

**SURVEY OF THE INTERTIDAL  
AND SUBTIDAL OYSTER RESOURCES  
OF THE GEORGIA COAST<sup>1</sup>**

by

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## INTRODUCTION

The American Oyster, *Crassostrea virginica* (Gmelin), is one of Georgia's ten most valuable marine fishery resources. In recent years, the oyster fishery has declined drastically. For this reason, in 1973 the Georgia Department of Natural Resources began a 5-year program to investigate the reasons for this decline and develop the technology to assist the industry to once again prosper. An integral part of the overall program was a survey (completed 30 June 1977) to determine the locations and the extent of Georgia's intertidal and subtidal oyster resources.

Previous surveys of Georgia's oyster resources were conducted by Drake (1891), Galtsoff and Luce (1930), and Linton (1969). The results of this recent survey are compared with the previous surveys to determine changes in the geographic locations and areal extent of Georgia's oyster resources through the years.

## HISTORY OF THE FISHERY

Oysters have been a source of food and construction material in Georgia for thousands of years. The presence of a 100 meter diameter oyster shell ring on Sapelo Island documents that coastal Indians utilized large amounts of oysters as long as 3500 years ago (Moore, 1897; Williams, 1965). Early settlers, including Spanish missionaries and English colonists, used oyster shell to make tabby, the chief building material of the time. Settlers also relied heavily on oysters as food (Hart, 1978, pers. comm.). During the late 1800's, oyster canneries developed in several locations along the Georgia coast. Oyster canneries were operated during the 20th century in Thunderbolt, Brunswick, and Cedar Point by the Maggioni family; at Harris Neck by the Oemlers; and in Darien by the Ploegers. The Ploeger facility was the last cannery to operate in Georgia, closing business in 1960. An indication of the magnitude of cannery activity is documented in a publication of the Brunswick, Georgia, Board of Trade (Irvine, 1902).

"There are over 50,000 acres of oyster beds in the county, and about one half of which are partly cultivated and protected. The Glynn County, or better known as the Brunswick oysters, are of superior quality, and command a premium in the markets. Thousands of bushels are shipped to the interior markets each season; and the two canneries pack and ship 30,000 cases of oysters annually. This industry affords excellent opportunities for further development."

During the latter part of the nineteenth century and early in the twentieth century, Georgia's oyster fishery experienced wide fluctuations in landings. Since complete annual records are not available prior to 1950, it is impossible to compare precise yearly differences; however, increases and declines representing over one million pounds of oyster meats occurred during two to five year time spans. The most drastic decline (from 8 million to 3 million lb.) occurred between 1908 and 1910 (Figure 1).

Since 1936, annual landings fluctuated only slightly, but gradually declined from a high of 330,000 lb. in 1936 to a low of 38,000 lb. in 1978. These figures, and discussions with persons familiar with statistics collection during that time, make the figures of the early 1900's suspect (Anderson, 1978, pers. comm.). However, landings throughout the region were high during the early 1900's suggesting that either overfishing and/or disease created a tremendous decline in Georgia's oyster population shortly thereafter.

From 1967 through 1973, oysters ranked fourth in value of all marine fishery products in Georgia, exceeded only by shrimp, blue crabs, and shad. During 1974 and 1975, the oyster industry suffered two of the worst years in the fishery's recent history, declining to sixth and seventh in value, respectively. During 1976 and 1977, oysters ranked fifth in value with only red snapper continuing to encroach on oyster's number four ranking (Table 1).

In 1976 and 1977, Georgia's oyster fishery appeared to be rebounding slightly from the low of 45,000 lb. (\$25,000) in 1975. Production had increased to 87,000 lb. (\$75,000) by 1977. In 1978, however, oyster landings declined to 38,000 lb. (\$33,100), the lowest production in recorded history.

In 1978, only nine operators were licensed to harvest oysters in Georgia, although each may have several pickers working for him. Only one licensed operator currently shucks oysters and sells the meats. The remaining operators simply sell their harvest as shell stock. All harvesting takes place in the intertidal zone near low tide and is done by hand.

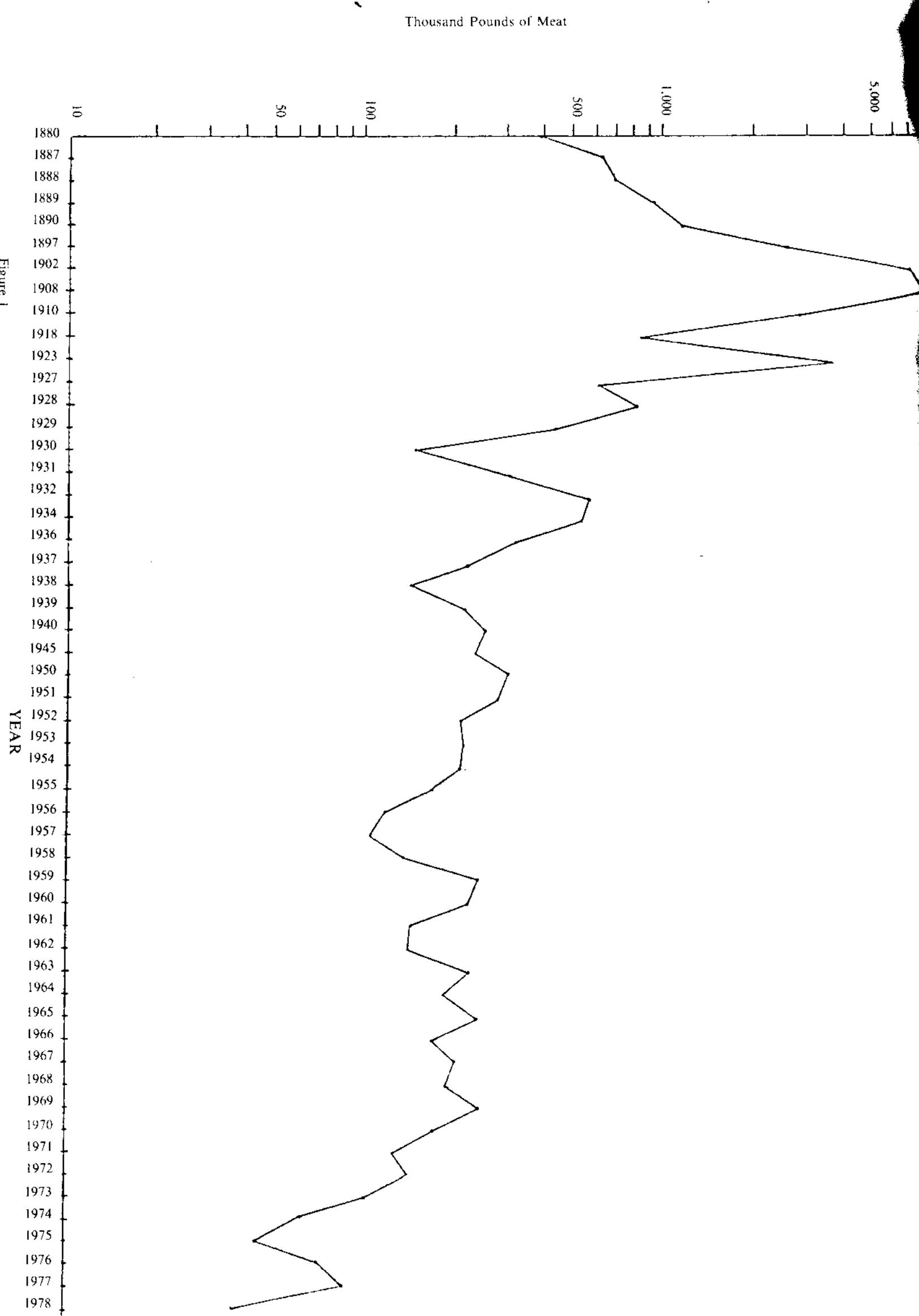


Figure 1.  
Natural logarithmic plot of quantity of oyster meats landed in Georgia during the years for which data are available from 1880 through 1978.  
(Source: Fishery Statistics of the United States, Statistical Digest No. 59-64, and Georgia Landings, Annual Summaries 1974-77).

## METHODS AND MATERIALS

### Intertidal Area

Charting the locations of oysters in the intertidal zone along the entire coast of Georgia was attempted by several methods. The first method involved measuring the lengths and widths of the beds with a 30 meter fiberglass tape measure. Since this was a very large and time consuming task, project personnel investigated two methods of remote sensing in an effort to accomplish the task in the most efficient, cost-effective manner. Thereafter, the tape measurement method was used only to gather ground truth data.

The first series of remote sensing methods used imagery taken with Kodak Aerocolor 2445 negative film at a scale of 1:24,000 exposed at low tide 2 December 1972. This imagery was selected since it was of the same scale as U. S. Geological Survey 7.5 minute topographic quadrangles that were to be used to chart the oyster bed locations.

Six frames of the 23 by 23 cm color transparencies were selected for evaluation. Ground truthing was first conducted by measuring the length and width of all beds imaged on the six test frames. Oyster beds were measured and recorded to the nearest meter. Project personnel then used the National Aeronautics and Space Administration's Earth Resources Data Analysis Facility at Kennedy Space Center to test the feasibility of delineating intertidal oyster beds from the photographs.

A Stanford Technology Corporation Digicol® (Model 40-20) with TV scanner was used to delineate the intertidal oyster beds located in selected sections of the photographs as well as the entire 23 by 23 cm image. Results were analyzed by direct observation of the scanner screen and compared with ground truth data.

Selected portions of the photographs were masked and processed using a Photomat P-1700 Drum Scanning Micro-Densitometer at 50 micron spot size and 100 micron spot size with Kodak Wratten 47B, 58, and 25 filters and without filter. Data were transferred to magnetic tape and analyzed using a General Electric Image 100® and compared with ground truth data.

The Image 100® was also used to analyze selected sections of the six test images as well as entire photographs using an integrated color TV scanner. Results were compared with ground truth data. The Image 100® was also used to provide an analysis of the color quality of the photographs.

A Nuclear Research Instrument (Division of Houston Fearless Corporation) Veriscan Viewer® (Mark II - Type 3) was used to enlarge the photographs up to 28 times in order to determine if direct visual observation after enlargement would provide adequate results.

The second set of remote sensing methods involved flying at low altitude over the oyster beds at low tide and sketching the length of the bed onto USGS 7.5 minute quadrangle charts. Since the quadrangles were of sufficient scale that even very small creeks were shown, it was a relatively simple procedure for an experienced technician to sketch reasonably accurate locations of the oyster beds onto the chart. Widths of the oyster beds were estimated and lengths calculated using dividers and comparing to chart scale. Sizes of oyster beds were presented in meters or square meters. Densities of oysters were divided into four categories: very dense, moderate, sparse, and very sparse.

### Subtidal Area

Locating subtidal oysters was accomplished by towing a tickler chain (a length of rope with a 2 meter length of 0.95 cm chain attached). The surveyor maintained hand contact with the rope as the chain was towed across the bottom in a zig-zag pattern across the bodies of water sampled. On encountering rough bottom, resulting vibrations were transferred via the chain to the rope and the hand of the surveyor. The cause of the vibrations was determined with a .67 meter conventional style oyster dredge. The size of subtidal oyster beds was determined by marking the limits of the bed using styrofoam buoys with 3 meter poles and flags attached. A 30 or 60 meter baseline was then established on shore, midway (as near as possible) between the two flag buoys. Three meter, 5 by 5 cm poles were driven into the substrate at both ends of the baseline. A sextant was then used to determine six angles (the angles between each of the flagbuoys and the opposite baseline pole and the angle between the adjacent pole and the flag buoys). Triangulation was used to determine the length of the oyster bed. Widths were estimated for lack of an area to establish a suitable baseline. Locations were charted on USGS 7.5 minute quadrangle charts and areas were calculated and presented in square meters.

