermicularia* sp. | 1 |
| Bivalvia | |
| *Arca zebra* | 1 |
| *Arcinella cornuta* | 2 |
| *Chama congregata* | 2 |
| *Chama* sp. | 5 |
| *Chione latilirata* | 5 |
| *Hiatella arctica* | 2 |
| *Laevicardium pictum* | 2 |
| *Macrocallista maculata* | 1 |
| Decapoda | |
| *Iliacantha intermedia* | 1 |
| *Micropanope sculptipes* | 1 |
| *Pachycheles* sp. | |
| Paguridae | 1 |
| *Parthenope granulata* | 1 |
| *Pilumnus sayi* | 2 |
| *Porcellana* sp. | 3 |
| *Portunus gibbesii* | 5 |
| *Pseudomedaeus agassizii* | 1 |
| *Trachypenaeus* sp. | 1 |
| Bryozoa | |
| *Smittipora levenseni* | * |
| Asteroidea | |
| *Luidia alternata* | 1 |
| *Luidia clathrata* | 1 |
| Holothuroidea | |
| *Thyonella pervicax* | 1 |
| Ascidiacea | |
| *Didemnum candidum* | * |
| Osteicthyes | |
| *Prionotus roseus* | 2 |