BEACH EROSION INVENTORY OF HORRY, GEORGETOWN, AND BEAUFORT COUNTIES, SOUTH CAROLINA

Dennis K. Hubbard
John H. Barwis
Francis Lesesne
Michael F. Stephen
Miles O. Hayes

Technical Report Number 8
South Carolina Sea Grant

December, 1977
SC-SG-77-8

BEACH EROSION INVENTORY OF HORRY,
GEORGETOWN AND BEAUFORT COUNTIES, SOUTH CAROLINA

Dennis K. Hubbard
John H. Barwis
Francis Lesesne
Michael F. Stephen
Miles O. Hayes

Coastal Research Division
Geology Department
University of South Carolina
Columbia, South Carolina 29208

This project was supported by the National Oceanic and Atmospheric Administration, Sea Grant Program, project number 04-6-158-44096, Miles O. Hayes, principal investigator, and the South Carolina Wildlife and Marine Resources Division. Additional funds were provided by the University of South Carolina, Geology Department.

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

INTRODUCTION

The purpose of this report is to provide a summary of beach erosion-deposition trends for Horry, Georgetown and Beaufort counties (Fig. 1). This completes the series for the South Carolina coastal counties (with the exception of Colleton County in St. Helena Sound), inasmuch as the trends for the Charleston County area were presented earlier (Stephen _et al._, 1975). Shoreline positions were measured from sequential vertical aerial photographs covering the period 1940 to 1973, as well as from historical charts dating to 1859. It is hoped that the information contained in this report will be used in formulating management plans which allow for optimum but sensible use of the beaches of the state.

ACKNOWLEDGEMENTS

Photographs were obtained from the Eastern Aerial Photographic Laboratory, U. S. Agricultural Stabilization and Conservation Service, and the National Archives, to whom we extend our gratitude for their valuable cooperation. Thanks are also extended to the U. S. Army Waterways Experiment Station in Vicksburg, Mississippi for permission to photocopy chart data pertinent to this study. The members of the Coastal Research Division, Department of Geology, University of South Carolina are also gratefully acknowledged for their help and cooperation throughout this project.

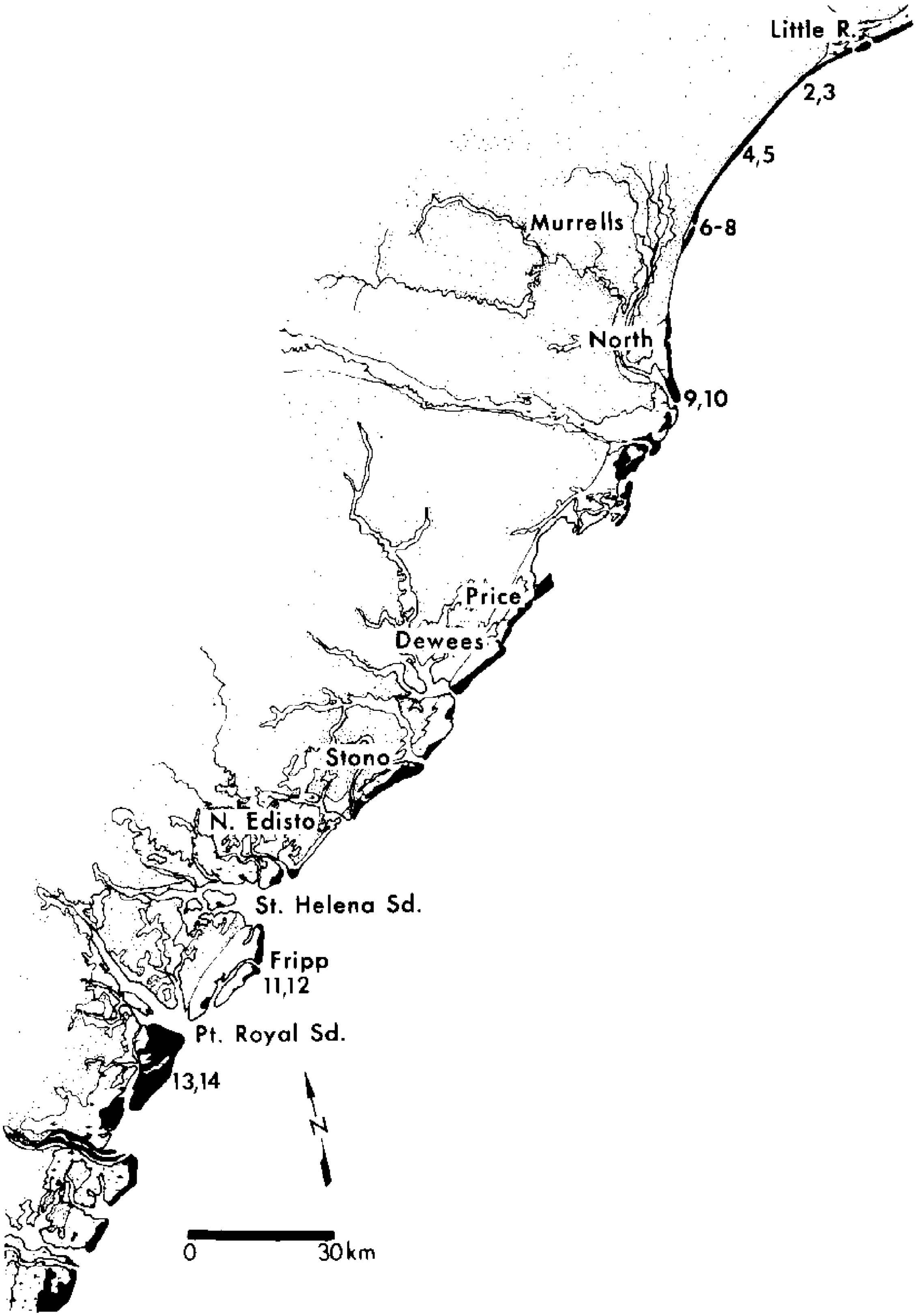


Figure 1. Map of the South Carolina coastal zone. Numbers indicate the location of the areas described in following figures.

STUDY PROCEDURE

Information appearing in this report is derived primarily from two sources: sequential vertical aerial photographs and historical shoreline charts. To refine the techniques used in Beach Erosion Inventory of Charleston County, South Carolina (Stephen et al., 1975), most of the vertical aerial photographs were computer-corrected for edge distortion, scale and camera tilt to within an accuracy of 1.0%. These corrected photographs were then used to construct semi-controlled photomosaics of the various sections of the coast.[1] As a control during construction of the mosaics, distances between two points on adjacent photographs were adjusted to proportionate measurements on 1:24,000 U.S.G.S. topographic sheets. To minimize any rotational errors, angular relationships were similarly matched to existing maps.

Next, acetate overlays of the finished mosaics were constructed. Reference points (road intersections, marsh creek patterns, etc.) were included to aid in comparison between overlays. Survey points 1000 m apart were established and marked on each overlay. Finally, the shoreline positions at the survey points on each overlay were digitized for analysis on an IBM 370 computer, which calculated and plotted erosion-deposition trends for each survey point.

Information on shoreline changes prior to the years of photographic record were obtained from NOAA hydrographic survey sheets dating back to 1859 and high water shoreline-change maps prepared by the U. S. Army, Coastal Engineering Research Center in Washington, D. C. Shoreline positions along each survey line were similarly input to the IBM 370 for inclusion with the

---

[1] Some of the older photographs did not have the information necessary to make the corrections - in this case, a "best fit" procedure was used, comparing spatial and angular relationships between points occurring on both the photomosaics and U.S.G.S. topographic sheets.

existing photographic information. Data from both the aerial and chart surveys were combined, and are displayed in both graphic and tabular form.

Methods employed in this study were similar to those outlined in Stephen et al., (1975). The use of computer-corrected aerial photographs, however, has increased the accuracy of this method considerably. Use of the IBM 370 to calculate and plot these trends has, in addition, eliminated much of the operator error and bias. Also, the increased consistency in both the preparation of the mosaics and the subsequent interpretation of shoreline positions greatly enhances the accuracy of the final output. It should be noted however, that although many of these errors have been reduced, they do still exist and need to be considered. These errors are discussed at more length in Appendix I.

We feel that the data presented here are the most accurate possible without using extremely costly ortho-photographic techniques.

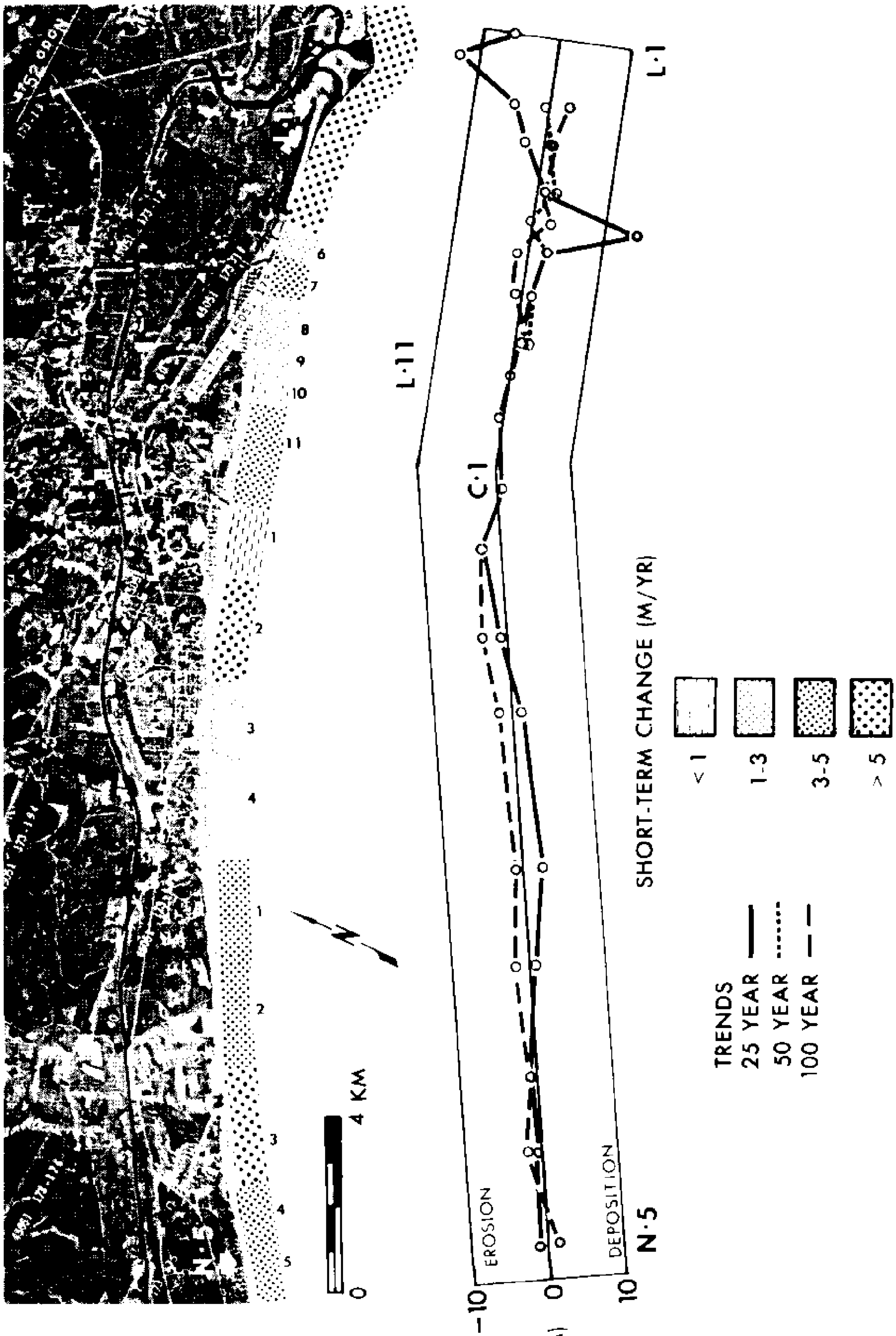
DATA PRESENTATION

The information in this report is presented at three levels. First, a set of graphs (Fig. 2, for example) is included to show average yearly shoreline changes at individual survey points based on 25, 50, and 100 years of record. This type of information is necessary in order for the effective coastal planner to determine critical set-back lines along the coast. The use of these graphs allows rapid determination of the general character of any stretch of shoreline in the study area. The reader should take note of the extreme variability that can occur in trends depending on whether the period of record is 25, 50, or 100 years. These trends are tabulated in Appendix II.

Caution should be exercised in the use of these graphs alone because they may, in certain situations, be somewhat misleading. The data displayed in the trend graphs are averages and do not reflect all the variability that might have occurred during the period of record. For example, an area that shows no erosion based on 25 years of record may have eroded 100 meters in the first 15 years and then built back 100 meters in the last 10 years. Thus, an area that appears very stable based on trend data alone might be quite the opposite. For this reason, a second type of information is provided, short term variability. This information classifies sections of beach based on the short-term changes that were observed during the years of available photographic record (essentially, since 1940). Short term variability was computed by dividing the change occurring between successive photographs by the number of years involved. The numbers appearing on the figures are based on the maximum erosion rate calculated by this method. It should be noted that these figures are also averages and, like the 25, 50 and 100 year trend graphs, do not tell the whole story. Without continuous monitoring of the beach, it is difficult to tell whether the changes between photographs occurred gradually or all at once. For planning purposes, the values that appear on the following figures should therefore be considered as minimum expected rates of change.