Table 1.  
Comparative values (thousands of dollars) of the top ten Georgia marine fishery products landed from  
1967-77 [N = not in top ten]

Product	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
Shrimp	3,022	4,929	4,984	3,371	6,466	5,615	9,343	5,587	10,488	10,879	6,842
Blue Crab	380	298	438	428	680	825	969	1,226	1,155	1,087	1,632
Shad	55	139	182	140	133	112	91	63	99	57	84
Oysters	114	107	144	100	73	87	65	36	26	49	75
Red snapper	21	7	9	11	40	41	18	42	33	76	125
Scup or Porgy	N	N	N	N	N	N	N	N	N	18	74
Groupers	16	3	2*	8	8	11	13	18	N	23	64
Catfish & Bullheads	15	12	24	24	23	25	34	43	43	43	42
King Whiting	19	15	13	15	19	25	34	30	41	48	38
Flounders	4	5	5	N	9	13	18	16	24	35	28
Spotted sea trout	2	N	N	N	N	N	10	N	13	N	N
Sea bass	N	N	3	N	16	29	N	17	6	N	N
Calico Scallops	N	28	N	34	N	N	N	N	N	N	N
Hard clams	N	N	N	7	N	N	N	N	N	N	N
Hickory shad	N	N	2*	N	N	N	N	N	N	N	N

\*Equal

Source:  
Fishery Statistics of the United States, Bureau of Commercial Fisheries; Fish and Wildlife Service, U. S.  
Dept. of the Interior, Annual Publications.

## RESULTS AND DISCUSSION

Approximately 101 hectares (251 acres) of live intertidal oysters, 16 hectares (40 acres) of subtidal oysters (averaging 50% live oysters and 50% dead shell), and 10 hectares (24.7 acres) of intertidal dead shell are located in Georgia's coastal waters (Table 2). Intertidal oysters were found in almost every body of water in coastal Georgia, while subtidal oyster beds were only found in Frederica River, Mackay River, Jones Creek, Hampton River, Altamaha Sound, and Darien River. The dead shell figure is probably very low, for it does not include the dead shell in areas where live oysters, even though sparse, were surrounded by dead shell.

Locations of Georgia's oyster resources are shown on photoreduced U. S. Geological Survey 7.5 minute quadrangle charts (Figure 2). On each of the photoreduced quadrangle sheets in Appendices A-BB, the sizes of oyster beds are given by length and width (in meters) or by area (in square meters). Those recorded in square meters indicate that several oyster beds were located in the general area, but for ease in charting, sizes were combined and general locations shown. Lack of a density notation in the charts indicates the beds were of the very dense category.

To determine changes which have occurred in Georgia's oyster resources over the years, it is necessary to compare results of the current survey with previous surveys.

The first survey of Georgia's oyster resources was conducted by the U. S. Coast and Geodetic Survey in 1889 (Drake, 1891). Drake charted over 700 hectares (about 1700 acres) of oysters in Georgia waters. Since Drake's methods included the use of a pole and sounding lead, he may have sampled an area the current survey missed—the subtidal area of shallow water directly adjacent to intertidal oyster beds. Although oysters do exist in this area, current observations indicate they rarely extend more than a few meters into the subtidal zone because of the presence of predators such as boring sponge (*Cliona* sp.) and oyster drills (*Thais* sp. and *Urosalpinx* sp.). Drake's (1891) figures are shown in parentheses next to the current survey's figures in Table 2.

As early as 1889, Drake (1891) noted a general depletion of natural oyster beds, especially beds which were located near oyster houses. Drake felt that continued depletion, especially that which was expected as a result of cannery harvest, would ultimately be beneficial to the industry by forcing private cultivation and the enactment of reasonable harvesting/transplanting laws.

A second survey of Georgia's oyster resources was conducted in 1925 (Galtsoff and Luce, 1930). This survey was not as extensive as Drake's 1889 survey for it did not include subtidal oysters. Galtsoff and Luce (1930) did not publish acreages for comparison but documented that no significant changes had occurred in the distribution and extent of intertidal oysters since Drake's survey 31 years earlier.

A third survey of Georgia's oyster resources was conducted in 1966-67 for the Georgia Game and Fish Commission by the University of Georgia Marine Institute (Linton, 1969). Linton's survey also excluded subtidal oysters. Linton did not provide individual water body acreages, but suggested that very few changes in the distribution of intertidal oysters had occurred since the 1925 study by Galtsoff and Luce (1930). This statement by Linton (1969) contradicts his findings that show 4130 hectares (10,200 acres) of intertidal oysters in coastal Georgia compared with the earlier figure of Drake (1891) of 700 hectares (1700 acres) of intertidal and subtidal oyster beds. It is not likely that a tremendous increase in Georgia's oyster resources occurred since Drake's 1700 acre estimate in 1889.

Of the three previous surveys, Drake's (1891) 1889 survey was the most useful for comparison with the current survey results. Drake's findings seem consistent with the findings of the current survey, since, in a fishery that has steadily declined over the years as has Georgia's oyster fishery, it is reasonable to assume that the resource has declined concurrently.

### Methodology Analysis

A secondary objective of this survey was to investigate the feasibility of using remote sensing technology to chart Georgia's intertidal oyster resources. Efforts to delineate intertidal oysters using the 1:24,000 color imagery described previously and analysis equipment proved promising, but at the time, economically unfeasible.

The Digicol® provided acceptable results for selected sections of one particular transparency but was unacceptable overall. Satisfactory results were obtained through General Electric Image 100® analysis after Micro-Densitometer processing at both 50 and 100 micron spot sizes, but again only for selected

Table 2.

Areal extent of intertidal and subtidal oysters located in coastal Georgia (from South to North) during a 1974-1977 survey (numbers in parentheses are those located during an 1889 survey by Drake (1891) and include both intertidal and subtidal oysters).

### Intertidal Oysters

Body of Water	m <sup>2</sup>	hectares	acres
Beach Creek	1,382	0.1	0.3
Cumberland Sound	80,019	8.0	19.8 (80.0)
St. Marys River	9,305	0.9	2.3 (12.0)
Point Peter Creek	351	<0.1	0.1
Kings Bay	23,285	2.3	5.8 (20.0)
Crooked River	16,936	1.7	4.2 (17.0)
Black Point Creek	1,697	0.2	0.4
Mud Creek	4,449	0.4	1.1 (16.0)
Cumberland River	109,272	10.9	27.0 (92.0)
Brickhill River	30,886	3.1	7.6 (20.0)
Mumford Creek	45	<0.1	<0.1
Grover Creek	144	<0.1	<0.1
Floyd Creek	423	<0.1	0.1 (13.0)
Christmas Creek	1,526	0.2	0.4
Satilla River	85,851	8.6	21.2 (26.0)
Jointer Creek	28,123	2.8	6.9
Turtle River	4,559	0.4	1.1 (82.0)
Umbrella Creek	5,383	0.5	1.3 (13.0)
Shellbine Creek	63	<0.1	<0.1 ( 1.0)
St. Andrew Sound	6,958	0.7	1.7 (25.0)
Little Satilla River	9,626	1.0	2.4 (25.0)
Jekyll Sound	1,576	0.2	0.4
Jekyll Creek	2,367	0.2	0.6
Cobb Creek	6,361	0.6	1.6
Luthram River	154	<0.1	<0.1
Brunswick River	25,609	2.6	6.3 (14.0)
South Brunswick River	917	0.1	0.2
St. Simons Sound	41,542	4.2	10.3
Plantation, Clubbs, and Parsons Creeks combined	1,360	0.1	0.3
Little River	250	<0.1	0.1 ( 8.0)
Mackay River	1,020	0.1	0.3 (37.5)
Frederica River	602	<0.1	0.1 (14.0)
Back River	2,850	0.3	0.7 (36.0)
Blackbank River	969	0.1	0.2
Village Creek	14,350	1.4	3.5 ( 7.0)
Hampton River	24,262	2.4	6.0 (33.5)
Buttermilk/Altamaha Sounds, Altamaha River combined	7,122	0.7	1.8
Beacon, Wolf Creeks combined	300	<0.1	0.1
South River	14,445	1.5	3.6 (20.5)
Rockdedundy, Darien and North Rivers combined	8,818	0.9	2.2 (36.0)
Back River	7,152	0.7	1.8

Table 2

Areal extent of intertidal and subtidal oysters located in coastal Georgia (from South to North) during a 1974-1977 survey (numbers in parentheses are those located during an 1889 survey by Drake (1891) and include both intertidal and subtidal oysters). (CONTINUED)

Body of Water	m <sup>2</sup>	hectares	acres
Doboy Sound	45,852	4.6	11.3
Carnigan River	11,348	1.1	2.8 (14.0)
Duplin River	9,632	1.0	2.4 (22.0)
Hudson, Atwood and Dark Creeks combined	14,703	1.5	3.6 ( 5.0)
Old Teakettle Creek	2,480	0.2	0.6 (25.5)
New Teakettle Creek	5,248	0.5	1.3 (14.0)
Crescent River	291	<0.1	0.1
Mud River	102,251	10.2	25.3 (40.5)
Eagle Creek	629	0.1	0.2
Front River	1,976	0.2	0.5 (11.5)
Sapelo River	1,952	0.2	0.5 (17.0)
Sapelo Sound	23,231	2.3	5.7
Blackbeard, Cabretta Creeks combined	32,794	3.3	8.1
Broro River	5,502	0.6	1.4
Julienton River	2,020	0.2	0.5 (14.0)
Shell Creek	321	<0.1	0.1
Little Mud River	4,716	0.5	1.2 (22.0)
Swain River	3,015	0.3	0.7
Barbour Island River	63,297	6.3	15.6 (15.5)
Wahoo River	9,301	0.9	2.3 (20.0)
Brunsen Creek	1,046	0.1	0.3
Johnson Creek	81	<0.1	<0.1 (37.0)
Harris Neck Creek	81	<0.1	<0.1
South Newport River	3,441	0.4	0.9 (32.0)
North Newport River	8,310	0.9	2.1 (43.0)
Timmons River	816	0.1	0.2 (20.0)
Mollclark River	2,225	0.2	0.5 ( 6.0)
Walburg Creek	861	0.1	0.2 (48.0)
Necessary Creek	72	<0.1	<0.1
McQueen Inlet	1,100	0.1	0.3
Jones, Gould and Dickinson Creeks combined	1,366	0.1	0.3
Vandyke, Dead, Ashley, and Cedar Creeks combined	1,534	0.2	0.4
Medway River	6,644	0.6	1.6 (49.0)
Bear River	2,256	0.2	0.6 (81.5)
Laurel View River	842	0.1	0.2
Belfast River	626	0.1	0.2
Carrs Neck Creek	415	<0.1	0.1
Kilkenny, Cabbage Creeks combined	918	0.1	0.2 (10.5)
Cane Patch Creek	670	0.1	0.2
Charles Creek	120	<0.1	<0.1
Bradley River	951	0.1	0.2 ( 8.5)

Table 2  
 Areal extent of intertidal and subtidal oysters located in coastal Georgia  
 (from South to North) during a 1974-1977 survey (numbers in  
 parentheses are those located during an 1889 survey by Drake (1891)  
 and include both intertidal and subtidal oysters). (CONTINUED)

Body of Water	m <sup>2</sup>	hectares	acres
Ogeechee River	7,176	0.7	1.8 (38.5)
Ossabaw Sound	954	0.1	0.2
Charles Creek	527	<0.1	0.1
Green Island Sound	1,261	0.1	0.3
Redbird Creek	301	<0.1	0.1 ( 2.5)
Little Ogeechee River	4,114	0.4	1.0 ( 7.0)
Delegal Creek	1,403	0.1	0.3 (22.5)
Vernon River	7,024	0.7	1.7 (20.0)
Adams Creek, Odingsell River combined	2,713	0.3	0.7 (42.5)
Wassaw Creek	326	<0.1	0.1 (17.0)
Old Romerly Marsh Channel, Romerly Marsh Creek combined	1,506	0.2	0.4 (10.0)
Burnside, Back Rivers combined	5,529	0.6	1.4 (17.5)
Skidaway River and Narrows combined	4,499	0.4	1.1 (12.0)
Isle of Hope River	732	0.1	0.2
Wilmington River	6,466	0.6	1.6 ( 8.0)
Halfmoon River, Tybee, Beard and Long Creeks combined	9,327	0.9	2.3
House Creek	258	<0.1	0.1
Tybee, Little Tybee Creeks combined	1,332	0.1	0.3
Tybee River	1,450	0.2	0.4 (49.0)
Shad River	519	<0.1	0.1
Wassaw Sound	541	<0.1	0.1
Oyster Creek	842	0.1	0.2 (1.75)
Turners Creek	129	<0.1	<0.1 (10.0)
Lazaretta Creek	252	<0.1	0.1 (19.0)
Herb River	695	0.1	0.2 (11.0)
Savannah River	939	0.1	0.2
<b>TOTALS</b>	<b>1,018,058</b>	<b>101.2</b>	<b>251.5</b>

#### Subtidal Oysters

Frederica River	1,372	0.1	0.3
Mackay River	13,990	1.4	3.5
Jones Creek	22,300	2.2	5.5
Hampton River	4,800	0.5	1.2
Altamaha Sound	107,246	10.7	26.5
Darien River	12,195	1.2	3.0
<b>TOTALS</b>	<b>161,903</b>	<b>16.1</b>	<b>40.0</b>

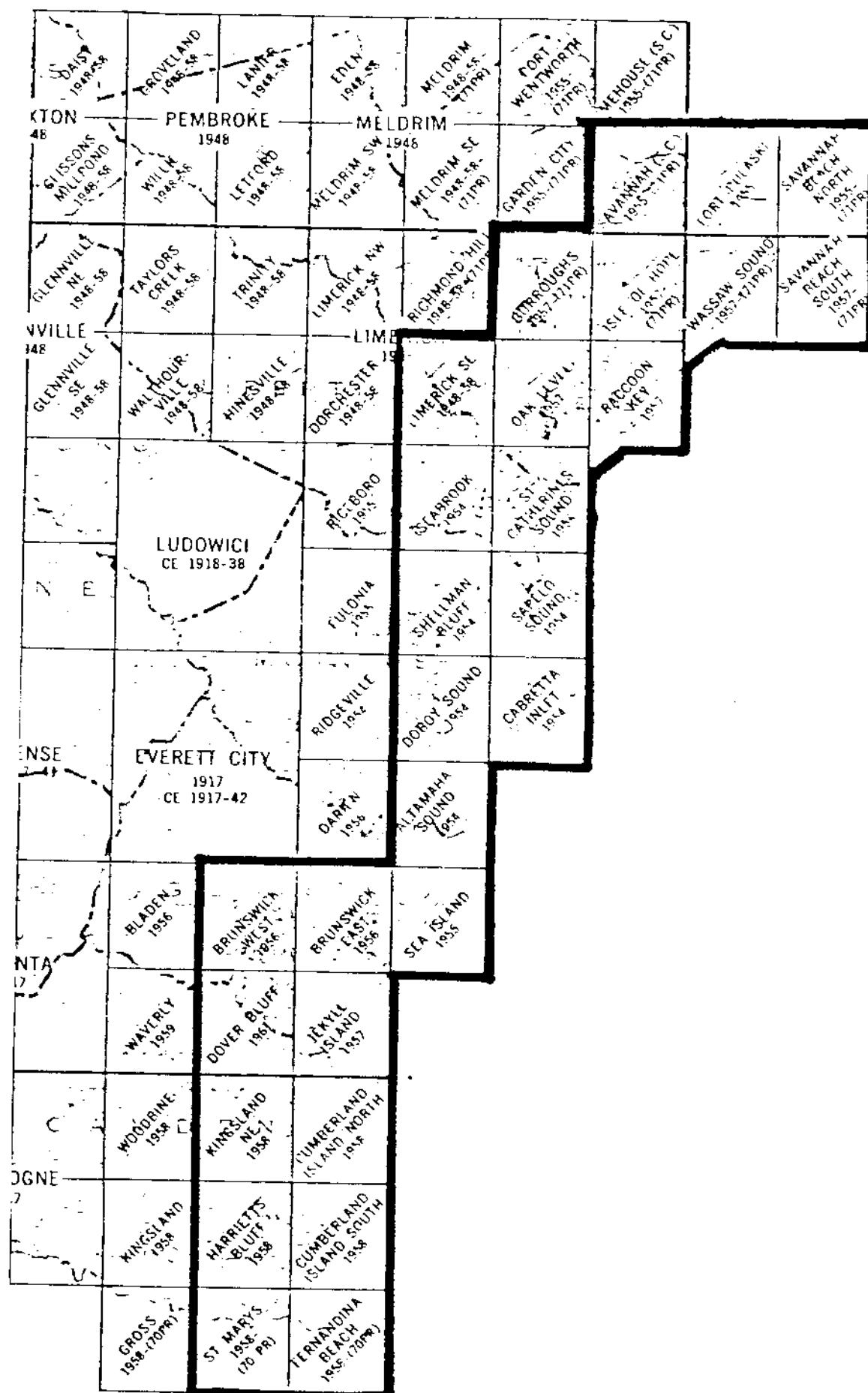


Figure 2.

Index to USGS 7.5 minute topographic quadrangles (charts for which live oyster resources were located in coastal Georgia are outlined in black).

sections of transparencies. This method was extremely time consuming. The Image 100® with TV scanner provided results similar to those obtained after Micro-Densitometer processing and was comparatively time-effective, except that only sections of transparencies could be accurately analyzed. Enlargement with the Veriscan Viewer® was of little use as definition was lost under enlargement.

Thus, while adequate results were obtained for specific sections of the six test frames using a variety of remote sensing techniques, none of the techniques provided the efficiency and time-effectiveness sought. It was conceded that an unreasonable amount of computer time and expense would be necessary to analyze over 400 photographs on a section-by-section basis.

Analysis of the color quality of the 1:24,000 scale color transparencies indicated that the imagery was extremely flat—differentiation within the color spectrum was of poor quality. It was the opinion of the staff technicians at Kennedy Space Center that better quality imagery, ideally multi-spectral, might provide the necessary spectral differentiation to accomplish the task in a time-effective manner.

Other existing imagery was considered but determined to be of too small of scale to provide necessary detail. It is the opinion of the investigator that 1:24,000 scale or larger imagery is necessary for charting intertidal oysters in Georgia. Preliminary prints of 1:10,000 scale 2.5 by 3.75 minute orthophotoquads were very promising but unavailable while the study was ongoing.

## CONCLUSIONS

The present distribution of intertidal oysters in Georgia is similar to the distribution of the resource in 1889. The extent of live oysters, however, is much reduced. It appears that Georgia's oyster resources have declined over the years concurrently with the decline in oyster landings.

The reasons for the decline in Georgia's oyster resources are not clear. Perhaps much of the decline is the result of poor management, including inadequate law enforcement. Good laws, especially those which require the harvester to return a portion of the shells harvested to the growing area, have been in the Georgia Code since at least 1889 (Drake, 1891). Judging from Drake's report, however, Georgia's oyster laws were difficult to enforce then, as they are today. Failure to replace shell material to harvested areas is probably the most significant reason for the depletion of Georgia's oyster resources. Obviously, this shortcoming rests not only with the resource managers and enforcers, but with the resource users. Oystering is a farming operation and one cannot continue to harvest without reseeding.

Disease may have been another major contributor to the decline in Georgia's oyster population. In the late 1950's, *Minchinia nelsoni* (MSX) disease caused mass mortalities of oysters in Delaware, Virginia and Maryland (Haskin, Canzonier, and Myhre, 1965; Andrews, 1966; Rosenfield and Sinderman, 1966). A protistan parasite, *Dermocystidium marinum*, has been identified as the cause of oyster mortalities throughout the Gulf and South Atlantic coasts (Perkins, 1976), and the parasitic oyster fungus, *Labyrinthomyxa* sp., has been reported in Georgia oysters (Hoese, 1969). To what degree these or other diseases have caused mortalities in Georgia oysters cannot be quantified.

Other factors, while not causing depletion of the resource, have resulted in extreme hardships on the industry itself. Pollution, and the lack of an adequate shellfish sanitation program are major factors, as they have resulted in the closing of about 75 percent of Georgia's oyster growing waters (Kumpf, 1977). Laws which grant riparian rights of shellfish in the intertidal zone to the adjacent landowner have also created additional problems related to leasing shellfish growing areas. The oysterman's inability to hire and retain good labor as a result of current federal and state welfare laws which make it more profitable not to work than to work in a seasonal industry is another problem.

The problems surrounding the decline in Georgia's oyster industry are numerous and complex. Although a significant decline in the areal extent of the resource has occurred, a large area (117 hectares) of oysters still exists. If the problems mentioned above can be resolved, Georgia's oyster industry still has a chance.

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## APPENDIX

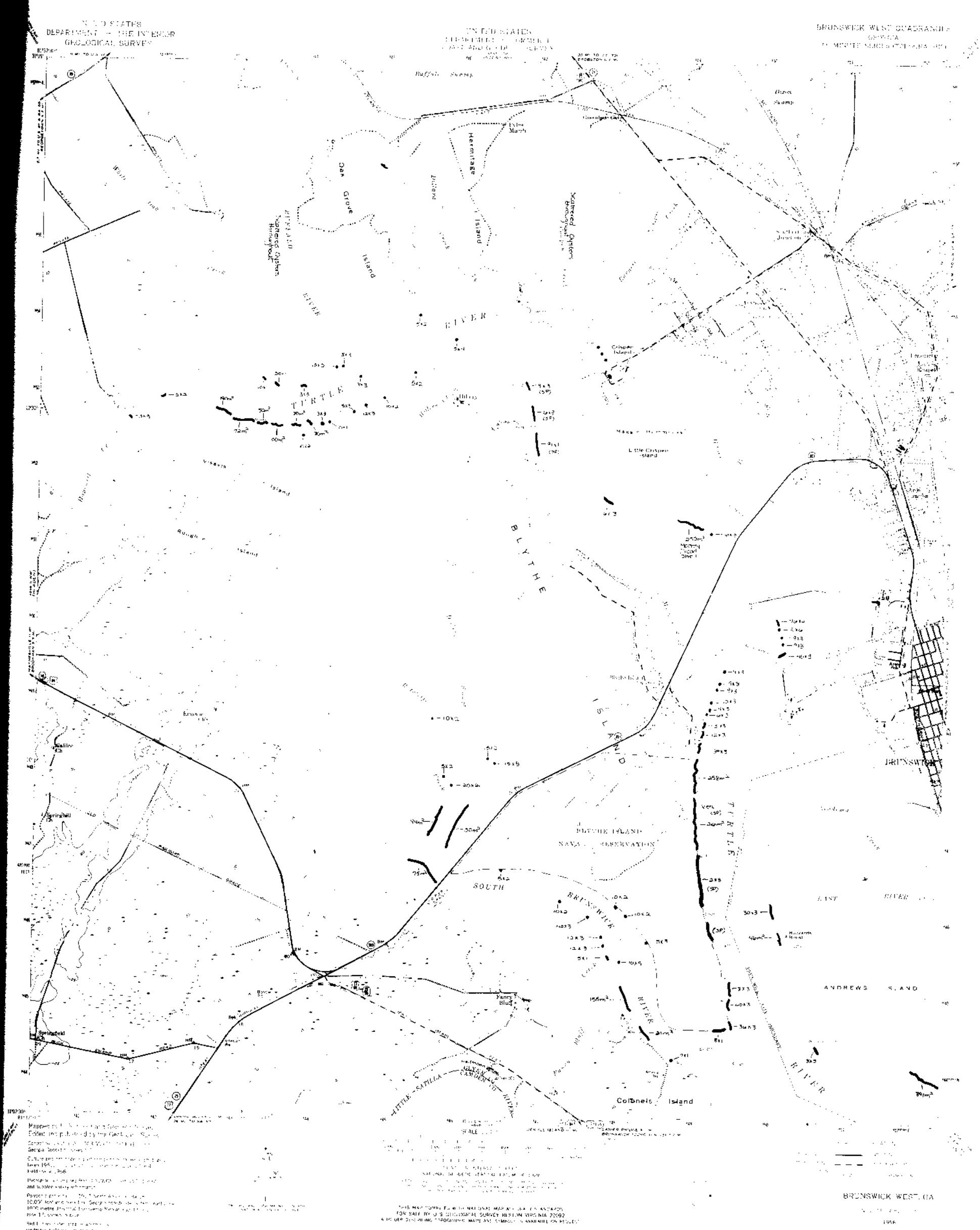
A - Altamaha Sound, Ga.  
B - Brunswick East, Ga.  
C - Brunswick West, Ga.  
D - Burroughs, Ga.  
E - Cabretta Inlet, Ga.  
F - Cumberland Island North, Ga.  
G - Cumberland Island South, Ga.  
H - Doboy Sound, Ga.  
I - Dover Bluff, Ga.  
J - Fernandina Beach, Fla. - Ga.  
K - Fort Pulaski, S. C. - Ga.  
L - Harriets Bluff, Ga.  
M - Isle of Hope, Ga.  
N - Jekyll Island, Ga.  
O - Kingsland NE, Ga.  
P - Limerick SE, Ga.  
Q - Oak Level, Ga.  
R - Racoон Key, Ga.  
S - Sapelo Sound, Ga.  
T - Savannah, Ga. - S. C.  
U - Savannah Beach North, S. C. - Ga.  
V - Savannah Beach South, Ga.  
W - Seabrook, Ga.  
X - Sea Island, Ga.  
Y - Shellman Bluff, Ga.  
Z - St. Catherines Sound, Ga.  
AA - St. Marys, Fa. - Ga.  
BB - Wassaw Sound, Ga.