The first two types of information are provided to allow a rapid estimate of shoreline behavior at any location. As previously discussed, however, both these types of information might be misleading in certain instances. Rapid changes which average out can result in a stable trend. Also, the large amounts of erosion shown by the short-term variation charts are often balanced by subsequent gains along the beach. For that reason, the third level of information, individual erosion-deposition graphs (Fig. 3, for example), have been included. In areas where changes are somewhat similar for large stretches of coastline, only representative curves are shown on

Figure 2. Erosion-deposition trends for stations L-1 (Little River) to N-5 (Myrtle Beach). The graph shows yearly erosion rates (in meters) based on 25, 50 and 100 years of data. Positive values indicate deposition; negative values represent erosion. The shaded patterns along the beach give an indication of the short-term variability that has occurred along this section of coastline since 1940. Several things of interest appear on this figure. First, the section of coast south of station C-1 has been rather stable, based on the 25 and 100 year trends. Note however, that despite this overall lack of change, significant short-term variations (shaded areas) have occurred since 1940, in some instances averaging over 5 m per year. Individual erosion-deposition curves are provided in Figure 3 to illustrate more completely the nature of this variability. The effect of tidal inlets on shoreline change can be seen by comparing stations L-1 through L-6 with the rest of the points on the graph. This variability is the result of constant inlet migration throughout the period of record.


L·1
L·11
C·1
N·5
EROSION
DEPOSITION
(M)
−10
0
10
0
4 KM
SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
TRENDS
25 YEAR
50 YEAR
100 YEAR

the figures. In areas that exhibit higher alongshore variability (especially near tidal inlets), all the data are presented. Erosion-deposition figures for all measured stations are presented in tabular form in Appendix III. Anyone using these data for serious planning purposes is urged to use the original data in tabular form for calculations. The graphs that appear in this report are included only to illustrate concepts and to provide a means for rapidly determining general trends along various areas of the coast.

USE OF THESE MEASUREMENTS FOR COASTAL ZONE PLANNING

An important consideration in any beach management program is the establishment of a reasonable set-back line, seaward of which no construction is allowed. Critical to the determination of such a line is the knowledge of the changes that can be expected along any given section of beach. The erosion-deposition trends outlined in this report define areas of general stability or instability. Data on short-term variability provides information about variations from these trends. Finally, the individual erosion-deposition curves detail the variability that exists at given locations along the beach.

Erosion-deposition data in this report could be used in conjunction with existing environmental data (wave height, storm surge expectance, etc.) to establish zones where construction should be prohibited. Sensabaugh (1976) outlined a similar program being initiated in Florida.

DESCRIPTIONS OF CHANGES

Grand Strand - Little River to North Inlet (Figs. 2 to 8)

This region falls within the zone classified by Brown (1976) as the arcuate strand. In this area, the beach sits against the Pleistocene mainland and has thus taken on a relatively stable character. Generally speaking, erosion rates of 1 meter per year can be expected, although the possibility of much higher maximum yearly erosion rates cannot be discounted.

Notable exceptions to this relatively stable trend occur in the vicinity of tidal inlets, where frequent changes of 15 meters per year can occur. Close inspection of changes associated with Murrells Inlet (Fig. 8) illustrates this point.

The erosion-deposition trend maps for the arcuate strand area (Figs. 2, 4 and 6) indicate that the erosion rate has generally slowed in the last 25 years of record. This may indicate that the retreat of the shoreline against the Pleistocene mainland in this area (and the resulting increase in stability) is a relatively recent event.

North Inlet to Charleston County Line

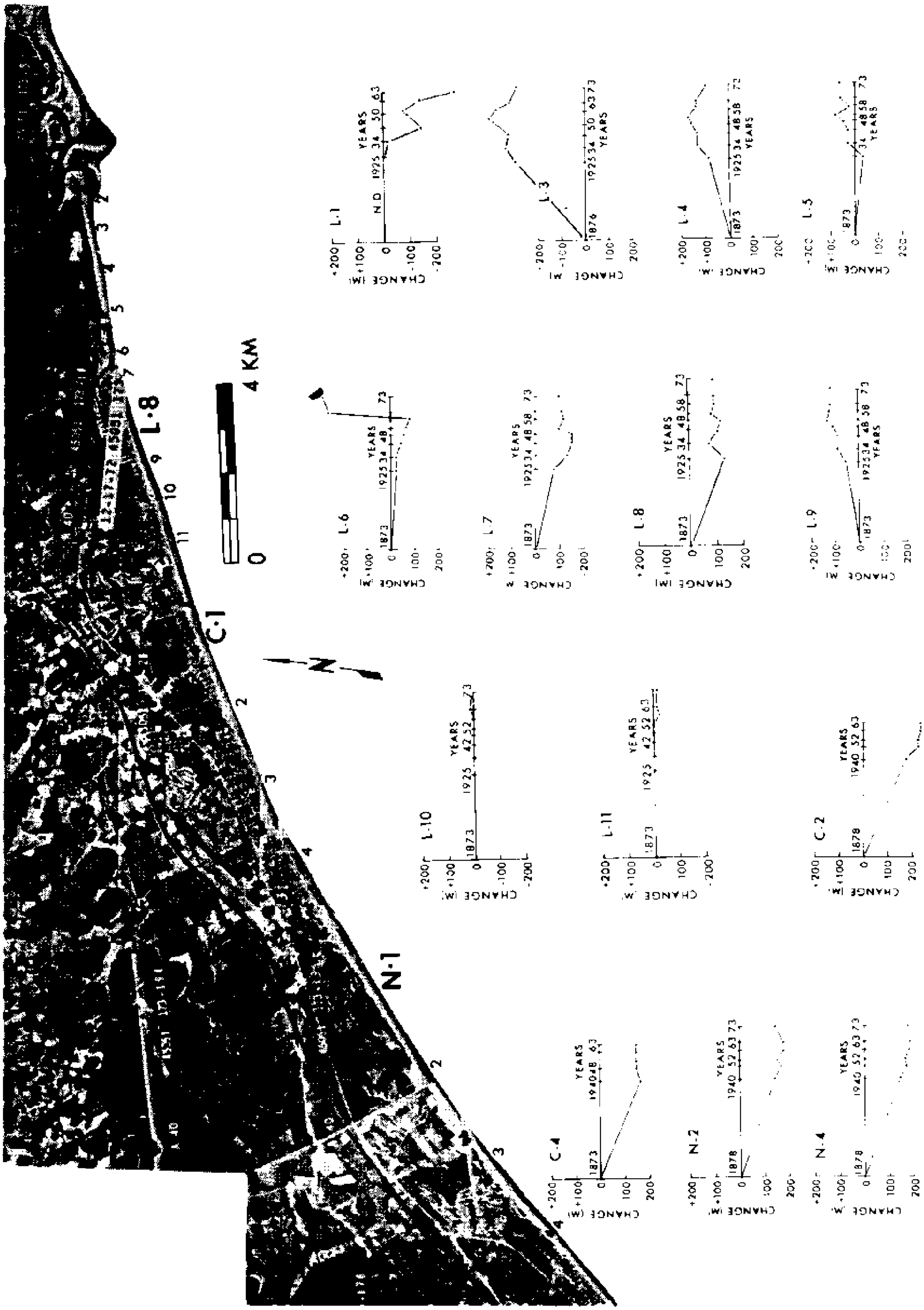
Trends along this stretch of beach (Figs. 9 & 10) are similar to those previously described for the grand strand, although individual erosion-deposition graphs (Fig. 10) show somewhat higher variability. The central portions of the islands show relative long-term stability while extreme changes can be noted at either end of the barrier (again, the effect of tidal inlets).

The area south of Winyah Bay (South Is.) has had a particularly interesting history since the construction of the Winyah Bay jetties. Aerial photographs and chart data indicate that the spit that extends into southern Winyah Bay was deposited between 1908 and 1929. Marsh development in the lee of the spit has occurred since that time. The recent history of the area is marked by shoreline retreat.

Beaufort County - General Statement

Erosion-deposition trends along this portion of the coast are much more complex than those in Horry and Georgetown Counties. The greater tidal

Figure 3. Erosion-deposition curves for stations L-1 (Little River) to N-4 (Myrtle Beach). These graphs show the individual changes that were measured from successive aerial photographs and coastal charts. A positively sloping line indicates net accretion; a negatively sloping line shows net erosion. The sums of these indivual measurements for 25, 50 and 100 years were used to calculate the values shown in Figure 2. An adequate understanding of the information shown in Figure 3 can be achieved only through careful inspection of these individual graphs and the values that appear in Appendix III. For example, the relatively high short-term variability seen at stations C-2 and N-3 is the result of erosion occurring between 1940 and 1948 (graph in Figure 2) and 1952 and 1958 (Appendix III) respectively. The high variability seen at Little River Inlet (stations L-1 through L-5) on the other hand, is the result of repeated large-scale changes in shoreline position. This is related to the constant shifting of the inlet and the resulting modifications in wave processes and sediment transport patterns along adjacent beaches. The variability seen at stations L-6 and L-7 attest to the effects that even small inlets (Hog Inlet) can have an adjacent beaches.



L-8
C-1
N-1
0
4 KM
L-1
L-3
L-4
L-5
L-6
L-7
L-8
L-9
L-10
L-11
C-2
C-4
N-2
N-4
YEARS
CHANGE (M)

Figure 4. Erosion-deposition trends and short-term variability (since 1952) at stations M-1 (Myrtle Beach) to G-4 (Garden City Beach). This section of coastline is contained within the arcuate strand of Brown (1976). The position of the beach against the Pleistocene mainland is the cause of the overall stability seen in the 25, 50 and 100 year trends for this area. Once again however, it should be noted that despite the long-term stability of the area, rapid, short-term variations can occur (stations G-1, 2 and 4).