Appendix A. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Altamaha Sound, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix B. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Brunswick East, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



Appendix C. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Brunswick West, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix D. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Burroughs, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

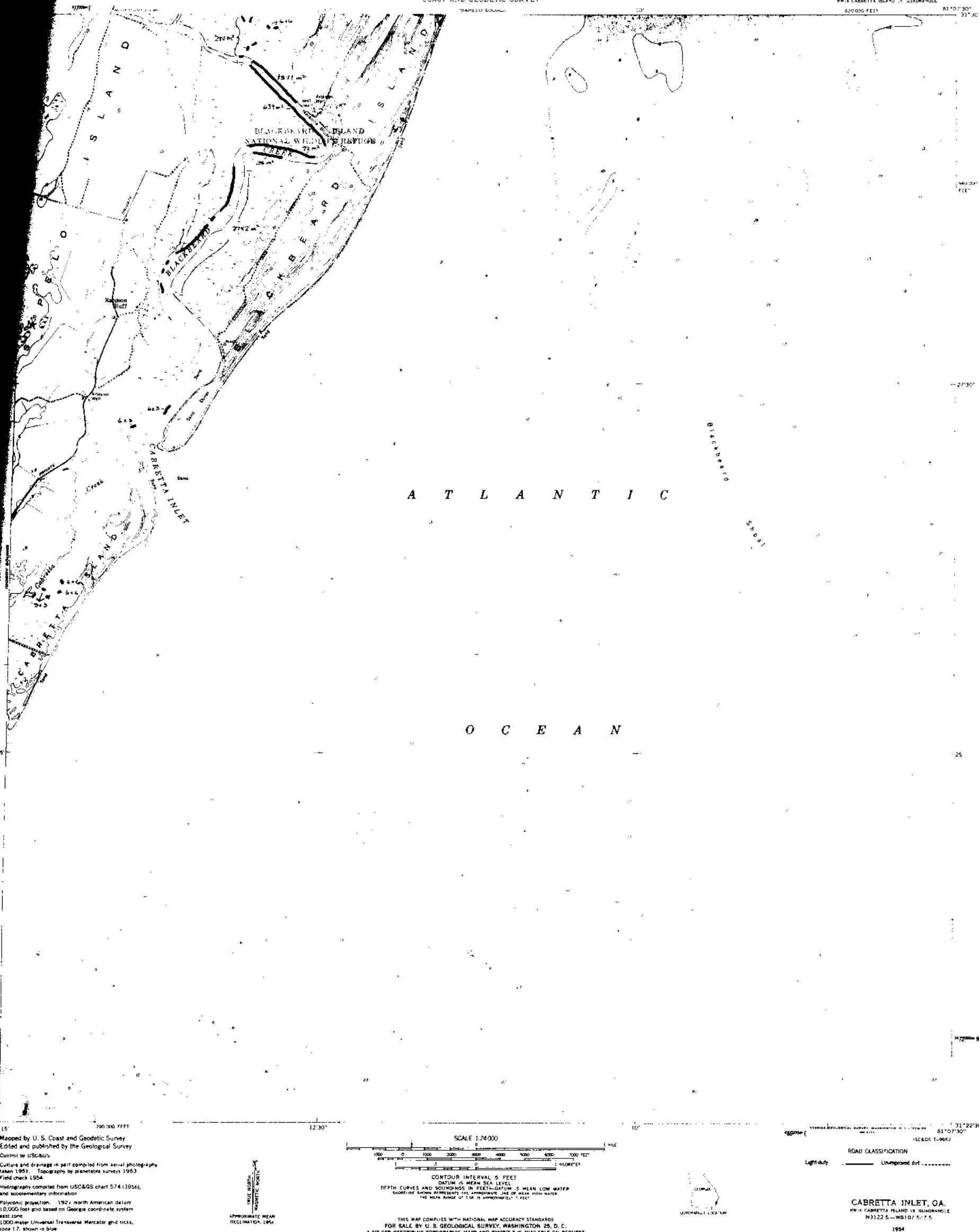
UNITED STATES  
DEPARTMENT OF COMMERCE  
COAST AND GEODETIC SURVEY

CABRETTA INLET QUADRANGLE  
GEORGIA—MCINTOSH CO.  
7.5 MINUTE SERIES (TOPOGRAPHIC)  
NW 1/4 CABRETTA ISLAND 1/4 QUADRANGLE

620,000 FEET

81° 07' 30"

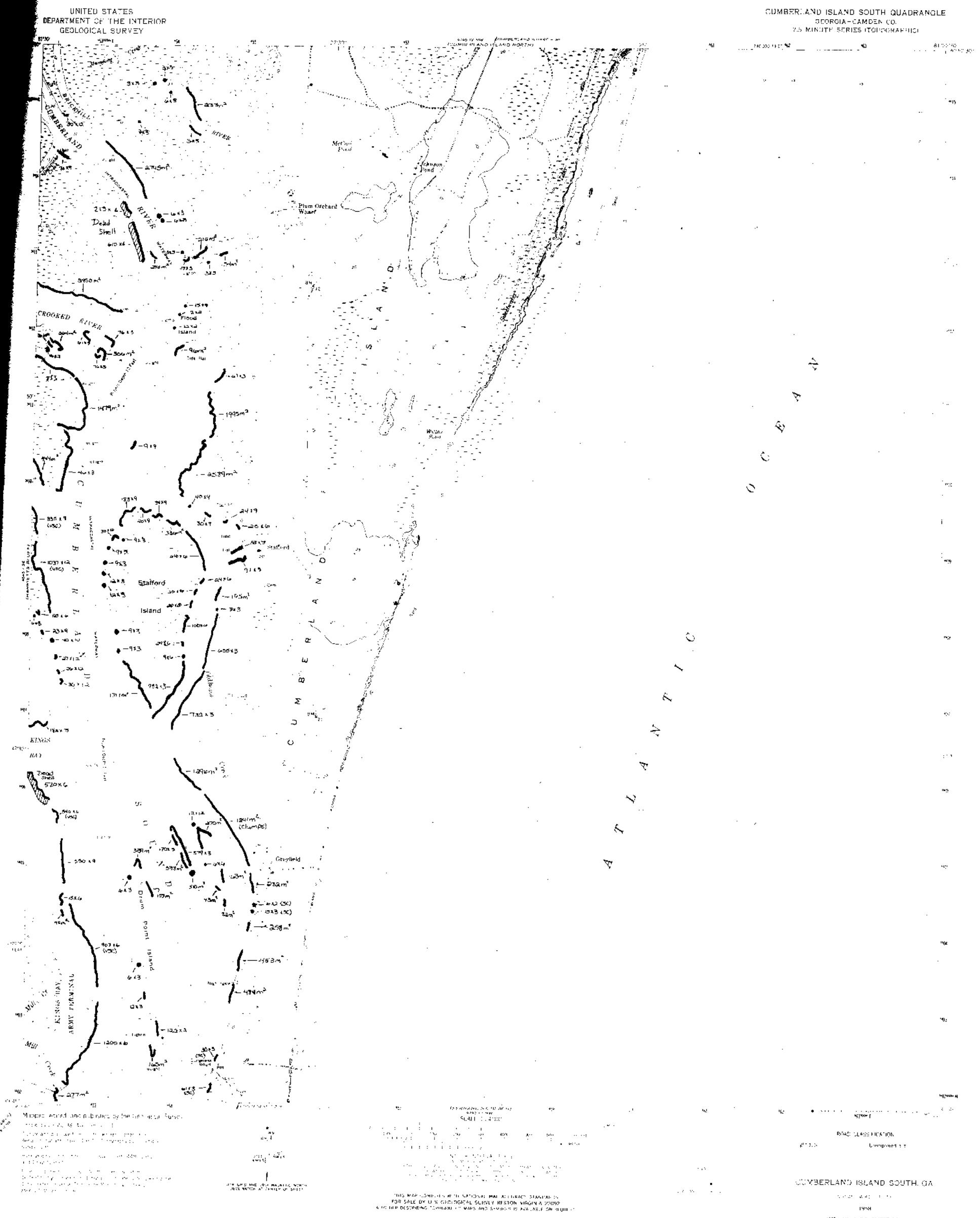
31° 30'



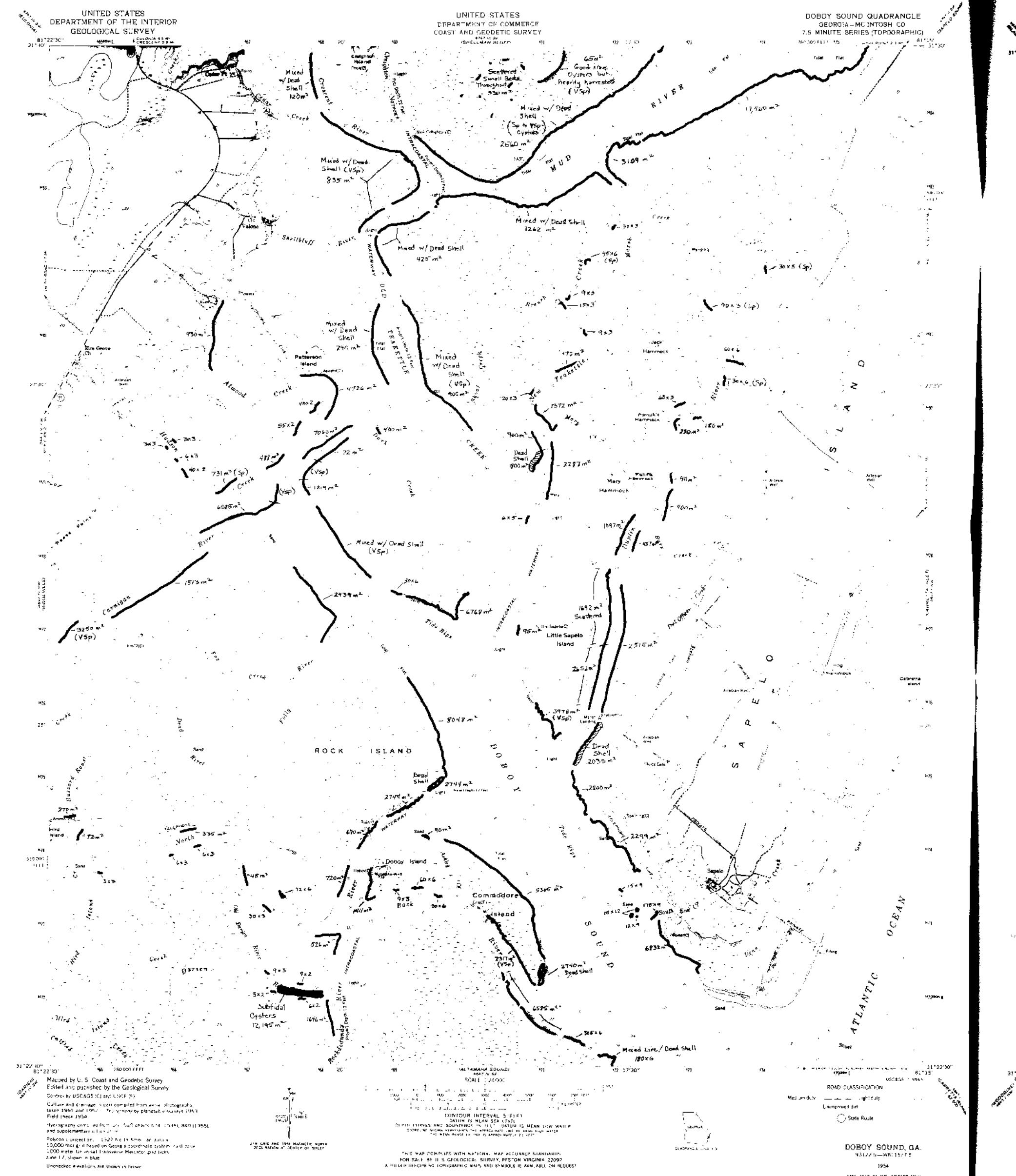
Appendix E. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Cabretta Inlet, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix F. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Cumberland Island North, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix G. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Cumberland Island South, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



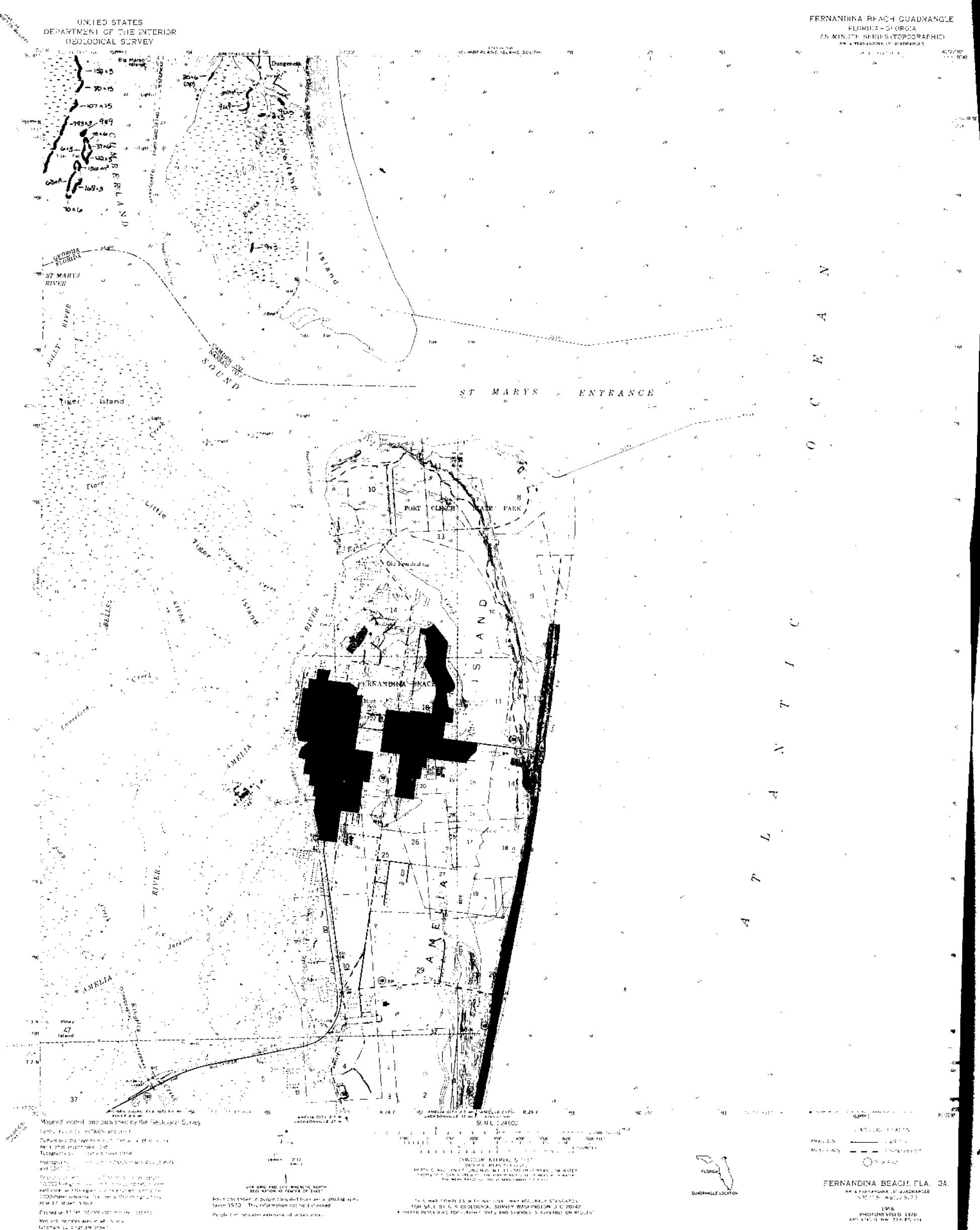
Appendix H. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Doboy Sound, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

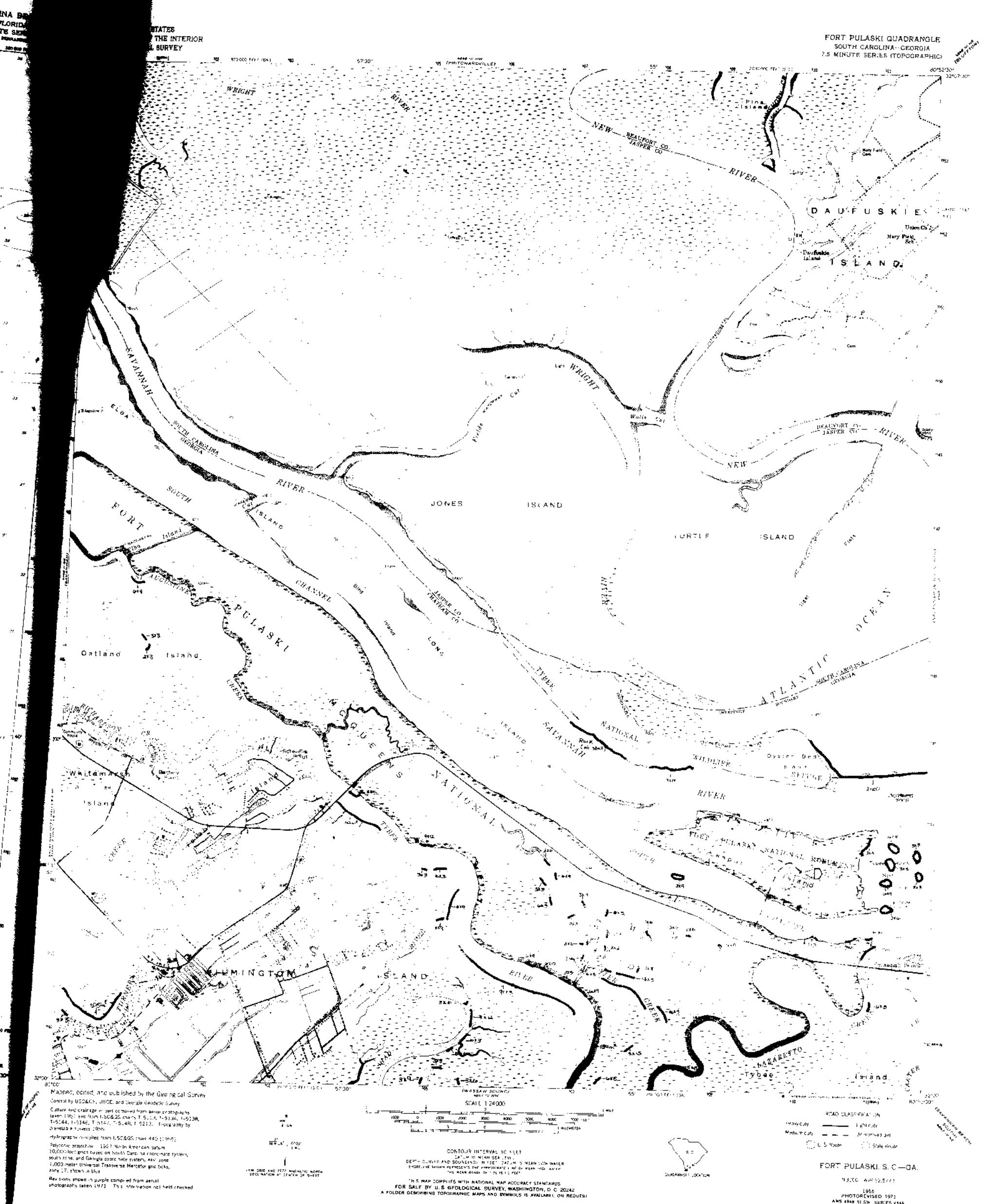
DOVER BLUFF QUADRANGLE  
GEORGIA  
7.5 MINUTE SERIES (TOPOGRAPHIC)  
1:250,000 SCALE



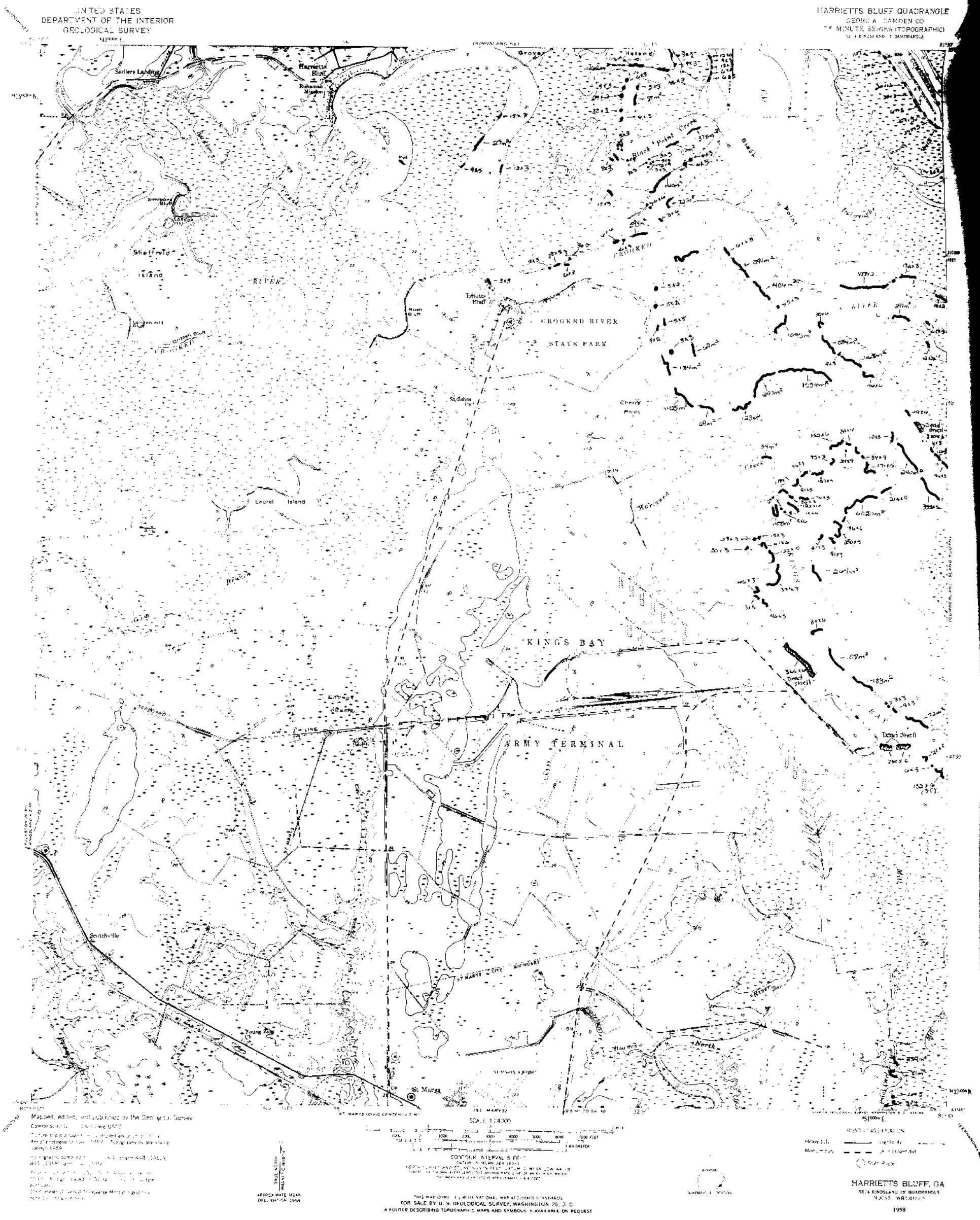
Appendix I. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Dover Bluff, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix J. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Fernandina Beach, Fla. - Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix K. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on 7.5 minute quadrangle, Fort Pulaski, S. C. - Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