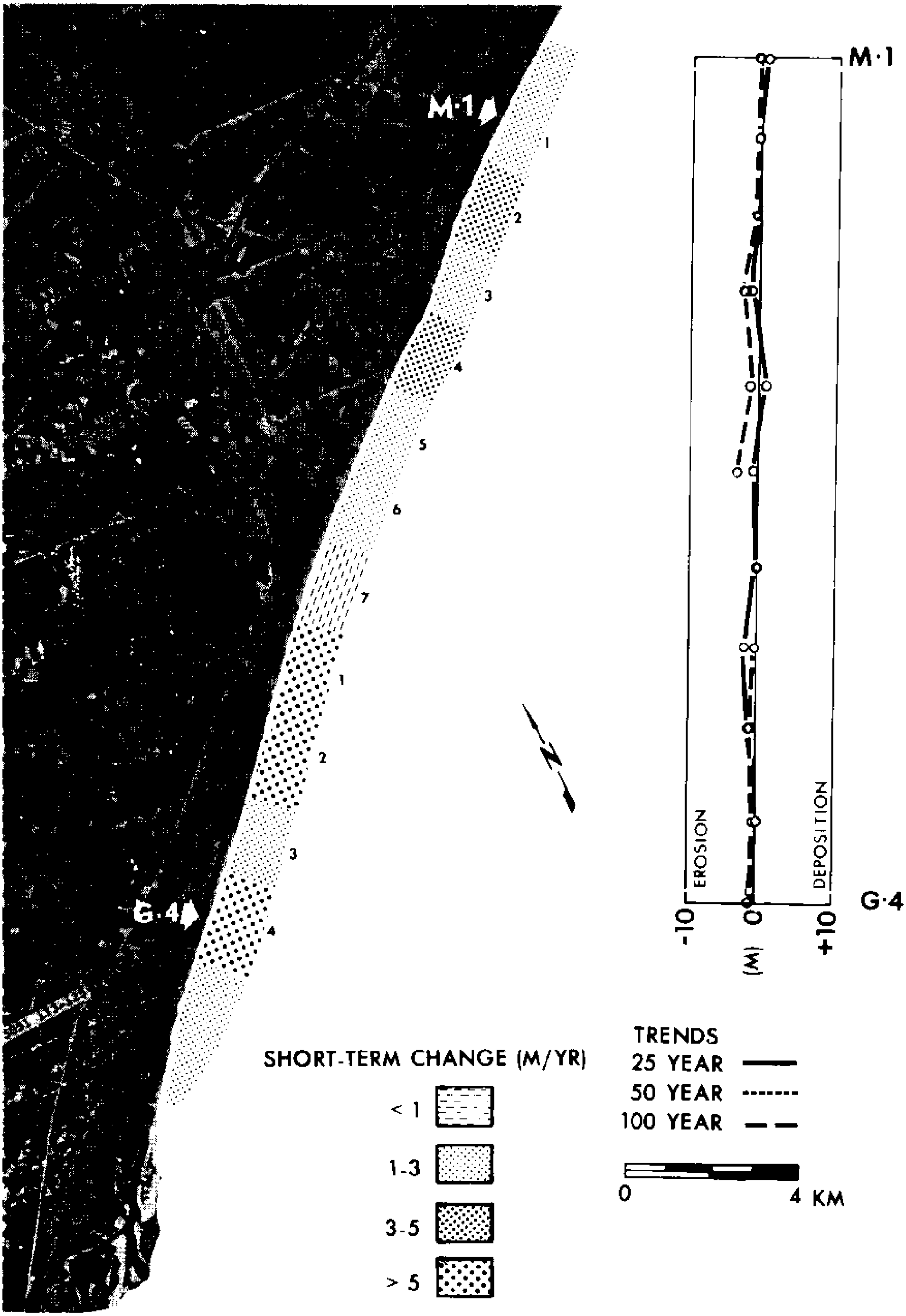
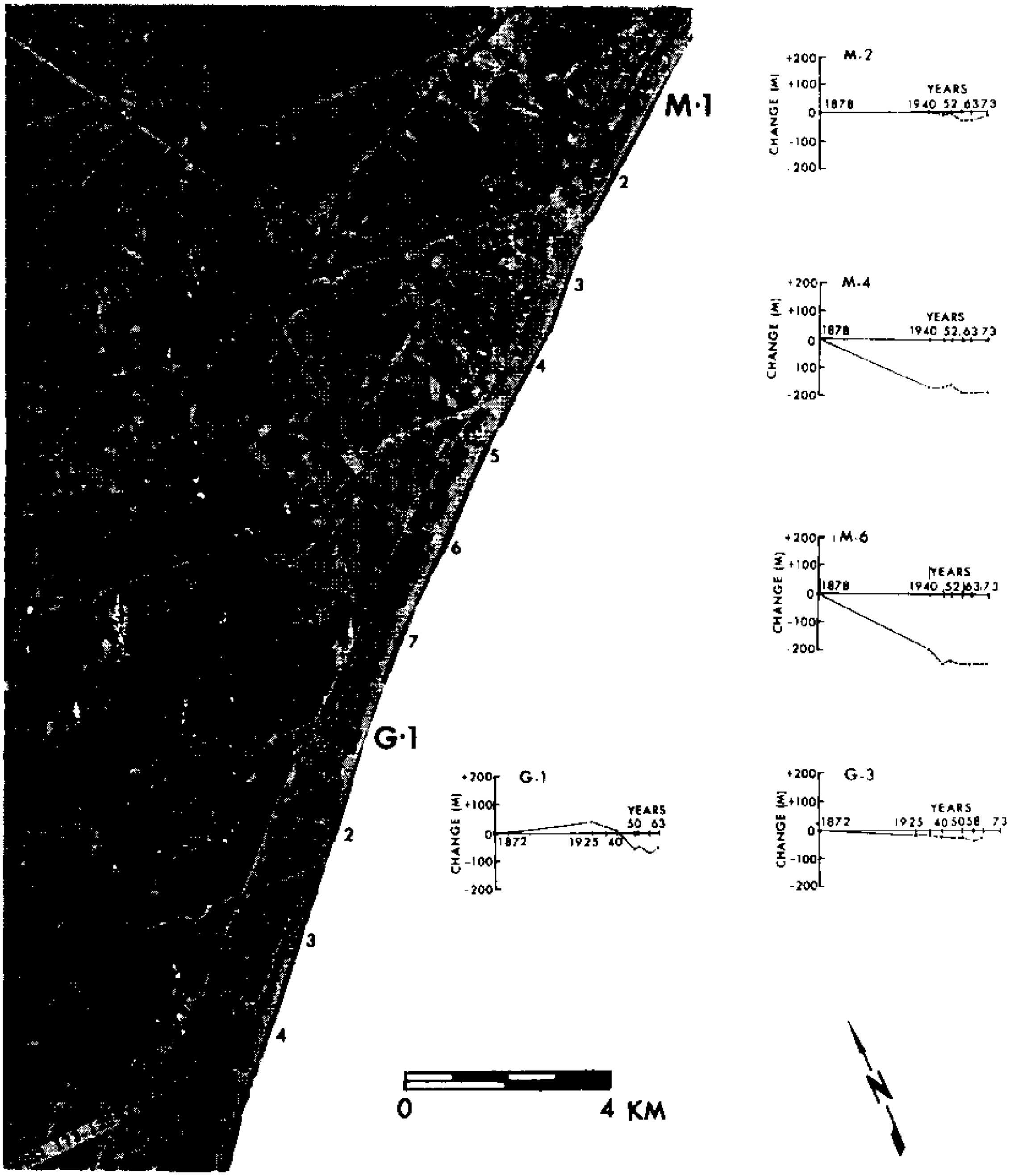

M·1
G·4
1
2
3
4
5
6
7
1
2
3
4
EROSION
DEPOSITION
-10
0
+10
(M)
SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
TRENDS
25 YEAR
50 YEAR
100 YEAR
0
4 KM

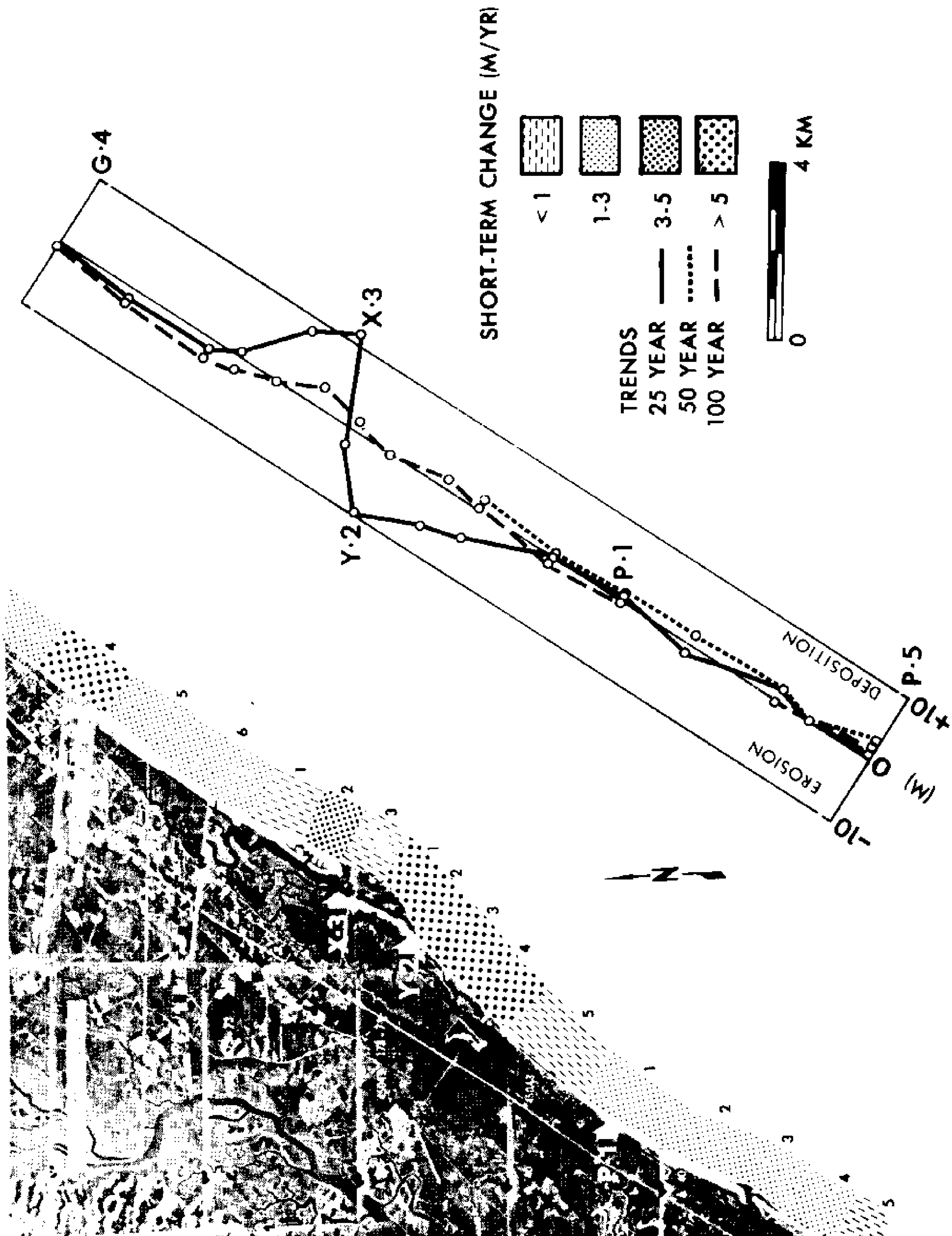
Figure 5. Erosion-deposition curves for stations M-1 (Myrtle Beach) to G-4 (Garden City Beach). The most noticeable characteristic of these curves is the nearly linear change at each station. Stations M-4 and M-6 show steady, gradual erosion throughout the entire period of record. Changes at stations M-2, G-1 and G-3 are consistently small. Intermediate stations (Appendix III) behave similarly.



M·1
2
3
4
5
6
7
G·1
2
3
4
M-2
M-4
M-6
G-1
G-3
CHANGE (M)
YEARS
+200
+100
0
-100
-200
1878
1940 52 63 73
1872
1925 40
50 63
1925 40 50 58 73
0
4 KM
N

Figure 6. Erosion-deposition trends and short-term variability (since 1950) at stations G-4 (Garden City Beach) to P-5 (Near Pawley's Inlet). Three things should be noted on the trend graph. First, the 25 year trend shows drastic changes in shoreline position in the vicinity of Murrells Inlet (these are described more fully in Figure 8). Second, the area under the erosion part of the trend (south of Murrells Inlet) is nearly equal to that under the deposition portion of the curve (north of the inlet), indicating a shift of sediment rather than a total loss of sand from the system. Finally, the difference between the 25 and 100 year trends in the vicinity of Murrells Inlet implies that the effect of migrating tidal inlets is much more important as a short-term event. This is certainly an encouraging thought to those trying to relate tidal inlet processes to changes on adjacent beaches.

The short-term variability figures illustrate one of the pitfalls that can occur in this type of data treatment. Station X-1 and X-3 show only slight change over the short term. This is due to the fact that these figures are based only on erosion measured during the most recent 25 years of record. This example illustrates, how, when using this type of information, the reader must consider all the input he has into the problem, including the erosion-deposition curves (see Fig. 7) and common sense. The location of these stations on a spit flanking an extremely active inlet should indicate to the prospective planner that these areas could be subject to sudden and extreme erosion (see Fig. 7: Station X-3, 1872-1925 and Station Y-1, 1925-1942, 1952-1957).



SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
TRENDS
25 YEAR
50 YEAR
100 YEAR
0
4 KM
G-4
X-3
Y-2
P-1
P-5
DEPOSITION
EROSION
+10
0
-10
(M)
N

Figure 7. Erosion-deposition curves for stations G-5 (Garden City Beach) to P-5 (near Pawleys Inlet). Note the extreme variability in the vicinity of Murrells Inlet. This is considered in more detail in Figure 8.

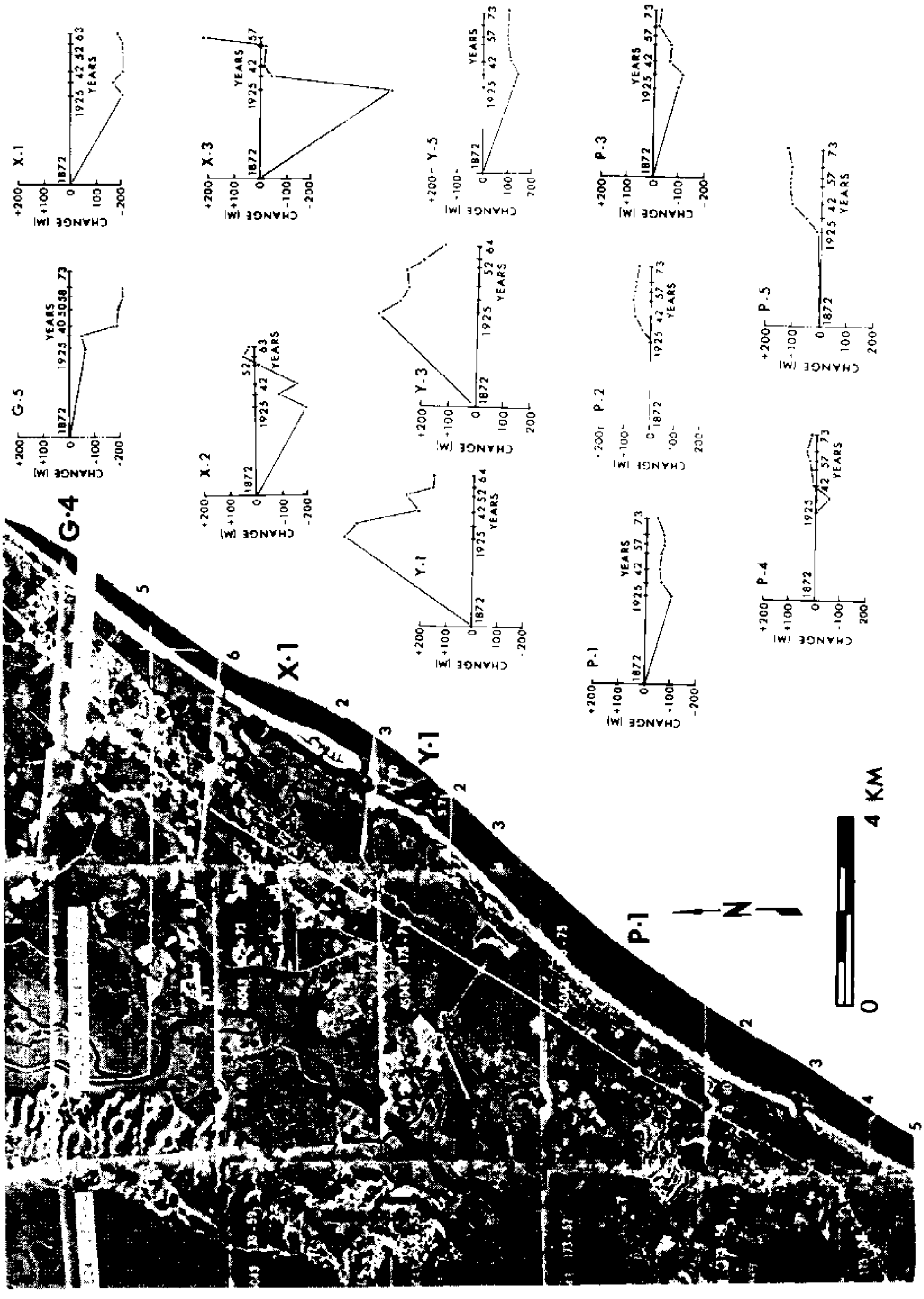

G·4
X·1
Y·1
P·1
N
0
4 KM
G-5
X-1
X-2
X-3
Y-1
Y-3
Y-5
P-1
P-2
P-3
P-4
P-5

Figure 8A. Low-tide aerial photograph looking north across Murrells Inlet. Note the large intertidal (I) and subtidal (S) sand bodies that dominate the inlet. Their occurrance is related to three factors:

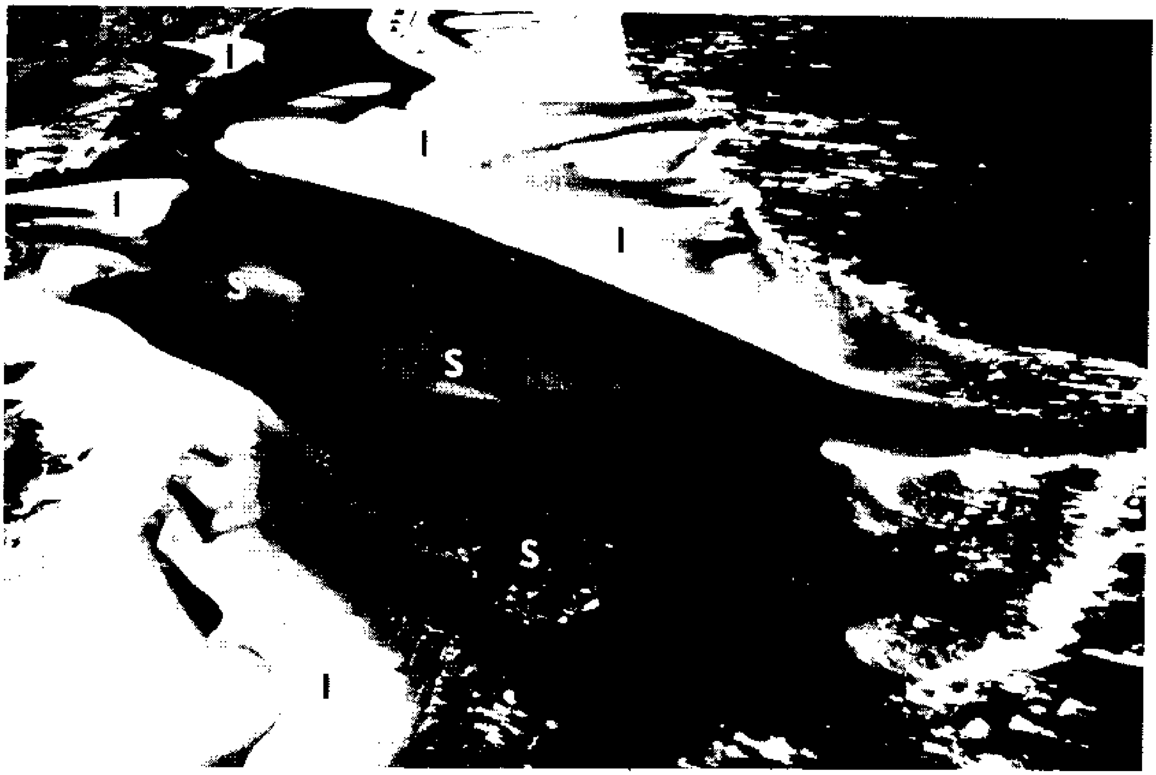
1) Large quantities of material are carried to the inlet from both the north and south beaches (gross longshore transport).
2) Northward and southward transport are nearly balanced. Therefore, most of the sediment that reaches Murrells Inlet tends to reside there.
3) The tidal currents cannot remove this material from the inlet throat.

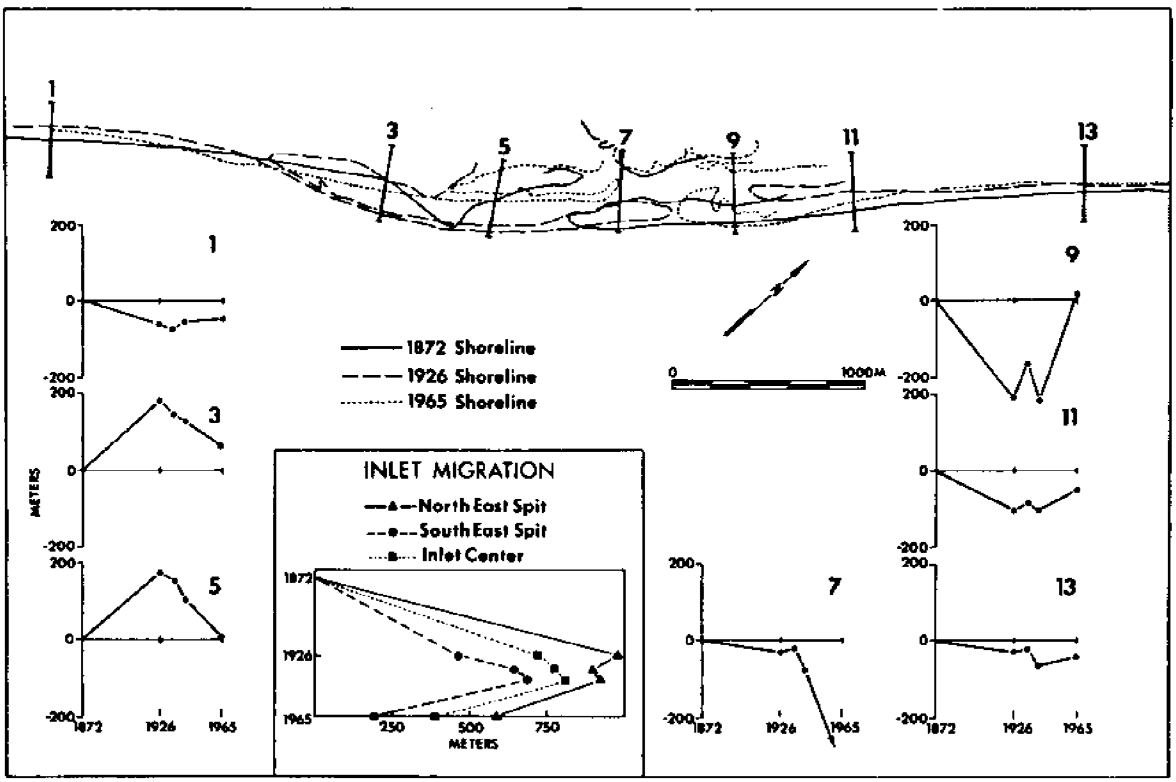
Due to the second factor (the near balance of northward and southward littoral transport) the inlet is extremely sensitive to major changes in wave climate. This is responsible for the migration habit of the inlet shown in B.

B. Depositional history of Murrells Inlet since 1872. Data summarized in this figure support two major points.

1) Greatly increased variability in shoreline behavior can be expected in the vicinity of Murrells Inlet (compare stations 3-11 with 1 and 13).
2) This variability is related to the migration of Murrells Inlet, first one kilometer to the north between 1872 and 1926, and then 250 m back to the south between 1926 and 1965 (inset).

For reference to Figures 6 and 7, station 3 is located near Y-2; station 11 is in the vicinity of X-1. The locations are not perfectly superimposed and slight differences between the erosion-deposition curves occur.


I
I
I
I
S
S
S
I


1
3
5
7
9
11
13
1872 Shoreline
1926 Shoreline
1965 Shoreline
0
1000M
INLET MIGRATION
North East Spit
South East Spit
Inlet Center
METERS
200
0
-200
1872
1926
1965
250
500
750

range in this area (2.6 m compared to 1.7 m further north) coupled with the vast marsh systems developed behind the barrier island chain results in larger tidal prisms, and often, higher tidal current velocities.

As a result, both direct (tidal currents on the beaches) and indirect effects (wave refraction around the ebb-tidal delta, sheltering of the beach from larger waves, etc.) of the tidal inlets on barrier island erosion and deposition are markedly increased. The lack of information on these inlets prevents anything other than a qualitative statement of this interaction. We feel this relationship warrants extensive investigation in the future.

Hunting Island

Hunting Island (Figs. 11 and 12) occupies the east-facing arm of the arc it forms with Fripp Island to the south. The truncation of the beach ridges on the northern end of the island and their angular relationship to the present-day beach indicate a realignment of this section of shoreline.

Hunting Island has shown a general erosional character along its entire length. The accretion shown in the 25 year trends along its northern and southern ends (Fig. 11) occurred, for the most part, since 1960 (Fig. 12). Some growth may be attributed to Corps of Engineers efforts to nourish the area, but the general trend has been for this material to be removed by wave action. On the south end of the island (H-5, H-6), accretion occurred as the result of recurved spit growth. On the northern end of the island (H-2) a swash bar from St. Helena Sound migrated onto the beach, resulting in 500 m of shoreline advance between 1960 and 1973. Based on longer trends, however (Fig. 11), these sections should be expected to retreat in the future, especially in the vicinity of station H-1.

Fripp Island and Pritchards Island

The trend along this section of coast (Figs. 11 and 12) has been one of erosion or only slight local accretion. Based on a 25 year trend, exceptions occur in the vicinity of Fripp Inlet (stations F-1, 2 and 3), presumably related to the landward migration and attachment of swash bars onto the beach at these locations. Erosion-deposition curves for these sites show, however, that sudden erosion can occur.

Capers Island and Baypoint Island

Capers and Baypoint Islands (Figs. 11 and 12) are examples of Brown's (1976) transgressive barriers. According to his classification, this type of shoreline is characterized by low relief and the absence of any well-developed beach-ridge system. In almost every case, short-term variations in excess of 5 m can be expected along these beaches. Development in this type of area would be unwise.

Hilton Head Island

The 25 year trend of this area (Figs. 13 and 14) shows a complex pattern of erosion and deposition along the island's length. Comparison of total volumes of material eroded and deposited along the entire island suggests that sand is not being lost from the island system, but is simply being shifted around from one place to another (Compare the area under the erosion portion of the 25 year trend in Figure 13 to the area under the deposition portion of the curve.). It appears that sand eroded from the more easterly-facing portion of the island is moving toward the southern half of the island.

Daufuskie Island

Daufuskie Island (Figs. 13 and 14) is a beach-ridge barrier in Brown's (1976) classification. The well-developed dunes backing the beach provide

Figure 9. Erosion-deposition trends and short-term variability (since 1952) at stations D-1 (Debidue Island) to W-6 (Santee Islands). Note the variability occurring near North Inlet (stations D-5 to I-3). Also note the rapid erosion occurring south of Winyah Bay (stations W-1 to W-6). The increase in erosion rate from station W-6 toward W-1 demonstrates the effectiveness of the Winyah Bay jetties as a sediment trap.

The pattern of short-term variability shown between stations I-1 and S-3 is similar to that described by Stephen et al (1975) for many of the barriers in Charleston County. The central portion of the island displays the most consistent stability. Variability generally increases in either direction toward the neighboring tidal inlets. The high rate of short-term change indicated for station I-4 is related to the overwash activity that can be seen on the accompanying photographic mosaic.