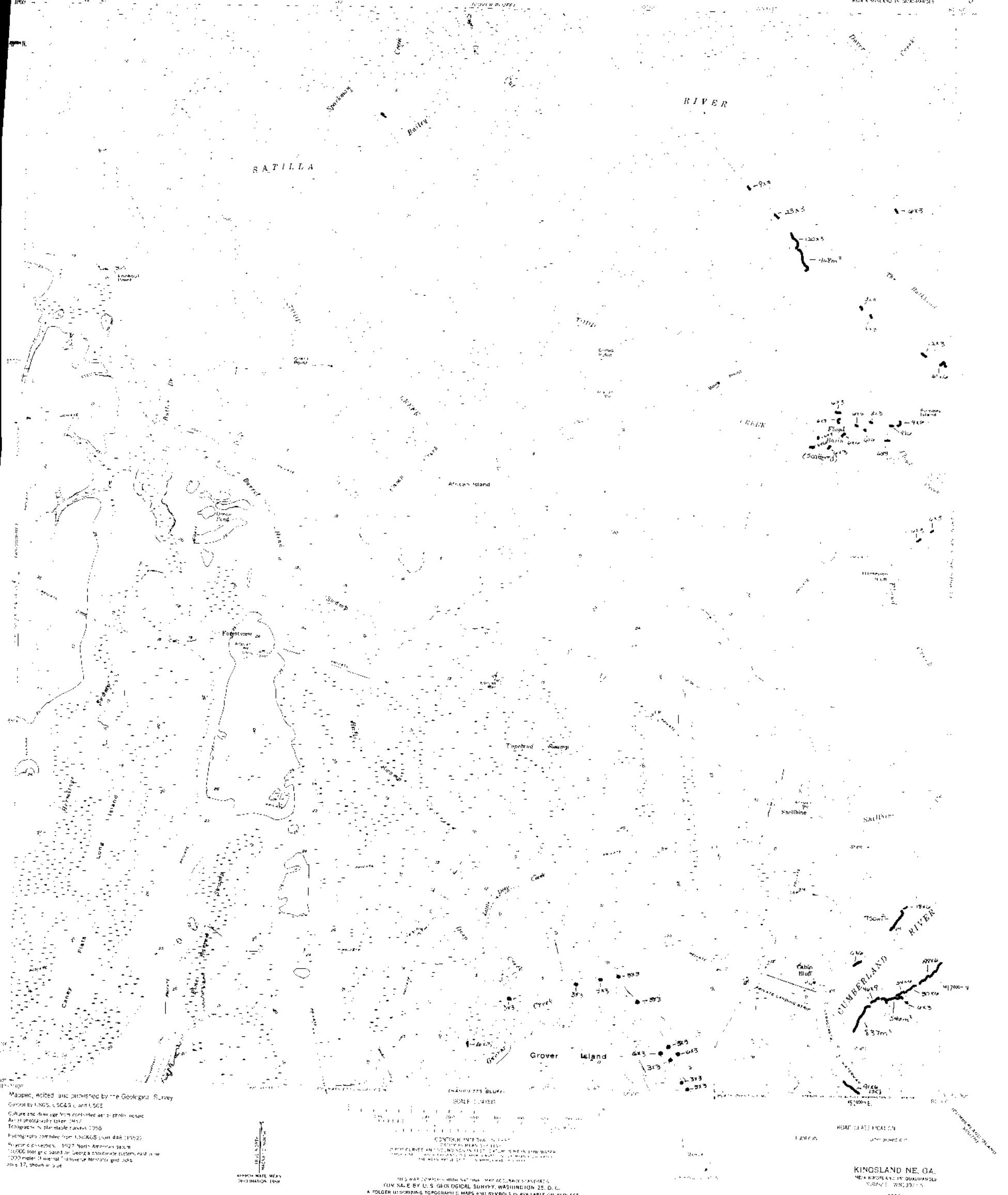
Appendix L. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Harriets Bluff, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



**Appendix M.** Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Isle of Hope, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



Appendix N. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Jekyll Island, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



Appendix O. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Kingsland NE, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).

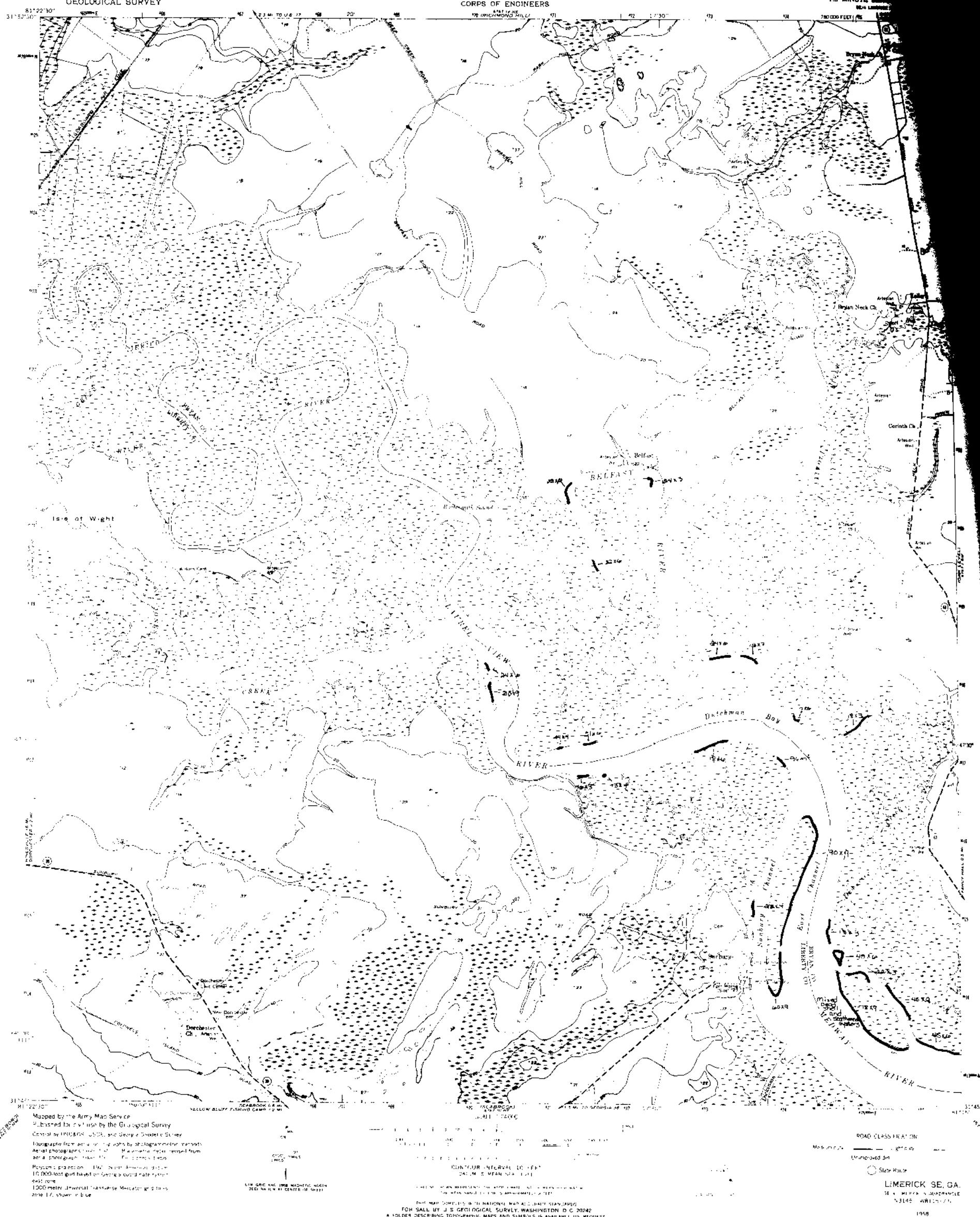
UNITED STATES  
DEPARTMENT OF THE INTERIOR  
GEOLOGICAL SURVEY

UNITED STATES  
DEPARTMENT OF THE ARMY  
CORPS OF ENGINEERS

LIMERICK

7.5 MINUTE SERIES

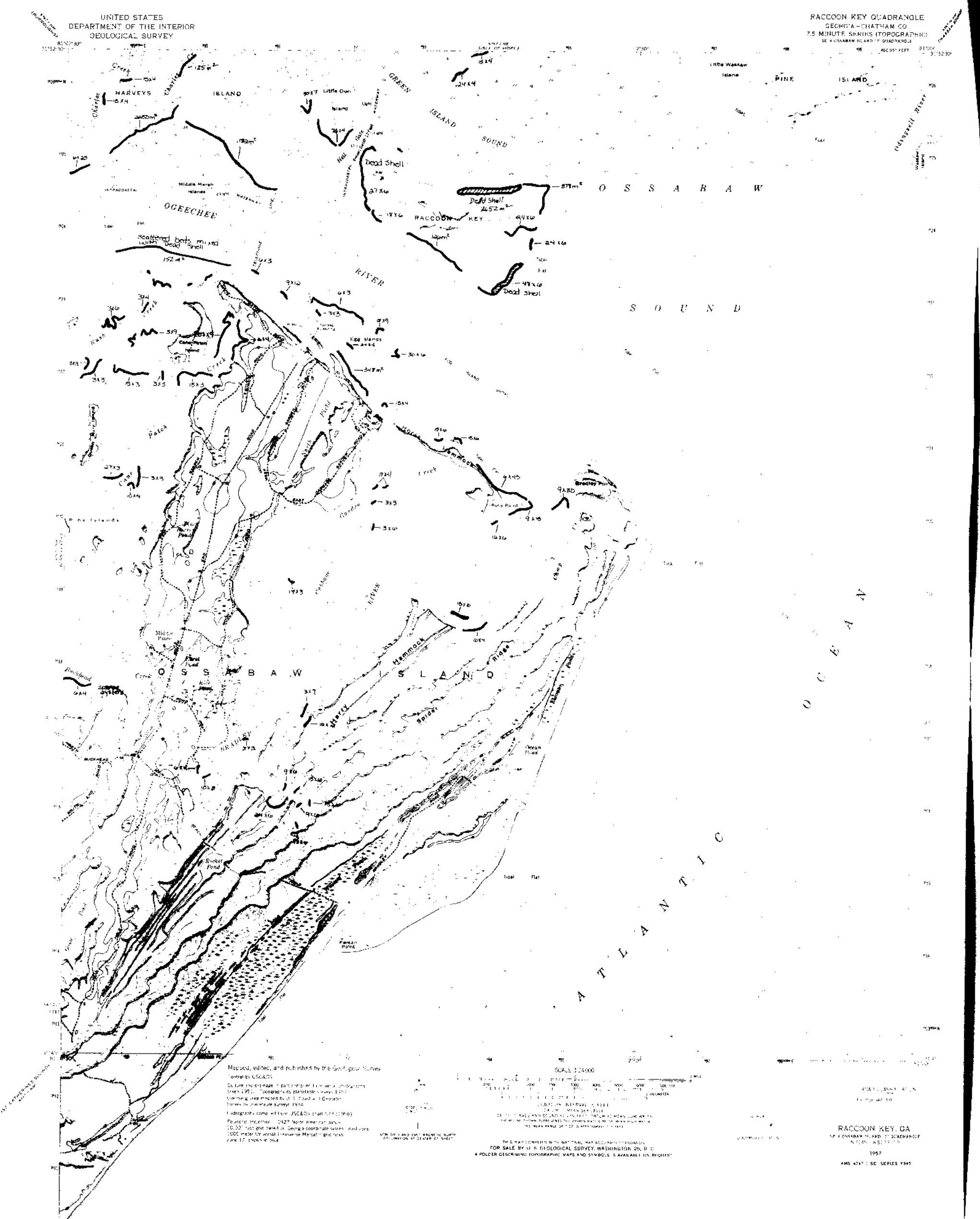
1:250,000 SCALE



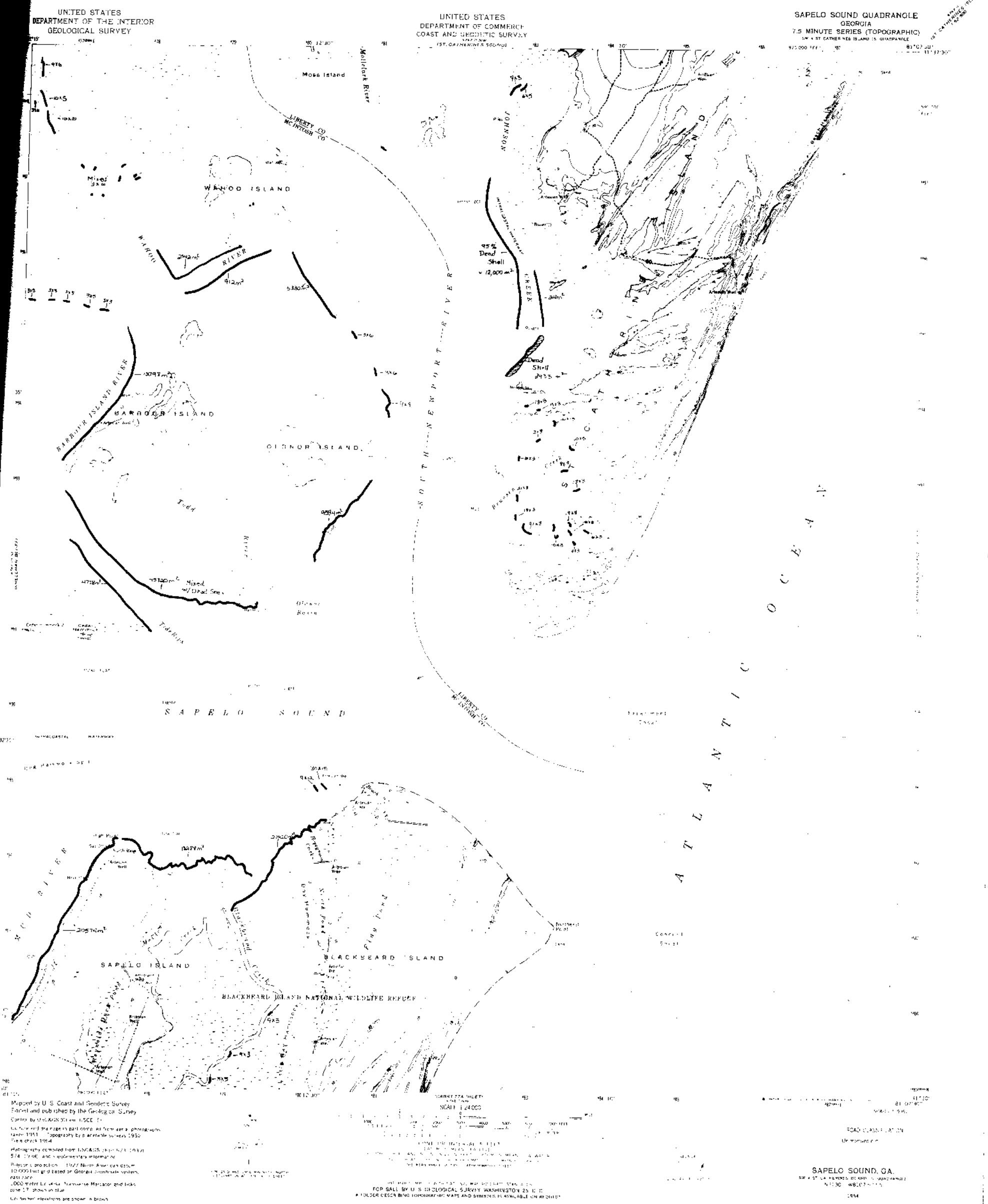
Appendix P. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Limerick SE, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix Q. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Oak Level, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



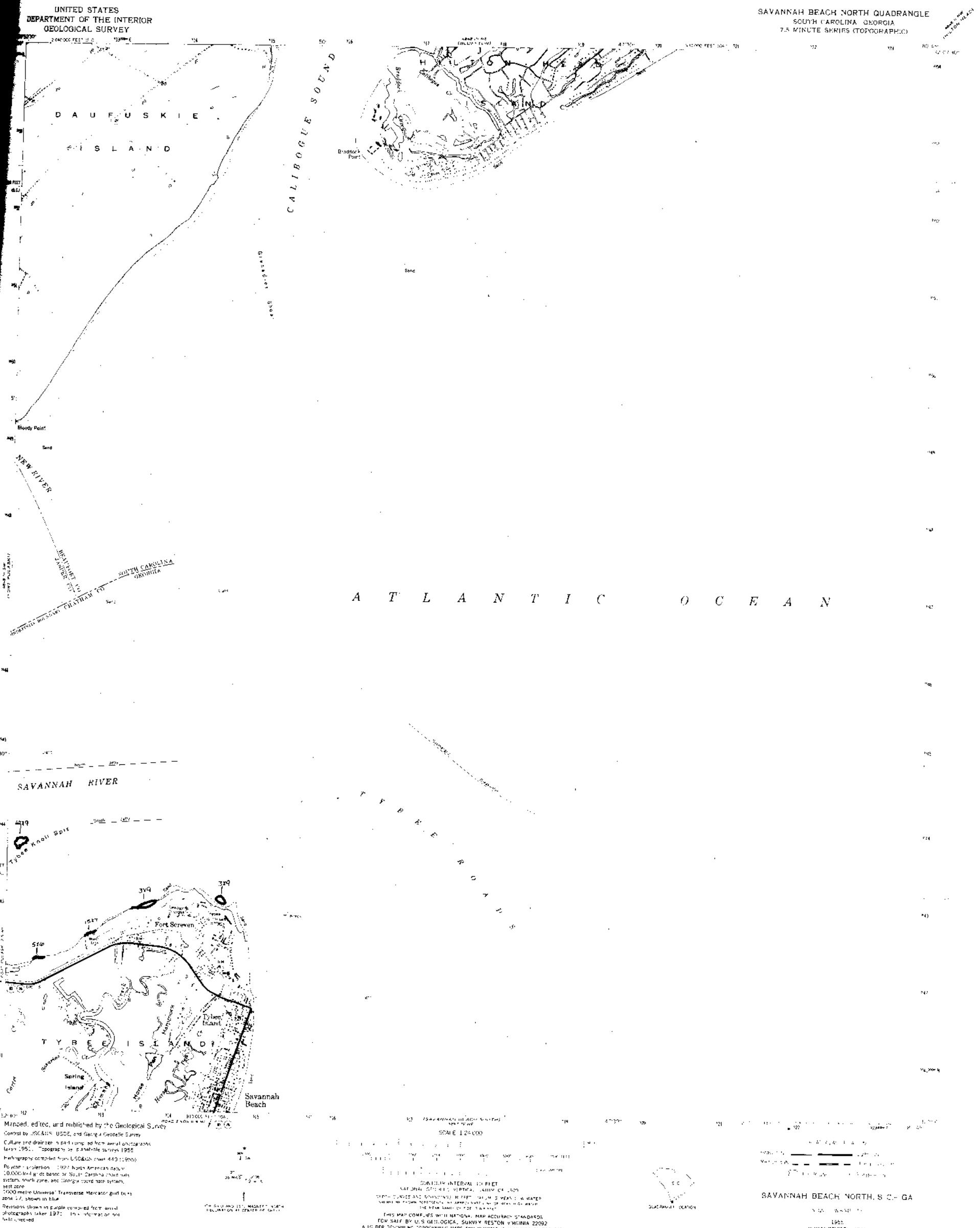
Appendix R. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Racoon Key, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



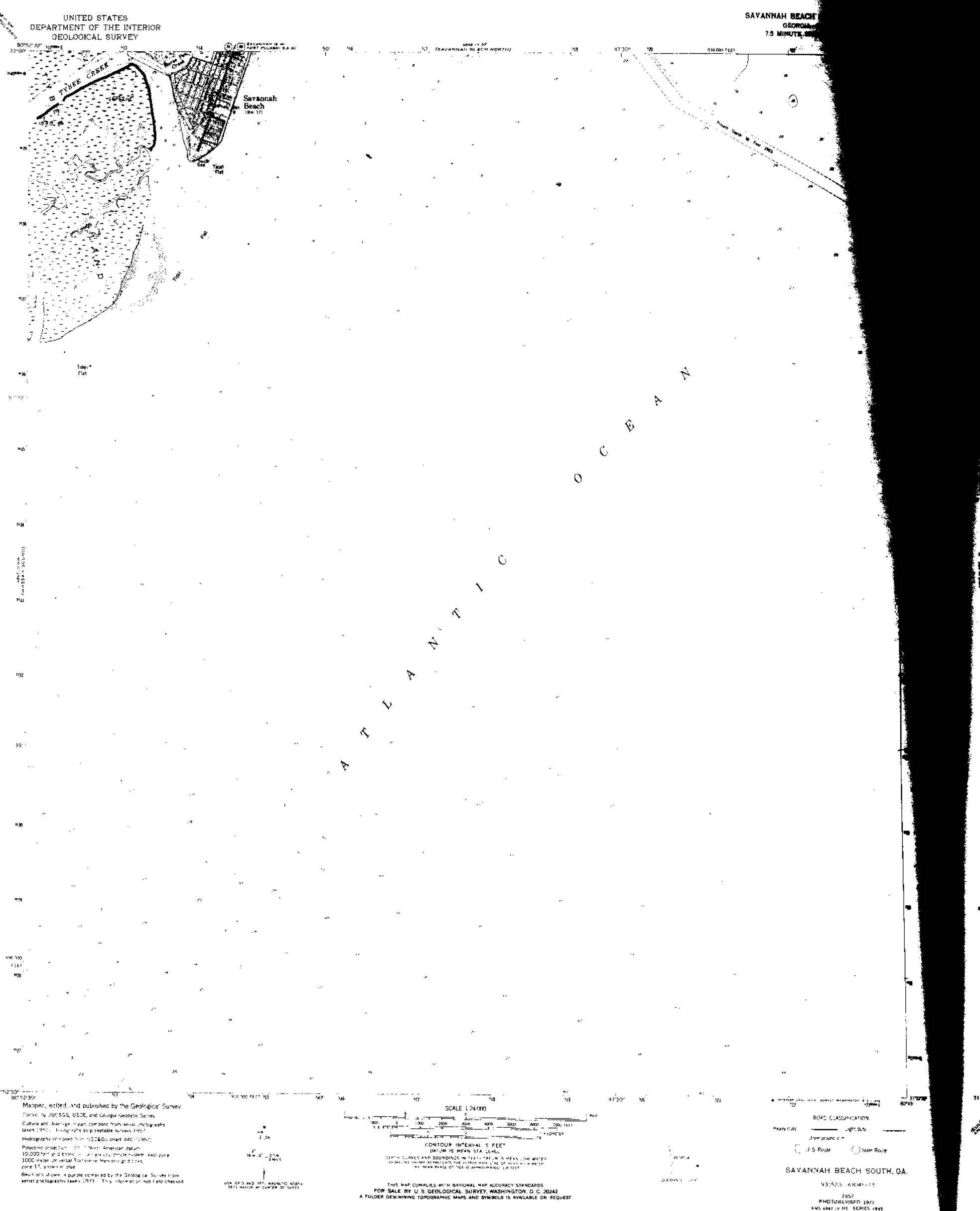
Appendix S. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Sapelo Sound, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