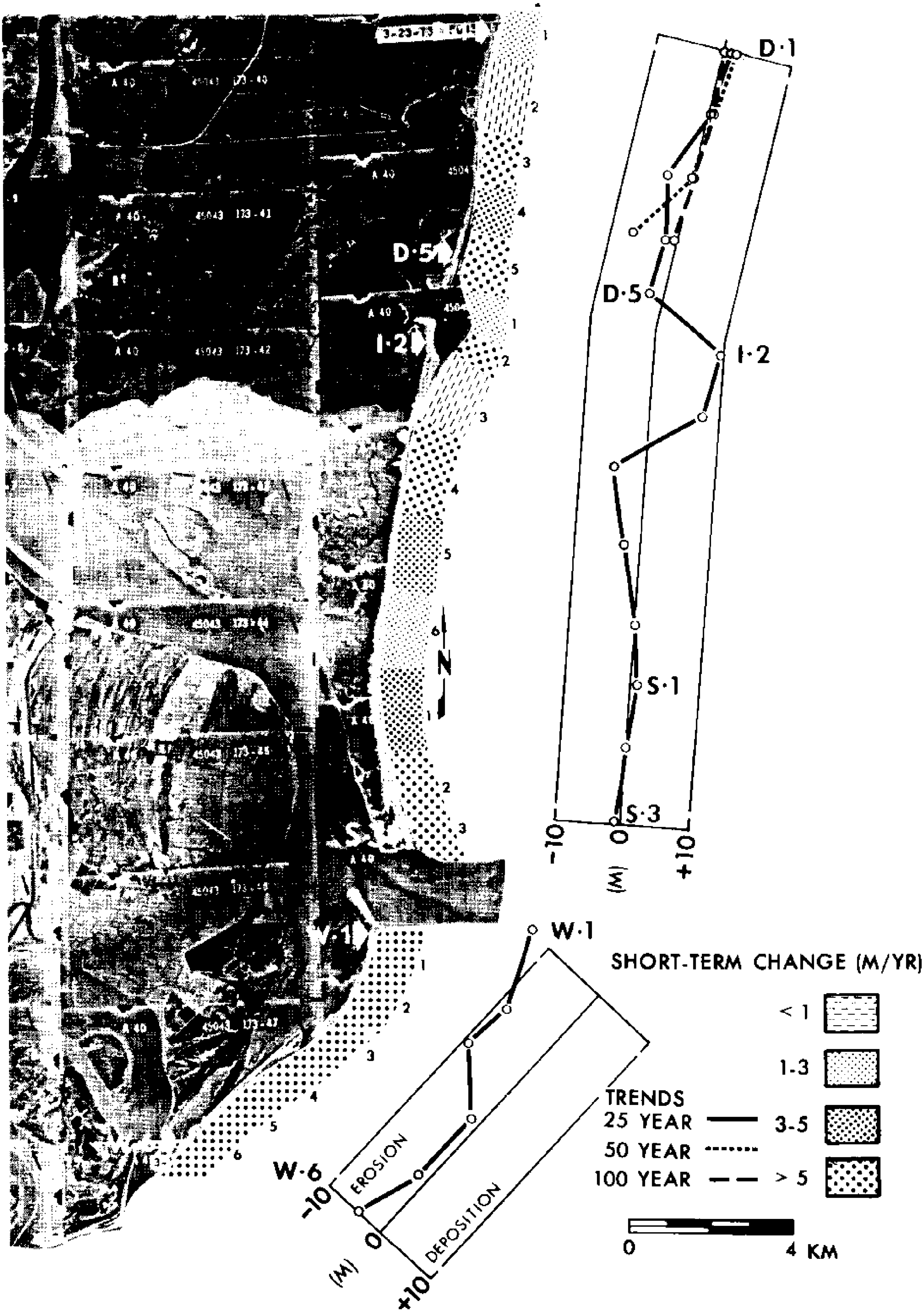

D·1
D·5
I·2
S·1
S·3
-10
0
+10
(M)
W·1
W·6
EROSION
DEPOSITION
SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
TRENDS
25 YEAR
50 YEAR
100 YEAR
0
4 KM
N

Figure 10. Erosion-deposition curves for stations D-1 (Debidue Island) to W-6 (Santee Islands). Note the rapid shoreline changes occurring in the vicinity of North Inlet (stations D-3 to I-3). The 1000 m of shoreline advance at station D-5 between 1934 and 1942 is a result of the southward migration of the Debidue recurved spit past that location and does not represent 1000 m of steady shoreline advance along that transect. Note also the rapid and steady shoreline retreat shown at station I-4. This erosion is related to the washover fans seen in the accompanying photomosaic.

Graphs W-1 through W-6 show shoreline retreat between 1952 and 1973. Inspection of earlier coastal charts showed a different trend. The spit extending northward into Winyah Bay was formed between 1908 and 1928. March deposition occurred subsequent to spit development. Recent erosion is most likely related to damming of the Santee in 1939.

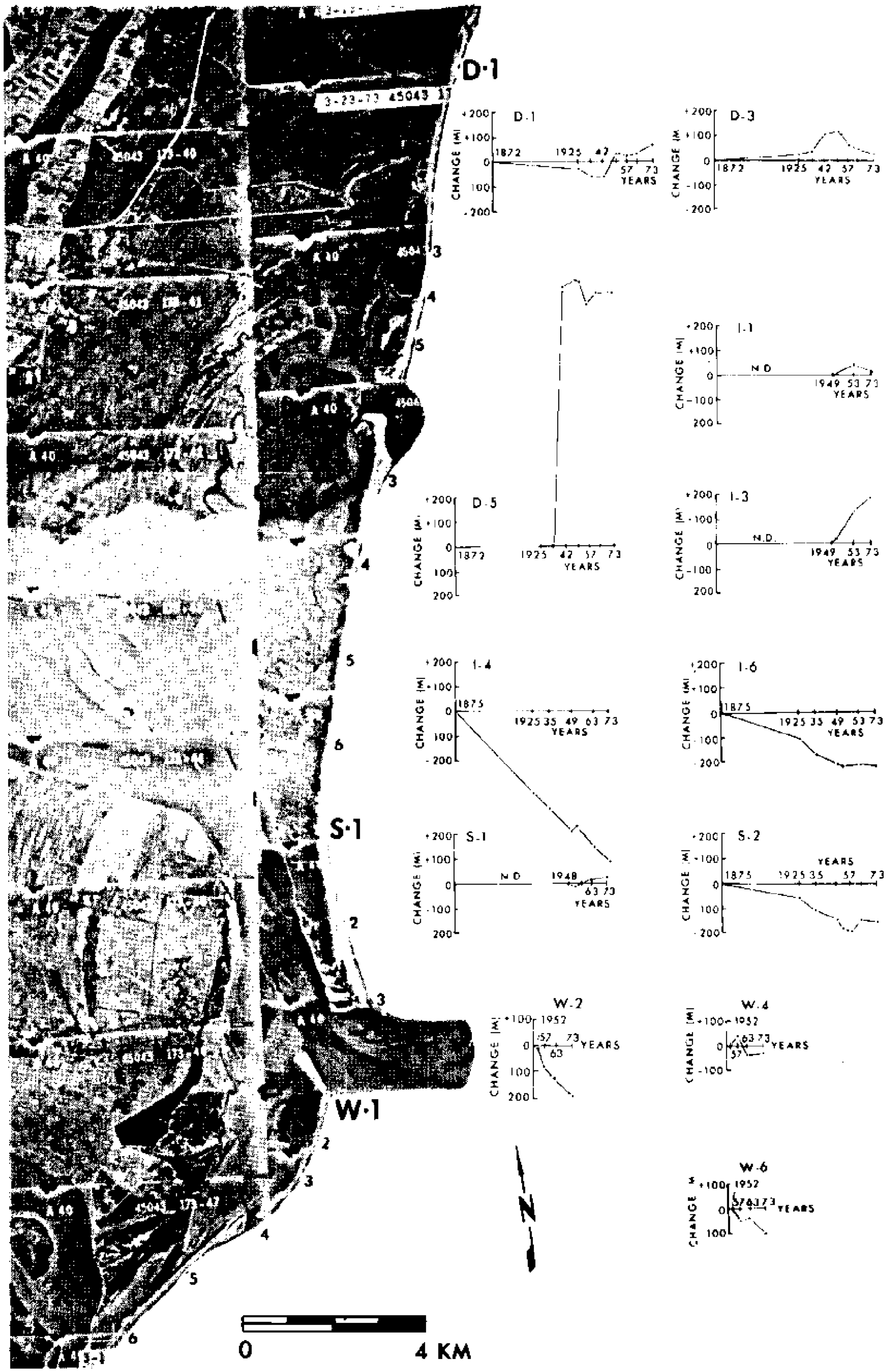

D·1
S·1
W·1
0
4 KM
N
D-1
D-3
D-5
I-1
I-3
I-4
I-6
S-1
S-2
W-2
W-4
W-6
CHANGE (M)
YEARS
N.D.

Figure 11. Erosion-deposition trends and short-term variations (since 1951) at stations H-1 (Hunting Island) to B-7 (Baypoint Island). Fripp Inlet (between H-6 and F-1), St. Helena Sound (to the northeast of Hunting Island) and Port Royal Sound (west of Baypoint Island) interact to produce a complex pattern of wave refraction and sediment transport in this area. This is responsible for the high short-term variability seen at nearly all stations. Extreme changes are no longer confined to the areas immediately flanking the tidal inlets as all sections of the beach come under the influence of inlet processes to some degree. Note that variability is significant regardless of the period of record.

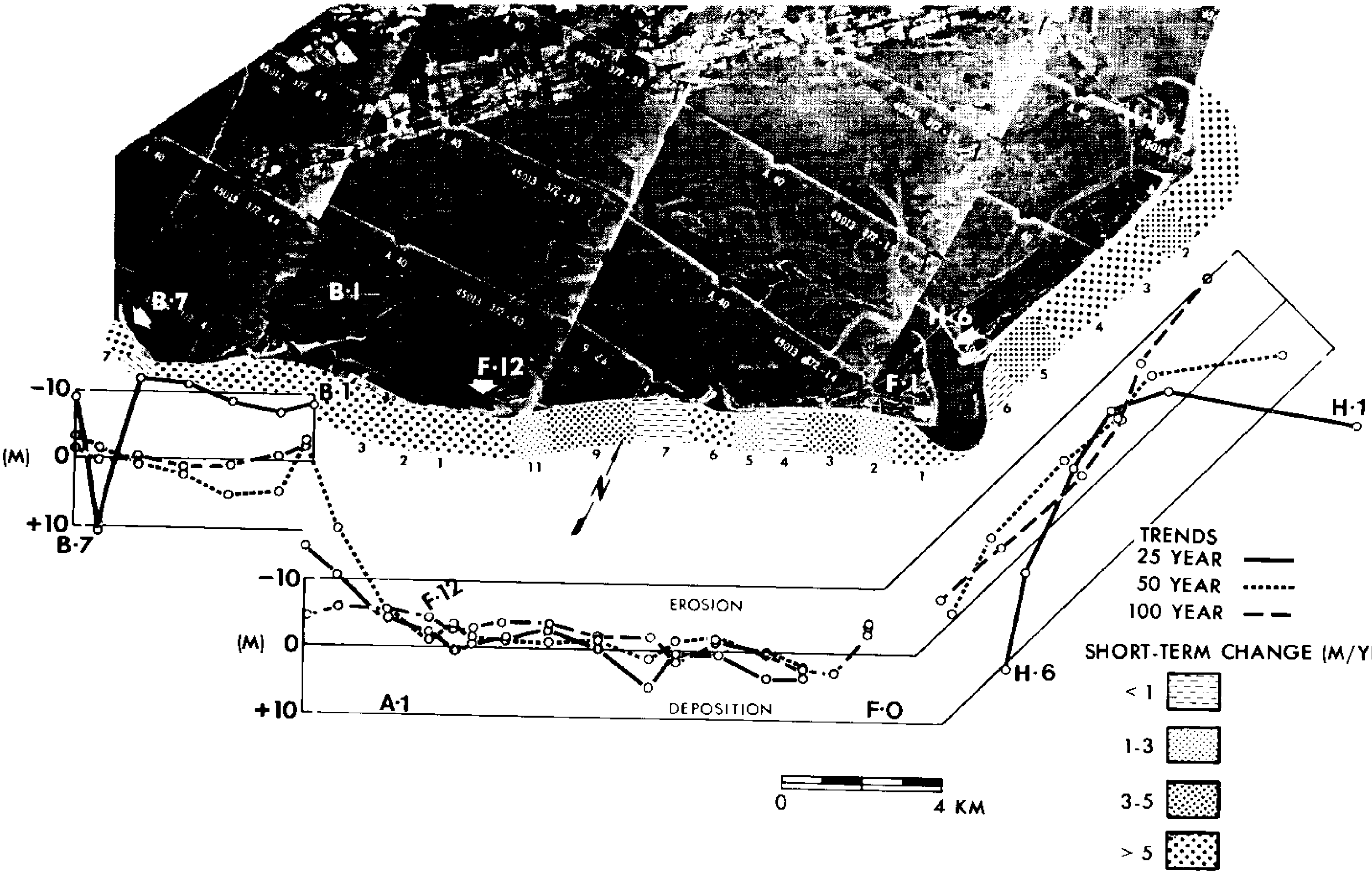

B·7
B·1
F·12
F·1
H·6
H·1
A·1
F·O
N
-10
0
+10
(M)
EROSION
DEPOSITION
TRENDS
25 YEAR
50 YEAR
100 YEAR
SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
0
4 KM

Figure 12. Erosion-deposition curves for stations H-1 (Hunting Island) to B-7 (Baypoint Island). The overall trend in this area is one of continued and, in many cases, severe erosion. This is largely due to the effect of tidal inlets discussed in Figure 11. The hardest hit areas are stations H-1 through H-6 (Hunting Island) and A-1 through A-3 (Capers Island). The retreat of Hunting Island is related to a reorientation of the beach in response to waves traveling across open St. Helena Sound. We feel that the rapid erosion at stations A-1, 2 and 3 is a function of coastal geomorphology. Unlike other barriers in this area, there are no beach ridges on Capers Island. Elsewhere along the South Carolina coast, (Stephen _et al._, 1975; Brown, 1976) areas lacking beach ridges have the highest erosion rates measured. This area is characterized by severe washover (see photomosaic) and erosion rates in excess of 29 m per year.

The only place not undergoing serious long-term erosion is the beach immediately to the west of Fripp Inlet (stations F-1 through F-3). Hayes _et al._, (1970) described a natural process in which the beach immediately downdrift of tidal inlets can build out due to the refraction of waves around the ebb-tidal delta (outer bar). According to this concept, storm waves approaching from the northeast would cause southward longshore sediment transport along Hunting Island which is gradually realigning itself in response to these waves. Upon encountering the shoals (ebb-tidal delta) of Fripp Inlet however, the waves would be refracted (bent) so that they would be approaching the beach from the south in the vicinity of stations F-1, 2 and 3. This reversal in wave approach direction causes easterly transport at these stations and the gradual building out of the beach in the area near the inlet. Despite the long-term accretional tendency in this area, rapid erosion can occur (station F-1, 1955-60). Field studies have shown this area subject to frequent erosional episodes.

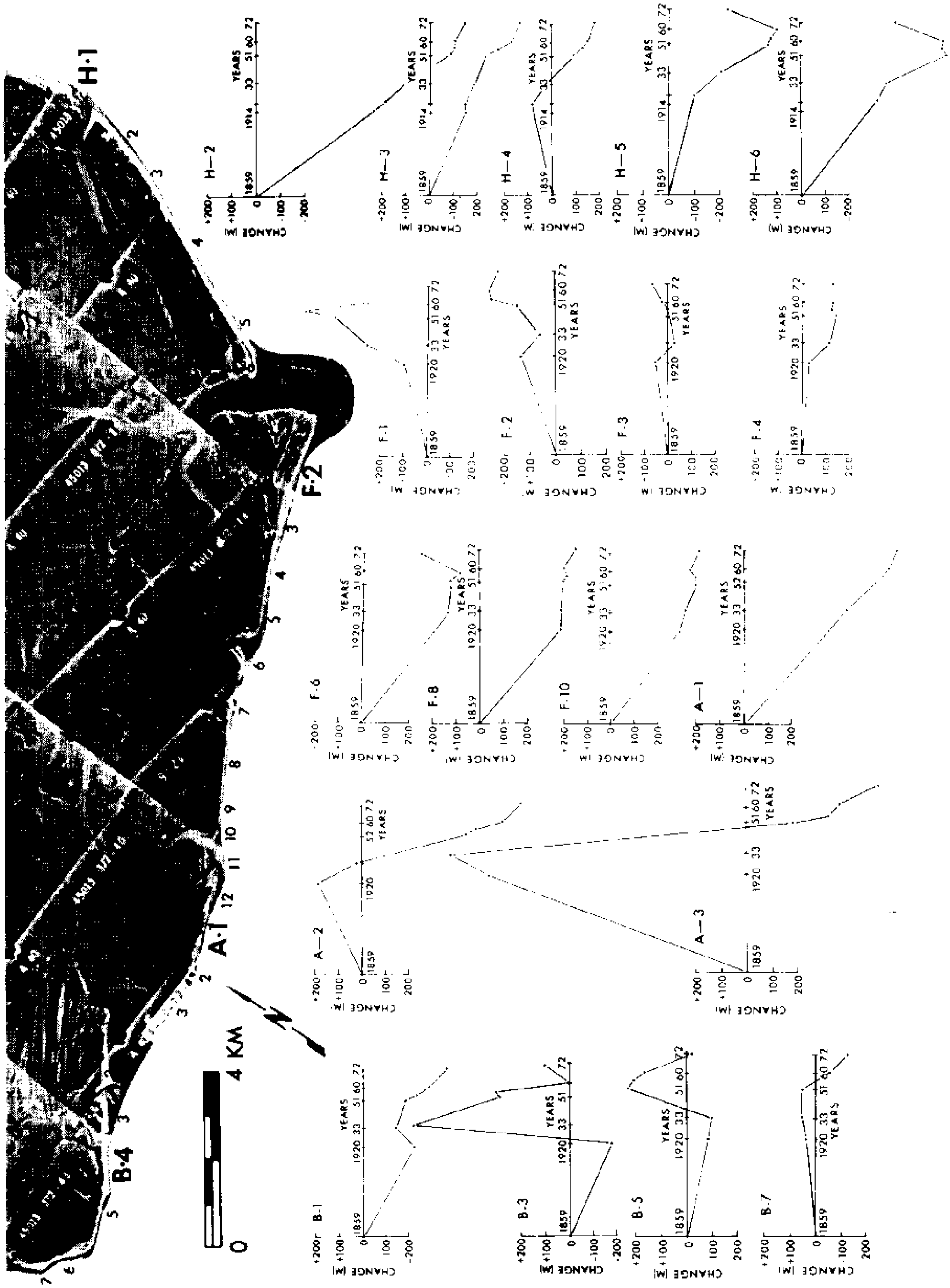

H·1
F·2
A·1
B·4
0
4 KM
N
H—2
H—3
H—4
H—5
H—6
F·1
F·2
F·3
F·4
F·6
F·8
F·10
A—1
A—2
A—3
B·1
B·3
B·5
B·7
CHANGE (M)
YEARS

Figure 13. Erosion-deposition trends and short-term variability (since 1951) for stations J-1 (Hilton Head Island) to Z-4 (Daufuskie Island). Generally, this area demonstrates greater stability than other beaches in Beaufort County. The 25 year trend for Hilton Head shows alternating zones of erosion and deposition. Oddly, one of the stabler areas in recent time is the section of beach near Port Royal Sound (stations J-1 to J-4). Along central Hilton Head Island, it appears that material is being eroded from the area between stations J-5 and J-7 and is being redeposited in the area between stations T-1 and T-4. The truncated beach ridges in the vicinity of stations J-5, 6 and 7 indicate that erosion along this stretch of beach is related to a reorientation of that portion of the Hilton Head Island. Daufuskie Island has shown steady, gradual retreat throughout the period of record.

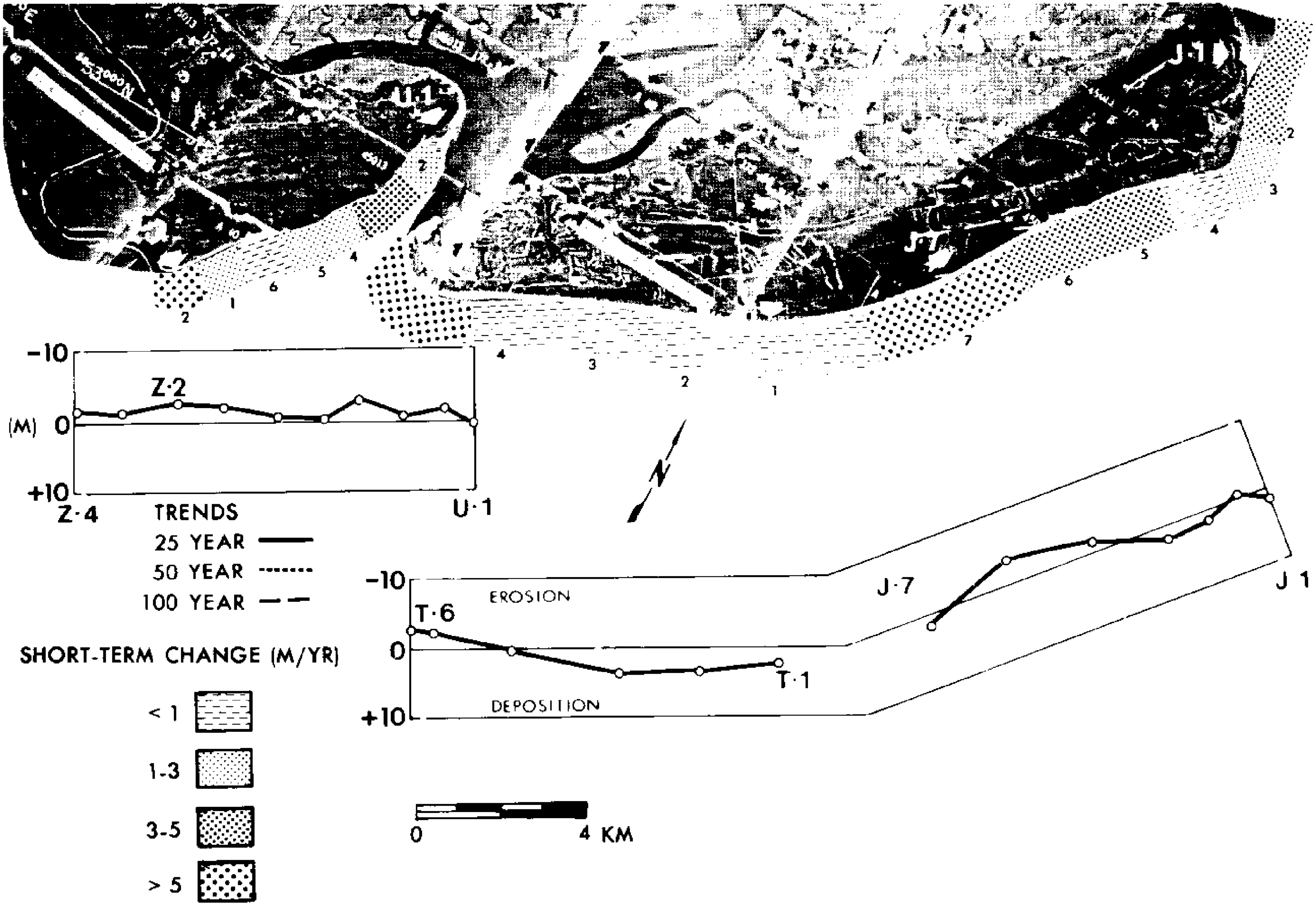
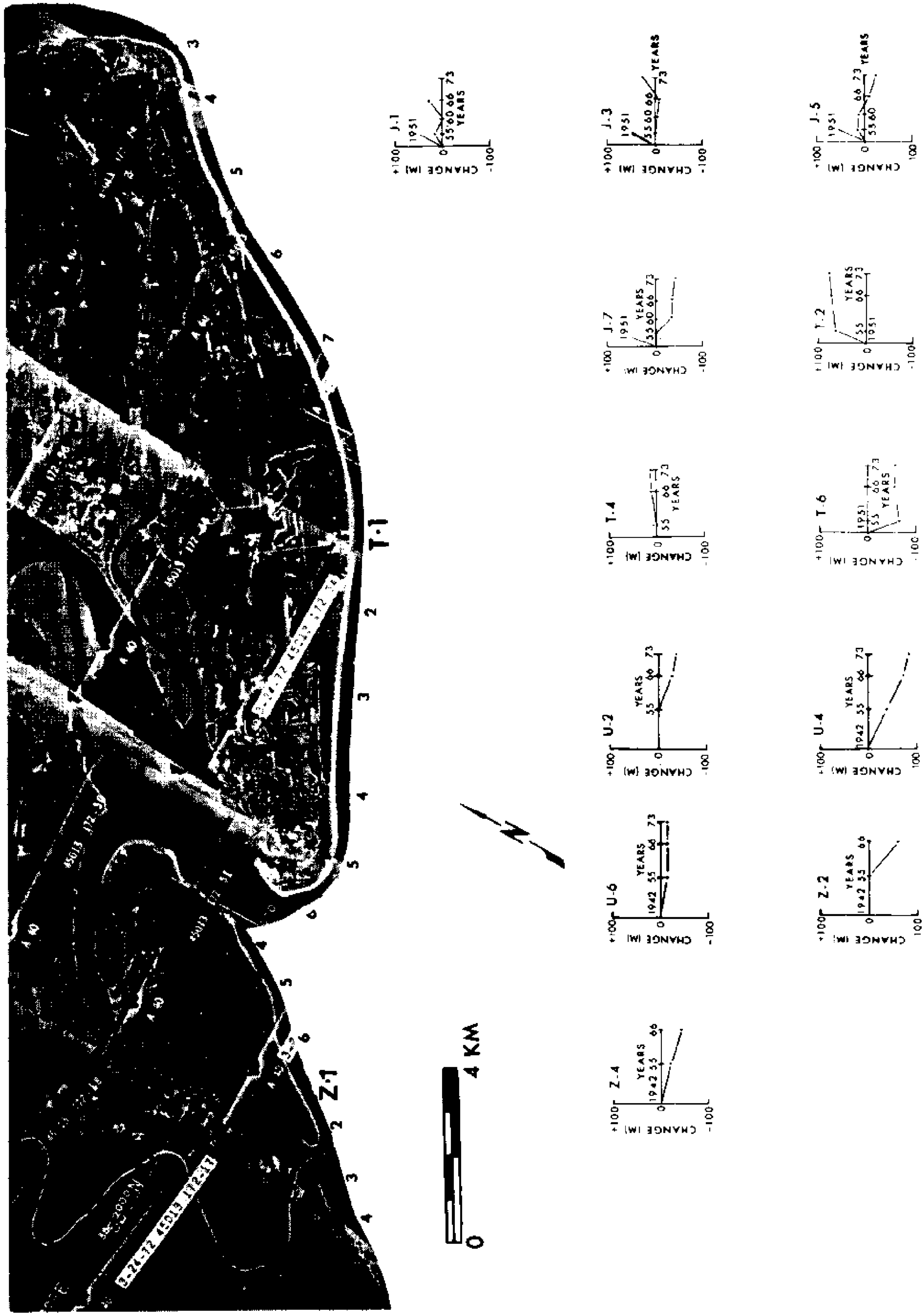

J·1
U·1
Z·2
-10
(M) 0
+10
Z·4
U·1
N
TRENDS
25 YEAR
50 YEAR
100 YEAR
-10
0
+10
EROSION
DEPOSITION
T·6
T·1
J·7
J 1
SHORT-TERM CHANGE (M/YR)
< 1
1-3
3-5
> 5
0
4 KM

Figure 14. Erosion-deposition curves for stations J-1 (Hilton Head Island) to Z-4 (Daufuskie Island). Despite the variability in shoreline change from station to station, the overall trend in this area is one of stability. When erosion occurs, it is <u>generally</u> slight. It appears that Hilton Head is gradually becoming reoriented by erosion along its northern half (note the truncated beach ridges at stations J-5, 6 and 7). Much of the sand being added to the beach at stations T-1 through T-4 probably was derived from this area. Daufuskie Island has undergone gradual retreat over the period of record. In addition to wave action, tidal currents from Calibogue Sound can be effective in removing sand from this beach.