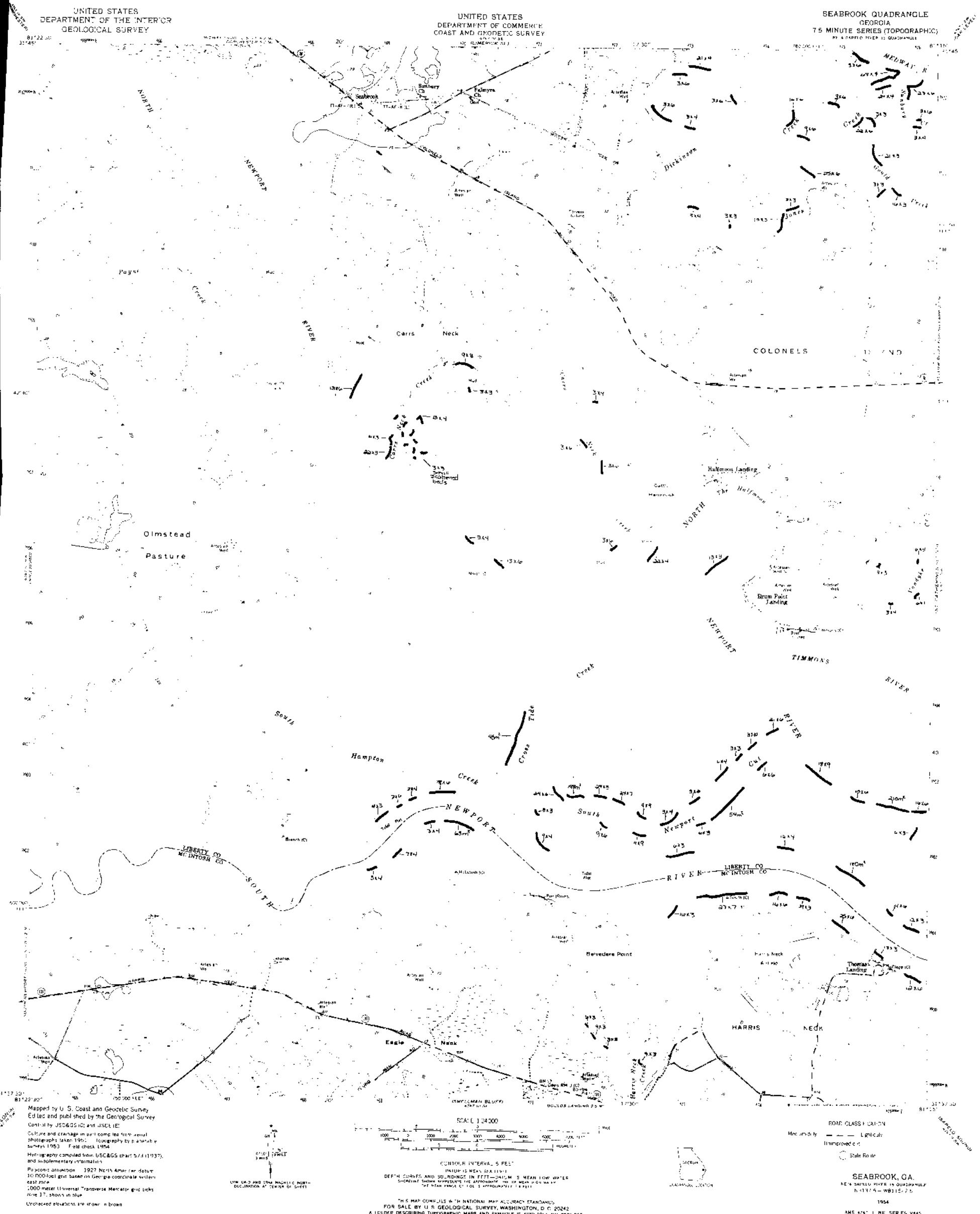
Appendix T. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Savannah, Ga. - S. C. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



Appendix U. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Savannah Beach North, S. C. - Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix V. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Savannah Beach South, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



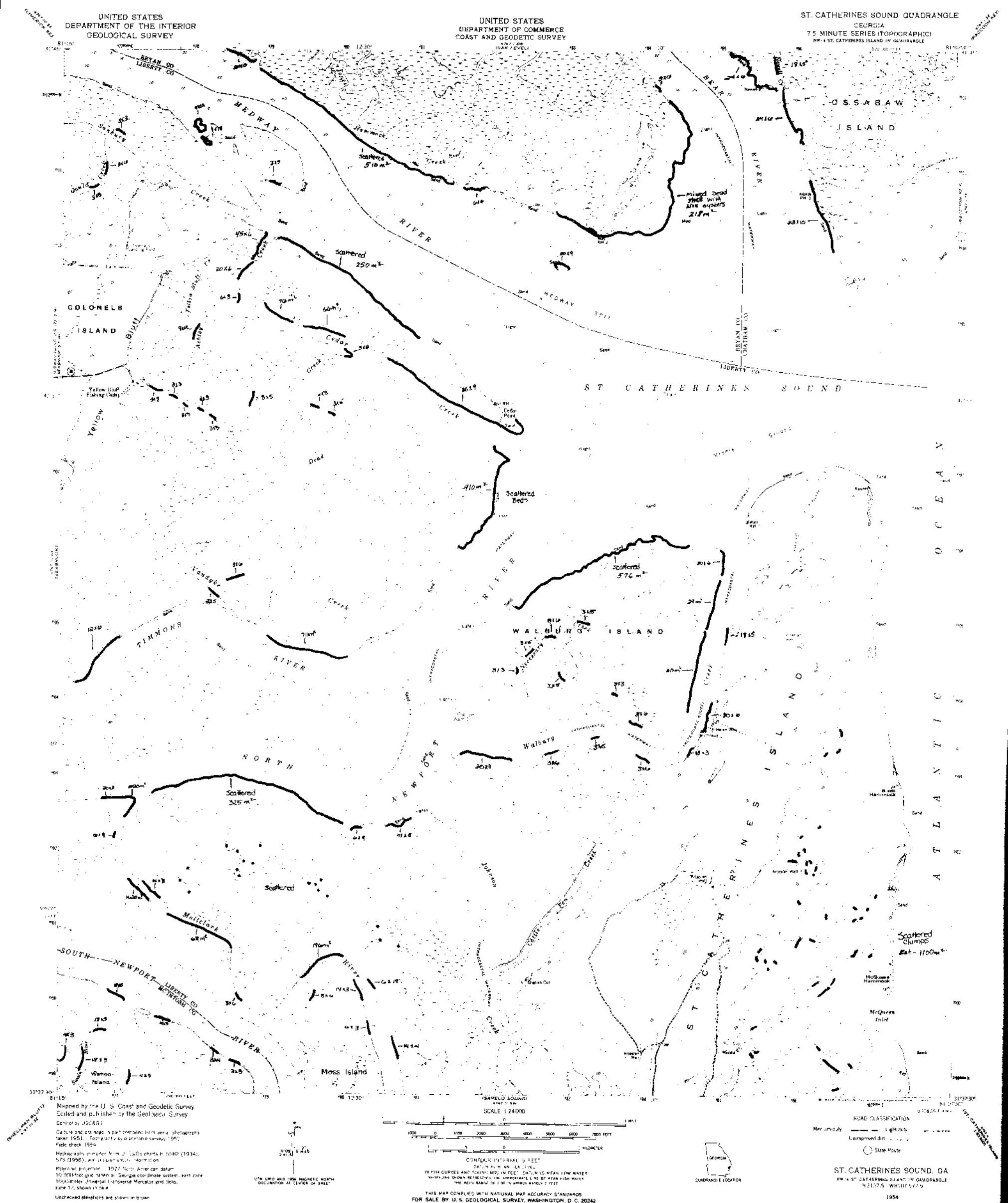
Appendix W. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Seabrook, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



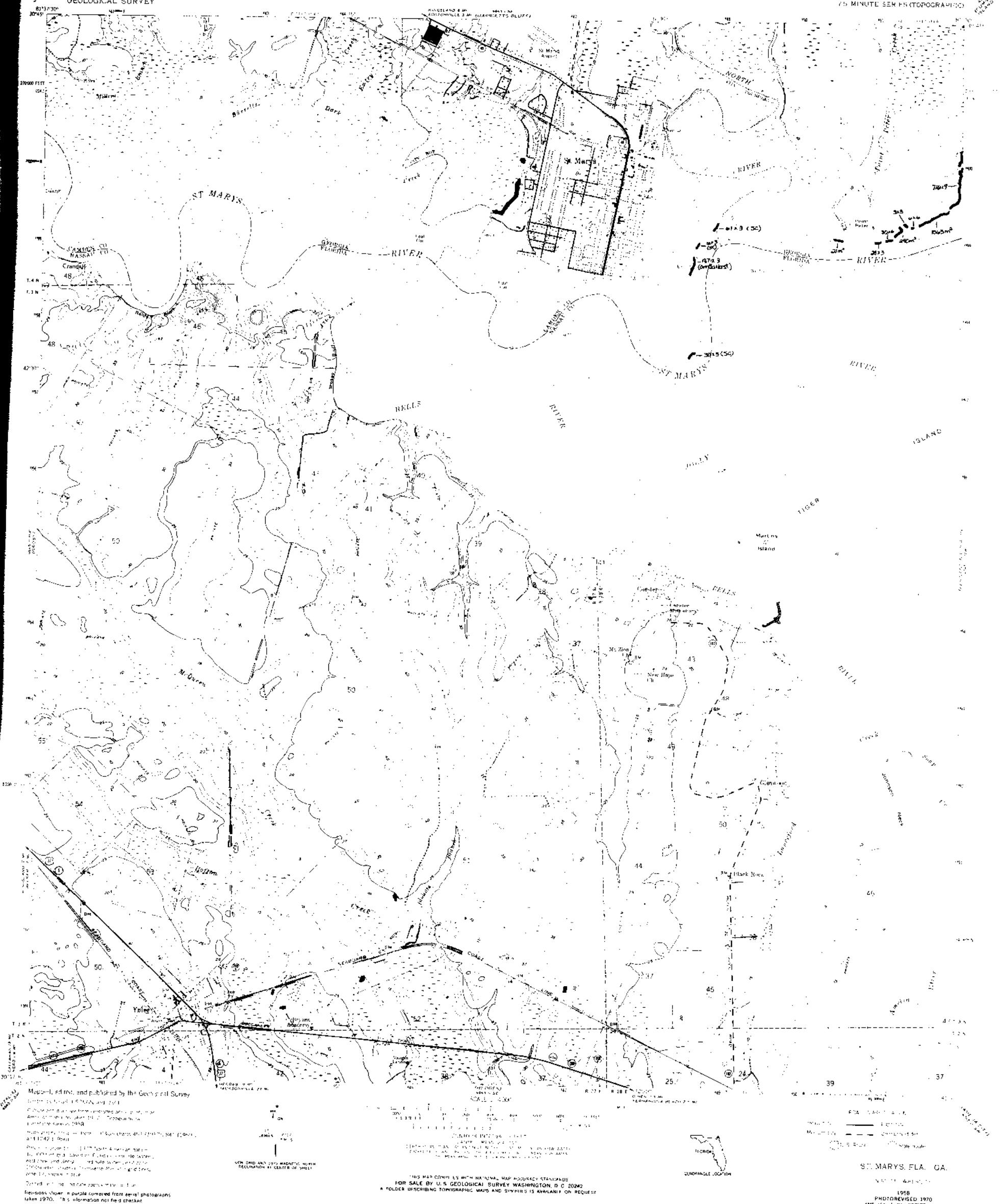
Appendix X. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Sea Island, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix Y. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Shellman Bluff, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix Z. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, St. Catherines Sound, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category)



**Appendix AA.** Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, St. Marys, Fla.-Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).



Appendix BB. Location of coastal Georgia's intertidal and subtidal oyster beds (and areal extent in square meters, or bed length and width in meters) in the area summarized on USGS 7.5 minute quadrangle, Wassaw Sound, Ga. (D-dense, M-moderate, S-sparse, VS-very sparse, lack of a density notation indicates beds were of the very dense category).