J-1
J-3
J-5
J-7
T-1
T-2
T-4
T-6
U-2
U-4
U-6
Z-1
Z-2
Z-4
YEARS
CHANGE (M)
4 KM
N

a buffer against serious erosion by waves; therefore, erosion rates are fairly small. Due to its position in Calibogue Sound (Fig. 1), Daufuskie Island is in an area affected by tidal currents. Much of the sand eroded from the beach by wave action can thus be carried out of the area.

SUMMARY

1. Computer-assisted analyses of chart and aerial photographic data has been used to determine short- and long-term beach erosion-deposition trends in South Carolina. These data are a necessary consideration in the planning and development of the coastal zone, inasmuch as they can help to minimize economic losses resulting from construction in unstable areas.

2. Users of this information are reminded that the relative stability of a shoreline must be considered on two levels:

   a. The long-term stability of a beach area is the rate at which it is either prograding or retreating over a period of, say, 50 or 100 years. It is reflected in major reorganizations of coastal geomorphology, and is probably caused by changes in local wave climate or sediment supply. Considerations of these rates of change are important but certainly not all-inclusive, because they only indicate the <u>net</u> change in a shoreline position, and shed no light on shorter-term events.

   b. The short-term stability of a beach area is the extent to which the shoreline fluctuates over periods of months or years, usually in response to storm conditions. These fluctuations are super-imposed on the longer-term changes, and are probably the most important to consider in terms of where to best locate a home or business.

3. Evaluation of the data presented here reveals some general trends along the South Carolina coast:

a. The grand strand area is relatively stable. Exceptions occur in the vicinity of Little River, Murrells and other small tidal inlets. The extent of the inlet's influence is a function of the size of the inlet and the distance over which it migrates.

b. Other portions of the coast exhibit varying degrees of stability, depending upon inlet size and frequency. In areas where moderate sized tidal inlets are separated by more than 10-15 km, the area midway between the inlets generally exhibits the greatest stability. Shoreline variations increase in either direction toward the inlets. In areas where inlets are much closer together and much larger (Beaufort County), few sections of beach are outside the effects of the neighboring tidal inlets. In these areas a complex history results which is closely tied to changes in the hydraulic and sediment transport patterns of the nearby inlets.

REFERENCES

Brown, P. J., 1976, Variations in South Carolina Coastal Morphology, in Hayes, M. O. and Kana, T. W. (Ed.), Terrigenous clastic depositional environments, Tech. Rpt. No. 11-CRD, Coastal Research Division, Department of Geology, University of South Carolina, p. II-2 to II-15.

Hayes, M. O., Goldsmith, V., and Hobbs, C. H. III, 1970, Offset coastal inlets, Proc. 12th Coastal Engineering Conference, p. 1187-1200.

Sensabaugh, W. M., 1976, Problems of Coastal Management, Shore and Beach, v. 44, no. 1, p. 6.

Stephen, M. F., Brown, P. J., FitzGerald, D. M., Hubbard, D. K. and Hayes, M. O., 1975, Beach erosion inventory of Charleston County, South Carolina: a preliminary report, South Carolina Sea Grant Tech. Rpt. No. 4, 79 p.

APPENDIX I

Possible Sources of Error in this Study

POSSIBLE ERRORS

When using the information in this report for interpretive purposes, it is important that the coastal planner be aware of the potential errors that are often encountered in the analysis of this type of data. Although the determination of some errors related to taking and processing of the imagery used are beyond the scope of this section, it is felt that the nature of these errors should be pointed out to the reader. Inaccuracies that can enter into the final product at any stage of the data reduction are therefore considered separately below. In addition, a table is provided which summarizes these errors and offers a brief statement of how each was treated.

Shooting and printing of photographs

Errors at this level are of two types, operational and internal. Examples of operational errors are camera tilt and altitude change during the photo survey. Internal errors are related to the optics of the camera system. The primary optical problem is the distortion that occurs along the edges of the photograph. For this report, photographs that were purchased had been corrected during printing to account for these types of error when possible. Scale accuracy is generally ± 1%. Errors due to edge distortion were generally estimated as less than ± 1%. *

Mosaic construction

The major errors in this step arise from overlapping a photograph out of

---

*These figures are based on estimates from the head of the U. S. Department of Agriculture Aerial Photography Field Office in Salt Lake City, Utah. For a more complete consideration of this problem, that agency should be consulted.

its proper attitude with respect to the adjacent photograph. To minimize this error, the distance between two or more locations on adjacent photographs were scaled to match the distances measured on the most recent corresponding U. S. G. S. topographic sheets. In addition, the angular relationships between linear features such as highways on adjacent photos were adjusted to be consistent with U. S. G. S. topographic sheets.

Determination of shoreline position

As this problem is related primarily to interpretation it is impossible to totally eliminate it. Aerial photographs were not always taken at the same water level stage, and the intersection of the ocean with the beach therefore cannot be used. Along each section of beach, a dominant feature (eg. dune scarp, berm crest, etc.) that was identifiable for all photo years was chosen. Each shoreline position was then agreed upon by a minimum of two people.

Transfer of shoreline positions onto overlays

This problem is closely linked to the one just discussed. The major problem is to determine exactly where the feature being used is located and to plot that feature on an overlay in a consistent manner. Transfer was therefore done by a single operator to keep any operator bias consistent.

Digitization of shoreline positions

As a check for gross digitization errors, all operations performed by the computer were calculated by hand. It appears that the small errors that might occur in this step are not cumulative and tend to average out.

Computer-related errors (measurement and plotting of changes)

Hand calculation of shoreline changes indicate that no programming errors exist and that data presented in this report is in no way affected by this step.

Errors in older charts

Comparison of landmarks appearing on successive charts can be used as a qualitative indicator of the reliability of these data. There is however, no objective way to quantify the errors that might occur in the oldest charts (circa. 1850) used in this survey. Despite inaccuracies that might exist however, it is felt that for describing long-term (100 year) shoreline changes (the primary purpose for which these data were included) these data can be considered reliable.

POSSIBLE ERRORS		
Step	Possible Inaccuracies	Preventative or Corrective Measures
1) Shooting and processing of original photos	Camera tilt	Corrected during printing of photograph.
	Edge distortion	1) Optical refinement has minimized this in recent imagery 2) Only the central portions of recent negatives are printed
	Errors in this step were estimated by the U. S. Dept. of Agriculture to be generally less than 1% (some of the oldest photographs may have errors approaching 5%)	
2) Construction of mosaics	Angular or distance errors between adjacent photographs	Completed mosaics were compared to existing U.S.G.S. topographic sheets. (It should be noted that inaccuracies can exist in these sheets.)
3) Determination of shoreline positions	Changing waterline	Did not use waterline for comparative purposes.
	Determining what features to use for shoreline comparisons	Along each section of coastline, a dominant feature that was identifiable for <u>all</u> photo years was used (eg. dune scarp, berm crest, etc.). Each shoreline position was determined by a minimum of two people.
4) Transferring shorelines to a common overlay	Interpretation of where the selected feature is on each photograph	All shoreline positions were transferred by one operator so that any bias or error would be consistent. (The width of a fine-tipped pencil line was 2-4 m) Also, due to the way shorelines were compared, errors are random, not cumulative.
5) Digitization of shoreline positions	Operator error	All measurements were hand checked
6) Measurement of shoreline changes by the computer	Programming errors	All measurements were hand checked
7) Plot and tabulate data	Programming errors	All results were hand calculated and checked

APPENDIX II

Tabulated Erosion-Deposition Rates for all Reference Points

The following rates are yearly averages based on approximately 25, 50 and 100 years of record. The actual number of years covered is indicated in parentheses.

Station	25 yr.	50 yr.	100 yr.	Location (Horry/Gtn. Cos.)
L-1	- 6.0 (21)	--	--	Little River Area
L-2	-12.3 (21)	--	--	
L-3	- 4.3 (23)	-0.2 (48)	+2.9 (100)	
L-4	- 2.6 (23)	+0.4 (48)	+1.0 (100)	Little River Area (A)
L-5	+ 0.9 (23)	+2.3 (48)	+0.8 (100)	
L-6	+14.6 (23)	+5.8 (48)	+2.9 (100)	
L-7	+ 2.6 (23)	-0.6 (48)	-1.1 (100)	
L-8	+ 1.1 (23)	+1.1 (48)	-0.8 (100)	
L-9	+ 0.4 (23)	+1.4 (48)	+1.3 (100)	
L-10	0.0 (23)	--	--	
L-11	- 0.8 (23)	--	--	
C-1	+ 0.4 (21)	--	--	Cherry Grove Beach
C-2	- 2.7 (23)	--	-2.8 (85)	
C-3	- 0.6 (23)	--	-3.2 (85)	
C-4	+ 0.9 (23)	--	-1.7 (85)	
N-1	+ 2.4 (21)	--	-0.6 (95)	North Myrtle Beach
N-2	+ 0.4 (21)	--	-1.5 (95)	
N-3	- 0.7 (21)	--	-0.9 (95)	
N-4	- 0.4 (21)	--	-1.8 (95)	
N-5	- 0.8 (21)	--	+1.5 (95)	
M-1	+ 1.1 (21)	--	-0.1 (95)	Myrtle Beach
M-2	- 0.4 (21)	--	-0.1 (95)	
M-3	- 0.8 (21)	--	-0.8 (95)	
M-4	- 1.4 (21)	--	-2.0 (95)	
M-5	+ 0.7 (21)	--	-1.1 (95)	
M-6	- 0.5 (21)	--	-2.6 (95)	
M-7	0.0	--	--	
G-1	- 2.8 (23)	--	-0.6 (91)	Garden City Beach
G-2	- 0.8 (23)	--	-0.6 (91)	
G-3	0.0 (23)	--	-0.4 (91)	
G-4	- 0.8 (23)	--	-0.4 (91)	
G-5	- 1.0 (23)	--	-2.3 (91)	
G-6	- 1.3 (23)	--	-2.9 (91)	
X-1	+ 0.8 (23)	--	-2.0 (91)	North Murrells Inlet
X-2	+ 8.0 (23)	--	-0.2 (91)	
X-3	+11.3 (23)	--	+2.6 (85)	

Station	25 yr.	50 yr.	100 yr.	Location (Horry/Gtn. Cos.)
Y-1	- 2.5 (22)	--	+1.6 (92)	South Murrells Inlet
Y-2	- 9.5 (22)	--	0.0 (92)	
Y-3	- 6.1 (22)	--	+1.3 (92)	
Y-4	- 5.0 (21)	+1.9 (47)	+0.5 (101)	
Y-5	0.0 (21)	+0.7 (47)	-0.9 (101)	
P-1	+ 0.8 (21)	+1.1 (47)	-0.6 (101)	Pawleys Island
P-2	- 1.1 (21)	+1.0 (47)	--	
P-3	+ 2.0 (21)	+1.4 (47)	-0.3 (101)	
P-4	0.0 (21)	+0.4 (47)	+0.2 (101)	
P-5	+ 0.4 (21)	+2.5 (47)	+1.3 (91)	
D-1	+ 1.5 (23)	+2.0 (47)	+0.6 (101)	Debidue Beach
D-2	+ 0.3 (23)	+1.0 (47)	+1.1 (101)	
D-3	- 4.1 (23)	0.0 (47)	+0.2 (101)	
D-4	- 2.1 (23)	-6.9 (47)	-0.4 (101)	
D-5	- 2.3 (23)	--	--	
I-2	+ 9.6 (24)	--	--	North Inlet
I-3	+ 7.8 (24)	--	--	
I-4	- 5.0 (24)	-5.8 (48)	-6.2 (97)	
I-5	- 2.8 (24)	--	--	
I-6	- 0.2 (24)	-2.3 (48)	-2.2 (97)	
S-1	+ 0.8 (24)	--	--	North Island
S-2	- 0.2 (24)	-1.2 (48)	-1.6 (97)	
S-3	- 1.2 (24)	--	--	
W-1	-13.7 (23)	--	--	Winyah Bay/Santee Islands
W-2	- 8.5 (23)	--	--	
W-3	- 9.0 (23)	--	--	
W-4	- 1.2 (23)	--	--	
W-5	- 1.3 (23)	--	--	
W-6	- 4.3 (23)	--	--	

Station	25 yr.	50 yr.	100 yr.	Location (Beaufort Co.)
H-1	+20.3 (21)	+5.9 (52)	-10.0 (113)	Hunting Island
H-2	- 2.7 (21)	-6.7 (52)	- 7.8 (113)	
H-3	- 6.6 (21)	-4.4 (52)	- 3.4 (113)	
H-4	- 4.1 (21)	-5.3 (52)	- 1.7 (113)	
H-5	+ 1.8 (21)	-4.6 (52)	- 3.0 (113)	
H-6	+10.4 (21)	-1.7 (52)	- 3.8 (113)	
F-0	- 4.4 (21)	-4.0 (52)	- 2.6 (113)	Fripp Island
F-1	--	--	+ 2.5 (101)	
F-2	+ 3.4 (21)	+1.6 (52)	+ 1.8 (113)	
F-3	+ 3.5 (21)	0.0 (52)	+ 0.5 (113)	
F-4	+ 0.4 (21)	-1.9 (52)	- 1.4 (113)	
F-5	+ 0.4 (21)	-1.2 (52)	+ 1.8 (113)	
F-6	+ 5.8 (21)	+1.2 (52)	- 2.1 (113)	
F-7	0.0 (21)	-1.3 (52)	- 2.2 (113)	
F-8	- 2.4 (21)	-1.1 (52)	- 3.5 (113)	
F-9	- 1.7 (21)	-1.3 (52)	- 3.6 (113)	
F-10	- 0.8 (21)	-1.5 (52)	- 3.3 (113)	
F-11	+ 0.6 (21)	-3.9 (52)	- 3.0 (113)	
F-12	- 2.2 (21)	-1.6 (52)	- 4.2 (113)	
A-1	- 4.1 (21)	-5.5 (52)	- 5.6 (113)	Capers Island
A-2	-11.1 (21)	-17.0 (52)	- 6.1 (113)	
A-3	-14.9 (21)	-29.8 (52)	- 4.5 (113)	
B-1	- 8.3 (21)	-2.5 (52)	- 3.1 (113)	Baypoint Island
B-2	- 7.0 (21)	+5.0 (52)	- 0.7 (113)	
B-3	- 8.7 (21)	+5.2 (52)	+ 0.8 (113)	
B-4	-11.6 (21)	+2.3 (52)	+ 1.1 (113)	
B-5	-12.2 (21)	+1.2 (52)	- 0.2 (113)	
B-6	+10.6 (21)	-1.9 (52)	+ 0.3 (113)	
B-7	- 9.1 (21)	-3.4 (52)	- 1.2 (113)	
J-1	+ 1.9 (15)	--	--	North Hilton Head Island
J-2	- 0.7 (22)	--	--	
J-3	+ 1.2 (22)	--	--	
J-4	+ 1.9 (22)	--	--	
J-5	- 1.2 (22)	--	--	
J-6	- 3.0 (22)	--	--	
J-7	+ 2.0 (18)	--	--	

Station	25 yr.	50 yr.	100 yr.	Location (Beaufort Co.)
T-1	+ 2.4 (22)	--	--	South Hilton Head Island
T-2	+ 3.5 (22)	--	--	
T-3	+ 3.8 (22)	--	--	
T-4	+ 0.5 (22)	--	--	
T-5	- 2.0 (22)	--	--	
T-6	- 2.5 (22)	--	--	
U-1	+ 0.4 (31)	--	--	Daufuskie Island
U-2	- 1.1 (31)	--	--	
U-3	- 0.7 (31)	--	--	
U-4	- 2.8 (31)	--	--	
U-5	- 0.1 (31)	--	--	
U-6	- 0.4 (31)	--	--	
Z-1	- 2.0 (24)	--	--	Daufuskie Island
Z-2	- 2.5 (24)	--	--	
Z-3	- 1.2 (24)	--	--	
Z-4	- 1.8 (24)	--	--	

APPENDIX III

Tabulated Erosion-Deposition Changes

for all Reference Points

LOCATION: LITTLE RIVER

Reference Point	Change 1873-1925	Change 1925-34	Change 1934-42	Change 1942-50	Change 1950-52	Change 1952-58	Change 1958-63	Change 1963-73
L 1	ND	-15	-146	58	15	-62	-136	ND
L 2	ND	-26	-151	-152	11	-52	- 66	ND
L 3	297	38	- 14	66	15	-29	- 52	-32
				1942-48	1948-52			
L 4	81	53	0	26	12	-32	0	-41
L 5	- 35	70	4	17	35	-59	45	0
L 6	- 22	0	- 19	- 9	-12	-13	338	22
L 7	- 79	-55	- 27	- 7	58	-22	11	12
L 8	-136	73	- 34	- 13	37	-13	1	0
L 9	61	38	0	18	23	- 6	- 8	0
L 10	ND	ND	ND	ND	0	0	11	-10
L 11	ND	ND	ND	ND	0	-21	8	- 6

LOCATION: CHERRY GROVE

Reference Point	Change 1878-1940	Change 1940-48	Change 1948-52	Change 1952-58	Change 1958-63	Change 1963-73
C 1	ND	8	0	0	0	14
C 2	-174	-50	0	-12	0	ND
C 3	-254	-10	0	- 5	0	ND
C 4	-166	20	0	0	0	ND

LOCATION: NORTH MYRTLE

Reference Point	Change 1878-1940	Change 1940-48	Change 1948-52	Change 1952-58	Change 1958-63	Change 1963-73
N 1	- 82	-14	-14	0	29	21
N 2	-142	-27	16	-24	0	33
N 3	- 58	-11	0	-38	24	0
N 4	-146	-26	7	-18	0	9
N 5	-113	-15	0	-24	6	0

LOCATION: MYRTLE BEACH

Reference Point	Change 1878-1940	Change 1940-48	Change 1948-52	Change 1952-58	Change 1958-63	Change 1963-73
M 1	0	- 6	- 7	-11	0	34
M 2	0	-10	10	-29	0	21
M 3	- 57	0	0	-17	0	0
M 4	-169	0	11	-29	0	0
M 5	- 80	-30	- 7	0	14	0
M 6	-195	-50	9	-10	0	0
M 7	-420	0	0	0	0	0

LOCATION: GARDEN CITY

Reference Point	Change 1872-1926	Change 1926-34	Change 1934-40	Change 1940-50	Change 1950-52	Change 1952-58	Change 1958-63
G 1	36	-14	- 13	-63	5	-23	17
G 2	- 18	-20	0	-31	0	-31	44
G 3	- 24	0	- 9	0	0	-10	10
G 4	- 26	12	0	- 5	-13	0	0
G 5	- 64	20	-136	- 8	- 6	-12	0
G 6	-112	- 8	-118	-12	- 4	-13	12

LOCATION: NORTH MURRELLS

Reference Point	Change 1872-1926	Change 1926-34	Change 1934-40	Change 1940-52	Change 1952-57	Change 1957-63
X 1	-204	40	-36	0	0	18
X 2	-200	106	-70	154	57	-28
X 3	-520	484	22	- 8	247	ND

LOCATION: SOUTH MURRELLS

Reference Point	Change 1872-1926	Change 1926-34	Change 1934-42	Change 1942-52	Change 1952-57	Change 1957-64	Change 1964-73
Y 1	500	-50	-250	50	-106	0	ND
Y 2	348	-38	- 98	- 8	-125	-77	-43
Y 3	360	-76	- 26	10	- 63	-82	ND
Y 4	- 40	90	- 30	135	- 23	-39	-44
Y 5	-122	-14	32	14	0	0	0

LOCATION: PAWLEY'S ISLAND

Reference Point	Change 1872-1926	Change 1926-34	Change 1934-42	Change 1942-52	Change 1952-57	Change 1957-63	Change 1963-73
P 1	-110	36	4	- 5	- 11	0	27
P 2	ND	32	30	10	- 8	- 6	-10
P 3	- 98	-20	54	- 10	24	25	- 7
P 4	0	-58	70	7	9	10	-19
P 5	18	36	60	11	0	- 3	12

LOCATION: DEBIDUE

Reference Point	Change 1872-1926	Change 1926-34	Change 1934-42	Change 1942-50	Change 1950-52	Change 1952-57	Change 1957-63	Change 1963-73
D 1	- 31	- 32	0	93	0	-10	-11	34
D 2	63	- 14	13	42	0	0	0	7
D 3	20	12	67	14	-13	-43	-18	-20
D 4	288	-261	-15	0	-10	-23	-15	0
D 5	0	0	1049	24	- 8	-88	43	0

LOCATION: NORTH INLET AND NORTH ISLAND

Reference Point	Change 1876-1925	Change 1925-35	Change 1935-49	Change 1949-52	Change 1952-63	Change 1963-73
I 1	ND	ND	ND	0	40	- 29
I 2	ND	ND	ND	-25	-95	-111
I 3	ND	ND	ND	27	107	53
I 4	-329	-61	-94	24	-83	- 62
I 5	ND	ND	ND	0	-43	- 25
I 6	-106	-64	-42	- 6	6	- 6

	1876-1925	1925-35	1935-48	1948-52	1952-57	1957-63	1963-73
S 1	ND	ND	ND	-12	13	8	10
S 2	-58	-50	-38	-38	- 8	48	-11
S 3	ND	ND	ND	-66	29	0	8

LOCATION: SANTEE ISLANDS

Reference Point	Change 1950-52	Change 1952-57	Change 1957-63	Change 1963-73
W 1	-60	- 66	-78	-113
W 2	-14	- 70	-42	- 70
W 3	0	-236	0	28
W 4	0	42	-78	8
W 5	-15	25	-39	0
W 6	0	- 50	11	- 60

LOCATION: HUNTING ISLAND

<table>
<tr><th>Reference Point</th><th>Change 1859-1914</th><th>Change 1914-20</th><th>Change 1920-33</th><th>Change 1933-51</th><th>Change 1951-55</th><th>Change 1955-60</th><th>Change 1960-72</th></tr>
<tr><td>H 1</td><td>-1478</td><td>36</td><td>- 73</td><td>- 46</td><td>-27</td><td>-89</td><td>544</td></tr>
<tr><td>H 2</td><td>- 491</td><td>-41</td><td>-106</td><td>-188</td><td>-17</td><td>0</td><td>- 39</td></tr>
<tr><td>H 3</td><td>- 154</td><td>0</td><td>- 37</td><td>- 51</td><td>-52</td><td>-55</td><td>- 32</td></tr>
<tr><td>H 4</td><td colspan="2">85</td><td>- 65</td><td>-124</td><td>-36</td><td>-26</td><td>- 24</td></tr>
<tr><td>H 5</td><td colspan="2">-102</td><td>-101</td><td>-177</td><td>-14</td><td>-25</td><td>77</td></tr>
<tr><td>H 6</td><td colspan="2">-337</td><td>- 22</td><td>-284</td><td>22</td><td>0</td><td>197</td></tr>
</table>

LOCATION: FRIPP ISLAND

Reference Point	Change 1859-1920	Change 1920-33	Change 1933-51	Change 1951-55	Change 1955-60	Change 1960-72
F 0	- 85	- 15	-102	- 30	- 9	- 53
F 1	106	160	138	124	-272	ND
F 2	126	- 59	69	98	6	- 33
F 3	57	- 94	19	6	24	43
F 4	- 35	- 73	- 36	14	- 5	0
F 5	258	- 39	- 30	0	- 10	19
F 6	-301	- 54	- 6	0	- 41	162
F 7	-187	- 12	- 55	0	0	0
F 8	-333	0	- 9	- 15	10	- 45
F 9	-345	- 10	- 21	- 14	14	- 35
F 10	-299	- 22	- 38	0	20	- 36
F 11	-138	0	-216	33	0	- 21
F 12	-392	20	- 56	36	0	- 83

LOCATION: CAPERS AND BAYPOINT ISLANDS

Reference Point	Change 1859-1920	Change 1920-33	Change 1933-51	Change 1951-55	Change 1955-60	Change 1960-72
A 1	- 351	- 82	- 116	- 24	- 27	- 35
A 2	197	-177	- 471	- 41	-114	- 79
A 3	1044	137	-1371	-121	- 51	-142
B 1	- 224	86	- 39	- 47	- 53	- 75
B 2	- 339	260	147	- 33	- 46	- 68
B 3	- 177	829	- 377	24	-327	120
B 4	0	839	- 476	- 22	-110	-111
B 5	- 81	- 13	330	- 23	- 44	-189
B 6	128	-171	- 149	30	108	85
B 7	37	22	- 9	- 97	- 50	- 45

LOCATION: HILTON HEAD ISLAND

Reference Point	Change 1951-55	Change 1955-60	Change 1960-66	Change 1966-73
J 1	15	-17	30	ND
J 2	0	-16	0	1
J 3	0	- 4	- 6	36
J 4	31	0	0	10
J 5	11	0	-23	-15
J 6	-10	-11	-12	-34
J 7	ND	-36	0	- 9

Reference Point	Change 1951-55	Change 1955-66	Change 1966-73
T 1	53	0	0
T 2	62	9	6
T 3	57	27	0
T 4	0	11	0
T 5	-66	9	14
T 6	-66	10	0

LOCATION: DAUFUSKIE

Reference Point	Change 1942-55	Change 1955-66	Change 1966-73
U 1	0	0	12
U 2	0	-28	- 7
U 3	0	0	-22
U 4	-39	-36	-11
U 5	20	-22	0
U 6	-14	0	0
Z 1	-18	-30	ND
Z 2	0	-60	ND
Z 3	-10	-19	ND
Z 4	-21	-22	ND